COTS® JOURNAL

Tech Focus : PC/104 in the Military

FIVE TECHNOLOGIES CHALLENGING THE MILITARY

PLUS:

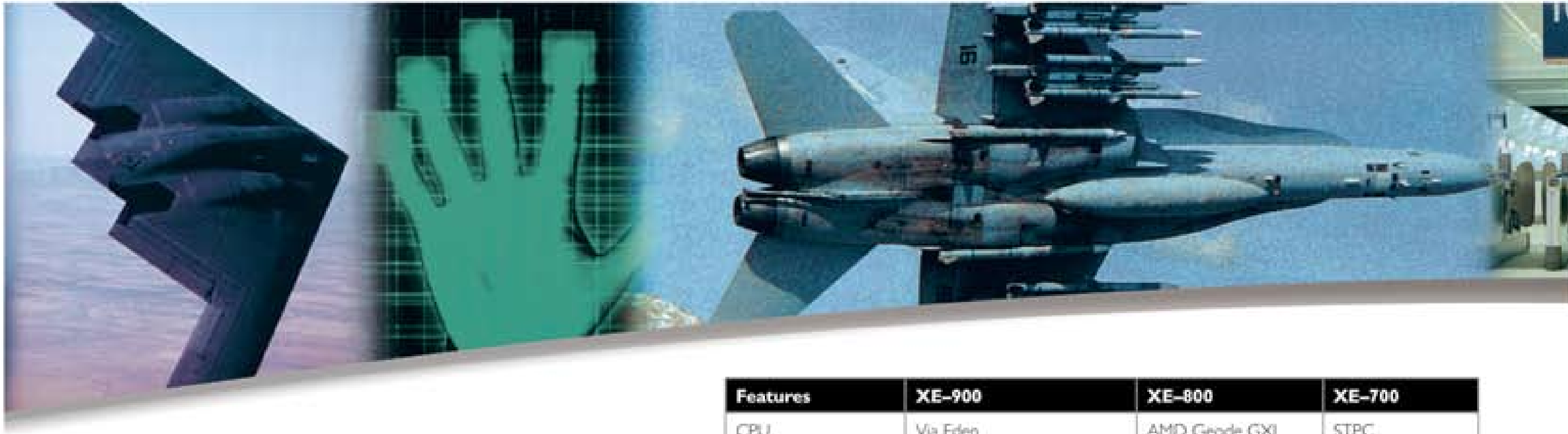
Military Market Update and Forecast

Rugged Displays Enlist for Video/Graphics Duties

Volume 8 Number 1 January 2006

www.cotsjournalonline.com

An RTC Group Publication



Need reliability?

–40° to +85°

EPIC™ XE–900
1.0 GHz CPU

Features	XE–900	XE–800	XE–700
CPU	Via Eden	AMD Geode GXI	STPC
Clock speed	400 MHz; 733 MHz; 1.0 GHz	300 MHz	133 MHz
BIOS	General Software	Phoenix	Phoneix
DRAM support	to 256 MB	to 256 MB	32/64 MB
CompactFlash	Type I or II	Type I or II	Type I or II
COM 1	RS–232	RS–232/422/485	RS–232
COM 2	RS–232	RS–232/422/485	RS–232/422/485
COM 3	RS–232	NA	RS–422/485
COM 4	RS–232	NA	RS–232
COM 5	RS–232/422/485	NA	NA
COM 6	RS–422/485/TTL	NA	NA
LPT1	0	0	1
EIDE	2	2	1
USB	2	6	2
CRT	1600 x 1200	1280 x 1024	1280 x 1024
Flat panel	LVDS	yes	yes
Digital I/O	24–bit prog.	48–bit prog.	24–bit prog.
Ethernet	10/100 Base–T	Dual 10/100 Base–T	10/100 Base–T
Expansion	PC/104 & *Plus*	PC/104 & *Plus*	PC/104
Power	3.6A operating	1.6A max.	1.6A max
Temp. range	–40° to 70/85° C	–40° to 80° C	–40° to 80/85° C
Shock/vibration	40/5g	40/5g	40/5g

Need Linux, QNX, Windows®?
Try our OS EMBEDDER™ KITS

Our kits are the shortest path to a successful OS on an Octagon embedded computer.

- Pick your Octagon SBC
- Pick the OS you prefer: Linux, Windows, QNX

Octagon delivers a high performance, total solution.

Typical Linux kit includes:

- *Target CPU card*
- *Preloaded OS image on 256 MB industrial CompactFlash*
- *256 MB SO–DIMM module*
- *Interface cables*
- *Hard copy of manual*
- *Mouse*
- *CPU OS bootable CD*
- *Optimized OS version*
- *Full driver support for on–board hardware*
- *X–Windows support*
- *Example applications and source code*
- *Extra documentation*

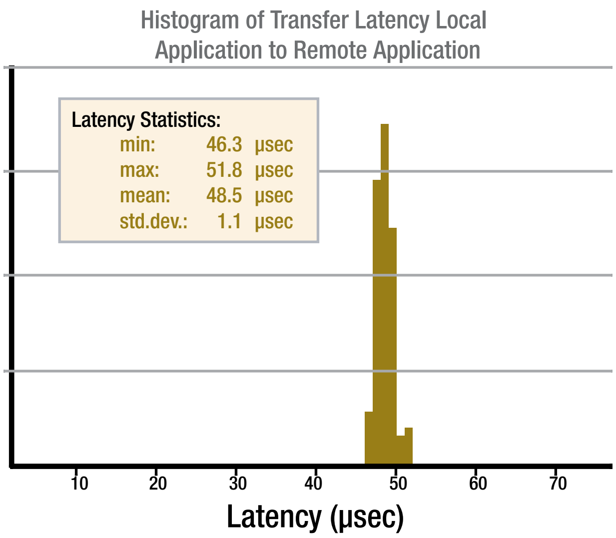
Microsoft® Windows® Powered

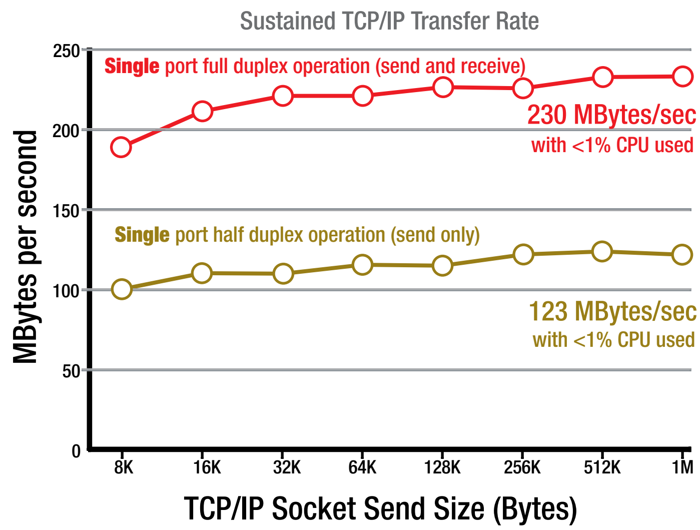
OUR GigE TOE DOES HARD REAL TIME.

Latency: 49 µsec ±1µsec

Dual Channel TOE Achieves:

442 MBytes/sec at 1% CPU





Note: Performance data collected using 1 GHz PowerPC CPUs running VxWorks. All transfers are from CPU memory to remote CPU memory. Latency measured from application send to remote application receive & notification, including Ethernet switch delay.

QUESTIONS?

Now you can use Gigabit Ethernet for your data intensive applications and get the throughput you need without sacrificing your precious CPU resources. The XGE TOE PMC provides complete offload of the TCP, UDP, IP, RDMA and iSCSI protocols to silicon. Extensive driver and software library support allows your application to easily access the XGE using standard Sockets or direct library calls.

visit our website at www.criticalio.com

NEW: Dual Channel TOE!

CRITICAL IO

COTS JOURNAL

Features

January 2006 Volume 8 Number 1

Main Feature

Five Technologies Challenging the Military

Tech Recon

Military Market Update and Forecast

System Development and Test

Rugged Displays

Technology Focus

PC/104 in the Military

COTS (kots), *n.* **1.** Commercial off-the-shelf. Terminology popularized in 1994 within U.S. DoD by SECDEF Wm. Perry's "Perry Memo" that changed military industry purchasing and design guidelines, making Mil-Specs acceptable only by waiver. COTS is generally defined for technology, goods and services as: a) using commercial business practices and specifications, b) not developed under government funding, c) offered for sale to the general market, d) still must meet the program ORD. **2.** Commercial business practices include the accepted practice of customer-paid minor modification to standard COTS products to meet the customer's unique requirements.

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

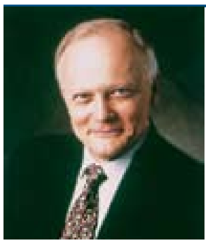
Departments

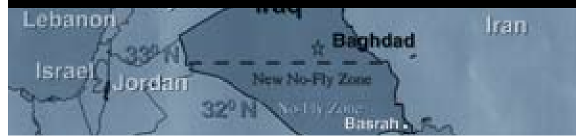
Coming in February ...
...See Page 69

Cover Story .... Page 15

A U.S. Navy plane captain signals the pilots of an E-2C Hawkeye to start their engines during evening flight operations on the flight deck of the aircraft carrier USS Harry S. Truman (CVN 75) operating in the Persian Gulf. The E-2C Hawkeye 2000 aircraft is undergoing a major upgrade program designed to speed up the Hawkeye's computers eight times faster than the older models. The mission computer system shown here has VME boards and a custom dual CompactPCI mezzanine card configuration.

Courtesy: (DoD photo by Airman Ryan O'Connor, U.S. Navy).





Once There Were Four and Now There Is One

Back in June of 2001 I wrote about the dynamic four that the Bush Administration was appointing to positions in the Defense Department: Thomas White as Secretary of the Army, Secretary of the Air Force James G. Roche, Secretary of the Navy Gordon England and Under Secretary of Defense; Acquisition, Technology and Logistics, Edward "Pete" Aldridge. Clearly these four gentlemen came to the Defense Department with impressive credentials—and great expectations to perform.

Thomas White retired as a Brigadier General of the Army in 1990 and then went to Enron. When the Enron debacle was exposed, the Enron connection and talk of insider trading crippled White; and he resigned as Secretary of the Army in May of 2003. Dr. James G. Roche, Secretary of the Air Force stepped down in January of 2005; Roche was a Northrop Grumman Corporate VP prior to this position. The Inspector General investigated Roche and apparently found two low-grade infractions that he was responsible for, but it was the Boeing Tanker scandal that really pushed him to resign.

Pete Aldridge was the CEO of Aerospace Corporation prior to becoming Under Secretary of Defense. Pete Aldridge resigned in May of 2003 without any apparent scandal surrounding his leaving. A good guess for his leaving was that he just didn't want to do it anymore; and because he was leaving on good terms, the Administration offered him the position as the Chairman of the President's Commission of Implementation of U.S. Space Exploration Policy.

The credentials and achievements of each of these individuals are outstanding and should have made each one a super star for the Defense Department. But because of missteps and events within and outside their control, now they are all gone. Only one of the original four powerhouses remains: Gordon England. Last May when England was appointed as Acting Deputy Secretary of Defense I expected a quick congressional review and confirmation. As with most things when it comes to politics, using logic to forecast results is a big mistake. The accolades from everyone in Congress regarding Gordon England up to this point would lead someone to believe that England was a shoe in. To date, England is still Acting Secretary. In the last days of 2005 England relinquished his position as Secretary of the Navy. You just know that this had to be a chicken or the egg deal between the Administration and Congress to clear the path for his confirmation.

England served as the 72nd Secretary of the Navy from May of 2001 to January 2003 when he left to become Deputy Secretary of the Department of Homeland Security. He returned to the post of Secretary of the Navy nine months later making him only the second person in history to serve as Secretary of the Navy more than once.

When England was appointed to take the reigns of the number two spot in the Department of Defense, replacing Wolfowitz, he promised to make acquisition reform a priority, ensuring the ability to rapidly field military equipment while assuring cost-effectiveness and product performance. Part of that promise's fulfillment is his establishment of the DAPA (Defense Acquisition Performance Assessment) Project designed to improve the performance of the Defense Department's acquisition process www.dapaproject.org. Being Acting Secretary has not slowed down or diminished his desire to reform the acquisition process. And whatever the chess game that went on between the Administration and Congress is now coming to an end with England's departure from the Navy position.

With midterm elections coming up the political chess game will only get worse; this is nothing new but it's no less annoying to the people who develop product for the military and have to try to navigate through these periods. When politics cause programs to get shuffled around in terms of their quantities and delivery times, our industry has to do a quick two-step in order to limit the impact of those shifts on their companies and their employees. The problems of component availability and obsolescence are of no concern to the decision makers. It's not their problem—someone else down the food chain will have to worry about that. If a problem arises as a result of some of these political decisions, there will no doubt be hearings and committees to investigate the cause and set the blame for any failures far away from the actual people responsible for the failure.

Without taking anything away from the people that have filled the positions of the three departed gentlemen from the dynamic four, there is deep regret that they never performed to the potential that we envisioned for them. It's all up to Gordon England now, and I have no doubt that he will live up to our expectations. ▮

Pete Yeatman, Publisher
COTS Journal

COTS JOURNAL

Publisher

PRESIDENT
John Reardon, johnr@rtcgroup.com

PUBLISHER
Pete Yeatman, mail@yeatmangroup.com

EDITORIAL DIRECTOR / Associate Publisher
Warren Andrews, warrena@rtcgroup.com

Editorial

EDITOR-IN-CHIEF
Jeff Child, jeffc@rtcgroup.com

SENIOR EDITOR
Ann Thryft, annt@rtcgroup.com

CONTRIBUTING EDITOR
David Cotton, davidc@rtcgroup.com

MANAGING EDITOR
Marina Tringali, marinat@rtcgroup.com

STAFF EDITOR
Craig Choisser, craigc@rtcgroup.com

COPY EDITOR
Rochelle Cohn

Art/Production

CREATIVE DIRECTOR
Jenna Hazlett, jennah@rtcgroup.com

DESIGNER
Melissa Gaeta, melissag@rtcgroup.com

PRODUCTION DESIGNER
Kirsten Wyatt, kirstenw@rtcgroup.com

DIRECTOR OF WEB DEVELOPMENT
Jan Garcia, jang@rtcgroup.com

WEB DEVELOPER
Marke Hallowell, markeh@rtcgroup.com

Advertising

CALIFORNIA COASTAL ADVERTISING MANAGER
Diana Duke, dianad@rtcgroup.com
(949) 226-2011

WESTERN REGIONAL ADVERTISING MANAGER
Lea Ramirez, lear@rtcgroup.com
(949) 226-2026

EASTERN REGIONAL ADVERTISING MANAGER
Nancy Vanderslice, nancyv@rtcgroup.com
(978) 443-2402

EMEA SALES MANAGER
Anna Brown, annab@rtcgroup.com
(949) 226-2025

BUSINESS DEVELOPMENT MANAGER
John Koon, johnk@rtcgroup.com
(858) 755-4999

BILLING
Maggie McAuley, maggiem@rtcgroup.com
(949) 226-2024

COTS Journal

HOME OFFICE

The RTC Group, 905 Calle Amanecer, Suite 250, San Clemente, CA 92673
Phone: (949) 226-2000 Fax: (949) 226-2050, www.rtcgroup.com

EDITORIAL OFFICES

Warren Andrews, Editorial Director/Associate Publisher
39 Southport Cove, Bonita, FL 34134
Phone: (239) 992-4537 Fax: (239) 992-2396

Jeff Child, Editor-in-Chief
20A Northwest Blvd., PMB#137, Nashua, NH 03063
Phone: (603) 429-8301 Fax: (603) 424-8122

Ann Thryft, Senior Editor
15520 Big Basin Way, Boulder Creek, CA 95006
Phone: (831) 338-8228

Published by THE RTC GROUP

The Inside Track

DDC Teams for High-Speed 1553 Technology Demo

Data Device Corporation (DDC), teamed with The Boeing Company and Honeywell Aerospace, has successfully completed a flight demonstration of a new technology that dramatically speeds up the transmission of tactical aircraft data. The flight demonstration, conducted last month from St. Louis, involved the Boeing F-15E1 Advanced Technology Demonstrator aircraft. The new technology is a high-performance 1553 data bus (called HyPer-1553) developed by DDC.

HyPer-1553 technology uses existing MIL-STD-1553 bus infrastructure to transmit data at much higher rates than 1 megabit per second that present-day conventional MIL-STD-1553 data buses provide. The new technology helps increase bandwidth between subsystems, which is becoming increasingly necessary for network-centric operations and sensor fusion applications. Because it's able to use the existing MIL-STD-1553 infrastructure, HyPer-1553 paves the way for avionics system upgrades in proven aircraft at much less cost and down time than would be required for other high data rate options that would require the installation of new wiring. These types of upgrades also may be done incrementally because HyPer-1553 technology can operate in parallel with MIL-STD-1553 data buses.

Figure 1

The 1553 bus enjoys a long legacy as an aircraft data bus, including F-15s. Shown here, a F-15E Strike Eagle takes to the skies en route to a deployment supporting Operation Iraqi Freedom. (U.S. Air Force photo).

During the test, Boeing Phantom Works engineers used the HyPer-1553 data bus to transmit digital imagery data between a rugged chassis mounted in the forward equipment bay of the F-15E and a modified Joint Direct Attack Munition (JDAM) weapon mounted on a wing pylon station. DDC's circuit card with the HyPer-1553 interface was mounted to a Honeywell general-purpose processor on each end of the interface.

During the test, the test team successfully transferred data at 40 megabits per second over an existing 1553 data bus infrastructure in parallel with MIL-STD-1553 data being transmitted at 1 Mbit per second. The team also transferred data at 80 and 120 Mbits/s on a second 1553 bus dedicated to the higher speed data.

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

VITA Releases Test Data for VITA 46

VITA and its Standards Organization (VSO) have announced the release of a comprehensive connector and module qualification report to support the VITA 46 standard, now called VPX. VPX is a next-generation VME Technology providing a mechanical format for standardization of switched serial interconnects for VME Technology applications, with specific concern taken to allow deployment in ruggedized environments. The findings in this test report are of vital concern to the developers and users of VPX, providing assurance that future products will be able to meet the market expectations.

Testing was done by a highly regarded, fully independent test house, Contech Research, whose focus is in the field of testing, applied research, product evaluation and interconnection technology. Key environmental parameters covered included: shock and vibration, temperature, humidity, sand and dust, durability and electrostatic discharge (ESD) protection.

