COTS JOURNAL

The Journal of Military Electronics & Computing

Tech Focus: XMC and Processor XMC Boards Roundup

SMALL UAVs

Expand Their Comms and Control Capabilities

PLUS:

Mips-per-mW: The Litmus in Power-Constrained Systems

HALT and HASS Push Board Testing to New Level

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The Journal of Military Electronics & Computing

Features

December 2009 Volume 11 Number 12

Special Feature

Control and Comms in Small UAVs

Tech Recon

Pushing the Mips-per-mW Curve

System Development

HALT, HASS for Embedded Boards

Technology Focus

XMCs and Processor XMCs

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

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Spc. Jeremy Squirres of Company A, 101st Military Intelligence Battalion, 3rd Brigade Combat Team, 1st Infantry Division, prepares a Shadow 200 UAV for launch at Forward Operating Base Warhorse, Iraq. Shadow's manufacturer AAI is adding the capability to acquire and designate a target to the Shadow's electronics. Deployed Shadow aircraft also are being equipped with a SINCGARS comms relay and other upgrades.

Photo courtesy of U.S. Army

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Managing Editor

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The Journal of Military Electronics & Computing

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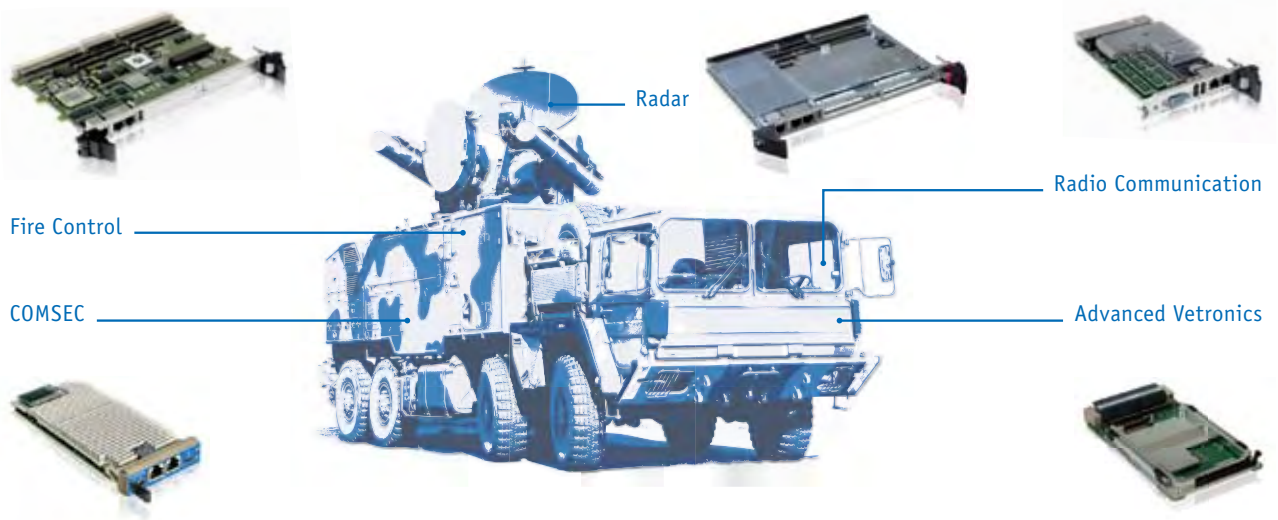

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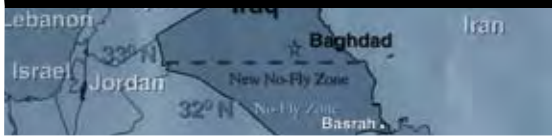

Space: The New Frontier

Well, 2009 is now behind us. And for those of us who generate revenue mostly from the military embedded market, it's been a much better year than for those companies that generate revenue elsewhere. We've all had to review our market and our position in it. In some cases we only needed to shift emphasis and in others we needed to make adjustments to our products. Overall, our industry has fared well, and all indications are that we will actually see double-digit growth—although just barely double-digits. That may not seem earth-shattering, but I know of many industries that wish their decline was only as little as our forecasted gain.

2010 will still be a transition year for military programs and the trickle down effect will be felt by our industry—as we compete for the new opportunities and recover from opportunities lost. One of the biggest unknowns is when the Administration will get rid of the Secretary of Defense, Robert Gates. It's clear that the time will come when he'll have outlived his usefulness as a target for all the issues from the last Administration. Or, he'll reach a point when he's just had enough. Gates has many detractors, mostly from people who feel he sold them out. Frankly, such people are the ones who just haven't been able to face reality and accept that the ride is changing. I speculate that sometime in 2010 Gates will announce his resignation. The big issue then: Will he be replaced by a highly qualified individual or by a political crony? The answer to that question will determine our industry's rate of continuing growth.

Every year we look at *COTS Journal* and figure out what we need to do to stay number one. In 2009 we added more images, made the book more people-interactive, and related the embedded technology to the end-use systems. We put up our improved website: www.cotsjournalonline.com / www.mecjournal.com. In 2010 we're going to continue the experiment. We started this year by having industry analysts contribute pertinent data for our market. This has been highly successful and we've received many positive comments from our readers. We're also continuing our affiliation with MILCOM and AUSA and adding a series of RTECC shows that will have an added military focus to them, near key military depots: Huntsville, AL; Robins Air Force Base (AFB); Melbourne, FL; Eglin AFB; Wright-Patterson AFB and Los Angeles/JPL. And we will also feature issues key to the military market at our premier shows in Santa Clara and Boston.

COTS Journal started tracking the space market in 2008 and we will continue to do so. Most recently we were invited to attend the STS-129 launch of the space shuttle—a great place to meet people who are in the industry and make connections. I made just such a connection in the Marshall Space Flight Center in Huntsville (one of our RTECC locations), a key participant in the Aries I & V programs. We all know that space is a very limited-quantity market, but it is a market that acts as a technology driver. I've perused through the NASA publications and was impressed by how many space industry technology creations recently moved to the military and commercial market. If *COTS Journal* is the leader in presenting and airing the technologies used in military/aerospace/severe environment markets, then we do need to stay on top of space electronics technologies, and we're committed to doing just that.

Figure 1

Space Shuttle mission STS-129 *Atlantis* launches on November 16th on its way to the International Space Station.

Everyone stay in touch, and have a happy holiday and a joyous and prosperous New Year. ▮▮

Pete Yeatman, Publisher
COTS Journal

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Raytheon Completes Design Review for CVN 78's Dual Band Radar

Raytheon and the U.S. Navy recently completed a critical design review (CDR) for the Dual Band Radar (DBR), which will be installed on the Navy's next-generation aircraft carrier, the USS Gerald R. Ford (CVN 78) (Figure 1). The DBR, produced by Raytheon Integrated Defense Systems (IDS), is the Navy's most advanced multifunction radar; it will provide superior surveillance capabilities supporting air operations and ship self defense. Leveraging advanced technologies to meet the carrier mission requirements in both deep water and littoral environments, DBR will be the U.S. Navy's most capable radar and a critical asset for the fleet.

The review demonstrated that the radar, currently in production for the Zumwalt-class destroyer (DDG 1000), meets the critical operational requirements of the Ford-class aircraft carrier. As a result of DBR's modular, open architecture design, only minor modifications need to be made to accommodate specific platform differences between DDG 1000 and CVN 78. The DBR's open architecture design provides the flexibility to adapt the radar to different naval surface combatant platforms, combat systems and missions. The Dual Band Radar combines the benefits of S-band and X-band radar capabilities to provide superior performance in a broad range of environments against a variety of threats; its innovative design greatly reduces manning.

Figure 1

The Gerald R. Ford-class aircraft carriers (or Ford-class) will be the next-generation supercarrier for the United States Navy. Shown here is an artist's depiction of the CVN-78 Gerald R. Ford.

Raytheon
Waltham, MA.
(781) 522-3000.
[www.raytheon.com].

Micro Power Awarded Two Patents for Battery Pack Tech

The U.S. Patent Office has awarded Micro Power Electronics two new patents covering innovative design techniques and manufacturing practices for battery packs. These patents improve the safety and reliability of the portable battery packs produced by Micro Power for mission-critical operations. One of the newly issued patents is for Micro Power's redundant battery protection system and method covering an enhanced protection system. The enhanced protection system includes both a primary protection circuit and a redundant protection circuit. The components of the redundant protection circuit are electrically coupled in parallel with the primary protection circuit. If the primary protection circuit fails, the redundant protection circuit will still operate to allow the enhanced battery pack to function.

The additional newly issued patent is for Micro Power's electrical insulation system and method for power storage component separation, which includes an electrical insulation method for electrical separation of power storage components. This patent describes the use of polyurethane elastomer material to electrically separate various components of electrical power storage components within battery packs.

Micro Power Electronics
Beaverton, OR.
(503) 693-7600.
[www.micro-power.com].

ITT Secures $9.7M Contract to Make Netted Iridium Tactical Radios

ITT has received a contract from the U.S. Naval Surface Warfare Center (NSWC) Dahlgren Division to supply 1,450 Iridium-based handheld tactical satellite communication devices for use by U.S. forces in Iraq and Afghanistan. Under the firm, fixed-price contract, valued at $9.7 million, ITT will manufacture and deliver the Distributed Tactical Communications Systems – Radio Only (DTCS-RO) transceivers (Figure 2) by March 2010. The DTCS-RO handheld push-to-talk radios use the Iridium satellite network to provide over-the-horizon, beyond-line-of-sight tactical networks for warfighters on the move.

In June, NSWC awarded Iridium a five-year development contract valued at up to $21.7 million for Phase Two of the DTCS program, also known as "Netted Iridium." Under Phase Two, Iridium is making in-orbit upgrades to the satellites and ground infrastructure to expand the footprint of DTCS nets from 100 to 250 miles, and to permit more than 2,000 nets to be activated simultaneously on the satellite network. The upgrades

Figure 2

The DTCS-RO handheld push-to-talk radios use the Iridium satellite network to provide over-the-horizon, beyond-line-of-sight tactical networks for warfighters on the move.

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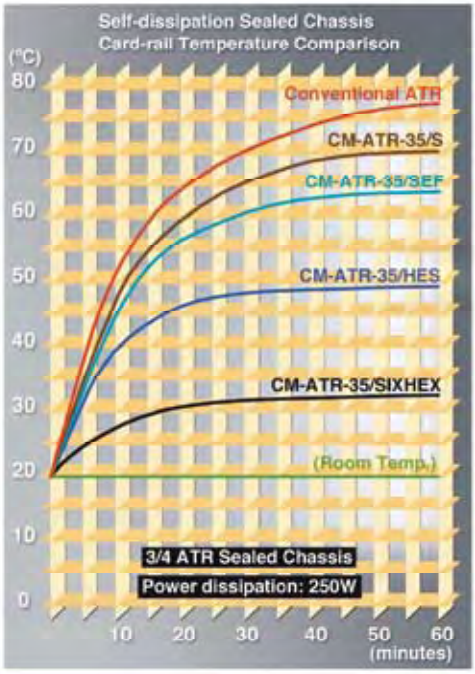

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DRS Technologies Nabs Contract to Upgrade Comms for AEGIS Ships

DRS Technologies has received a $14 million Indefinite Delivery Indefinite Quantity (IDIQ) award from the U.S. Navy to provide a modernized integrated voice communications system (IVCS) for Aegis cruisers and destroyers. Figure 3 shows the USS Lake Champlain, a Ticonderoga-class Aegis guided missile cruiser. This contract award includes options that, if exercised, could continue the work until 2014 and bring the cumulative value of the contract to a total value of $59 million. Work will be performed at DRS facilities in Kanata, Canada, Gaithersburg, MD, Chesapeake, VA, Johnstown, PA and is expected to be completed by late 2010.

This contract award was the result of a competitive process in which DRS Technologies was selected as the "Best Value" for the U.S. Navy. According to DRS, this award further strengthens DRS' position as a leading supplier to the U.S. Navy. DRS is a supplier of tactical and administrative intercommunications systems. The Cruiser and Destroyer AEGIS Modernization (AMOD) Secure Voice System (SVS) ON-

Figure 3

AEGIS Cruisers like the USS Lake Champlain will receive upgrades as part of the AEGIS Modernization (AMOD) Secure Voice System (SVS) ON-568 program.

Military Market Watch

Emerging Standards and Groups Will Impact A&D Software

A number of groups are emerging, or have emerged that will influence the future of software for aerospace. Most of these organizations have been sponsored by the Department of Defense, and some have extensive opportunities for industry involvement. The following is only a partial list of the Lone Star/EMF derived data, containing some of the more notable efforts within current working groups:

- ***UAI – Universal Aircraft Interface:*** On first blush, this seems to be nothing more than an effort to update the MIL-STD-1760 specification. In fact it is much more. The services (in particular, the USAF and USN) have become very frustrated with the time and expense to integrate new stores and weapons with combat aircraft. The UAI will be the first "plug and play" architecture adopted across all combat weapon types. This is a major sea change in the management of Operational Flight Programs (OFPs), which are a significant business for the prime that manages the aircraft configuration. Industry participation has been aggressive, and this has become a quasi-standards body.
- ***Network Centric Weapon:*** Another quasi-standards body, aimed at defining the architecture and data set for data linked weapons. This has implications that reach far into the network. This is much more than just a data link standard.
- ***System of Systems Modeling:*** Example – The Joint Strike Fighter (JSF) has interrelationships with 8 classes of other systems, which average about 4-5 programs per class. The health of each program is assessed three ways (schedule, performance cost), and the interfaces are also assessed independent of the program assessment. Some capabilities only exist at the family of systems level. The goal is to take a group of family programs of records and create systems engineering at the major functions across several programs. This could be a major opportunity for UML and other model-driven approaches.
- ***JCIDS Process:*** The new process to manage military operational capabilities and requirements calls for extensive systems modeling. This is another area where we expect UML-driven models and standards to emerge. Significant funding is in place to expand these capabilities.
- ***FIPS 140-2:*** The standard for networked security. With IPv6 chosen as the standard protocol for all DoD systems, there is now a significant opportunity for standardizing software solutions in networked warfare in the IDE.

In order to seize the opportunities inherent to these efforts, any firm wishing to participate needs to carefully assess these (and other activities) developing key messages, questions and value propositions. In some cases, the road to competitive advantage will require some time, and hence must be viewed as a strategic move. In other cases, the time to generate sales may be driven more by product development than the sales cycle. In either case, careful homework is required before first engaging with the government and before committing to a course of action.

This information is relatively new to the embedded RTOS and software tools industry that in the past was content to get the occasional subcontract from a prime. Vendors need to be better connected and proactive in order to get a slice of the emerging large piece of the action. And this activity has to be initiated before the RFP is let.

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Teledyne Controls to Supply Flight Data Acq Gear for Navy E-6B Aircraft

Teledyne Controls has been awarded a contract of approximately $5 million by subcontractor L3 Communications to supply the flight data acquisition system, ground-based flight data monitoring tools, and flight training simulator crew debriefing station for the U.S. Navy E-6B Mercury aircraft.

Figure 4

The U.S. Navy E-6B is a modified Boeing 707 that provides survivable, endurable, reliable airborne command, control and communications in support of the President, Secretary of Defense and USSTRATCOM.

As part of the contract awarded to Boeing by the U.S. Navy to upgrade their fleet of 16 E-6B aircraft (Figure 4), Teledyne Controls will provide its latest generation Digital Flight Data Acquisition Unit (DFDAU), along with a suite of ground-based applications including AirFASE for flight data monitoring and analysis, Vision for 3D flight visualization and event investigation, and ReVision for digital flight crew briefing and debriefing. Delivery of the systems is expected to start in mid 2010.

The U.S. Navy will use Teledyne Controls' COTS systems to monitor the E-6B aircraft for a wide range of health issues, including airframe structural life expended, engine performance, avionics system fault reporting and flight operations quality assurance (FOQA). The data acquisition solution offered for the E-6B aircraft is an enhanced configuration of Teledyne's standard commercial Digital Flight Data Acquisition Unit (DFDAU).

