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The Journal of Military Electronics & Computing

Tech Focus: Small Form Factor Boards Roundup

MILITARY CASTS GPUs FOR GENERAL PURPOSE COMPUTING ROLES

PLUS:

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12th Annual End-of-Life Directory

Volume 13 Number 3 March 2011 cotsjournalonline.com

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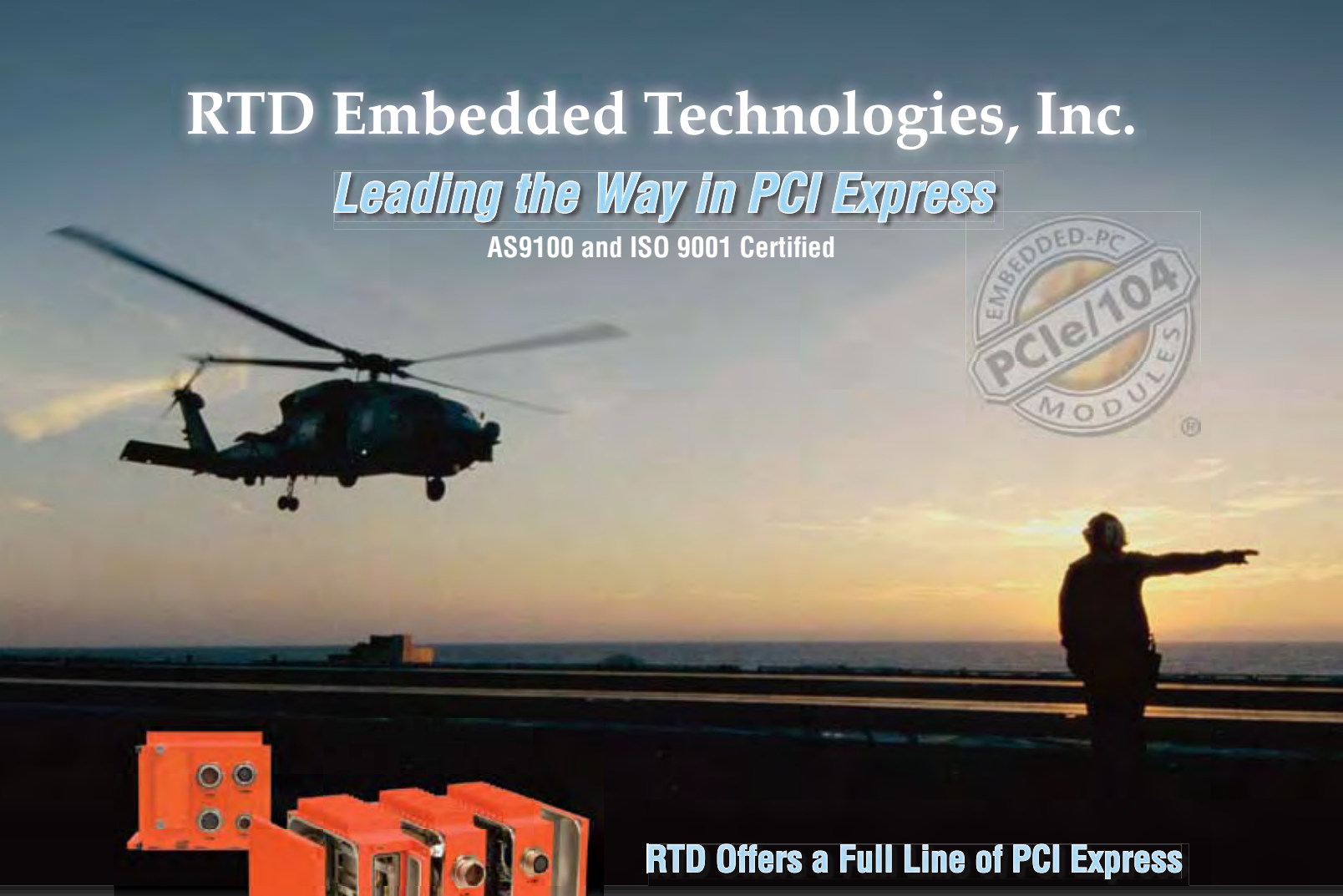

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10 GPGPU Computing Carves Out New Military System Design Territory

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Sunshine State Spectacular

Coming in April
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On The Cover: The E-8C Joint Surveillance Target Attack Radar System (Joint STARS) is a modified Boeing 707-300 series commercial airframe outfitted with radar and computer subsystems that gather and display detailed battlefield information on ground forces. Northrop Grumman's test bed E-8C recently completed a demonstration of the Navy/Air Force joint Network-Enabled Weapon (NEW) architecture, of which Joint STARS is a key enabler. (Photo provided courtesy of Northrop Grumman).

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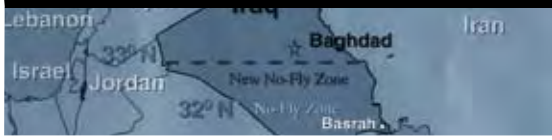
Publisher's Notebook



The Ides of February?

The end of February had a couple things going on that are of interest to our industry: the last flight of the Space Shuttle Discovery with mission STS-133, and the AUSA (Association of the U.S. Army) Winter Conference in Ft. Lauderdale, Florida. Both of these events get the *COTS Journal* team traveling, and when they both happen in the same week, we have to hustle.

Prior to going to AUSA, Jeff Child (Editor-in-Chief) and I tried to speculate as to what changes we expect to see over previous years. The most revealing revelation that AUSA provided was that their Winter Symposium is declining in size while they are expanding their Annual Meeting in DC. I'm not sure what the official attendance was this year to past years, but while walking around and talking to exhibitors the feeling was that attendance was lighter. From an exhibitor standpoint it was noticeably smaller with the elimination of the Annex facility and a large unused space in the main hall. This is the converse of the AUSA DC Meeting where they have added major space while there are still a bunch of potential exhibitors on a waiting list.

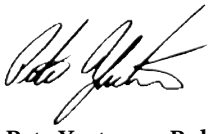
Space Shuttle Discovery launches from the Kennedy Space Center on its last mission under a blue Florida sky on Feb 24. The Shuttle and its crew of six launched with a new International Space Station module in its cargo bay. (Photo by Warren Andrews.)

The only major industry trend that I noted was that the primes and second tier suppliers were shifting their focus more to the upgrade and retrofit arena. While there was an overall decline in exhibitors, there was a consistency in the number of subsystem supplier exhibitors. Among these were Curtiss-Wright, DDC, Extreme Engineering, Parvus and others from the display and power arena.

We interrupted our AUSA visit to run up and cover the launch of Shuttle Mission STS-133. Any of you that know me personally know that I am big on freely talking to people that compete in areas that I'm involved in. I did that at AUSA and talked to all the media people I could find—such as *Defense News* and *Army Times*, *Kerrigan Media*, *Defense Systems* and *Jane's*. At the NASA Media Center things are different than at a conference. There, we're all just working stiffs trying to talk to contractors and NASA employees. Many of the journalists we saw have been there from the beginning of the Apollo program. Yes, there are a lot of sour grapes watching the U.S.'s manned space program coming to an end. There are few—if any—who believe the government's PR that private industry will be able to step in and place men in orbit and return them to earth anytime in the next four or five decades. Instead that endeavor will have to be outsourced—like most other things we're doing—to countries like China and Russia.

At the Shuttle launch, our interest was more focused on extracting decades of information from other reporters. Overall the consensus appears to be that government has limited interest in participating in the expansion of mankind's knowledge and presence in space, and wants private industry to exploit this area.

Major primes and subs don't have as many new big items that they are trying to promote. Upgrades and tech insertions don't need the big promotion push outside of the DC political circle. So why spend the money doing a big iron conference outside DC? Space has never been—and in our lifetime will never be—a high volume market. Yes, commercially available electronics will be used by some developers. But much will still be custom designed and the volume for any one item will be extremely small. So unless there is heavy outside funding to enhance hardware products already designed for military applications, very few industry suppliers of electronics will commit funds to provide products for space applications. Meanwhile, military upgrades and tech insertions are going to be like a tsunami for the electronics industry. The need to improve what the warfighter requires is growing daily, while the support for new programs is waning. As those needs get closer to critical, the volume of those upgrade and tech insertion opportunities will grow exponentially. ▮▮



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The Inside Track

Wind River RTOS Flies on First Flight of X-47B UAS

The U.S. Navy / Northrop Grumman X-47B unmanned aircraft successfully completed its first flight at Edwards Air Force Base in California on February 4, 2011 at 2:09 p.m. PST for 29 minutes. Wind River's VxWorks real-time operating system (RTOS) is a key technology for the X-47B in the Navy's Unmanned Combat Air System Carrier Demonstration (UCAS-D) program. VxWorks was chosen by Northrop Grumman as the software platform for the UCAS-D program, and by GE Aviation as the foundation for the Common Core System, the backbone of UCAS-D computers, networks and interfacing electronics and provides the primary computing environment.

The X-47B (Figure 1) is an unmanned aircraft Northrop Grumman developed for the Navy to demonstrate that an unmanned, tailless aircraft can operate safely and autonomously from aircraft carriers and refuel in-flight. Northrop Grumman developers leveraged VxWorks to rapidly create, deploy and maintain critical applications for this unmanned aircraft. The UCAS-D program is an essential step toward the future of carrier-based unmanned systems technology. "Launching the X-47B is a major milestone for the Navy, Northrop Grumman and Wind River, whose technology was important to its success," said Janis Pamiljans, vice president and UCAS-D program manager for Northrop Grumman's Aerospace Systems sector.

Wind River
Alameda, CA. (510) 748-4100. [www.windriver.com].

Figure 1

The Navy X-47B Unmanned Combat Air System Demonstration aircraft took off and flew for the first time Feb. 4, 2011 at Edwards Air Force Base, Calif. The Northrop Grumman-built aircraft flew for 29 minutes during the flight test.

ARINC Tapped for Comms Upgrades on Navy E-6B Aircraft

ARINC Engineering Services has been selected to perform a major communication systems upgrade on U.S. Navy E-6B aircraft that are part of the Take Charge And Move Out (TACAMO) strategic communications relay mission and the Airborne Command Post (ABNCP) command and control missions. Under a subcontract just received from Rockwell Collins, ARINC will install Rockwell's Block I avionics modifications on multiple Navy E-6B aircraft, effectively upgrading most of the advanced communications systems on board.

The Navy E-6B is designed to provide survivable and endurable command, control and communications in support of the President, Secretary of Defense, Chairman of the Joint Chiefs of Staff, and United States Strategic Command. ARINC will perform the E-6B Block I work at its Aircraft Modification and Operations Facility in Oklahoma City, OK. Completion is expected to take about 26 months, with induction of the first aircraft scheduled for July 2011 and final delivery by September 2013.

ARINC
Annapolis, MD.
(410) 266-4000
[www.arinc.com].

ViaSat Awarded 2nd Limited Production Order for MIDS JTRS Terminals

ViaSat has been awarded a Limited Production order valued at $6.8 million for Multifunctional Information Distribution System Joint Tactical Radio System (MIDS JTRS) terminals for the U.S. government. The award resulted from a competitive procurement through the Space and Naval Warfare Systems Command (SPAWAR). The order was awarded under the MIDS Indefinite Delivery/Indefinite Quantity contract initially executed in March 2010. The MIDS JTRS terminals are for F/A-18E/F, RC-135 Rivet Joint (Figure 2), and EC-130H Compass Call aircraft.

MIDS JTRS is a joint development of ViaSat and Data Link Solutions and provides a migration path from the MIDS-Low Volume Terminal (LVT) to a certified, reprogrammable, software-defined radio architecture for tactical data links. The terminal has completed contractor and government qualification testing and ViaSat expects to enter full production and fielding this year. The MIDS JTRS adds three programmable channels to the legacy Link-16 and TACAN capabilities of the MIDS-LVT. The three new channels are designed to host future advanced airborne networking waveforms. MIDS JTRS

Figure 2

RC-135 Rivet Joint aircraft will use the MIDS JTRS terminals. Shown here, an RC-135 Rivet Joint aircraft moves into position behind a tanker for an aerial refueling.

is "plug-and-play" backward compatible with MIDS-LVT so it can easily replace the MIDS-LVT, but remain interoperable.

ViaSat
Carlsbad, CA.
(760) 476-2200.
[www.viasat.com].

U.S. Navy Deploys RGB Spectrum's JPEG2000 Recording Systems for UAV Training

RGB Spectrum's DGy high-definition digital recording and streaming systems were selected for Northrop Grumman's advanced Ground Control Station (GCS) operator training system for the BAMS UAS program. A key requirement is recording video at up to 1920x1200 pixels resolution for after-action-review. To maximize effectiveness, Northrop Grumman devised realistic imagery making the simulated ground stations indistinguishable from the real thing. The GCS training system utilizes three DGy 201HD codecs, each recording one of three PCs generating the simulated visuals, including complex telemetry, avionics, navigation, radar, HD video, geo-specific terrain imagery, and other related information. The DGy system achieves near lossless image compression with a leading-edge JPEG2000 wavelet-based codec.

The U.S. Navy's new intelligence, surveillance and reconnaissance (ISR) program, the Broad Area Maritime Surveillance Unmanned Aircraft System (BAMS UAS) (Figure 3), is the next generation of the Defense Department's high-altitude, long-endurance system for coverage of oceanographic and littoral areas. Supplied by Northrop Grumman's Aerospace Systems sector, the Navy will deploy the maritime derivative of the RQ-4B Global Hawk aerial vehicle designated the MQ-4C BAMS UAS. A key advantage of the MQ-4C is its ability for continuous, sustained operations over an area of interest at great distances, enabling it to deliver all-weather, persistent "eye in the sky" ISR directly to the maritime commander.

Figure 3

Artist's illustration of the U.S. Navy's new MQ-4C Broad Area Maritime Surveillance Unmanned Aircraft System (BAMS UAS). Construction of the first MQ-4C began last September.

RGB Spectrum
Alameda, CA.
(510) 814 7000.
[www.rgb.com].

Military Market Watch

Mil/Aero Market Still the Largest User of PC/104 Family Boards

Among the most tried and true small form factor solutions used by the military and other embedded computing market segments, PC/104 remains a mainstay in the defense arena. According to research from VDC, global demand for PC/104-based technology is predicted to expand at a 6.07% CAGR over the 2009-2014 forecast period and reach a global market size of $193 million by 2014 (Figure 4).

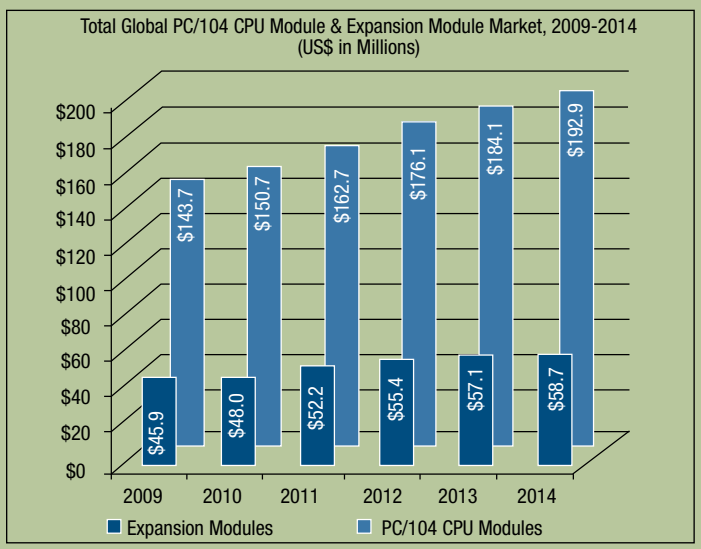

Figure 4

VDC Research forecasts global demand for PC/104-based technology to expand at a 6.07% CAGR over the 2009-2014 forecast period and reach a global market size of $193 million by 2014.

Meanwhile, PC/104 expansion modules are expected to reach a nearly $46 million global market by the end of 2010, and grow to nearly $59 million by 2014, displaying a CAGR of just over 5%. Collectively, the combined global PC/104 CPU module and expansion module market is expected to reach approximately $251.6 million by 2014, displaying a CAGR of 5.82%.

VDC sees demand for PC/104 technology continuing to be driven by both OEMs and system integrators for support of both military and aerospace, and industrial automation & control segments where compact, self-stacking design and low power consumption are required. For its part, the military and aerospace market consumed the most PC/104 family CPU modules (33% of all dollar volume shipments), with the industrial automation and control market segments a close second (32%).

