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The Journal of Military Electronics & Computing

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Volume 12 Number 5 May 2010 www.cotsjournalonline.com

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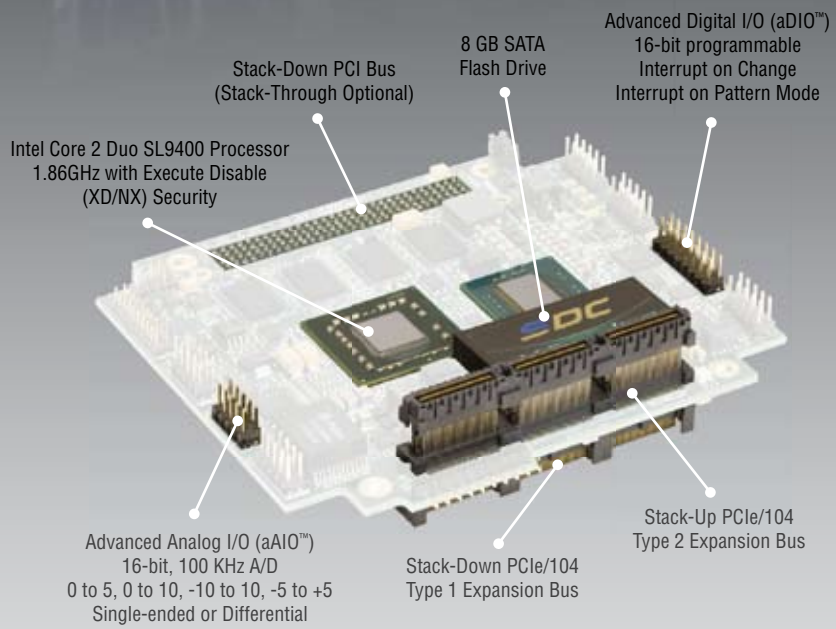

Intel Core 2 Duo Processor	1.86 GHz – 1.20 GHz
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†*See figure on left for details*
‡*See web site for details on each model*

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14
Fresh Start and Net-Centric View Drive Vehicle Modernization

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CONTENTS

May 2010 Volume 12 Number 5

SPECIAL FEATURE
Military Vehicles Embark on Modernization

TECH RECON
ATCA in Military Comms

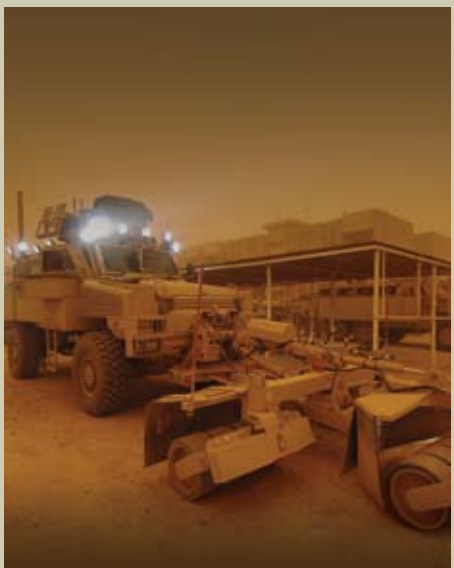
SYSTEM DEVELOPMENT
Military Batteries and Power Conversion

TECHNOLOGY FOCUS
FPGA Processing Boards

Departments

Coming in June
See Page 68

On The Cover: Plans for a new Ground Combat Vehicle call for combining the underbelly protection offered by MRAPs (shown), off-road mobility and side protection of a Bradley, and the urban/operational mobility of the Stryker. In this photo an amber glow caused by a sandstorm is accented by the search lights of mine resistant ambush protected (MRAP) vehicles. The vehicles were staging up before departing on a mission near Tikrit, Iraq. *(Photo by Chief Petty Officer Michael Heckman, Joint Combat Camera Center Iraq.)*



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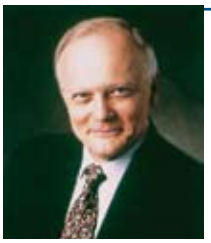

I have a Twit for You

Writing this column is both a privilege and a chore. Each month I try to find a topic that is current to our industry. And to do that I use the pool of what people have discussed, complained or questioned me about as my source. This month I'm going to deviate and opine about the information media. Now that I have you at the edge of your seat, let me quickly move on before you turn the page thinking: "I don't have any interest in this."

Twitter has a max length of 140 characters—I think. I expect soon someone will propose something like Twit and it will be 40 characters max. Why do we limit the number of characters? Everybody is bombarding everybody with information—most of it absolutely useless—but everyone is fixated on getting it just in case it's personally important to them. And with Twitter we can cram more of that in per day.

In the past we'd be deleting from our computers hundreds of e-letters, Web invites, product blasts, white papers, promos from shopping Web sites we've been on, and so on and so on. I almost long for the days when the spam I'd get was just offers from Nigeria, or ways to enhance myself physically. At least then I just had to delete a dozen a day. This trend of getting messages from Twitter, Facebook, Linkedin and all the other social networking sites has made PDAs more prominently a personal social device than a business device. Unless we have a tight business connection with the person or company that is messaging us, we ignore or instantly delete any non-personal messages. When we finally get home to sit at our computers we do the same thing and delete all the stuff that has been thrown at us, dealing only with things that are key to us individually.

Television is experiencing a similar situation because of all the options that are available to potential viewers: more cable or satellite channels, Web TV and DVRs. Individual programs and channels are seeing a significant decline in real-time viewing. In an effort to compensate for loss in revenue, producers increase the number of advertisements per show. That in turn drives up the desire by viewers to eliminate more advertisements from their limited time. Movies aren't made for theaters anymore—nor is there a big interest in quality of content. The business model is: crank any movie out using notable actors, promote the hell out of it on TV, then get it on a DVD and cable before anyone realizes how bad it really is.

Print media hasn't been immune from change either. In fact different segments have had different degrees of difficulty. Newspapers have really been devastated. Paid circulation publications that have a highly targeted subject have probably been doing the best. Meaning, much of the controlled (free) circulation business-to-business publications have been chasing the carrot of electronic media to save postage and printing costs. Many view electronic media as intending to replace print rather than support it. The problem is Internet advertising can't support the overhead or quality editorial. Most recently Reed Elsevier announced that it was divesting its portfolio of a couple dozen publications—several of which have been key for our market: *EDN*, *Design News*, *Control Engineering* and *Test and Measurement World*.

How to sum up all this confusion? There are a couple ads on TV that to me say a lot about the Web and electronic blasts. In one ad a partner asks a specific question and the response is a series of random unending comments about unrelated thoughts, demonstrating that we are all under information overload. In another ad an individual is looking for a pharmacy in a specific area and one Web source supplies everything about pharmacies while the other supposedly responds specifically. We're due for another quantum change in electronic information transmission to resolve these current problems. Businesses' attempt to use social media to get their message to customers is going to fall flat on its face. People aren't going to stand for it. Social media is personal and we don't want to have that interfered with. The big unknown is what will the quantum change be, and how will it be sold to the users.

Marketing hasn't changed because we have the Internet. If there is a product or service offered with a perceived need for value, people will buy it. The current shotgun trend of dumping high-volume information with questionable value on people has reached its limit—with diminishing returns. Marketing departments will have to find ways of rifling their message to a receptive audience. The first thing that needs to be done is to have an effective message that can instantly be absorbed. That's the way people react these days. The next step is finding a delivery vehicle. Television and print along with their *supporting* Internet outlets should have an easier opportunity for delivery. In contrast, most Internet-centric/Internet-focused outlets cannot produce a business model that supports high-quality independent content to hold an audience, and therefore will be lost in the clutter. So here is my Twit: *The media is no longer the message.* ▮▮

Pete Yeatman, Publisher
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The Inside Track

Curtiss-Wright Awarded Contract for Upgraded Radar Signal Processing

Curtiss-Wright has been awarded a $10.5 million contract by Northrop Grumman to provide an upgraded Radar Signal Processing (RSP) solution for use in the Joint Surveillance and Target Attack Radar System (Joint STARS) program. The initial portion of the contract, for $5.1 million, was awarded for the Joint STARS Prime Mission Equipment (PME) Diminishing Material Source (DMS). An additional $5.4 million was awarded to enhance the RSP solution so that it meets advanced radar processing capacity requirements necessary to support future radar performance needs.

Figure 1

Crew performs preflight procedures in the cockpit of the E-8C Joint STARS at an air base in Southwest Asia.

The U.S. Air Force's E-8 Joint STARS aircraft (Figure 1) is the world's premier ground surveillance platform, which is able to track slow moving or stationary targets at sea, on the ground or hugging the terrain in slow flight. The Air Force's Radar Airborne Signal Processor (RASP) system performs the radar signal processing capabilities of the Joint STARS aircraft, enabling it to process data that results in the ability to locate targets. The contract is part of a larger upgrade to the RASP system used in Joint STARS. Curtiss-Wright's Motion Control segment will design and manufacture the Radar Signal Processing (RSP) solution at its San Diego, CA facility.

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

LynuxWorks and GD C4 Systems Team for Secure OS Development

LynuxWorks announced that it has been working jointly with General Dynamics C4 Systems to accelerate the feature set of LynuxWorks LynxSecure technology and broaden its adoption into secure systems. As part of a joint development activity, engineering teams from both companies have collaborated to meet customer high assurance security requirements based on the LynxSecure software separation kernel from LynuxWorks. RTOS technology and expertise from LynuxWorks, along with the Information Assurance knowledge and expertise from General Dynamics, has been combined to create products and solutions for the security market.

Spanning two years, the joint effort is yielding dramatic increases in computer security including the consolidation of dissimilar operating system environments that enable a diverse array of applications to be co-resident on a single processor, multiple processors and multicore processors. In the case of General Dynamics' use of LynxSecure for secure mobile computing, the company reduced hardware quantities, in addition to cost and power requirements, while allowing easier reuse of legacy software and enabling operational efficiencies all within a secure, assured environment. LynxSecure was designed from the ground up to be evaluated to the highest levels of Common Criteria evaluation, namely EAL 6+.

LynuxWorks
San Jose, CA.
(408)979-3900.
[www. lynuxworks.com].

Parvus Supplies Router/ Switch Subsystem for MEADS Program

Parvus announced a design win for Parvus' DuraNET 3825 subsystem into the NATO MEADS (Medium Extended Air Defense System) program. BMC4I developer Lockheed Martin Space Systems has specified the DuraNET 3825, a ruggedized version of Cisco Systems' 3825 Integrated Services Router (ISR), to provide the network connectivity for the MEADS Tactical Operations Center. Parvus has shipped initial quantities to Lockheed and other NATO partners. No financial details were disclosed.

Figure 2

Intended as a replacement for Hawk and Patriot systems worldwide, the medium extended air defense system (MEADS) is designed for rapid deployment and tactical mobility.

Under development by Germany, Italy and the United States, MEADS (Figure 2) is a mobile system that will replace Patriot in the United States and Nike Hercules in Italy. It will replace Hawk and Patriot systems in Germany. The system is designed to permit full interoperability between the U.S. and allied armies, and it is the only medium-range air defense system to provide full 360-degree coverage. The DuraNET 3825 combines the features available in Cisco IOS software, Catalyst Layer 2 LAN switching, and flexible Layer 3 WAN routing

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into a single ruggedized platform. Featuring mechanical packaging enhancements designed to suit shipboard / military shock and EMI environments, the Dura-NET 3825 is designed to meet MIL-S-901D Grade B shock levels and MIL-STD-461 radiated emissions requirements.

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

General Dynamics to Lead Development of Airborne Network Node for WIN-T

General Dynamics C4 Systems has been awarded a $12.4 million contract modification to the Warfighter Information Network – Tactical (WIN-T) Increment 3 contract by the U.S. Army to lead a defense-industry team in the development of a line-of-sight communications payload for Extended Range/Multi-purpose (ER/MP) Unmanned Aircraft Systems (UAS). Once aboard the UAS, the WIN-T communications payload will use the Highband Networking Waveform (HNW) to serve as a radio repeater while the UAS is in flight. This capability is critical in an urban environment or on rugged terrain where there are barriers to ground communication.

HNW is a key technology on the WIN-T program, providing automation in establishment of a communication link that results in increased robustness of the communication network. WIN-T enables warfighters to communicate and collaborate on the move, in urban areas, mountains or isolated locations where there is no communications infrastructure. General Dynamics will lead the WIN-T Increment 3 team that includes Lockheed Martin, BAE Systems and Harris Corporation. The teammates will work closely to design the Communications Payload B-kit with General Atomics, makers of the ER/MP platform. The U.S. Army Communications Electronics Command (CECOM), Fort Monmouth, N.J. is the contracting authority.

General Dynamics C4 Systems
Scottsdale, AZ.
(480) 441-3033.
[www.gdc4s.com].

GE Intelligent Platforms Order for B-1B Upgrade Includes 6U VME

GE Intelligent Platforms today announced that it had completed delivery of a $6.5 million order from Boeing. The order, to enable the development of upgrades to the U.S. Air Force's B-1B bomber

Figure 3
A ground crew member moves in to assist a U.S. Air Force B-1B Lancer bomber with aircraft shutdown procedures.

(Figure 3), was received in March 2008, with a requirement for completion in time to enable planned flight testing early in 2011. The upgrades, which are expected to generate production orders starting in 2011, will provide the B-1B with a Vertical Situation Display Upgrade (VSDU), giving aircrew improved protection against hostile action. Included are an adapted version of the GE Intelligent Platforms Octegra3 6U VME rugged video/graphics processor and VIM2 rugged video input mezzanine.

Importantly, Boeing's requirement was that the subsystems were DO-178B certified, meaning that the development process used conforms to strict quality criteria designed to maximize the safety of airborne systems. GE Intelligent Platforms subcontracted with Ultra Electronics Controls to undertake the necessary development and qualification of the board support package (BSP). Ultra Electronics Controls was selected because of the company's extensive experience and expertise in delivering DO-178B-certified systems. In addition, Presagis provided a DO-178B-compliant version of its OpenGL embedded graphics solution.

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

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Military Market Watch

U.S. Army Releases Modernization Strategy

The U.S. Army recently released its 2010 Army Modernization Strategy (AMS), providing the blueprint for how the Army will achieve its goals in the area of modernization. It defines how the U.S. Army continues to modernize and transform to fulfill its mission to sustain soldiers and maintain readiness of the Army. There are several significant changes in the 2010 AMS from previous editions, among them being strategies shaped by guidance from the Secretary of Defense concerning the Future Combat Systems (FCS) program, and a description of the new Brigade Combat Team (BCT) Modernization approach that replaces FCS.

The FY11 Army Modernization base budget provides funding for new procurement, rebuild, upgrade of existing system fleets, and grows future capabilities through science, technology, research and development efforts. Requested funding totals $31.7 billion for research, development and acquisition. Some major procurement efforts are listed in Figure 4.

Army Modernization Budget: a Breakdown

$459 million	to add UAS reconnaissance and surveillance capabilities to the MQ-1 ER/MP.
$1.4 billion	for UH-60M/HH-60M Black Hawks to meet modular force requirements.
$887 million	for modernization of AH-64 Apache Helicopters.
$505 million	for modifications to RQ-7 UAS, Shadows.
$1.159 billion	for transition of CH-47 Chinook Helicopters from "D" to "F" Model.
$480 million	for Patriot PAC-3 Missiles.
$14 million	for modernizing the Ammunition Production Base.
$300 million	for Stryker Vehicles.
$231 million	for M1 Abrams Tank modifications. $1.468 billion for modernization of Medium and Heavy Trucks (FMTV; FHTV).
$503 million	for Tactical Surveillance Equipment (ex, Night Vision Thermal Weapon Sights and Long Range Advanced Scout Surveillance System).
$630 million	for WIN-T and JTRS.
$2.5 billion	for BCT Modernization.
$1.8 billion	for continued development of Aviation, Intelligence, Air Defense, and Combat Range Vehicle Program.

Figure 4
Requested Army funding totals $31.7 billion for research, development and acquisition.

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May 27
Real-Time & Embedded Computing Conference
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June 8
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Montreal, QC.
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June 10
Real-Time & Embedded Computing Conference
Ottawa, ON
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June 22
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Special Feature

Military Vehicles Embark on Modernization

Fresh Start and Net-Centric View Drive Vehicle Modernization

Moving forward with its new overhauled BCT modernization strategy, the Army is kicking off new vehicle development while repurposing its ongoing net-centric technology work.

Jeff Child, Editor-in-Chief

It's taken some time, but the defense industry seems to be over the shock of life beyond the Army's Future Combat Systems program. For over a decade FCS was an inherent part of any discussion about next-gen Army vehicles and the transition to a lighter, faster and more functional combat force. In April of last year, Secretary of Defense Robert Gates made the bold move to not just restructure FCS but to cancel the program and start fresh.

Since that time, the Army has been busy over the summer and through the fall conceptualizing the goals for a new Ground Combat Vehicle (GCV) and its overall Brigade Combat Team (BCT) modernization strategy. A Request for Proposal for the GCV has been out since February, with a deadline for submissions of late last month. Contracts for the GCV program aren't expected to be awarded until the fall. Meanwhile the current plan is to deliver Increment 1 capability to seven Infantry Brigade Combat Teams starting in 2011. The rest of the BCTs will then receive upgraded capabilities on an incremental basis.