Teledyne Controls
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Event Calendar

January 26
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February 2
AFCEA West 2010
San Diego, CA www.afcea.org

February 9
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February 11
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February 24-26
AUSA Winter
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March 9
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Special Feature

Control and Comms in Small UAVs

Small UAVs
Step up to
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By employing integrated comms and computing subsystems, Small UAVs are expanding their ability to transmit data and extend control range.

Jeff Child
Editor-in-Chief

The brisk investment in UAV development and procurement continues across all branches of the DoD. And that situation isn't expected to change under the current Administration. In volume, the Small UAV segment of this market naturally exceeds that of medium and large UAVs. This class of UAVs faces the most difficult challenges with reducing size, weight and power (SWaP) while at the same time cramming more functionality and autonomy into Small UAV payload systems.

While the term "small" UAV is relative, the Class 2 and Class 3 UAVs—as defined by the DoD's latest Unmanned Systems Integrated Roadmap—are distinct in terms of their electronics needs compared to larger UAV systems. Class 2 and Class 3 encompass UAVs spanning from 21 pounds to 1,320 pounds in take-off weight. And UAVs under 21 pounds (Class 1) are controlled by relatively straightforward custom electronic circuitry.

While larger classes of UAVs rely on backplanes crammed with VME and CompactPCI boards, small UAVs and their payloads have been slower to embrace standard form factor boards. Form factors like PC/104, COM Express and others are often used in the development phase, but few get deployed in the end product. That's beginning to change as small UAV system developers seek to outfit UAVs with more mission autonomy and more powerful sensors. Meanwhile, complete compact box-level subsystems—often designed for a special payload function—are also having an impact in this market space as box-level systems with small size/weight footprints emerge.

Workhorse Tactical UAVs

Exemplifying the success of small tactical UAVs, the Shadow Tactical Unmanned Aircraft Systems (TUAS) last

Figure 1

An Army unmanned aerial system maintainer prepares a Shadow UAV for launch. The Shadow UAV has achieved its 100,000 mission milestone, with most of its flight hours in support of combat operations in Iraq and Afghanistan.

Figure 2

The Integrator UAV's payload enables the capture of high-resolution imagery both day and night, camera turret functionality and long-lasting flight endurance. Its beyond line-of-sight (BLOS) capability enables control of the Integrator from anywhere in the world via satellite communications.

month achieved its 100,000 mission milestone. With 113 systems ordered and 87 delivered, Shadow systems (Figure 1) are deployed across the Army and Marine Corps with most of its flight hours in support of combat operations in Iraq and Afghanistan.

Technology system upgrades have been a critical part of the Shadow's success. While initially created as a day/night reconnaissance platform, Shadow's manufacturer AAI is adding the capability to acquire and designate a target to its Shadow TUAS. In addition, deployed Shadow aircraft are being equipped with a Single Channel Ground and Airborne Radio System, or SINCGARS, communications relay. Other upgrades include a new lithium battery designed to provide power in the event of generator failure. AAI also is integrating a new electronic fuel injection engine and a new fuel delivery system, which together are expected to bolster system reliability.

Adding Digital Data Link Support

This past summer, AAI also got a $32 million contact from the U.S. Army Unmanned Aircraft Systems Project Office to enhance the Shadow TUAS with the tactical common data link (TCDL). The TCDL is a Ku-band digital data link that delivers wide-bandwidth communications using common data link, or CDL, waveform standards. It is being integrated using a NATO standardization agreement (STANAG) 4586-compliant architecture that enables interoperability with the latest NATO and U.S. Army standards.

The enhanced system will be designed to provide Shadow TUAS users a common interface with other military systems that incorporate TCDL and these interoperability standards, including the Extended-Range, Multi-Purpose Sky Warrior UAV, the Hunter UAV, and the Apache helicopter. TCDL can accommodate state-of-the-art digital sensor technology. In addition, its encryption capabilities provide enhanced data security.

In other comms-related small UAV activity, Boeing-subsidiary Insitu, along with Harris, successfully completed a demo in October of a Single-Channel Ground and Airborne UHF/VHF Radio

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Relay System on the Insitu Integrator UAV (Figure 2) during a Communications Relay Payload (CRP) test flight in Eastern Oregon. Harris is one of Insitu's team members for the small tactical unmanned aircraft system (STUAS)/Tier II competition. The Integrator UAV, outfitted with a relay based upon the field-proven Harris Falcon III (AN/PRC-152) radios, enables mobile ground units to relay voice and data with an extensive end-to-end reach.

Communications relay supported by an airborne asset is essential in situations where line of sight obstructions exist. The demonstration represents a culmination of development efforts spanning several years to provide the warfighter with ground communication capabilities. The UHF/VHF relay provides a variety of frequencies and waveforms, including Single-Channel Ground-Air Radio System (SINCGARS), and extends the range between users for voice and data communications, including chat text, instant messaging and imagery. Integrator's small operational footprint is the same as its Insitu UAS counterpart ScanEagle, using the SkyHook retrieval system and a common launcher that enable true runway-independence.

Another STUAS/Tier II Contender

Meanwhile, AAI in July unveiled its contender for the U.S. Navy and Marine Corps' joint Small Tactical Unmanned Aircraft System (STUAS)/Tier II program: the Aerosonde Mark 4.7. Developed as a part of AAI's Aerosonde fleet of SUAS, including the Mark 4.4 and Mark 5.0, the Mark 4.7 delivers greater than 10-hour endurance, a low acoustic signature and a small footprint, all of which make it ideal for confined-area land or maritime intelligence, surveillance and reconnaissance missions as well as for communications relay. Its modular payload installation allows the rapid addition of new payloads and capabilities as they become available, enabling technology refresh with little to no aircraft or system modifications. The system also uses AAI's Expeditionary Ground Control Station (EGCS). The EGCS is based on the company's proven One System command and control architecture that provides interoperability between the Aerosonde Mark 4.7 and other One System platforms, including the Shadow UAV. Users receive digital and analog data from the aircraft's electro-optic and infrared payloads on compact, ruggedized laptops. ■■

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Common Computing Architecture Wins for UAV Programs

Building a custom, proprietary computing architecture for UAV control is both costly and time-consuming. The use of a common computing architecture helps remedy those issues.

Tom Clancy, CTO and VP of Tactical Systems
Aurora Flight Sciences
Mike Southworth, Director of Marketing
Parvus

The use of Unmanned Aerial Vehicles (UAVs) in the military has skyrocketed as UAVs have proven their military worth in Afghanistan and Iraq. UAVs are credited with saving soldiers' lives while improving battle space efficiency, making these aircrafts a vital component in the warfighter's toolbox. However, with unmanned vehicles becoming a mainstay of battlefield and reconnaissance operations, equipping these aircraft with a custom, proprietary computing architecture is costly and time-consuming—two unacceptable consequences for military subcontractors.

To alleviate this concern, the use of a common computing architecture in UAVs is becoming the obvious solution for many aerospace manufacturers, such as Aurora Flight Sciences. For Aurora, a designer and builder of robotic aircraft and other advanced aerospace vehicles for scientific and military applications, the advantage of using a common computing architecture is clear—a high reuse fraction. By leveraging the computing architecture in multiple aircraft, Aurora reduces costs and improves efficiency, which empowers their ability to design and build a range of unmanned platforms designed to meet the diverse needs of military, law enforcement and homeland security personnel.

Figure 1

While first developed as the Aurora Common Mission Computer (ACMC), this system has since been added to Parvus' standard product offerings as the DuraCOR 820.

Designing the ACMC

As a common computing architecture was necessary to serve as the

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Figure 2

The GoldenEye 80 Unmanned Aircraft System (UAS) from Aurora Flight Sciences was designed to use a common mission computing platform.
(Image courtesy of Aurora Flight Sciences)

Figure 3

The Excalibur UAV from Aurora Flight Sciences uses the Aurora Common Mission Computer (ACMC).
(Image courtesy of Aurora Flight Sciences)

foundation for Aurora's future aircraft, Aurora needed to find a robust computing solution that could meet stringent military requirements while withstanding the different environments encountered by various UAVs. In addition, the mission computer needed to support a superset of features and requirements to meet all the different UAVs technical demands.

Aurora began working with Parvus to develop the Aurora Common Mission Computer (ACMC) (Figure 1) as part of Aurora Common Avionics Components program. From the outset, the goal of developing the ACMC was to use industry standards to support long-term system evolution and reliability. The DuraCOR mission computer product line from Parvus met this goal as it offered a modular open-architecture computing platform that could be adapted to its various UAVs. However, the DuraCOR 810 model that Aurora was eyeing was too large for its needs. By shrinking the mechanical form factor and selecting miniaturized components, Parvus created the ACMC, which has since been added to Parvus' standard product offerings as the DuraCOR 820.

New-Life Reusability

Important to Aurora was the concept of new-life reusability for this computing subsystem to accommodate the demands of future aircraft mission profiles and payloads. To meet this requirement, the ACMC was designed with excess computing power and additional throughput over current application requirements. By building in margin for growth upfront, the ACMC could accommodate future software loads and advanced processor throughput. The resulting ACMC/DuraCOR 820 is less than 3.0 inches in height and 3 lbs in weight and features a conductively cooled 1.4 GHz Intel Pentium M processor—equivalent to a 2.8 GHz Pentium 4 performance—and a solid-state disk preloaded with a Linux or Windows XP Embedded operating system.

Rugged, watertight, ultraminiature Mil-spec performance connectors bring out dual 10/100 Ethernet network con-

nections, 3x USB, 2x RS-232, video, DIO, keyboard and mouse. This robust combination of function and small form factor ruggedness enables the unit to support a wide range of field applications, including Command and Control (C2) On-the-Move, Unmanned Vehicle Operator Control and C4ISR Situational Awareness.

Like its hardware, Aurora also develops its software for unmanned aircraft systems with high reuse functions in mind. Although each UAV serves a different purpose, Aurora minimizes the customization of its software by architecting its code to apply to multiple programs. By developing for reuse and modularity, Aurora has simplified its design procedures to ensure high value and increased efficiency.

Ruggedizing ACMC for Multiple Platforms

As the ACMC is deployed in various UAVs that encounter different environmental and physical requirements, further testing and qualifications were required to ensure heightened durability. Testing under MIL-STD-810F environmental conditions (high altitude, thermal, shock, vibration, humidity) was completed, and a 28V avionics power supply compliant with MIL-STD-704E was integrated. To ensure the ACMC could endure high altitudes encountered by some of Aurora's latest UAVs, Parvus completed additional analysis and/or testing to ensure the unit could operate at up to 60,000 feet.

After the ACMC passed qualification testing, production units were installed and successfully flew on board the GoldenEye 80 vertical takeoff and landing (VTOL) aircraft (Figure 2) and the Excalibur turbine hybrid-electric unmanned air system (UAS) (Figure 3). In addition, the unit flew on board the fully autonomous conventional takeoff and landing (ATOL/CTOL) Chiron demonstrator based on a Cessna 337. These aircraft represent new classes of tactical unmanned air vehicles. The ACMC is also being considered for installation in Aurora platforms currently under development.

COTS Development for UAVs

As UAVs have escalated from a niche technology to a key military strategy, the costs and risks associated with its computing architecture are heavily scrutinized. By leveraging COTS technology to sustain multiple UAV platforms, Aurora has proven that common computing architecture improves efficiency and provides the foundation for future growth. As commonality and commercial standards drive many of the military's programs, the further development of COTS products for UAVs will only help the warfighter improve mission efficiency. ▮▮

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Special Feature

Control and Comms in Small UAVs

Small UAVs Tap the Rich Variety of Embedded Options

Embedded technologies are providing Small UAVs the control and communications capabilities to help soldiers complete their missions more effectively and safely.

Christine Van De Graaf, Product Manager
David Pursley, Field Applications Engineer
Kontron

UAVs (Unmanned Aerial Vehicles) were originally developed to take the soldier out of harm's way and have come a long way since the days of "large" surveillance drones like the Predator and the Global Hawk. Today's UAVs range widely in size, weight and function, with a number of embedded computing technologies enabling a new breed of small UAVs. Advancements in power storage, motor design, miniaturization, and design and optimization techniques have led to the continuing evolution of the small UAV category. Today's crop of embedded computing form factors span a range of features and physical configurations suited to various small UAV requirements. The challenge is to pick the right one for the right job.

Simplicity with PC/104

Military applications have been using PC/104 and PC/104-compatible modules in instances where very low cost, small footprint and moderate performance are key requirements. With little or no customization, these COTS products fit the bill for a wide range of battlefield implementations.

Figure 1

UAVs like this micro plane are used to detect counter forces movement in variable terrain. Such systems rely on a COM (Computer-on-Module) that has generic PC functions, mounted on a larger custom designed carrier board containing application-specific I/O and power circuitry.

With a CPU board and optional stacked peripheral boards, PC/104 requires no motherboard, backplane or card cage. Pin- and socket-bus stack-through connectors offer a reliable signal path even in harsh environments. Each module measures 3.575 inches x 3.775 inches (90 mm x 96 mm), and contains four corner-mounting holes for board support to resist shock and vibration. Card spacing is 0.6 inches when stacked. PC/104 bus specifications are identical to those of ISA with one exception—PC/104 reduces the drive requirement for most signals to 4 mA of sink current, lowering overall power requirements and enabling ASIC devices to directly drive most bus signals without the need for separate driver components.

PC/104 is a stable platform with wide availability from a multitude of vendors that has evolved to deliver increased performance within very small form factors. Ideal for designs that require minimal or no hardware customization, PC/104 is a viable option in applications such as compact surveillance helicopters (similar in look only to the kind a RC hobbyist might fly for weekend entertainment), where simplicity is key and superior performance is just not required.

COMs: Compact Performance

Placing an entire computer host-complex on a small form factor module, COMs (Computer-on-Modules) are compact off-the-shelf modules that inherently provide all generic PC functions, including graphics, Ethernet, sound, COM and USB ports, along with other system buses. Mounted on

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a larger custom designed carrier board containing application-specific I/O and power circuitry, the combination provides the additional functionality required for specific applications including a micro plane used to detect counter forces movement in variable terrain (Figure 1).

The Embedded Technology eXtended (ETX) standard takes COMs further to provide full PC functionality, minimum engineering and adoption cost, reliable connectors, slim design, and simple upgradability and scalability. These highly integrated, very compact (95 mm x 114 mm, 12 mm thick) COMs contain the connector layout to carry a specific set of signals that gives designers the means to create a single-system baseboard that will accept current and future ETX modules.

Further evolution to the newer ETX 3.0 specification provides the same benefits of the original ETX standard, and adds in 2x Serial ATA with no change in ETX pins, making new modules 100 percent pin-to-pin compatible with previous versions to ensure long-term support and scalability. COM Express advances the standard, satisfying the higher performance applications of the military and demonstrates the push toward size reduction and mobility. And many of the military's smaller UAV designs have additional options within the COMs standard—microETXexpress possesses a very compact footprint at 95 mm x 95 mm, and nanoETXexpress is just 39 percent the size of the original COM Express standard form factor module.

Figure 2

COMs standards like this microETXexpress offer a very compact footprint at 95 mm x 95 mm.

Designs that require a good deal of application-specific customization and can accommodate a two-board solution (module plus custom carrier board) are well served by COMs (Figure 2). When a high run of product and some scalability from generation to generation is required, COMs are the ideal choice. In fact, COMs are an excellent option for devices or applications that not only require scalability from generation to generation, but also within a single generation.