VITA
Scottsdale, AZ.
(490) 951-8866.
[www.vita.com].

Catalyst Enterprises Acquires Ancot

Enhancing the company's presence in aerospace and other markets, Catalyst Enterprises announced the acquisition of Ancot, which was the first company to ship a Fibre Channel analyzer (1994). Ancot's latest products include a 4 Gbit/s Fibre Channel analyzer, tester, error injector and bit error rate tester (BERT). The acquisition adds Fibre Channel, SCSI and networking products to Catalyst's product line. Catalyst's development tools incorporate a reconfigurable hardware core architecture, which can be updated in the field with software, keeping the tool current with the latest standards and updated feature sets.

Catalyst Enterprises
San Jose, CA.
(408) 365-3846.
[www.getcatalyst.com].

Thales JTRS Radio Is First to Get Government Certifications

Thales Communications announced that its Cluster 2 Joint Tactical Radio System (JTRS) Enhanced Multiband Inter/Intra

Team Radio (MBITR), or JEM, has achieved Software Communications Architecture (SCA) certification by the U.S. Government. The JEM Operating Environment has been certified as "SCA-compliant with Waivers," making it the first JTRS radio to be certified by the JTRS Joint Program Executive Office (JPEO) for SCA compliance.

The JEM has been certified by the National Security Agency to protect the confidentiality of voice and data up through the TOP SECRET level. Thales' JEM is the first SCA-certified JTRS radio to be approved by NSA for Type 1 encryption. The JEM has been developed as part of the JTRS Cluster 2 program, on which Thales Communications is the prime contractor. The JEM Operating Environment includes Raytheon's Version 2.2 Core Framework, Objective Interface Systems ORBexpress object request broker and Wind River's VxWorks operating system. The JEM's Type 1 encryption is provided by the General Dynamics' Advanced INFOSEC Machine (AIM) software-programmable encryption engine.

Thales Communications
Clarksburg, MD.
(240) 864-7000.
[www.thalescomminc.com].

Figure 2

Boeing's 777-300ER is an extended-range aircraft designed to serve the nonstop routes. Flight testing of the 777-300ER began in early 2003. Aside from the 777-300ER, Green Hills Software has also been selected for multiple safety-critical systems on both the Boeing 787 and Airbus A380, among others.

Smiths Aerospace Selects Green Hills Software for New Boeing 777 Systems

Smiths Aerospace selected Green Hills Software's GMART run-time system and AdaMULTI development environment to develop the software for the Electrical Load Management System (ELMS2) and Fuel Quantity Indicating System (FQIS) for the new Boeing 777 300ER aircraft. The software running in both systems has been certified to the Federal Aviation Administration's (FAA) standard for safety-critical software, RTCA/DO-178B. Both the FAA and European Joint Aviation Authority (JAA) were involved in the certification process.

According to Smiths Aerospace, AdaMULTI development systems met Smiths' safety requirements and supported the low-power and low-cost Freescale ColdFire 5307 processor that they were using. In addition to the Boeing 777-300ER, Green Hills Software has also been selected for multiple safety-critical systems on both the Boeing 787 and Airbus A380, among others.

AdaMULTI is a complete software development environment for embedded computer-based applications developed using the Ada 95, C, C++ and Embedded C++ (EC++) programming languages. AdaMULTI contains an integrated set of tools that maximizes software developers' productivity while enabling them to optimize the reliability, performance and resource requirements of their devices. GMART supports the SPARK safety-critical subset of the Ada language. It is ideal for those applications requiring a small, fast and deterministic run-time environment. Further, SPARK facilitates the development and certification of safety-critical software. GMART has been proven in numerous systems certified to DO-178B, including flight-critical systems that require the most stringent, Level A certification.

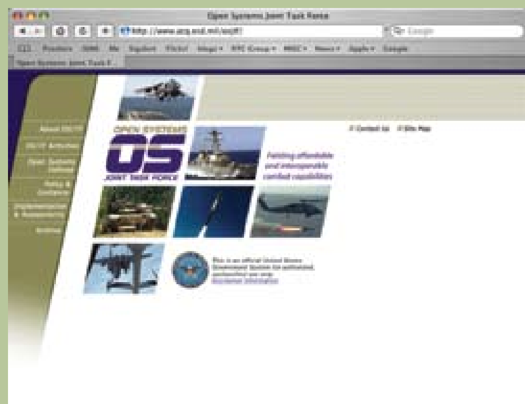
Green Hills Software
Santa Barbara, CA.
(805) 965-6044.
[www.ghs.com].

COTS Websites

www.acq.osd.mil/osjtf

DoD's Hub for All Things Open Systems: OSJTF

One of the core enablers of the COTS movement is the concept of open systems. Open system architectures not only make it easier to mix and match subsystems from several different commercial vendors, they also streamline the process of technology refresh. In fact, open systems are so vital to today's military system development, that the Department of Defense created the Open Systems Joint Task Force (OSJTF), chartered as a cooperative effort of the Department of the Army, the Department of the Navy, the Department of the Air Force, and the Office of the Under Secretary of Defense (Acquisition and Technology). The group is tasked to sponsor and accelerate the adoption of an open systems approach for new systems and system upgrades.



To support that goal, the OSJTF's Web site offers a wealth of resources to help developers of military systems educate themselves on open systems standards and concepts. The site also serves as a portal to network with the various DoD and industry entities involved in open systems. Visitors to the site can access a wealth of standards and policy documents related to open systems. A complete indexed library on the site offers downloaded open systems resources files in Power Point, MS Word and PDF formats. A contact page provides contact info for each military branch that's part of OSJTF. The site provides links to a wealth of educational resources including course information, conferences and links to several open-systems-based trade associations and standards bodies.

Open Systems Joint Task Force
Arlington, VA. (703) 602-0851.
[www.acq.osd.mil/osjtf].

Main Feature

Five Technologies Challenging the Military

Jeff Child, Editor-in-Chief

The drive to maintain a technological edge is nothing new for U.S. Military; the pace of those efforts has ramped way up over the past several years. And it must in order to meet the DoD's vision for goals like complete sensor-to-shooter networked-centric operation and an ever increasing reliance on autonomous unmanned land and air assets. Advanced embedded computing technologies play a critical role in those efforts.

For this special section, we've drafted all the talents of our RTC Group editorial pool to cover, as a team, five areas that pose the most significant technology challenges facing today's military system designer. The five areas include Configurable Processing, Switched Fabrics, Monitoring and Control Systems in UAVs, Multicore Processors and Java. The list of programs that push the envelope of these technologies is long—including Future Combat Systems, Joint Tactical Radio System (JTRS), the Navy' DD(X) program, and a myriad of new and upgraded design projects for Unmanned Aerial Vehicles (UAVs).

As a subject of academic discussion, reconfigurable computing is far from new to the worlds of embedded system and defense electronics. Enabled by advances in FPGA technology, configurable computing at the system level has matured quickly over the last couple of years to where it's the preferred choice for deployment in signal-processing-intensive systems. Indeed signal processing—whether the signal is audio, visual, radar or other medium—is a natural for reconfigurable computing. Such systems typically use several algorithmic components, each suited for different processing devices, such as FPGAs, DSPs and general-purpose processors.

Meanwhile, serial switched fabric technologies—PCI Express, InfiniBand, Serial RapidIO and others—continue to vie for position as the favorite for high-end military embedded computing applications. Fabric technologies have been around for several decades in niche, high-end embedded applications. But even when they started to migrate into the mainstream embedded computing realm around six or so years ago, the military market expressed absolutely zero interest in them, and rightfully so. Given the decades-long design cycles in the defense arena, it's too risky to take any long-term development project on an interconnect scheme that won't be around in a few years. Fortunately the embedded board community started the ball rolling a couple years ago on the underlying spec development to bring serial switched fabrics into such universes as VME, AMC, EPIC and CompactPCI.

As other larger military programs get trimmed back and cut, development of Unmanned Aerial Vehicles (UAVs)—across all the U.S. Military branches—is ramping up exponentially. The growing UAV demand is great news for vendors of embedded modular computers. That's because computing and communications technologies available in today's embedded systems are the two key enablers of UAVs. The two basic approaches to implementing unmanned flight are autonomy and pilot-in-the-loop. Embedded processing and communication technology, respectively, are making a big difference in UAV capabilities.

The processor road maps of the leading processors show that all roads lead to architectures sporting multiple CPU cores on the same device. Some military applications have an immediate need for the level of computing muscle such devices provide. Compute-intensive applications such as sonar, radar, SIGINT and UAV control systems fall into that category, along with several others. But because the trend is fundamental across all processor vendors, issues surrounding multicore processing must be faced by all high-end computing applications in the near future.

And finally, the Java language has become entrenched as the preferred language for new software development in today's military programs. That includes shipboard weapon systems, such as anti-aircraft cannon controls as well as avionics systems aboard naval aircraft. The standard calls for all new software to be developed in either C++ or Java, and makes specific mention of moving away from Ada. They plan to continue to use Ada only as required to support legacy systems that have already been developed. ▮

Quickly Configurable Systems Secure Their Place in Military Computing

The mix of high-performance processors and large, fast programmable logic devices promises to deliver a new level of flexibility and speed to systems throughout the military.

Tom Williams, Editor-in-Chief, *RTC* Magazine

"Adapt or die" can be used as an idiom for biology, but can be equally applicable in terms of advanced computing, especially in the fast-changing—and perilous—world of military computing. The goal is to meet and overcome the ever-shifting conditions of the battlefield while preserving flexibility, performance, size, weight and cost. The concept of configurable computing fits these demands, but exactly what is it and how is it being addressed by manufacturers serving the military market? After all, computers are inherently configurable by simply loading different software. True enough, but that doesn't always meet the other requirements. So the race is on to make every deployed system as light, as low-power, as secure, as fast and as adaptable as possible.

One of the most important tools being used to address these demands is programmable logic in the form of large FPGAs—or more properly, a combination of FPGAs with powerful general-purpose microprocessors and DSPs. Combining these elements in the right proportions is only half the battle. The rest consists of optimally mapping the application to the underlying configurable hardware and being able to monitor and control it. An example defense application relying heavily on configurable processing is the tri-mode seeker used on the new Joint Common Missile (JCM) built by Lockheed-Martin (Figure 1). The tri-mode seeker's processing engine is implemented using Mercury Computer's FPGA-based compute node (FCN) module, known as VantageRT FCN.

Complementary Solutions

Today's large, high-performance FPGAs can seriously be used as complementary computing resources to high-end microprocessors such as the PowerPC. FPGAs lend themselves to algorithms such as signal processing, encryption/decryption or beam forming that are complex, require fast execution and are done repetitively and can exploit hardware parallelism. Microprocessors are better at tasks that are more segmented and may have more potential branches, for example. It is up to the application developer to decide exactly how to partition the application. It is up to the platform vendor to provide a versatile and powerful hardware environment to accommodate those decisions.

Figure 1

Mercury Computer's FPGA-based compute node (FCN) module, known as VantageRT FCN, provides the processing engine of the tri-mode seeker used on the new Joint Common Missile (JCM) built by Lockheed-Martin. The seeker design includes imaging, infrared, semi-active laser and millimeter wave radar capabilities for active and passive "fire-and-forget" and precision-strike targeting with minimal collateral damage, all-weather capability and robustness against enemy countermeasures.

Figure 2

The CHAMP-FX from Curtiss-Wright Controls harnesses the computing power of two Xilinx Virtex-II Pro FPGAs for DSP applications such as radar, sonar and signal intelligence. The FPGAs are complemented with more than 10 Gbytes/s of I/O capability, implemented with an array of technologies including high-speed differential serial RocketIO, XMC/PMC sites and StarFabric interfaces. With both large DDR SDRAM and fast DDRII SRAM memory, the FPGAs have more than 8 Gbytes/s of memory bandwidth to service memory-intensive algorithms.

Mark Littlefield of Curtiss-Wright Controls Embedded Computing, for example, notes that his company is "putting a great deal of engineering effort into the problem of integrating the FPGA computing with the rest of the multi-computer and how one would naturally spread the application—putting a portion on the FPGA, a portion on the microprocessor and have them work together naturally and seamlessly." Figure 2 shows an example of a board that harnesses the benefits of FPGA computing and a PowerPC general-purpose processor.

One big advantage of COTS hardware, according to SBS' Frank Willis, is "the common use of electronics in diverse applications." A fire control computer for an F-16 might have essentially the same box and cards as a flight management system for a UAV. Or, for example, an aircraft's mission computer may be uploaded with mission data at the same time the pilot is being briefed, but that does not mean the enemy is going to sit still by the time he gets over the target.

In addition to updated information from ground sensors, the pilot needs to make quick decisions on things like a weapons mix for changing situations. The data can be quite complex, including things like g forces and GPS coordinates, yet the pilot needs to choose simple commands and have everything quickly configured to meet those requirements. This means instant reconfiguration of heads-up displays, weapons and so forth—at a single touch.

In addition to the ability to work with general-purpose processors, certain FPGAs, such as those from Xilinx, contain hard-wired PowerPC cores on-chip, while others can use "soft" processors defined in the programmable logic

Figure 3

The Model 7640 PCI version of Pentek's software radio transceiver module combines both transmit and receive capability with a high-performance Virtex II-Pro FPGA. Because the FPGA controls the data flow within the module as well as providing signal processing, the module can be configured for many different functions. In addition to acting as a simple transceiver, it can perform user-defined DSP functions on the baseband signals. These can include demodulation/modulation, decoding/encoding, decryption/encryption, digital delay and channelization of the signals between reception and transmission.

fabric such as the Nios by Altera and the MicroBlaze by Xilinx. According to Mercury Computers' John Bloomfield, customers tend to view these cores as useful "when they have a very tight, low-latency control loop and they need some feedback or control function related to the data flow being processed though the FPGA." For other tasks, they are more inclined to use a full PowerPC with a higher clock speed, Altevec instructions and on-chip cache.

The main thing here, according to Bloomfield, is, "as long as there is enough bandwidth between all the pieces that you can use that interface for any place in the partitioning, then you have the flexibility to partition the application however you want." This extends beyond chips on a board, out to partitioning an application among boards in a system. For all this you may have different ratios of general-purpose processors, FPGAs, fabric interfaces and—let us not forget—memory.

Configurable Communications

Communications is shaping up to be a huge arena for configurable computing. The U.S. government has recently mandated the Software Communications Architecture (SCA) specification, for software-defined radio, specifically for JTRS, but which is destined to be the basis for all future government radios. SCA will also eventually work its way into municipal governments and emergency services as a result of the need to coordinate first responders, which became so apparent after 9/11. The idea is to design radios that are actually many different radios under one hardware "skin" and that would be dynamically reconfigurable to communicate with selected units, forces and nations as one moves through a theater of war. Of course, they must also be capable of providing secure communications.

According to Pentek's Rodger Hosking, "One of the reasons it hasn't been done yet is that it's hard." The SCA specification implements reconfigurability with layers of abstraction in defining standards, software and middleware, which results in a big burden on performance. Currently, the more successful deployed systems use a lot of general-purpose processors like PowerPCs because they lend themselves to a POSIX environment and middleware such as object request brokers. The push to add programmable logic is strong because of its advantages in parallelism, performance and configurability. The committees working on the SCA are struggling with a specification for the use of FPGAs.

Despite the performance advantages of FPGAs, however, they do not have the software operating system environment that lets them participate in all the layers of middleware. For example, it is hard to dynamically reallocate computing resources that are based in FPGAs in response to the needs of the application when they are being used in a distributed environment. It's particularly tricky when those resources are allocated by CORBA middleware. Still, the FPGA is very much in the future for software defined radio. Figure 3 shows a radio transceiver module product that combines both transmit and receive capability with a high-performance Virtex II-Pro FPGA for in-line data flow processing.

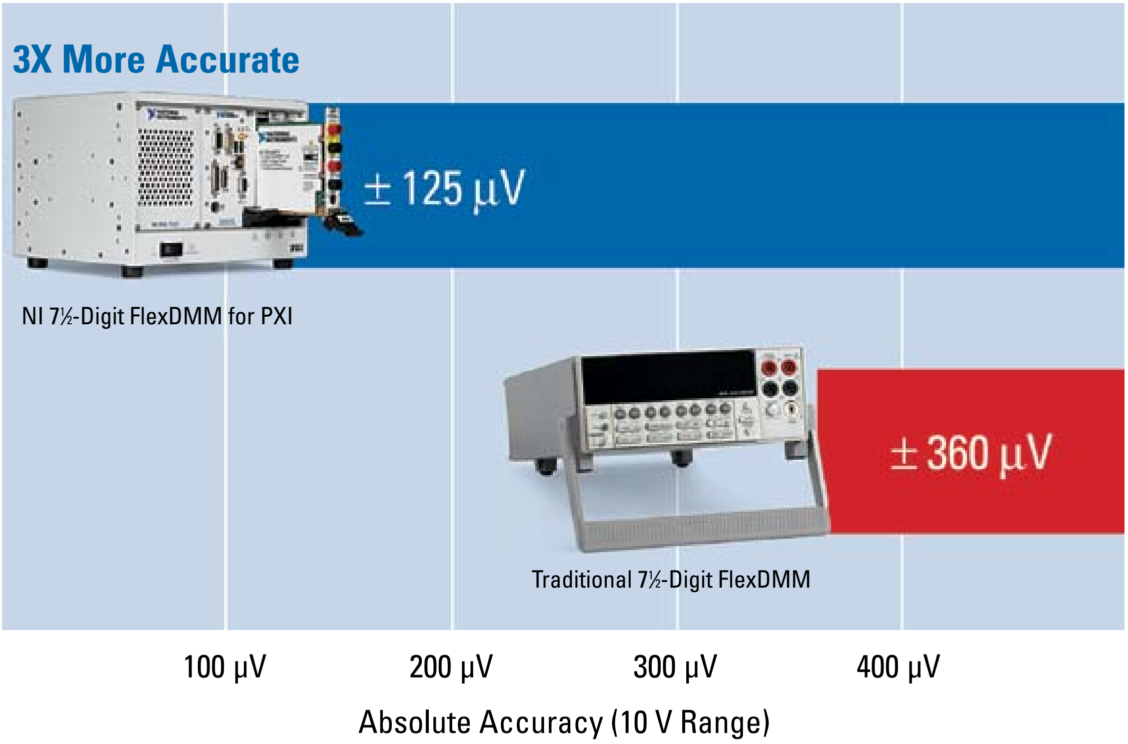
According to Hosking, the specification is complete enough that radio components can be defined as tasks, such as demodulators, modulators, up- and down-converters and even as waveforms that are SCA-compliant. These can now be run in a Pentium environment such as Pentek's SCA development system and "when the definitions emerge for FPGA, we'll be ready," Hosking says.

