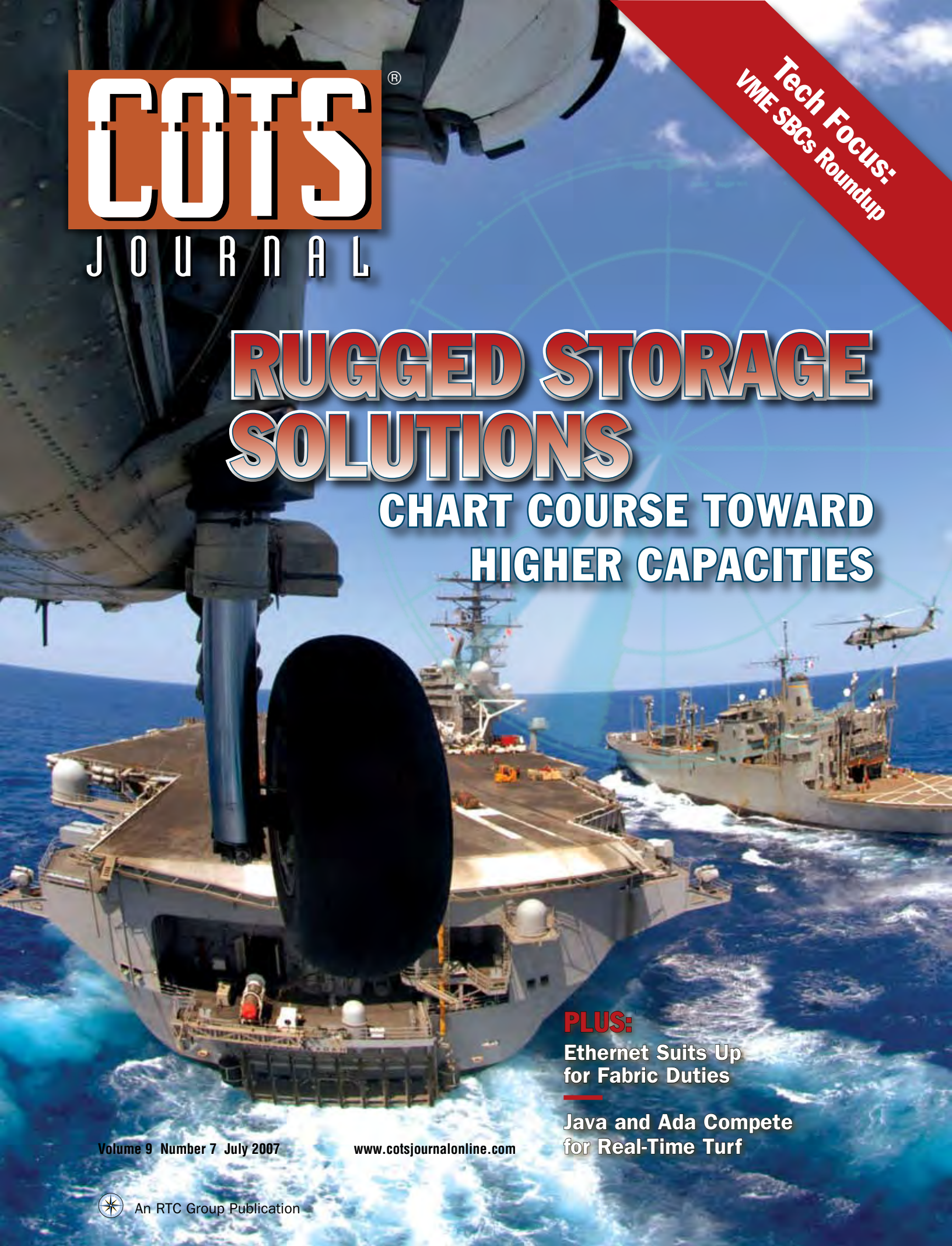


COTS JOURNAL

Tech Focus: VME SBCs Roundup

RUGGED STORAGE SOLUTIONS

CHART COURSE TOWARD HIGHER CAPACITIES

PLUS:

Ethernet Suits Up for Fabric Duties

Java and Ada Compete for Real-Time Turf

Volume 9 Number 7 July 2007 www.cotsjournalonline.com

An RTC Group Publication

Need a small system?