CompactPCI: Extending Life

Many of today's battlefield applications, such as image processing and control systems, require the much higher bandwidth, gigabit Ethernet capabilities and more powerful rear I/O of 3U CompactPCI. Another COTS solution, Compact PCI in its 3U implementation addresses legacy issues inherent to military designs, and now offers new features that meet more harsh computing environment requirements. A rugged form factor that is less likely to succumb to shock and vibration, 3U CompactPCI has Rear I/O and can be either air-cooled or conduction-cooled. Rear I/O is an important requirement in many military applications, offering different capabilities for different applications. Board I/O signals routed to the backplane, in addition to or in lieu of routing them to the front panel, make the board much simpler to replace in the field. In fact, the CompactPCI board itself can be thought of as a Line Replaceable Unit (LRU).

3U CompactPCI has certainly kept up with the military's demand to reduce size, weight and power. With the broad range of processors available, the form factor can provide as much or as little power as needed. 3U CompactPCI continues to be widely supported with a broad selection of rugged chassis. And if a legacy military system has been using CompactPCI, it can be upgraded to the latest processors, extending further the life of the unit and negating the need to move to a new form factor.

VME and VPX: Legacy and the Future

According to standards group VITA, revenue points to mil/aero as VME's largest market segment. More than well-established in military design, VME legacy controller boards have a huge installed base and have been the go-to form factor for applications such as telemetry, GPS and sonar. As one of the first open standards, the VMEbus archi-

tecture offered a long list of benefits—it supplied high bus bandwidth and its backplane provided simpler maintenance and improved configuration flexibility. Optimized for real-time computing, VME featured a 32-bit addressing and data path, along with a highly ruggedized connector. These features have extended the life of VME, but with connector technology changing very little, the growing requirement for handling increased signal rates had to be met by another form factor.

Serial switched fabrics have improved performance in embedded computing, but have also created issues in power consumption and heat dissipation. Add to that the increased use of video and graphics, digital signal processing, sensor data acquisition and processing, and the UAV's more compute-intensive applications with feedback being provided in real time to ground monitoring systems. As a result, the VPX platform has emerged as ideal for data-intensive UAV applications, such as next-generation radar and electronic warfare monitoring, where high bandwidth is an issue. The VPX standard (originally VITA 46), developed as a migratory path to ease the transition from VME, is more costly than other form factors; however, these high-performance boards save data transmission time and increase intelligence gathering capabilities.

VPX gives designers exceptionally powerful and rugged performance for real-time military computing. By integrating VPX into legacy VME platforms, military designers have a path to retain the best of VME and incorporate significantly higher throughput. Figure 3 shows an example VPX board.

Considering Capabilities and Costs

As with all embedded system applications, considerations related to development time, enclosure space, environment, performance and cost play a large part in the selection of the appropriate platforms used for any UAV onboard system. Exemplifying this trend are UAVs

Figure 3

Based on the latest dual core 1.5 GHz Intel Core2 Duo LV processor, the VX3020 VPX CPU board offers high-end processing performance to meet a wide range of demanding signal and data processing requirements.

Figure 4

A Navy Petty Officer recovers a RQ-7 Shadow 200 UAV. The Shadow TUAS can carry payloads up to 27 kg, including a variety of sensors and electronic warfare systems, for up to seven hours.

like the Shadow (Figure 4)—a tactical UAV designed to carry payloads up to 27kg, including a variety of sensors and electronic warfare systems, for up to seven hours. While DoD budgets have been cut across the board, UAV programs are actually seeing an increase in funding, especially in the BCT Modernization program. Even so, there is always pressure to reduce cost and limit the amount of hardware on board, making COTS products the ideal option.

Form factors such as VMEbus, COMs (Computer-on-Modules), PC/104 and 3U CompactPCI have been among the technologies of choice for some time, depending on the size, purpose and functionality required within the UAV. COMs, for example, are used in many implementations but are being heavily integrated into smaller UAVs like those used to investigate mine fields. And VPX—with its roots in VME—is making the newest high-bandwidth applications a reality.

Significantly lighter than its piloted counterparts—achieving better fuel efficiency, longer flight time and other unique capabilities—today's small UAV systems run the gamut from telemetry to flight control to target acquisition to surveillance and even armament deployment. There is a whole collection of different subsystems and supporting technologies that go into the successful design of these vehicles, holding much promise for continued widespread growth and impact of unmanned aerial applications. ▮▮

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Fading fast are the days when performance and power consumption requirements were considered separately. Many military system developers are now thinking in terms of Mips-per-milliwatt.

Jeff Child,
Editor-in-Chief

Compute-density has become the watchword in many segments of military system design. More and more programs are pushing for as much computer processing muscle as can possibility fit into a board-level solution. Feeding such needs, embedded computer vendors are focusing not just on raw performance but on "Mips-per-mW," seeking the right balance of processing and power consumption.

Not all military embedded SBC vendors publish power consumption specs for their products, although most will provide such information upon request. If there's a trend in low-power board-level computers over the last 12 months, it's the proliferation of the Intel Atom processor in new board designs. The Intel Atom processor has been among the top architectures on new SBC products over the past year. The emergence of the Atom means there's no longer a reason to suffer with high power dissipation as a trade-off for using an Intel Architecture platform.

Figure 1

The TR A40/30x RC complies with the OpenVPX VITA 65 standard and sports the 1.6 GHz Intel Atom processor Z530. The board supports up to 2 Gbytes SDRAM and a wide variety of I/O interfaces, including a CANbus interface, while maintaining a typical power requirement of under 10 watts.

Atom Weighs In

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

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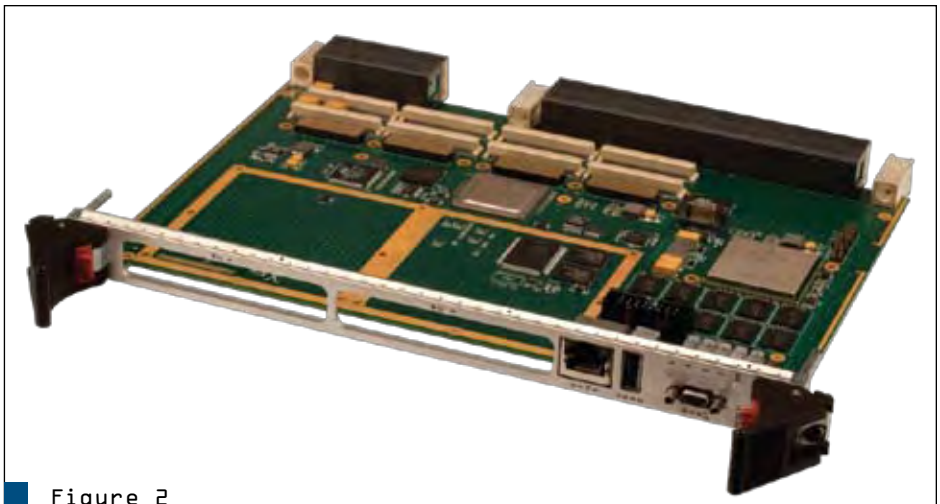

Figure 2

The XCalibur1541 is a high-performance 6U VPX SBC that has dual PowerPC e500 cores running at up to 1.5 GHz. The board provides two separate channels of up to 4 Gbytes of SDRAM and two PrPMC/PrXMC slots, at a power consumption of around 36 watts.

until the assurance of 15-year part availability was offered.

Exemplifying this embracing of the Atom, Concurrent Technologies makes a low-power 3U VPX-REDI single SBC, the TR A40/30x RC (Figure 1), designed to comply with the OpenVPX VITA 65 standard. The TR A40/30x RC uses the 1.6 GHz Intel Atom processor Z530 and the highly integrated Intel System Controller Hub US15W, both from the Intel embedded roadmap, ensuring long-term availability. The board supports up to 2 Gbytes DDR2-533 soldered SDRAM and a wide variety of I/O interfaces, including a CANbus interface, yet maintains a typical power requirement of less than 10 watts.

This VPX SBC also supports dual Gbit Ethernet (or dual 1000 Base-BX) ports, a high-speed CANbus controller, two USB 2.0 ports, two RS-232/RS-422/RS-485 ports, two Serial ATA300 interfaces, DVI-D graphics, and Intel High Definition stereo audio. An XMC module can be fitted to the onboard XMC site within a single slot. The XMC interface supports a x4 PCI Express link along with Pn6 XMC rear I/O to the P2 connector mapped out as P2w7-X8d+X12d. For embedded applications the board supports, as standard, 4 Gbytes of onboard NAND Flash via an EIDE interface. Other features provided are a PC real-time clock, watchdog timer, long duration timer and four GPIO signals. The VPX data plane interface is a configurable PCI Express backplane fabric interface. The backplane fabric interface can be configured as 8 x1 PCIe ports, 2 x4 PCIe ports, or 1 x4 and 4 x1 PCIe ports. All fabric configurations are compatible with OpenVPX slot profiles.

Spanning a Variety of Form Factors

The Atom processor is showing up on nearly every variety of embedded standard form factor. An example of a recent CompactPCI-based Atom SBC offering is a 3U CompactPCI system called the CP305 from Kontron. The rugged Kontron CP305 features EN50155-compliant reliability and extremely low TDP (Thermal Design Power), soldered processor, chipset and RAM for harsh environments. Equipped with the 1.6 GHz Intel Atom processor N270, Intel 945GSE plus ICH7M chipset and up to 2 Gbytes of soldered DDR2 memory, the Kontron CP305 has a typical power consumption of only 10 watts. According to Kontron, this is less than half compared to earlier generations with identical performance.

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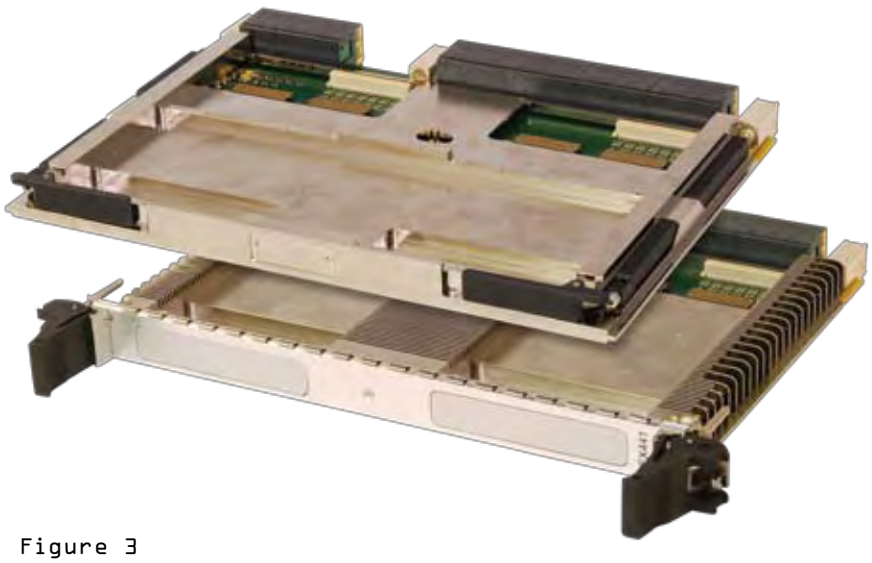

Figure 3

The PEX441 Rugged 6U VPX XMC Carrier Card is optimized for excellent thermal performance, with the capability to enable power densities of up to 30W per XMC. One or two XMCs can be accommodated.

CompactFlash socket. The graphics accelerator, integrated into the Mobile Intel 945GSE Express chipset, provides excellent 2D, 3D and video features for the VGA connector on the front. The 3U CompactPCI CPU board is available as single slot (4HP) or dual slot (8HP). Engineers profit from the 8HP version by additional features including COM, PS/2, DVI on the front for dual monitor operation and a 2.5-inch SATA hard disk interface to mount a HDD or SSD required for harsher environments.

Strong PowerPC Legacy

While the Intel Atom is relatively new on the low-power embedded processing scene, the Freescale PowerPC architecture enjoys a long legacy in military systems and has always enjoyed an edge over the latest and greatest Intel desktop processor. Extreme Engineering has recently rolled out the XCalibur1541 (Figure 2), a high-performance 6U VPX single-board multiprocessing computer aimed at ruggedized systems requiring high bandwidth processing and low power consumption. With dual PowerPC e500 cores running at up to 1.5 GHz, the MPC8572E delivers enhanced performance and efficiency for today's embedded computing applications.

The XCalibur1541 provides two separate channels of up to 4 Gbyte (2 Gbyte each) DDR2-800 ECC SDRAM, two PrPMC/PrXMC slots, as well as 256 Mbytes of NOR flash (with redundancy). The XCalibur1541 also supports four Gbit Ethernet ports, PMC I/O, XMC I/O, and RS-232/422/485 serial ports out the front panel and/or VPX backplane connectors. Power requirement for the board is estimated at 36W per board.

Non-Backplane Rugged SBC

Non-backplane embedded computers are gaining traction in a lot of military embedded applications where size and weight reduction is on par with low-power needs. Serving such needs, MEN Micro offers an ultra-small form factor called ESMini. MEN's MM1 was the first Ultra-Small Computer-on-Module of the new ESMini family. Based on the Intel Atom processor in 45nm technology, the COM module offers processor frequencies of up to 1.6 GHz combined with a power consumption of only 5 to 7W and extended temperature range. The chief attraction of the MM1: The electronics are completely enclosed, which means that they are thermically coupled to the system via conductive cooling as well as 100 percent EMC-protected. Combined with

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- Best performance-per-watt
- Low power consumption, 5 W
- Passive cooling with EMC shield
- Long term availability (10 years +)
- Fail Safe BIOS
- Extended temperature range
  -40°C ... +85°C (opt.)

A new form factor

LiPPERT's latest development, CoreExpress-ECO, is the smallest COM module available today. It measures only 65 x 58 mm, yet comes with the best performance-per-watt figures. Minimum power consumption and an optimized cooling concept make its integration a snap. The processor independent module concept does not use any legacy interfaces.

Future proof

CoreExpress-ECO modules are designed for long product life. Its components have been specially selected for long-term availability. Versatile IO interfaces allow flexible implementation of all required interfaces on the carrier board.

Versatile

Applications profiting from the flexibility and robustness of the CoreExpress-ECO are industrial image processing, communication systems, logistics, medical devices, mobile health care, mobile embedded PC systems, POI, POS, robotics, traffic management, and digital signage devices.

LEMT - LiPPERT Enhanced Management Technology

CoreExpress modules support the System Management Controller based LEMT. It provides auxiliary functions like condition monitoring, operating hours counter and secure flash memory, (WORM) usable for encryption keys.

Development Support

The ready-to-run evaluation kit is the easiest way to test and evaluate the CoreExpress-ECO.

Operating systems supported are Windows XPE, Windows CE, QNX and Linux.

++++++++++ www.coreexpress.com ++++++++++

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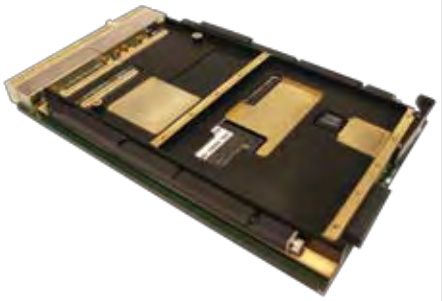

Figure 4

The S950-02 is an enhanced version of the Aitech space-flown S950 3U cPCI rad-tolerant SBC. Using the high-performance PowerPC 750GX running at 1 GHz, the conduction-cooled S950-02 combines a significantly low overall board power consumption of less than 10W.

an application-specific carrier board, the small module with dimensions of only 95 mm x 55 mm is the perfect solution for industrial, harsh, mobile and safety-critical applications.

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

Low-Power Carrier-Board Solution

One way to keep power consumption under control is to avoid a high-power SBC altogether and instead mix and match mezzanine functionality on a carrier board. With just that in mind, GE Fanuc Intelligent Platforms' PEX441 Rugged 6U VPX XMC Carrier Card (Figure 3) is designed to enable system architects and integrators to include a broad range of high-performance XMCs in their designs. The PEX441 is specifically optimized for excellent thermal performance, with the capability to enable power densities of up to 30W per XMC. One or two XMCs can be accommodated. Typical XMC applications will include system I/O, FPGA processing, graphics, and digital/analog and analog/digital interfaces.