Just an Extension of Computing

The idea of reconfiguring hardware for specialized functions to add performance and flexibility to a system is really just an extension of computing—doing different, specialized things with a single piece of hardware. But the demands of complexity, speed, power consumption and cost in military systems keep calling for more innovative ways to do this. The combination of high-performance general-purpose processors with the latest advances in programmable logic puts powerful tools in the hands of application developers and confronts them with decisions in terms of partitioning and resource allocation.

The goal is systems that can help war fighters make quick, effective decisions and coordinate the action of large and small units. The technology is emerging to make this happen and to put intuitive tools into the hands of the military—because a guy with two bogeys on his tail has other things on his mind than programmable logic.

Industry's Most Accurate 7½-Digit DMM



To view a tutorial on minimizing error in DC measurements, visit **ni.com/modularinstruments.**

(800) 891 8841

Measure Signals from Picoamps to Kilovolts

The new National Instruments PXI-4071 7½-digit FlexDMM is a modular instrument that uses patented techniques and industry-leading software to deliver:

- **Three times more accuracy than traditional 7½-digit DMMs**
- **Flexible resolution from 26 bits at 7 S/s to 10 bits at 1.8 MS/s**
- **Wide measurement ranges ±10 nV to 1,000 VDC, ±1 pA to 3 A, and 10 µΩ to 5 GΩ**

With innovative hardware capabilities and more than 400 measurement and analysis functions, the NI PXI-4071 revolutionizes DC measurements for user-defined applications. From DC to RF, NI modular instruments power measurements from prototype to production.

Choose from a complete set of NI modular instruments.

Multimeters	7½ digits, 1000 V
Audio Analyzers	24 bits, up to 500 kS/s
Digitizers	8-24 bits, up to 200 MS/s
Signal Generators	Up to 16 bits, 200 MS/s
High-Speed Digital I/O	Up to 400 Mb/s
RF	2.7 GHz, 20 MHz RTB
Switching	Multiplexers, matrices, RF switches, relays
Multifunction I/O	Analog input and output, digital I/O, counters

NATIONAL INSTRUMENTS™

Main Feature

Five Technologies Challenging the Military

Switched Fabrics Challenge the Military and Vice Versa

A variety of serial switched fabrics technologies have made their way into the embedded board-level computing realm. Whether or not a single winner will dominate the field remains in question.

Warren Andrews, Editorial Director

Not too long ago in these pages we headlined an article, "Can Parallel-Bus Architectures Survive in the 21st Century?" The answer, we concluded, was a resounding yes. That opinion has not substantially changed from then until now. However, serial and pseudo-serial switched fabrics are beginning to take their place alongside, and in hybrid configurations with, parallel-backplane designs in the lineup of embedded computers in military and aerospace applications. And that is what makes switched fabrics one of the five challenging technologies in the military for 2006.

What is expected to make switched fabrics particularly challenging in the military is that, at least in the early goings, there is no single standard that has universally been accepted. And, it's entirely possible that no single standard will evolve as each approach lends specific capabilities. Some approaches work well in network-centric approaches, others are better for board-to-board or box-to-box interconnects while others are better within a box.

And then there are market factors. Switched fabrics such as InfiniBand have a broad following in the enterprise arena with companies such as Dell, Intel, Sun, IBM and others using the standard and driving the technology forward and chip prices down. On the other hand, RapidIO claims a stable of close to 50 supporters, many already supporting the interconnect with products. And, the ubiquity of PCI Express has already driven chip prices down. There is a ready supply of designers familiar with, and having experience with the standard, and scores of applications have been deployed in the commercial space. Then, there's PCI Express, Advanced Switching, commonly known now as ASI (Advanced Switching Interconnect) that is a network-centric superset of PCI Express.

Figure 1

Shown is a new conduction-cooled, rugged version of VMETRO's Phoenix VPF1 dual-FPGA/dual-PowerPC VME/VXS Processing card. Air-cooled versions of the VPF1 have been shipping since mid 2004. VMETRO designed the conduction-cooled VPF1 around industry standard IEEE 1156.1-1993 "IEEE Standard Microcomputer Environmental Specifications for Computer Modules."

Clear Winner?

Will any clear winner emerge from what some have called the "fabric wars?" From the current vantage point it doesn't look like that will happen. However, there is little question but that PCI Express will undoubtedly see the largest volume of systems in the business in a number of formats including VME hybrid, VSX; switched-fabric-only standards such as VITA 46; small form-factor boards such as EPIC that are making significant inroads into the military markets; and CompactPCI Express, which will leverage off the success of cPCI; and even ATCA and AMC in a growing number of military applications. Table 1 provides a list of embedded computer form-factor specs that implement switched fabrics. Figure 1 shows an example of a board based on the VXS spec, a scheme that marries switched fabric support while maintaining compatibility with legacy VME.

RapidIO will also see some significant growth as it is particularly well tuned to a variety of signal-processing tasks that are key to everything from imaging to communications. Mercury Computers has spearheaded this move and has rallied a formidable number of partners into the RapidIO camp.

InfiniBand continues to be stalled as a widely deployed standard because it hasn't developed a broad base of embedded system suppliers necessary to carry it into the forefront despite a large backing from the enterprise group and semiconductor suppliers such as Mellanox. And, perhaps its closest competitor, ASI continues to suffer a blight of critical mass both in subsystems and silicon.

Halting Growth

As we've moved past the first half of the first decade of the 21st century, the explosion in the application of switched fabrics forecast in Y2K failed to materialize. Instead, growth has been halting—partially because of the hiccup in the embedded-computer market in general,

Form-Factor	Switched Fabric
AMC Express (AMC 1.2)	PCI Express
ATCA Express (PICMG 3.4)	PCI Express
COM Express	PCI Express
Compact PCI Express	PCI Express
CompactTCA Express	PCI Express
EPIC Express	PCI Express
VITA 41.1, 41.2, VITA 41.4	InfiniBand, Serial RapidIO, PCI Express, ASI
VITA 46	PCI Express, ASI, RapidIO
XMC : VITA 42.2, VITA 42.3	Serial RapidIO PCI Express, ASI

Table 1

Serial switched fabrics have moved into nearly every niche of the standard embedded computing form-factor. PCI Express ranks as the most widely adopted by far.

but perhaps more specifically because of a surprisingly large amount of inertia within the design and development community. The embedded market tends to follow the commercial markets, which have also been relatively slow in adopting switched fabrics.

However, the time is coming soon when chips for parallel bus architectures will be in short supply. How long will Intel and others continue to produce PCI chips? How long will Tundra continue to make VME interface chips? Yes, intellectual property for making such IC functions on FPGAs exists, but it remains relatively expensive. And often such solutions come with additional baggage such as additional support chips, performance limitations and additional testing.

The year 2006 will undoubtedly see the military and aerospace community rally to the challenges of adopting and deploying subsystems and systems incorporating switched fabric interconnects. But it's not likely to be with the same religious fervor that it has embraced VME with over the past 25 years. PCI Express will win the day in terms of the number of boards and systems deployed, yet it is possible that RapidIO will take the honors for the largest revenue numbers. PCI Express will leverage off the low-cost commercial products, while RapidIO is likely to go into very high-end applications such as all types of imaging from radar and sonar on to infrared and newer types of remote surveillance.

Look to see systems based on both RapidIO and PCI Express (perhaps combined) on a broad cross section of UAVs and remotely driven land vehicles. In addition, these two are likely to be teamed up with high-speed Ethernet in a variety of network-based systems as the military continues to become more network-centric. Will such systems be led by other standard form-factor boards such as ATCA and AMC? Keep tuned to *COTS Journal* for the answers. ▮▮

The year 2006 will undoubtedly see the military and aerospace community rally to the challenges of adopting and deploying subsystems and systems incorporating switched fabric interconnects.

UAV Control Systems Hunger for Compute Density

Military UAV designs have a huge appetite for high-denisty embedded computing and communications. Such solutions are critical for autonomous and pilot-in-the-loop implementations.

Jeff Child, Editor-in-Chief

Among the most dynamic areas of military system development, UAV designs are hungry for high-density embedded computing and communications. That growing UAV demand is great news for vendors of embedded modular computers. That's because computing and communications technologies are the two key enablers of UAVs.

Unmanned Aerial Vehicles rely on two basic approaches to implementing unmanned flight—autonomy and pilot-in-the-loop—which rely predominantly on microprocessor and communication (data link) technology, respectively. And while both are used in differing levels in all of today's fielded UAVs, those together are what compensate for the absence of an onboard pilot and thus enable unmanned flight. Advances in both depend on commercial markets, the PC industry for microprocessors and memory—just as embedded computers such as VME and CompactPCI do—and the wireless communication industry for data protection and compression.

Get Connected
with companies mentioned in this article.
www.cotsjournalonline.com/getconnected

Downloading secure, high-speed transport of encrypted surveillance data, real-time control and harvest of data from networked military and intelligence assets such as the Global Hawk and Predator UAVs requires a lot of overhead (Figure 1a and 1b). If processing of data and decision making can be performed onboard the UAV itself rather than performed via a communication link with the ground, the more efficiently the craft can be used.

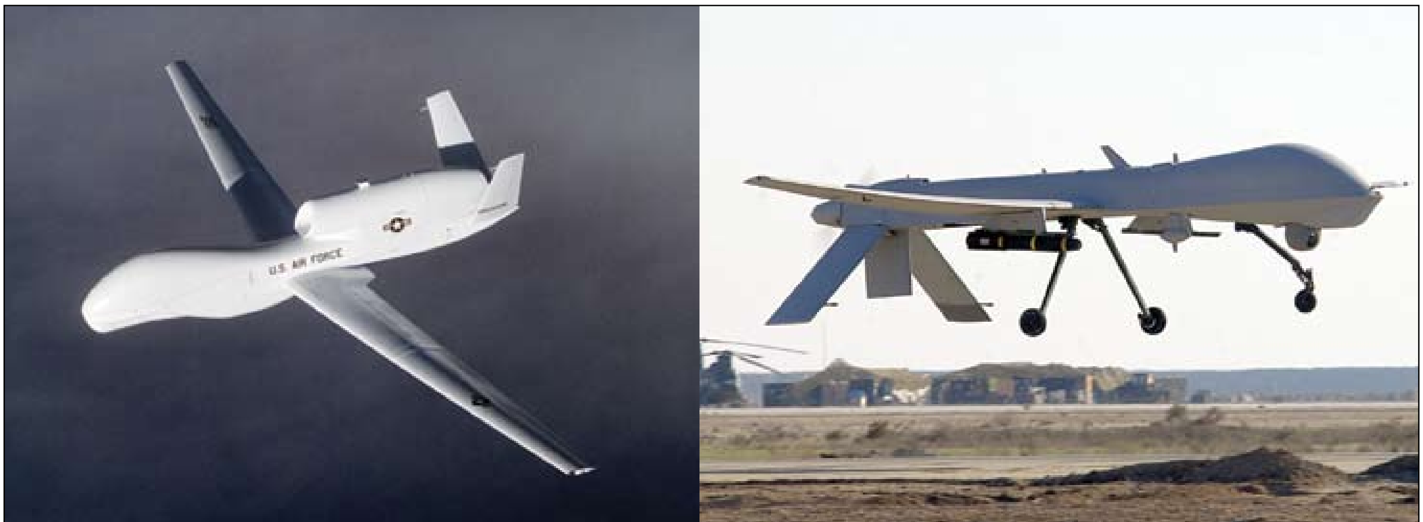
Data Link Challenges

Airborne data link rates and processor speeds are in a race to enable future UAV capabilities. Today, and for the near-term, the plan is to relay virtually all airborne data to the ground and process it there for interpretation and decision making. But eventually, onboard processing power will outstrip data link capabilities and allow UAVs to relay the results of their data to the ground for decision making. At that point, the requirement for data link rates in certain applications, particularly imagery collection, should drop significantly. Meanwhile, data compression will remain relevant as long as band-limited-communications exist, but it is unlikely compression algorithms alone will solve the near-term throughput requirements of advanced sensors.

For now, compression is a concession to inadequate bandwidth. In the case of radio frequency (RF) data links, limited spectrum and the requirement to minimize airborne system size, weight and power (SWAP) have been strong contributors for limiting data rates. Rates up to 10 Gbits/s (40 times currently fielded capabilities) are considered possible at current bandwidths by using more bandwidth-efficient modulation methods. At gigahertz frequencies however, RF use becomes increasingly constrained by frequency congestion. This is especially true for the 1-8 GHz range, which covers L, S and C bands. Currently fielded digital data links provide an efficiency varying between 0.92 and 1.5 bps/Hz, where the theoretical maximum is 1.92.

Airborne optical data links, or lasercom, will potentially offer data rates two to five orders of magnitude greater than those of the best future RF systems. However, lasercom data rates have held steady for two decades because their key technical challenge was adequate pointing, acquisition and tracking (PAT) technology to ensure the laser link was both acquired and maintained.

Although mature RF systems are viewed as lower risk, and therefore attract investment dollars more easily, Missile Defense Agency funding in the 1990s



a b

Figure a and b

UAVs like the Global Hawk (a) and Predator (b) are tasked with downloading secure, high-speed transport of encrypted surveillance data, real-time control and harvest of data from networked military and intelligence assets, which requires a lot of overhead. If processing of data and decision making can be performed onboard the UAV itself rather than performed via a communication link with the ground, the more efficiently the craft can be used.

allowed a series of increasingly complex demonstrations at Gbit/s rates. The small apertures (3 to 5 inches) and widespread availability of low-power semiconductor lasers explain why lasercom systems typically weigh 30% to 50% that of comparable RF systems and consume less power. The smaller apertures also provide for lower signatures, greater security, and provide more jam resistance.

Although lasercom could surpass RF in terms of airborne data transfer rate, RF will continue to dominate at the lower altitudes for some time into the future because of its better all-weather capability. It's expected that both RF and optical technology development should continue to progress out to 2025.

Supercomputing Levels of Processing

Although today's processors allow UAVs to fly entire missions with little or no human intervention, if the ultimate goal is to replace a pilot with a mechanical facsimile of equal or superior thinking speed, memory capacity and responses (algorithms) gained from training and experience, then processors of human-like speed, memory and situational adaptability are necessary. Human capabilities are generally agreed to equate to 100 million Mips in speed and 100 million Mbytes in memory. Today's supercomputers are probably within a factor of 10 of achieving human equivalence in speed and capacity and could achieve human parity by the 2015 timeframe.

The principal issue of communications technologies is flexibility, adaptability and cognitive controllability of the bandwidth, frequency and information/data flows. This means that the systems will be net-centric and that network services—like command and control, data management and flow control—will have to be integrated into the systems and concepts of operations. One way of addressing bandwidth and spectrum constraints is by reusing certain communications paths in new ways. Communications technologies might be repartitioned to address apertures, RF Front ends, software defined modems/bandwidth efficient waveforms, multiple signals in space, crossbanding, digital interfaces, new communications approaches like free space optics, and hybrid approaches. ▮

Main Feature

Five Technologies Challenging the Military

Multicore Processors Empower Next-Gen Military Systems

The military's transformation into a more nimble and information-aware fighting force means that high-demand, compute-intensive military systems need huge amounts of processing power in a small space. Multicore processors are leading the way.

Ann R. Thryft, Senior Editor

A major shift is coming in the world of microprocessors that will help improve the performance of next-generation electronic defense systems: new architectures sporting multiple CPU cores on the same device. Applications that most need the computing muscle offered by multicore processors include radar, sonar, SIGINT and UAV control. High-speed processing is demanded by the high-bandwidth image processing requirements of a host of intelligent data acquisition subsystems used by reconnaissance systems for surveillance and situational awareness.

On the silicon side, the move to multicore processors is being driven by the limitations of single-core CPUs in these high-demand systems. UAV image recognition and collision detection processing, for example, requires many DSPs or general-purpose processors, or a combination of both. Pushing single-core processors any further in performance can't be done without drastic consequences in the heat produced and the power consumed.

Different Approaches to Multicore CPUs

Several different approaches are being taken to multicore processor architecture. Heterogeneous multicore systems-on-chip (SoCs) aimed at image processing applications might contain a DSP or video processor for dedicated real-time processing and a general-purpose CPU. More recent designs consist of two or more cores of the same general-purpose processor. In this symmetric multiprocessing (SMP) approach taken by mainstream processor vendors such as Intel, AMD and Freescale, each core runs a separate program thread. In an application with two unrelated threads, one can be calculating while another is waiting for I/O.

A completely different method is the Cell architecture, a type of tiled processor developed by IBM, Toshiba and Sony Group. It includes eight identical, synergistic processing elements plus a core based on IBM's Power Architecture. Created for the video game market, the Cell processor offers peak performance of more than 200 GFLOPS, or 200 billion FLOPS. IBM has since made the chip and its source code available to embedded hardware and software developers.

Figure 1

Multicore processors will help high-demand, compute-intensive military systems, like reconnaissance, which need huge amounts of processing power in a small space. The Air Force's E-8C Joint Surveillance Target Attack Radar System aircraft, the world's most advanced wide-area airborne ground surveillance, targeting and battle management system, played a vital role in Operations Desert Storm and Iraqi Freedom with its ability to see through the now-famous sand storm attack. *(Photo by Tech. Sgt. Mary Smith, courtesy of U.S. Air Force.)*

To address aerospace and defense applications, as well as other markets, Mercury Computer Systems partnered with IBM to bring Cell technology into the embedded world. Last year, Mercury rolled out its dual Cell-based blade, based on IBM's BladeCenter design, and its Turismo system, designed to pack 800 GFLOPS into a 600 cubic-in. footprint.

"The Cell processor has a number of characteristics good for military purposes," says Mercury CTO Craig Lund. "One is long life. Video game consoles must last five or six years, versus only about two for PCs. Another is the fact that these chips have been optimized for floating-point, which is important for many signal processing applications like radar, sonar and SIGINT."

Designed for next-generation interactive digital media apps, the Cell processor has grabbed the interest of image processing designers for automatic target recognition and related uses. Its extremely high performance suits these systems well, since their compute power needs are much higher than single-core solutions can provide.

One IBM licensee is P.A. Semi, which offers a 64-bit multicore PWRficient processor SoC based on the PowerArchitecture. The company's first chip, targeted for sampling in the third quarter of this year, is a 2 GHz dual-core device, with an extremely low power dissipation of only 5 to 13W typical. It includes two DDR2 memory controllers, 2 Mbytes of L2 cache and an I/O subsystem that supports eight PCI Express controllers, two 10 Gigabit Ethernet XAUI controllers and four Gigabit Ethernet SGMII controllers sharing 24 serdes lanes.