Need reliability?

PC/104

2050 PC/104 SBC

2732 I/O card

HE 104 power supply

–40° to +85°

EPIC™ XE–900 1.0 GHz CPU

2050	–40° to 85° C	Ethernet	CompactFlash		Linux & Windows available
2060	–40° to 85° C	Drives CRTs & flat panels	CompactFlash		265 MB DRAM for large programs
2133	–40° to 85° C	17 digital I/O lines	Serial port used as console		"headless" systems
2732	–40° to 85° C	Analog module, autocalibrating	16-bit resolution	32 analog inputs	Settings constant over temp. range
2851	–40° to 85° C	CardBus card adapter	Type I, II, III formats	Supports 8–16–, 32–bit data widths	Linux & Windows support
HE 104 Mobile Power Supply	–40° to 85° C	6–40 VDC input	40–60 watts	+5V, +12V, –12V	Mounts on PC/104 stack

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	Phoenix
DRAM support	to 256 MB	to 256 MB	32/64 MB
Compact/Flash	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–232/422/285	NA	NA
COM6	RS–422/485/TTL	NA	NA
LPTI	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 a fanless high performance server?

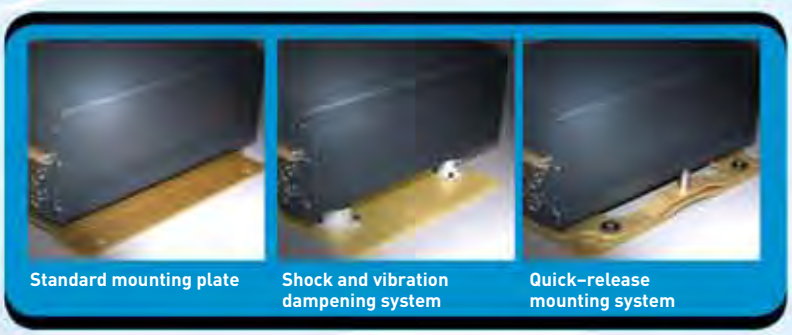
RMB

The RMB is the newest edition to Octagon's line of CORE SYSTEMS™. The RMB enclosure system performs over a wide temperature range with processors at 1 GHz, or higher. A no-compromise design optimizes the electrical, thermal and mechanical components for maximum reliability. Both MIL–CORE™ and IND-CORE™ versions are easily expanded using PC/104 I/O function blocks, or Octagon's XBLOK™ half-size PC/104 modules that save space and cost.

The MIL–CORE case is sealed from weather, salt spray and environmental hazards. Rated to IP67 & NEMA 4X. The IND–CORE version offers the same reliable operation in harsh industrial environments. The case is rated to IP52 and NEMA2.

The basic unit includes processing power, mobile power supply, memory, connector card and I/O for most applications. Enclosure with standardized end plates, option panel and standardized I/O and power connectors. Software drivers for Linux and Windows® XPe are included. Software on a CORE SYSTEM is easily ported to other applications.

RMB & XMB mounting options



Standard mounting plate | Shock and vibration dampening system | Quick–release mounting system

We offer three mounting options for the RMB/XMB. The standard mounting plate is designed for benign environments with low-stress vibration. The shock and vibration dampening system is ideal for use in trains, buses, planes and other mobile applications, especially where shock and vibration is more or less constant. The quick-release mounting system provides a convenient way to quickly remove the RMB/XMB enclosure from a bulkhead or overhead location.

Please call today for a datasheet

303–430–1500

OCTAGON SYSTEMS

GE Fanuc
Embedded Systems

Wouldn't you rather have two?

Dual core options abound with GE Fanuc Embedded Systems.

Choosing dual core technology ought to be a no-brainer, especially when you have the range of choices offered by GE Fanuc Embedded Systems. Our Intel® Core™ Duo and Core™ 2 Duo single board computers are available in a full selection of embedded form factors, including VME, VPX, CPCI and ATCA.