A Plan Emerges

This rebooting of the Army's modernization strategy has been the cause of much uncertainty among makers of electronics and embedded computer products aimed at next-gen military vehicles and other systems. That uncertainty was eased somewhat when the Army rolled out its overall Army Modernization Strategy document, which details the various elements and implementation plans for the future. The four major elements of the plan are incremental improvements to the Army BC Network; Incorporating Mine Resistant Ambush Protected (MRAP) vehicles into the force; Accelerating the fielding of "capability packages" to BCTs by 2025; and developing a new Ground Combat Vehicle within seven years (Figure 1).

New Ground Combat Vehicle

The GCV operates effectively with current Army and joint service systems as well as systems in development. GCV hosts the Army's battle command network systems, and possesses growth potential in electrical and computing power to incorporate changes as network systems evolve. These vehicles also retain mission functionality with a degraded or interrupted network. GCV facilitates soldier integration into the network, employment of air and ground robotic systems, and enables access to joint capabilities at all levels.

The requirements for the Ground Combat Vehicle were developed from input of a variety of expert sources. Among


M704T
TOW

these was an Army-sponsored Blue Ribbon Panel, which received input from Joint-Service partners, retired Generals, think tank analysts, representatives from the Office of the Secretary of Defense, Army Soldiers, and leaders with a wide range of operational experience to inform the Ground Combat Vehicle operational requirements development effort. That input was supplemented by contributions from commanders and soldiers with recent combat experience in Iraq and Afghanistan.

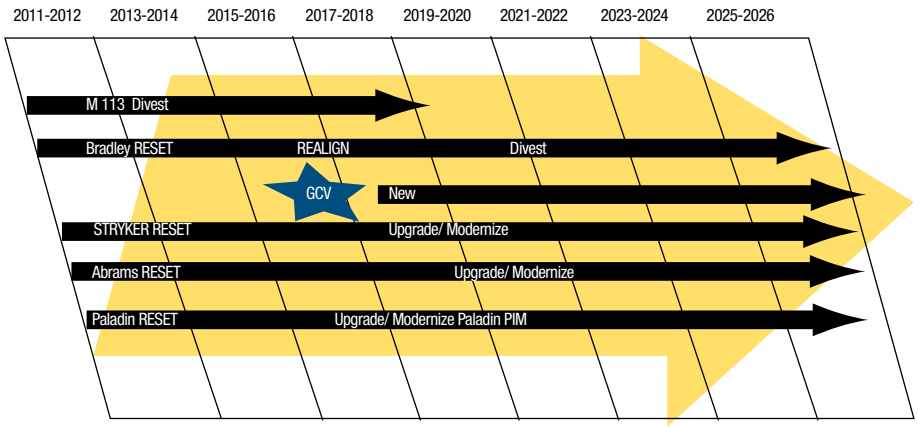

Figure 1

The Army's vehicle modernization strategy calls for a new Ground Combat Vehicle by 2017, while meanwhile upgrading, resetting or divesting its other existing vehicle platforms.

The GCV as conceived takes the best aspects of different existing vehicle platforms. This includes the underbelly protection offered by MRAP, the off-road mobility and side protection of the Bradley Fighting Vehicle, and the urban and operational mobility of the Stryker. An ability to integrate into the network to maintain situational awareness in urban and other operations is also a key requirement. This mandates sufficient space and electrical power to accept the network systems while also ensuring the ability to integrate upgrades and new technologies. The Ground Combat Vehicle's development schedule calls for production of the first vehicle by fiscal year 2017.

Figure 2

Combining rugged news, high performance and Second-Level Maintenance features, OpenVPX is the likely form factor for future military vehicle embedded computing.

Big Role for Embedded Computing

While it's far too soon to know what shape the onboard computing systems for GCV will take, it's likely that the significant body of work done for FCS computing systems will be leveraged for the GCV. OpenVPX—designed with just such harsh environment, high-performance applications in mind—is the most likely form factor (Figure 2). Early prototypes for FCS Integrated Computing Systems were based on 3U CompactPCI cards with Pentium M computing and 10-port Gbit Ethernet switching. And while such systems would have been part of the first spin-out of FCS future force technologies (for Bradley fighting

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vehicles, Abrams main battle tanks and Command-Variant Humvees) had FCS continued, the new FCS vehicles were looking toward VPX.

The heart of the FCS networking technologies has its current rebirth in a modular set of gear the Army calls Network Integration Kits (NIK). The NIK is part of the Army's E-IBCT Enhanced Brigade Combat Team requirement. The NIK (Figure 3) is an integrated suite of equipment on a HMMWV that provides the Network connectivity and battle command software to integrate and fuse sensor data into the common operational picture (COP) displayed on the Future XXI Battle Command Battalion/Brigade and Below (FBCB2).

NIKs are engineered with technologies that can receive and distribute data, voice, video and images across the force using multiple high-bandwidth waveforms; they consist of vehicle-mounted software-programmable Joint Tactical Radio Systems (JTRS) such as the Ground Mobile Radios (GMR), a so-called "dual-enclave" Integrated Computer System (ICS) built to handle classified and unclassified information, and a Blue Force Tracking display screen. The software and operating systems are connected through the use of a middleware called System of Systems Common Operating Environment (SOSCOE).

Figure 3

Network Integration Kits are an integrated suite of equipment on a HMMWV that provides the Network connectivity and battle command software to integrate and fuse sensor data into the common operational picture displayed on FBCB2.

Demonstrating their versatility, last month Network Integration Kits (NIKs) developed with Increment 1 of the Army's Brigade Combat Team Modernization Program began being installed on MATV versions of the Mine Resistant Ambush Protected (MRAP) vehicle (Figure 4) at White Sands Missile Range in preparation for fielding in 2011 to the 3rd Brigade of the 1st Armored Division when it is deployed to Afghanistan. In addition to providing "networked" combat-relevant information such as sensor feeds from a UAV across the force in real time, the NIKs may help MRAPs overcome some of their mobility restrictions.

Battle Command Network Modernization

A critical backdrop to the Army's new vehicle plans is its ongoing effort to build out and improve its Army's Battle Command Network. Its goal is to enable networking the force to operate across the full spectrum of conflict including austere and complex environments. This means interoperable, affordable and capable of incremental upgrades to ensure soldiers have the right information at the right place and time. It keeps our soldiers connected at extended ranges with voice, data and video through the integration of existing capabilities combined with the development of new capabilities.

Network modernization is implemented via two primary ongoing transport programs: WIN-T and JTRS. The WIN-T is the backbone for the Army's transport modernization plan and will be fielded in three increments. Fielding of Increment 1 is almost complete, which provides reach-back capabilities to Battalion Command Posts. Increment 2 provides an initial On-the-Move (OTM) transport capability including real-time high-definition imagery to BCT and Battalion Commanders, as well as Beyond Line of-Sight (BLOS) services to the BCT Company level. This is scheduled for initial fielding in FY12. Increment 3 expands OTM capabilities and adds an aerial tier vastly improving network reach, redundancy and management.

Meanwhile, the JTRS program provides a dynamic, scalable, OTM network architecture, connecting the soldier to the network, and enhances capability to exchange increased voice, data and video faster than current systems. The advanced network waveforms provide rapid distribution of data and imagery with increased information assurance protection and automatic routing across complex terrain. The JTRS is also backward compatible and therefore interoperable with current radios. The Network plan accelerates the fielding of new tactical radios aligned with capability package fielding to 29 BCTs by the end of FY16.

Tying it All Together

Tying the elements together is convergence to a common operating environment with upgraded applications and network services. The Network Integration Kit (NIK) provides control of the Unattended Ground Sensor (UGS) and updates the Common Operation Picture (COP) of UGS status, sensor reports and imagery into Force XXI Battle Command, Brigade and Below (FBCB2) and Army Battle Command System (ABCS).

The Army's BC Network modernization strategy is focused on converging several systems, providing increased information superiority on the move. Current and future Army BC programs will address these capability gaps and reduce the current growing number of products across the battlefield. By 2012 the Army plans to incrementally transition from the current legacy and off-the-shelf network systems to a new network based on the latest increments of WIN-T and JTRS programs to provide secure data, voice and video capabilities to a mobile force. Because the Army has funded programs for network, applications and supporting systems modernization for FY10-15, it will reap the benefits of this investment as fielding begins deploying BCTs in FY11.

Last month the U.S. Army awarded General Dynamics C4 Systems a $164 million contract that will enable a General Dynamics-led team to begin low-rate initial production of the Warfighter Information Network – Tactical (WIN-T) Increment 2. The not to exceed value for this initial WIN-T delivery order, which for the first time provides commanders with mobile networking capability, is $338 million. The WIN-T units produced during this phase include equipment sets configured for a Division Headquarters and three Brigade headquarters. The equipment then will undergo formal testing during 2011, culminating in an Initial Operational Test and Evaluation (IOT&E) in November 2011.

Figure 4

Network Integration Kits (NIKs) developed with Increment 1 of the Army's BCT Modernization Program are being installed on MATV versions of the MRAP.

On-the-Move Vehicle Networking

The WIN-T program comprises three increments. Increment 1 is currently fielded to a number of deployed U.S. Army units. Increment 2 will equip vehicles with on-the-move broadband communications enabling command and control from anywhere in the battlespace. Increment 3 delivers a more au-

tomated and robust network connection with extended line of sight communication using airborne relays, increased network reliability and capacity, and smaller and more tightly integrated communications and networking gear needed for the Army's Brigade Combat Team Modernization. General Dynamics C4 Systems is the prime systems integrator for WIN-T and is teamed with Lockheed Martin, BAE Systems, Harris Corporation, L-3 Communications, Cisco Systems and Juniper Networks.

After a significant investment in JTRS—and years of turmoil—the Army will begin fielding JTRS starting in 2012. The JTRS Ground Mobile Radio (the JTRS version for ground vehicle mounted platforms) begins to close the data capability gap at the BCT company level and provides the capability to build a data extension to the lowest echelons, and then enables the extension of services from the Forward Operating Base to the platform. Handheld, Manpack, Soldier (HMS) JTRS radios extend the network to the dismounted soldier. Rifleman Radio extends connectivity down to the individual soldier, which delivers key networking capabilities to bring the individual soldier into the network, and provide voice connectivity and visibility of the soldier's position location information to the squad/team leader.

Figure 5

A convoy of future on-the-move platforms for the Warfighter Information Network – Tactical (WIN-T) Increment 2 including the two point of presence vehicles on the left during the WIN-T Increment 2 Engineering Field Test.

Lessons Learned, Fresh Start

As the Army's overall plan for modernization and its specific new efforts in new vehicle development move forward, they have the benefit of hindsight—avoid the pitfalls and problems suffered by the Future Combat Systems program. This new Army Modernization Strategy also has the benefit of kicking off when its companion programs—namely WIN-T and JTRS—are further along toward maturity. While it's too soon to know many specifics about where all the embedded computing and electronic opportunities will be for the Ground Combat Vehicle and associated platforms, there's no doubt that the DoD's continued focus on network-centric technology will keep demand alive for a wide spectrum of high-performance, fabric-based compute platforms. ▮▮

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Tech Recon

ATCA in Military Comms

ATCA Evolves its Niche in Mil/Aero Systems

ATCA's success in the military has moved out of the realm of theory and into reality as high-performance military programs embrace ATCA's benefits.

John Long, Product Line Manager
RadiSys

In the past decade, open-standards solutions such as ATCA have moved from hypothetical to accepted options for mil/aero market segments. Making impressive inroads, modular technologies offer interoperability, ruggedness, reliability and demonstrated longevity—key factors for risk-adverse mil/aero customers.

Interoperability: ATCA blades share a common form factor, and so military equipment manufacturers can build many different applications using ATCA platforms. This shared form factor means that one can create multiple network elements on a standard architecture simply by selecting the appropriate set of ATCA blades. This common architecture fosters multi-vendor interoperability and maximum flexibility in implementation.

Ruggedness: With features such as conformal coating and the ability to modify mechanicals to deal with vibration, ATCA solutions are rugged enough to handle the toughest environmental factors—shock, vibration and G-forces—yet are efficient enough to meet application needs for power and heat dissipation.

Reliability: The level of redundancy achieved by ATCA is carrier-grade reliability (99.999 to 99.9999 percent availability or total outage time of 30 seconds to five minutes per year). ATCA standards are developed to provide redundancy in hardware at every level including fans, power entry modules, backplane data redundancy and shelf managers. Open standards-based high-availability (HA) middleware on ATCA platforms provides further fault tolerance on an application level that allows continued operations of critical missions even with some hardware and software failures. This is one reason ATCA has gained entry into applications like UAV Ground Control Stations (Figure 1).

Figure 1

Reliability and support for high levels of redundancy makes ATCA a fit for applications like UAV Ground Control Stations.

Longevity: The equipment necessary to accomplish today's military objectives must often remain in the field for many

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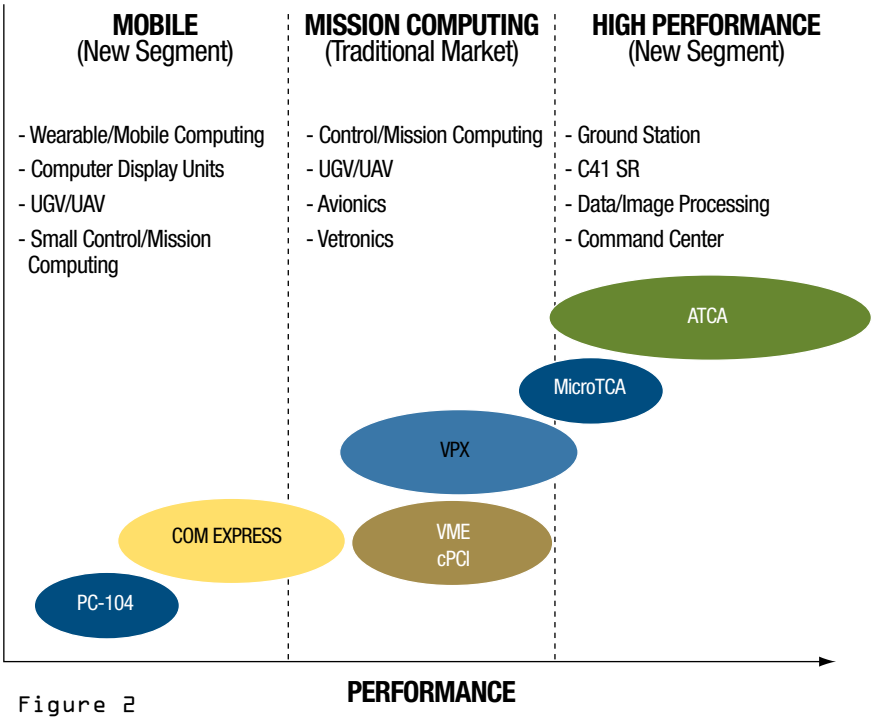

Figure 2

ATCA is best suited for the high-performance end of military applications. These include systems like C4ISR, UAV ground control applications, cluster computing for large aircraft and naval units, and secure network communications installations.

years after initial deployment. As such, equipment providers need solutions with lifecycles of a decade or more that support efficient and cost-effective technology deployment to manage obsolescence. ATCA supports these requirements by utilizing long-life embedded components provided by vendors that will support them throughout the product lifecycle.

The goal of ATCA is to reap the benefits of a standardized platform architecture while maintaining carrier-grade reliability. ATCA provides a dynamic architecture that enables product developers and mil/aero organizations to field innovative new capabilities with very short development times, and scale those systems as they take hold.

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with other vendor products or not easily scalable, you missed the boat. ATCA has offered the telecom and related industries an open modular standard to deal with these development risks.

At its core, ATCA is a set of documents specifying all the electrical and mechanical requirements of the ATCA industry standard platform—backplane properties, module size and backplane interface specifications, power rating, cooling and so on. More specifically, ATCA is a set of open standards defined by PICMG and supported by multiple vendors in order to provide an industry-standard platform enabling organizations to build carrier-grade products in multi-vendor environments.

The popularity of ATCA rapidly increased in the telecom sector because of the potential cost savings, increased functionality and multi-vendor compatibility it provides. In addition, ATCA offers Telecom Equipment Manufacturers (TEMs) drastically reduced development time, which in turn leads to faster time to-market. ATCA has proven longevity in the telecom industry, with more than five years of successful deployment to improve the performance, scalability and reliability of mission-critical systems. Billions of telephony consumers rely on ATCA infrastructure, and the ATCA segment has grown into a $500 million industry and is well on its way to several billion dollars over the next few years.

ATCA has achieved significant success in commercial markets by applying its technical and cost benefits to increase profitability and reduce time-to-market. These same benefits can be leveraged in the mil/aero industry to reduce capital acquisition and operational costs, as well as to meet the stringent performance requirements of mil/aero applications.

ATCA in an Expanding Military Market

The Network-Centric Warfare (NCW) doctrine represents a fundamental shift in military culture, moving away from powerful compartmentalized war machines and toward interconnected units operating cohesively. In addition to the increasing need for robust information sharing, access and speed brought about by NCW, the rugged requirements of mil/aero applications have historically driven system engineers to use expensive, inflexible and proprietary components to keep up with current technologies. However, an alternative exists.

Traditionally, military and aerospace standards-based applications were limited to mission computing and built with rugged VME or CompactPCI. These components managed heavy I/O, but their form factor limited networking and processing capability. The traditional markets for these solutions, which were served mostly by VME, cPCI and VPX, include Avionics, Control/Mission Computers, Unmanned Vehicles and vetronics.