The benefits of dual-core SMP designs, such as AMD's 64-bit, dual-core, 30/55/95W Opteron processor, are many. Aside from the performance boost, lower latency can also be achieved, as well as lower overall system cost from less design complexity. Dual cores on the same die increase performance without demanding more power or an increase in system footprint and weight. It's not just performance, but performance per watt that counts in

Figure 2

Portable systems such as the FleXtreme NextDimension from NextCom make it possible to set up a flexible, movable battlefield network. Using the NextDimension, which incorporates AMD Opteron dual-core technology, larger distributed networks, such as those processing and transmitting high volumes of surveillance and communications data, can be accessed and maintained from any location.

the great majority of military systems, which must operate under extreme thermal and physical conditions.

The Opteron's throughput is due partly to a 16-byte ECC integrated DDR memory controller. In addition, on-chip L2 cache eliminates the need for the CPU to constantly fetch processing loads from RAM, as would be necessary with traditional Northbridge bus architectures, says AMD's David Rich, director of 64-bit embedded markets and president of the HyperTransport Consortium.

One of the first vendors to work with AMD on board implementations of its dual-core chips, WIN Enterprises designed its AMD Opteron-based EBX controller to support both single- and dual-core processors, as well as multiple processors via the stackable HyperTransport connector, says CEO and CTO Chiman Patel. In the case of the Opteron processor, dual cores combine with multithreading, improved microarchitecture—including thread-level parallelism—and HyperTransport connectivity to provide high performance, scalability and high I/O throughput.

Multicore System Design Challenges

Multicore chips are not without challenges for military system designers. System partitioning and task assignment via multithreaded software, along with bus communications and memory hierarchy, become more complex issues. This is especially the case with heterogeneous multicore processors.

However, "servers have been dual-core-based for several years, some even with quad cores, and many applications are already dual-core aware," says AMD's Rich. Some PCs also incorporate dual-core chips from AMD and Intel.

The challenges of software integration and migration for multicore systems are being addressed by vendors such as QNX. The operating system chosen for a multicore design can significantly reduce, or increase, the effort required to address a strategy that allows the greatest performance improvement from multicore processing while requiring the least amount of effort for porting.

Bound Multiprocessing (BMP), pioneered by QNX, uses a single instantiation of the OS to manage all of the processor cores simultaneously while binding each application to a specific core.

Meanwhile, Mercury is working with Terra Soft Solutions to deliver the first commercially available Linux support package for Cell-based products, including one for Mercury's dual Cell-based blade.

So that products from multiple vendors will work together, a new industry group, The Multicore Association, has formed to focus on non-proprietary implementations. Begun last year as a series of meetings among chip vendors, semiconductor IP providers, and RTOS, compiler and development tool vendors, the association became official in November. ■

Main Feature

Five Technologies Challenging the Military

Java Becomes Entrenched as Language of Choice

With its advantages in programming productivity, integration and networking, Java has stepped forth as the favorite technology for new military software development projects.

Jeff Child, Editor-in-Chief

Recognized as a clean, well-defined language that incorporates the flexibility of C, the object-oriented structure of C++ and "write once, run anywhere" portability, Java has attracted the eyes of several key U.S. military programs. Among the key motivations for the military's interest in Java is a drive to transition away from Ada. The feeling is that Java represents a modern and more commercially available technology than alternatives.

The Navy, for example, has crafted its Navy Open Architecture Computing Environment (NOACE) to be the standard for all future software systems on Navy warships. That includes shipboard weapon systems, such as anti-aircraft cannon controls as well as avionics systems aboard naval aircraft. The standard calls for all new software to develop in either C++ or Java, and makes specific mention of moving away from Ada. They plan to continue to use Ada only as required to support legacy systems that have already been developed.

Figure 1

The U.S. Navy's DD(X) program centers on a family of advanced technology surface vessels, spanning over several classes of ships. The project reportedly has a huge amount of Java in it, with over a thousand developers.

Java has to prove itself across the broad and rigorous implementations relevant to the military and their requirements.

Thousands of developers are working on military-specific applications using Java. Consider the U.S. Navy's DD(X) program (Figure 1), whose purpose is to produce new systems for a family of advanced technology surface combatants, not just a single ship class. The project reportedly has a huge amount of Java in it, with over a thousand developers already in the early stages of developing code. The DD(X) contract was awarded to Northrop Grumman in 2002.

Suited for UAVs

Java is also finding its way into UAV systems. Java's unique virtual machine, write once, run everywhere structure fits the bill perfectly for systems like UAVs that must be reprogrammed for different mission tasks. The networking, security and portability of the Java language makes it a natural fit for large-scale networked applications like UAV communications and control. Last fall, Boeing selected Aonix's PERC real-time embedded Virtual Machine (VM) for the Joint Unmanned Combat Air Systems' (J-UCAS) X–45C program.

The J-UCAS program is a joint Defense Advanced Research Projects Agency (DARPA), U.S. Air Force and Navy effort to demonstrate the technical feasibility, usefulness and operational value of networked unmanned combat vehicles. J-UCAS will employ a Common Operating System, integrating the system components, which will provide the necessary software and services that enable system functionality, while minimizing the impact of platform constraints. High-performance unmanned air vehicles complete with intelligent weapon systems are being designed to suppress enemy air defenses, provide surveillance and execute precision air strikes within the emerging global command and control architecture.

There are some important missing pieces to Java technology. Java has to prove itself across the broad and rigorous implementations relevant to the military and their requirements. To do so it needs to support safety-critical and hard real-time usage, meaning response times in the nanosecond range.

Road to Safety-Critical Java

In May 2003, members of the Real-Time and Embedded Systems Forum (within The Open Group) agreed to submit a Java Specification Request (JSR) to the Java Community Process to begin official work on a safety-critical Java specification. A draft specification has been developed and work is under way to implement the reference implementation (RI) and technology compatibility kit (TCK).

Those efforts got a kick start last year thanks to new funding now provided by NASA for a project lead by Kestrel Technology. The company has been given one year for their first milestone to deliver at least a partial implementation of a safety-critical Java reference implementation. It's to be a reference implementation that various vendors and customers can look at and make the "gold standard" for how safety-critical Java should work.

Aonix, for its part, has plans to roll out a commercial product based on the developing safety-critical Java spec. Deeply involved with the real-time Java spec. from its inception, Kelvin Nilsen, Chief Technology Officer at Aonix, is Technical Chair of the J-Consortium and the editor of the Java Real-Time Core specification. Aonix expects they will make their product, called JRTK, available before the Kestrel implementation is done. That product will provide developers a chance to experiment with safety-critical Java, which will in turn help move the spec. toward a working final implementation.

Aonix plans its first pre-commercial release of its JRTK product this quarter. The company last month began offering a pre-release version of it for those few early evaluators that want to start using it. The pre-release version is targeted at a mission-critical audience who wants to use some of the benefits of the safety-critical specification.

Completing the Java Puzzle

Looking again at the DD(X) project, developers very much want to see the Java technologies mature into a robust, safety-critical, reliable part of their system. Many parts of the DD(X) software are not safety-critical, but there are very important parts that are—such as the firing of missiles. And because all the ship's systems are networked together, and also need to serve the DoD's overall vision of the Network Centric Operations, it's helpful if both the safety-critical and non-safety-critical portions of the system can be done in Java.

When a system is developed exclusively in Java the result is much more reliable than one using two different languages. One of the shortcomings some of the early adopters of Java experienced had to do with the interface between Java and C code. C programming is a much different philosophical mindset than Java, so there's this mismatch of paradigms when the two are used for the same project. At the interface between Java and C is where the strengths of Java tend to break down. This is because it is where all the inner workings of the Java Virtual Machine (VM) are exposed to the C programmer and the C programmer may not understand or may not follow the protocol exactly.

Net-Centric Friendly

Java also suits networking and communications better than other languages. In a network it's difficult to predict exactly what kind of information might arrive to a system and what the receiver has to do with that information. Different kinds of messages arrive at different times from different sources. That means you can't predict exactly how much

RTD Embedded Technologies, Inc.

"MIL Value for COTS prices"™

Intel Celeron cpuModules™

VIA Eden cpuModules™

8000 MIPS dspModules™

cpuModules™ −40 to +85°C

		Intel Celeron™				VIA Eden™				AMD Geode™					486DX	
		CME46786HX650HR	CME47786HX650HR	CMX46786HX650HR	CMX47786HX650HR	CME36786HX1000HR	CME37786HX1000HR	CML36786HX1000HR	CML37786HX1000HR	CMG26686HX333HR	CMG27686HX333HR	CME26686HX333HR	CME27686HX333HR	CML27686HX333HR	CMV6486DX100HR	CMi6486DX100HR
Bus	AT Expansion Bus	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	PCI Universal Expansion Bus		✓		✓		✓		✓		✓		✓	✓		
	PC/104-*Plus* PCI Bus Masters		4		4		4		4		4		4	4		
	APIC (add'l PCI interrupts)	9	9	9	9											
CPU and BIOS	CPU Max Clock Rate (MHz)	650	650	650	650	1000	1000	1000	1000	333	333	333	333	333	100	100
	ACPI 2.0 Power Mgmt	✓	✓	✓	✓	✓	✓	✓	✓							
	Max Onboard DRAM (MB)	512	512	512	512	512	512	512	512	256	256	256	256	256	32	32
	RTD Enhanced Flash BIOS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Nonvolatile Configuration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Quick Boot Option Installed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Fail Safe Boot ROM (KB)	768	768	768	768	768	768	768	768	768	768	768	768	768	384	384
	USB Boot	✓	✓	✓	✓	✓	✓	✓	✓							
Peripherals	Watchdog Timer & RTC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	IDE and Floppy Controllers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
	SSD Sockets, 32 DIP	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1
	Audio	✓	✓	✓	✓	✓	✓	✓	✓							
	TFT Panel TTL or LVDS			✓	✓			✓	✓	✓	✓	✓	✓			
	SVGA Interface	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	AT Keyboard/Utility Port	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	PS/2 Mouse	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
	USB Mouse/Keyboard	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
I/O	RS-232/422/485 Ports	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	USB Ports	2	2	2	2	2	2	2	2	2	2	2	2	2		
	10/100Base-T Ethernet	1	1	1	1	1	1	1	1			1	1	1		
	ECP Parallel Port	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
	aDIO™ (Advanced Digital I/O)	18	18	18	18	18	18	18	18	18	18	18	18	27		
	multiPort™(aDIO, ECP, FDC)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
SW	ROM-DOS Installed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DOS, Windows, Linux	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

utilityModules™ −40 to +85°C

dspModules™
- Coprocessors
- Accelerators

Specialty I/O
- Pulse width modulator
- Incremental encoder
- Opto-isolated MOSFET
- User defined FPGA

Frame Grabbers
- Single or multi-channel
- MPEG-2 compression

Video Controllers
- Analog VG A
- TTL and DVI panel support

Communication Modules
- Copper or fiber Ethernet
- USB 2.0, Firewire, CAN, serial

Wireless Telematics
- GSM, GSM-R, CDMA
- EDGE, GPRS, SMS
- GPS, Wi-Fi, Bluetooth

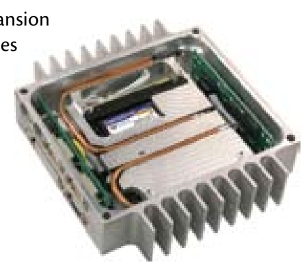
Motion Controllers
- DC motor controllers
- Synchro, resolver, LVDT

Power Supplies
- 50/75/83/100 Watts
- Wide input range
- UPS backup
- MIL-STD-704/461

Mass Storage
- 1.8 and 2.5-inch IDE
- CompactFlash and PCMCIA

IDAN™—Intelligent Data Acquisition Node

- Build your own IDAN system
- Rugged PC/104 stacking concept
- Quick interchangeability and expansion
- Structural heat sinks and heat pipes
- Optional cooling fins
- Milled aluminum frames
- Optional MIL-SPEC paint
- Standard PC connectors
- Shock-mount isolation base
- −40 to +85 °C

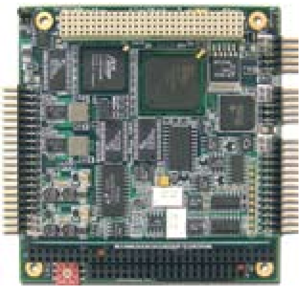


Full Product Line and Pricing Online

A Founder of the PC/104 Consortium • ISO9001:2001 Certified

HighRel PC/PCI-104 Modules and Systems

−40 to +85°C



Autonomous SmartCal™

Wireless Telematics

Frame Grabbers

dataModules® −40 to +85°C		Smart A/D				Analog I/O					Digital I/O				
		SDM6440HR	SDM6540HR	SDM7540HR	SDM8540HR	DM6420HR	DM6430HR	DM7520HR	DM7530HR	DM6620HR	DM6812HR	DM6856HR	DM6888HR	DM6956HR	DM7820HR
Bus	AT Expansion Bus	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	PCI Expansion Bus Master			✓	✓			✓	✓						✓
	McBSP™ Serial Ports		✓	✓	✓			✓	✓						
Analog Input	Single-Ended Inputs	16	16	16	16	16	16	16	16						
	Differential Inputs	8	8	8	8	8	8	8	8						
	Max Throughput (kHz)	500	1250	1250	1250	500	100	1250	100						
	Max Resolution (bits)	12	12	12	12	12	16	12	16						
	Input Ranges/Gains	3/4	3/7	3/7	3/7	3/4	1/4	3/6	1/4						
	Autonomous SmartCal™	✓	✓	✓	✓										
	Data Marker Inputs	3	3	3	3	3		3							
Conversions	Channel-Gain Table	8k	8k	8k	8k	8k	8k	8k	8k						
	Scan/Burst/Multi-Burst	✓	✓	✓	✓	✓	✓	✓	✓						
	A/D FIFO Buffer	8k	8k	8k	8k	8k	8k	8k	8k						
	Sample Counter	✓	✓	✓	✓	✓	✓	✓	✓						
	DMA or PCI Bus Master	✓	✓	✓	✓	✓	✓	✓	✓	✓					✓
	SyncBus		✓	✓	✓			✓	✓						
Digital I/O	Total Digital I/O	16	16	16	16	16	16	16	16	16	48	32	64	32	48
	Bit Programmable I/O	8	8	8	8	8	8	8	8	8	24				48
	Advanced Interrupts	2	2	2	2	2	2	2	2	2	2				2
	Input FIFO Buffer	8k	8k	8k	8k	8k	8k	8k	8k						2M
	Opto-Isolated Inputs											16	48	16	
	Opto-Isolated Outputs											16	16		
	User Timer/Counters	2	3	3	3	2	2	3	2	3	3				10
	External Trigger	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓
	Relay Outputs													16	
Analog Out	Analog Outputs	2	2	2	2	2	2	2	2	4					
	Max Throughput (kHz)	200	200	200	200	200	100	200	100	200					
	Resolution (bits)	12	12	12	12	12	16	12	16	12					
	Output Ranges	4	4	4	4	3	1	4	1	4					
	D/A FIFO Buffer		8k	8k	8k			8k		8k					

RTD FieldPads™

- Ruggedized, embedded computer systems
- User-specified CPU and PC/PCI-104 expansion
- Weathertight components
- Integrated 6.5-inch video panel, keyboard
- Heat pipes for high performance CPUs
- User-defined MIL connectors
- Internal and external battery packs
- Expand with any RTD PC/PCI-104 product

Industrial FieldPad™

Ideal for control and monitoring of processes on factory floors or industrial installations. Mounting flanges allow the unit to be installed on machinery or walls, enabling standard PC access in a rugged enclosure resistant to industrial environments.

Tactical FieldPad™

Designed for mobile and portable applications where the angled panel and ergonomic design allow for optimal viewing with flexible positioning. Data collection/downloading and information access accomplished through wired or wireless connections.

HiDAN™ and HiDAN*plus*™—HighRel Intelligent Data Acquisition Node

- HiDAN is a rugged, watertight enclosure for a stack of PC/104 modules
- HiDAN*plus* combines the modularity of IDAN with the environmental ruggedness of HiDAN
- Integrated tongue and groove O-ring for environmental sealing and EMI suppression
- Structural heat sinks and heat pipes
- Optional cooling fins
- Milled aluminum frames
- **Stackable signal raceway**
- Optional MIL-SPEC paint
- MIL I/O connectors
- Shock-mount optional
- −40 to +85 °C

www.rtd.com
Specifications, manuals, drivers, and plant tour

RTD Embedded Technologies, Inc.
103 Innovation Blvd • State College, PA 16803
T: 814-234-8087 • F: 814-234-5218

"Accessing the Analog World"®

memory or what kind of memory you are going to need at any given time. Because of that dynamic workload, it's helpful to be able to allocate memory on-the-fly. When a message arrives, some temporary processing job is done on the information, then the memory used is discarded as the system prepares to take on a new task when a new message arrives.

Java's automatic garbage collection provides a way to handle dynamic memory allocations that works very easily, and very reliably. Doing the same thing with a traditional C++ approach would more likely lead to problems. In C++ , it's more difficult to avoid memory becoming fragmented and ensure that memory gets discarded on schedule.

Programmers who write network software also find that Java has a rich set of libraries available that serve networking needs—both socket libraries and the Java.net libraries. There are also third-party protocol conversion libraries and CORBA and XML parsers available as open source components in Java. All of that eases the task's protocol conversion and processing information. ▮

Military Embedded Computer Market Fails to Reach 2004 Predictions

Despite best efforts, the military market failed to reach growth levels anticipated last year. While a small handful of programs were scrapped, most continue. However delivery dates continue to be pushed back and new programs are having development and production dates delayed even further.

Warren Andrews
Editorial Director

Each year, forecasting the market for embedded computers in the military and aerospace market becomes increasingly difficult. At about this time of year, the market usually looks rosy: design wins are booming, bookings are way ahead of billings and everything is right with the world. It looked that way in December of 2004, the last time we looked at the market. We predicted a solid 15% to 18%—or maybe higher—growth in the industry overall with some areas spiking up.

Instead, what we observed was a flat to slightly up market with some spikes, but nothing significant. When all the numbers are in next month, we expect growth to level out in the 7% to 10% area across the board. What happened? The story keeps getting repeated each year and as the actions in Afghanistan and Iraq continue to suck up funds earmarked for system development and upgrades. Meanwhile, natural disasters such as hurricanes Katrina and Wilma sap even more revenue from the government coffers. All that is causing programs to be trimmed or at best, stretched out. And fuel costs escalate further pinching budgets.