While the overall size of the PC/104 market is predicted to increase through 2012, specific architecture types used will evolve. The VDC forecast data shows the PC/104 family will experience a single-digit rebound through 2014. That said, in order for this technology to remain viable over the longer term, vendors will have to commit resources to developing performance enhancements for advanced applications. Otherwise, the recovery of these architectures is in jeopardy and could stall over the short term, according to VDC. In terms of specific architectures, VDC's research supports the migration prediction that PCI-104 and PC/104 Express will expand its percentage of the PC/104 market over the forecast period. For further information about the Stackables report, part of VDC Research Group's 2010 Embedded Hardware Market Intelligence Service, contact: Richard Dean, program manager at rdean@vdcresearch.com.

VDC Research Group
Natick, MA. (508) 653-9000. [www.vdcresearch.com].

Special Feature

GPUs Do Military General Purpose Computing

GPGPU Computing Carves Out New Military System Design Territory

Graphics processors used as general purpose processors are the latest disruptive technology to invade military embedded computing. Powerful and dense processing combined with easy programming give it a decided edge over traditional signal processing approaches.

Jeff Child, Editor-in-Chief

The concept of GPGPU computing is beginning to gain traction. This disruptive technology is the emerging idea of using the latest crop of high-performance graphics processors to handle general-purpose processing tasks. GPUs have potential in application areas including target tracking, image stabilization and SAR (synthetic aperture radar) simulation. Sensor processing and software defined radio are also well suited for this kind of processing. Board-level products have emerged specifically for GPGPU computing in a number of form factors including OpenVPX.

On the forefront of this wave is NVIDIA, the graphics technology firm that originally coined the term "graphics processor." Graphics processing units, or GPUs, are programmable floating-point graphics-rendering engines primarily used in personal computers, workstations and gaming consoles. But thanks to architectural advancements in recent years, the scope of applications to which GPUs can be applied has grown dramatically. For traditional signal processing algorithms like the FFT (Fast Fourier Transform), they provide unprecedented performance, particularly performance per watt. For UAV (Figure 1) applications such as ISR, the increases in the compute capability that are offered by the use of GPGPUs have a direct relationship to more capable detection systems, increased UAV autonomy and increased survivability. Decreases to the size, weight and power (SWaP) of the compute platform result in greater range, greater payload and greater loiter time.

Easier Programming

Feeding this notion of GPUs as general-purpose processing engines, NVIDIA developed a parallel computing architecture called CUDA (an acronym for Compute Unified Device Architecture) that addresses a key weakness of FPGA parallel processing systems: the complexity of programming them. CUDA is the computing engine in NVIDIA graphics processing units (GPUs) that is accessible to software developers through industry standard programming languages. The CUDA architecture enables programmers to write programs in conventional computing languages to access the massively parallel processing capabilities of the GPU. Programmers use "C for CUDA," which is C language with NVIDIA extensions, to write code to run on the GPUs.

Aside from serving applications in radar, signals intelligence, and video surveillance and interpretation, GPUs based on the CUDA architecture have potential in other application areas including target tracking, image stabilization, SAR (synthetic aperture radar) simulation, pattern recognition, video encoding/decoding, graphics rendering, object recognition, in-crowd behavioral monitoring and analysis, cryptography, sensor processing and software defined radio. GE Intel-

Figure 1

An Air Force Staff Sergeant prepares the RQ-4 Global Hawk for launch using the vehicle test controller while reviewing technical orders at Beale Air Force Base, Calif.

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ligent Platform, a major prime contractor in the military/aerospace industry, has evaluated the CUDA architecture in a radar system and found that performance improvement of 15x is achievable with minimal reprogramming effort.

Where GPGPU Technology Shines

One advantage of GPUs is their highly parallel nature. Some GPUs have as much as several hundred thread processors. In the military applications, that parallelism is helpful in signal processing applications that can be expressed as vector and matrix operations or linear algebra. Likewise image processing applications are also well suited because the native architecture of the GPU is geared toward handling textures, surfaces and shaders.

Because one CPU can host several GPUs, in many situations data streams arriving from sensors may be required to be staged through host processor memory before being accessed by the GPU. This can mean there is added latency in the data stream in some applications. There are several techniques to mitigate this—use of page locked host memory, direct access of host memory from the GPU and direct PCIe transfers from input device to GPU memory are some. Devices that support such functionality include FPGAs, InfiniBand interfaces, 10 Gbit Ethernet, video capture and video encoder devices. Even using these, some applications with very tight latency constraints, such as control loop systems, may not be a good fit for GPGPU.

The need for double precision floating-point operation may dictate which GPUs are suitable: some do not sup-

Figure 2

The IPN250 combines NVIDIA's GT240 96-core GPU with an Intel Core2 Duo processor operating at 2.26 GHz and 8 Gbytes of DDR3 SDRAM to deliver up to 390 Gflops of performance per card slot.

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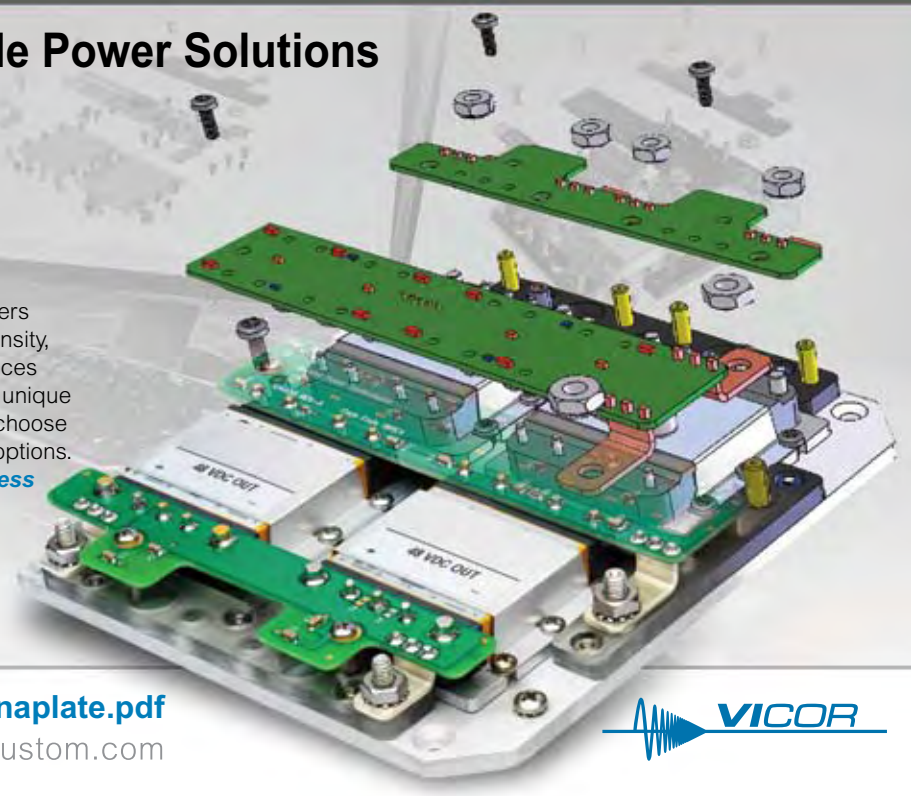

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port double precision at all, some have reduced capability and some have fully fledged support. Another deciding factor may be the need for Error Correcting Code (ECC) on the GPU memory, caches and register files: not all devices have ECC. Access to global memory on GPUs has a large latency penalty. That's nothing new—most systems rely on data locality for performance. There are many applications that can either tolerate this or mitigate it by use of such techniques as concurrent transfers and processing, and pipelining of many more execution threads than there are physical processors (thread occupancy). This can be done with minimal overhead to switch thread execution. The common characteristics are large data sets, a high computational intensity—where each data point undergoes multiple calculations—and a tolerance to some degree of latency.

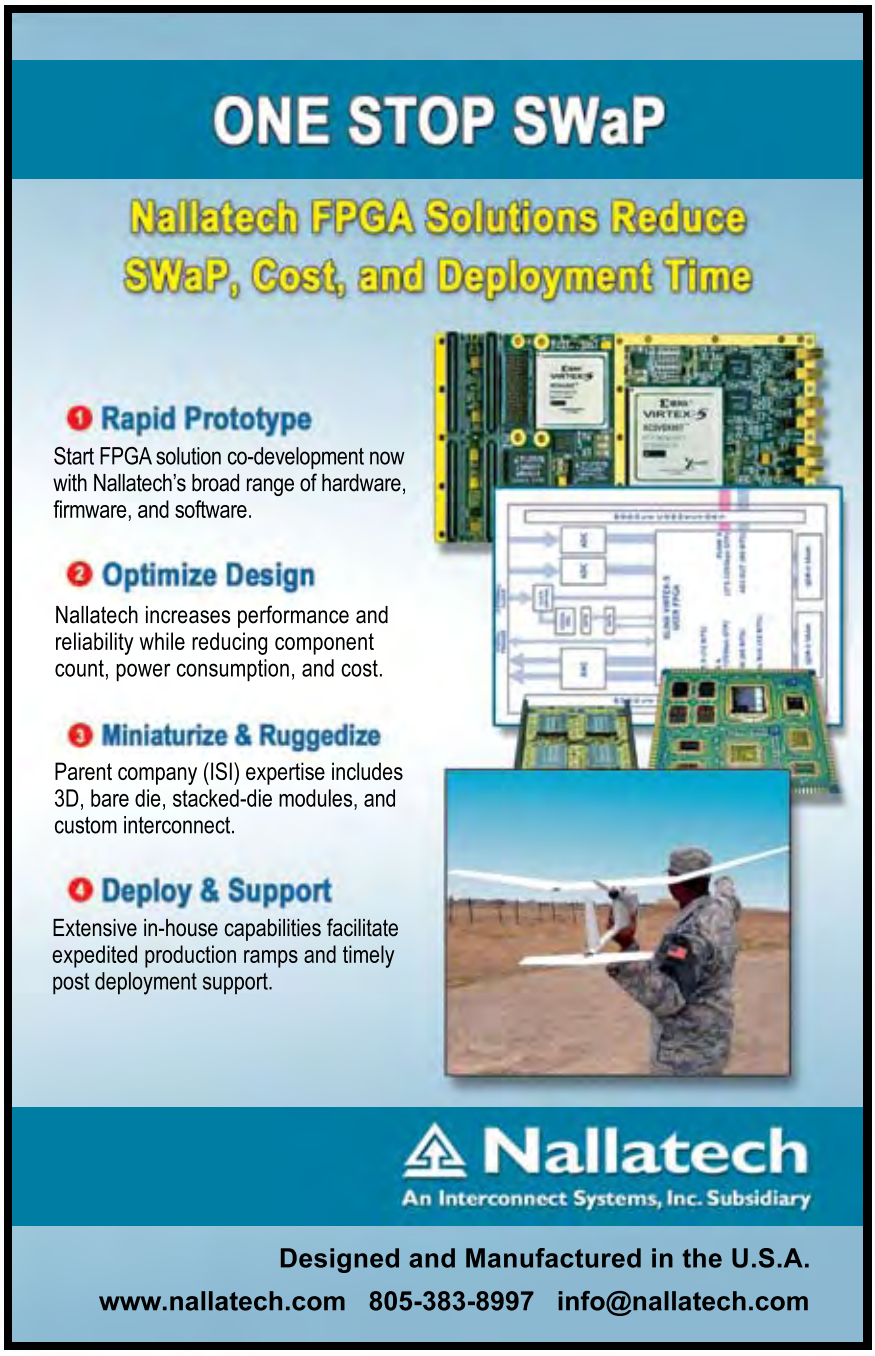

Figure 3

MXC cards enable users to create VPX, VME, Compact PCIe, COM Express and custom baseboard variations. They support both expanded video input and output, and provide parallel GPGPU processing.

GPGPUs on OpenVPX

Among the first to bring GPGPU computing to the embedded realm was Mercury Computer Systems. Its latest offering is an OpenVPX, dual GPU-based conduction-cooled subsystem. This subsystem is currently deployed in an embedded rugged defense surveillance platform, performing processing, exploitation and dissemination (PED). The system is powered by the Ensemble 6000 Series GSC6200. The subsystem currently delivers performance in the Teraflops range, and the incorporation of GPUs enables the solution to be delivered in an optimized size, weight and power (SWaP) footprint. Packaging technology on the GSC6200 leverages the easy-to-upgrade MxM GPU form factor, which enables users to rapidly upgrade and deploy the latest and fastest GPUs from ATI or NVIDIA.

GE Intelligent Platforms latest GPGPU offering is its IPN250, the second product from GE to feature NVIDIA's CUDA technology. The IPN250 (Figure 2) combines NVIDIA's GT240 96-core GPU with an Intel Core2 Duo processor operating at 2.26 GHz and 8 Gbytes of DDR3 SDRAM to deliver up to 390 Gflops of performance per card slot, depending on the application. It is designed from the ground up to be compliant with the OpenVPX standard. It is also VITA48/REDI compliant, allowing it to be deployed in the harshest environments: build options for air-, spray- and conduction-cooling are available.

The IPN250 feature set includes two primary data plane, 10 Gigabit Ethernet ports supporting multi-board switched fabric OpenVPX architectures. A 16-lane PCI Express gen2 interface on the P2 expansion plane provides high-speed interconnect for multi-board GPGPU clusters as well as system I/O to PCI Express-enabled sensor modules such as GE's family of Xilinx Virtex5 and Virtex6 mezzanine cards. Two 1000Base-T and two 1000Base-Bx control plane ports are available, together with additional PCI Express, USB 2.0, SATA, COM ports, GPIO, audio and TV input. Video and multimedia is supported via the dual link DVI, HDMI and VGA ports directly into the NVIDIA GT240 device to cater to a wide range of interfaces.

Figure 4

This rugged 2U expansion enclosure provides four or eight PCIe x16 Gen2 slots, two PCIe x16 cable interfaces, ample cooling, and an 850W power supply to support up to four GPU boards or other high-speed I/O cards.

Modular GPGPU Approach

Providing a modular approach to GPGPU computing, Wolf Industrial Systems recently rolled out a GPGPU solution in its MXC form factor (Figure 3). The MXC technology is a hybrid derivation of the XMC, MXM 3.0 and PMC specifications. MXC embedded modules are small (70 mm x 85 mm), conduction-cooled mezzanine boards designed to be used with carrier cards. These include, but are not limited to, 3U and 6U VPX, cPCI, VME64 and custom or COM Express baseboard configurations. To improve upon the successes of XMC, PMC, MXM 3.0, and the standard busing scheme of PCIe, the MXC specification utilizes the SAMTEC Searay connector to provide superior support during extreme shock and vibration situations, while enabling high-speed electrical signals through dedicated connectivity. Five hundred individual pins are defined for each video input and output, eliminating the need for signal multiplexing.

The new WOLF MXC cards are smaller than XMC and PMC units, yet present over 500 pins, offering more than 100 combinations of video input and outputs including. This generous pin configuration allows WOLF to create VPX, VME, Compact PCIe, COM Express and custom baseboard variations, enabling a family of products offering both expanded video input and output, parallel GPGPU processing, plus the capacity to upgrade to future technologies through drop-in replacement MXC modules. Current MXC cards use the AMD Radeon e4690, providing superior graphics ca-

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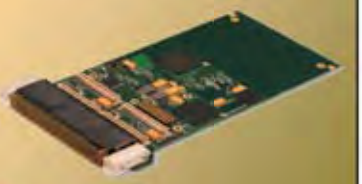

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pabilities coupled with video input and capture capabilities using Xilinx Spartan 6 and Virtex FPGAs.

2U Server Solution

When sheer compute density combined with off-the-shelf server compatibility are priorities, the rackmount server style form factor ranks as a leading choice. Bringing GPGPU technology onto that form factor, One Stop Systems offers a system that integrates an AMD-based motherboard featuring dual "Istanbul" processors and eight GPU boards providing 10 Teraflops compute power. The server can also accommodate a combination of GPU boards and SSD (solid-state drive) boards. Four GPU boards and four 640 Gbytes SSD boards provide 5 Tflops GPU processing and 2.5 Terabyte memory in addition to the compute power of the dual six-core processors. In addition, OSS has packed even more storage capacity into the system with four hot-swappable hard disk drives and an internal RAID controller. The server is powered by dual, redundant 1,500W power supplies and housed in a 2U-high chassis designed and manufactured to meet rigorous environmental demands.