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Suited for the Big Networks

Today, the high-performance and bandwidth capabilities of ATCA bring the latest technologies to standards-based applications, such as command and control, aerospace surveillance, land mobile communications and maritime networks, which must collect and manage large amounts of data in real time (Figure 2).

These next-generation mil/aero applications can be segregated into two major categories. The first, C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance), includes UAV ground control applications and cluster computing for large aircraft and naval units. The second is secure network communications, such as shipboard networks where the infrastructure is similar to COTS IT networks.

ATCA is the perfect fit for these requirements. Unlike VPX, which is simply an updated version of the VME standard, ATCA was specifically designed to address high-density network communications applications and delivers up to eight times the performance of VPX and 40 times the performance of VME or cPCI. In addition, ATCA is a broadly adopted

Figure 3

The Xeon 5600-based ATCA-4550 series provides 10 Gigabit fabric connectivity, eight DDR3 DIMM sockets, an AMC slot and several optional RTMs that offer additional storage and network interface options.

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standard that has proven its interoperability through five years of deployment in the communication segment.

The demands of next-generation applications mean that migration to new, high-performing networks is inevitable. With ATCA it is easy to integrate new networks with legacy systems. ATCA supports Advanced Mezzanine cards (AMCs) to provide legacy connectivity with communication equipment that performs functionalities like Signal Intelligence (SIGINT) and Command Intelligence (COMINT). A new system can come online using ATCA while maintaining interconnectivity with older systems.

Adopting ATCA to Network-Centric Warfare

ATCA offers a number of key technical advantages that make it particularly well suited for mil/aero applications. These advantages include enhanced security, higher performance per watt and higher bandwidth.

Military networks require technologies that provide strong authentication and easy configuration capabilities to improve security and reduce maintenance costs during the life of the network. ATCA systems provide easy-to-use API and management interfaces to configure secure and complex networks.

ATCA also has performance/watt and thermal benefits. A chassis can often require six to nine months to validate, and for some complex applications, development can require 18 to 24 months to complete. It's imperative, therefore, that new blade solutions can be cooled in existing generations of chassis. By adopting the industry-leading processors, ATCA can realize significant power and thermal savings.

Addressing Thermal Requirements

The combination of lower power dissipation and fewer board components enables ATCA to incorporate a more robust yet less expensive thermal solution. An example ATCA board designed with thermal performance in mind is the single-socket Promentum ATCA-4550 (Figure 3) from Radisys. The Xeon 5600-based ATCA-4550 series provides 10 Gigabit fabric connectivity, eight DDR3 DIMM sockets, an AMC slot and several optional RTMs that offer additional storage and network interface options.

Military networks host applications to keep soldiers in communication with their command units during missions and with their families at other times. Video and audio are increasingly becoming critical elements of these applications, which combine to create tremendous bandwidth requirements. Current ATCA technologies can fully support 10 Gbit of traffic on the system backplane to process voice and video traffic, while future ATCA solutions will handle 40 Gbit of traffic for video applications such as HD video.

In addition to its significant technical advantages, ATCA offers certain financial benefits that maximize the return on technology investments and make more

efficient use of those technologies in the field. ATCA allows reduced initial and long-term costs while getting new technologies in the field and making them operational more quickly.

Time and Cost Issues

Reducing development time and saving on total cost of ownership have moved to top priorities for today's military programs. The sooner a new product is made available to units in the field, the sooner that product starts making an operational impact. When a military unit needs to implement a new and innovative capability, pressure builds to get the product built, tested and operational in the field. The modularity of ATCA fosters faster development to handle new capabilities and to get them in the battlefield more quickly. It also possesses the flexibility to address entry into new areas of operation with minimal downtime.

Capital expenditures can be reduced by procuring less equipment. ATCA lowers the cost of development and creates a common platform, thus reducing the amount and cost of hardware and software needed for an application. In fact, according to industry experts, ATCA blades can save up to 40 percent in overall product development costs.

Saving on Operations Expenditures

Every organization needs to save on training and personnel costs. Because of ATCA's common management specification, implementers can expect more cost-efficient and consistent service from outside vendors and unit personnel. Selecting ATCA for a network leads to less training (and retraining) required for staff to perform multiple tasks and fewer staff to maintain equipment. In addition, ATCA allows a network operator to save space and money with ATCA by sharing common system components across a number of modules. For example, the ATCA architecture allows all cabling to be done through the rear of the chassis, allowing service personnel to quickly replace a failed blade without having to change cables.

ATCA is an established standard, with broad success in the Telecommunications industry. As the military evolves toward network-centric operations, ATCA's niche in the mil/aero marketplace is becoming significantly larger. New market segments are taking shape, and ATCA is poised for significant growth as military equipment manufacturers leverage open systems for both technical and commercial benefits. With ATCA, manufacturers can manage the risk of integrating COTS technologies into complex and mission-critical military networks to support the next generation of mil/aero applications. ▮▮

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Tech Recon

ATCA in Military Comms

Mission-Critical Apps Blend Benefits of ATCA and Service Availability

By marrying the building blocks of ATCA and SA Forum specifications, military system designers can craft highly reliable real-time systems for a variety of defense applications.

John Fryer, President
SA Forum

The increasing use of computer systems in the military and aerospace world and the escalating complexity of applications are placing new demands for continuous operation on next-generation network infrastructures. These go beyond traditional requirements, such as tolerance of shock, vibration, extreme temperatures and environmental hazards, to include the network-centric concept of service availability. Service availability implies a service is always available, regardless of hardware, software or user fault, and is often taken for granted until downtime occurs. It can easily be overlooked or discounted, even when it is crucial to the successful deployment of mil/aero applications in the field.

There are both real-world and theoretical examples of what can happen when service availability is overlooked, or not fully specified. Over the last three years, the FAA's aging National Aerospace Data Interchange Network (NADIN) system, which tracks more than 1.5 million flight schedules daily, has experienced a number of major service outages. These have resulted in delays of up to 6 hours at as many as 100 airports at a time on a nationwide basis. Perhaps most troubling of all is that in many of these incidents, the FAA was unable to trace the cause of the problem in the 24-year-old system.

Figure 1

Service availability technology is particularly suited for complex ship-borne radar systems like those aboard Aegis guided-missile destroyers (USS Roosevelt DDG 80 shown). There, computer hardware failures, software failures or network failures can have disastrous consequences—including missing the target or losing the missile.

Need for Service Availability

If one looks at modern guidance systems, the lack of service availability can have deadly consequences. For example, in ship-to-air systems, missiles are guided by shipborne radar until they come within self-guidance range of their target (Figure 1). Until this time, the shipborne control systems must continuously take radar measurements of the target, compute the missile guidance commands and send them to the missile. Concurrently,

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the command and control systems must collect the missile's health status and determine whether it is within permissible parameters. If not, then the missile must be destroyed. The failure of any aspect of this process, which includes control loop closure times not being met, computer hardware failures, software failures or network failures, can have disastrous consequences, including missing the target, or losing the missile, which could lead to the potential loss of the ship.

These examples highlight the importance of service availability in the daily operations for military and aerospace systems. Further, the unpredictable and often unclear causes of problems reveal the need for a transparent and reliable approach to service availability that prevents outages.

Proprietary Problems

Service availability concepts are nothing new in the military and aerospace world, but they have generally been addressed on a system by system, application by application basis. While this enables operation to be tailored to specific requirements, it results in highly proprietary systems, which become less flexible over time and, as a result, much more costly to maintain. The challenges faced by upgrading the FAA's aging NADIN system are a prime illustration of this.

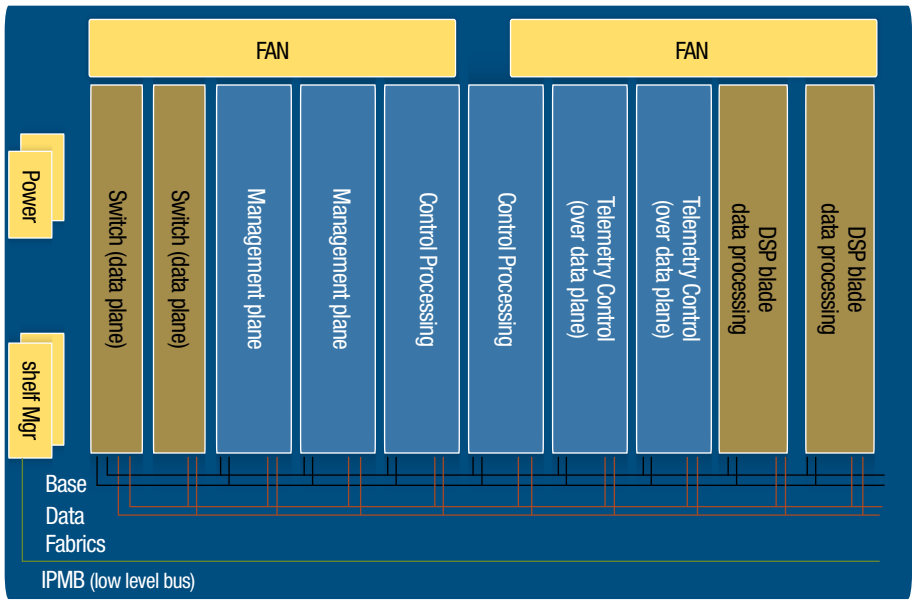

Figure 2

A typical ATCA system will separate fabrics into a base fabric and a data fabric. This enables two switch modules to be placed in a system, with up to 12 payload blades and with every blade interconnected via each of the switch blades, providing an inherently redundant system.

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

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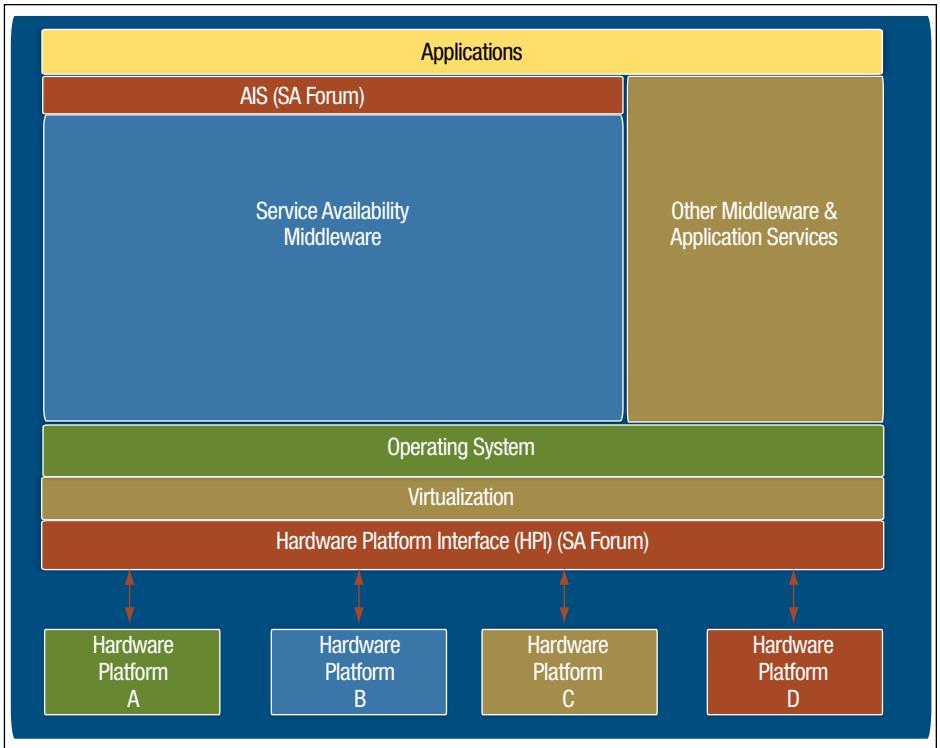

Figure 3

The SA Forum's Hardware Platform Interface (HPI) is used to abstract low-level information from hardware so that it can be accessed and programmed through common interfaces.

An alternative approach is to leverage commercial systems and service availability (SA) middleware to provide a common infrastructure basis for service availability. The benefits of infrastructure options based on open specifications can be substantial.

Since the early 2000s, two complementary organizations have developed open specifications to help create commercial ecosystems around five-nines (99.999% uptime, or five minutes and 15 seconds of downtime per year) SA-based systems for markets including mil/aero. These specifications include the AdvancedTCA specifications developed by the PCI Industrial Computer Manufacturers Group (PICMG), and the Hardware Platform Interface (HPI) and Application Interface Specification (AIS) defined by the Service Availability Forum.

No Single Point of Failure

AdvancedTCA specifications are based on a no single point of failure concept, and they provide considerable flexibility to the mil/aero equipment provider in terms of systems that can be built. These systems are defined around a chassis with multiple switch fabric options, with large systems generally accommodating 14 card slots. ATCA guidelines about the use of power and cooling include a 200W per slot maximum and a 48V DC power requirement, and while not required, systems generally have multiple units, allowing for field replacement without taking a system out of service during deployment.

A fundamental concept is the base fabric, which provides a dual star Gigabit Ethernet interconnection mechanism between all blades in a system (Figure 2). This enables two switch modules to be placed in a system, with up to 12 payload blades and with every blade interconnected via each of the switch blades, providing an inherently redundant system. The base fabric is typically used for control traffic within the system itself.

Payload traffic is generally carried on the data fabric. The PICMG specifications allow for a range of options in this area, including a dual star approach and full mesh interconnectivity, with a broad

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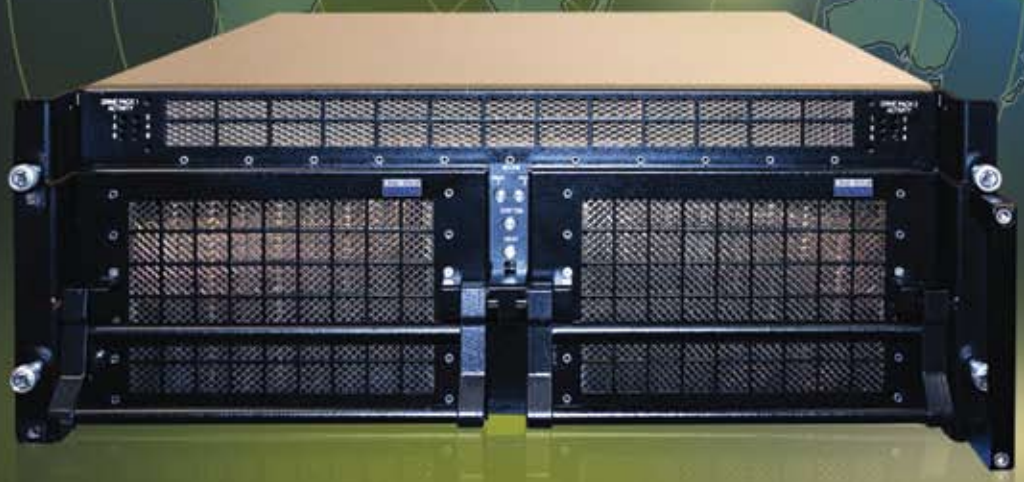

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range of transport technology options. The industry has consolidated around a dual star topology with Ethernet as the preferred interconnection mechanism, although some special applications use alternatives, such as Serial Rapid IO. The commercial industry is now in its third and fourth generations of systems; thus, a robust ecosystem now exists where many of the interworking issues among multiple manufacturers have been resolved. The current data fabric standard is 10 Gbit/ss with 40 Gbit/s data fabric systems starting to appear.

Separate Fabrics for Control and Payload

The use of separate fabrics for internal control and payload applications enables system designers to provide increased predictability of performance. Configuration, management and SA monitoring can be carried over the base fabric and there is no fear that sudden high-payload activity on the data fabric will inadvertently disrupt internal operation or accidentally trigger a service availability failover event. Similarly, the data fabric traffic is not subject to sudden spikes in system control traffic, which may affect application performance. In the case of the NADIN system and the missile control example, such factors could be critical.

However, a robust open hardware system only addresses part of the service availability issue. With the capability to install multiple applications with a wide variety of requirements in a single ATCA system, it is really the service availability middleware that ties the system together, enabling systems designers to take full advantage of the underlying hardware flexibility.

The Service Availability Forum (SA Forum) was founded in 2001 to address the issues of defining services and application programming interfaces for an open specification approach to continuous hardware and software operation. The concept of the SA Forum specifications is to create abstractions between the underlying hardware and the application environment to support standards-based SA middleware implementations. Since inception, the SA Forum has created a critical mass of specifications for service availability. The robust offerings include the Hardware Platform Interface (HPI), which abstracts the hardware from management middleware and makes each independent of the other, as well as the Application Interface Specification (AIS), which standardizes the interface between SA Forum-compliant, high-availability (HA) middleware and service applications (Figure 3).

Abstracting Low-Level Hardware Info

HPI is used to abstract low-level information from hardware so that it can be accessed and programmed through common interfaces. This enables applications directly accessing hardware functions and receiving hardware events to run on multiple platforms with minimal modification. Indeed, HPI is now implemented in many commercial and proprietary platforms and

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is viewed as a market success. HPI exposes a set of platform-defined management instruments and through the HPI interface, the various instruments can be read and configured. Common application triggers, such as voltage drops or watchdog timer expirations, constitute failure "events," which serve as inputs to AIS high-availability middleware. The specifications also allow for instrument grouping to create resource records that can then be further subdivided into domains with a common set of capabilities.