The PEX441 supports a broad range of flexible I/O options, allowing systems designers a choice of switched fabric topology. The PEX441 is available in five build levels, providing a cost-effective choice between platforms for benign environments through to systems that will be deployed in harsh environments. It is optionally compliant with the VITA 48/REDI specification for rugged systems. The carrier board extends the functional envelope of a 6U VPX system by leveraging an array of GE Fanuc or customer proprietary XMC modules into a distributed, fabric-based architecture, removing the need to host high-power mezzanines on high-power CPU cards.

Low Power for Rad-Hard Environments

Rugged military requirements are one thing, but outfitting an embedded computer to work in space takes a whole different level of ruggedness. Aitech Defense Systems meets those needs in the S950-02 (Figure 4), an enhanced, 1 GHz version of its space-flown S950 3U CompactPCI (cPCI) radiation-tolerant SBC. Using the high-performance PowerPC 750GX running at 1 GHz, coupled with silicon on insulator (SOI) PowerPC technology, the new conduction-cooled S950-02 combines a significantly low overall board power consumption of less than 10W with configurable processor speeds and better radiation tolerance to provide an effective unshielded total ionization dose (TID) greater than 15 krad (Si). The highly reliable SBC provides a low single event upset (SEU) rate of less than one upset per 900 days of operation in LEO with considerations for the worst case solar flare and the South Atlantic Anomaly (SAA).

To protect onboard memory resources from radiation effects, the S950-02 incorporates 128 Mbytes of triple-re-

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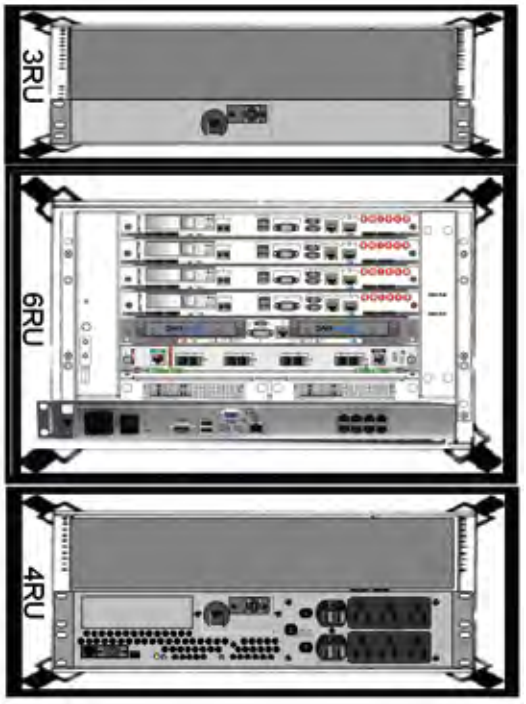

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Expansion Bus	PC/104 ISA Bus			✓						✓	✓	✓	✓	✓	✓
	PCI-104 PCI Bus	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓
	PCIe/104 Express Bus	✓	✓												
CPU and BIOS	CPU Max Clock Rate (MHz)	1860	1200	1400	1400	1400	1400	1400	1400	650	650	650	650	500	500
	Intel SpeedStep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

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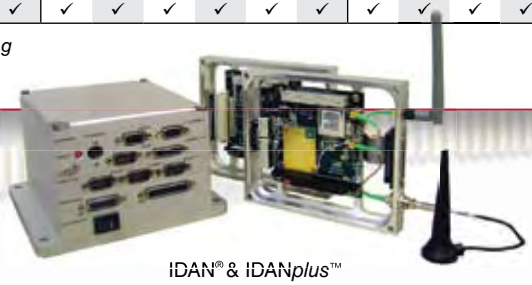

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Bus	Active Bus	PCI	PCI	ISA	ISA	PCI	PCI	PCI	PCIe	ISA	ISA	ISA	PCI	PCI	PCIe	PCI
	Passthrough Bus	ISA				ISA	ISA		PCI				ISA		PCI	ISA
	DMA or PCI Bus Master	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓
	McBSP Serial Ports	✓	✓			✓	✓	✓	✓							
Analog Input	Single-Ended Inputs	16	16	16	16	16	16	16	16							
	Differential Inputs	8	8	8	8	8	8	8	8							
	Max Throughput (KHz)	1250	1250	500	100	1250	500	500	500							
	Resolution (bits)	12	12	12	16	12	16	16	16							
	Input Ranges/Gains	3/7	3/7	3/4	1/4	3/6	3/3	3/3	3/3							
	Autonomous Calibration	✓	✓													
	Data Marker Inputs	3	3	3		3										
Conversions	Channel-Gain Table	1K	1K	1K	1K	1K	1K	1K	1K							
	Scan/Burst/Multi-Burst	✓	✓	✓	✓	✓	✓	✓	✓							
	A/D FIFO Buffer	8K	8K	8K	8K	8K	8K	8K	8K							
	Sample Counter	✓	✓	✓	✓	✓	✓	✓	✓							
	SyncBus	✓	✓			✓	✓	✓	✓							
Digital I/O	Total Digital I/O	16	16	16	16	16	16	16	16	48	18/9	64	48	48	48	48
	Bit Programmable I/O	8	8	8	8	8	8	8	8	24	6/0		48	48	48	✓†
	Advanced Interrupts	2	2	2	2	2	2	2	2	2			2	2	2	✓†
	Input FIFO Buffer	8K	8K	8K	8K	8K	8K	8K	8K							
	Versatile Memory Buffer												4M	4M	4M	8MB
	Opto-Isolated Inputs											48				
	Opto-Isolated Outputs											16				
	User Timer/Counters	3	3	2	2	3	3	3	3	3	3		10	10	10	6
	External Trigger	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓†
	Incr. Encoders/PWMs										3/9		4/8	4/8	4/8	✓†
Analog Out	Analog Outputs	2	2	2	2	2	2	2	2							
	Max Throughput (KHz)	200	200	200	100	200	100	100	100							
	Resolution (bits)	12	12	12	16	12	16	16	16							
	Output Ranges	4	4	3	1	4	5	5	5							
	D/A FIFO Buffer	8K	8K			8K	8K	8K	8K							

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dundant SDRAM with three bits per cell. On the rad-tolerant FPGA, a voting mechanism performed only on the read cycle allows for data correction before sending to the CPU or PowerPC bus. One Mbyte of dual-redundant boot flash stores the onboard boot firmware and ensures full data integrity in the event of corruption during the boot-up sequence. ▮▮

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HALT/HASS Testing Goes Beyond the Norm

The defense industry is looking to HALT/HASS testing methodologies for greater levels of system reliability. The overall investment reduces development time with improved performance

Rob Dixon, Staff Reliability Engineer
RadiSys

The increased focus on network-centric warfare in today's military operations has expanded the use of embedded systems in the deployment of mobile, mission-computing and high-performance applications. These embedded systems must be rugged enough to handle the toughest environmental conditions such as extreme temperatures, yet be efficient enough to meet application needs for power and heat dissipation. For many embedded applications in the mobile and mission-computing segments, HALT (Highly Accelerated Life Testing) and HASS (Highly Accelerated Stress Screening) testing is a necessity. Given the recent shift from internal, proprietary developments to solutions built from commercial off-the-shelf components, the military is now looking outside of its engineering ranks to guarantee that its components are rigorously temperature tested.

Aerospace and Defense end users are requiring Original Equipment Manufacturers (OEMs) to adhere to HALT/HASS testing methodologies in order to ensure greater levels of product quality and reliability. In today's economy, spending time and resources performing these tests, not to mention investing in the test equipment itself, could be a weighty proposition. Companies may find it difficult to balance the upfront commitment with smaller budgets and reduced manpower. However, unexpected failure modes and/or high failure rates can result in expensive field service calls or significant downtime. As a result, product failures usually end up costing manufacturers more in the end.

Figure 1

Talon Unmanned Ground Vehicles (UGVs) made by Foster-Miller are rugged, lightweight tracked vehicles that are widely used for explosive ordnance disposal (EOD), reconnaissance, communications, sensing, security, defense and rescue.

For OEMs, finding a partner to perform HASS/HALT testing in-house is crucial to managing testing expenses. Equally important is finding a vendor that utilizes best testing practices, including extended temperature testing. Given the cost and security implications associated with military deployments, it is important to test at a wide temperature spectrum and high vibration levels upfront. By partnering with a HALT/HASS testing specialist, OEMs can reduce development time as well as deploy military applications quickly and cost-effectively with improved performance.

COM Express Can Take the Heat

The standards-based, highly reliable architecture of COM Express is an ideal fit for many military applications in the mobile and mission-computing segments, including ruggedized multipurpose computers and unmanned

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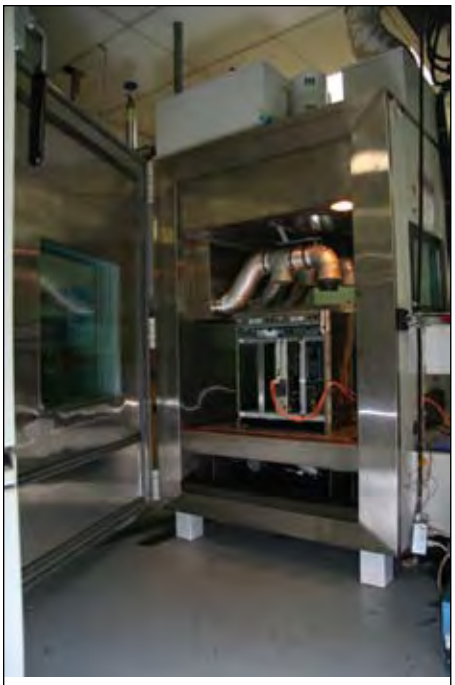

Figure 2

Shown here is a HALT (Highly Accelerated Life Testing) chamber containing a chassis/board-level system under test.

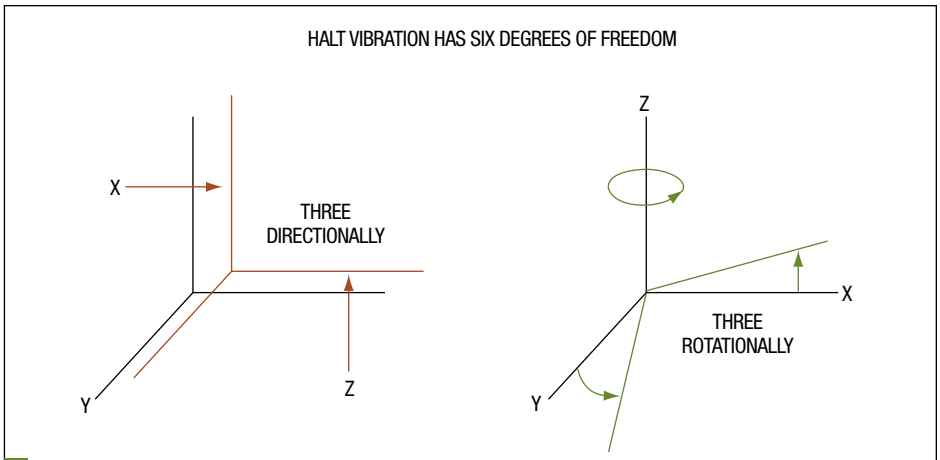

Figure 3

Unlike traditional vibration tests, HALT covers six degrees of vibration movement.

vehicles. COM Express is the PICMG specification for Computer-on-Module, and solutions based on this form factor reap the benefits of modularity, scalability and ease of upgradeability. In addition, COM Express-based solutions are highly integrated and compact, delivering high-performance processing within a small, low-power embedded form factor. Those aspects make it an ideal platform for portable, battery-powered applications and helps designers meet the unique enclosure needs for aircraft and ships. COM Express solutions leverage the latest Intel mobile processors and chipsets, are engineered to support current performance requirements such as PCI Express and SATA, and most importantly, are rugged enough to handle the harshest environmental factors.

Systems like Unmanned Ground Vehicles (UGVs) (Figure 1) or man-wearable computers must be ruggedized to stand up to extreme temperatures, shock, vibration and G-forces, in the air, under water or on the ground, and must perform reliably under extreme temperatures and vibration conditions in the field. Portable and in-vehicle devices are additional applications that can benefit from a COM Express embedded component. Mobile computing applications and wearable units must be lightweight, rugged and perform reliably under extreme temperatures in the field.

Testing Rugged Form Factors for Tactical Apps

Though there are varying degrees of ruggedness for different military embedded applications, HALT and HASS are advanced approaches to testing in the design stage and manufacturing stage to ensures that solutions are capable of operating at extended temperatures under harsh vibration reliably.

The first step in extended temperature testing is to demonstrate a product's capability by employing HALT (Highly Accelerated Life Testing) techniques. Figure 2 shows a HALT chamber containing a chassis/board-level system under test. HALT is used in the design phase to explore and maximize the full limits of a product design. This testing consists of a stepped thermal and vibration stress process during which the actual limits of the design and component performance are determined. As Figure 3 shows, HALT covers six degrees of vibration movement. As failure modes are discovered, they are corrected by design or component improvement until no further improvement is practical or is limited by the fundamental limit of the underlying technologies. By establishing that the design and components are capable of operating not only to the extended temperature specification but well beyond, HALT demonstrates the true operational limits of the product. The concept and execution of maximizing the design margin is critical to successfully producing reliable, extended temperature products.

As shown in Figure 4, note that the HALT range exceeds the product operating specifications by a large margin. Even with ongoing production variation represented by the normal curves, note that the operating limits never fall within the product specification range. In other words, with enough margin, the product becomes immune to normal variation and will thus produce very high yields and sustained conformance to the product specifications during production life. Once the HALT process demonstrates sufficient margin, ongoing monitoring of that margin must take place to ensure the detection of changes that could affect the performance.

The Next Step: HASS

Once rigorous testing has established the product capability for extended tem-

perature operation, it is critical to also have a process for ongoing monitoring of that capability. The HASS (Highly Accelerated Stress Screening) process is used to accomplish this next phase in the process. HASS screen limits can be set beyond the product specification to ensure that the product maintains operating margin. In order for HASS to be truly effective, it must be performed on 100 percent of the products manufactured. In this way, an OEM can guarantee that each product not only meets the extended temperature requirement, but that it does so with additional operating margin, ensuring long-term performance and reliability.

By driving operating margin into the design, an OEM can become immune to material and process variation in manufacturing, attain high yields during all production phases, and have sustained reliability and low warranty costs, all with no surprises in the field. So to recap, HALT drives the design to its fullest capability, and HASS ensures at the production end that each and every product operates at the specified range.

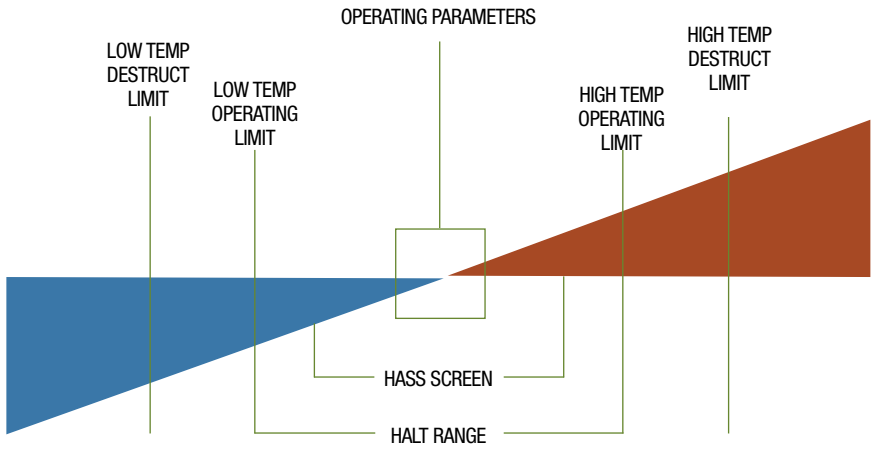

Figure 4

The HALT range exceeds the product operating specifications by a large margin. With enough margin, the product becomes immune to normal variation and will thus produce very high yields and sustained conformance to the product specs during production life.