Figure 1

The V-22 Osprey tilt rotor aircraft is one of the projects that will remain funded for 2006. The budget appears to be favoring big-iron such as the V-22, F/A-22, F-35, DDX and other projects over other programs such as Future Combat Systems.

In addition, the Pentagon budget still hasn't (at the time of this writing) passed the final hurdle of legislative approval. Therefore, the military services have been limited to somewhat less than last year's appropriations until the new budget passes. The result has been that many programs have been pushed back even further than expected. Now that the current $450 billion budget looks like it's going to go through, there may be even more changes and push backs.

The new budget has retained a lot of "big-iron" projects including the DD(X) Navy destroyer program, a cut-back but still vibrant F/A-22 Raptor program, full speed ahead on all three versions of the F-35 JSF, full funding for the V-22 Osprey program (Figure 1), continued funding for a new carrier and a handful of others. One of the biggest programs to be cut was the Future Combat Systems (FCS), which is taking a $280 million haircut.

Then there's some $29 billion in the defense budget for Katrina relief (in the defense budget?), another $50 billion to Iraq and $8 billion in procurement to replace equipment worn out, broken or damaged. In addition, there's a 1% overall reduction in discretionary spending.

QDR

Further, the QDR (Quadrennial Defense Review) has yet to be heard from. And we expect that to be released early in January prior to the President's defense budget request that usually hits the street in February. At this time, it's not yet clear what will come out in the QDR. Some speculate that it will be a continuation of the past, looking for a sleeker, more responsive and smaller military; consistent with the actions we've had over the past several years in Bosnia, Afghanistan and Iraq. But others feel it might weigh more heavily in the direction of heavy weapons, looking at a possible threat from China. That could turn the budget more in the direction of new aircraft, land and sea vehicles.

However there is likely to remain a priority addressing the safety of troops. Therefore, it's expected that any new budgets will include an increase in the development and deployment of unmanned vehicles whether land- or air-based. In addition, there will be an increase in a broad spectrum of unmanned reconnaissance systems.

Also, as *COTS Journal* publisher, Pete Yeatman, pointed out in his Publisher's Notebook (December 2005), limited funds are also pushing more and more training from real exercises to simulation. That shift is happening for everything from flying and driving to maintenance and support. This was amply evidenced by the number of vendors and attendees at the annual I/ITSEC conference and expo in Orlando in November. Many traditional COTS embedded computer suppliers currently participate in this market, and as simulation technology continues to suck up more and more computer power, look for a new rash of embedded supercomputers to be prominent.

No one is exactly sure what all this means to the embedded-computer market. However, it's kind of axiomatic that if a lot of big dollars are spent on large new programs, there will be less available for smaller programs, older equipment upgrades and retrofits. The other side of that coin is that a lot of money going into these new programs is probably going to cancel some intermediate programs resulting in stretching the life—and therefore more upgrades—of older equipment. No telling.

But despite dire predictions from on high, the future actually remains bright for the embedded-computer industry in the military. All indications are that design wins and billings are up. Further, there are strong indications that some programs that have been delayed for as much as a year may start kicking in shortly after the first of the year.

One of the indicators in the market is the ratio of bookings—new orders booked—to billing—invoicing for material shipped. One deceptive part of this measure—and a part that makes business appear better than it is—is that as shipments fall off because of push backs or delays, new order bookings become a greater percentage of the billings.

While that is the case to some extent, the total revenue must be measured to get a complete picture. Figure 2 shows that the industry has grown at a modest rate in the area of 8% to 12% overall for the year. Therefore, with the two factors taken into account it's a safe assumption to predict at least some growth in 2006. As indicated in the projection in Figure 2, growth is expected to be in the 12% to 14% range for 2006. That said, we may be repeating the first paragraph next year.

As in the past, the upcoming QDR and Defense Appropriations Request from the President are not expected to have a major impact on current business. However, if it were to reflect a major decrease from that expected from the previous year, or if it severely threatened particular programs, such as FCS, it could cause some programs to be reduced in scope or prematurely shut down or be pushed back even further.

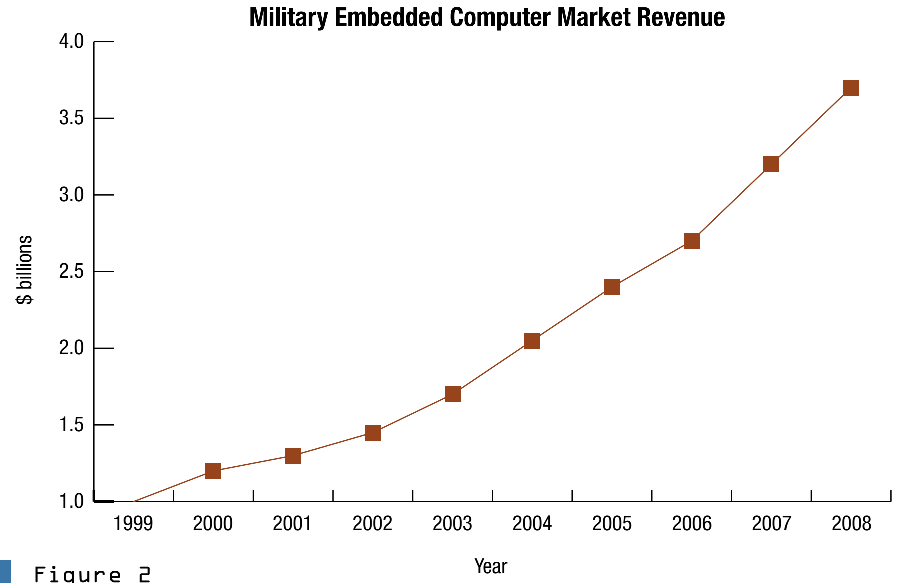


Figure 2

Sales of embedded computers in the military grew by approximately 10% for the year ended December 2005. This was significantly off from the 15% to 18% that was largely forecast at the beginning of the year. Current projections show a growth of 12% for 2006 as some of the projects that have been delayed are pushed up.

Industry Trends

And while the military's requirements continue to change, so does the technology to address these changes. VMEbus still remains the mainstay in many systems today and will probably continue to enjoy that position far into the future. Many systems don't require much more computer power than traditional VME 64, and the standard, upwardly compatible nature of the architecture allows for technology insertion along the life cycle of a program. For those applications requiring more horsepower, newer platforms are now becoming available including the upwardly compatible hybrid (parallel and switched fabric) VITA 41 (VXS) and the all-new, serial-switched fabric only VITA 36 (while developed by the VS0, this will not be considered "VME"). Both of these are expected to be designed into several programs over the next year.

Equally significant, however, are new generations of systems that may use some industry-standard form-factor as a backbone yet evolve as fully blown systems or subsystems. Many of these are designed for space- and weight-sensitive applications such as UAVs, where more powerful electronics packages are mandated but no (or very little) additional space or payload weight is budgeted. Typical installations are on unmanned aerial vehicles for both surveillance and tactical applications. Other field-deployable systems and land vehicle applications are also prominent.

Many of these newer systems and subsystems are based on PC/104, 3U CompactPCI or other small form-factor standards because of the need for compact size, low power dissipation and low weight. In fact, only a few years ago the PC/104 community didn't know how to spell "military" and now it's estimated that more than $25 million dollars worth of PC/104 hardware is in everything from tanks to UAVs and high-performance aircraft. Such systems vary in complexity from full-blown control and communications

packages to sophisticated vision systems to stand-alone, single application computers used for such things as checking to see that ordinance is properly released from an aircraft. And it's reported that the numbers are growing in the small-form-factor business.

Integrated Systems

There is a move on the part of prime contractors toward purchasing more integrated systems instead of components or boards. Part of the move toward more integrated systems is driven by the technology and external needs of the prime contractors and the military. Increasingly prime contractors are looking for complete and tested solutions and no longer want to be systems integrators at the board level.

In the past, primes would look for boards that provided the functionality they required and then integrate them into a finished system. Today, it's more likely a prime will go to a supplier with a total system or subsystem requirement including packaging and cooling.

Whether the demands of primes came first, or a change in business structure of companies providing embedded computers led, is not clear. However, many leading suppliers of COTS embedded computers have grown through the acquisition of other companies that provide compatible products and make it possible to provide more of the components of a system, therefore increasing the total sale and hopefully the margin. In many cases, such vendors provide a "black box" complete with operating system and sometimes even work directly with primes or other subcontractors in integrating the applications software.

Over the past several years, hopes were high for a major watershed in the military embedded-computer market. However, the market grew as many anticipated and in some cases even slower because programs and deployment had been delayed. And now that it looks as if many of the roadblocks are being lifted, other clouds are moving in such as a reduction in the budget of both the DoD and the country as a whole, and the need to allocate funds to other projects.

At the bottom line, the industry is likely to grow by as much as 12% in 2006, but nowhere near the 20% to 22% that the industry was looking at only a few years ago. And, as far as we can see ahead, growth is going to be somewhat hard to come by. That said, there will undoubtedly be growth in the number of embedded computers in the military though probably at somewhat lower ASPs. And, because of the resultant shift in technology and architecture, companies that can stay on the leading edge are expected to outdistance the pack while traditional suppliers are likely to fall back. ▮

Loosely Coupled Scheme Eases Marriage of Graphics and Sensor Video

By separating display and application processing, loosely coupled imaging platforms provide systems integrators with flexible video and graphics display capabilities. The approach makes for easier system configuration.

David Johnson, Product Development Director
Curtiss-Wright Controls Embedded Computing

A blend of graphics and real-time video together are key elements of many military and C4ISR programs including naval consoles, rugged vehicles, UAV ground stations and airborne command and control (Figure 1). Such applications demand an integrated video display architecture that allows graphics and sensor data to be displayed with flexible mixing, and must support sensor inputs from digital and legacy analog sources.

A modern military command and control display system typically combines the graphical elements of a user-interface with the need for complex mapping and real-time sensor display. Sensor data may arrive through a legacy analog interface to provide compatibility with existing sensors, but increasingly arrives at the display processor in a digital format over a network or high-speed data link.

Figure 1

Combined support for graphics and real-time video is a critical part of many military and C4ISR programs including those aboard rugged vehicles. Shown here, a soldier locates checkpoints on the computer screen inside a Stryker vehicle during a convoy exercise at the Joint Readiness Center in Fort Polk, LA. (U.S. Army photo).

Fusion of Data Sources

The method of displaying the real-time sensor video depends on the sensor type, but one common feature is the need to present a combination of sensor video and graphics, where the display processor is responsible for the fusion of one or more data sources. In the simplest scenario, the graphics simply overlay the real-time video, and in more complex situations, multiple sources of graphics and real-time data may need to be fused with a combination of mixing, blending and switching.

For example, in situations where real-time video (from a camera) is presented in a window, a graphics overlay is provided for symbology or telemetry information that relates to the video content. The graphics content is relatively simple so as not to obscure the underlying video, but it may be updated at the frame rate of the video.

In more complex scenarios, the graphics may need to be displayed both as an underlay and overlay to the video. A typical example of this is the presentation of radar video with an underlay map or chart. The objective of this display mode is to present the radar as a semi-transparent overlay to the map, allowing the intensity of the radar video to affect the appearance of the map, effectively achieving a color blend of the two display components. Furthermore, it is still required to overlay some graphics on top of the combined radar plus underlay, achieving a three-layer display presentation.

A further, and yet more complex scenario, involves video mixing with graphics overlay. For example, two co-registered real-time video signals may need to be combined into a single display window, such as when the two video sources are showing optical and infrared images of a scene. Again, it is likely that a graphics overlay would be required to provide context or telemetry data.

Board-Level Solutions

A variety of graphics cards for display processing are available off-the-shelf. These are commonly offered in the PMC form-factor for military programs, and provide a compact and standardized format that integrates as a mezzanine card into VME or Compact PCI architectures. These cards typically provide standardized interfaces for software based on X Windows and Open GL programming interfaces, utilizing the host processor on the base card to support the driver software. The adoption of a standard graphics library for the application software ensures that, in principle at least, the graphics solution can be upgraded at some time in the future with minimal impact on the expensively qualified application code.

In practice, the PMC graphics card generally offers limited capabilities for sophisticated display processing. The best of the bunch provide support for a wide range of analog sensor types from RS170, STANAG 3350 and non-interlaced RGB, but the subsequent presentation of the video with the graphics is limited to overlay, and the number of simultaneously displayed sensor signals is seldom more than one.

The integration of a PMC module onto a 3U or 6U processor baseboard is often an ideal solution for display requirements that require high-performance graphics overlaying a single video window. The current generation of PMC cards integrates high-performance graphics processors with video capture and windowing.

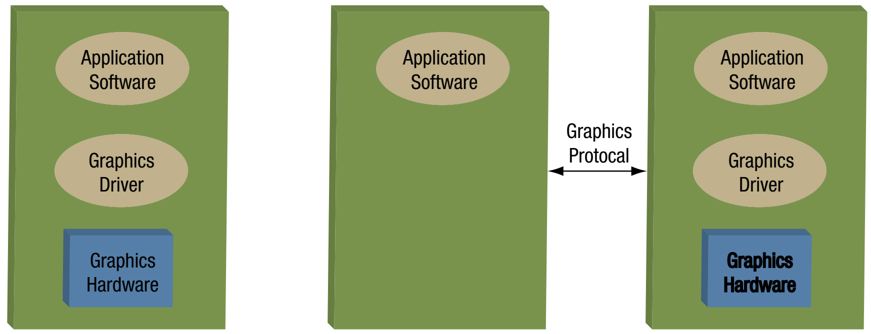


Figure 2

An imaging platform can either incorporate application software and display software on a single integrated card (left) or else separate the two functions across two processors using a standard graphics protocol as the communications link.

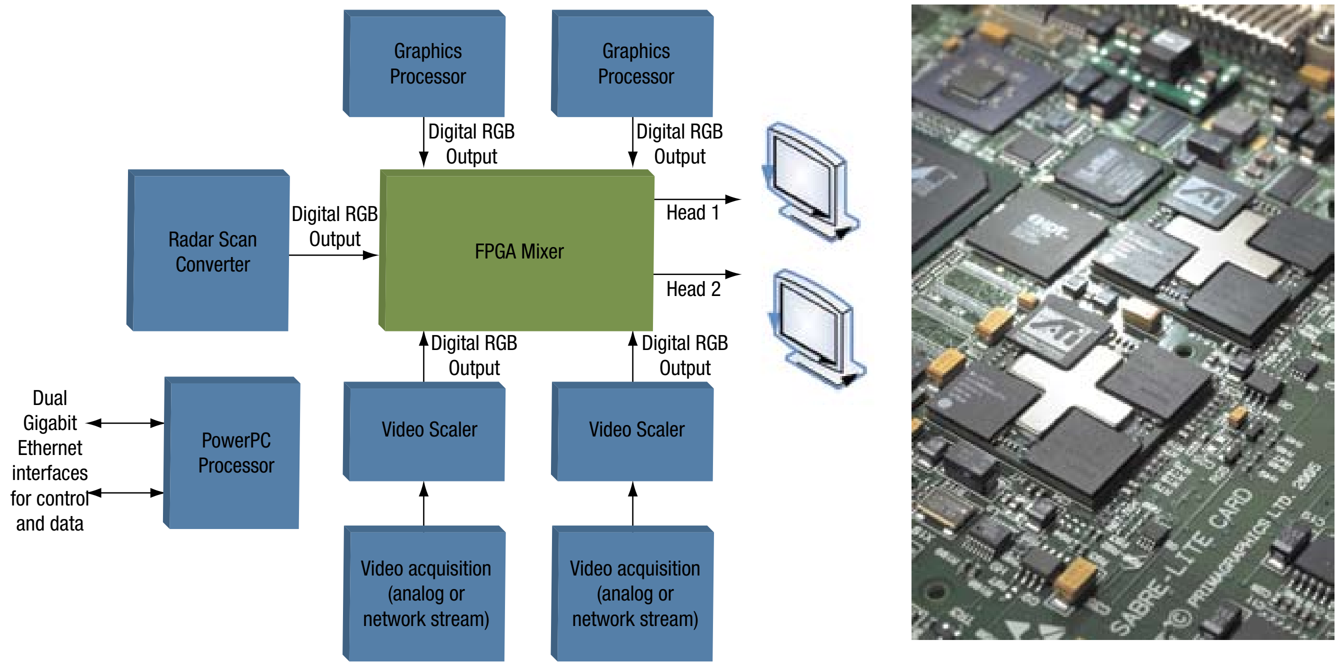
Loose Coupling for Technology Insertion

An alternative architecture to the PMC solution is to devote a full card—VME or Compact PCI—to the graphics and imaging function, coupling the graphics and video display more closely to the processor. Two architectural options then present themselves (Figure 2). Either the architecture could assume a separate host processor to run application software, communicating to the dedicated display processor over a network or backplane, or alternatively, the architecture could assume that the display processor is the sole processor, supporting both the application software and the display driver.

In the single processor configuration the solution tightly couples the application processor and the graphics subsystem. All software, including the display driver, runs on the single processor and resources must be apportioned between the needs of the application and the display function. Furthermore, the single board solution needs to balance the requirements of the processor sub-system, including all its input-output, with the needs of the imaging system. A single-slot solution may not meet all the requirements.

In the split configuration, the solution requires more slots, likely consumes more power and may be more expensive. However, it offers the significant benefits of cleanly separating the application processor from the display processor, as well as providing more board space to be dedicated to the display function.

Furthermore, the separation of the processing from the display function offers important benefits to system integrators. The display processor becomes an entirely self-contained solution that incorporates a local processor with a well-defined control interface to the application. The activities of the application processor are then decoupled from those of the display processor, minimizing the interaction and pro-



a b

Figure 3

Shown here (a) is a display processor architecture that combines graphics and video processing and associated drivers onto an embedded product. Application software runs on a separate processor connected over a VME bus, PCI bus or Ethernet. Curtiss-Wright's Sabre (b) board offers such a architecture. The card incorporates a mid-range IBM PowerPC processor and dual high-performance ATI M9 graphics chips, providing a total of four display heads.

viding more deterministic performance.

Since the display driver is entirely encapsulated on the display processor card, any changes to the application processor require no porting of the display driver, thereby minimizing non-recurring engineering (NRE) expenses. This loose-coupled approach provides a convenient break point for system upgrades, allowing technology insertions of enhanced processing or display modules with minimal impact on each other.