AIS is significantly more sophisticated as it provides the set of services necessary to support highly available software applications. All HA middleware implements most or all of these services, as they are fundamentally necessary for an "always on" system. What is different is the layered approach and open forum collaboration to create application- and platform-agnostic architectural models with a rich set of APIs. The AIS specification includes a set of core services, such as checkpointing, cluster management, event handling, etc., which are the necessary underpinnings for any system. Additionally, and perhaps where the SA Forum has brought the most value, services and frameworks provide standardized mechanisms for managing an integrated SA environment through an availability management framework, along with a standard mechanism to manage an overall environment, including both hardware, through HPI, and software. The most recent additions complete the core services with a software management framework, enabling seamless upgrade and downgrade campaigns to be implemented.

Portability across Multiple Systems

It is important to remember that AIS does not dictate how an application should be written; rather, it provides a set of interfaces and capabilities to create applications in a service available system. AIS is driven and configured by its application environment, and it is the common approach to the middleware that enables rapid portability across multiple systems and between multiple applications.

With the increasing use of AdvancedTCA and the rise of SA Forum middleware implementations in mil/aero applications, the HPI and AIS specifications are in turn increasingly being adopted by the mil/aero industry. A number of defense implementations using AIS have appeared in the last 2-3 years. The U.S. Navy has adopted the SA Forum AIS specification as the core of its high-availability requirements for its objective architecture efforts to create commonality and reuse across combat systems.

In early 2010, SA Forum member company GoAhead Software announced partnering with Global Technical Systems (GTS) and Northrop Grumman (NGC) to support the Navy's Common Processing System program. The SA aspects of the system are based on SA Forum specifications and integrate GoAhead's SAFfire solution, ensuring continuous service of warfighter systems without loss of service or data. Pre-SA Forum versions of

GoAhead's software, Self-Reliant, have already been deployed through Lockheed Martin's work on the LCS COMBATSS-21 combat system, and with the Royal Australian Navy for installation of the Aeigis system aboard the Australian Hobart-class air warfare destroyers.

The next generation of SA middleware is taking shape through the OpenSAF open source project. This project was formally launched in early 2008 and has since gathered significant industry backing. GoAhead Software has embraced this industry move and announced a commercial distribution of OpenSAF: OpenSAFfire. This includes contribution of many of the key concepts of its SAFfire and Self-Reliant products to the project to enhance the code base. The upcoming release 4.0 of OpenSAF incorporates the latest specifications from the SA Forum in a highly modular architecture, which is expected to form the basis for next-generation implementations, and the migration of existing applications into an open SA environment.

Building Block Ecosystem Approach

It is important to understand that open specifications provide key benefits in building and creating service available systems in the diverse application areas of military and aerospace. The building block ecosystem approach of AdvancedTCA and the SA Forum specifications enables system designers to leverage the commercial ecosystem, yet provide their own value-add and expertise in specific areas without having to design the whole system. This not only leads to cost-effective and more rapid development timeframes, but enables system upgrades as new generations of blades appear based on the latest technology. With a common SA infrastructure based on SA Forum specifications, applications can be ported, combined and updated in a much more seamless manner. With a common system infrastructure, the management of many aspects of these systems can be aligned, saving time, money and reducing the need for specialized training on all aspects of each individual system.

As network-centric defense operations continue to evolve and increase in importance, the complexity of next-generation systems could produce a myriad of unforeseen outages across diverse applications. It is expected that the requirements for five-nines service availability and higher, along with increased usage of commercial systems and open specifications building blocks, will continue to grow in the military and aerospace segments. AdvancedTCA and the SA Forum specifications are key elements in the effective use of commercial ecosystems for service availability. The resulting enhancement of system transparency and reliability will eliminate the dramatic outages and confusion about their causes and offer cost and time saving benefits. ■

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David French, Military and Aerospace Director
Alan Baldus, Field Application Engineer
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Broad new military initiatives such as the U.S. Navy's (CANES) Consolidated Afloat Networks and Enterprise Servers, Brigade Combat Team Modernization, (JTRS) Joint Tactical Radio System and (WIN-T) War fighter Information Network-Tactical (Figure 1) are bringing greater levels of networking capabilities to various deployed and ground command units. Complex network-centric systems that meet a diverse set of application requirements support these evolving programs and at the same time must meet the military's mandates for security, mobility, flexibility and ruggedness.

When weighing the options for an embedded computing solution, it is typically an application's size, weight and power (SWaP) requirements that continue to be a deciding factor in selecting an optimum platform. However, designers of network-centric applications for command and control now have expanded demands for higher computing performance, system throughput, high availability and a greater need for larger memory capacities and more sophisticated signal processing, all delivered in an open and standardized COTS form factor. While tried and true embedded computing platforms such as VME and CompactPCI remain attractive for many military communications applications, system designers have started to focus on standards-based AdvancedTCA and MicroTCA platforms that have been well proven in the communications market for these new network-oriented military programs.

Overlapping Telecom and Military Needs

The open modular computing specifications from PICMG for AdvancedTCA and MicroTCA were specifically designed for the demanding telecommunications market and are integrated with a long list of leading-edge features and server class performance that are well positioned to meet the military's broader requirements for networking applications. Both platforms are designed to provide reliable

Figure 1

Soldiers from the Training and Doctrine Command (TRADOC) Capabilities Manager Networks and Services examine WIN-T equipment during the WIN-T Increment Two Engineering Field Test at Fort Huachcuca, Ariz. last December.

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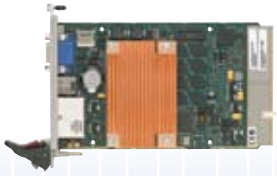

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performance while reducing development and operational costs. This design architecture allows for the high-performance operations and expanded communication capabilities needed for the military's diverse operational needs, particularly when higher performance is required. With their proven combination of performance and reliability, each has found a place in network-centric military applications, bringing distinct advantages depending upon program specifications.

MicroTCA has a small form factor advantage over both VME and CompactPCI including their derivatives VITA 31, VITA 41, VITA 46 and PICMG 2.16. MicroTCA blades are smaller and use less power, yet they can still deliver more communication bandwidth and higher computational abilities by using multiple processors on a single backplane. VME or CompactPCI designs can match this performance in 6U, but fall short when modified to 3U. And at 2U x 3-6HP x 183.5 mm, MicroTCA may be one of the larger small form factors, but is still more compact than 3U VME or CompactPCI.

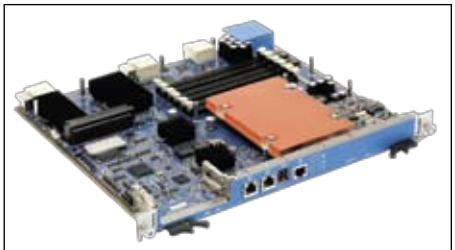

Figure 2

The AT8060 is a drop-in compatible Intel Xeon 32 nm, 6-core AdvancedTCA node Blade.

A Compelling Case for xTCA

AdvancedMCs together with AdvancedTCA and MicroTCA have been defined by market research company VDC as the xTCA architecture. All are the result of current and expanding PICMG specifications and have demonstrated their worth as more than viable solutions for next-generation systems. Of specific importance to the risk-adverse military market, xTCA platforms have been proven for more than six years in the telecommunications industry. This sustained continuity of deployed technology fits the demands of military systems. Not only is xTCA a mature, readily available architecture that touts broad industry adoption, but it offers a diverse ecosystem of hardware, software and design resources to support it. This comprehensive ecosystem ensures that innovation remains high, and the list of industry-leading suppliers that support life cycle and logistics help keep costs down.

In addition, the ability to leverage an established and modular standards-based COTS platform simplifies the design pro-

cess for developers aiding design flexibility and interoperability while helping system architects meet application specifications, decrease development time and reduce operational costs. With these demands fulfilled, military suppliers are better able to satisfy tighter time-to-market schedules with less risk. AdvancedTCA, in particular, has been widely adapted due in large part to its sustainable interoperability demonstrated in more than six years of deployments.

Ongoing PICMG Work

PICMG is a consortium of companies who collaboratively develop open specifications. For the xTCA architecture, this group has combined all the best features of proprietary architectures and other standards to initially meet the high-density, reliability, availability and serviceability needs of the telecommunications industry. Military system suppliers are confronting many of the same challenges faced by Network Equipment Providers. Designed for NEBS Level 3 requirements for ruggedization, these xTCA platforms address similar military requirements for extended thermal management, fire suppression, electromagnetic compatibility and the ability to continue working during extended mechanical environmental conditions such as shock and vibration. Military designers can be assured that these platforms are rugged enough for many ground installations and widebody airborne applications.

PICMG is also working on an extension of the base MicroTCA specification to MTCA.3. MicroTCA.3 will standardize a conduction-cooled build grade allowing AdvancedMCs to meet ANSI/VITA 47's most extreme thermal, shock and vibration profiles. This would then allow reliable performance in conduction-cooled system applications for ground mobile and other airborne environments. Independent third-party tests currently being conducted have proven MicroTCA will qualify to these environments offering systems designers another high-performance option for future military embedded designs. Already adopted ruggedized specifications for MicroTCA include rugged air-cooled MicroTCA (MTCA.1) and a hardened MicroTCA for military applications (MTCA.2). Table 1 summarizes the timeline of these PICMG spec efforts.

Figure 3

ATCA is being evaluated for integration into airborne applications on widebody aircraft such as AWACS. The E-3 Sentry is a modified Airborne Warning and Control System (AWACS) Boeing 707/320 commercial airframe with a rotating radar dome.

MicroTCA Specification Timeline

MTCA.0	MicroTCA	R1.0	6-Jul-06	Adopted	Define a system architecture that uses AdvancedMC mezzanine cards plugged directly into a backplane without modifications
MTCA.1	Air-Cooled Rugged MicroTCA	R1.0	19-Mar-09	Adopted	Ruggedized version of MicroTCA for exterior and mobile communications applications
MTCA.2	Hardened Air-Cooled MicroTCA			Under Development	Expand the market for MicroTCA into commercial and military ruggedized applications
MTCA.3	Hardened Conduction-Cooled MicroTCA			Under Development	

Table 1

MicroTCA ruggedization efforts include independent third-party tests and work within PICMG committees.

AMCs Smooth the Way

AdvancedMCs provide flexibility to AdvancedTCA platforms by giving developers the ability to add specific features or functions as mezzanines. AdvancedMC's usage has broadened, however, from its original purpose modules as a mezzanine-only building block to an AdvancedTCA Blade or system. In a more recent usage model in MicroTCA platforms, AdvancedMCs provide full-scale PCI Express, 1 and 10 Gigabit Ethernet or serial Rapid IO (s-RIO) infrastructure. This new usage model provides a lower-cost backplane and enclosure solution with the same basic features of the PICMG3.x in a smaller footprint.

From a technology perspective, xTCA utilizes multicore processors for the intensive computing performance needed for networking and hosting a variety of applications. In fact, an AdvancedTCA Blades, featuring a new six-core processor can deliver up to 10 times the throughput with an Intel Xeon processor at 2.56 gigabytes per second when compared to other legacy standards and represents a threefold increase in bandwidth over previous processor generations.

For example, the WIN-T program leverages these proven xTCA telecommunication industry functions such as interconnects, high availability and software protocol stacks. AdvancedTCA and MicroTCA platforms offer ideal native support of Internet protocol-based network topologies found in the network-centric nature of WIN-T. In particular, the secure network approach to warfare is an ideal fit for the features of the AdvancedTCA and MicroTCA platforms, characterized by high processing capacity, extremely high communication bandwidth and high availability.

Cost pressures and time to deploy challenges in the defense electronics market are driving system designers to leverage commercial products and technologies for their next-generation platforms. Old stovepiped solutions are giving way to open-standard, COTS solutions, which can deliver on all the important demands requirements for next-generation military deployments. Proprietary platforms simply cannot sustain the military's crucial need for more performance, high reliability, ruggedness, interoperability and demonstrated product longevity.

Leading-Edge xTCA Platforms

Today's xTCA platforms take advantage of highly integrated processor architectures and updated chipsets to achieve higher computing density and deliver better power-to-performance ratios. This architecture advantage ensures technical leadership and the highest level of security for the continued advancement of our modernized military operations. Leveraging more I/O per slot, accelerating I/O traffic and lower CPU utilization in both native and virtualized environments are vitally important for next-generation military networks. The xTCA architecture and platform chipsets can support up to 36 lanes of PCI Express and directly assignable I/O for virtualization. Virtualization will be a key technology to boost operating system and network utilization without increasing system costs, and enable cross domain and secure applications to leverage common computing platforms.

Additional xTCA platform features are available to ensure interoperability, reliability and network functionality. These include full IPMI and supervisory

remote control capabilities with power on-off, clean shutdown, warm reset/cold reset controls via any IPMI channel including LAN even when the payload power is off. For the applications that can allow removable storage, the option exists to have a rear transition module built with a SAS controller or an AdvancedMC module that can support a hot swappable SAS/SATA storage.

Maximizing Memory

Another significant benefit of the AdvancedTCA architecture is that it allows maximum use of available memory—much more than other platforms, with today's boards supporting up to 48 Gbyte DDR3. Scalability is also enhanced with simplified upgrades that enable the exchange of existing node blades without having to upgrade the chassis platforms.

The most sophisticated AdvancedTCA boards today are PICMG 3.1 Option 9, Option 2 compliant. An example of a high-performance AdvancedTCA board is the Kontron AT8050. It features outstanding performance with 10 + 10 Gbit Ethernet on the fabric interface, plus two 10/100/1000 Mbit/s Ethernet on the base interface and two 10/100/1000 Mbit/s Ethernet via the front panel or RTM. In addition, the Kontron AT8050 (Figure 2) is a single-socket processor blade and, as opposed to a dual socket approach, enables designers to make use of the one available AdvancedMC slot for further feature extensions.

xTCA Finds a Niche in Military Applications

The case has definitely been made for the compelling advantages of integrating proven xTCA COTS platforms into defense network-centric military command, control, communications and computing systems. xTCA provides an optimal embedded computing platform able to meet the military's high-reliability, high-performance, life cycle management and sustainable technology requirements.

The flexibility of the architecture enables a wide range of applications along with helping suppliers meet strict program completion goals. Suppliers are already evaluating AdvancedTCA platforms for integration into airborne applications on widebody aircraft such as P8, AWACS (Figure 3) and AEW&C; ground deployable command and control and combat operations, as well as in shipboard network enterprise computing systems. Designers have found that xTCA's leading-edge features and server class performance are well positioned as a viable upgrade path for a growing list of evolving initiatives. ▮▮

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Role of the Military Battery: Lightening the Load

Soldier-worn electronic gear and small UAVs are pushing the envelope in their demand for high energy density. That calls for batteries that offer top notch performance at smaller sizes and weights.

Eric Lind, V.P. Business Development
Contour Energy Systems

There are a number of advantages to having a battery with a higher energy density—for the soldiers on the ground and the unmanned aerial vehicles overhead during any mission. Higher energy density lets them extend missions, be more agile and go further into the field. It's important to understand how energy density—both gravimetric and volumetric—plays a role in such systems and how existing primary lithium batteries stack up in different military applications. Primary batteries do and will continue to play a vital role in actual missions. The exclusive focus on primary batteries here is not meant to diminish the growing importance of rechargeable batteries; rather it is to limit the scope of the topic to one that can be covered in sufficient depth.

The burden on today's soldier to carry an increasing amount of high-tech equipment, such as advanced soldier systems, next-generation radios and imaging and sensing systems, is great and growing. The Future Force Warrior will be asked to bear an even greater burden. The batteries needed to power all of this equipment already constitute too high a percentage of the total weight. And because the batteries must last for an entire mission, soldiers often need to carry spares (or a charging system when rechargeable batteries are used).

Figure 1

U.S. Army soldier flies the Honeywell Gas Micro Air Vehicle UAV system at Camp Taji last year. This was the unit's first use of the UAV from outside the wire on a combat mission.

A similar situation exists for a small or micro unmanned aircraft system (UAV) (Figure 1) where the battery needs to power the motor, controls, radio and imaging equipment. As with the soldier, the battery must last the full duration of the mission. The allowable weight for the battery typically limits today's mission duration to between 30 minutes and two hours.

Lighter Is Better

The solution to these limitations is a lighter battery. By doubling the energy density, the weight of the battery pack needed for a mission of any given dura-

tion can be cut in half, which would allow the soldier or UAV to carry other equipment or systems. Alternatively, the same size and weight in battery pack(s) with double the energy density could double any mission's duration. This would be particularly valuable in remote reconnaissance and surveillance, and target acquisition missions, where being aloft longer may make the difference between success and failure.

Doubling the energy density is, of course, far easier said than done. Commercial off-the-shelf batteries that employ a variety of different technologies are readily available. The two types that are most popular in military applications today are Lithium/Sulfur Dioxide (Li/SO_2) and Lithium/Manganese Dioxide (Li/MnO_2). While these batteries have similar energy densities of 200-250 watt-hours/kilogram (Wh/kg), volumetric energy densities are 350-450 watt-hours/liter (Wh/l) and 500-650 Wh/l, respectively. Note that because energy densities vary with the different form factors used for different applications, the ranges used here depict typical values for cells in applications requiring moderate to high rates of discharge.

When Weight Is an Issue

In applications where the weight is a significant design consideration, Sulfur Dioxide and Manganese Dioxide batteries have similar gravimetric energy density. Despite these similarities, Manganese Dioxide batteries are increasingly preferred, owing to their enhanced safety over pressurized Sulfur Dioxide batteries. In applications where the space available for the battery is limited, however, Manganese Dioxide batteries have a greater advantage with their 40% improvement in volumetric energy density.