Recently One Stop Systems expanded that offering with a rugged 2U expansion enclosure (Figure 4) that provides four or eight PCIe x16 Gen2 slots, two PCIe x16 cable interfaces, ample cooling, and an 850W power supply to support up to four GPU boards or other high-speed I/O cards, a two PCIe x16 Gen 2 host cable adapter, and two PCIe x16 one-meter cable. The system includes a system monitor (fans, temperature, voltage).Operating temperature range is 0° to 35°C while storage temperature is -40° to 85°C. The unit operates in 10 to 90 percent relative humidity (non-condensing) and operates at 0 to 10,000 feet. ▮▮

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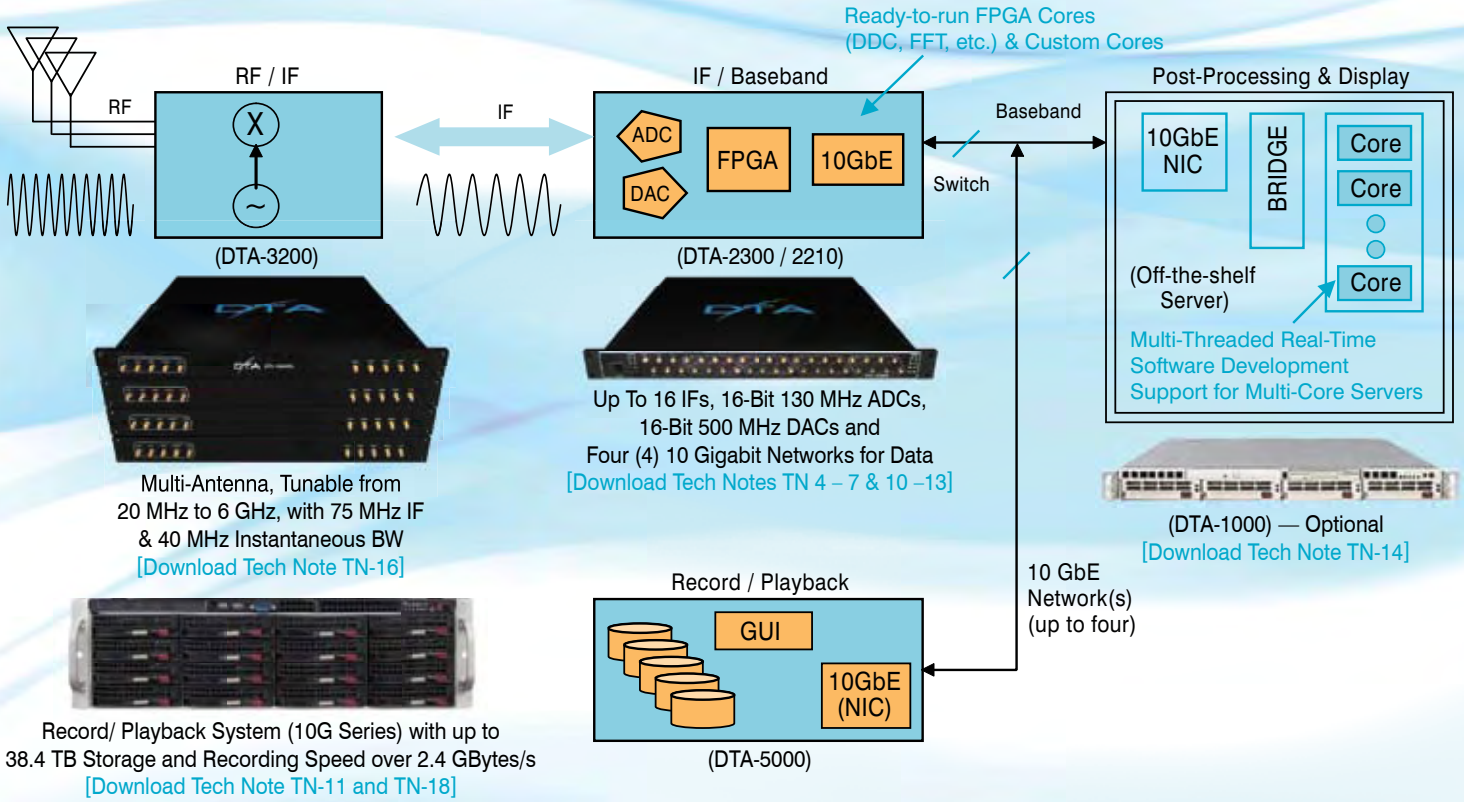

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Carrier Landing Modeling System Leverages GPGPU Advantages

Well suited for data-intensive, parallel processing, GPGPUs are powerful tools. The technology has been applied to modeling aircraft carrier landing scenarios.

Mark Lovett, Chief Marketing Officer
Trenton Technology

Since Intel introduced the 8088 microprocessor and Motorola released their 68000 over 30 years ago, CPUs have been at the forefront of discussions related to computing power. Users eagerly anticipated each successive iteration that brought with it faster processing speeds and enhanced functionality. But alongside this CPU juggernaut, coprocessors, also known as hardware accelerators, have played a critical role in advancing the ability of computers to deal with increasing volumes of data by offloading the CPU.

In the early days of personal computing Intel's 8087 and Motorola's 68881 math coprocessors were popular with anyone involved in scientific research and analysis, and the subsequent development of graphics coprocessor technology was equally adopted by users of CAD software and gaming machines. More recently, hardware acceleration solutions that utilize Graphics Processing Units (GPUs) working in tandem with Central Processing Units (CPUs) have fostered the GPGPU (General-purpose computing on graphics

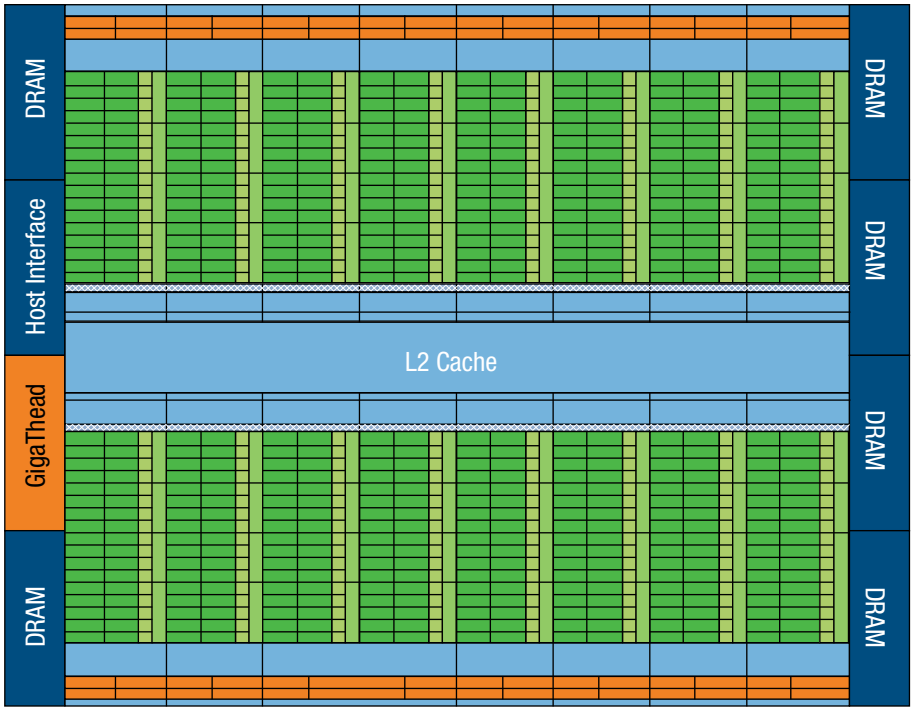

Figure 1

Fermi's 16 SMs (Streaming Multiprocessors) are positioned around a common L2 cache. Each SM is a vertical rectangular strip that contains an orange portion (scheduler and dispatch), a green portion (execution units) and light blue portions (register file and L1 cache).

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Figure 2

Shown here is an artist's rendering of an X-47B Carrier-Capable Stealth UAV landing on a carrier deck.

Applications Suited for GPGPU Technology	
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✔	Object detection and pattern recognition
✔	Radar, sonar and radio signal processing
✔	Still photo and video image enhancement
✔	Intelligence, surveillance & reconnaissance
✔	Encryption/decryption and cryptanalysis
✔	Physics-based modeling and simulation

Table 1

The GPGPU paradigm has proven itself to be an ideal platform for data-intensive military applications.

processing units) computing paradigm, and this hybrid architecture has proven itself to be an ideal platform for data-intensive military applications. Table 1 lists the kinds of military applications suited for GPGPU technology.

A Powerful Combo

The basic reason this combination works so well is that CPUs and GPUs process instruction and data sets differently, and there is great synergy in utilizing both approaches to address the needs of data-intensive applications. As a general rule, CPUs are designed to excel at serial tasks, processing a range of diverse functions as quickly as possible. But the inherent "general purpose" nature of CPUs, combined with architecture advances such as superscalar design, out-of-order execution, dynamic scheduling, branch prediction and simultaneous multithread-

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ing, have served to limit the number of cores that can be packed onto a single die while still remaining within acceptable power and thermal envelopes. This explains why many supercomputers employ hundreds of servers providing thousands of PowerPC, Opteron or Xeon processors clustered by way of an InfiniBand interconnect.

GPUs, on the other hand, are built with hundreds of simpler cores designed as massively parallel vector processors and tailored for high-performance solutions that involve a high degree of data parallelism. While originally targeted at graphics-intensive applications to perform texture mapping and polygon rendering, GPUs happen to be a natural fit for mathematically intensive problems that involve large datasets, taking advantage of this massively multithreaded computing architecture.

Simpler Cores in Parallel

But this shift from serial to parallel processing in hardware must also be mirrored in the writing of code. "Programming has typically been focused on a linear

Figure 3

TRC4008 is a 4U rackmount computing solution that includes a 14-slot PCI Express backplane with four double-wide x16 PCIe slots that can support up to four NVIDIA C-Series Tesla GPU cards.

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process of executing program functions," says Allan Snavely, associate director for the San Diego Supercomputer Center, "but programs that involve parallel processing of very large data sets outside the CPU require a different mindset—the programmer needs to think about how the data can be broken up into smaller units for simultaneous processing across hundreds or thousands of cores, and that's a skill most programmers are still learning."

With potentially thousands of cores available, the key to maximizing performance is to keep those cores as busy as possible, and that requires application developers to write or modify their code in a way that extracts computationally intensive units of data staged in the CPU and maps them to run on the GPU while allowing the CPU to handle the remainder of the application. Figure 1 shows the architecture of NVIDA's Fermi GPU.

While GPU hardware is designed to manage thread execution and scheduling, the programmer is still responsible for supplying data to thousands of simultaneous threads. Traditionally, GPGPU used to require a great deal of time and effort in order to map algorithms using graphics languages, but the release of new programming tools has made life simpler and accelerated the adoption of GPGPU computing. One such solution was Brook, an extension of standard ANSI C that incorporates the concept of data parallel computing, which in turn allows the GPU to function as a streaming coprocessor.

OpenCL (Open Computing Language), initially developed by Apple, is an open standard programming framework that allows code to execute across both CPUs and GPUs. With broad industry acceptance, implementations of OpenCL are available for Intel, AMD/ATI, S3 and NVIDIA hardware. Previous to the release of OpenCL, NVIDIA created CUDA, a proprietary solution allowing programmers to write in high-level languages such as C, C++ and Fortran, as well as utilize OpenCL and DirectCompute APIs.

Keep CPU Cores Busy

Modeling and simulation applications, with their large data sets and reliance on mathematical functions, can take full advantage of GPGPU computing's massively parallel computational model. As a result, more complex problems can be addressed and additional scenarios analyzed. This shift in processing capability is significant, as real-world testing of multiple scenarios significantly increases project cost, and in many cases is virtually impossible as conditions that require testing occur at unpredictable times.

Such is the case when trying to analyze aircraft carrier operations at sea. Setting a jet fighter down on a moving carrier deck is never an easy task, and the degree of difficulty increases during adverse weather. As a rigid body residing within three-dimensional space, a carrier is subject to the six degrees of freedom while at sea, requiring algorithms to deal with displacement motions (heave, sway and surge) as well as angular motions (yaw, pitch and roll) as the ship interacts with oceanic and atmospheric conditions.

As a result, the Navy conducts aircraft missions when conditions are within predetermined operational envelopes, but testing the limits of such operational envelopes using aircraft and pilots is not a practical option due to safety concerns. This is why computer models are used on a range of scenarios to more accurately predict how aircraft and the carrier react under different sets of environmental conditions.

An added benefit to creating computer models is that flight scenarios can be saved and subsequently used with flight simulators to train pilots, giving them the valuable experience of landing in a variety of less than optimal conditions without risking lives or aircraft. Such simulation models not only apply to piloted aircraft, but are also relevant for operating unmanned aerial vehicles off a carrier flight deck (Figure 2).

Modeling Complex Scenarios

To address this complex issue, EM Photonics is developing a hardware-accelerated computational fluid dynamics (CFD) tool based on NVIDIA GPGPU technology that will rapidly and accurately model aircraft interaction with naval vessels, especially with regard to the vessel's airwake. Once developed, these CFD solv-

ers can also be used to model a range of other scenarios where small moving objects interact with larger moving structures, from helicopters landing on ships to deploying payloads from aircraft.

The first challenge for the team involved verification that complex CFD computations map well to the multicore NVIDIA GPU hardware and that significant performance increases were possible by way of utilizing a massively parallel processing architecture. CFD solvers are generally optimized for a particular application of interest, and in this case the objective is the modeling of the Dynamic Interface (DI) for complex CFD problems involving very large and very small moving objects.

While the programming model for GPU computing is relatively new, developers must often deal with code that has been around for a long time. "Creating wholly new CFD solvers based around CUDA is interesting, but not practical because customers are familiar with their present applications and don't want to validate and re-learn new solvers, so the need to modify existing code is a reality" said John Humphrey, Director of Computing at EM Photonics. "What we look for is the roughly 10% of program code that's responsible for consuming 90% of the runtime cycles, as parallelizing the most compute-intensive portions of the program will yield the greatest performance improvement when applying GPGPU technology."

During Phase I of the program—which was designed to be a proof of concept—compute time of a solver for the Euler equations was reduced from 18 hours to 20 minutes, resulting in a 54x improvement. While this level of performance gain is quite impressive, the challenge for the project's next phase is to deal with computations that can take up to 150,000 CPU hours to run. According to Humphrey, in Phase II they will build on this prototype to create a full solver that will target both desktop users with GPU coprocessors as well as large GPU clusters meant for running the most difficult simulations. In the process they will also encapsulate functionality that can be leveraged across multiple CFD engines.

GPGPU Hardware Solutions

While GPGPU computing is often deployed on personal computers within office environments, or on commercial-grade servers within data centers, rugged military-grade rackmount computers are required to address the harsh realities of shock and vibration, extended temperatures and SWaP considerations. Trenton's TRC4008 (Figure 3) is a 4U rackmount computing solution that includes a 14-slot PCI Express backplane with four double-wide x16 PCIe slots that can support up to four NVIDIA C-Series Tesla GPU cards. These PCIe slots support either PCIe 2.0 or 1.1 electrical interfaces by virtue of the backplane's PCIe Gen 2 switch and the CPUs used on the single board computers.

The TRC4008 system can support either a single-processor or dual-processor single board computer. The SBCs in turn may feature either dual or quad-core CPUs to handle the application's serial computing tasks while the parallel processing is offloaded to the bank of GPUs. The choice of SBC largely depends on the overall application in terms of the amount of serial processing vs. parallel processing needed to produce the most efficient GPGPU system solution. The rugged nature of this integrated GPGPU system, coupled with its inherent application flexibility and long-term configuration stability, provides military and government users with a hardware platform choice designed from the ground up to handle the needs of MIL-COTS field deployments. ▮▮

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Thomas Roberts, Product Marketing Manager
Mercury Computer Systems

The pressure to deliver next-generation defense capabilities faster and to deliver them within the guidelines of recent Department of Defense (DoD) Acquisition Reform mandates continues to mount. Under Secretary of Defense, Dr. Ashton Carter, describes defense acquisition reform as the need for every program to "Do More without More." In defense electronics, this mandate is driving the need to leverage best of breed legacy technology and combine it with the advantages new technologies can bring. For example, current Intelligence, Surveillance and Reconnaissance (ISR) programs are challenged to deliver valuable information to warfighters by combining—in real time—data from different types of sensors. Some sensor interfaces have already been developed and deployed on existing programs. Other interfaces are completely new. The goal is to use them all within one platform in an efficient and cost-effective manner. An example of a system where marrying new and legacy technology is important is the U.S. Navy's Surface Electronic Warfare Improvement Program (SEWIP) Block 2 upgrade program (Figure 1). SEWIP is an upgrade for the next-generation AN/SLQ-32(V) Electronic Support Measures system.