To summarize, system integrators have three architectural choices for a video and graphics display solution:

1. PMC module on application processor card
2. Integrated Imaging Platform with application and display processor on a single card
3. Loose-coupled imaging platform, with separate application processor and display processor

There is no best architecture for a display solution, and vendors like Curtiss-Wright and others have products to meet all three approaches. But the choice will ultimately come down to a customer's priorities. A compact PMC solution tightly integrated with a high-performance, feature-rich processor will provide the best solution for many graphics and video applications. However, for complex requirements that demand multiple channels of high-resolution video to be combined with underlay and overlay graphics, the solution will be different. While the integrated imaging platform offers a single-card solution, the advantages of the loose-coupled imaging platform—albeit requiring two slots to accommodate the application and display processors—is justified for many specialist command and control solutions.

Two Module Architecture

By separating the application and display processors into two modules, the design of the display processor can focus entirely on the provision of capabilities that support high-resolution graphics, multi-channels of video capture and sophisticated video combining modes to meet the display requirements presented earlier. With the entire display driver encapsulated in the display processor, there is no dependency on the application processor for a display driver, or any impact on the graphics performance from activities of the application processor. This makes it easier to control resource utilization, eliminating any possibility that an acceptable level of graphics performance is achieved at the expense of stealing CPU cycles from the application processor—a common difficulty with a PMC-based solution sharing the application processor.

The interface between the application and display processors uses standard X Windows protocol for graphics. This ensures that the display processor could be easily upgraded or replaced with minimal impact on the application program. It even opens up the possibility that the application program could be running on a remote server with the display processor becoming a stand-alone network node, receiving graphics requests over a gigabit Ethernet. Going further, the display processor can then be integrated with the display itself, replacing the console electronics with an intelligent display terminal.

A display processor architecture based on these principles has been implemented by Curtiss-Wright for its new Sabre COTS imaging platform shown in Figure 3. The solution incorporates a mid-range IBM PowerPC processor and dual high-performance ATI M9 graphics chips, providing a total of four display heads. Although the graphics chips themselves have a video input port to support the insertion of real-time video in a graphics window, more flexibility and higher performance is attained by using a separate video processing approach that mixes the video with the graphics outside of the graphics chip. Dual video capture and video scaling processors support the input of analog video from RS170 through to 1600 x 1200 resolution. This video is scaled by a dedicated scaling processor, eliminating the contention for bandwidth that could occur if it were routed through the graphics processors.

A high-performance FPGA is responsible for combining the graphics inputs, video input and optionally scan-converted radar video arriving through the PMC site. The FPGA offers considerable flexibility to support, as standard, all the display processing modes identified earlier in the article, including multilayer graphics, video cross-mixing, video overlays and alpha-blended radar. The final output is through two independent display heads operating at any programmable resolution up to 1600 x 1200. The mixing of the graphics inputs interprets the inputs as either underlay or overlay, with the FPGA providing different data options to combine the different video layers. For complete flexibility, the FPGA may even be reprogrammed for special mixing requirements

Balancing Performance and Flexibility

Display solutions can be provided by PMC graphics and video capture modules married with single board computers. However, for specialist applications that demand multiple channels of sensor data combined with multilayer graphics, an imaging platform architecture offers a number of benefits. Although the application processor can be closely coupled with the graphics subsystem in a single card solution, more flexibility is provided by a dedicated single board display processor that is loosely coupled to a separate application processor. With a network-based architecture, both control and sensor input can be provided over a high-speed LAN connection, offering the potential to move all signal acquisition into a centralized server and leaving the display processing to a network node.

Systems integrators developing complex video and graphics display systems in today's network-centric market want to balance performance and flexibility with long-term support. They also want to reduce non-recurring engineering (NRE) expenses and to minimize obsolescence over the 10 to 20-year life of the system. This loosely coupled imaging platform provides exactly that without locking the customer in to a single supplier, graphics technology or processor.

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

Rugged Displays Suit Up for Challenging Environments

A number of design issues come into play when outfitting a display system for harsh environment applications. Complex tradeoffs drive the choices between tailored designs and standard integrated solutions.

David Lippincott, Chief Technologist
Chassis Plans

Designing military computing systems for field deployment within potentially harsh environments presents a number of challenges. Among those are high and low ambient temperatures, dust, moisture, vibration, shock and the inevitable risk of abuse by users who are operating under pressure-packed conditions. These challenges can be especially difficult when designing the displays and keyboards that provide critical user interface functions and also are exposed to the greatest risk of damage. Rugged displays are engineered inside and out for the intended environment to survive natural and human-caused events. A rackmount display engineered for a controlled datacenter environment, for example, will not survive the rigors of the battlefield

For instance, an entire rackmount system with user interface might be packed into the back of a four-wheel-drive or tracked vehicle and subjected to jarring rides across a dusty desert to set up in remote locations dictated by the mission. Other systems may need to function within airborne or shipboard environments that present additional challenges of shock, ambient temperature swings, atmospheric pressure variations and/or exposure to moisture. In some situations, the systems need to be quickly booted up at remote sites or operational while on the move—like in a Humvee-based communications center, for example (Figure 1).

Even in relatively benign environments such as command centers, displays and keyboards need to be designed to withstand the "human factor" such as spilled coffee or water, which can cause a catastrophic failure for an unsealed keyboard assembly. The most carefully controlled command center in the current combat arena is still a severe environment as compared to the worst civilian installation.

Integrated Approach

In any of these environments, it can be very helpful to have rackmount displays and keyboard assemblies that slide away into the rack, both to save space and to protect the display and keyboard when not in use. Integrating the keyboard and display together also allows for efficient, simplified servicing by providing a single field-replaceable unit that can be easily swapped out if necessary. Rack space can be expensive or not available so the thinnest 1U display/keyboard is often the only option.

Figure 1

Many rugged display systems require the ability to be quickly booted up at remote sites or to be operational while on the move—like in this Humvee-based communications center, for example.

Figure 2

This integrated display/keyboard assembly from Chassis Plans starts with a NEMA-4-compliant, optically bonded and sealed 17" display with NEMA-4-compliant keyboard, which are integrated together in a short-depth clam-shell design, 1U high, primarily for transit case and vehicle installation.

Figure 3

This system employs telescoping rear arms to extend the display up to 36 inches, and optional transit case arms allow the same basic unit to be adapted for compact transit case applications. The basic rackmount unit is only 17 inches deep and supports three different arm lengths. The short arms are used for the 17-inch depth and the telescoping long arms provide the 36-inch depth.

A number of key environmental specifications and Mil-Spec standards should be kept in mind when designing a rackmount display/keyboard assembly for field deployments. These include:

- MIL-STD 187-1 (vibration)
- MIL-STD 901d Class A (shock, hammer and barge test)
- MIL-STD 810C (non-operating temperature)
- MIL-STD 810F (environmental testing, shock, vibration, humidity, blowing dust, rain, salt fog, temperature, thermal shock)
- MIL-STD 461D (EMI)
- MIL-STD 2036A (shipboard motion)
- MIL-HDBK 188 (communications systems design)
- NEMA-4 & IPC-65 (sealing for enclosure protection and user safety)

Although full compliance with all of the above standards may not be required for every application, designers should be familiar with these and other applicable specifications in order to meet required system survivability objectives while balancing overall cost and performance goals for equipment.

It is also important to address overall system design issues as they relate to the display. For example, LCD screens have a tendency to experience performance degradation (slower responsiveness) at low operating temperatures, so some system designs specifically provide for heating the display during operation. High-temperature operation typically presents an engineering challenge to manage heat in the enclosure and component temperature limits.

Other key application-specific considerations for displays include a variety of ambient lighting conditions and viewing angle, ranging from sunlight readability to darkened conditions using night-vision goggles. In addition, physical space is almost always at a premium in field deployment environments, with a growing demand for maximizing the screen space that can be leveraged into a 1U or 2U amount of rack space and/or fit into a ruggedized transit case. Battle conditions require more information to be presented to the war fighters. Screen resolution is directly related to available information so higher screen resolutions and sizes have become a prime consideration in system design. Trading off against larger displays is the requirement for transportability (weight) and installed depth for transit case applications.

Ruggedized Solutions

In many cases, system designers are turning to suppliers that can provide ruggedized display solutions, which can deliver the required performance and flexibility to be adapted for use in a wide range of operating conditions and functional requirements.

For example, the integrated display/keyboard assembly in Figure 2 starts with a NEMA-4-compliant, optically bonded and sealed 17” display with NEMA-4-compliant keyboard, which are integrated together in a short-depth clam-shell design, 1U high, primarily for transit case and vehicle installation. An available option includes an optically bonded safety/filter glass for enhanced display protection and superior daylight viewability. Touch screens can also be provided depending on mission requirements.

Clam-Shell Design

The clam-shell design is held open with two high-torque hinges that provide stability for easily positioning the display at a variety of viewing angles for both static and moving vehicle operation. Rugged ball bearing slides and integrated mounting brackets allow the assembly to be easily secured into any standard 19” rack and provide quick setup for operation and/or storage for transport. The drawer is held closed by either a keyed cam-lock or optional thumb screws.

Telescoping rear arms provide the flexibility to extend the display up to 36 inches, and optional transit case arms (Figure 3) allow the same basic unit to be adapted for compact transit case applications. The basic rackmount unit is only 17 inches deep and has three different arms (short, regular and long). The short arms are used for the 17-inch depth and the telescoping long arms provide the 36-inch depth.

Designed for use in a variety of ambient light conditions, the SXGA 1280 x 1024 monitor provides high-contrast, sunlight viewability and low-light performance. The keyboard backlight also has five levels of adjustability, allowing for use with night goggles. Large On Screen Display (OSD) buttons and the pressure-sensitive keyboard pointing device accommodate easy operation, even if the user is wearing gloves or protective gear, and they are also watertight to protect the unit during usage in moisture and dust-intensive operating conditions.

Unique Challenges

While the fundamental issues of ruggedized display design apply across a wide range of applications and operating environments, every application presents a unique mix of specific implementation challenges. The demands of diverse mission-critical programs cannot be handled by a simplistic “one-size-fits-all” approach; nor is it practical to mount a new “from-the-ground-up” design for each new application. The most cost-effective solution is to select both product solutions and vendor relationships that can span a wide range of requirements and support custom-tailoring wherever needed.

Ultimately, the overall goal of any ruggedized system design is to leverage core engineering expertise and product features, while combining optimal performance, reliability and survivability within acceptable cost parameters. By starting with a ruggedized display/keyboard assembly that is designed to meet the key MIL-STD and NEMA requirements while providing a high level of adaptability and configurability, system designs can tailor the specific design to meet both their environmental and budgetary objectives. ▮▮

Chassis Plans
San Diego, CA.
(858) 571-4330.
[www.chassisplans.com].

PC/104 SBCs Soar in Small Spaces

With two decades now under its belt, PC/104 shows few signs of age. For space-constrained military designs, it continues to win mindshare.

Jeff Child, Editor-in-Chief

With its blend of compact size and inherent ruggedness, PC/104 continues to gain fans in the military realm. Factors driving its acceptance are many. PC/104 fills a key niche in embedded applications—such as aboard aircraft (Figure 1) and inside missiles—where backplanes won't fit or are otherwise impractical. Its small size makes it naturally a sturdier mechanical option than the larger standard form-factors. And finally, the PC/104 community has kept its eye ever on the trailing edge of desktop PC technology. As a result, PC/104 developers enjoy the luxury of integrating chip and system architecture solutions that have first matured in the desktop realm.

By leveraging the PC as the core foundation of PC/104, PC/104 board developers are able to leverage all facets of the PC infrastructure. That infrastructure includes more than just bus timing or packaging. PC-compatibility brings with it an ability to leverage all the components that go into a PC system including the CPU family, DMA, interrupts, timing, serial ports, network interfaces, video and disk storage.

Simplicity is part of PC/104's appeal. PC/104 is essentially a repackaged, modular version of the PC. A PC/104 module is an ISA bus board reduced to 3.6 x 3.8 inches (90 x 96 mm), which is approximately the size of a 3.5-inch diskette. PC/104-Plus implements PCI on a stackable board that maintains the 3.6 x 3.8-inch form-factor. PC/104-Plus modules can also include original PC/104 connectors to allow the most system configuration flexibility.

In the Footsteps of the PC

Following in the footsteps of the PC, PC/104 has embraced the same I/O and bus technologies that have proven themselves. Because USB, for example, is common in the core logic chip sets, PC/104 SBCs get USB for free. System designers are getting more saavy about making use of USB for high data rate serial I/O needs. As the "PC/104 SBCs Roundup" on the next few pages shows, USB has become entrenched as a key feature in today's crop of PC/104 SBCs.

Meanwhile, PCI Express has moved into the desktop space, but not directly into the PC/104 form-factor. Instead PCI Express has been married to PC/104's larger and younger cousin, the EPIC form-factor. In September, the same group of five embedded SBC manufacturers that created the EPIC form-factor announced the publication of the EPIC Express Specification, which adds high-bandwidth PCI Express I/O expansion to EPIC form-factor SBCs without sacrificing support for legacy PC I/O. The specification defines the EPIC SBC interface as well as the mechanical layout, connectors and pin definitions for EPIC Express I/O Expansion cards. The PCI Express interface itself consists of a high-performance connector and design rules to support up to four EPIC Express I/O expansion cards with up to six total PCI Express devices in a unique stacking configuration.

Figure 1

PC/104 was used in the External Bus Monitoring (EBM) device designed for the Communication Navigation and Identification (CNI) system of the F/A-22. Mounted within a enclosure, developed by Parvus, that meets military mounting specification MS25212, the PC/104-based unit incorporated an x86 CPU, high efficiency power supply, dual 1553 bus interface, embedded audio card and dual PC/104 stack motherboard.

The specification accomplishes this without terminating support for legacy PC devices and buses that are used pervasively in embedded applications. The original EPIC Specification is now administered by the PC/104 Embedded Consortium, and the developers of EPIC Express intend to submit the new specification to the Consortium by the end of 2005. EPIC-compatible SBCs are supplied by over a dozen manufacturers today and the form-factor is expected to dominate the small form-factor SBC market by the end of the decade.

PC/104 Embedded Consortium
San Francisco, CA.
(415) 243-2104.
[www.pc104.org].

Technology Focus:

PC/104 SBCs Roundup

1 GHz Eden-based Board Offers Upgrade Solution

Choosing the SBC for a military design has long-term implications. Not only does the right level of cost and performance have to be considered, but also the long-term availability and upgrade options for the components onboard. With those issues in mind, Ampro Computers offers its CoreModule 550, a low-cost migration path from 486-based PC/104 boards as well as an ideal replacement for

end-of-life modules using AMD Geode or Transmeta processors. The CoreModule 550 offers a choice of proven, long-life 300 MHz Via Eden ESP 3000 or 1 GHz Eden ESP 10000 processors.

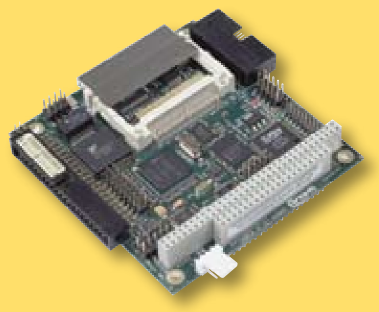
It includes popular embedded features such as 10/100BaseT Ethernet port, two RS-232/422/485 ports, USB, onboard CompactFlash socket, PC/104-Plus expansion, soldered RAM for better vibration resistance than SODIMM sockets, CRT and flat panel video with AGP4x performance, and Ampro BIOS extensions. In addition to resistance to shock and vibration, the CoreModule 550 features fanless reliability with a standard operating temperature of 0° to +70°C and extended operation from -40° to +85°C.

Enhancements added by Ampro include USB Boot, battery-free boot (in case the battery for CMOS settings fails or is not installed for harsh environments), watchdog timer, serial console and BIOS recovery. Unlike the Via C3 processors that are rated up to 15W and require a cooling fan, the Via Eden ESP processors selected by Ampro for CoreModule 550 have ratings below 7W, making them a much better choice for high-reliability applications. Prices start at the mid-$300s in production quantities.

Ampro Computers
San Jose, CA.
(408) 360-0200.
[www.ampro.com].

400 MHz ARM SBC Draws a Mere 1.9W

Mobile and portable military applications typically call for a pretty stingy power budget. For such needs, the compact PC/104 form-factor and the ultra low-power XScale ARM processor together are a marriage made in heaven. Arcom's VIPER is an ultra low-power PC/104 compatible single board computer based on the Intel 400 MHz PXA255 XScale RISC processor. The PXA255 is an implementation of the ARM-compliant, Intel XScale microarchitecture combined with a comprehensive set of integrated peripherals including a flat panel graphics controller, DMA controller, interrupt controller, rea- time clock and multiple serial ports. The VIPER board offers a long list of features making it ideal for power-sensitive embedded applications. The board has been designed to take advantage of the power-saving modes of the PXA255 processor and other onboard peripherals to achieve a typical power consumption of 1.9W.

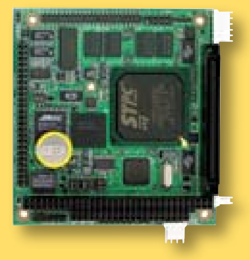


The VIPER is supported with Development Kits for the leading embedded operating systems including Windows CE .NET, embedded Linux and VxWorks 5.5. Arcom also provides support for RedBoot, a utility based on the eCos RTOS, which serves as a simple boot manager and download tool for embedded Linux applications. The board includes a TFT/STN flat panel graphics controller, onboard soldered SDRAM and resident flash—up to 64 Mbytes SDRAM, 32 Mbytes of flash and 256 Kbytes SRAM. Also onboard is 10/100baseTx Ethernet, five serial ports, dual USB host controller, USB client, AC97 audio/codec, CompactFlash interface and a standard PC/104 bus expansion connector. Prices start at $380 in small OEM quantities.

Arcom
Overland Park, KS.
(888) 941-2224.
[www.arcom.com].

Board Blends CPU and Data Acquisition

What comes next after you can integrate all the functions of a computer into a compact PC/104 form-factor? Blend it with the functionality that used to require its own card—like data acquisition. Diamond Systems did just that with their Elektra board. Elektra



integrates a Pentium-II class CPU running at 200 MHz, 128 Mbytes of memory, Ethernet and a professional-quality analog and digital I/O circuit with autocalibration onto a single PC/104 board. Linux, DOS, QNX and Windows CE operating systems are supported. Elektra consumes only 5.5W and operates over the -40° to +85°C extended temperature range without a fan.