In a BA-5X90/U battery pack, for example, Manganese Dioxide's increased volumetric energy density delivers about 11.5 amp-hours (Ah) of service compared to about 7.5 Ah with Sulfur Dioxide. But the problem remains: the 11.5 Ah battery in this example is significantly heavier than the 7.5 Ah battery because Manganese Dioxide's gravimetric energy density is relatively the same as Sulfur Dioxide.

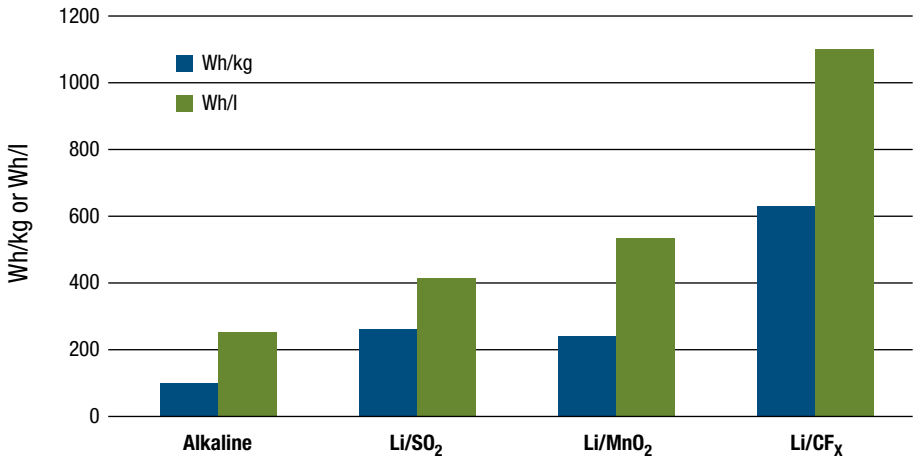

Figure 2

This comparison of both gravimetric and volumetric energy densities for four different types of chemistry systems demonstrates the significant advantage Carbon Fluoride has over both Sulfur Dioxide and Manganese Dioxide. For comparison, energy densities are also shown for primary alkaline batteries.

The military has looked at other lithium-based systems and are investigating a Lithium/Polycarbon Monofluoride (Li/$(CF)_n$)system as a potential next-generation solution. While the military likes the potential advantages in gravimetric and volumetric energy density (350 Wh/kg and 700 Wh/l), there are some significant disadvantages. First, these systems typically have a low power density, so changes need to be made to satisfy device power requirements. Additionally, low temperature performance of these Polycarbon Monofluoride systems is poor and show start-up related issues at these low temperatures. Finally, the costs of these systems are relatively high and therefore do not satisfy the cost per unit of energy for these other systems.

Advanced Lithium/Carbon Fluoride Batteries

In the never-ending quest for a better battery, a new technology has emerged as an off-shoot of the Lithium Polycarbon Monofluoride systems: Lithium/Carbon Fluoride (Li/CFX). Carbon Fluoride not only has higher gravimetric and volumetric energy densities of >700 Wh/kg and 700-1000 Wh/l, respectively, it also shows promise in satisfying the demand for ever-increasing improvements in price/performance, shelf life, service life, durability, safety and environmental impact.

This advanced Carbon Fluoride battery maintains the benefits of high energy and power densities, wide operating temperature range and long shelf life found in Sulfur Dioxide batteries, while employing a solid cathode (with no heavy metals or other toxic materials) to eliminate the safety and environmental concerns. In addition, the advanced CFx battery possesses none of the operational problems exhibited by some other batteries, such as passivation.

The biggest advantage of Carbon Fluoride technology is the significant improvement in both gravimetric and volumetric energy densities. Because this technology is new, it is only now being commercialized. But as shown in Figure 2, the gravimetric and volumetric energy density improvements may be even greater in some configurations than the conservative estimates provided above.

Extending UAV Mission Life

In the BA-5X90/U battery pack example cited above, a Carbon Fluoride version of this popular battery should be able to deliver 16 Ah of operation—perhaps even more—while weighing less than the Sulfur Dioxide version. This greater than 50 percent improvement in service life could extend a UAV mission by more than an hour, and eliminate

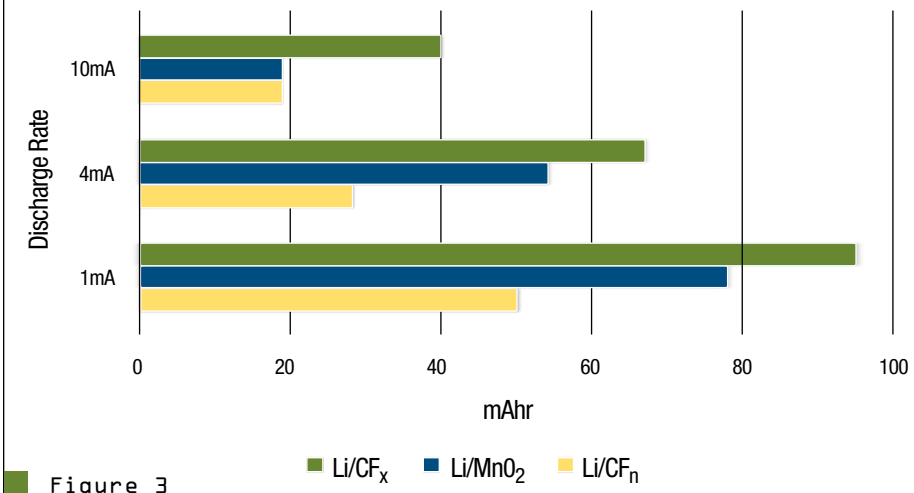

Figure 3

These test results of available capacity at three different rates of discharge (to 2.0V) for three different 2016 coin cells quantify the Carbon Fluoride battery's improvements in power density at low, moderate and high discharge rates.

the need for soldiers to carry spares on a three-day mission.

An additional major advantage of the advanced Carbon Fluoride battery is its ability to exceed all others in both power density and maximum safe current draw. Laboratory tests (Figure 3) have demonstrated up to an eight times improvement in high-current applications, and a nearly two-times improvement in low-current applications. This makes the advanced CFx battery particularly well suited for applications that require high sustained or pulse currents.

Like the other lithium-based primary batteries, Carbon Fluoride batteries can be packaged in a variety of form factors, including coin, cell, film or prismatic. This enables CFx batteries to accommodate both standard sizes and customized packs, which may combine cells in series and/or parallel to satisfy specific needs for operation in the typical military range of 6-24 volts.

Other Important Considerations

How does the Carbon Fluoride battery stack up against other battery types in other respects? Figure 4 provides a comparison summary for the four types covered here, as well as for Lithium/Thionyl Chloride ($Li/SOCl_2$). The use of only solid materials and a nontoxic electrolyte makes Carbon Fluoride batteries far safer than Sulfur Dioxide batteries, especially in those applications that draw a high,

sustained current where Sulfur Dioxide batteries might overheat and fail. Solid materials eliminate the need for pressurized cans that can vent or leak corrosive or noxious gases, making Carbon Fluoride batteries safe even when mishandled or damaged, or when subjected to a short circuit condition. This is obviously a particular concern for the soldier, but even the batteries used in weapons and unmanned vehicles must still be handled during transport and replacement.

	Li/MnO_2	Li/SO_2	$Li/SOCl_2$	$Li/(CF)_n$	Li/CF_x
Gravimetric Energy Density (Wh/kg)	200-250	240-280	250-400	300-400	>600
Volumetric Energy Density (Wh/l)	500-650	350-450	600-900	600-800	700-1000
Temperature Range (°C)	-20 to 60	-55 to 70	-55 to 150	-20 to 60	-60 to 160
Typical Shelf Life (Years)	5-10	10	15-20	15	15
Safe (High-rate Discharge)	Yes	No	No	Yes	Yes
Environmental Impact	Moderate	High	High	Moderate	Moderate
Relative Price/Performance	Fair	Good	Fair	Poor	Good

Figure 4

Shown here is a comparison summary for six types of battery chemistries.

Temperature Concerns

Operating temperature range is not a factor for the soldier, but can be for weapon and surveillance systems. And here, too, Carbon Fluoride has made improvements over both Manganese Dioxide and Sulfur Dioxide. Indeed, the operating temperature range of Carbon Fluoride batteries far exceeds the requirements of today's military applications.

With its higher gravimetric and volumetric energy densities, Carbon Fluoride batteries will provide a longer service life than both Manganese Dioxide and Sulfur Dioxide batteries. Just as significantly, Carbon Fluoride batteries also afford a longer shelf life—up to 50 percent longer than either Manganese Dioxide or Sulfur Dioxide batteries.

Is Lithium/Carbon Fluoride a better battery? Whether for the soldier on the ground or the unmanned aerial vehicle overhead, the higher energy density and other advantages do make CFx a much better battery. Does it cost more? Yes, at least until production ramps up and economies of scale kick in. But considering its higher energy density, Carbon Fluoride already enjoys a significant price/performance advantage today. ▮▮

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Technology Focus

FPGA Processing Boards

FPGA Boards Rev Up for Signal Processing Duties

FPGA processing and I/O boards are fueling new capabilities for signal processing-intensive military applications.

Jeff Child,
Editor-in-Chief

Military applications like sonar, radar, SIGINT and software radio—all of which rely on heavy amounts of waveform processing—continue to leverage advances in FPGA technology. Faster FPGA-based DSP capabilities combined with an expanding array of IP cores and development tools for FPGAs are enabling new system architectures. As FPGAs evolve to ever greater sophistication, complete systems can now be integrated into one or more FPGAs. Using those FPGAs, board-level subsystems are able to quickly acquire and process massive amounts of data in real time.

Board-level product developers continue to create powerful compute engines that perform signal processing computation on the FPGAs themselves. At the same time, FPGAs are enabling a new class of I/O board solution that enables users to customize their I/O as well as do I/O-specific processing functions. The product roundup here shows a representative sample of FPGA processing boards on a variety of embedded form factors—including PMC, PCI Express, XMC, VME/VXS, VPX, CompactPCI and FMC.

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

An example radar system that's shifted toward FPGA technology is Lockheed Martin's AN/SPY-1—a passive electronically scanned system that is part of the Aegis combat system (Figure 1). AN/SPY-1 is computer controlled, using four complementary antennas in order to provide full 360 degree coverage. The Multi-Mission Signal Processor (MMSP) for the SPY-1 radar receives signals that are down converted from S-band and digitized. The digitized signals are processed by FPGA modules and Power PC boards, pulse compression is done in the FPGAs, and subsequent processing is done in the Power PC modules.

On the I/O side, FPGAs have become an ideal way to combine multiple I/O functions and their associated conversion and processing functions on the FPGA. Providing a platform for this approach, a VITA form factor spec was formed called VITA 57, the FPGA Mezzanine Card (FMC) specification. The spec defines an I/O mezzanine module designed to work intimately with an FPGA. FMC modules enable I/O devices that reside on an industry standard (VITA 57) mezzanine card to be attached to and directly controlled by FPGAs that reside on a host board. About half the size of a PMC mezzanine module, FMCs provide a small footprint, reduced I/O bottlenecks, increased flexibility, and reduced cost through the elimination of redundant interfaces.

Last month VITA members launched the FMC Marketing Alliance. The Alliance is responsible for promoting the capabilities of the FMC specification and educating, training, informing and promoting FMC use. Last month also saw some updates to the FMC standard. The revision adds support for a wider range of applications that harness high-speed serial interfaces including high-resolution imaging and JEDEC JESD204A-based data converters.

Figure 1

The guided-missile cruiser USS Lake Erie (CG-70) sports AN/SPY-1 radar antennas on the front and starboard side of its superstructure.

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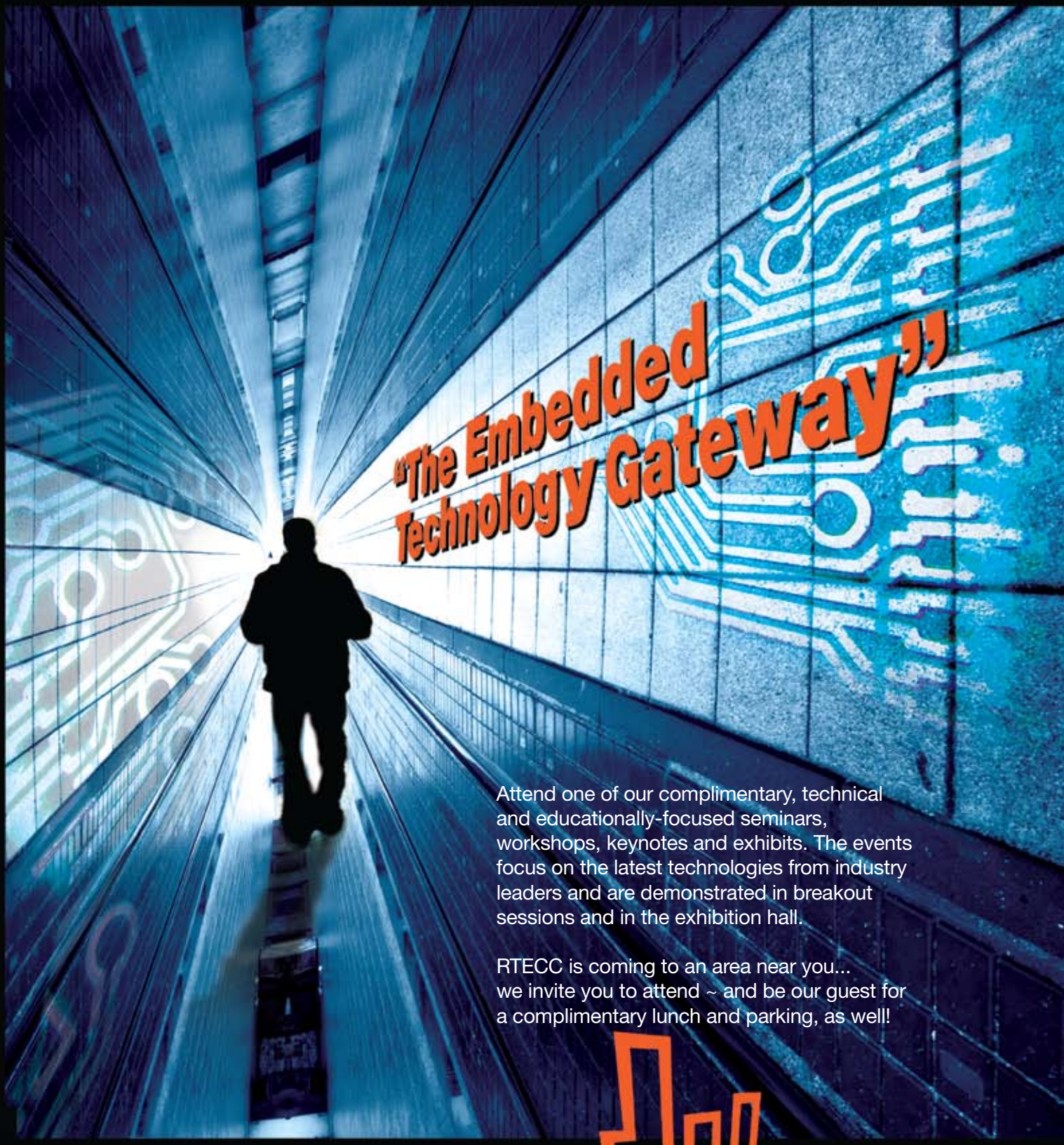

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Technology Focus:
FPGA Processing Boards Roundup

Virtex-5 FPGA PMC Aims at I/O Processing

At one time FPGAs served merely as glue logic interfaces. Now they function as complete processing engines. Acromag's PMC-VFX modules feature a Xilinx Virtex-5 FPGA with a hard core PowerPC block that is reconfigurable for high-performance I/O processing and user-developed computing applications. Now users can offload CPU-intensive operations such as video/3D data processing or floating-point math for superior system performance. For fast data transfer in and out of the FPGA, the PMC-VFX provides large banks of DDR2 DRAM and dual-port SRAM for high-speed DMA transfer to the PCI bus. The PMC base

card provides 64 I/O channels or 32 LVDS lines accessible via P4 rear connectors. Inserting optional front-connecting AXM I/O extension modules augments I/O processing capabilities with an efficient interface for 16-bit 105 MHz A/D conversion, CMOS digital I/O, RS-485 differential signals, or extra LVDS I/O lines. Typical uses include processing of video, 3D data, radar/sonar, software-defined radio, electronic warfare, floating-point math and fuzzy logic algorithms.

A high-throughput PCI-X interface ensures plenty of bandwidth to rapidly move data. An assortment of plug-in I/O extension modules offers great flexibility to interface various analog and digital I/O signal types. By streamlining the design and limiting the features to core functions needed for fast and easy implementation, Acromag makes FPGA-based computing accessible to many more applications. Boards start at $4,950 with extended temperature (-40° to 85°C) and conduction-cooled models available.