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Lower Risk Tech Refresh

Meeting this type of challenge sometimes requires the use of hybrid backplanes to bridge legacy solutions by bringing together heterogeneous backplane architectures such as fabric-based OpenVPX and legacy VME into a single system. A major advantage of a hybrid backplane is allowing the continued use of existing hardware and preserving years of development and system cost. OpenVPX offers flexibility in terms of interconnects and topologies to mix and match with legacy boards, which enables integrators to custom design the interconnects over a hybrid backplane to meet the unique needs of the application. Moving forward, widespread adoption of the OpenVPX (VITA 65) standard is creating a healthy ecosystem of interoperable components and systems providing defense contractors with the benefits of reuse, choice of best of breed, faster time-to-market and lower risk technology refresh.

Not every legacy application is a good candidate for a hybrid backplane solution. However, when key factors align using a hybrid backplane it can save a significant amount of time and money. In many cases, recreating a custom-designed VME board as an OpenVPX module is cost-prohibitive. Industry experience shows that spinning, testing, debugging and then respinning a new 6U board of moderate complexity can cost, conservatively, $1 million to $2 million and sometimes go as high as $20 million. In addition, this process takes man-years of engineering effort. Alternatively, with a hybrid backplane, development time can be cut to a matter of months with costs as low as $50,000. In addition, this approach lowers the overall project risks by using proven technology for a specific function.

Hybrid backplanes are an optimal solution for a system upgrade in situations where (a) an existing legacy board performs a function that won't cause a system bottleneck and (b) the legacy board was highly customized for a unique and very specific purpose that can't be replaced with a commercially available solution. For example, a micro-

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Figure 1

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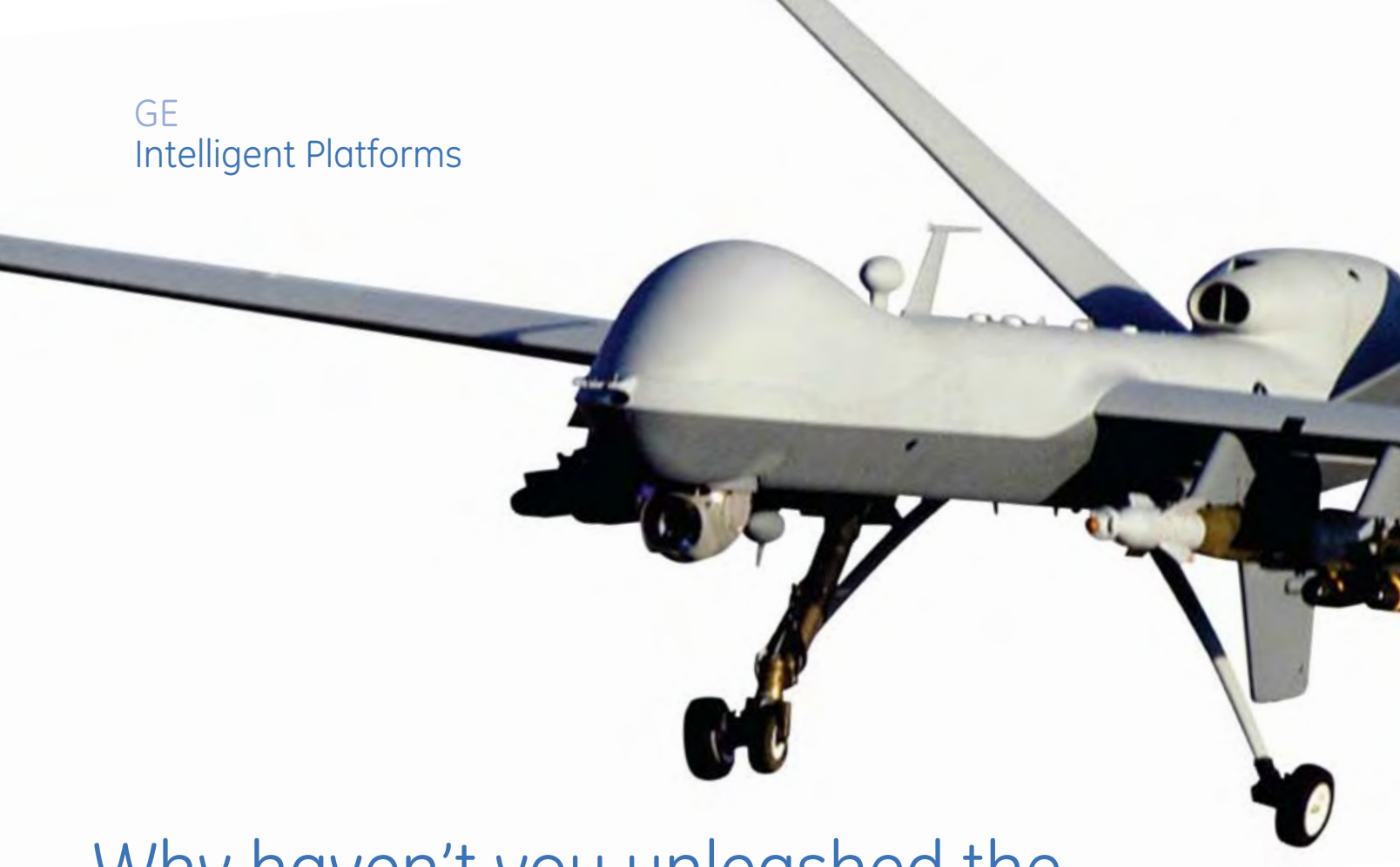

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Hybrid Backplane Challenges

Customized hybrid backplanes can be key solutions in meeting the ongoing pressure to deliver more with less, however, they require both design and manufacturing expertise to implement effectively. As a start, design engineers must determine how many slots are required, what subsidiary protocol will each slot support, what interconnections topology will be required from slot to slot, how the communication between the modules will be managed, what voltages will be supported at each slot and what slot(s), if any, will need rear transition modules. Physically, the spacing between the slots differs between standards, which must be accounted for in the design plan.

Establishing communication between legacy modules and new system components is a key function provided by a hybrid backplane. For

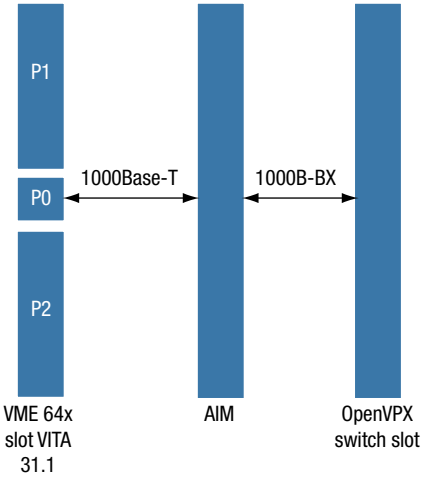

Figure 2

The approach shown here is based on an interface module and a VME VITA 31.1 compact packet switched backplane (cPSB over VME).

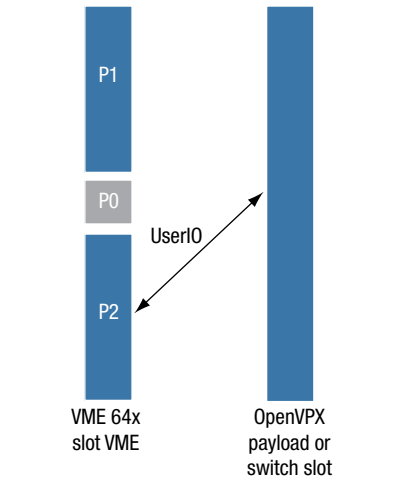

Figure 3

In this simple method for implementing a hybrid backplane, user-defined pins in the VME P2 connector are mapped by the hybrid backplane onto selected pins of the OpenVPX connector.

example, communication between a VME slot and an OpenVPX slot involves customized connections between mapped pins on both types of connectors. On the OpenVPX side, the concept of profiles can be used to assist this mapping.

The OpenVPX standard defines a set of system architectures within VPX and provides a framework for interoperability between modules and backplanes. With OpenVPX, system integrators can more readily architect an application-specific system based on compatible OpenVPX profiles for modules, backplanes and development chassis. An OpenVPX backplane profile is a physical definition of a backplane implementation that includes details such as the number and type of slots that are implemented and the topologies used to interconnect them. Ultimately a backplane profile is a description of channels and buses that interconnect slots and other physical entities in a backplane. Profile parameters are used to further describe properties of a backplane profile. Reviewing a few generalized hybrid backplane options will help show what is possible;

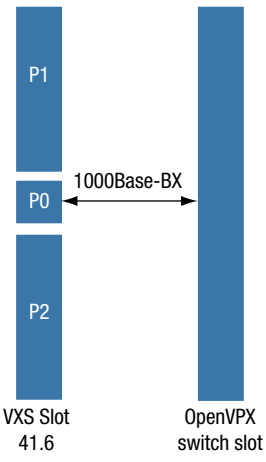

Figure 4

In this hybrid VXS-OpenVPX backplane approach, VITA 41.6 is wired by the hybrid backplane directly into the appropriate pins of an OpenVPX switch slot.

a great number of variations could be implemented.

Hybrid Backplane Design Approaches

The approach shown in Figure 2 is based on an interface module and a VME VITA 31.1 compact packet switched backplane (cPSB over VME). Since VITA 31.1 is a full 1000BASE-T implementation and VPX uses a 1000-BX SERDES interface, a PHY conversion must be completed in order to interconnect the Ethernet interfaces. Often in a conduction-cooled embedded system a specialized active interface module is created in order to break out I/O. This conversion can be placed

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

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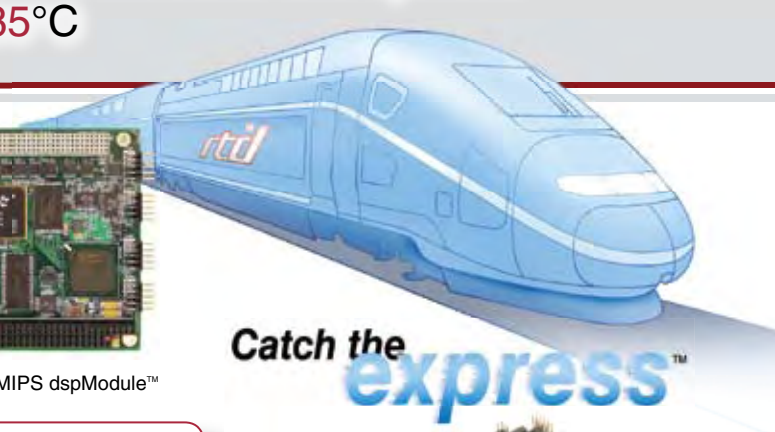

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Bus		Active Bus	PCI	PCI	ISA	ISA	ISA	PCI	ISA	ISA	ISA	PCI	PCI	PCIe	PCI
		Passthrough Bus	ISA					ISA				ISA		PCI	ISA†
		DMA or PCI Bus Master	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓
		McBSP Serial Ports	✓	✓				✓							
ANALOG	Analog Input	Single-Ended Inputs	16	16	16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

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onto that module. The hybrid backplane must be laid out to make the connections form the P0 pins in the VITA 31.1 slot to the designated user-defined pins on the AIM module. Note that there is a bandwidth mismatch from what would be available with VME (320 Mbytes/s), versus two Gigabit Ethernet at 250 Mbytes/s.

A simple but effective method for implementing a hybrid backplane is shown in Figure 3. User-defined pins in the VME P2 connector are mapped by the hybrid backplane onto selected pins of the OpenVPX connector. This approach could be used with a PMC or XMC I/O interface attached to the VME module. That VME module brings the I/O down to P2 pins. The user can then implement a lower-speed serial protocol or another parallel interface. Depending on what is being implemented, this could connect to the data plane, the control plane, the expansion plane, or into the user I/O area of the VPX module.

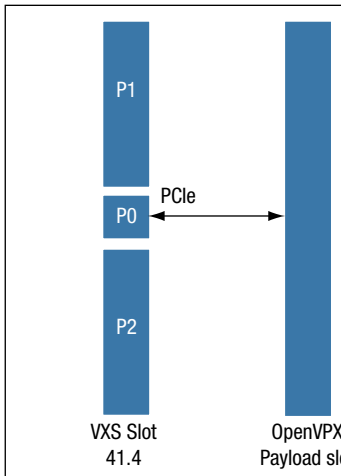

Figure 5

This demonstrates how VITA 41.4 can be wired by the hybrid backplane directly into an appropriate payload slot that uses PCI Express on the expansion plane or onto the dataplane.

A third approach, shown in Figure 4, is a hybrid VXS-OpenVPX backplane. VITA 41.6 can be wired by the hybrid backplane directly into the appropriate pins of an OpenVPX switch slot, such as the J1 section of SLT6-SWH-20U19F-10.4.1 (OpenVPX profile definition), the J1 section of SLT6-SWH-16U20F-10.4.2, or J3/J4 section of SLT6-SWH-4F24T-10.4.4. Figure 5 demonstrates how VITA 41.4 can be wired by the hybrid backplane directly into an appropriate payload slot that utilizes PCIe on the expansion plane or onto the dataplane. A prime example would be profile SLT6-PAY-4F1Q2U2T-10.2. Meanwhile, Figure 6 shows a more advanced maneuver, with the VXS slot wired by the hybrid backplane to both an OpenVPX payload slot and a switch slot, using different communication protocols. This

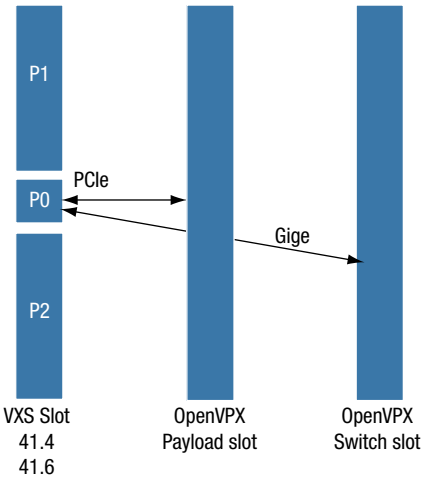

Figure 6

In this more advanced approach, the VXS slot is wired by the hybrid backplane to both an OpenVPX payload slot and a switch slot, using different communication protocols.

demonstrates the types of variations that can be achieved.

Requirements Met Using Hybrid Backplane

Designing a hybrid backplane, mapping out communications, defining and routing signals, is an engineering effort requiring special skills. And, like most complex technical tasks, it is greatly aided by experience. To help meet unique design challenges, like hybrid backplanes, many companies are turning to Services and Systems Integrations experts like Mercury Computer Systems, who can bridge resource gaps with a broad range of customized solutions and professional services. Many system integrators (SI) have worked on a diverse array of challenging problems requiring flexible, rapid response to augment and complement a company's internal resources, to design, develop and/or implement a solution without vendor bias, becoming a cost-effective, real-time extension to a team, and enabling a company to maximize its resources.

With careful planning and experienced system architecture design, custom hybrid backplanes can often create a path forward for defense contractors helping them evolve to next-generation technology while continuing to use critical legacy boards, minimizing costs, risks and time to deployment. ■■

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System Development

Twelfth Annual End-of-Life Supplier Directory

Obsolescence Management Becoming an End-to-End Game

DMSMS woes are an occupational hazard for military system developers. An entrenched cadre of government groups, distributors and specialty engineering firms offers ways to ease component obsolescence challenges.

Jeff Child
Editor-in-Chief

The problem of obsolescence—referred to as Diminishing Manufacturing Sources and Material Shortages (DMSMS) in military circles—shows no sign of going away any time soon. In fact, as commercial and consumer system lifecycles shrink, the components used in those broader markets are facing ever shorter life spans. Fortunately there's a growing infrastructure of companies and organizations armed to battle this problem. *COTS Journal*'s Twelfth Annual End-of-Life Supplier Directory, displayed on the following three pages, lists those players and what they do.