Partnering with Experts Reduces Cost, Risk

It is critical that an OEM not just perform HALT/HASS testing, but also that they employ industry-leading best practices to deliver extreme capability and sustained reliability to their customers. However, robust HASS/HALT testing can be quite costly and time-consuming for an OEM to conduct in-house. To overcome these resource drains, OEMs are turning to their ecosystem partners to share the responsibility and costs involved with testing their solution's components, and to save precious time in the development process.

Extended temperature and vibration testing can be an expensive, time-consuming process that requires specific facilities and staff who are able to identify and work through the unique challenges of HALT/HASS testing to achieve success. The ideal ecosystem partner for COM Express has a solid reputation for employing manufacturing and engineering best practices and has a proven track record of successful embedded deployments in the field. They will also have invested significantly in state-of-the-art testing equipment, saving its customers from investing significant upfront capital expenditures, along with operating expenditures in terms of precious engineering resources that could be allocated elsewhere.

Deployment-Ready Systems

When a partner undertakes the screening of its COM Express products, it assumes the associated risks. Since the partner specifies the products' operating range, then it is held responsible for any fallout that may occur. In the past, a mil-aero end user could face "hit or miss" success when purchasing commercial off-the-shelf components. Although several components of a solution may not be mil-grade, the OEM can leverage its partners' expertise to ensure that the entire solution meets the end user's specific temperature requirements, providing a warranty for extended temperature.

Lastly, time-to-market goals depend on thorough and upfront testing. Partnering with a company with a proven track record of qualified and fielded deployments provides OEMs with a fast path through the testing process. These resources help OEM customers quickly and economically identify and correct product issues before they become costly customer support problems in the field.

RadiSys is an example of an embedded computing provider that employs HALT testing to meet and exceed the published product specifications—providing significant operating margins for harsh environments. The company also implements an on-going HASS program for consistent monitoring of extended temperature products to ensure their reliability during field deployment and throughout the lifetime of the product. The Extended Temperature line products are designed with high-capability components and are subjected to an extensive suite of environmental tests to demonstrate capability of operation in -25° to +70°C temperature range. ▮▮

RadiSys
Hillsboro, OR.
(503) 615-1100.
[www.radisys.com].

Technology Focus

XMCs and Processor XMCs

XMCs and PrXMCs Open Door to New Levels of Performance

XMCs and Processor-based PrXMCs pick up where the ever popular PMCs and PrPMCs left off, paving the way to the next generation of performance requirements.

Jeff Child
Editor-in-Chief

Mezzanine cards have held an entrenched position in military embedded systems since the early days of SBCs and standard backplanes. They enable system developers to mix and match the functions they need and by doing so create a semi-custom solution using off-the-shelf products. Meanwhile, processor-based mezzanines pioneered the idea of separating computing functions from I/O, and application-specific functions have become a core theme in military applications—a notion that's extremely attractive for applications with long design cycles like the military. Today, the long popular PCI-based PMC and Processor PMC (PrPMC) each have their respective successors in the form of XMC and PrXMC.

The VITA 42 XMC set of standards provides backward compatibility with legacy PMC modules while allowing PCI bus products to integrate switched fabric architectures. The standards build on the existing PMC standards by adding switched fabric interconnects to the existing PCI bus interface. XMC has a conduction-cooled option that piggybacks off the VITA 20 Conduction-Cooled PMC standard.

To support gigabit serial interfaces, notice that both P15 and P16 connectors define 10 full-duplex differential pair lines. The VITA 42.0 base specification does not dictate signal types, data rates, protocols, voltage levels or grouping for these signals. Instead, it leaves that up to the several sub-specifications that are part of the VITA 42 family. This allows XMCs to evolve as new interconnect technologies and protocols emerge.

Over the past couple of years, FPGAs have become a fixture in mezzanine card designs. As the product roundup on the next several pages shows, FPGAs are a dominant part of most of the latest crop of XMC products. FPGAs offer a collection of resources ideally suited for peripheral I/O functions. FPGAs may be configured to implement numerous electrical interface standards as well as a variety of protocol engines.

Reconfigurable FPGAs can be used to enable an I/O board to replace several legacy products, while adapting to future standards and protocols as well. This helps to mitigate product obsolescence, both at the board level and at the deployed system level. Thanks to the magic of today's level of semiconductor integration, multi-function board products have emerged enabling military system designers to blend a variety of I/O functions onto a single XMC card. The challenge has been to choose I/O technologies that are suited for use together.

Figure 1

The E-2D Advanced version of the Hawkeye aircraft is currently under development. The E-2D features an entirely new avionics suite, including the new APY-9 radar, radio suite, mission computer, integrated satellite communications capability, flight management system, improved engines, and an advanced "glass" cockpit.

In applications that depended heavily on signal acquisition, raw resolution and bandwidth are only effective if the analog front end and the acquisition subsystem maintain good signal integrity as the signal is moved into the digital domain for processing. Here, XMC mezzanines help that issue as the analog components can be physically on a separate card from the digital processing components on the carrier card.

An example of a system suited to take advantage of XMC-based FPGA processing solutions is the E-2D Advanced Hawkeye (Figure 1). The data recording and playback systems for the E-2D can scale up to dozens of modular, heterogeneous input/output channels and FPGA-based protocol engines to support application-specific processing in real time during record and playback. As storage technology and FPGA technology advance, that approach allows the system architecture to boost throughput and storage capacity through reuse of the modular building blocks within an open standard framework.

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Technology Focus:

XMC and PrXMC Roundup

Rugged 10 Gbit Ethernet XMC Sports Dual Front-Panel Interfaces

The military has completely embraced Ethernet both as a network technology and as a fabric interconnect scheme. With that in mind, AdvancedIO Systems offers the V1121, a conduction-cooled 10-Gigabit Ethernet (10GbE) XMC module with dual front-panel optical interfaces. The V1121 brings the benefits of open standards-based connectivity to real-time high-bandwidth applications operating in harsh physical environments where long cable runs or challenging electromagnetic interference (EMI) concerns preclude the use of copper-based interconnects. The V1121's programmability, supported by AdvancedIO's ExpressXG FPGA framework, enables the integration of application and preprocessing functionality directly into the 10GbE fat pipe. This capability solves challenging connectivity bottlenecks that would occur in more traditional architectures where this tight integration is not possible.

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

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

Ultra-Low-Power 1.6 GHz Atom Processor Rides XMC

Reducing Size, Weight and Power (SWaP) has become the mantra for many advanced military embedded computing systems. Feeding such needs, Concurrent Technologies has introduced an ultra-low-power processor PMC/XMC module, the XP A40/x03. The board features the 1.6 GHz Intel Atom processor Z530 and the integrated Intel System Controller Hub US15W, both chosen from the Intel embedded roadmap to ensure long-term availability of supply. Additional features include up to 2 Gbytes DDR2-533 SDRAM, 4 Gbytes of NAND Flash, graphics and a variety of I/O interfaces including a CANbus controller and dual Gbit Ethernet ports.

The board has a typical power consumption of less than 10W and is available in commercial and extended temperature variants, with a rugged conduction-cooled board being released in the near future. The XP A40/x03 Processor PMC/XMC module interfaces to a variety of base boards via a 64-bit PCI/PCI-X (up to 133 MHz) interface (PMC option) or via a x1 PCI Express interface (XMC option). The PMC option supports monarch and non-monarch modes of operation and the XMC option supports Root Complex and Endpoint operation. The XP A40/x03 Processor PMC/XMC module supports, via the Pn4 rear panel connector, a 1600 x 1200 DVI-D graphics interface, a high-speed CANbus controller, four USB 2.0 ports (with a fifth USB port to the front panel), two RS-232/422/485 ports (one switchable to the front panel as RS-232), and two Gbit Ethernet channels. Other features provided are a PC real-time clock, watchdog timer, long duration timer, three GPIO signals and a legacy speaker interface.

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

Wireless XMC Blends Wi-Fi, Zigbee, GPS and Cryptography

The magic of chip integration has enabled board designers to pack several functions on one card. Exemplifying that trend, Curtiss-Wright Controls Embedded Computing has introduced the XMC-660, a multifunction mezzanine card that combines wireless, GPS and cryptography to deliver portable, secure in-the-field wireless connectivity. The lightweight, small form factor XMC-660 is an ideal solution for quickly and easily adding high-performance trusted wireless communications to VME, VPX and CompactPCI embedded systems for applications including luggable computers, manpacks and secure laptop computers.

Designed for rugged environments, the XMC-660, based on the VITA 42 XMC standard, uniquely combines support for Wi-Fi 802.11 n/a/b/g communications, Zigbee 802.15 asset tracking, and GPS location services on a single plug-in mezzanine card, to deliver an ideal solution for systems integrators building embedded wireless networks. Power dissipation for the card is 7W (typical) / 8.4W (max). It requires only a 5V power supply from the basecard. All other necessary voltages are generated on board the XMC-660. Pricing for the XMC-660 starts at $4,600 in single quantities.

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

Conduction-Cooled PrXMC Sports Dual-Core QorIQ

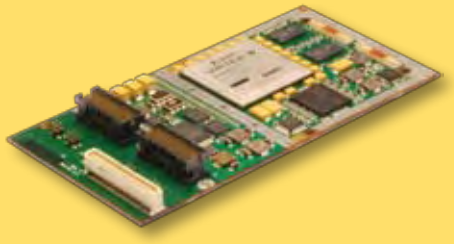
The processing muscle that once required multiple boards is now possible in a single processor-XMC mezzanine card. An example along those lines is the XPedite5501, a PrPMC/XMC single board computer targeting the Freescale QorIQ P2020. Hardware options range from commercial / air-cooled to full military conduction-cooled solutions. With dual PowerPC e500 cores running at up to 1.2 GHz, the P2020 delivers enhanced performance and efficiency for today's network information processing and other embedded computing applications.

Complementing processor performance, the XPedite5501 features up to 4 Gbytes of DDR3-800 ECC SDRAM. A configurable SerDes interface (PCI Express or Serial RapidIO) to the XMC connector and a conventional PCI interface to the PMC connectors provide ample bandwidth to the P2020. Two Gbit Ethernet ports, USB 2.0 port and two RS-232/422/485 ports are routed to P14 or P16 for additional system flexibility. A detachable front panel provides one 10/100/1000 Mbit/s Ethernet port and one RS-232 serial port for development. The XPedite5501 provides a high-performance, feature-rich solution for current and future generations of embedded applications. Operating system support packages for the XPedite5501 include Wind River VxWorks, QNX Neutrino, Green Hills Integrity and Linux 2.6. XPedite5501 is shipping today; pricing varies from $1,995 to $3,595 depending on memory configuration and Level 1 to Level 5 ruggedization level. Volume discounts are available.

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

Rugged XMC Offers Choice of Three FPGAs

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

FPGA-Based XMC Card Exceeds 300 GMACs/s

XMC has become the de facto upgrade path for the venerable and popular PMC mezzanine. The X5-GSPS from Innovative Integration is an XMC I/O module that serves up the National Semiconductor 1.5 GSPS ADC08D1500 dual-channel, 8-bit A/Ds connected to a Virtex5 FPGA computing core, DRAM and SRAM memory plus an eight lane PCI Express host interface. A Xilinx Virtex5 SX95T with 512 Mbyte DDR2 DRAM and 4 Mbyte QDR-II memory provides a very high-performance DSP core for demanding applications such as emerging wireless standards. The close integration of the analog I/O, memory and host interface with the FPGA enables real-time signal processing at extremely high rates exceeding 300 GMACs per second.

The X5-GSPS provides engineers a turnkey, modular solution suited to radio-frequency demodulation applications or other wideband analog signal capture applications. IP blocks available from Innovative can be embedded within the FPGA to perform digital down-conversion and decoding, unburdening the host of this computationally intensive processing function. The X5 XMC modules couple Innovative's Velocia architecture with a high-performance, 8-lane PCI Express interface that provides over 1 Gbyte/s sustained transfer rates to the host. Quantity one pricing for the X5-GSPS is $9,995.

Innovative Integrations
Simi Valley, CA.
(805) 578-4261.
[www.innovative-dsp.com].

Dual 10 Gbit Ethernet XMC Supports Copper or Fiber

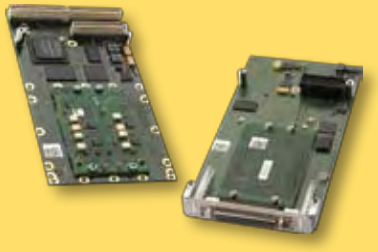
Mezzanine boards offer a tried and true method for extended functionality on SBC. With just that in mind, Kontron's new dual 10 Gbit Ethernet XMC401 mezzanine board extends all CompactPCI, VME and custom boards offering a XMC slot by two 10 Gbit Ethernet ports. Based on the Intel 82599ES 10 Gbit Ethernet controller, Kontron's next-generation Ethernet XMC provides more than sufficient data throughput for the Ethernet networks of today and tomorrow. The new dual 10 GbE controller, which connects to the host computer via PCIe x8, efficiently reduces CPU load. Combined with the new capabilities and enhancements of the Intel 82599ES 10 Gbit Ethernet controller such as checksum offload, TCP segmentation offload and reduced interrupt operations, the Kontron XMC401 helps release processors from network I/O bottlenecks to unleash blazing performance in a variety of usage models.

By supporting the latest Intel VT technologies, Kontron provides the platform foundation for virtualization and storage over Ethernet and opens up new possibilities for efficiently utilizing network connections. Offering the possibility of either one or two SFP+ channels as well as support for copper and/or optical transmission, the Kontron XMC401 allows for maximum flexibility. Furthermore, it has intelligent behavior through the operation of 1GbE direct attached copper or 1/10 GbE fiber network configurations. The Kontron XMC401 dual 10 Gbit Ethernet mezzanine board is available now.

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

FPGAs Enable Custom PMC and XMC Solutions

Standard mechanical form factors are one thing, but many military applications need their own unique processing configuration. Feeding such needs, MEN Micro now offers its FPGA-based Universal Submodule (USM) concept on two additional mezzanine cards: the P699 XMC and the P598 conduction-cooled PMC (ccPMC). All products based on MEN Micro's USM concept use one or more IP cores in an FPGA to help designers easily and quickly turn individual I/O requirements into production-ready products reducing design time and costs. The use of Cyclone FPGAs on the two new cards enables exceptional I/O combinations in a very small space for moderate volumes and at a low cost.



The corresponding line drivers are implemented on the individually designed USM submodule that plugs into the main XMC or ccPMC. Because they function independently of other electronic components, the IP cores provide trouble-free, long-term operation over the temperature range of -40° to +85°C (-40° to +185°F). A USM development package includes a main PMC with a USM submodule, test hardware and an FPGA package with a Nios CPU, memory control, connection to the PMC, Avalon/Wishbone bridges and detailed documentation. Pricing for a USM development kit starts at $2,993.

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

XMC Digital Receivers Employ FPGA Technology

FPGAs are providing a vital function in today's signal processing-based military systems. FPGA processing lets systems convert incoming analog signals quickly into a digital format, and do critical preprocessing of the data before sending it along. Feeding such needs, Mercury Computer Systems provides a series of high-performance, Virtex-5-based digital receivers. The Echotek Series DCM-V5-XMC digital receiver features the latest in A/D and D/A technology, allowing for high-speed/high-resolution data conversion while still preserving the quality of the original signal. It implements either a Virtex-5 SX95T or LX155T FPGA, which can be programmed by the end user for customer-specific application features.