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

PCIe FPGA Processing Boards Boast Rich I/O Options

Military applications such as radar, SIGINT, software radio, image processing and encryption all have something in common: they all have a big appetite for FPGA-based processing. Serving those needs, Annapolis Micro Systems offers its WILDSTAR-5-for-PCI-E Xilinx FPGA-based processing boards, using Xilinx's Virtex-5 FPGAs. Available with

a variety of Virtex-5 Xilinx choices—including XC5VLX110T, XC5VLX155T, XC5VLX220T, XC5VLX330T, XC5VFX100T, XC5VFX130T, XC5VFX200T, or XC5SX240T—the boards offer a choice of DDRII DRAM, DDRII SRAM, QDRII SRAM, SIO RLDRAM, or CIO RLDRAM. With up to 16 Rocket I/O Lanes and up to 96 Differential Pairs providing easy and fast access to the one or two mezzanine I/O cards, and DMA across the PCI Express bus back to the host, Annapolis has the fastest, widest and most encompassing range of analog to digital, digital to analog and communication solutions.

The WILDSTAR family provides faster performance, more processing power per slot, more efficient power and thermal management, and lower cost per performance. The family includes Industrial, Rugged and Conduction-Cooled versions, and uses the latest more powerful backplanes, like PCI-X, PCI Express, VXS and the IBM Blade Chasssis. Very high-speed data movement into, through and out of the system is supported with industry standard InfiniBand, 10G Ethernet, Rocket I/O and Serial FPDP.

Annapolis Micro Systems Inc
Annapolis, MD.
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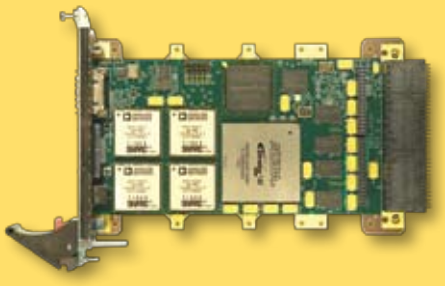
[www.annapmicro.com].

3U VPX Board Blends FPGA and TigerSHARC DSP

FPGAs and DSPs have different strengths when it comes to the signal processing muscle they provide. BittWare has brought together the best of those worlds with a hybrid system sporting both a high-end FPGA and the TigerSHARC DSP with the release of the GT-3U-VPX (GT3X) board. The GT3X features a large Altera Stratix II GX FPGA and one cluster of four ADSP-TS201S TigerSHARC processors from Analog Devices. The front panel provides high-speed SerDes, 10/100 Ethernet and RS-232; and the extensive back panel interface



supports PCI Express, Serial RapidIO, GigE and 10 GigE. The GT3X can achieve simultaneous onboard and off-board data transfers at rates exceeding 2 Gbytes/s via BittWare's ATLANTiS FrameWork implemented in the Stratix II GX FPGA.

The GT3X provides a hybrid signal processing architecture that takes advantage of both FPGA and DSP technology, creating a complete solution for applications requiring flexibility and adaptability along with high-end signal processing, all on a ruggedizable platform.

BittWare
Concord, NH.
(603) 226-0404.
[www.bittware.com].

Rugged XMC Does FPGA-Based Video Capture

A new rugged, high-resolution frame grabber and video capture XMC (VITA 42.3) card delivers high-resolution analog and digital video capture functionality and advanced serial connectivity. The XMC-270 from Curtiss-Wright Controls Embedded Computing also features a built-in PCI Express core to provide

high-performance video and image storage. Extra functionality and customizability is provided through an advanced Xilinx Virtex-5 FPGA. The XMC-270 simplifies and speeds the integration of high-end image and video capture functionality into embedded COTS systems designed for use in harsh environments.

Available in both air- and conduction-cooled versions, the XMC-270 supports high-resolution digital and analog video formats, including legacy interlaced analog video. The card can transfer raw video data in a wide variety of color depths including 8-bit YCbCr (BT.656-4), 32-bit RGB8888 (with Alpha), 16-bit RGB565 and 8-bit Mono (green only). It provides a comprehensive range of video capture features including full frame rate, reduced frame rate (user programmable) and snap shot. The XMC-270 supports a wide range of video capture functionality including six independent NTSC/PAL/RS170 CVBS/S-Video inputs, two independent DVI (TMDS) inputs and two independent RGB HV/SoG inputs. XMC-270 performance features include an x8 PCI Express interface, video integrity monitoring for video freeze detection on DVI channels, thermal sensor, and is available in a range of air- and conduction-cooled ruggedization levels. Price of the XMC-270 begins at $5,683.

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Embedded Computing
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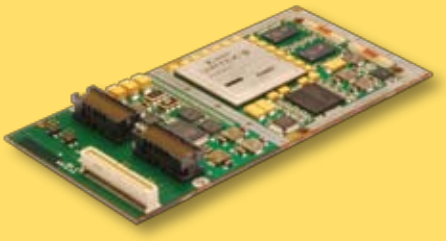
[www.cwcembedded.com].

Rugged FPGA XMC Serves SIGINT Needs

In demanding signal processing applications, many customers are turning to FPGA technology because of the flexibility and performance it brings. The XMCV5, an XMC mezzanine card from GE Fanuc Intelligent Platforms, is designed for a wide spectrum of digital signal processing (DSP) applications in ground mobile, airborne fixed and rotary wing and naval applications including radar, sonar, signals intelligence (SIGINT) and image processing.

The card lets developers choose from a selection of three Xilinx Virtex-5 FPGAs. The



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

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

3U cPCI Card Serves Up FPGA and Atom CPU

FPGAs are now powerful enough to be used alongside general-purpose CPUs as coprocessors. MEN Micro offers a 3U CompactPCI SBC that combines low-power Intel Atom XL processors with an onboard FPGA for user-defined functions, the first SBC available to offer this capability. Depending on the application, the board can be equipped with various 45 nm-based Intel Atom XL processors, which offer a maximum power dissipation of

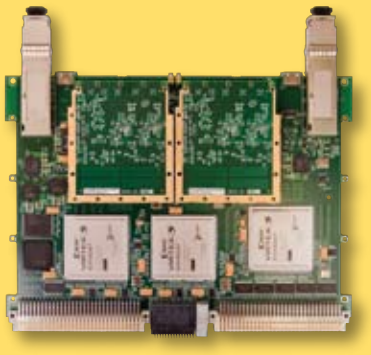
7W at a speed of up to 1.6 GHz. The board's specially designed heat sink enables operation across an extended -40° to +85°C (-40° to +185°F) temperature range. The board's standard front I/O includes a COM interface via a D-Sub connector as well as two USB 2.0 ports, graphics via VGA or UXGA and a PS/2 interface for a keyboard or a mouse. Further interfaces include a Gigabit Ethernet slot via PCI Express x1 and an FPGA-based Fast Ethernet slot on the RJ45 connectors.

The onboard FPGA also allows for customer-specific interfaces, such as serial interfaces, CAN bus, binary I/O, protocol converters or touch controllers to suit a user's specific application. The F11S can accommodate up to three SA-Adapters for additional I/O. The memory configuration contributes to the board's flexibility with the incorporation of up to 2 Gbytes of soldered DDR2 SDRAM, 2 Mbytes of non-volatile SRAM, a CompactFlash card and a microSD card slot in addition to the 512 Kbyte of L2 cache integrated in the processor. Pricing for the F11S starts at $1,443.

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

VXS Digital Receiver Boards Sport Three FPGAs

FPGAs are a critical technology for today's sensor data processing applications. Feeding such needs, Mercury Computer Systems has announced two Echotek Series products, both using three Xilinx Virtex-5 FPGA processors, two high-speed fiber transceivers and two FPGA Mezzanine Card (FMC) sites for high-bandwidth I/O. As integrated components, they



extend the functional range of Mercury's VXS and RACE++ Series systems with digitization and FPGA processing of sensor-based data streams.

The new Echotek Series DCM-V5-VXS digital receiver features the latest in A/D and D/A technology via converters mounted on the FMC sites, allowing for high-speed/high-resolution data conversion while still preserving the quality of the original signal. The module couples this data conversion capability with market-leading processing power delivered by a set of three Virtex-5 SX240T or LX330T FPGAs, which can be programmed by the end user for customer-specific application features. Moreover, these FPGA processors provide up to 3,156 DSP slices. Each Virtex-5 FPGA is accompanied by both DDR-II-SDRAM and QDR-II-SRAM chips and is connected by multiple high-speed data paths to the FMC sites, to the system backplane interface, and to two fiber transceivers.

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

PCIe FPGA Accelerator Card Delivers 10 Gbit Ethernet

A low-profile PCI Express FPGA accelerator card features a 10 Gbit Ethernet interface directly coupled to a Xilinx FPGA. The PCIe-180 from Nallatech is targeted at Signal Intelligence, Network Security and Algorithm Acceleration applications. The PCIe-180 features an onboard Xilinx Virtex-5 user FPGA directly coupled to a high-bandwidth, flexible memory configuration that includes ECC and parity protection. Five independent banks of DDR-II SRAM provide up to 10 Gbyte/s of sustained, random access memory bandwidth. A single bank of DDR2 SDRAM memory

provides 4 Gbyte/s of deep storage local to the user FPGA. The PCIe-180 is tightly integrated to the Host platform via a x8 PCI Express connection supporting sustained bandwidths of up to 2.2 Gbyte/s. Optimized VHDL memory controller IP cores and reference designs are included as part of the standard product deliverables along with driver and API source code for 64-bit Linux operating systems.

The PCIe-180 complies with the "low-profile" half-height, half-length PCI Express mechanical specification. This enables compatibility with almost all high-density server and blade center platforms from leading OEMs such as HP, IBM, DELL, CRAY and SGI. Depending upon configuration, pricing for the PCIe-180 starts at $2,995 in volume production.

Nallatech
Camarillo, CA.
(805) 383-8997.
[www.nallatech.com].

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Reconfigurable Controllers Offer Extended Temp Operation

FPGA technology has changed the way measurement and control systems are designed. National Instruments offers two CompactRIO programmable automation controllers (PACs), which offer engineers and machine builders an ideal solution for high-performance measurement and control applications operating at extended temperatures. The NI cRIO-9023 and NI cRIO-9025 (shown) real-time controllers also are available with conformal coating for additional protection of components and circuitry within harsh conditions.

The CompactRIO controllers provide even more processing for advanced measurement and control applications ranging in temperatures between -40° to 70°C. The NI cRIO-9023 controller has a 533 MHz PowerPC processor, and the NI cRIO-9025 controller has an 800 MHz PowerPC processor, as well as dual Ethernet

ports for network programming, communication and expansion I/O. Both controllers work with the existing CompactRIO reconfigurable chassis, which include field-programmable gate arrays (FPGAs) that are programmed using the NI LabVIEW 2009 graphical system design platform. Using LabVIEW and CompactRIO, engineers quickly can implement custom analog and digital control loops, along with high-speed signal processing algorithms to meet their advanced measurement application needs. In addition to an extended operating temperature, the CompactRIO controllers are available with conformal coating. This coating is a specially formulated thin film material applied directly to circuit boards or circuit card assemblies and provides an impermeable seal to protect circuitry from humidity, moisture, mold, mildew, fungus, dust and corrosion caused by exposure to extreme environments.

National Instruments
Austin, TX.
(888) 280-7645.
[www.ni.com].

Virtex-6 FPGA Module Targets Radar and Telemetry Apps

The latest high-end FPGAs have been a real game-changer for radar and telemetry system designs. Pentek's 71620 module is a multichannel, high-speed data converter XMC that is designed for connection to HF or IF ports for communications, radar and telemetry. The Pentek 71620 analog front end features three Texas Instruments ADS5485 200 MHz 16-bit A/Ds delivering wide dynamic range and an input bandwidth of 350 MHz, ideal for

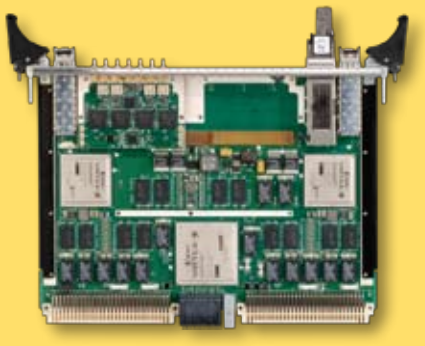
signal intelligence, radar, beamforming and undersampling applications. In addition, a dual channel TI DAC5688 800 MHz 16-bit D/A provides two wideband analog outputs. Built-in 2x, 4x and 8x interpolation filters and a digital upconverter translate real or complex baseband input signals to any IF center frequency up to 360 MHz.

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

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

VME/VXS Signal Generator Offers Eight 1.2 Gsample/s Channels

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



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

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

CompactPCI Card Sports High-Density FPGA

The advent of high-density FPGAs has enabled a new level of flexibility for military board-level systems. Tews Technologies has introduced the TCP631, a user-programmable FPGA-based cPCI module with 1,500,000 or 5,000,000 system gates. Designed for applications where specialized I/O or long-

term availability is required, the TCP631 provides a number of advantages including a customizable interface for unique applications and a FPGA-based design to extend product lifecycle. For flexible front I/O solutions, the TCP631 provides a PIM Module slot that allows active and passive signal conditioning. With the TPIM003-10 all I/O signals are provided on a HD68 connector. The TCP631-2x also offers rear I/O via the J2 connector. The TCP631 offers 64 I/O lines to the front I/O and 64 I/O lines to the rear I/O. All I/O lines are directly connected to the FPGA-pins, which maintains the flexibility of the Select I/O technology of the Spartan III FPGA. All I/O lines provide external ESD-protection devices. In addition, the FPGA is connected to two banks of 128 Mbyte, 16-bit wide DDR2 SDRAM.

The FPGA is configured by a serial flash. The flash device is in-system programmable via driver software over the PCI bus. An in-circuit debugging option is available via an optionally mounted JTAG header on the backside of the board for readback and real-time debugging of the FPGA design using Xilinx's "ChipScope."

TEWS Technologies
Hastenbeck, Germany.
+49 (0) 4101 4058-0.
[www.tews.com].

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6.5-Inch Panel PC Targets Extended Temperature Applications

The military's shift to net-centric operations has driven demand for various panel-based systems where that networked information gets displayed. WinSystems has introduced the PPC3-G-6.5, a 6.5-inch open frame, color flat panel PC based upon a PC/104-Plus single board computer (SBC) that operates from -20° to +70°C. It is a compact, ready-to-mount flat panel display subsystem that also includes a resistive touch screen integrated into a chassis about 2 inches thick. The open frame chassis (without a front bezel) permits flexible mounting of the system for OEMs and integrators with content-rich applications.

WinSystems' Panel PC consists of an outdoor-use, 6.5-inch diagonal color TFT flat panel display with a resolution of 640 x 480 pixels. It has a high luminance of 500 cd/m^2 (nits) and uses two long-life CCFL lamps that are user-replaceable. The display has a wide viewing angle for operator flexibility and a contrast ratio of 600:1. The screen has an anti-reflective coating to preserve readability in high ambient light. A PC/104-Plus SBC serves as the computing and display engine for the PPC3-G-6.5. It is an all-in-one processor module that contains the flat panel video controller, Ethernet port, two USB 2.0 ports, 4 COM channels, LPT, AC97 audio, 48 lines of digital I/O and CompactFlash connector.

PC/104 expansion modules can be added for even more I/O such as wireless, specialty A/D and other industrial interfaces. A resistive touch screen is supplied to eliminate the need for a keyboard and mouse. It allows all kinds of touch input devices to activate the screen including fingers, fingernails, styluses and gloved hands. A USB controller communicates with the screen and SBC. The open frame chassis permits flexible mounting options. It is designed to hold both the flat panel in place and to prevent any twisting or excessive stress on the glass surface. Aluminum has a high strength-to-weight ratio, will not rust like steel and is corrosion resistant. The PPC3-G-6.5 is RoHS compliant. The 6.5-inch PPC3-G-6.5-359-0 is priced at $795 in OEM quantities.

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

3.5-Inch SBC Sports New Generation Atom Processor

The Atom processor has caught on like wildfire in military embedded applications where size, weight and power top the list of requirements. Feeding those needs, WIN Enterprises announces the MB-80190, a 3.5-inch SBC that supports Intel second-generation Atom processors in single and dual core versions. Providing OEMs a choice of Intel Atom N450 (single core) and D510 (dual core) processors with Intel 82801HM I/O controller, the MB-80190 features dual GbE LAN ports, CompactFlash, VGA, LVDS, up to 2 Gbytes DDR2 SODIMM memory, six USB 2.0 ports, high-definition audio interface, 2x SATA, 2x RS-232, mini-PCI connector, VGA and LVDS. The low power consumption (8W) board is based on an Intel Atom N450 processor + chipset. The fanless, compact design measures 145 mm x 102 mm (5.7 x 4 inches). Two Gbit Ethernet ports are provided along with up to 8 COM ports via optional daughter board.

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

DC/DC Modules Feature 25W Output in Compact Size

Power supply makers continue to push the barriers of power density and squeeze more power into smaller spaces. Martek Power UK announces a significant addition to its Powertron family of railway standard DC/DC modules. The new MBRH Series takes the output power up to 25W while retaining the same physical envelope and mechanical platform as existing 15W models. Martek's use of the latest manufacturing techniques at its UK facility allows the company to offer the MBRH high power modules at the same cost as the lower power MBR models. Like earlier models, the MBRH units are fully encapsulated DC/DC converters available in single and dual output configurations with outputs available from 5V to 48V. The MBRH units require no additional external components for EMI filtering and 10ms EN51055 S2 hold up time.

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

StackableUSB Carrier Boards Support SUMIT Spec

The SUMIT connector interface ranks as one of the most innovative approaches to maximized small form factor board space. Micro/sys has added to the growing line of StackableUSB carrier and hub boards with the addition of a SUMIT version, enabling StackableUSB I/O modules to make plug-and-play connections to SUMIT CPU single board computers. The CRR-SUMIT and HUB-SUMIT attach to SUMIT-enabled 104 Form Factor (3.55 x 3.775 inch) SBCs providing OEM users four bays for the powerfully small StackableUSB I/O modules that come either USB, SPI or I^{2}C enabled.