There are a number of ways to deal with the problem of a chip that has gone end-of-life. There are numerous after-market chip suppliers who stock inventories of devices that have gone obsolete. Among them is a mix of small firms specializing in after-market business, and large distributors who include after-market products in their portfolio. There are also packaging firms who do custom assembly of obsolete integrated circuits using existing wafer and die. Taking the next step beyond that, there are even some firms that will remanufacture the obsolete die—often at a more modern process size.

For the military, the problem of obsolescence is ever present. Adding fuel to the fire is the fact that many military platforms continue in service for decades. An example along those lines occurred in the early 1990s when engineers in the F-16 (Figure 1) program identified a critical

Figure 1

In the early 1990s engineers in the F-16 (Figure 1) program identified a critical shortage of 1553 connectors due to a supplier filing bankruptcy. Shown here, an Air Force captain conducts a preflight inspection of his F-16 Fighting Falcon at Komatsu Japanese Air Self-Defense Force Base last December.

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shortage of connectors due to a supplier filing bankruptcy. Phoenix Logistics was tasked to solve the problem by designing and developing fully qual-tested production quantities of 31 different RF connectors. Even today, Phoenix Logistics says they continue to produce those and other RF connectors in support of the F-16.

The directory lists the key DoD initiated organizations whose responsibilities include component obsolescence management and support. Among these, the Defense Microelectronics Activity (DMEA) plays a key role by developing and coordinating solutions to DoD obsolescence problems. The group has specific responsibility for issues relating to semiconductors. When any large military program gets underway, a Diminishing Manufacturing Sources (DMS) team is set up. That team comprises members from the program office itself as well as from the various depots, acquisition logistic centers (ALCs) and OEMS involved. The DMEA then acts as a resource to the team by offering technical advice.

The solution to any obsolescence program takes either one of two paths. First is a logistics solution—finding the appropriate components through DSCC or other sources. The other is an engineering solution—redesigning the system in order to negate the need for the obsolete parts. If the DMS team can't find a part, the DMEA can sometimes help find the part through its contacts. Their main focus, however, is to help evaluate whether a logistics solution is best or whether it's perhaps more cost-effective to either reverse engineer the ICs involved and move to an ASIC, or compress several functions into a single ASIC. As ASIC mask costs rise, increasingly FPGAs are being used instead of ASICs.

Sometimes it still makes sense to go with a logistics solution. That's particularly true when a component could help several different programs. The role of the Defense Supply Center, Columbus (DSCC) Sourcing and Qualifications Unit is to establish and maintain a known-good supplier base. Such suppliers must successfully demonstrate that their products meet the specified performance, quality and reliability levels via the DoD Product Qualification Program. In essence, the DSCC's role is an item manager for piece-parts, working with the inventory control points of the various branches of the military.

Rounding out the team of organizations serving a DMS role is the Government-Industry Data Exchange Program (GIDEP). GIDEP acts as a centralized database for various kinds of information, including DMS issues. Its broader role is as a center for sharing technical information essential during research, design, development, production and operational phases of the lifecycle of systems. They keep track of DMS notices when parts become obsolete and solutions for those notices. GIDEP also has the responsibility of hosting the DoD DMS Teaming SubGroup on their databases. ■

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Center for Advanced Life Cycle Engineering (CALCE)	College Park, MD. (301) 405-5323. [www.calce.umd.edu].	B, DB, R, S	The Center for Advanced Life Cycle Engineering (CALCE) is recognized as a driving force behind the development and implementation of physics-of-failure (PoF) approaches to reliability, as well as a world leader in accelerated testing, electronic parts selection and management, and supply-chain management.
CPU Technology	Pleasanton, CA. (925) 224-9920. [www.cputech.com].	B, E	CPU Tech produces secure processors that protect software and systems from reverse engineering. Acalis enables the development of secure and compatible electronics modernization technology solving obsolescence problems while reducing size, weight and power (SWAP).
DMEA	McClellan Park, CA. (916) 231-1555. [www.dmea.osd.mil].	B, E, F, G, P	DMEA provides long-term, strategic support for the entire range of DoD systems that utilize microelectronics. DMEA presents the system manager with appropriate solution options to not only keep the system operational but also transform it to the next level of sophistication. These solution options range from component upgrades to board or system upgrades with advanced technology.
DPA Components International	Simi Valley, CA. (805) 581-9200. [www.dpaci.com].	D, P, S	Provider of testing and analysis of electronic parts for mission-critical systems in the aerospace, space and military industry. Offers custom packaging, qualification, screening, counterfeit analysis and its own DPEM (De-capsulate Plastic Encapsulated Module) process for obsolete parts.
DSCC	Columbus, OH. (614) 692-0663. [www.dscc.dla.mil].	DB, G, R	Defense Supply Center, Columbus (DSCC) is a Supply/Demand Chain that manages more than 2 million different items. It maintains a known-good supplier base, who have successfully demonstrated that their products met the specified performance, quality, and reliability levels via the DoD Product Qualification Program.
e2v aerospace and defense	Santa Clara, CA. (408) 737-0992. [www.e2v.com/qp].	DB, D, E, F, R	(Formerly QP Semiconductor). The largest fabless semiconductor firm serving the military, aerospace and high-reliability industries. Focuses on providing replacement hermetic parts for DMS (Diminished Manufacturing Sources) and EOL (End of Life) products.
Electronic Material Industries	Toluca Lake, CA. (818) 763-9584. [www.militarycomponents.com].	O	Buys, sells and stocks military and commercial electronic components. Specializes in military, industrial and commercial-type component parts, and carries a large selection of obsolete and hard-to-find spare parts.
Falcon Electronics	Commack, NY. (800) 444-4744. [www.falconelec.com].	L, O, S	Distributor to the avionics, military and space industry. Segregated product handling per JEDEC and MIL-STD. Offers DMS support services such as Global Semi Search and access to an extensive obsolete inventory. Also offers upscreening.
GD California	Livermore, CA. (925) 456-9900. [www.gdca.com].	B, E, O	Manufacturer specializing exclusively in legacy boards, system-level products and obsolescence management. These products include: VME bus, STD & STD32 bus, CompactPCI, MBI, MBII, SBUS, QBUS, UNIBUS, telecommunications systems, SCSI bus boards; graphic boards; data storage units; chassis and canisters; and small computer systems. Once the manufacturer transfers these products to us, their form, fit, and functionality are maintained at the level of revision, at the time of transfer.

Company/ Organization	Contact	Category	Comment
GIDEP	Corona, CA. (951)898-3207. [www.gidep.org].	DB, G, R	GIDEP works closely with different government activities on several DMSMS projects that will eventually be migrated to a GIDEP system. Among these projects are the DMS Shared Data Warehouse, the DMSMS Prediction Tool, and the Army DMS Info System. Future migration of these systems in GIDEP would facilitate GIDEP's role as the central repository of data for DMS management.
IEC/IECQ	Geneva, Switzerland. + 41 22 919 02 15. [www.iecq.org].	R	IEC generates international standards for the practice of uprating components and using them in systems. IECQ conducts the IEC's certification program for electronic components, processes and related materials, including aerospace.
IHS	Englewood, CO. (303) 790-0600. [www.IHS.com].	DB, L	IHS offers strategic sourcing solutions for maintenance & repair and Integrated Logistics Support (ILS) functions, for identifying alternate sources for parts and components. Users can check to see if a part is obsolete in its Haystack database and if there is an active source. If you decide to modernize instead of buying up available parts inventories, IHS provides the correct Milspecs, NGS, and commercial standards for modernization needs.
Innovasic Semiconductor	Albuquerque, NM. (505) 883-5263. [www.innovasic.com].	E	A fabless semiconductor company that offers extended-life processors, peripherals and mixed-signal devices for embedded communication and control. Solves obsolescence problems by developing pin-compatible integrated circuits that have been discontinued by the original manufacturer.
Inventory Locator Service (ILS)	Memphis, TN. (901) 794-5000. [www.ilsmart.com].	DB, L	Inventory Locator Service enables subscribers in the aerospace, defense and marine industries to buy and sell parts, equipment and services. Over 5 billion parts listed, 60,000 customer accesses each day and 20,000 subscribers.
L-3 IEC	San Diego, CA. (858) 552-9500. [www.iechome.com].	B, E, P	Facilities for electronic and mechanical design, rapid prototype development, ISO-compliant flexible manufacturing systems, and complete functional lifecycle support.
Lansdale Semiconductor	Tempe, AZ. (602) 438-0123. [www.lansdale.com].	D, E, O, P	Aftermarket support of obsolete ICs from major semiconductor suppliers. Manufactures products using the original tooling to ensure same performance and quality. QML certified to MIL-PRF-38535.
Maxwell Technologies	San Diego, CA. (858) 503-3300. [www.maxwell.com].	E, P	Uses MCM package as form, fit and functional replacement. Maxwell Technologies is qualified to MIL-PRF-38535, Class Q and Class V. Many of our products are manufactured using MIL-PRF-38534 as a guideline and screened to Maxwell's self-defined Class H and Class K flows.
Micross Components	Los Angeles, CA. (215) 997-3200. [www.micross.com].	B, DB, D, L,P, R	Global provider of specialist products & services and distributed components for the electronics community. Specialty is in solutions for high-reliability and state-of-the-art electronic applications. Capabilities include post wafer fab processing, including dicing, inspection, engineering and test services; obsolescence management/lifecycle planning.
Minco Technology Labs	Austin, TX. (512) 834-2022. [www.mincotech.com].	D, O, P	Semiconductor, processor and tester serving military, space and commercial industries. Offers custom packaging division with additional emphasis in standard part packaging, known-good die processing, and other high-reliability applications. QML 19500 Certified by DSCC.
NAPCO	Hopkins, MN. (952) 931-2400. [www.napcointl.com].	B, DB, D, O, P, S	A material manager, procurement, distribution and light manufacturing supplier of military spare and repair parts for a wide range of military vehicles and electronic equipment to the U.S. Department of Defense, OEMs and over 60 Defense Forces around the world.
Now Electronics	Huntington, NY. (631) 351-8300. [www.nowelectro.com].	L, O, P	Distributor specializing in military and aerospace level components. Approved supplier to Lockheed-Martin, Northrop-Grumman, Raytheon, Boeing Sanmina-SCI Systems, the U.S. Defense Dept., NATO and many others.
Phoenix Logistics	Tempe, AZ. (602) 231-8616 [www.phxlogistics.com].	E, O	Provides complete system development and life cycle management of integrated data transmission and avionics interconnect solutions including MIL-STD-1553, RF/Microwave, and High Speed data to the military and aerospace market.
Pikes Peak Test Labs	Colorado Springs, CO. (719) 596-0802. [www.pptli.com].	B, D, E, L, O, P, S	Lab experienced in SEM (Scanning Electron Microscopy) with Elemental Analysis (EDX) capabilities, electronic component upgrade screening to MIL-STD-883, Class B, lid torque, radiation hardness testing and evaluation. Offers in-house services to assist in determining whether your components are genuine or potentially counterfeit.
Precience	Gaithersburg, MD. (240) 883-9170. [www.precience.com].	DB	Precience ComplianceXpress provides a cohesive regulatory RoHS, China RoHS, and WEEE environmental compliance management. It centralizes all component and bill of material information for collaboration with suppliers and regulators. The solution offers additional capabilities such as component obsolescence and lifecycle management solutions.

Company/ Organization	Contact	Category	Comment
Richardson Electronics	LaFox, IL. (630) 208-2200. [www.rell.com].	DB, O, P	Engineering services to aid product manufacturing, systems integration, prototype design and parts logistics from design-in through after-market stages.
Rochester Electronics	Newburyport, MA. (978) 462-9332. [www.rocelec.com].	D, F, O, P, R	Authorized/franchised supplier of aftermarket parts. Manufactures more than 20,000 devices from a wafer bank of over 10 billion manufacturer-supplied die and Rochester-fabricated die using the original manufacturer's tooling and process information. Manufacturing flows include commercial, industrial, military temp, MIL-STD-883, SMD, QML, Space and customer SCD.
Sarnoff	Princeton, NJ. (609) 734-2168. [www.gemes.com].	B, E, F, R, P	Sarnoff has developed a variety of specialized processes and design approaches that provide quick-turn, low-volume, military-quality microcircuits to solve DMS obsolescence problems. Government-authorized contractor for Generalized Emulation of Microcircuits (GEM) program.
Sensitron Semiconductor	Deer Park, NY. (631) 586-7600. [www.sensitron.com].	B, D, E, F, P, R, S	Full-service provider including R&D, design, wafer fabrication, packaging, screening, testing and engineering. Maintains a wafer fabrication clean room and a microelectronics manufacturing clean room. Facility Certified to MIL-PRF-19500 - JANTXV Level. Qualified to MIL-PRF-38534 Hybrids Class H Level.
Tektronix Service Solutions	Beaverton, OR (800) 438-8165. [service-solutions.tektronix.com].	S	Offers test and calibration services to space and defense prime contractors, government agencies and commercial manufacturers, including automotive, avionics, telecom and medical. Services include semiconductor and passive component test, wafer probe, product test and evaluation, and repair and calibration of general electrical and mechanical test equipment. Fixed locations, on-site locations and mobile calibration facilities nationwide. ISO-9001:2000 registered, DSCC-approved, A2LA (ISO/IEC-17025) accredited and ISTA-certified.
T.S.I. Microelectronics	Danvers, MA. (978) 774-8722. [www.tsimicro.com].	D, E, O, P	Specializes in Hybrid Microcircuits and assembly of semiconductors in hermetic packages, such as: Flat Packs, DIPS, TO-46, TO-18, TO-87, TO-39, TO-99, TO-3, TO-254, TO-257, TO-258 to name a few. T.S.I.'s product line includes replacement devices for products that have been discontinued by sources.
Total Parts Plus	Fort Walton Beach, FL. (850) 244-7293. [www.totalpartsplus.com].	DB	Provides a proactive means to managing obsolescence with a real-time PCN/PDN Alert Service, alternate component sourcing, and life-cycle forecasting. Total Parts Plus also provides environmental compliance information such as RoHS Compliance data with IPC-1752 reporting files, lead-finish analysis and reporting, a RoHS Compliance Wizard for quick validation and specialty metal analysis and reporting for the Berry Amendment.

Abbreviation	Categories	Explanation
B	Board level	Solves board-level DMS problems (as opposed to component-level problems).
DB	Database	Provides a database covering topics such as alternate sources, devices that are obsolete, cross-references or uprating results.
D	Die processor	Refers to processing OEM die, not an emulated solution.
E	Emulation/reverse engineering	Vendor may emulate a DMS device in a gate array or full-custom device, or provide a pseudo-form, fit and functional equivalent.
F	Foundry	Has foundry capability to fabricate wafers.
G	Government agency	-—
L	Locator	The vendor provides a service to locate DMS components and boards/systems.
O	Obsolete inventory	Maintains OEM inventory in die or packaged form.
P	Specialty packaging	Packages components as monolithic or multi-chip modules.
R	Industry reference	Denotes an organization or company with widely recognized knowledge or information concerning the DMS industry.
S	Uprating/upscreening	Performs uprating or upscreening.

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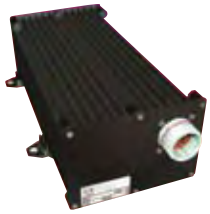

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Technology Focus

Small Form Factor Boards

SWaP Challenges Drive Small Form Factor SBC Needs

Driven by the need to reduce size, weight and power (SWaP) of onboard embedded computing systems, military system developers are eager to leverage the latest product and standards innovations from the small form factor board community.

Jeff Child
Editor-in-Chief

Once playing on the peripheral of military system needs, small form factor boards are now at the center of many key defense applications. The programs include small UAVs, robotics, mission-specific handheld systems, intelligent munitions and many others. Robotic systems like the Small Unmanned Ground Vehicle (SUGV) (Figure 1)—one of the platforms to survive the latest round of cuts to the Army's Early Infantry Brigade Combat Team (E-IBCT) program—exemplify the type of systems facing the most difficult hurdles to reducing size, weight and power (SWaP).

As the "Small Form Factor Boards Roundup" on the following pages shows, today's crop of choices includes Pico-ITXe, mini-ITX, StackableUSB and COM Express along with a variety of small non-standard boards. Since *COTS Journal* will cover PC/104 and PC/104-family boards as a dedicated Roundup topic in the June issue this year, this Roundup is restricted to small form factors other than PC/104-family boards.