Each Virtex-5 FPGA is accompanied by both DDR-II-SDRAM and QDR-II-SRAM memory chips; the memory is available for buffering input data streams and for supporting computationally intense applications. This set of flexible resources delivers unique capabilities, such as multi-board coherency, making the new product especially well suited for beamforming and direction-finding, as required by many radar, signals intelligence, electronics intelligence and communications applications.

Mercury Computer Systems
Chelmsford, MA.
(978) 256-0052.
[www.mc.com].

Virtex 6 FPGA Climbs Aboard Data Converter XMC

Military communications, radar and telemetry systems seem to have an endless appetite for high-speed, multichannel data conversion. Pentek's 71620, the first member of Pentek's Cobalt family of products, employs Xilinx's new Virtex-6 family of FPGAs to address those needs. With greater than two times more resources than previous Virtex generations, including new enhancements in digital signal processing, logic and clocking technology, the Virtex-6 family delivers the industry's most advanced FPGA technology.

The Pentek 71620 analog front end features three Texas Instruments ADS5485 200 MHz 16-bit A/Ds delivering excellent dynamic range and an input bandwidth of 350 MHz, ideal for signal intelligence, radar, beamforming and undersampling applications. 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, making the dual D/A extremely flexible for generating many popular communications and radar signals. 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. In the case of multiple board systems, each 71620 can receive and lock to a front-panel system reference clock. The 71620 XMC module is designed for conduction-cooled assemblies and PCIe versions are also available. Software support packages are available for Linux, Windows and VxWorks operating systems. In addition, Pentek's GateFlow Design Kit is available for custom IP development. The 71620 is immediately available starting at $11,500.

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

Serial FPDP PMC/XMC Boasts 25.6 Gbit/s Throughput

Raw, full-out bandwidth is what FPDP is all about. With that in mind, TEK Microsystem's JazzFiber-V5 Serial Front Panel Data Port (FPDP) I/O module features high-performance streaming sensor I/O interfaces. The JazzFiber-V5 module provides single and multichannel ANSI/VITA 17.1-2003 Serial FPDP interfaces with the hardware, firmware and software features to support the emerging VITA 17.2 standard for Serial FPDP extensions.

The JazzFiber-V5 module is the first Serial FPDP I/O module to support four fiber optic interfaces at up to 6.4 Gbits/s for aggregate throughput of 25.6 Gbits/s. It uses the latest Virtex 5 FPGA technology, including FXT devices. The card does classic Serial FPDP plus draft VITA 17.2 extensions, including channel bonding, higher bit rates and protocol enhancements. The card sports 512 Mbytes of DDR3 memory with 6.4 Gbytes/s of onboard throughput. The module will support memory capacities of up to 2 Gbytes when higher density memory devices are available in 2009.

The PMC interface is a PCI-X 64-bit 133 MHz local bus. The XMC interface is PCI Express 1.0a x8 for 2 Gbyte/s full duplex throughput. Commercial, rugged air-cooled and rugged conduction-cooled options are available. The integrated firmware and software transparently support single Serial FPDP streams as well as logical streams using x2 and x4 channel bonding defined in VITA 17.2.

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

Products

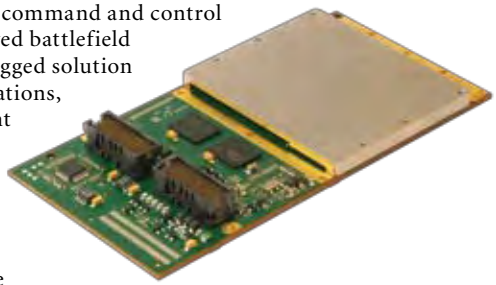
Upgraded nanoETXexpress-SP COM Ups Memory, Video and I/O

The credit-card-sized nanoETXexpress form factor fits nicely with the military's demands for reducing size, weight and power. Kontron introduced an updated design for the credit-card-sized (55 mm x 84 mm) Intel Atom processor-based Kontron nanoETXexpress-SP Computer-on-Modules, which are used in ultra-small system designs and are a compatible extension to the PICMG COM Express specification, following the pin-out type 1 definition. The new module features an 8-chip 1 Gbyte memory solution, SDIO/GPIO switching via BIOS and an optional implemented SDVO connection.

The revised nanoETXexpress-SP is Kontron's first nanoETXexpress specification 1.0 solution to support the newly adopted SDVO interface. This opens up new application fields for ultra-small embedded solutions. In addition to LVDS, the optional SDVO support makes the small nanoETXexpress Computer-on-Modules particularly flexible and cost-efficient: Two displays are now independently controllable. The enables mobile handheld devices with two (touch) displays or mobile devices with a separate independent monitor via a docking station. A wide array of future-focused interfaces is available via the COM Express Type 1 connector including 1 x Gbit Ethernet, 1 x SATA, 8 x USB 2.0 (one of which is client capable), as well as a PCI Express x1 lane for application-specific expansions. 2 x PCIe is also possible if the Gigabit Ethernet is not required. An external PCIe to PCI bridge is also supported.

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

GPU-Based Rugged XMC Ready for Harsh Environments



The military is demanding advanced video and graphics not just in command and control areas, but in deployed battlefield areas. Offering a rugged solution for just such applications, GE Fanuc Intelligent Platforms offers the rugged XMCGA6 High Performance Graphics XMC. Featuring either the NVIDIA G72 or G73 GPU (graphics processing unit) used in high-end consumer gaming platforms such as the GeForce 7300GS and GeForce 7600GT, the XMCGA6 is designed to deliver outstanding graphics performance in demanding applications that will be deployed in harsh environments.

The XMCGA6 supports 8-lane PCI Express for optimum communication with a host platform such as the GE Fanuc PowerXtreme 6U VME PPC9A single board computer; it can, however, automatically adapt to 4-lane PCI Express environments. Up to 256 Mbytes of GDDR3 memory (G73) is supported. With its rich set of I/O, the XMCGA6 is designed to serve many of the most common video applications. Dual, independent channels mean that it is capable of driving RGB analog component video and digital DVI 1.0 at maximum resolutions of 1,600 x 1,200, and supports the RS170, NTSC or PAL standards. In addition, the XMCGA6's video input capability allows integration of sensor data using RS170, NTSC or PAL video formats.

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

4-Channel Serial FPDP Recorder Does 960 Mbyte/s Data Streams

Instrumentation recording, mission recording and SIGINT/ELINT recording and storage applications have an endless appetite for high-speed data recording. Curtiss-Wright Controls Electronic Systems has introduced the new Vortex SDRxL, a fully featured off-the-shelf 4-channel Serial FPDP (sFPDP) data recorder system for demanding sensor-to-processor streaming data applications. The Vortex SDRxL combines a uniquely equipped 3U rackmount controller with a reliable, scalable storage subsystem. This data logger can record and store up to four channels of sFPDP data at rates up to 960 Mbytes/s.

Vortex SDR recorders support the recording of GbE, 10GbE, and now sFPDP protocols, at line rates without interruption from sensors such as radar, sonar, FLIR, RF tuners, MRI and cameras. The Vortex SDRxL's flexible design enables system integrators to add one or more Vortex SBOD or RAID storage systems, as needed, to configure the data recorder for their application's required recording duration. Compatible Curtiss-Wright Controls storage systems include the compact Vortex 2U RAID that houses 12 SATA or SAS disks, and the Vortex 4U RAID that supports up to 48 SATA disks. For applications requiring rugged storage, the Vortex SANbric system supports rotating Fibre Channel (FC) disks.

Curtiss-Wright Controls Embedded Computing, Leesburg, VA.
(703) 737-3660.
[www.cwcembedded.com].

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Four-Way Power Divider Spans 6 to 18 GHz

Power subsystem design can sometimes become an afterthought, but it has the potential to be a make or break aspect of a military system. Narda, an L-3 Communications company, has introduced the Model 3326B-4 four-way power divider, which operates from 6 to 18 GHz and features precise phase and amplitude balance, high port-to-port isolation and low input VSWR. The power divider is well suited for a broad array of commercial and military applications.

The Model 3326B-4 has insertion loss of less than 2 dB, isolation of at least 18 dB, and input and output VSWR of less than 1.5:1 or less. Amplitude balance is maintained to 0.5 dB or less and phase balance is maintained to 7 deg. or better. It can handle an average RF input power of 30W into a VSWR of 1.2:1 or less and up to 10W into a 2:1 VSWR. The Model 3326B-4 measures 4.3 x 1.4 x 0.5 in. and has Type-N female connectors. The power divider is a custom product and its electrical performance, connector type and configuration can be modified to meet the needs of specific requirements.

Narda Microwave-East, Hauppauge, NY. (631) 231-1700. [www.nardamicrowave.com].

Fanless Box PC Features Redundant Ethernet Ports, RAID 0/1 Support

Rugged box systems have become a fixture in today's military embedded systems marketplace. For its latest offering, the Industrial Automation Group of Advantech has introduced the UNO-3272, a Fanless Box PC equipped with a Celeron M 440 1.86 GHz CPU, 1 Gbyte DDR2 SDRAM, 2 x Gbit Ethernet ports with teaming function, 4 x serial communication ports (2 x RS-232 and 2 x RS-232/422/485 with Auto Flow Control), 2 x PCI expansion slots, audio, DVI-D, VGA dual video output and 1 x external CompactFlash slot.

The UNO-3272 supports SATA RAID 0/1 function, allowing customers to backup their operating system, applications and important data if they have installed two hard drives. A Gigabit LAN port supports teaming function with fault tolerance, link aggregation and load balance features. Also, the UNO-3272 supports Windows 2000/XP/Vista, Linux or Embedded OS such as Windows XP Embedded and Embedded Linux. The UNO-3272 provides high-performance, multiple I/O interfaces, PCI and multimedia expansion, with a fanless design and superior thermal protection for harsh environments.

Advantech, Industrial Automation Group, Cincinnati, OH. (800) 205-7940. [www.advantech.com].

Linear 6W Power Supply Boasts Rugged Design

Military applications demand more from power supplies than other systems. They must work reliably under some of the toughest environment conditions. Calex has announced the availability of the 3.15.1000 linear power supply. The 3.15.1000 provides a low-noise, highly regulated +5V and +/-15V output for a total of 8 watts of output power. The rugged, epoxy potted construction of the 3.15.1000 makes the unit ideal for use in a wide variety of sensitive analog circuitry applications utilizing operational amplifiers, function modules and data conversion circuits.

The 5V output of the 3.15.1000 provides up to 1A and the +/-15V outputs provide up to +/-100 milliamps. The output voltage accuracy is +/-1.0%. Line and load regulation is +/-0.20%. Noise and ripple is very low at 2 mV RMS. The 3.15.1000 can be powered by 100, 115, 220, 230 and 240 VAC. The model features foldback current limiting short circuit protection so the unit can be shorted indefinitely without damage. The case temperature operating range of the 3.15.1000 is -25° to +50°C. The case size is 3.50 x 2.5 x 1.56 inches and uses an industry standard pin-out. The 3.15.1000 is available with two optional mounting kits that provide solder lug or screw terminal connections.

Calex, Concord, CA. (925) 687-4411. [www.calex.com].

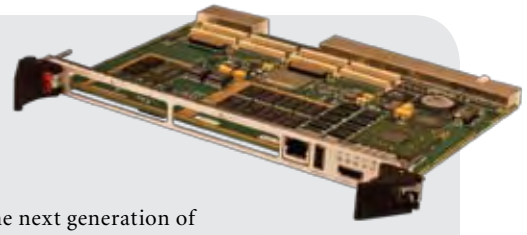
Multifunction Boards Get ARINC429 Support

Semiconductor integration has enabled board-level products to cram multiple functions on a single card. Along just such lines, North Atlantic Industries (NAI) has announced the availability of ARINC429/575 support for its wide range of VPX, VME, cPCI and PCI Multifunction boards. Known as the A4, it joins an extensive list of functions that are currently available from NAI. The ARINC 429/575 A4 provides up to six programmable ARINC-429/575 channels. Each channel is software selectable for Transmit and/or Receive, High or Low Speed, and Odd or No Parity, supporting multiple ARINC429 and 575 channels simultaneously.

One major advantage of this multifunction approach is higher functional density, which reduces overall board count, thereby saving space and cost, reducing heat dissipation and increasing overall system reliability. Other available functions include A/D, D/A, Synchro/Resolver/ LVDT/RVDT Simulation and Measurement, CANBus, MIL-STD-1553, Synch/Asynch RS232/422/485, Discrete, TTL/CMOS, Reference Generator, Differential Transceiver and Resistance Temperature Detectors (RTD). The ARINC429/575 function is supported on VPX, VME, cPCI and PCI Multifunction Boards with operating temperature ranges of -40° to +85°C and 0° to +70°C. Pricing for 100 pieces of the 64C2 VME Board with 6 channels of ARINC429/575 support starts at $2,880.

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

6U CompactPCI SBC Sports Core2 Duo Processor



The multicore trend has hit every corner of embedded computing, and the military is no exception. Extreme Engineering Solutions is now shipping the XCalibur4101, a 6U CompactPCI single-board computer featuring the Intel Core2 Duo processor and a ruggedized, conduction- or air-cooled design, making it ideal for today's rugged embedded computing applications.

XCalibur4101 is a ruggedized, high-performance, feature-rich solution designed to support the next generation of rugged embedded applications and features up to 4 Gbytes of DDR2 ECC SDRAM, hot swap support, up to 64 Gbyte SSD, front and dual rear-panel Gbit Ethernet ports, and two PrPMC/XMC interfaces. The board complies with PICMG 2.0, 2.1, 2.3, 2.9 and 2.16. In-house X-ES operating system support includes Green Hills Integrity Board Support Package (BSP), Wind River VxWorks BSP, QNX Neutrino BSP and Linux BSP. XCalibur4101 is available now from stock; pricing starts at $8,530 and may vary based on processor speed, memory configuration and ruggedization level. Volume discounts are available.

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

Dual Fast Ethernet PMC Uses USM Form Factor

MEN Micro's Universal Submodule (USM) concept implements a board's desired functionality through one or more IP cores in an FPGA. The corresponding line drivers are located on the main USM module, which simply plugs into the respective base mezzanine. The company now offers the P511 Dual Fast Ethernet PMC, based on USM. Because the Ethernet functionality resides on an IP core in the P511's onboard FPGA, the PMC provides exceptional design flexibility, since the IP core is easily updated and changed. This helps designers quickly turn individual I/O requirements into production-ready products, reducing design time and costs.

The PMC is fully integrated to comply with IEEE802.3, features a 1,500 VAC isolation voltage and can withstand an extended temperature range of -40° to +85°C. For extremely dusty or humid environments, an optional conformal coating is available. Guaranteed minimum availability of the P511 Dual Fast Ethernet PMC is 10 years, reducing the chance of component obsolescence. Pricing for the P511 Dual Fast Ethernet PMC is $743 in quantities of 1 to 9.

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

Xeon Multicore System Serves up 10 Gbit LAN

The challenge in multiprocessing systems is keeping the processors fed by moving data between them quickly. With just that in mind, WIN Enterprises offers the PL-80100, a 2U server-grade platform that uses Intel 5300 Series technology to provide 10 Gbit Ethernet (2x) and support for a range of high-performance Intel Xeon processors for OEM solutions. Developed for network service applications, the PL-80100 features the Intel 5520 chipset (Tylersburg), which supports two socketed processors of the Intel Xeon Processor 5500 Series. The device employs Intel QuickPath Interconnect (QPI), Intel's new point-to-point interconnect technology, to provide high-bandwidth, low-latency communications between the processors and chipset. The chipset delivers up to 32 lanes of PCI Express 2.0.

Two versions of the unit are available. One offers 10x RJ45 LAN ports with eight GbE LAN ports and two ports of 10 GbE performance. The second version offers 24x GbE LAN ports. The PL-80100 provides a 1+1 redundant power supply, hot swappable HDD trays and system fan module to address server grade requirements. Pricing for the PL-80100 in OEM quantities begins at $2,500. Price does not include the processors or memory.