Micro/sys offers a root-port carrier and a hub version. The HUB-SUMIT expands a single USB port from the SBC into 4 USB channels. Alternatively, the CRR-SUMIT allows an OEM to interface with up to four separate root USB ports from the SBC, assuming the SBC has that number of Client ports. Additionally, for users who are concerned about stacking I/O devices directly over the CPU (as the SUMIT standard requires), the CRR-SUMIT and HUB-SUMIT solve OEMs' space concerns for air circulation. The basic CRR-SUMIT starts at $125 in single quantity. The basic HUB-SUMIT starts at $150 in single quantity.

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

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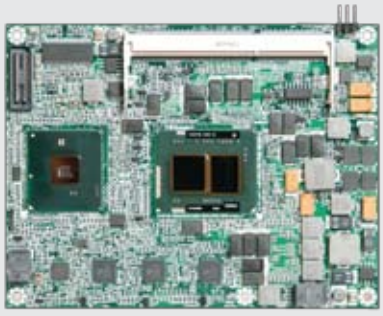
PCIe-over-Cable Products Offer Cost-Effective Solutions

PCI Express is the only bus that can effectively extend over cable without requiring software conversion and thus incurring increased overhead and latency. That means what happens on the end of the cable appears to the host system like it's part of that system. Such technology is ideal for a variety of military applications. One Stop Systems has rolled out its new line of PCIe Gen 2 products, having twice the bandwidth of Gen 1 at lower costs. OSS' PCIe x4, x8 and x16 Gen 2 host and target cable adapters are re-driver-based boards that boost the signal without altering it. The host adapters install in the PCIe slot of the host system and accept a PCIe cable of the same lane count. The target cable adapters install in the OSS 2-slot backplane and bring the host bus to an I/O card installed in the second backplane slot. Host adapters can also cable to other PCIe devices. The x4 cable adapters (OSS-PCIe-HIB25-x4-H, OSS-PCIe-HIB25-x4-T) list for $175 per unit; the x8 cable adapters (OSS-PCIe-HIB25-x8-H, OSS-PCIe-HIB25-x8-T) list for $195 per unit; and the x16 cable adapters (OSS-PCIe-HIB25-x16-H, OSS-PCIe-HIB25-x16-T) list for $495 per unit.

The PCIe x4 Gen 2 switch-based cable adapter contains a non-transparent port and a DMA controller. The switch-based adapter is used for PC-to-PC communication when coupled with the appropriate driver. The OSS-PCIe-HIB35-x4 lists for $695 per unit. The new XMC x8 cable adapter installs in the XMC site of a carrier board or CPU board. The XMC adapter is often used in VME and cPCI Express systems for military and other embedded applications. The PCIe x8 Gen 2 XMC cable adapter (OSS-XMC-HIB25-x8) lists for $595 per unit. OEM quantities can be quoted on all adapters and all are available immediately. Also part of the new family is a PCIe x8 Gen 2 expansion link board. The unit installs in the SHB slot, or system slot, of a PCIe backplane and extends the host bus to the backplane slots. OSS has assembled many of the cable adapters, cables and backplanes into kits to make selecting the exact solution for any PCIe application easier. The PCIe x4 kit (OSS-KIT-EXP-3500-2M) lists for $466, the x8 kit (OSS-KIT-EXP-8000-2M) lists for $711, and the x16 kit (OSS-KIT-EXP-9000-2M) lists for $1,498. The new family of products also includes a 1U 9-port switch, expansion backplanes and expansion systems.

One Stop Systems, Escondido, CA. (877) 438-2724). [www.onestopsystems.com].



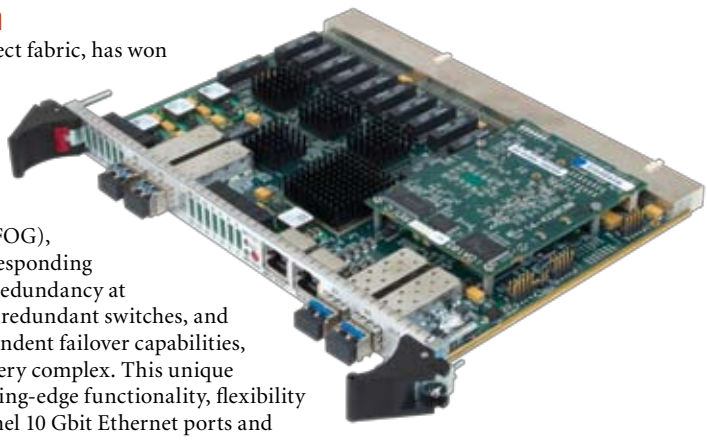
3.5-Inch Embedded Board Marries Atom and 2 Gbyte DRAM

The popular Atom CPU, now in its second generation, is finding its way into a variety of embedded board level platforms. Along such lines, American Portwell Technology has released a new 3.5-inch compact embedded system board. The new compact (5.75 x 4.00-inch) PEB-2780VG2A embedded system board is based on Intel Atom N450 (single core) and D510 (dual core) processor with Intel 82801HM I/O controller. The PEB-2780VG2A supports DDR2 667 non-ECC system memory up to 2 Gbytes, dual display via VGA and LVDS, dual Gbit Ethernet, onboard 12V DC input, two SATA interfaces, one 44-pin IDE connector, Type II Compact Flash socket, six USB ports, four serial ports and GPIO. Expansion capabilities include a connector with PCI-E x1 signal for a daughter board.

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

cPCI Gbit Ethernet Switch Supports Failsafe Operation

Ethernet, both as a networking technology and as a high-speed interconnect fabric, has won its way into the mindshare of military system developers. GE Intelligent Platforms has announced the NETernity CP921RC-30x 6U CompactPCI 24-port Gigabit Ethernet switch. Designed for challenging applications in telecommunications, industrial and military systems, it is a fully managed Layer 2/3+ switch with support for "future-proof" IPv6 switching and routing.



Important new functionality is included in the form of Failover Groups (FOG), a feature that is part of GE's OpenWare switch management environment. Responding to the need for very high-availability networks, FOG is designed to support redundancy at different levels—redundant links across backplanes from nodes to switches, redundant switches, and redundant links to external networks. This provides fast, application-independent failover capabilities, suitable for a wide range of network configurations, from the simple to the very complex. This unique combination of innovative hardware and software technologies delivers leading-edge functionality, flexibility and availability. The CP921RC-30x is optionally available with two front panel 10 Gbit Ethernet ports and two Gbit Ethernet ports capable of supporting SFP+ and SFP transceivers (which can be copper or fiber) respectively for greater configuration flexibility. These ports are invaluable for very high external bandwidth traffic aggregation environments.

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

10 kW Rectifier Boasts 5 by 5-inch Package

Military systems call for a whole different level of reliability than other systems. Feeding that need, Pioneer Magnetics has introduced a 10 kW Rectifier, the PMI 36220B-8P. With power factor correction and in keeping with PMI's standard-setting 5 x 5-inch package, this super high power density rectifier is designed for supporting standalone or N+1 redundant power applications. With 3P AC Input (180 to 264VAC,) PMI's single rectifier provides continuous full output power for operating temperature from of 0° to +50°C. Using PMI's patented power factor correction, the 10 kW rectifier is designed and manufactured using premium quality components. A standard 3U, 19-inch power shelf can also provide up to 30 kW of System Power or 20 kW of Redundant Power.

Forced internal air-cooling is built in when electrical overload production is required. Other output voltages are available such as 28V, 40V, 48V and 240 VDC. PMI's 10 KW rectifier comes with a variety of standard features and options such as Fully Floating Output, Over Current/Over Voltage Protection, Remote Sense, Over Temperature Protection, up to 92 percent efficiency as well as Internal Isolation Diodes. Custom features and options are also available.

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

Rackmount System Offers 24-inch HD-Ready LCD

Sophisticated graphics and video data are becoming the norm for military situational awareness systems. Feeding those and similar applications, Neuro Logic Systems has announced what it's calling the world's largest ruggedized 2U rackmount HD-ready 24-inch LCD. Designed for installation in a standard 19-inch RETMA equipment rack or military transport case, it provides the largest, high-resolution video display in the smallest storage space. The RFTD-24-R display is fully operational in the rack or transit case, and the modular display head can be easily removed and placed on a desktop stand for added convenience. All features and components are installed in an aluminum alloy housing designed to meet Military Specifications 461E, 167, 810 and 901D. Although originally designed for military use, the RFTD-24-R can be used in any harsh environment.

Neuro Logic Systems, Camarillo, CA. (805) 389-5435. [www.nlsdisplays.com].

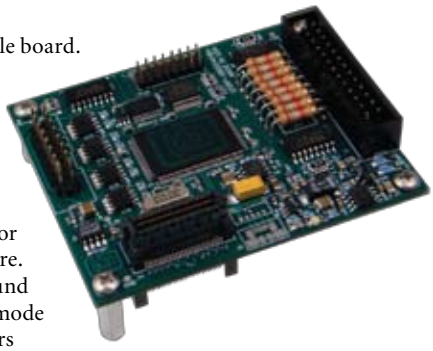
USB Synch Serial Radio Adapter Targets Tactical Radios

Gone are the days when military radios were just about voice. Now they're sophisticated data communications devices. Supporting that trend, Sealevel recently launched four new variations to the ACC-188 USB synchronous serial radio adapter family. When combined with free software from the Defense Information Systems Agency (DISA), the ACC-188 provides an interoperable, high-speed tactical data communications solution for tactical radios to send and receive IP data such as email, text messages, GPS maps, images and coordinates. The ACC-188 operates in conjunction with standard PDA-184 software developed by and available from DISA. The PDA-184 software provides a Graphical User Interface (GUI) that allows radio users to transmit and receive a variety of data types at much higher speeds than is possible with comparable, proprietary solutions.

Sealevel Systems, Liberty, SC. (864) 843-4343. [www.sealevel.com].

Multifunction Pico-I/O Module Offers Rich I/O Functions

The magic of semiconductor integration enables board makers to squeeze a variety of function onto a single board. Exemplifying this trend, ACCES I/O Products has added to its growing line of Pico-I/O small form factor products with the Model PICO-II8IDO4A. Designed for expansion on Pico-ITXe single board computers, this dense, multifunction product features 8 individually optically isolated inputs, 4 fully protected solid-state FET outputs capable of switching up to 3A each, and two 16-bit analog inputs. The circuit isolation makes the module ideal for use in control and instrumentation applications where high-voltage protection is required. Individual channel-to-channel isolation allows every channel to be physically and electrically separated from the others. In addition, the two 16-bit analog inputs provided by the PICO-II8IDO4A allow for the monitoring and control of a variety of system parameters such as temperature, voltage, humidity and more.



The tiny module occupies just half the area of a PC/104 board yet approaches the capability commonly found on the larger board standard. The PICO-II8IDO4A is especially useful in applications where high common-mode external voltages are present. Isolation is required to guard electronics from transient voltage spikes and offers greater common-mode noise rejection in electrically noisy surroundings containing industrial machinery and inductive loads. In addition to protecting industrial applications from accidental contact with high external voltages, the isolation provided eliminates troublesome ground loops. The PICO-II8IDO4A utilizes a high-speed custom function driver optimized for a maximum data throughput that is 50-100 times faster than the USB human interface device (HID) driver used by many competing products. This approach maximizes the full functionality of the hardware along with capitalizing on the advantage of high-speed USB 2.0. The Model PICO-II8IDO4A is priced at $295 with OEM and volume pricing available.

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

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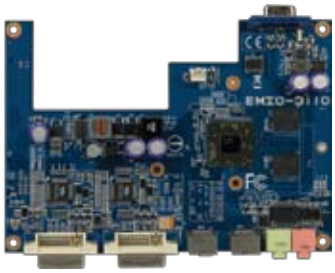
Module Serves Up Features for In-Vehicle Functions



In-vehicle hardware platforms need rugged design. Such platforms need to be ready for any bump on the road. With that in mind, VIA Technologies offers the EMIO-3110 (an Em-IO expansion module designed for extending multimedia capabilities) and the EMIO-3430 (an Em-IO expansion module designed for supporting wireless networks). The combination of the VIA EITX-3000, EMIO-3110 and EMIO-3430 enables an in-vehicle system to display, maintain and control multimedia content across a wireless network using Wi-Fi or Bluetooth. The EMIO-3430 also supports GPS, which makes it ideal for implementing a real-time tracking system for a fleet of vehicles.

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

Pre-Integrated Payload Solution Serves up 3U VPX

More and more, military system designers are looking for higher levels of pre-integration. Going to the next level, Themis Computer has announced its Mission and Payload Systems Initiative (MPSI). The Themis MPSI is aimed at providing integrated system solutions and value-added services to Themis military and aerospace customers. Themis' MPSI will focus on specific market platforms including Unmanned Air Vehicle (UAV), helicopter, fixed wing aircraft, ground vehicles and military robotics. The MPSI target applications include UAV Sensor Processors, Data Processing and Recording Units, Mission Computers, Display Processors and EW/SIGINT Suite Controllers for new platforms as well as platform upgrades.

As a part of the MPSI, Themis has assembled an ever-growing suite of 3U VPX conduction-cooled hardware to use as building block solutions for these applications. The new Themis hardware includes both a 5-Slot conduction-cooled chassis, as well as an 8-Slot ½ ATR conduction-cooled chassis with Universal Cooling and Configuration Options. Complementing Themis' new 3U VPX rugged chassis products are an Intel Core i7-based Single Board Computer, an ATI E4690-based General Purpose Graphics Processing Unit (GPGPU), an 8 channel SATA / SAS RAID Controller with PMC/XMC mezzanine site, and a general-purpose PMC/XMC carrier card for miscellaneous I/O. Themis will also provide integration services and support for third-party partner companies that will provide Software Defined Radio (SDR) functionality, FPGA and Power PC Processing, as well as Avionics Data Bus Interfaces, including MIL-STD-1553 and ARINC 429. As part of the larger MPSI, Themis has also developed the capability to integrate its air-cooled Intel and SPARC processors into airborne systems utilizing ½ ATR and ¾ ATR convection-cooled rugged chassis products (shown).

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

10 Gbit Ethernet System Boasts Multicore Processing

A new dual-processor network appliance features the Intel Xeon 5600 processor series to offer enhanced computing performance for high-speed modular I/O processing of multiple Gbit Ethernet and 10 Gbit Ethernet links. Purposefully built for high-end network security and packet processing applications, the FWA-6500 from Advantech takes advantage of the Intel AES New Instructions (Intel AES-NI), which frees up valuable processor cycles for more virtualization and processing. Intel AES-NI adds new instructions that provide robust encryption without the need for additional appliances or increased performance overhead. Intel Trusted Execution Technology (Intel TXT) performs SHA-1 hash measurements for RSA decryption key exchanges as part of the code authentication process. Two further PCIe x4 slots are available internally for standard add-in cards for offload purposes or network processor-based coprocessing.

Advantech, Irvin, CA. (800) 866-6008. [www.advantech.com].

3U VPX SBC Serves Up Intel Core2 Duo

Intel processors are certainly well represented in the latest crop of VPX product announcements. One of the most recent examples is Interface Concept's new IC-DC2-VPX3a 3U VPX board based on the Intel Core2 Duo processor SL9380 (or SU 9300) associated to the Intel 3100 Chipset, compliant with several Payload Slot Profiles of the OpenVPX standard. Designed for applications requiring a very high level of performance in a compact 3U form factor, the IC-DC2-VPX3a provides a flexible combination of interfaces, supporting VPX's high-bandwidth serial switched fabrics (PCI Express VITA 46.4).

The embedded Intel Core2 Duo processors, based on Intel Core microarchitecture, deliver breakthrough energy-efficient performance for embedded platforms. Intel 45nm process technology allows it to integrate two complete execution cores in one physical package, providing advancements in simultaneous computing. The SL9380 is coupled with the Intel 3100 Chipset, single integrated chip that contains the functionality of a Memory Controller Hub and an I/O Controller Hub via the NSI interface bus. The IC-DC2-VPX3a board also provides two Gbit Ethernet ports that can be used on P1 as 1000BT or 1000KX interfaces. The IC-DC2-VPX3a is available in standard, extended, rugged and conduction-cooled grades.

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

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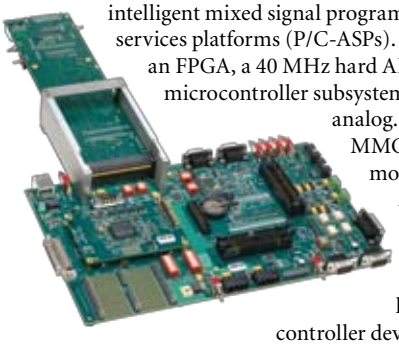
MMC Management Solution Targets xTCA

A new module management controller (MMC) board management reference (BMR) starter kit is based on Actel's SmartFusion intelligent mixed signal programmable/configurable application services platforms (P/C-ASPs). SmartFusion integrates an FPGA, a 40 MHz hard ARM Cortex-M3-based microcontroller subsystem (MSS) and programmable analog. The new kit addresses the MMCs on AdvancedMC (AMC) modules, which are used in both AdvancedTCA (ATCA) carriers and MicroTCA (µTCA) shelves, collectively referenced as xTCA. Included in the kit is a benchtop management controller development board that is implemented in an AMC form factor, which means that it can be inserted into any compliant AMC slot.