We also give you the choice of multiple levels of ruggedization, all the way from standard air cooled commercial grades through extended temperature, up to fully conduction cooled boards. We probably have exactly the configuration you're looking for, and we even have custom build options.

Better yet, we offer you the services of our trained sales and technical staff during the evaluation and transition to two cores. And our lifecycle management program, product roadmaps and technology insertion strategies will give you the insurance you need to make the move to a dual core design. With this kind of selection and support, why settle for one, when you can have two?

www.gefanucembedded.com/coreduo

V7865
Intel® Core™ 2 Duo
single board computer

GE FANUC

intel Communications Alliance Associate

COTS JOURNAL

July 2007 Volume 9 Number 7

Features

Special Feature

Rugged Storage

Tech Recon

Networking the Battlespace

System Development

Java in Defense Apps.

Technology Focus

VME SBCs

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 August...
...See Page 69

Cover Story ..... Page 14

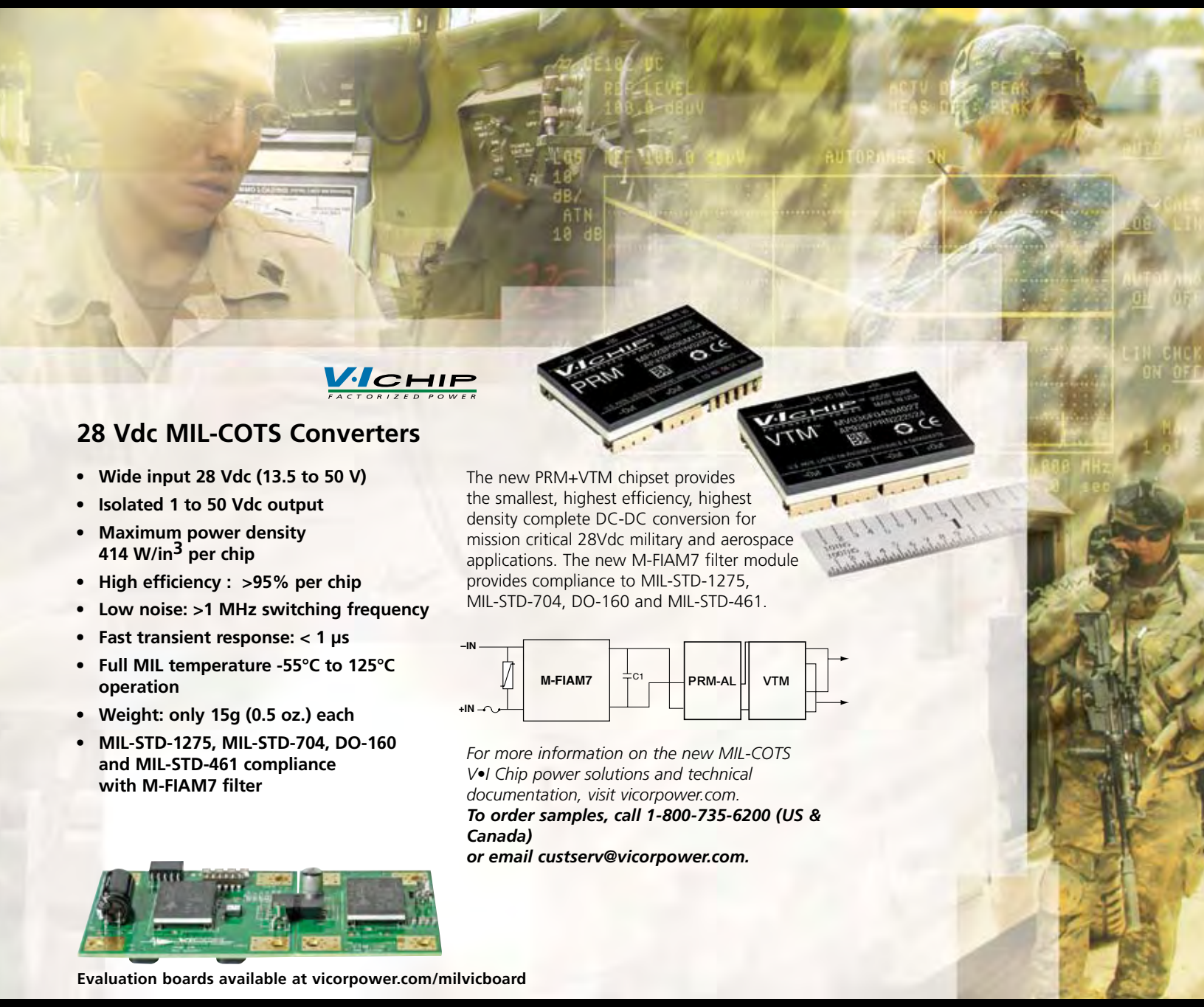
Shock-resistant solid-state flash drives play a key role in gear such as the fuel-control system on ships like the Nimitz Class nuclear-powered aircraft carrier USS Ronald Reagan. Shown here Petty Officer 2nd Class David Rankin leans out the door of an SH-60 Sea Hawk helicopter as it approaches the USS Ronald Reagan during operations in the South China Sea earlier this year.