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

First UltraSPARC T2-Based VPX Board Rolls

This is truly becoming the year of VPX as vendors roll out many types of VPX products for military applications. Themis Computer has announced its new T2VPX 6U VPX board computer. The T2VPX is the first member of the company's new family of VITA 46-compliant, board-level-computers. Themis' T2VPX supports the VITA 46 and VITA 65 standards, providing customers with next-generation processing performance and high-bandwidth serial switched fabrics. The board features a new system architecture that combines up to eight processor cores and 64 threads, with a VPX IO fabric. The T2VPX is ideal for compute-intensive military and aerospace applications requiring rugged computing solutions, beyond the reach of today's VME-64-based systems.

The T2VPX is based on the Sun UltraSPARC T2 CMT (chip multi-threading) processor, the industry's first "system on a chip" and runs both Linux and the Solaris 10 Operating System. Themis' new T2VPX board further proliferates Sun's advanced UltraSPARC T2 processor technologies into embedded computing markets. The T2VPX will be offered with 6 and 8 core processor options. T2VPX features and specifications include up to 32 Gbyte of DDR2 memory with ECC protection, onboard 1.8 inch HDD/SSD support, multiple Gbit and 10 Gbit Ethernet channels and more.

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

REDI VITA 48.5 Power Supply Delivers 800W

VITA 48 "Ruggedized Enhanced Design Implementation" (REDI) standard for 3U and 6U x 160 mm embedded modules creates a unified mechanical standard for 3U and 6U COTS modules using air-, conduction- or liquid-cooling methods. The REDI mechanical enhancements are independent of electrical standards such as VITA 46 (VPX) or VITA 41 (VXS). American Avionic Technologies Corporation (AATC) has announced the availability of a 6U, 800W power supply compliant to the REDI (VITA 48.5) standard.

The AATC Model 1251 provides outputs of +5, +12 and +3.3 volts with a MIL-STD-704F, +270 volt DC input. The supply was designed for rugged military ground vehicle and aerospace environments. Operating over a temperature range of -40° to +55°C with forced air cooling, the 6U power supply boasts an efficiency of 85%. Also provided is an I2C serial communications bus, providing extensive monitoring and control. The unit meets MIL-STD-461E EMI requirements and provides inrush current limiting and transient protection.

American Avionic Technologies, Medford, NY. (631) 924-8200. [www.aatcorp.com].

Chassis Duo Does High-Performance USB Data Acquisition

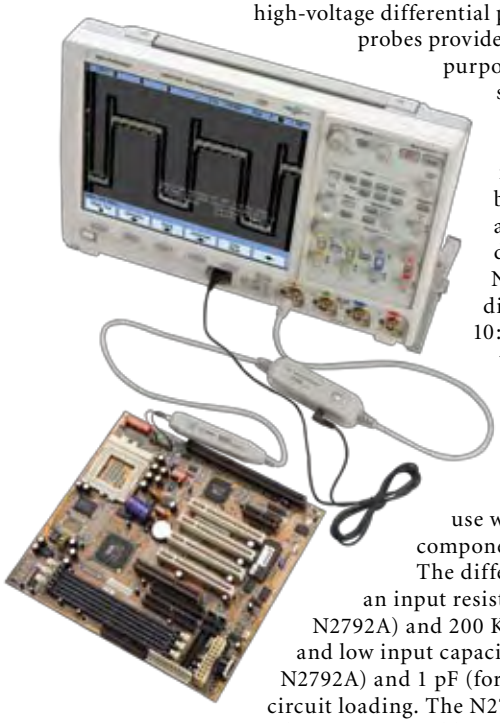
Testing complex military systems used to require large racks of instrumentation boards. Today, the same functionality can be done with USB-based modules in a desktop chassis. Along just those lines, National Instruments announced the NI cDAQ-9174 four-slot and cDAQ-9178 eight-slot NI CompactDAQ chassis, which are advanced versions of the popular NI CompactDAQ chassis released in 2006. The two new chassis build on the functionality of the original chassis by adding a four-slot option; the ability to take mixed-sensor measurements at different rates; two built-in, external BNC triggers; and four advanced counters.

With the new cDAQ-9174 and cDAQ-9178 chassis, engineers can sample from NI C Series analog input modules at different rates instead of implementing single-rate sampling in the cDAQ-9172 chassis. The cDAQ-9178 eight-slot chassis features external BNC triggers. The chassis operate in a temperature range of -20° to 55°C and can withstand up to 30g shock and 3g vibration. NI CompactDAQ achieves High-Speed USB throughput with NI signal streaming technology, so that the chassis can simultaneously perform multiple high-speed operations such as waveform measurements, generation, digital I/O and counter operations. The NI cDAQ-9174 is priced from $699, and the NI cDAQ-9178 from $1,099.

National Instruments, Austin, TX. (512) 683-0100. [www.ni.com].

Probes Enable General-Purpose Differential Signal Measurements

As semiconductor devices get even faster, the burden on test gear keeps pushing test gear developers to keep pace. Agilent Technologies has introduced 200 MHz and 800 MHz, high-voltage differential probes. The differential probes provide superior general-purpose differential signal measurements required for today's high-speed power measurements, vehicle bus measurements and digital system designs. The Agilent N2792A and N2793A differential probes offer 10:1 attenuation, allowing them to be used for a broad range of applications. The probe comes with various probe tip accessories for use with small and large components in tight places. The differential probes have an input resistance of 1 Mohm (for N2792A) and 200 Kohm (for N2793A) and low input capacitance of 3.5 pF (for N2792A) and 1 pF (for N2793A) to minimize circuit loading. The N2792A and N2793A probes are compatible with any oscilloscope with a 50-ohm BNC input. The probe can be powered by any USB port on a scope or computer, or by an internal battery (9V battery included). The Agilent N2792A and N2793A differential probes are available now at a price of $1,700 and $3,000 each.



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

AMC Carrier for Three IndustryPack Modules

A standard double-width mid-size or full-size AMC.1-compliant carrier can handle three single-size IndustryPack (IP) modules. The TAMC200 from Tews Technologies can be used to upgrade well known and well proven IndustryPack I/O solutions to a high-performance form factor, and to provide AMC users a large selection of over 200 off-the-shelf IndustryPack modules for analog, digital, communications, motion control, CAN and other various functions.

All IP interrupt request lines are mapped to PCIe INTA. Alternatively, message signaled interrupts (MSI) can be used. The TAMC200 also provides a special IP interrupt status register for fast interrupt source detection. The IP power lines are fuse protected by self-healing fuses and RF filtered. Easy I/O cabling is facilitated with the use of three 68-pin SCSI-V type connectors (VHDCI/Champ) that provide access to all IP I/O lines. Designed for demanding environments, the TAMC200 operates from -40° to +85°C and has a five year warranty.

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

Atom-Based Series of Fanless, Cable-Free Rugged I/O Platforms

A series of rugged and fanless I/O platforms based on the Intel Atom N270 are targeted for providing rugged I/O solutions to the market. The Matrix MXE-1000 and MXC-2000 from Adlink Technology are the result of combining Adlink's experience in x86 platform design, versatile I/O function development and thermal design to push fanless systems to a higher standard, including a -20° to 70°C temperature range, 5g vibration and cable-free durable structure.

The MXE-1000 and MXC-2000 series include a specifically designed single board computer to fit the respective fanless chassis in which all heat-producing components come in direct contact with the aluminum shell. This allows for the widest operating temperature range among all off-the-shelf fanless computers. To increases reliability and durability, all connectors and components are mounted directly onto the PCB so there is no internal wiring. In addition to general I/O connectors such as Gigabit Ethernet (GbE), COM and USB ports, the MXE-1000 series also provides dedicated GbE and 1394b interfaces to support cameras for outdoor or in-vehicle video/imaging applications. The Matrix series is currently available at list prices starting at $550 and $750 for the MXE-1000 and MXC-2000, respectively.

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

ETX 3.0 Module Combines Core 2 Duo Performance with Legacy I/O

A series of ETX 3.0-compliant computer-on-module (COM) products is based on Intel's LV and ULV Core 2 Duo and Core Duo processors. The ETX-945 series modules from Diamond Systems operate over an extended temperature range of 40° to +85°C, making them suitable for performance- and reliability-critical applications, including aerospace, defense, transportation, energy management and industrial automation. To simplify the migration of PC/104-Plus stacks to these high-performance Intel processors, the ETX-945 is available as a pre-integrated "Pluto" module with a PC/104-Plus expansion interface.

The highly compact (4.5 x 3.7 inches; 114 x 95 mm) ETX-945 is built around Intel's 945GME and ICH7M chipset, and provides an onboard SODIMM socket for up to 2 Gbytes of high-speed DDR2 system DRAM. The ETX-945's high-resolution display controller works with analog and LVDS-interfaced CRTs and LCDs at resolutions up to 2048x1536 pixels and supports dual independent displays. Other onboard I/O interfaces include one 10/100 Mbit/s Ethernet port, two SATA interfaces (support 1 drive each), one IDE interface (supports 2 drives), four USB 2.0 ports and two serial ports. Five ETX-945 models are offered, each with a different soldered-on Intel processor ranging from the 1.66 GHz Core Duo LV to the 1.06 GHz Celeron M ULV. The ETX-945 CPU module is priced at around $650.

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

XMC Module Serves Up Dual channel 1 GS/s 12-bit Digitizer,

An XMC I/O module features dual channels of 1 GSample/s 12-bit digitizing with a Virtex5 FPGA computing core, DRAM and SRAM memory, and eight lane PCI Express host interface. The X5-G12 from Innovative Integration includes a Xilinx Virtex5 SX95T or LX155T with 512 Mbyte DDR2 DRAM and 4 Mbyte QDR-II memory to provide a high-performance DSP core for demanding applications such RADAR and direct RF digitizing. The close integration of the analog I/O, memory and host interface with the FPGA enables real-time signal processing at rates exceeding 300 GMAC/s.

The X5 XMC modules couple Innovative's Velocia architecture with a high performance, 8-lane PCI Express interface that provides over 1 Gbyte/s sustained transfer rates to the host. Private links to host cards with >1.6 Gbyte/s capacity using P16 are provided for system integration. The X5 family can be fully customized with VHDL and Matlab using the FrameWork Logic toolset. The Matlab BSP supports real-time hardware-in-the-loop development using the graphical, block diagram Simulink environment with Xilinx System Generator. Software development tools for the X5 modules provide comprehensive support including device drivers, data buffering, card controls and utilities that allow developers to be productive from the start.

Innovative Integration, Simi Valley, CA. (805) 578-4261. [www.innovative-dsp.com].

FPGA-Based Ethernet Module Sports a High-Capacity Switch-IP

An industrial Ethernet module (IEM) implements a cost-efficient and flexible solution to adapt to various Industrial Ethernet technologies. The IEM from IXXAT is based on an Altera Cyclone III FPGA which, in addition to an integrated 32-bit CPU, PHYs, magnetic modules and RJ45 jacks, includes the new 3-port switch IP for Profinet, EtherNet/IP and Modbus-TCP.

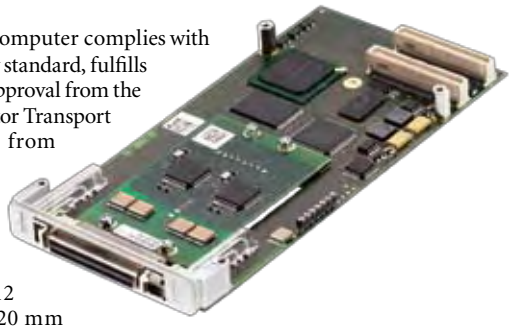
The IP implements a store-and-forward switch and is explicitly designed for real-time Ethernet networks. An implementation as cut-through switch is already in preparation. The switch IP makes use of priority information to transfer real-time Ethernet frames with lowest latency and jitter—in the range of a few microseconds. The switch IP comes with integrated MACs that support 10/100 Base-T, half and full duplex. To make use of features like static or dynamic address table, aging mode, routing mode, etc., the customer can configure the IP by using its management interface. On top of this, the internal port supports filters and backpressure to reduce the load of the connected system. The switch IP is also available as a product, based on Altera Cyclone III (further FPGA types on request).

IXXAT, Bedford, NH.

(603) 471-0880.

[www.ixxat.com].

Fanless Box Computer Targets Mobile Extreme Apps



A new rugged box computer complies with the EN 50155 railway standard, fulfills IP67 and has an E1 approval from the German Federal Motor Transport Authority. The RC1 from Men Micro provides up to 1.6 GHz of processing power and combines a robust 8.66 inch x 5.12 inch x 3.39 inch (220 mm x 130 mm x 86 mm) aluminum enclosure with solid wall-mounting equipment to provide ruggedization in even the most extreme applications, from hot, dry and dusty to extremely humid or cold environments.

The RC1 is available as standard either with a 3.5" 4:3 color TFT LCD touch panel with a resolution of 640x480 pixels, 262,144 colors and touch functionality for service purposes or without a display. All I/O interfaces including two Fast Ethernet interfaces and a service interface with USB and RS-232, are accessible at the front via robust 8-pin M12 connectors. Two slots are available for additional I/O options implemented using special SA-Adapter kits. The onboard FPGA allows the integration of further interfaces such as CAN bus, RS-485, IBIS or binary I/O. Pricing starts at $1,413 per unit without display and at $1,839 with display.

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

PCI Express Digitizer Capable of Sustained Recordings over 1.2 Gbytes/s

A new high-speed digitizer in the form of an advanced wideband and high dynamic range A/D board, captures signal frequencies up to 200 MHz when using the programmable gain amplifier in 1 dB steps for maximum gain attenuation flexibility. Frequencies go up to 400 MHz if the direct transformer coupled connection is employed for the cleanest possible signal path to the ADC. The PX14400 from Signatec includes 1 Gbyte of onboard memory configured as a large FIFO and a PCIe x8 bus to ensure it can continuously sustain long recordings at over 1.2 Gbytes/s through the PCIe x8 bus to PC disk storage without any break in the analog record.

Up to five PX14400 boards may be interconnected in a Master/Slave configuration via a ribbon cable that connects at the top of the board. In this configuration, clock and trigger signals from the Master board drive the Slave boards for synchronized sampling across all boards. Additional boards can be synchronized, even across computer chassis, when using Signatec's Sync1500-6 product. The PX14400 supports single shot, segmented and pre-trigger triggering modes.

Signatec, Newport Beach, CA. (949) 729-1084. [www.signatec.com].

www.rtecc.com/gateway

1 kW Power Supplies Have Ultra-Low Profile

The military market was late to the game embracing distributed power architectures, but now it's all in. Supporting that need, TDK-Lambda has introduced the RFE1000 series, a new 1 kW single-output AC-DC power supply in an ultra-low profile (only 1.61" high) 1U package for stand-alone or distributed power architectures (DPA). These supplies are ideal for applications requiring reliable 24V, 32V or 48 VDC bulk power. Up to +20% and -10% output voltage adjustment is possible, enabling the RFE1000 to be used in a variety of customer-specific applications. Operating from a universal input of 85 to 265 VAC with PFC, the unit boasts an efficiency of up to 88%.

The RFE1000-24, -32 and -48 power supplies can be used individually, or up to 8 units can be connected in parallel to form an N+1 redundant power system with built-in ORing diodes. Each power supply has variable-speed cooling fans and can operate in temperatures ranging from 0 to +70°C. The RFE1000 has a power density of 10.5W/in^3 with dimensions of 12 x 5 x 1.61 inches. Overvoltage, overcurrent and overtemperature protection are standard features, and for system monitoring there are opto-isolated signals for DC-OK, AC-fail and overtemperature warning, along with a LED indicator for DC-OK. Remote On/Off control is also standard, as is remote sense. The new RFE1000 family of power supplies is available now and priced at $295 each in 1,000 piece quantities.