The small form factor area of the embedded computer market for a long while had been lacking when it came to new approaches. That's changed in recent years as groups like the Small Form Factor Special Interest Group (SFF-SIG) have focused on trying a variety of different approaches to suit the miniaturization of board-level electronics. Formed only about four years ago, the SFF-SIG has been very active in rolling out new specifications.

Figure 1

Shown here during testing at White Sands, the Small Unmanned Ground Vehicle (SUGV) was designed in partnership by iRobot and Boeing. The robots can be equipped with cameras, sensors, computers and sophisticated software to perform basic reconnaissance, dispose of explosives and other tasks.

In its most recent specification effort, the SFF-SIG last month made public the new RS-DIMM Rugged Memory Specification. The Specification defines a highly rugged, DDR3 mezzanine memory module with a pin-and-socket connector optimized for small form factor CPU boards in applications with exceptional shock and vibration requirements—like the military. Use of this standardized memory module provides significant flexibility in memory sizes compared to memory soldered to a CPU board. An RS-DIMM module provides a significantly higher level of resistance to shock and vibration than commercial-grade memory expansion modules such as SO-DIMM. In addition, the specification provides for both RAM and a flash memory SSD drive on the same module through a SATA-2 interface.

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

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Technology Focus:

Small Form Factor Boards Roundup

COM Express Sports 2 GHz i7 Processor

Gone are the days of a long gap between when a mainstream processor emerged and when it made its way into the military embedded board realm. Exemplifying that trend, several vendors have rolled out Intel i7-based products in the last month. The latest from ADLINK Technology is the Express-CBR. The Express-CBR COM Express module combines the latest high-performance Intel

Core i7 processor running at up to 2.0 GHz with the advanced Mobile Intel QM57 Express chipset. The Express-CBR achieves hardware ruggedness by careful component selection and an extreme-rugged design methodology that gives reliable operation over a wide power supply range from 9V to 16V and over the extended temperature range of -40° to 85°C.

The Express-CBR uses Extensible Firmware Interface (EFI) for a highly reliable, proven, versatile and adaptable BIOS layer that allows streamlined implementation of custom design-specific baseboard features. The powerful capabilities provided by EFI enable more in-depth control than ever before of the pre-boot and boot environments. The Express-CBR supports up to 8 Gbytes of DDR3 memory and provides onboard I/O interfaces for Gbit Ethernet, eight USB 2.0 ports, four SATA ports and an IDE (PATA) channel. Legacy support is also provided for PCI, LPC, SMBus and I^2C. Single unit pricing of the Express-CBR starts at $1,299.

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3.5-inch CPU Using Atom Z510/ Z530 Runs up to 1.6 GHz

The Intel Atom is a single core processor built on a 45 nm process that boasts an impressive 2.64 watts TDP (CPU only). The Intel Atom delivers the benefits of genuine Intel architecture to small form factor and thermally constrained military applications. The ADLS15HD from Advanced Digital Logic is a 3.5-inch embedded single board computer based on the Intel Atom and the Intel US15W (Poulsbo) chipset.

The Intel graphics controller drives graphics up to 1600 x 1200 at 60 Hz by way of onboard DVI and/or 18/24-bit LVDS LCD. Memory is added via a SODIMM200 socket that will

accept up to 2 Gbytes of DDR2-400/533 DRAM. In addition to ACPI/APM functions, the ADLS15HD has the following features: EIDE, 8xUSB 2.0, 2xRS232 COM ports, PS/2 keyboard and mouse, AC'97 and HDA 5.1 Sound and dual Gigabit Ethernet LAN. The ADLS15HD also supports ELO resistive touch screen and has an isolated 24 VDC input that is 20-30 VDC tolerant for powering the board. The ADLS15HD also provides a built-in UPS (1 second std.) that will allow for a fast but safe shutdown. The board runs on a 24 VDC power source and includes an onboard UPS, and its functionality can be expanded with an onboard miniPCI.

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

SBC with New Atom N455/D525 Targets High Reliability

A new ISA half-size Single Board Computer (SBC) features the latest high-performance Atom single and dual core processors. The PCA-6782 in versions N and D from Advantech integrates the Intel Atom N455/D525. The Atom D525 dual core CPU brings compact size, low power consumption, dual core parallel computing power and a maximum of 2 Gbytes

of DDR2 667 MHz memory and makes PCA-6782D a powerful small form factor embedded platform for today's applications that require high performance in small packages. The fanless single core Atom N455 CPU with a maximum of 2 Gbytes of DDR2 667 MHz memory makes PCA-6782N ultra reliable in all kinds of high-temperature and dusty environments. PCA-6782 has an integrated graphic core based on Intel's Embedded Gen 3.5+ graphic technology with 224 Mbytes shared memory.

PCA-6782 provides a rich array of I/O interfaces: it has three SATA ports (300 Mbyte/sec) for mainstream SSD (Solid State Disks), HDD and ODD connections, and legacy I/O connection: one IDE, one PS/2, one FDD and one parallel port. It also has a CF socket, a PC/104 expansion, one Gigabit Ethernet LAN for high networking capability and two COM ports. Optional Advantech COM port upgrade module (P/N: PCA-COM485-00A1E) is also available to give an extra four RS-485 ports with auto-flow control capability.

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

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3.5-inch ECX Embedded System Board with Dual-Core Atom D525

Achieving increased performance while keeping power consumption in check is the aim of a new 3.5-inch ECX compact embedded system board that includes the performance enhancing advanced features gained from Intel's second-generation dual-core Atom processors. The new compact (146 mm x 105 mm) PEB-2771VG2A from American Portwell is suitable for a range of general applications such as medical devices, industrial automation and handheld gaming as well as embedded applications.

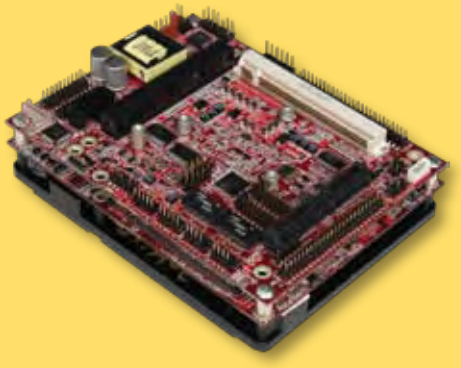
Based on Intel's dual-core Atom processor D525 with Intel NM10 Express Chipset, the PEB-2771VG2A board supports DDR3 800 SODIMM system memory up to 4 Gbyte, dual display via VGA and LVDS, dual Gigabit Ethernet, onboard 12V DC input, two SATA interfaces, one 44-pin IDE connector, Type II Compact Flash socket, six USB ports, four serial ports and GPIO. The dual-core 1.8 GHz processor can handle most essential applications in the low-power segment.

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

Board Set Marries COM Express and Multifunction I/O

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

Called Magellan from Diamond Systems, the CPU core consists of a COM Express CPU module and heat spreader mounted on its bottom side, resulting in optimal thermal management and increased space for I/O functions and connectors. This design makes it



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

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

Rugged COM Express Card Suits Constrained Apps

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

Duo processor operating at up to 2.26 GHz and up to 4 Gbytes of soldered DDR3 SDRAM. Soldered components substantially improve reliability.

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

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

Atom-based Rugged SBC Is iPhone-Sized

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

Easily accommodating 64 Gbytes of storage via onboard solid-state disk in its miniature 3.5 x 2.5 x 0.5-inch package, Atom is the world's smallest full-featured rugged computer.

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

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

Credit Card Size COM Express Card Sports Atom E6xx

The Atom CPU and the COM Express form factor are a marriage made in heaven for size- and power-constrained military systems. With that in mind, Kontron has launched a COM Express-compatible module (55 mm x 84 mm) with the new Intel Atom processor E6XX. Called the COM nanoETXexpress-TT, the card is also equipped with the newly defined PICMG COM Express COM.0.R.2 Type 10 pin-out that

was added to the COM.0 R2.0 specification. With industrial grade components, functional in the range (E2) -40° to +85°C and different options for data storage, it is suitable for use in harsh environments and thus complements the existing portfolio. Finally, the nanoETXexpress COM family gains four new members, broadening the scalability from 600 MHz to 1.6 GHz and throughout the industrial-grade temperature range.

The nanoETXexpress-TT customer has four PCI Express lanes of which three can be utilized for dedicated customer-specific interfaces. This enables the use of even more dedicated mini-devices in a semi-custom solution. In addition to LVDS, it offers the newly implemented Digital Display Interface (DDI) for SDVO, Display Port or HDMI that allows two displays to be controlled independently. The board also features Intel's Platform Controller Hub EG20T, allowing the new Computer-on-Module to be configured very flexibly. In addition to three PCI Express Lanes for custom extensions, the module also supports two different options for data storage: either a robust micro-SD Card socket offering up to 32 Gbytes and 2x SATA II 300 Mbyte/s interfaces, or a planned version with industrial-grade SATA Flash Memory (up to 16 Gbytes) and 1x SATA II 300 Mbyte/s connector.

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

Atom-based COM Module Offers Extended Temperature Operation

Ideal for systems where the overhead of slot-card backplanes isn't desirable, COM modules are becoming a key form factor choice for military systems. An upgraded ESMexpress Computer-on-Module (COM) incorporates the Intel Atom XL processor to provide tested, qualified operation in the extended temperature range of -40° to +85°C (-40° to +185°F) in both conduction- and convection-cooled environments. It also features an increased memory capacity of 2 Gbytes, double its predecessor. Because the enhanced XM1L from MEN Micro conforms to the ANSI-VITA

59 RSE standard currently in development, it provides a cost-effective and easily upgradeable means of employing advanced embedded technology in highly rugged applications as found in industrial, harsh, mobile and mission-critical environments.

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

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

StackableUSB Carrier Boards Support SUMIT Spec

The SUMIT connector interface ranks as one of the most innovative approaches to maximized small form factor board space. Micro/sys has added to the growing line of StackableUSB carrier and hub boards with the addition of a SUMIT version, enabling StackableUSB I/O modules to make plug-and-play connections to SUMIT CPU single board computers. The CRR-SUMIT and HUB-SUMIT attach to SUMIT-enabled 104

Form Factor (3.55 x 3.775 inch) SBCs providing OEM users four bays for the powerfully small StackableUSB I/O modules that come either USB, SPI or I²C enabled.

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

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

Core i7-based Module Boasts -25° to 70°C Temp Operation

While the first generation of COM Express boards wasn't generally rugged, a new set of products has emerged specifically crafted for harsh environments. With that in mind, the ruggedized Procelerant CEQM57XT COM Express from RadiSys combines the Intel Core i7 and i5 processors and the Mobile Intel QM57 Express chipset with extended temperature range from -25° to 70°C and ruggedized vibration specifications that are required for many mil/aero and industrial applications such as ruggedized computers/tablets, unmanned vehicles/robots and in-vehicle computers. The CEQM57XT features the Intel Core i7 2.53

GHz, 2.0 GHz and 1.06 GHz processors and the Intel Core i5 2.4 GHz processor for increased processing performance and a seven-year lifecycle, a key requirement for mil/aero and industrial applications.

The board's COM Express 1.0 Type 2 pin-out ensures smooth upgrades. Six PCI Express x1 ports, one PCI Express x8 port and optional PCI Express x16 expansion port are provided for increased peripheral performance. The board also provides Gbit Ethernet, Trusted Platform Management (TPM), optional conformal coating and optional extended and industrial temperature stand-alone SODIMM memory.

RadiSys designs ruggedness into the CEQM57XT by utilizing its proprietary implementation of the Highly Accelerated Life Test (HALT) during the design process to identify and correct product weaknesses prior to production; Highly Accelerated Sample Screen (HASS) is then used during production to continually monitor supplier quality and component robustness. Through rigorous HALT/HASS testing, RadiSys ensures that the product is designed to its extended temperature range limits required by its target markets.

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

1.6 GHz Intel Atom SUMIT-ISM Board Supports COMIT

The SUMIT I/O connector scheme and the COMIT Computer-on-Module standard rank as the two most significant fruits of the Small Form Factor-SIG in the past year. Supporting both is the EBC-Z530-G from WinSystems—an SBC powered by an Intel 1.6 GHz Atom processor that measures 203 mm x 147 mm (8.5 x 5.75 inch) and supports the new Stackable Unified Modular Interconnect Technology—

Industry Standard Module (SUMIT-ISM) expansion standard. The RoHS-compliant EBC-Z530-G operates over an industrial temperature range of -40° to +70°C.

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

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

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Single-Chip GPS Requires Only 7 x 8 mm PCB area

Designed for small, low-power, low-cost applications, a single-chip GPS device from u-blox delivers the positioning performance of u-blox 6 technology in a micro-miniature package: only 5 x 6 x 1.1 mm. Its high-level of integration means a complete, stand-alone GPS system design can now fit on a PCB area smaller than the size of a thumbtack. The chip requires no external host. Advanced RF-architecture and interference suppression ensures maximum performance even in GPS-hostile environments. UBX G6010-NT minimizes PCB area to less than 7 x 8 mm for a complete stand-alone GPS receiver. With most passive components integrated, the total system BOM requires as few as 5 external components including SAW filter and TCXO. The chip operates from -40° to 85° C.

U-Blox, Thalwil, Switzerland. +41 44 722 7470. [www.u-blox.com].

COM Express Card Module Boasts Quad-Core Processor, USB 3.0

Parallel to the launch of the second generation Intel Core processor family, Kontron introduced the COM Express basic form factor ETXexpress-SC Computer-on-Module. These Computer-on-Modules incorporate an Intel Core i7 2715QE quad-core processor, Intel Mobile QM67 I/O Hub and USB 3.0. Additionally, they feature the fastest Intel graphics on the market. The new Computer-on-Modules are available with the Type 2 or Type 6 Pin-out of the PICMG COM Express rev. 2.0 specifications, increasing the speed of new designs and upgrades. They also include new features such as enhanced Intel Turbo Boost Technology, Intel Advanced Vector Extensions and Kontron Embedded Application Programming Interface (EAPI) middleware.

Based on the COM Express Type 6 Pin-out, the Kontron ETXexpress features three digital display interfaces for SDVO, DisplayPort and DVI/HDMI besides VGA (2048 x 1536) and dual-channel LVDS (1600 x 1200). Optionally, customers can also upgrade two of the eight USB 2.0 ports to the SuperSpeed USB 3.0. The Type 2 Pin-out differs from Type 6 by offering PCI and PATA. SDVO, Display Port or DVI/HDMI is brought out by the Type 2 version with one DDI multiplexed with the PEG port. Both the Type 2 and 6 versions use VESA DisplayID to automatically indentify the connected displays, which simplifies integration. All versions feature 4x Serial ATA (2 x SATA II and 2 x SATA 3). Samples of the new modules with Type 2 Pin-out will be available in Q1/2011. Type 6 versions will follow in Q2/2011.

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

3U VPX SBC Features Second Generation Core i7 Processor

A conduction- or air-cooled 3U VPX Single Board Computer (SBC) is based on the second generation Intel Core i7 processor. The XPedite7470 from Extreme Engineering Solutions utilizes the processor's quad-core technology operating at 2.1 GHz to deliver enhanced performance and efficiency. XPedite7470 customers will benefit from the performance boost provided by the Intel Advanced Vector Extensions (Intel AVX) incorporated into the second generation Intel Core i7 processor. X-ES has teamed with RunTime Computing Solutions to support applications that can take advantage of the SIMD architecture of Intel AVX. VSI/Pro, the premier math and signal processing library available from RunTime Computing, will be supported on the XPedite7470 and all X-ES products based on the second generation Intel Core i7 processor.

The XPedite7470 initially will be based on the Intel Core i7-2715QE processor and Intel QM67 Express chipset. Other XPedite7470 processor options will be available later in 1Q11. The XPedite7470 features include a quad-core Intel Core i7-2715QE processor with Intel Hyper-Threading Technology and up to 8 Gbytes of DDR3-1333 ECC SDRAM in two channels along with 32 Mbytes of boot flash and up to 16 Gbytes of user flash. The board supports an XMC/PrPMC site, two x4 Gen2 PCI Express VPX backplane interconnects and two optional 10/100/1000BASE-T or 1000BASE-BX Ethernet ports. In addition, there are two DVI graphics ports and, optionally, two each USB 2.0 high-speed ports and SATA 3.0 or 6.0 Gbit/s ports.