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

High-Speed Solid-State Drives Do 3.0 Gbit/s SATA

A new family of solid-state drives (SSDs) features fast read/write speeds in high capacities and is designed for embedded system OEM applications that require superior performance, high reliability and long product life. The single-level cell (SLC)-based SiliconDrive N1x SSDs feature a native SATA 3.0 Gbits/s interface with target read speeds up to 240 Mbytes/s and write transfer rates up to 140 Mbytes/s in capacities up to 128 Gbytes/s. WD SiliconDrive N1x SSDs deliver maximum drive endurance and high sustained sequential write speeds to satisfy the 24/7 operational requirements in critical OEM applications. The WD SiliconDrive N1x products also feature WD's innovative Speed Assurance technology for consistent read/write performance.

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

Signal Recorder Synchs Two 16-Bit Channels at 200 Msamples/s

Military applications that involve radar, communications and storage have an endless appetite for high-speed synchronized recording of multiple data channels. With just that in mind, Pentek offers its Model RTS 2703 Real-Time Recording Instrument, which packs up to 4 Terabytes of removable RAID storage and dual 200 MHz, 16-bit sampling channels into a 4U rackmount instrument. Both sampling channels use the same start, stop, triggering and clock timing to ensure that the two data sets are fully synchronized. In addition to the data acquisition and recording functions, the instrument forms a complete high-performance Windows XP workstation that can run under standalone operation as well as connect to a Gigabit Ethernet network for remote access and control.

The two 16-bit data acquisition channels deliver nearly 90 dB of spurious free dynamic range, allowing users to detect small signals of interest surrounded by large interferers. A hardware-driven DMA engine continuously streams data at 200 Msamples/s from each channel to dedicated five-unit RAID arrays with a capacity of 2 Terabytes per channel, ensuring more than an hour of continuous recording without dropping a single sample. The storage system incorporates 10 SATA disk drives configured as dual five-unit RAID arrays. The units can offer RAID levels 0, 1, 5, 6 10 and 50 and can be configured to offer redundancy in the recording to ensure that data is never lost. The hot-swappable RAID disks are front-panel accessible, which allows users to readily remove and replace the drives for extended recording or transport to another location. As with other members of Pentek's RTS 27xx family, the dual-channel recording instrument is fully supported by Pentek's Model 4990 SystemFlow Instrument Software. The price of the Model RTS 2703 Dual-Channel Signal Recording Instrument, including SystemFlow Instrument Software, starts at $58,995.

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

Embedded Computer Blends Rich I/O and Windows CE 6.0

Keeping size, weight and power as small as possible seems like the mantra these days in military systems design. The Relio R9 from Sealevel Systems is based on the Atmel AT91SAM9263 processor boasting a 32-bit ARM instruction set. The Relio R9 is an attractive platform for embedded applications requiring small size, wide operating temperature range and flexible I/O connectivity. Available with up to 256 Mbyte RAM and 256 Mbyte flash memory, the I/O features of the Relio R9 extend the possible uses beyond traditional ARM applications. Standard I/O includes Ethernet, serial, USB, CAN Bus, digital and analog interface. The Windows CE 6.0 BSP binary and low-level drivers for system I/O are included. The Relio R9 is priced from $599, and a QuickStart Development Kit is available.

Sealevel Systems, Liberty, SC. (864) 843-4343. [www.sealevel.com].

Solid-State Power Controller Sports 8 KW over 16 Channels

A third-generation solid-state power controller provides reliable solid-state protection and control for sixteen independent 28 VDC channels, with a total power output of more than 8 KW. Programmable trip points, channel paralleling and power-on defaults support maximum power distribution system flexibility. The RP-26200 embedded controller and network interface from Data Device Corporations (DDC) enable real-time load monitoring, which can be used for efficient load management and preventative maintenance. The RP-26200 is based upon field-proven technology, with more than 500,000 nodes installed since 1988 on vehicles including the M1A2 Abrams tank and the Bradley fighting vehicle, and recently on upcoming unmanned ground vehicles and tactical wheeled vehicles.

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

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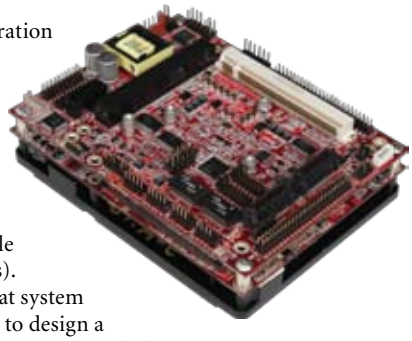
Board Set Merges COM Express Cores with Triple-Play I/O



Today's level of board integration has enabled board functions that once took several boards to now fit on a single card. A board-level "embedded-ready subsystem" (ERS) combines the benefits of computer-on-modules (COMs) with those of stackable single-board computers (SBCs). This announcement means that system manufacturers no longer need to design a custom carrier to deploy COM Express modules.

Called Magellan from Diamond Systems, the CPU core consists of a COM Express CPU module and heat spreader mounted on its bottom side, resulting in optimal thermal management and increased space for I/O functions and connectors. This design makes it possible for Magellan to integrate dual gigabit Ethernet LAN ports, a 7-30V DC/DC power supply, a full set of peripheral interface header connectors, stackable PCI-104 or SUMIT expansion and a FeaturePak I/O module socket, in addition to a complete embedded-PC core—all within the 95 x 125 mm COM Express footprint. Stacking boards in one direction greatly simplifies the thermal design of embedded systems based on high-end CPUs, avoiding costly custom heat pipes and milled aluminum thermal-transfer blocks.

Diamond Systems, Mountain View, CA. (800) 367-2104. [www.diamondsystems.com].

COM Express Module with Mobile Core i7 and QM57 Chipset

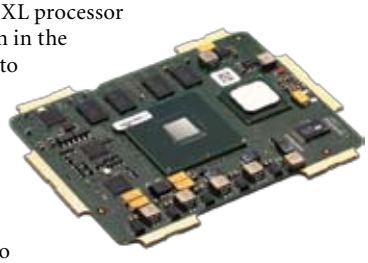
A new COM Express module is part of a portfolio of Type VI COM Express Basic (small footprint) modules from American Portwell. The Type VI COM Express Basic is becoming a new standard in 2010. At 125 mm x 95 mm (4.92″ x 3.74″), the compact PCOM-B216VG-VI is based on the Intel Core i7 processor and the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

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

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

Atom-Based COM Module Offers Extended Temperature Operation

Ideal for systems where the overhead of slot-card backplanes isn't desirable, COM modules are becoming a key form factor choice for military systems. An upgraded ESMexpress Computer-on-Module (COM) incorporates the Intel Atom XL processor to provide tested, qualified operation in the extended temperature range of -40° to +85°C (-40° to +185°F) in both conduction- and convection-cooled environments. It also features an increased memory capacity of 2 Gbytes, double its predecessor. Because the enhanced XM1L from MEN Micro conforms to the ANSI-VITA 59 RSE standard currently in development, it provides a cost-effective and easily upgradeable means of employing advanced embedded technology in highly rugged applications as found in industrial, harsh, mobile and mission-critical environments.



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

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

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EIC Solutions	28	www.eicsolutionsinc.com
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Extreme Engineering Solutions, Inc.	25	www.xes-inc.com
Global Technology Congress	61	www.globaltechnologycongress.com
I/O & 3U CompactPCI Boards Gallery	45	
Interface Concept	58	www.interfaceconcept.com
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Kontron America	27	www.kontron.com
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Phoenix International	67	www.phenxint.com
PICO Electronics, Inc	60	www.picoelectronicsinc.com
RTECC	55	www.rtecc.com
Red Rapids, Inc.	12	redrapids.com
Red Rock Technologies, Inc.	10	www.redrocktech.com
RSI INc. CRI Division	35	www.rsi-cri.com
RTD Embedded Technologies	2,36,37	www.rtd.com
RunCore	33	www.runcore.com
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SynQor Inc.	24	www.synqor.com
Tadiran	17	www.tadiranbat.com
Themis Computer	49	www.themis.com
VICOR	18,52,71	www.vicorpower.com
VPT, Inc,	43	www.vpt-inc.com
Xembedded, Inc.	20	www.xembedded.com

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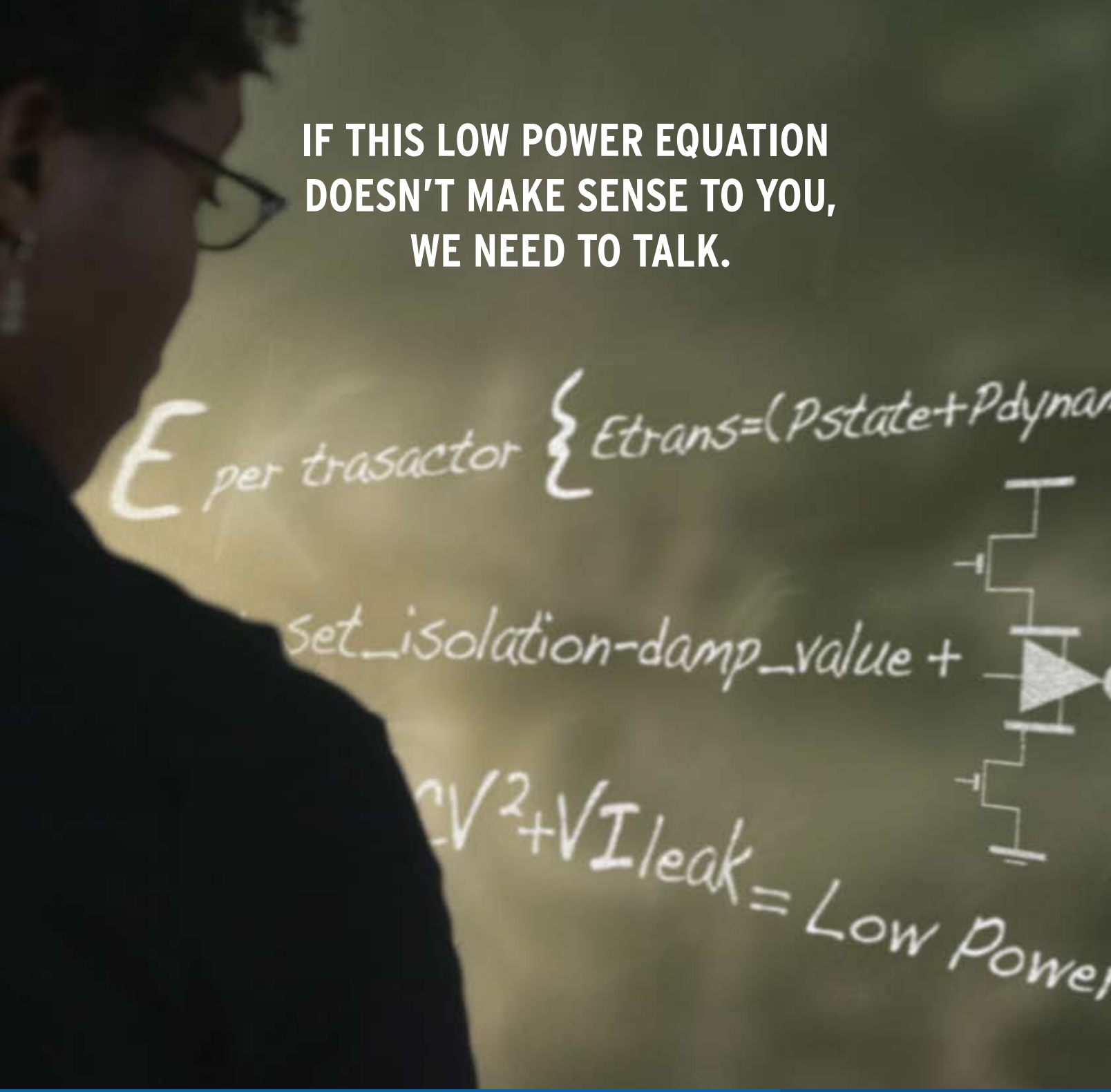
Coming Next Month

Special Feature: The Military I/O Continuum: From 1553 to Switched Ethernet Tried and true I/O schemes such as MIL-STD-1553 and ARINC 429 remain popular for pure control applications, but they're bandwidth-limited by today's standards. A slew of multipurpose communications protocols provide options to suit emerging needs, and Ethernet is a top contender among them. Articles in this section compare today's crop of I/O schemes relevant to military users.

Tech Recon: New NASA Programs Look to Space-Qualified COTS With the Space Shuttle program reaching its end of life and new programs like Constellation and Orion underway, NASA is certainly in a period of transition. Feeding those systems, space-based semiconductors and board-level systems must be capable of withstanding everything from intense radiation due to high-energy atoms to bombardments from neutrons and other particles. Articles in this section explore the radiation concerns facing space designers, and update readers on radiation-hardened boards, subsystems as well as ASICs, FPGAs and power components designed for those applications.

System Development: Rugged Displays Feed New Situational Awareness Demands Leveraging cutting-edge graphics chips developed for the demanding gaming market, military graphics subsystems are now able to offer complex video and graphics functionality in highly integrated board-level solutions. Cockpit displays and simulation/training applications rank as two of the most demanding users of these advanced graphics technologies. Articles in this section examine the graphics solutions available in PMC and other form factors, and included is a product roundup of display interface products.

Tech Focus: PC/104 and PC/104 Family Boards PC/104 has become entrenched as a popular military form factor thanks to its compact size and inherent ruggedness. Sweetening the deal, a number of special enclosure techniques are used to outfit PC/104 for extremely harsh environments. This Tech Focus section updates readers on these trends, along with a look at the new PC/104 follow-ons: EPIC, PCI-104, PCI/104-Express and PCIe/104. Also provided is a product album of representative boards.



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Editorial

Jeff Child, Editor-in-Chief

All Eyes Toward the New GCV

Five years ago we had a great looking cover on *COTS Journal* depicting graphical representations of several of the proposed Future Combat Systems vehicles. They were all linked by lines representing "the network" to a central box that said "FCS Network: Initial Logon: June 1, 2014." It was kind of a stretch of the imagination on my part, but at the time it seemed an exciting notion. The cover feature story even won an award if I recall. But, as seems to be the curse of anything with the word "future" in its name, Future Combat Systems wasn't meant to be. Although some elements of FCS live on in the form of the Army's BCT Modernization efforts, the manned vehicle portion of it is no more.

Over the past year, the DoD has been working to retarget its plans in the wake of that decision. And now all eyes are turned toward the development of a new vehicle dubbed the Ground Combat Vehicle (GCV). The GCV is just one acquistion program element of the Army's overall modernization strategy—detailed and clarified in its Army Modernization Strategy document released last month.

Plans—sketchy as they are at this early stage—for the new GCV call for an open architecture design to enable incremental improvements in modular armor and network architecture along with improvements in subsystem size, weight, power and cooling. Materiel development decisions for the GCV were made in February resulting in the release of request for proposals (RFPs) for GCV technology development.

The Army expects to follow the analysis with a Milestone A decision review on whether to begin technology development in September. After that the plan is for competitive prototyping with multiple contractors. How many contractors will depend on available funding. The technology development phase will encompass several subsystem prototypes, including an automotive test rig and a mine blast test asset. All that will be followed by a series of design reviews with the first production vehicles possibly to be delivered in late fiscal year 2017, about 7 years from inception of the program.

According to Army officials, prime contractor proposals for GCV are expected to include plans, solutions or both for, among other things, survivability—hit avoidance system, armor and vehicle layout—and mobility—propulsion and power generation and cooling. The RFPs for the GCV state that the proposals are permitted to make use of prior Army investment in armor configurations, but that the contractors will not get an inherent advantage for doing so. Rather, each solution will be based on its own merits. Cost-plus type contracts are scheduled to be awarded after the Milestone A decision in September 2010.

With the demise of FCS and its problems fresh in the minds of Congress, it's clear that there will be a high degree of scrutiny on the GCV program as it moves forward. According to the GAO report last month, the challenge facing both the DoD and the Army is to set these ground force modernization efforts—including the GCV—on the best footing possible by buying the right capabilities at the best value. The report cites that the DoD and the Army can reduce risks by considering lessons learned from problems that emerged during the FCS development effort. Initial indications are that the Army is moving in that direction. The GAO does question the merits of proceeding with low-rate initial production of one brigade set of Increment 1 systems—this means the Network Integration Kits, Unmanned Ground Vehicles and other elements that were part of the FCS efforts.

The big question for what the GCV means to our military embedded computing industry is, of course, what type of embedded form factors and architectures will be used in these vehicles. Several vendors from our industry had contracts to supply boards to various manned vehicles of the FCS programs, so they're watching what happens with the GCV with a keen eye.

It's too soon to speculate, but it seems very likely that VPX technology will play a big role on board the GCV. In a way, it's a good thing that FCS has been rebooting as the GCV because the delay has allowed the embedded computing industry time to get their ducks in a row in making OpenVPX a reality. With OpenVPX, the industry can now go to their defense customers with a clearly defined specification that ensures compatible VPX products between vendors. The delay also provides time for the OpenVPX ecosystem of products to flesh out and grow—which it's done at an exponential rate since the release of the OpenVPX spec. Once again, this is all an exciting example of the military embedded bus/board community having a solution ready and mature before their customers ask for it. And that's a very good thing. ▮▮

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