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

Conduction-Cooled ATR 6U VPX Platform Provides High Thermal Performance

A new conduction-cooled ATR 6U VPX platform provides an extremely high level of environmental protection while also allowing for optimal cooling that convection-cooled platforms cannot offer. The conduction-cooled ATRs from Elma Electronic feature a machined card cage that accommodates wedge locks to transfer heat from the boards to the machined platform walls within the integrated card guides. Special grade aluminum joined by a dip-braising process for the chassis parts ensures the best conductivity of the payload.

The COTS manufacturing approach for the ATR platform meets multiple MIL-STDs. Elma's design techniques meet MIL-STD 810, 461, 167, 901 and 704. The 6U VPX platform meets ARINC 404A, ARINC 600 and IEEE 1101.2 specifications and accepts 6U VPX boards compliant with VITA 46.x. The new lightweight ATR platform is suitable for applications where a lower weight is crucial. The -40° to +70°C operating temperature range, combined with cooling optimized via thermal simulation studies, allows for exceptional thermal performance. The platform also features fixed mount devices, a 28V DC PSU input, and top-load card orientation. All removable covers are equipped with captive screws. Basic pricing starts between $15,000 and $20,000.

Elma Electronic, Fremont, CA. (510) 490-7388. [www.elmaelectronic.com].

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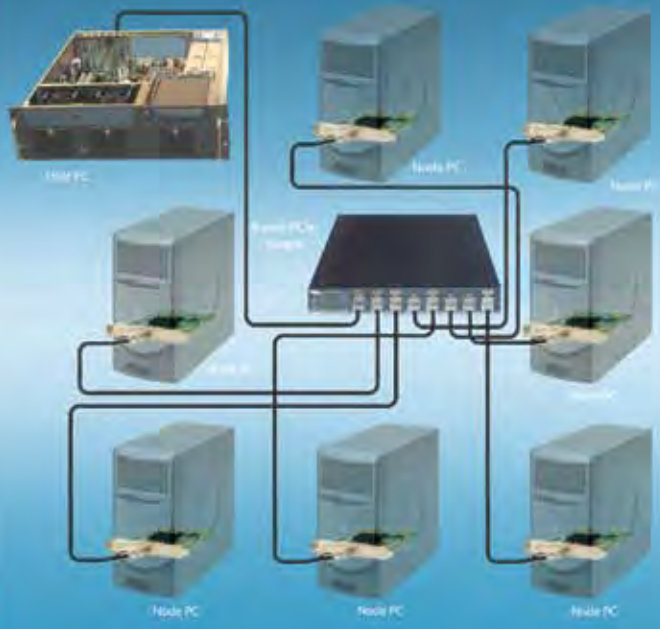

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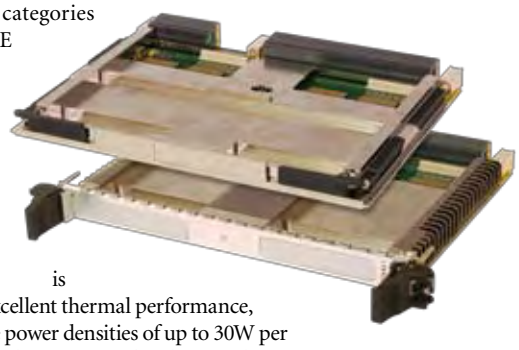
6U VPX Carrier Card Enables 30W per XMC



The VPX ecosystem continues to expand as more and more categories of products are emerging. GE Fanuc Intelligent Platforms' latest is the PEX441 Rugged 6U VPX XMC Carrier Card. Designed to enable system architects and integrators to include a broad range of high-performance XMCs in their designs, the PEX441 is specifically optimized for excellent thermal performance, with the capability to enable power densities of up to 30W per XMC. One or two XMCs can be accommodated. Typical XMC applications will include system I/O, FPGA processing, graphics and digital/analog and analog/digital interfaces.

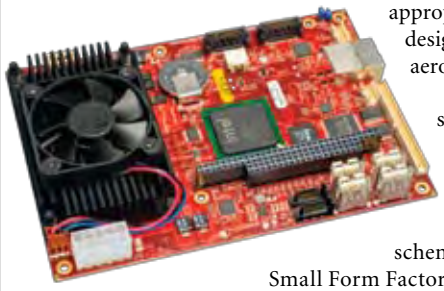
The PEX441 supports a broad range of flexible I/O options, allowing systems designers a choice of switched fabric topology. The PEX441 is available in five build levels, providing a cost-effective choice between platforms for benign environments through to systems that will be deployed in harsh environments. It is optionally compliant with the VITA 48/REDI specification for rugged systems. The carrier board extends the functional envelope of a 6U VPX system by leveraging an array of GE Fanuc or customer proprietary XMC modules into a distributed, fabric-based architecture, removing the need to host high-power mezzanines on high-power CPU cards.

GE Fanuc Intelligent Platforms, Charlottesville, VA.

(800) 368-2738. [www.gefanucembedded.com].

EPIC-Sized SBC features Core 2 Duo and SUMIT connector

New performance levels in an EPIC-sized SBC have been achieved with the integration of the new Intel Core2 Duo (model P8400) 45 nm processor in the Komodo SBC from VersaLogic. The module performs at 2.27 GHz with mid-range power consumption. Komodo also deploys the new Stackable Unified Module Interconnect Technology (SUMIT) interface, making this SBC an appropriate solution for OEM designers in demanding defense, aerospace markets.



Komodo fits the industry standard EPIC footprint of 4.5 x 6.5 inches and is one of the first EPIC-sized products to feature the SUMIT expansion scheme developed by the Small Form Factor Special Interest Group (SFF-SIG). The SUMIT interface supports a variety of expansion options, including up to three PCIe x1, four USB, an SPI and an LPC connector. Standard onboard features include Gigabit Ethernet, up to four Gbytes of DDR3 memory, four USB 2.0 ports, two SATA interfaces, two RS-232 COM ports, two RS-232/422/485 COM ports, PS/2 keyboard and mouse, HD audio, as well as dual LVDS and analog VGA support. Featuring the new MiniBlade module, a rugged, removable solid-state drive (SSD) and the robust MiniBlade socket, which together comprise the SFF -SIG's MiniBlade specification; the Komodo offers versatile expansion and application storage.

VersaLogic, Eugene, OR. (541) 485-5712. [www.versalogic.com].

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AD350 Digitizer and Waveform Generator

The AD350 is a low-cost, low-power digitizer and waveform generator available in the PMC form factor. The AD350 features two 14-bit A/D channel inputs sampling up to 150MSPS, and a dual-channel 16-bit 500Msps high-speed D/A converter. With two on-board Cyclone III FPGA devices, the AD350 is the ideal prototyping system to implement flexible and scalable multi-input and multi-output antenna transmitter systems (MIMO).

AD350

FM486 Virtex-5 PMC-X and XMC

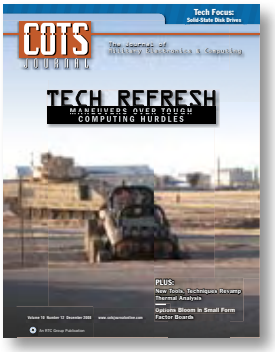
The FM486 is a high performance PMC-X/XMC module dedicated to data acquisition, processing and communication applications with complex requirements. Built on the success of the FM48x series, the FM486 offers fast on-board memory resources and two FPGAs (Virtex-4 and Virtex-5). High bandwidth communication throughput is easily achieved via optical transceivers for applications where data acquisition, processing and real time recording cannot suffer the bandwidth throttle associated with conventional processors.

Virtex 5 PMC/XMC

4DSP

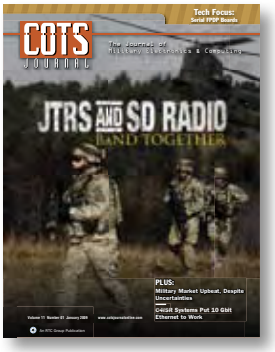
www.4dsp.com
info@4dsp.com
800.816.1751

December 2008



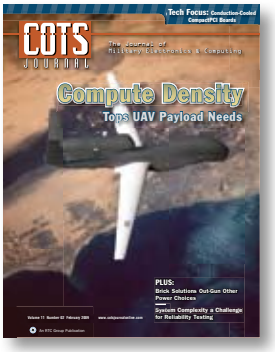
Tech Refresh Maneuvers Over Tough Computing Hurdles

January 2009



JTRS and SD Radio Band Together

February 2009

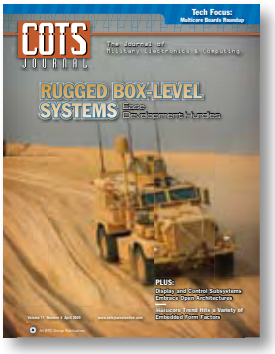


Compute Density Tops UAV Payload Needs

March 2009

FPGAs Launch Radar & SIGINT to New Heights

April 2009

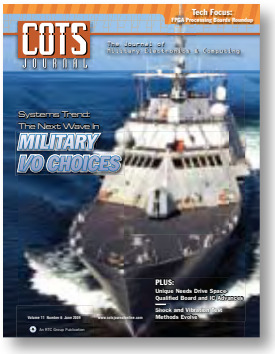


Rugged Box-Level Systems Ease Development Hurdles

May 2009

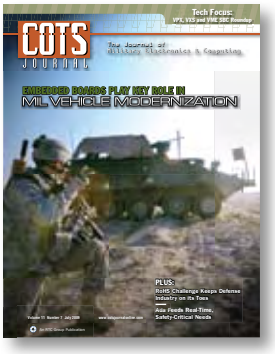
Rugged Displays Ride the Net-Centric Wave

June 2009



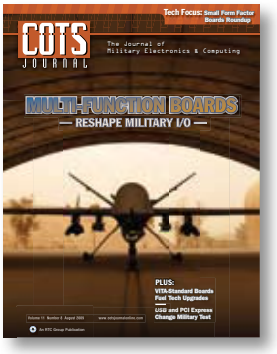
Systems Trend: The Next Wave in Military I/O Choices

July 2009



Embedded Boards Play Key Role in Mil Vehicle Modernization

August 2009



Multi-Function Boards Reshape Military I/O

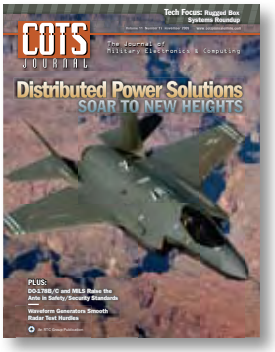
September 2009

Net-Centric Processing Chain Leans on FPGAs and Ethernet

October 2009

Small Form Factor Camp Boasts Innovative Boards and Standards

November 2009



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Coming Next Month

COTS JOURNAL

Target Report: Spotlight on the Five Most Compute-Intensive Defense Application Areas Compute density has become the mantra for many of today's advances in military programs. More and more of system functionality is now implemented as software running on single board computers, rather than using hard wired electronic assemblies. This section picks out the five most compute-intensive military applications, and explores what embedded form factors and technologies are available to serve their needs.

Tech Recon: Military Market Outlook 2010 It's likely that the overall DoD budget will shrink in the coming year. As the political landscape changes and forces within the government drive that budget down, the embedded computer component of the overall DoD budget is going to increase dramatically. In this special section, analysts from top market research firms will plot out the industry's future. This special technology and market analysis section is something that will help decision makers over the next 12 months as they verify their system-architecture and business development choices.

System Development: Ethernet: 10 Gbit Ethernet and Beyond Ethernet is becoming entrenched as a favorite interconnect fabric in compute-intensive applications like sonar, radar or any application that networks sensor arrays together. This section updates readers on the product and technology trends driving board-level Ethernet switch products and explores how system designers can benefit from the marriage of Ethernet with embedded computing form factors like VPX, VXS, Compact PCI Express, MicroTCA and AMC.

Tech Focus: Serial FPDP Boards The Front Panel Data Port (FPDP) interconnect standard is a simple idea, but sometimes simple ideas are big winners. It's particularly useful in military applications like radar and sonar where FPDP is used as the interface to sensor networks. The Serial FPDP version adds speed and nullifies the length limitations of parallel FPDP. The Tech Focus section updates readers on Serial FPDP trends and provides a product album of representative board-level products.

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COTS

Editorial

Jeff Child, Editor-in-Chief

Your Attention Please

A former industry colleague of mine had a great saying. "If you want to draw attention to something" he said, "you need to paint it red, strip it naked and put it in the middle of the street." He meant all that figuratively, of course, but it's a lesson I often keep in mind when I observe companies in our industry as they work to promote and market their technologies and products. The core of the idea is that you can't depend solely on the pure technical elegance of a technology or product for it to be successful. For it to succeed, you need to get out there and connect the dots between the customer's problem and your solution.

All that gets tougher in a down economy, when resources are tight. And that was certainly the case for the broad electronics industry as a whole this year—although the military market got hurt far less than other market segments. I remember talking to people in the industry at the start of 2009 and many expressed an uncomfortable sense of uncertainty about the future. Yet despite a gloomy overall economic picture in the general economy, the prospect wasn't too bad for anyone who does a majority of their business in the military market. As the year winds down, some have seen a bit less growth than expected, or delayed growth, but the overall picture is certainly positive. And, as we've said often, this is totally in keeping with the trend we've seen over the past ten years: The electronics and embedded computer component of the overall DoD budget continues to ramp up no matter what the total DoD budget does.

Bottom line is, I predict that those makers of embedded computers, power supplies and any defense-oriented electronics suppliers that kept themselves visible and active this year will reap even more rewards in the year ahead. This applies, I think, to not just an individual company's products but also to industry standard platforms. Among the success stories of the year has been OpenVPX. In the space of less than a year, a group of military embedded computer vendors and prime contractors accomplished a nearly impossible task.

Under the OpenVPX Industry Working Group, these companies morphed the VPX 46 architecture into an interoperable system level draft spec called OpenVPX. OpenVPX provides implementation details for VPX payload and switch modules, backplane topologies and chassis products. OpenVPX solves the well-known problem that has faced VPX from the beginning: With the large number of open pins and the variety of fabric options available to it, it's difficult to ensure any compatibility between VPX products of different vendors. The spec provides defense primes and suppliers clear direction for crafting interoperable computing and comms platforms.

As with any open standard, VPX and OpenVPX isn't a slam dunk. Even though defense customers were directly involved with it, there's no guarantee that it will gain acceptance across the wide scope of applications that it's intended for. But all the signs are there that its chances are very good, and the industry is being very proactive in elevating awareness of OpenVPX. VME and CompactPCI are two examples of open standard architectures that didn't enjoy overnight success with the military, but rather achieved acceptance in the defense market after considerable product development and marketing efforts gained them the mindshare needed for the military to embrace them. Along just those lines, earlier this month VITA announced the formation of the VPX Marketing Alliance with the goal of continuing the marketing efforts accomplished by the OpenVPX Marketing Working Group. The list of alliance members can be found at www.vita.com/vpx.html.

Just as we've historically done with any emerging technology trend, we at RTC Group aren't just sitting on the sidelines. For our Real-Time Embedded Computing Conference (www.rtecc.com) in January, we've put together a panel of key industry experts, each of which has a unique perspective on what OpenVPX has to offer and how to implement OpenVPX-based systems to meet emerging military/aerospace program needs. Look for more special OpenVPX event-based and editorial-based activities from us throughout 2010. In this age, when "virtual" relationships seem to dominate the news, we support the notion that all forms of interaction are key to getting the job done, and that includes face-to-face events like conferences and exhibitions—both our own and other key industry venues where military technology can be showcased.

On that note, here's wishing all of you who read *COTS Journal*, or participate with us as industry partners, a wonderful holiday and a healthy and prosperous New Year. And thanks our friends at Falcon Electric who came up with the clever idea of having a caricature sketch artist in their booth at this year's MILCOM show. The artist's drawings of me and our Publisher Pete Yeatman were so good that we've used them in our columns this month. And, as we can never say often enough, thank you to all the men and women in uniform that serve our nation in the Armed Forces. ▮▮

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