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

Oscilloscope Family Provides 400 MHz to 4 GHz Bandwidth

LeCroy has launched the WaveRunner 6 Zi, its newest mid-range oscilloscope series. The new platform is the latest design in a comprehensive rollout of technology-leading products that LeCroy initiated in the fall of 2010. The new flagship WaveRunner features 4 GHz bandwidth and 40 Gsamples/s per channel sample rates with an innovative new industrial design, comprehensive serial-data and probing. The WaveRunner 6 Zi oscilloscopes feature a pristine signal path that offers unmatched signal fidelity with low electronic noise. The system has a pivoting display that permits viewing signals vertically as well as horizontally to obtain more detail for optimum analysis. The comprehensive toolset includes everything engineers need to productively validate and thoroughly debug their designs.

LeCroy, Chestnut Ridge, NY. (800) 553-2769. [www.lecroy.com].

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400 Watt DC/DC Converter Boasts Wide Input Range

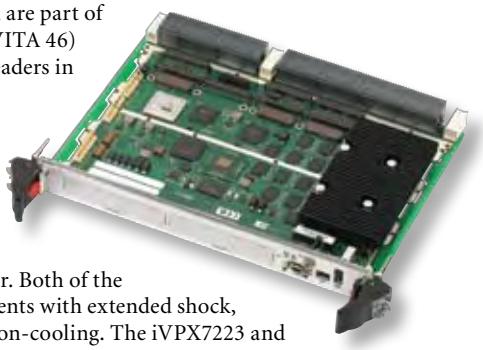
Calex Manufacturing has released its 400W FBW DC/DC Converter Series. The FBW Series offers an industry first, a 9-36 VDC and 18-75 VDC input range in a 4.6 x 2.4 x 0.55-inch package.

The wide input range provides an ideal solution for industrial and military COTS applications that have a wide input voltage requirement. The FBW is housed in a metal case and encapsulated with a thermally conductive potting compound for improved thermal characteristics as well as protection against the environment. Efficiencies run as high as 93 percent, reducing the need for heatsinking or forced air. The case operating temperature of the FBW is -40° to 100°C. The output voltages available are 5, 12, 24, 28 and 48 VDC. The FBW offers output voltage remote sense and trim.

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

OpenVPX SBC Features 2nd Gen Core i7 Processor

Intel processors have shed the past hurdles to acceptance among military system designers. Low power offerings are the main reason. Emerson Network Power has released a set of OpenVPX (VITA 65) SBCs. The iVPX7220 (shown) and iVPX7223 feature the new second generation Intel Core processors and are part of a growing family of VME and OpenVPX/VPX (VITA 46) boards for rugged applications from one of the leaders in embedded computing.



The 6U iVPX7220 and 3U iVPX7223 boards feature the dual-core 2.20 GHz Intel Core i7 2655LE processor with integrated graphics and memory controller, and the Intel QM67 PCH chipset for advanced I/O functionality. The iVPX7220 also supports the quad-core second generation Intel Core i7 2715QE processor. Both of the products are rugged SBCs for extreme environments with extended shock, vibration and temperature ratings, and conduction-cooling. The iVPX7223 and the dual-core variant of the iVPX7220 feature up to 8 Gbytes DDR3-1333, while the quad-core processor variant of the iVPX7220 is designed to support up to 16 Gbyte DDR3-1333 memory. Fabric connectivity includes Gigabit Ethernet to the control plane and PCI Express to the data plane, while the iVPX7220 also offers PCI Express to the expansion plane.

The iVPX7220 also offers 4 Gbytes of embedded USB flash and 256 Kbytes of non-volatile Ferroelectric Random Access Memory (F-RAM). Additional connectivity includes up to nine USB 2.0 ports, five serial ports, five SATA ports, ten GPIOs, three DisplayPort connections, VGA and dual XMC sites for maximum flexibility. An optional 2.5-inch SATA solid-state disk is also available. The iVPX7223 offers 4 Gbytes of embedded USB flash and 256 Kbytes of non-volatile F-RAM. Additional connectivity on this board includes three USB 2.0 ports, two serial ports, three SATA ports, eight GPIO, one DisplayPort connection, one VGA and one XMC site.

Emerson Network Power, Embedded Computing, Carlsbad, CA. (407) 241-2751. [www.emersonnetworkpower.com].

SUMIT-ISM I/O Card Offers Wi-Fi, Ethernet, USB, and SSD Expansion

The SUMIT-ISM has become a popular small form factor among embedded computer users and the military market is beginning to take notice. Diamond Systems has unveiled Corona, the first multi-function SUMIT-ISM I/O module to combine Wi-Fi, dual Ethernet, USB and solid-state disk (SSD) expansion capabilities. Within a single SUMIT-ISM Type I form factor module, Corona integrates a variety of features. Among these are a socketed 802.11a/b/g Wi-Fi radio card, two 10/100Base-T Ethernet LAN ports and two USB 2.0 ports (derived from SUMIT-A bus signals). A mounting location for an optional 2.5-inch SATA SSD card is located on the bottom of Corona).

The optional onboard 2.5-inch SATA solid-state disk (SSD) accommodates local data storage prior to its offload via either Corona's Wi-Fi or Ethernet communications functions. Diamond's board-level 2.5- inch SATA SSD modules further simplify system integration and reduce size, weight, power and cost. Corona derives its PCI Express and USB host interface signals from the host SBC's SUMIT-A connector, but does not use signals or power from its PC/104 bus stackthrough connector. Single-unit pricing for the COR-LANWIFI-XT model (includes Wi-Fi card) starts at $350, while the COR-LAN2-XT model (without Wi-Fi card) starts at $225. Diamond's SATA SSD cards are priced separately.

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

Rugged 4 Gbyte DDR3 SODIMMs Sport Heat Spreaders

Swissbit offers new variations of its industrial family of DDR3 SODIMMs. In order to increase the heat dissipation and to avoid thermal hot spots on the memory modules in systems with difficult cooling, Swissbit can add an aluminum heat spreader to the existing portfolio of DDR3 SODIMMs. The dual-sided heat spreader is attached with a thermally conductive tape and increases the heat dissipating area. By keeping the maximum thickness below 5 mm and the height below 31.5 mm, these SODIMMs still fit into the standard socket and the regular keepout area for the memory modules. The SODIMMs are available in industrial temperature grade of -40° to +95°C (TCase), allowing for further flexibility in operating environments where cooling resources may be limited.

Swissbit, Bronschofen, Switzerland. +41 71 913 03 03. [www.swissbit.com].

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Mission Computer Targets SWaP-Sensitive Refresh and Upgrade Programs

Optimizing for Size, Weight and Power (SWaP) is a major requirement in many of today's military systems. Eurotech subsidiary Parvus has introduced the DuraCOR 830, a rugged tactical mission processor subsystem for constrained military/civil unmanned and manned air, ground and shipboard technology refresh programs. The unit features a modular, COTS PC/104-Plus architecture with an ultra-low-power Intel Atom CPU (running at 1.6 GHz), dual avionics interfaces (MIL-STD-1553), I/O expansion capabilities and mechanically compact chassis. With two open expansion slots for PC/104, PCI-104, or PC/104-Plus cards, along with more than 100 spare connector pins on lightweight MIL-38999 connectors, the DuraCOR 830 is primed for tailoring to application-specific I/O configurations. To reduce program risk, cost and time to deployment, Parvus offers professional subsystems integration services to rapidly tailor this computing platform using COTS technologies to program-specific I/O requirements.

The DuraCOR 830 is designed for use under extended temperature (-40° to +71°C) and other demanding MIL-STD-810G environmental conditions (shock, vibration, altitude, humidity, immersion). Its corrosion-resistant, sealed aluminum chassis incorporates protection from water and dust ingress, as well as MIL-STD-461F emissions and susceptibility. Designed for avionics and ground vehicle platforms to enhance situational awareness and computational capabilities, the DuraCOR 830 delivers processing and multimedia performance similar to Pentium M-based DuraCOR subsystems, but with less power consumption, double the RAM memory capacity, and dual Flash SSDs. The system is also equipped with a 28V power supply compliant with MIL-STD-1275 and MIL-STD-704 voltages, spikes and surges. Limited quantities of the DuraCOR 830 will become available by end of Q2 2011.

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

AMC Module Features FMC I/O Expansion

Nallatech has announced the availability of the AMC-420, a mid/full size processing card designed for telecommunications, networking, defense and imaging applications. This PICMG AMC.0 R2.0-compliant AMC features a Xilinx Virtex-6 FPGA that provides high-performance processing resources, with a range of devices that include logic-oriented LXT and DSP-oriented SXT. A flexible memory architecture supports configurations with up to 1 Gbyte DDR3 SDRAM or up to 36 Mbytes of QDR-II+ SRAM. High-speed backplane communications are enabled by two 1 Gbit Ethernet links, and up to four x4 GTX fat pipe interfaces, which support protocols including PCIe, SRIO, Aurora and XUAI. The IPMI backplane interface directly connects to an onboard Pigeon Point MMC with integrated IPMI v1.5 capability.

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

Line of Rugged Military Computers Are MIL-STD-810 Certified

A new line of MIL-STD-810-certified military computers from Trenton Technology provides rugged system solutions geared toward military requirements. The military computers feature the dual-processor JXM7031 MicroATX embedded motherboard and the JXT6966 single board computer, paired with a variety of PCI Express backplane options. The TMS6700 is a compact ATR-like vehicle-mounted computer with certification ratings for temperature, dust, shock and vibrations, salt fog, humidity and EMI/EMC. The TMS4701 is a rugged 19-inch rackmount system with a dual-processor SBC and backplane, front access HDDs and cert ratings for temperature, dust, shock and vibe, salt fog, humidity and EMI/EMC. The TMS4700 and TMS2700 are respectively a shallow-depth 4U system ideal for shipboard applications and a compact 2U system that maximizes component rack utilization. Both units feature long-life motherboards.

Trenton Technology, Gainesville, GA. (770) 287-3100. [www.trentontechnology.com].

IRIG-B Timing/Synchronization Boards Support Variety of Inputs

United Electronic Industries (UEI) has released its DNA- and DNR-IRIG-650 Timing Generation and Synchronization Boards. These boards are general-purpose IRIG-B timing interfaces for systems designed around UEI's PowerDNA Cubes and RACKtangle Chassis. The boards may be used to capture IRIG-B timing data when the IOM is slaved to an external master timing device and may also be configured as a master time keeper for the entire system. Accuracy is 1 PPM with stability of 1 PPM per year over a temperature range of 0 to 50°C.

The IRIG-650 boards provide inputs for standard analog, modulated IRIG-B signals as well as non-modulated DC inputs. The boards also allow a user to use an external 10 MHz master clock and/or a 1 PPS synchronization pulse. A generic digital input may be used to capture event timing directly. The IRIG-650 can be directly connected to UEI's GPS interface board, providing power to the GPS unit and a 1PPS UTC sync pulse. A convenient multi-cable assembly that provides four BNC-terminated cables and a 15-pin DB-15 connector in a single assembly for various IRIG, clock and trigger signals is available as an option. Pricing for the boards ranges from $2,500 to $2,650.

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

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Terabyte Rugged NAS System Is Palm-Sized

Today's military system design is all about compute density and that often means storage density too. Along such lines, General Micro Systems has developed a fully sealed, rugged, ultra-small, low-power system with Quad Removable SSD. The SX401R-4 ("Depot") is the industry's smallest, lightest, total out-of-the-box data logger/recorder that supports all Network Attached Storage (NAS) protocols, and still offers superior performance as a fully functioning computer. It offers 1 Terabyte of data in only 63 cubic inches and 2.5 lbs, with sustained operation never exceeding 20W.

Up to four removable, sealed SSD drives (250 Gbytes each) in the unit are each accessed via SATA or a USB port when removed, which means users don't need a system to read the data, just a USB cable. Because the drives are sealed, Depot and the drives can be dropped in water as well as withstand the forces of adverse weather conditions, making it ideal for handling by military personnel and critical field operations. Connectors are hermetically sealed to ensure the unit stays watertight even when the cables and drives have been removed. Even though its footprint is exceptionally small (only 6 x 3.5 x 3 inches), Depot piles on full-size performance through its single NanoSBC module (GMS's XPC40x), which is a full-featured 1.6 GHz Atom processor with 512 Kbytes of L2 Cache, up to 2 Gbytes of 533 MHz DDR-2 SDRAM and 64 Gbytes of internal memory.

Depot is compliant to MIL-STD-810G, MIL-STD-704E and MIL-STD-461F. It is available as a rugged, conduction-cooled and extended temperature (-40° to +85°C) package. Single units ship 60 days ARO. Pricing for single quantities of Depot (SX401R-4) (without SSDs) starts at $4,850. Taking into account rapidly declining SSD pricing, 1 Terabyte is available for less than $9,000 at press time.

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

1.80 GHz Atom D525 Dual Core CPU Rides PCI/104-Express

Advanced Digital Logic has released its ADLD25PC single board computer. The ADLD25PC PCI/104-Express SBC features the Intel Atom D525 processor, which is designed for a two-chip platform as opposed to the traditional three-chip platforms requiring a CPU, GMCH and ICH. The D525 has an Intel-rated Thermal Design Power (TDP) maximum of 10 to 13W and an Intel idle TDP of 4 to 4.8W. TDP refers to how much heat annotated in watts a thermal solution must be able to dissipate while keeping the processor below its maximum die temperature. The ADLD25PC is ideal for rugged and mobile applications where power consumption is critical. These jobs include deeply embedded industrial applications, as well as rugged portable applications such as transceivers for tactical communication.

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

10 Gbit Ethernet Record/ Playback System Targets Signal Processing

Gone are the days when slot-card, backplane-based systems were the only way to go. D-TA Systems offers their 10 G Series Record & Playback systems for synchronous (phase-coherent) record and playback of radio signals from multiple antennas. A 10 G system is comprised of the DTA-2300, a 10 Gigabit network attached Digital IF Transceiver (software radio, up to 16 Channels), and one or more DTA-5000(s) server-based disk storage system. The DTA-3200 Multi-Channel Tunable RF1IF Transceiver system is optional.

The DTA-2300 offers 16-bit precision and supports sample rates up to 130 MSPS. In the record mode, the IF signals are digitally down converted to baseband and stored as complex (I & Q) signals. The IF and BW (FIR filter decimation) are programmable. In the playback mode the baseband signals are up converted to desired IF(s). The DTA-2300 provides four 10 Gigabit links, one for each group of four channels. One DTA-5000 system is used for each 10 Gigabit link. A 16-channel system can offer a sustained throughput rate close to 3 Gbytes/s and a storage capacity of over 38 Terabytes.

D-TA Systems, Ottawa, Ontario, Canada. (613) 745-8713. [www.d-ta.com].

6U CPCI SBC Is Based on 2nd Gen Intel Core Processors

An SBC based on the latest Intel Core i7 processor is designed to give OEMs the competitive advantage through the performance enhancements and scalability of the second generation Intel Core processor family. The MIC-3395 6U CompactPCI SBC fits in a single 4HP slot and expands memory capacity to up to 4 Gbyte on board DDR3 with ECC support and one SO-UDIMM module for up to a further 8 Gbyte. I/O expansion is ensured via an XMC slot. Mass storage is available with onboard 2.5-inch SATA-III support, onboard CompactFlash and RTM-based SAS storage options. Six independent Gigabit Ethernet ports cater to a wide range of integration options with dual GbE connectivity to front, rear and PICMG 2.16 ports.

Advantech, Irvine, CA. (949)798-7178. [www.advantech.com].

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Wideband Digital Receiver/Exciter Module Suits Anti-IED Apps

IEDs represent the largest cause of casualties in current U.S. conflicts. Electronics to defeat such devices are therefore extremely key. GE Intelligent Platforms has announced the SPR870A 3U VPX Wideband Digital Receiver/Exciter Module. Building on GE's legacy of industry-leading digital receiver families and extending still further the growing ecosystem of GE 3U VPX solutions, it features Xilinx Virtex-6 FPGA technology to enable its deployment in wideband signal acquisition and conversion applications such as radar ECM (electronic counter measures), pulse intercept and analysis (ELINT) and RF (radio frequency) test applications. The type of highly demanding, sophisticated ECM applications for which the SPR870A is ideal include spoofing hostile radar—allowing the host to change its perceived characteristics, for example, to confuse enemy intelligence—or for jamming remote control IED (improvised explosive device) signals, enabling bombs to be defused more safely.