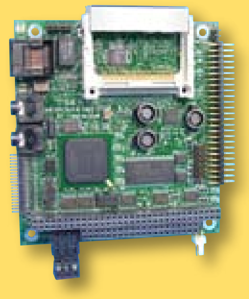
Elektra's built-in data acquisition circuit provides high-accuracy, stable A/D performance with 16-bit resolution and programmable input ranges. A 512 sample FIFO and onboard programmable timer enable error-free 100 kHz A/D sampling rate in any operating system. It includes four 12-bit D/A channels, 24 programmable digital I/O lines and two programmable counter/timers. The built-in autocalibration circuitry provides enhanced accuracy for analog measurements, reducing errors by a factor of 10 over competitors' manually calibrated boards.

Two configurations are available for Elektra: Model ELK200-EA-XT includes CPU plus data acquisition, while model ELK200-E-XT is the lower-cost CPU-only configuration. Both versions include four RS-232 ports, two USB 1.1 ports with USB floppy support, 10/100 Mbit/s Ethernet, PS/2 keyboard/mouse, parallel and IDE ports, programmable watchdog timer and onboard backup battery for real-time clock and BIOS settings. In quantities under 10, the ELK200-EA-XT is priced at $750, while the ELK200-E-XT is $450. Volume discounts apply when purchasing 10 or more units. Both models are available now.

Diamond Systems
Newark, CA.
(510) 456-7800.
[www.diamondsystems.com].

ARM-based SBC Boasts Multimedia Features

As the U.S. Military moves its Net-Centric Warfare strategy into high gear, the drive is on to more supplicated human-machine interface displays. That calls for integrated graphics and video capabilities blended together in compact embedded solutions. Case in point is the SBC1670 from Micro/sys, which combines a flat panel display interface with a fast, yet low-power ARM processor in a PC/104 footprint. Operating at temps from -40° to +85°C, the board has multimedia capabilities, which include support for an 800 x 600 color flat panel display, audio output and debounced



keypad input. This allows implementation of sophisticated, feature-rich control panels with fewer peripheral boards required.

In addition to its multimedia features, the SBC1670 also features five serial ports and a 10/100BASE-T Ethernet controller to handle a variety of communication needs. Four of the serial ports have RS232 transceivers, while the remaining serial port is configured for RS485 communication.

At the heart of the SBC1670 is the 524 MHz Intel PXA270 processor, 128 Mbytes of SDRAM and a 64 Mbyte resident flash array. The SBC1670 can boot Linux, Windows CE and VxWorks from its onboard flash. If more I/O is needed, the SBC1670 allows expansion through its CompactFlash socket, which supports storage devices and I/O devices. The SBC1670 has a 16-bit PC/104 bus interface, which allows access to numerous off-the-shelf boards such as modems, analog I/O or digital I/O. The basic SBC1670 starts at $495 in single quantity. An industrial temperature (-40° to +85°C) version is also available starting at $575.

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

Geode GX1 SBC Provides Boot-Failure Protection

There are many ways that an embedded board can fail. So, for mission-critical applications, the more features onboard designed to avoid such problems, the better. Along such lines, Octagon Systems offers a rugged, PC/104 SBC, called the 2060, that avoids the common boot-failure from a depleted CMOS battery by storing an image in serial EEPROM, minimizing downtime and service calls. The serial ports and the parallel port have back-drive protection. Designed to operate from -40° to 85°C, the 2060 is a low-cost, low-power, Pentium II performance SBC designed for high-performance, embedded applications. Its CPU is an AMD Geode GX1 CPU with CS5530A companion chip. Clock speed is 233 or 300 MHz, jumper selectable. In addition to the two serial ports and the standard PC I/O, the 2060 has two USB ports, digital I/O, onboard video and a CompactFlash socket for bootable and removable memory to 2 Gbytes. The CompactFlash requires no drivers and is available with board support packages for popular operating systems. The 2060 is a cost-effective, high-performance PC/104 USB engine for a variety of embedded applications.

The 2060's two USB ports and onboard video support give users a unique combination of capabilities due to the wide variety of low-cost USB devices available with built-in, flat

panel support. An on board video controller for CRT or TFT flat panels is also included. The card also has over-voltage and reverse voltage protection. Board support packages, Octagon's OS Embedder kits, are available for Linux 2.6, QNX and DOS. The watchdog timer is programmable from 2 ms to 120 seconds. The 2060 is priced at $395 for quantities under 20.

Octagon Systems
Westminster, CO.
(303) 430-1500.
[www.octagonsystems.com].

Trio of Fanless Processor Boards Support Extended Temps

PC/104's compact form-factor gives it a leg up with inherent ruggedness. But there are numerous ways to provide an extra level of ruggedization. Exemplifying that strategy, Parvus offers a family of three ruggedized 800 MHz Pentium III-based embedded processor boards—the SpacePC 1460, 1461 and 1463. Based on a true Intel architecture, the new SpacePC 146X family combines an 800 MHz ULV Pentium III processor with an Intel 815E

chipset and a powerful combination of high-speed peripherals. The three models include the SpacePC CPU-1460, which includes standard embedded PC peripheral devices, the SpacePC CPU-1461, which supports up to 8 USB devices (6 of which are high-speed USB 2.0-compliant) and the SpacePC CPU-1463 (shown), which features dual network controllers, including a Gigabit Ethernet interface and a 10/100 Ethernet controller. The new CPU-146X series boards integrate 256 Mbytes of RAM soldered directly onto the boards.

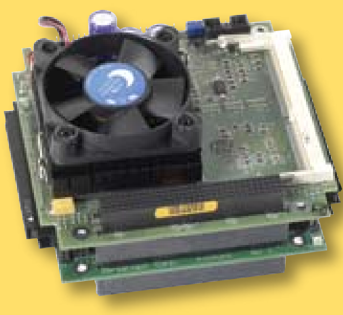
Similar to Parvus' 400 MHz Celeron SpacePC 145X boards, these new Pentium III models incorporate a flat, aluminum heat spreader plate on top of the processor boards so that sealed embedded systems can reliability operate from -40° to +85°C without a fan. This thermal interface plate provides a smooth surface designed for structural heatsinking—to be mounted in direct contact with a conductive gap pad and the wall of the enclosure, a traditional heatsink, or other thermal management device. The new CPU-146X models are now in stock and priced from $1,023 to $1,253/each in quantity of 100+ units.

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

Two-Board Stack Delivers 850 MHz Pentium III Processing

For their size, PC/104 boards offer a lot processing muscle in a compact space. One way to squeeze even more processing capability out of the same footprint is to implement the CPU in a two-board stack. That's what VersaLogic did with their Jaguar PC/104-Plus SBC. The Jaguar is designed for projects requiring fast processing, compact size, flexible memory options, high reliability and long-term availability. The compact two-board set is fully compatible with a wide selection of popular operating systems, including most Windows and Real Time OSs.

The Jaguar features full socket 370 compatibility, which supports a number of Celeron and Pentium III CPUs, with speeds up to 850 MHz. See the Ordering Information section for the models available. It also features the ATI Rage Mobility video processor for high-speed rendering, with standard CRT and LVDS interface. Fast Ethernet (10/100) and USB ports are also included.



Up to 256 Mbytes of low-power system RAM can be used in the high-reliability latching 144-pin SODIMM socket. Additional features include DiskOnChip support, 128 to 256 Kbyte level 2 cache, watchdog timer and Vcc sensing reset circuit. Standard I/O ports include floppy, keyboard, PS/2 mouse, PCI-based IDE, LPT and two COM (one RS-232/422/485 selectable).

The high-reliability design and construction of this board features Transient Voltage Suppressors (TVS) on user I/O ports for enhanced ESD protection, latching I/O connectors, low EMI clock generation, industrial long-life battery and self-resetting fuse on the 5V supply to the keyboard, mouse and USB ports.

VersaLogic
Eugene, OR.
(541) 485-8575.
[www.versalogic.com].

AMD SC520-based Card Has Onboard Ethernet Link

Ethernet has grown to become a dependable ally for military system designers. And it's not only the embedded board large form-factors that have embraced it. It's now available on PC/104 as well. An example is WinSystems' PCM-SC520, a PC/104-compatible single board computer (SBC) based upon the low-power, high-integration AMD SC520 CPU. Included on the PCM-SC520 module are 4 serial COM ports and a 10/100 Ethernet controller. It measures 3.6 x 3.8 in. (90 x 96 mm) and will run x86-compatible software for space- and power-limited embedded designs over an extended temperature range of -40° to +85°C.

The board is based upon the AMD Elan SC520 processor that combines a 32-bit, low-voltage, 133 MHz AM5x86 CPU with a complete set of integrated peripherals that are PC/AT-compatible. The PCM-SC520 supports up to 256 Mbytes of SDRAM. It is field-upgradeable since it is mounted in a standard SODIMM socket; however, it can be ordered with soldered-down SDRAM for high shock and vibration applications. Either a Compact Flash card or a DiskOnChip Flash memory device can be installed for solid-state disk (SSD) storage of up to 1 Gbyte. This SSD solution is a viable alternative for fragile floppy and hard disk drives in harsh environmental applications.

The onboard Intel 82559ER integrated Ethernet controller has a 32-bit PCI interface and supports 10 and 100 Mbit/s data transfers in both full- and half-duplex modes. Four 16C550-compatible UARTs support RS-232 serial data communication up to 115,200 bits per second. The board is priced at $399.

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

Need More Bandwidth

For Networked Enabled Warfare?

Turn to DDC for a broad range of products and capabilities that include Gigabit Ethernet, High Performance 1553, and Fibre Channel. DDC COTS solutions are designed and manufactured to military specifications. Contact DDC for a complete list of products for your networking needs.

DDC is your Data Networking Solution

- MIL-STD-1553 COTS Boards and Components
- Fibre Channel
- Gigabit Ethernet
- High Performance 1553
- High Speed 1760
- Enhanced Bit Rate (EBR)
- Miniature Munitions Stores Interface (MMSI)

Toll Free: 1-800-DDC-5757 **Web: www.ddc-web.com** **E-mail: info@ddc-web.com**

DDC®
®Data Device Corporation
ISO 9001:2000 REGISTERED

SDR Development Platform Uses TI DSPs

Developers of two-way communication radios need the versatility to produce a broad range of radio and waveform applications for military and public safety radios and high-speed data acquisition systems. A new software defined radio development platform from Sundance uses Texas Instruments' DSPs to provide a flexible rapid-prototyping solution.

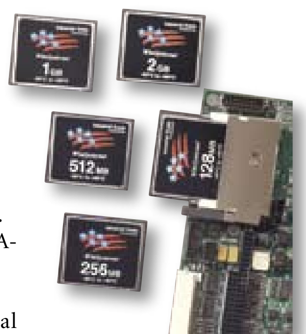
The Sundance SMT8096 platform lets engineers design radios that can be easily upgraded and reconfigured to adjust to varying protocols. Based on TI's 1 GHz TMS320C6416T fixed-point DSP with a 64-bit external bus, the platform uses two TI ADS5500 14-bit, 25 Msample/s A/D converters, designed for applications that need low power, high speed and high dynamic performance in a small space. A TI DAC5686 dual 16-bit, 500 Msample/s D/A converter delivers dual-channel, single-sideband and quadrature modulation.

The system's SMT310Q PCI carrier provides access to a TI module over the 33 MHz/32-bit PCI bus. The onboard XDS510-compatible JTAG controller lets developers use TI's Code Composer Studio and 3L Diamond software development environments. With a 64-bit/66 MHz PCI interface, the SMT145 carrier can be used for more demanding SDR applications, or a carrier such as the SMT148 can be chosen for embedded systems. The SMT8096 is MathWorks' Simulink-compatible and supports Windows, QNX and Linux environments. Single unit price is $8,395.

Sundance, Waterside, Chesham, UK. +44 (0)1494 793167. [www.sundance.com].

CompactFlash Cards Deliver Extended Temps

Although CompactFlash cards can bring versatility, inherent reliability and space savings to high-demand military storage applications, they must often withstand rugged environments and conform to specific industry standards. A new family of CompactFlash cards from WinSystems delivers extended temperature operating ranges, IDE HDD emulation and compliance with True IDE Mode and ATA-3.



The five cards, in densities of 128 Mbytes, 256 Mbytes, 512 Mbytes, 1 Gbyte and 2 Gbytes, operate from -40° to +85°C. Compliance with True IDE Mode and ATA-3 make them compatible with operating systems such as Linux, Windows CE and Windows XP Embedded without additional drivers. Samsung NAND-type single-level-cell flash and a dedicated 32-bit RISC/DSP-based system controller allow error checking and flash management schemes for additional levels of reliability and endurance. The cards have more than 2 million program/erase cycles and unlimited reads while maintaining fast burst transfer speeds of up to 16.6 Mbytes/s. In addition, the controller supports Windows XPe's Enhanced Write Filter mode.

WinSystems' CompactFlash cards support a dual 3.3V/5V interface and meet CFA 2.0/2.1, PCMCIA PC Card Standard 7.0 and PCMCIA PC Card ATA Specification 7.0. List price starts at $45 for the CFLASH-128M-I.

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

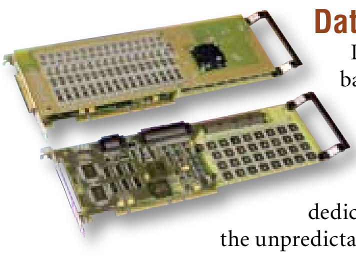
3U PXI/CompactPCI Digitizers Target Fast Test Apps

High-speed testing applications require fast data acquisition and testing rates. With that in mind, Acqiris has introduced the 10-bit, 4 Gsample/s, 3U PXI/CompactPCI dual-channel DC152 and single-channel DC122 digitizers, with input bandwidths of up to 3 GHz.

The single-slot digitizers incorporate Acqiris' proprietary chipsets, the XLFidelity ADC front-end and the JetSpeed II A/D converter. The dual-channel DC152, with 2 GHz of bandwidth, provides synchronous sampling of 2 Gsamples/s on both input channels with up to 256 Mpoints of optional acquisition memory. The single-channel DC122 offers sampling rates of up to 4 Gsamples/s with 512 kpoints of standard, or 512 Mpoints of optional, acquisition memory. DC122 options include standard or high-frequency front-ends.

The 50 ohm input stage of the DC122 standard front-end is fully protected against overvoltage signals. The XLFidelity provides input voltage ranges from 50 mV to 5V full scale (in a 1, 2, 5 sequence) with variable voltage offset. The DC122 high-frequency input front-end gives direct access to the XLFidelity crosspoint switch. The full-scale range is fixed at 1V, providing a bandwidth of 3 GHz. The input channel has an overvoltage protection to ±3V. The DC152 and DC122 are supported with AcqirisLive and AcqirisMAQS software and Windows, Linux and VxWorks drivers. Pricing begins at $16,480.

Acqiris, Monroe, NY. (877) 227-4747. [www.acqiris.com].



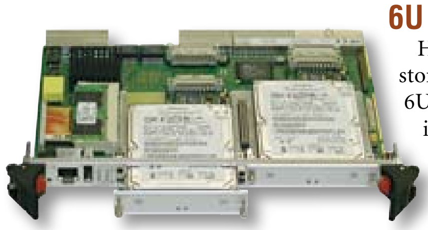
Data Acquisition Board Delivers More Storage, Bandwidth

Designers of high-frequency sonar, test and measurement and radar applications are always looking for more bandwidth and storage. The ICS-645D 32-channel data acquisition board from ICS is based on the company's 645C board, and improves on it by boosting the amount of onboard storage and raising available I/O bandwidth over PCI or FPDP.

The ICS-645D includes two high-bandwidth data paths for communication with host systems. The 64/66 PCI interface provides data rates greater than 400 Mbytes/s sustained aggregate rate, while the FPDP II port delivers a dedicated connection for collecting data from multiple cards. Up to 16 Mbytes of onboard storage let the board tolerate the unpredictable interrupt latencies encountered in non-RTOSs.

The full-length PCI board bundles A/D conversion, gain and anti-alias filtering resources, removing the need for separate signal conditioning circuitry before the A/D conversion stage. Differential inputs, four voltage ranges and anti-alias filtering are included, as well as high-speed delta sigma AD9260 A/D converters with onboard gain and filtering. Pricing starts at $9,795.

Interactive Circuits & Systems, Part of Radstone Embedded Computing, Ottawa, Canada. (613) 749-9241. [www.ics-ltd.com].



6U NAS Blade Delivers Removable Storage

High-performance embedded military applications often need highly available and redundant blade-level storage. The Network-Attached Storage (NAS) RAIDStor module from ACT/Technico is a hot-swappable 6U, single-slot blade designed to eliminate file management coherence and synchronization issues when implementing high-availability systems.

The hot-swappable 6U, single-slot RAIDStor with removable storage can be used with either PICMG 2.16- or VITA 31.1-compatible systems. Since these standards use dual-star network topology, a fabric-based network system architecture for building highly available systems, designers can take advantage of system scalability as well as availability or redundancy.

The blade is managed as an appliance via a Web browser interface or via an SNMP interface. RAIDStor provides two packet switched, backplane-compatible Ethernet connections for implementing links to two different networks. Features include automatic network synchronization of data written to an active RAIDStor operating in a mirrored NAS configuration, as well as support of redundant NAS controllers. Pricing starts at $6,295 for a standard RAIDStor blade.

ACT/Technico, Ivyland, PA. (215) 957-9071. [www.acttechnico.com].

Processor/SRIO Switch Fabric Cards Target Signal Processing Apps

In ruggedized military and aerospace net-centric applications, it's rare to find distributed switch solutions where the switch can easily grow with the number of nodes in the system. Recognizing this lack, Thales Computers has introduced a switch fabric card that provides a full mesh fabric by bundling its dual 1 GHz PPC74587 PowerNode3 processor card with a Serial RapidIO mezzanine card.

The dual 1 GHz 74587 SBC (PowerNode3) interconnects through the PMC-RIO SRIO switch fabric PCI mezzanine card, allowing military system designers to interconnect computing nodes inside a signal processing calculator. The PMC-RIO card's distributed switch prevents any system single point of failure. Thales' SRIO switch fabric allows an aggregate throughput of up to 1.6 Gbytes/s, thanks to the 400 Mbyte/s sustained link bandwidth (peer-to-peer), making the bundled cards ideal for demanding signal processing applications such as radar and sonar.

The bundled solution includes a dual 1 GHz PowerNode3 processor card with 512 Mbytes of RAM and 32 Mbytes of flash, as well as a RapidIO PCI mezzanine card mounted and tested and a complete Lynx 4.0 software suite. Pricing starts at $10,200, depending on specifications.

Thales Computers, Raleigh, NC. (919) 231-8000. [www.thalescomputers.com].