Fully rugged and conduction-cooled, the SPR870A is capable of digitizing analog input signals from below 50 MHz to over 1.5 GHz, using a dual channel 10-bit ADC (analog to digital converter) and two 12-bit DACs. (digital to analog converters), and (re) creating analog output waveforms over a similar frequency range. In near real time the ADC input pass band is 10 MHz to 3.0 GHz (3 dB) to allow for second Nyquist applications. An open source Xilinx Virtex-6 FPGA is provided which, when combined with up to four banks of DDR3 SDRAM, will enable skilled users to create massively parallel processing algorithms. For the most demanding, sophisticated applications, a second Virtex-6 FPGA provides a Gen 2 PCI Express interface to the system controller. Other protocols, such as Serial RapidIO, can be provided on request.

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

Conduction-Cooled 1/2 ATR Box Has 6-slot 3U VPX Backplane

A new ½ ATR conduction-convection-cooled enclosure with a unique, advanced airflow design that distributes air across external fins in sidewalls helps to ensure fast removal of dissipated heat, yet still maintain a low profile design. The ½ ATR box from Elma Electronic Systems ships with a 6-slot 3U OpenVPX (VITA 65) backplane on 1-inch pitch; it is also available with either a 3U cPCI backplane or a single-width MicroTCA backplane. The unit also offers the choice of a fixed mount or plug-in 28 VDC power supply. The unit weighs only 12.5 pounds prior to power supply or payload. The all-aluminum ATR is made from milled plates as well as punched and formed sheet metal. The main body is dip-brazed for optimum heat conductivity. The enclosure meets ARINC 404A and ANSI/VITA 48.2 standards. Pricing for the 1/2 ATR configuration starts at $15,000 in low quantities.

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

Slave SBC Serves as Ethernet Diagnosis Buffer

A new 3U CompactPCI PowerPC-based slave CPU board serves as an Ethernet diagnosis buffer. The F218 from Men Micro helps to reduce wiring and installation requirements for easier implementation and reduced maintenance. Two Ethernet controllers within the FPGA enable the host to view the F218 as an Ethernet device, similar to a front connection of two CPU boards via an Ethernet cable. The use of FPGA technology enables the incorporation of additional user-specific I/O functionality into the board. The card is qualified for operation from -40° to +85°C and supports VxWorks and Linux as standard with QNX available upon request. The VxWorks board support package (BSP) boots in less than two seconds. MTBF, according to IEC/TR 62380 (RDF 2000), is 427,994 hours at 40°C. Single quantity pricing is $940.

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

Controllers Provide Fan Monitor/Control/Reporting for Chassis Management

Curtiss-Wright Controls Electronic Systems has announced the availability of its new family of Hybricon rugged intelligent fan controllers for chassis management. These MIL-STD-461F, MIL-STD-810G and MIL-STD-704F fan controllers provide intelligent nodes for use in PMBus-based chassis management systems, enabling system designers to quickly and easily integrate system fan monitor and control functions into a Built-In-Test (BIT) strategy for rugged air- and conduction-cooled systems.

The fan controllers are provided in both Pulse Width Modulation (PWM) control and voltage regulated controller configurations. These rugged fan controllers can be used as part of a PMBus chassis management system to monitor and control various chassis level elements, such as power supplies, fans, displays, front panel controls and indicators. The chassis management system is modular and extensible, allowing it to adapt to the requirements of the specific system application. The fan controller family supports both PWM fans and voltage regulated fans (-40° to 85°C) in both air-cooled and conduction-cooled applications. The voltage regulated version can control 12 VDC or 24 VDC fans directly with MIL-STD-704F 28 VDC input power, eliminating the need for a power supply to regulate the fan voltage.

Curtiss-Wright Controls Electronic Systems, Littleton, MA. (978) 952-2017. [www.cwcelectronicsystems.com].

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XMC Module Serves Up Configurable FPGA, Digital I/O

To address the need for low-cost configurable FPGA computing solutions, a series of new XMC-SLX mezzanine modules from Acromag features an economical Xilinx Spartan-6 FPGA. The Spartan-6 FPGA's logic structure leverages the premium-performance Virtex FPGA platform's architecture and system-level blocks for faster, easier and more compatible development. Acromag supports the FPGA with a high-throughput PCIe interface, generous memory and convenient access to field I/O signals. Typical uses include hardware simulation, in-circuit diagnostics, communications, signal intelligence and image processing.

Field I/O interfaces to the FPGA via the rear J4/P4 connector and/or with optional front mezzanine I/O extension modules. 64 I/O or 32 LVDS lines are accessible through the rear connector. Acromag's plug-in AXM mezzanine cards provide additional I/O processing capabilities. A variety of these AXM mezzanine I/O cards are available to provide front-end 14-bit 105 MHz A/D conversions or an interface for CMOS digital I/O, RS-485 differential signals, or extra LVDS I/O lines. Large, high-speed memory banks enable high-efficiency data handling. 256k x 64-bit, or optional 1M x 64-bit, dual-ported SRAM facilitates high-speed DMA transfers to the bus or CPU. This memory provides direct links from the PCIe bus and to the FPGA. The high-bandwidth PCIe 4-lane interface ensures fast data throughput. Acromag's Engineering Design Kit provides utilities to help users develop custom programs, load VHDL into the FPGA, and establish DMA transfers between the FPGA and the CPU. Pricing starts at $2,895 with options for extra memory and extended temperature operation.

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

NTSC/PALVision System Has Core2 Duo 2.26 GHz Processor

An embedded vision system features an Intel Core2 Duo processor and four independent analog NTSC/PAL ports with real-time image acquisition rates up to 120 fps. The EOS-2000 from Adlink is a compact-size 200 (W) x 165 mm vision system supporting four vision channels, making it suitable for space-critical applications. Compared with smart camera solutions in the market, the EOS-2000 provides a lower unit cost per channel with more flexible system configurations, as well as software development kit support that allows users to develop their own machine vision solutions. The EOS-2000 also features I/O support that includes two RS-232/422/485 ports, four USB ports, 32 isolated digital I/O lines, and dual storage options (a SATA interface and a CompactFlash slot) for factory-floor networks. Pricing starts at $1,750.

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

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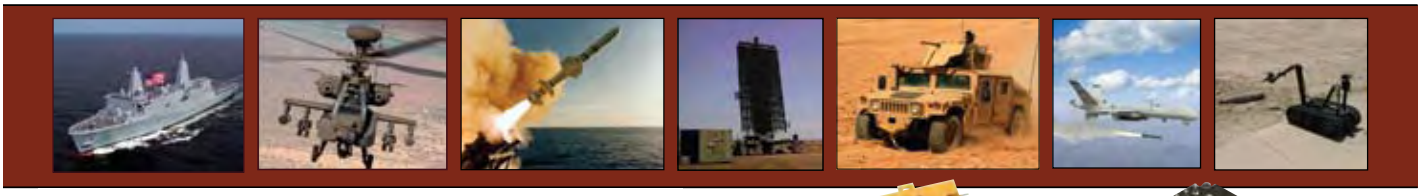

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Portable System Offers 800 Mbyte/s PCI Express Recording and Playback

Conduant has introduced its Big River LTX3 Portable Recorder powered by Amazon Express. It supplies up to 800 Mbytes/s of sustained PCI Express recording and playback performance and capacity for mobile, portable or space-constrained applications. The Big River LTX3 Portable Recorder is a compact, power efficient system that can operate independently from a host computer with command/control performed over an Ethernet network connection. Control can also be automated from a software application using Conduant's StreamStor software API from a network connected computer. An 8-lane cabled PCIe interface provides connectivity to a host computer for command/control and/or data access. Highly scalable with storage capacities up to 8 Terabytes, the LTX3 1U chassis measures only 17 x 20 x 1.75 inches.

Based on the StreamStor Amazon Express architecture, the LTX3 supports many of the same external interface mezzanine cards provided by the Amazon Express platform. This includes serial protocols such as Serial FPDP, SerialLite II and 10GigE utilizing optical or copper interconnect. LVDS raw data is also accommodated through a parallel interface. Pricing for the LTX3 starts at $28,000 and units are currently available.

Conduant, Longmont, CA. (303) 485-2721. [www.conduant.com].

H.264 Video Cards Ride PC/104-Plus and Mini PCI

Advanced Micro Peripherals has introduced two high-performance H.264 (MPEG-4 Part 10 AVC) frame grabber / video codec boards for the PC/104-Plus and mini PCI markets—both supporting four analog input channels with full frame rate video acquisition at full resolution NTSC / PAL image size. H.264-based video codec technology offers significantly improved compression and video quality at lower bit rates and is quickly becoming the standard of choice for new digital video recorder and video streaming applications. Both modules include integrated motion detection hardware on all channels, a 4-channel audio encoder (G.723) along with a video and audio decoder for local playback. These products have been designed for remote monitoring and situation awareness applications in defense, traffic management and automated inspection equipment. Both the microH264-D4 and VCODEC-H264-D4 cards are available with extended temperature range options (-40° to +85°C).

Advanced Micro Peripherals Witchford, Cambridgeshire, United Kingdom. +44 1353 659 500. [www.ampltd.com].

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Special Feature: Box vs. Slot Card Approaches for UAV Payload Designs A trend has been building in the past couple years where traditional embedded board vendors are adding stand-alone rugged box-level systems to their military market offerings. These complete system boxes provide a complete, tested and enclosed computing solution that eliminates complex integration chores for customers. This section looks at this emerging product class and their trade-offs versus slot-card solutions and how system consolidation is impacting the radar, imaging processing and communications capabilities of next-gen UAVs.

Tech Recon: System Cooling: Challenges and Solutions There's just no avoiding the trend toward processors and other key components ramping up in wattage. And more power means more challenges dissipating heat. Airborne systems, ground systems and shipborne systems all have unique trade-offs facing them. Exotic techniques such as spray-cooling and liquid-cooling are all on the table as possible ways to attack the cooling challenge. Articles in this section touch on all these present-day and future cooling solutions.

System Development: Shock & Vibration Testing for Boards and Enclosures Meeting the stringent levels of shock and vibration ratings required by most defense and aerospace programs is no slam dunk. As systems get more dense and complex, the problem of engineering boards and enclosures isn't getting any easier. Relying only on outdated Mil-Spec guidelines like MIL-STD-810F is no longer sufficient, and full environment stress screening techniques like HASS and HALT have moved into the forefront. Articles in this section delve into those areas and compare the solutions available.

Tech Focus: Rugged Ethernet Switch Boards 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 will include a product album of representative Ethernet switch board products in form factors such as VPX, VME, cPCI, MicroTCA and more.

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Editorial

Jeff Child, Editor-in-Chief

Sunshine State Spectacular

February was a busy month for the *COTS Journal* team. Our annual trek down to the AUSA Winter coincided with the final launch of the Discovery Space Shuttle. We made the most of our presence in Florida that week to see both. While Pete has been to more Shuttle launches than he can count, this was the first for me—and the last seeing as the Space Shuttle program is ending this year. Witnessing the launch from just a few miles away in the press area was a spectacular experience—and I'll treasure the memory. For more on the Shuttle launch, see Pete Yeatman's column on page 6.

While the Shuttle launch was a first for me, at AUSA, in contrast, I was more in my element. This will be the ninth year I've attended AUSA Winter. While definitely smaller this year in terms of exhibitors, there were at least as many or more exhibitors there from the embedded computing supplier segment. This may be another sign that our industry—the military embedded computing industry—is seeing robust growth as upgrades and tech insertion opportunities increase at the expense of new program wins.

Similar to the past couple years, much of the AUSA activity this year had to do with vehicle-mounted electronics of various kinds. BAE Systems for its part showed off its Integrated SMART V (ISV) HMMWV (Humvee). Earlier last month BAE demoed the system at the Nevada Automotive Test Center's (NATC) annual Vehicle Systems Demonstration. The central component of the ISV solution is a layered monocoque hull with a V-shaped underbody that totally encapsulates the crew, providing protection from all sides through an integrated hull that significantly boosts underbody blast protection.

Northrop Grumman meanwhile showcased its Force XXI Battle Command Brigade and Below (FBCB2) system, called Joint Capabilities Release (JCR). The U.S. Army recently approved FBCB2 JCR for fielding. FBCB2 is the key situational awareness and command-and-control system used by U.S. and coalition forces. More than 95,000 FBCB2 systems have been deployed worldwide, forming the world's largest tactical network. The system has been successfully fielded for 16 years. JCR will be incorporated into the LandWarNet/Battle Command Baseline for fielding to deploying units scheduled to receive software block 2. JCR upgrades include an increase in network bandwidth that allows the system to move more information to more users within seconds rather than in minutes. JCR also provides a common FBCB2 platform solution for both the Army and U.S. Marine Corps.

A number of the products on display from embedded technology suppliers at AUSA were likewise vehicle focused. Curtiss-Wright Controls Electronic Systems, for example, displayed its Condition Based Maintenance (CBM) sensor system. This technology, based largely on architecture research performed for the U.S. Army's PM-HBCT, can, according to Curtiss-Wright, be used to comply with the emerging Victory standard for both legacy vehicles needing a gradual technology insertion path, as well as new vehicle platforms. This approach enables easy integration of capabilities such as data/video distribution, recording/playback and network attached data storage. It enables seamless bridging of legacy databus devices over the Gbit Ethernet backbone, and integrated "smart" power monitoring and control to better assist the vehicle crew in managing critical onboard power resources.

At AUSA in Ft. Lauderdale, Editor-in-Chief Jeff Child tries out the Zypad BR2000 wearable computer. Made for wearable systems, constrained vehicle and aircraft platforms, the device offers full PC functionality for Command and Control (C2) applications.

Another interesting vehicle-oriented product on display was the Zypad BR2000 (see photo) from Eurotech subsidiary Parvus. This rugged, small form factor wearable computer and vehicle server uses an Intel Atom processor together with high-speed wired and wireless network and device I/O interfaces. The BR2000 serves as an ideal soldier/worker wearable computer or vehicle-mount subsystem ready for Linux and Windows applications. The unit is designed to be worn on a tactical vest, utility belt, pocket or backpack and interface with a wrist-worn, vest-mounted or hand-held display, and/or helmet monocle. It weighs less than 1.8 lbs when fully integrated with its rechargeable/removable battery in a very small and lightweight mechanical package, similar in size to a portable cassette tape player. ▮▮

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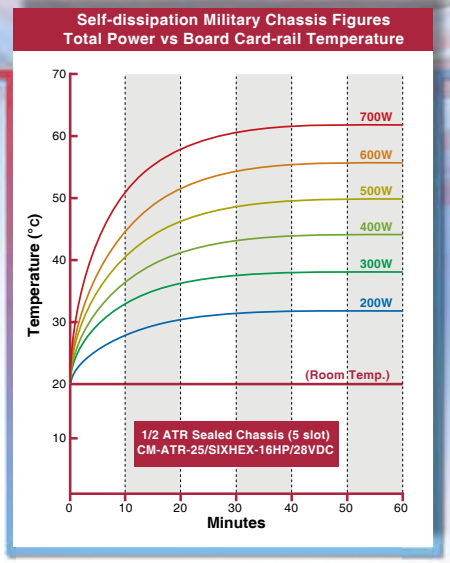

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- Six internal Heat Exchangers
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- Up to 1.8 KW total Power Dissipation
- Up to 150 W per slot
- Integrated Temperature Control Unit
- Dramatically increases payload MTBF
- 2 User defined PSU DC outputs
- 25°C less than heat exchanger ATRs
- 50°C less than conventional ATRs
- In-line EMI/EMC MIL-STD 461E Filter
- Stand alone low weight solution
- Customizable to specific requirements
- Mounting Tray with quick release system

CM-ATR-25 SixHex-16HP Power Supply Options		Vin Options		Backplane DC				Suggested BUS			Max Input Power
		28VDC	OTHER†	+5VDC	+3.3VDC	+12VDC	-12VDC	VME64	cPCI	VPX	Excluding Rear Fans
PSU Models	A-475W	✓		40A	22A	8A	8A	✓			700W
	A-575W		✓	40A	22A	12A	12A	✓			850W
	B-450W	✓		20A	45A	8A	8A		✓		700W
	B-550W		✓	20A	45A	12A	12A		✓		800W
	C-475W	✓		20A	22A	16A	8A			✓	700W
	C-575W		✓	20A	22A	21A	12A			✓	850W

† All Inputs except 28VDC : 48VDC / 270VDC / Autorange 90-264VAC @ 47-880Hz / 200VAC-3Phase @ 47-880Hz

It has been demonstrated in the field that military ATR enclosures are crucial to your end system reliability and performance. CM Computers is proud to develop superior products that guarantee your payload electronics are matched with excellence.

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