Pentium M-Based Embedded Computer Is Small, Quiet, Powerful

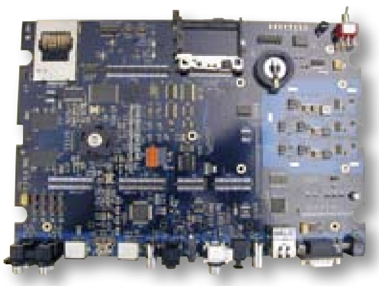
A tiny, fully featured embedded computer for military system designers is now available for use in environments where constant ambient noise is an issue. The low-power, quiet-running enclosed PL-06051 from WIN Enterprises is only 7 1/2 in. wide by 1 3/4 in. high by 12 7/8 in. deep, and consumes only 60W of power. It operates from -10° to +40°C.

The enclosed PL-06051 is also available as an SBC version, the MB-06051. Based on the Pentium M processor running at either 1 GHz or 2 GHz, it includes the 855GM(E) + ICH4 chipset and a dual Winbond W83627 HF-AW I/O chipset.

Two 184-pin 200/266/(333) DDR DIMM sockets are included for up to 2 Gbytes of memory. For I/O, the computer is equipped with a CompactFlash Socket, an FDD Interface, a USB interface and either a 10/100 or a 10/100/1000 Ethernet port. An optional TV-out interface is available. Additional features of the PL-06051 enclosed version include 1U height, integrated 110V and 210V power supply and a mounting bracket for a hard drive.

Pricing for a single, bare-bones PL-06051, without CPU or memory, is $621. The single-unit cost for a bare-bones MB-06051 is $476.

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



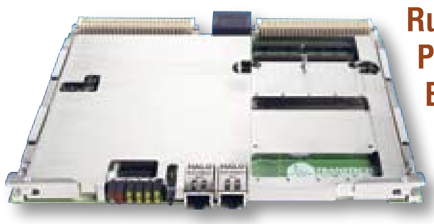
Development Platform Eases Video-Intensive Military Apps

High-performance defense and aerospace applications often require advanced, integrated graphics and digital video processing. The DaVinci development platform from Texas Instruments delivers an open platform for digital video design without requiring extensive expertise. Adding digital video to an application becomes as simple as writing to an API.

The DaVinci platform includes two DSP-based SoCs optimized for video system implementation, multimedia codecs, APIs, frameworks and development tools, and the Digital Video Evaluation Module (DVEM). The SoCs' TMS320DM644x architecture has absorbed many external components, dropping hardware bills of materials by as much as 50%. Offering up to 1080i MPEG-2 decode and up to 720p MPEG-4 simple profile encode, the TMS320DM6443 decoder and the TMS320DM6446 encoder/decoder are based on TI's performance-leading TMS320C64x+ DSP core, an ARM926 processor, video accelerators, networking peripherals and external memory/storage interfaces tuned for video performance.

The DVEVM includes MontaVista Linux Professional Edition, an NTSC/PAL camera, LCD screen, pre-wired video encode and decode codec demos, video inputs/outputs, networking interfaces, storage interfaces and standard daughter card connections. The pin-for-pin-compatible and software-compatible TMS320DM6443 and TMS320DM6446 are code-compatible with previous TMS320DM644x devices. The DM6443 is priced at $29.95 and the DM6446 at $34.95, both in quantities of 10,000 units. The DVEVM (TMDXEVM6446) is priced at $1,995.

Texas Instruments, Dallas, TX. (800) 336-5236. [www.ti.com].



Rugged VXS Processing Board Boosts UAV Compute Power

VXS is rapidly finding its way into deployable systems as a solution to the high volumes of data typically generated by advanced sensors in applications such as radar, mobile communications and electronic warfare. For its part, VMETRO has introduced a rugged, conduction-cooled version of its Phoenix VPF1 dual-FPGA/dual-PowerPC VME/VXS processing card. The Phoenix product family enables system solutions for real-time multiprocessors with high-speed serial communications.

The conduction-cooled, rugged VPF1 processing card is intended to help defense engineers deploy systems with substantially more compute power in autonomous vehicles such as UAVs. It features dual AltiVec-based PowerPCs and dual Xilinx Virtex-II Pro XC2VP70 onboard FPGAs. Eight 2.0 Gbyte/s to 3.125 Gbyte/s off-board serial communications channels, onboard Ethernet and RS-232/RS-422 ports are provided, along with a 64-bit/66 MHz PMC site for local I/O. VxWorks and Linux are supported.

Standard lead time for the conduction-cooled VPF1 board is 4 to 6 weeks ARO. Pricing starts at $37,710 in single unit quantities.

VMETRO, Houston, TX. (281) 584-0728. [www.vmetro.com].

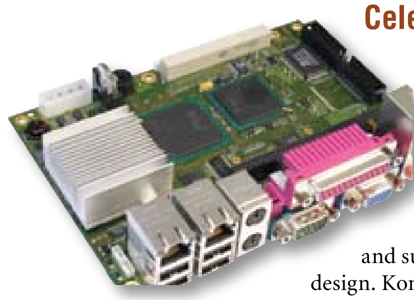
VXS Multicomputer Triples Channels, Improves Bandwidth 10x

As data acquisition sampling rates continue to increase, defense SIGINT and radar applications are limited by fabric throughput. Adding Serial RapidIO to VME can nearly quadruple sampled bandwidth in SIGINT systems, while VXS can more than triple the number of radar/SIGINT antenna channels. A new multicomputer system from Mercury Computers is the first 6U VME system based on the SRIO interconnect fabric and is VXS-compliant.

The PowerStream 6100 is an integrated multicomputer that combines a sophisticated software development environment with RapidIO switch fabric communications, quad MPC7448 PowerPC modules, FPGA compute capability and a broad set of I/O options in a Serial RapidIO VXS chassis infrastructure. It incorporates the Mercury Momentum Series VPA-200 dual-PowerPC 7448 VXS host/PMC carrier module combined with the Echotek Series 3000T and 5000T RF tuner modules. The system provides 761 GigaFLOPS and 42 Gbytes/s sustained fabric throughput.

The Mercury MCOE open software environment on the PowerStream 6100 supports Linux, VxWorks and Mercury's MCexec POSIX-compliant real-time kernel. A PowerStream 6100 base configuration that includes the chassis, two high-density compute modules, two RapidIO switch cards and a VME host is priced at $92,000 in volume.

Mercury Computer Systems, Chelmsford, MA. (978) 256-1300. [www.mc.com].



Celeron-based EPIC/CE SBC Loaded with Front-Panel I/O

The EPIC board form-factor has been gaining adherents in military product development for its size-to-performance ratio and superior thermal management design. Kontron has expanded the EPIC board product selection by offering its EPIC/CE SBC, available either as a 733 MHz LV Intel Celeron processor version, or a fanless version equipped with the 400 MHz ULV Celeron.

The EPIC/CE SBC’s PCI-to-ISA bridge provides support for PC/104 and PC/104-Plus expansion assemblies. Kontron has standardized the board’s physical interfaces for internal and external peripheral connection to facilitate scalability. The board supports up to 512 Mbytes of SDRAM-SODIMM and a CompactFlash socket is provided. For connectivity, the board’s front-panel I/O connections include four USB 2.0 interfaces, two 10/100 BaseT Ethernet interfaces, keyboard, mouse, CRT, sound, LPT and a serial interface.

Two additional USB 2.0 interfaces, three additional COM ports, 25 GPIO interfaces as well as EIDE hard drives, removable storage media and power supply are optional. Pricing starts at $443.

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

AA-size Lithium Battery Powers Advanced Mil/Aerospace Apps

In military and aerospace systems such as aircraft ejector seats, smart ammunition and unattended ground sensors, the batteries must not only be small and high-powered, but also extremely reliable and with a long shelf life. In response to this need, Tadiran has developed the TLM 1550HP.

The AA-size battery delivers 2 Wh of energy with an open circuit voltage of 4.0V, capable of handling pulses of up to 15A and 5A maximum continuous current at 3.2V. TLM 1550HP cells provide up to 15 years of storage life. Their fast activation and instantaneous voltage after prolonged storage let them be periodically tested without the need to fully discharge the battery. This enables easy confirmation of system readiness to reduce the number of “duds.”

The batteries’ operating temperature range is -40° to +85°C. They utilize a glass-to-metal hermetic seal, rather than a crimped elastomer gasket, and their safe design allows them to be shipped as non-hazardous items. Pricing is $6 each in volume.

Tadiran, Port Washington, NY. (516) 621-4980. [www.tadiranbat.com].

Get Connected with companies and products featured in this section.
www.cotsjournalonline.com/getconnected

Advertisers Index

Get Connected with technology and companies providing solutions now

Get Connected is a new resource for further exploration into products, technologies and companies. Whether your goal is to research the latest datasheet from a company, speak directly with an Application Engineer, or jump to a company's technical page, the goal of **Get Connected** is to put you in touch with the right resource. Whichever level of service you require for whatever type of technology, **Get Connected** will help you connect with the companies and products you are searching for.

www.cotsjournalonline.com/getconnected

Index

COTS Journal (ISSN#1526-4653) is published monthly at 905 Calle Amanecer, Suite 250, San Clemente, CA 92673. Periodicals Class postage paid at San Clemente and additional mailing offices. POSTMASTER: Send address changes to COTS Journal, 905 Calle Amanecer, Ste. 250, San Clemente, CA 92673.

Coming Next Month

COTS JOURNAL

Like fine wine and good food, our unique editorial content in *COTS Journal* is a tasty blend of traditional "core" subjects that we visit each year, and new topics that delve into emerging trends. Among our most popular annual features is our Special Software Defined Radio section, crafted by our SDR technology specialist Contributing Editor, Dave Cotton. Articles in this section explore the key technology trends driving SDR, with an update on the latest status and developments in the DoD's Joint Tactical Radio System (JTRS) program. Here's what else we're serving up in our February issue:

- *Monitoring and Control Systems in UAVs.* The computing and communications technologies available in today's embedded systems are the two key enablers of military Unmanned Aerial Vehicles (UAVs). Articles in this section examine the two basic approaches to implementing unmanned flight, autonomy and pilot-in-the-loop—and how embedded processing and communication technology, respectively, are making a difference in UAV capabilities.
- *Power Conversion Directory.* Last year's expanded Power Conversion Directory was an extremely popular tool for system developers tasked to select power conversion products for their next design. Once again, this year's directory is a free editorial listing for all vendors of DC/DC converters, power supply module bricks and slot-card power supplies (VME, cPCI and others). Concurrent with the directory we'll also be posting it on our Web site with some special interactive features.
- *Processor PMCs.* Processors and memory face shorter life cycles than the rest of a system—like custom I/O, storage interfaces and comm links. Processor PMCs accommodate that trend nicely, enabling military system integrators to swap out just the computing core and leave the baseboard unchanged. This Tech Focus section updates readers on PrPMC trends and provides a product album of representative PrPMC products.

COTS

Editorial

Jeff Child, Editor-in-Chief

The Coming RoHS Storm

The way different organizations and individuals react to RoHS reminds me of how people prepare for impending hurricanes. I have both immediate and extended family members who live in Florida, so I can attest that reactions vary. Some are of the "get out of town immediately" mind set, while others like my younger brother prefer to stay home—squeegee and mop in hand—to deal with incoming water. And their reactions also vary based on what kind of house they had and so on.

I've heard some pretty extreme predictions about the impact of RoHS on the military electronics industry. Some claim the RoHS will force customers to upgrade and move to newer interconnect schemes like PCI Express or RapidIO, driven by fear that older PCI-X or plain-vanilla PCI chips won't be available in lead-free versions. The most outrageous prediction I heard was that the RoHS would kill the COTS movement, and force designers to go back to military-specific ICs.

With the RoHS Directive only six months away, suppliers, OEMs and system designers in every corner of the electronics industry report different levels of readiness. I won't bother restating for you the particulars of the restriction of certain hazardous substances (RoHS) directive. You'd have to have been hiding under a pretty substantial rock to have not seen the intense level of news, analysis and speculation on the topic. But briefly, the provisions of the legislation, which go into effect July 1, 2006, restrict makers of electronic equipment from selling to the European Union market, equipment that exceeds a specified maximum concentration per homogeneous substance of materials considered hazardous including lead and four other substances. Military equipment is exempt—although that could change in the future. That doesn't mean makers of board-level products, for example, are off the hook, because in this age of COTS, most companies craft board designs targeted for both military and non-military markets.

Every media area from the electronics industry trade press to the business press to the national news has given it ample coverage. When last I Googled the term "RoHS" I got over 4,750,000 hits. With that level of discussion, it's difficult to say anything new. But talking to companies at this year's Bus & Board conferences, it was enlightening to take the pulse of how companies in our embedded computer industry have prepared and are preparing for RoHS. I'm not sure where that prognosticator thinks he'll find the now virtually non-existent industry of Mil-Spec semiconductors.

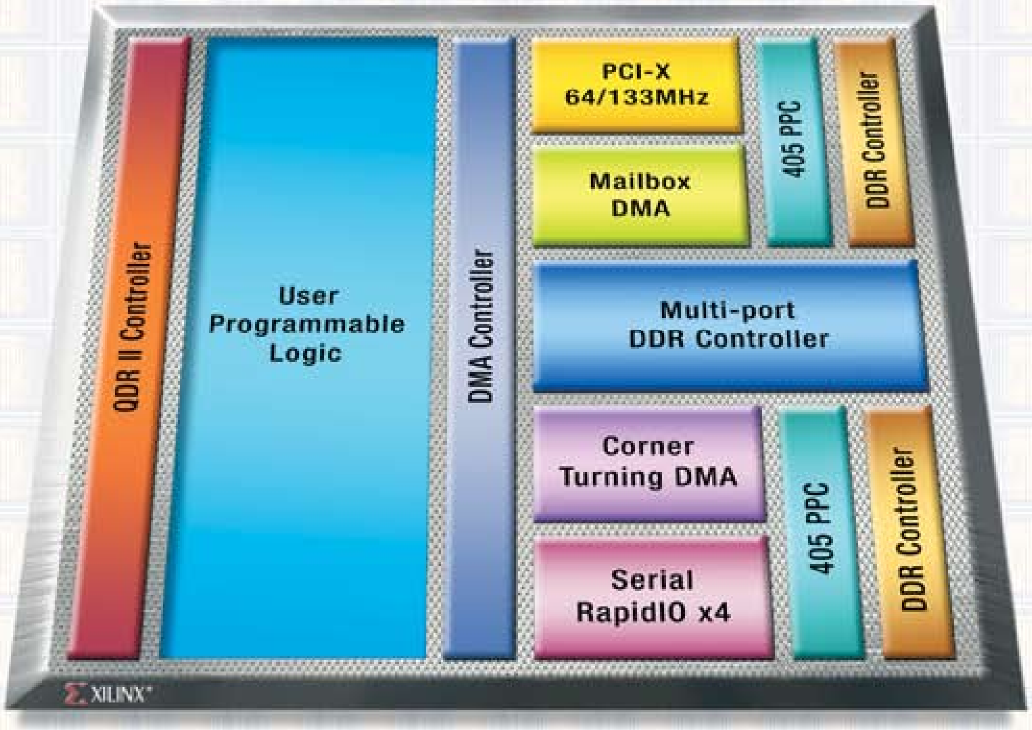
From talking to those companies, the general theme I heard is that they will strive to take on the RoHS burden and isolate it from their customers—much the same way they've successfully kept component obsolescence issues from directly impacting customers. One of the most interesting services I heard about was a Web-based database just announced by enclosure and backplane vendor Schroff, which enables visitors to the site to quickly determine if the product they wish to purchase complies with RoHS. By logging on to www.schroff.us/rohs, Web site visitors can type in the part number of the product that they wish to purchase to determine if the product is RoHS-compliant. If it is, they can create an individualized certificate of compliance that includes their own company information and a unique serial number.

Another company at Bus & Board, PCI chip specialist PLX Technology reported their plans to continue to offer standard, lead-free, Green and RoHS packaging options for all its products, a process they began in 2004. Meanwhile, Thales Computers speculated that European-based companies may gain an advantage over U.S.-based vendors if they stay ahead of the pack in RoHS compliance.

It's clear that military and aerospace markets face some unique requirements. Much higher reliability requirements, extremely long service lifetimes (decades) and extended temperature ranges top the list. Add to that the fact that the DoD is among the few segments that actually repairs embedded computer boards, rather than just disposing of them when a component goes bad. Meanwhile, lead-free components face solder issues and tin whisker failures that aren't acceptable. Strategies to deal with those issues are immature at this point, and it's likely to be years before they're solved. And I doubt the U.S. DoD or other countries will jump the gun before there are satisfactory, well-verified solutions in place.

What concerns me is that the uncertainly surrounding RoHS will affect availability of obsolete components. There's a rich infrastructure and industry in place that does end-of-life buys of any critical semiconductor device. Will those EOL suppliers be willing to invest in parts with leaded packaging, knowing they could be holding inventory they can never move? It's a variable that will be hard to account for. One thing is for sure, the intense discussion going on about RoHS won't end when July 1 rolls by. Particularly in the defense market, there's much more discussion and analysis ahead.

CoSine™ SoC



System-on-Chip for FPGA Processing

CoSine is a fully integrated, completely preconfigured System-on-Chip for real time FPGA based signal processing. Bridging two high speed interfaces (Serial RapidIO®, PCI-X®, or PCI-Express®) through a multi-port DDR controller, the elegant design enables non-contentious access to a User Programmable Logic (UPL) block.

Similar to a structured ASIC, the IP cores, memory controllers, specialized DMA engines, embedded processors and surrounding logic are factory preconfigured and supplied as a fully tested system. This provides users the ability to focus on application specific state machine processing in the UPL block without concerning themselves with coding other modules, complicated SoC integration, or verification.

The CoSine development toolkit includes a standalone ATCA® board with up to 8GB of DDR that demonstrates continuous sustained transfers from a 64-bit/133MHz PCI-X PrPMC site at maximum bandwidth through CoSine to a Serial RapidIO x4 XMC site. Along with a complete *"How to"* Developer's Manual, the kit includes a demo program using an off-the-shelf Xilinx 1024 FFT, robust library of VHDL test benches, and extensive suite of PCI, sRIO, and standalone diagnostic "C" test code.

CoSine will also be offered on several forthcoming XMC, AMC, and Othello VxS® VITA 41 and 46/48 formats in both commercial and conduction cooled options.

MICRO MEMORY, LLC.
9540 Vassar Avenue, Chatsworth, California 91311 U.S.A.
(US) Tel 818 998 0070 • (US) Fax 818 998 4459
www.micromemory.com • sales@micromemory.com