DoD photo by Chief Petty Officer Spike Call, U.S. Navy

20% More Power

1/3 the Volume

Miniature, rugged 28 Vdc MIL-COTS converters deliver breakthrough performance and flexibility



V·I CHIP FACTORIZED POWER

28 Vdc MIL-COTS Converters

- **Wide input 28 Vdc (13.5 to 50 V)**
- **Isolated 1 to 50 Vdc output**
- **Maximum power density 414 W/in^3 per chip**
- **High efficiency : >95% per chip**
- **Low noise: >1 MHz switching frequency**
- **Fast transient response: < 1 µs**
- **Full MIL temperature -55°C to 125°C operation**
- **Weight: only 15g (0.5 oz.) each**
- **MIL-STD-1275, MIL-STD-704, DO-160 and MIL-STD-461 compliance with M-FIAM7 filter**

The new PRM+VTM chipset provides the smallest, highest efficiency, highest density complete DC-DC conversion for mission critical 28Vdc military and aerospace applications. The new M-FIAM7 filter module provides compliance to MIL-STD-1275, MIL-STD-704, DO-160 and MIL-STD-461.

For more information on the new MIL-COTS V•I Chip power solutions and technical documentation, visit vicorpower.com.
To order samples, call 1-800-735-6200 (US & Canada)
or email custserv@vicorpower.com.

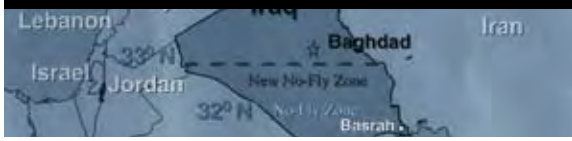
Evaluation boards available at vicorpower.com/milvicboard

All parts in mass production and available from stock.

800-735-6200 **vicorpower.com/milvichipcj** VICOR

Publisher's

Notebook



Bees, Recycling Plastics, and the Web

I need to whine a little. It has to be my age, but I'm hoping people younger than me have a problem with this too. For me, reality TV is watching *Deadliest Catch* or an auto race. My wife just shakes her head. Now, I'm not knocking those folks who watch week after week to see if the hunky young guy chooses a forty-something-year-old divorcee with three kids or a twenty-something super model…different strokes for different folks. My issue is getting news. And I don't mean cable news—I've been conditioned for that to be bad. The problem is I like to use TV to catch up on things of interest that are going on in the world. By that I mean technology and science and the like—you know, like those 3 to 5 minute clips of the Consumer Electronics Show, or stories on new work on a vaccine—things like that. After that, I'll then follow up on those things that piqued my interest.

This past Sunday I think it finally hit me: the straw that broke this camel's back. Over a period of about forty minutes there were numerous teaser lines prior to each commercial break. The teaser said a report would be coming up on the disappearing bees and what's behind it. I've heard about this bee issue before, consider this a problem of immediate concern, and understand the implication this presents to agriculture. So naturally I turned up the volume on the TV so I would be triggered to watch while I started to do some domestic chores…maybe too much information for you. Finally the segment starts diving right in stating the problem that bees are dying off—and they've given the problem a name, although my memory fails me as to what that name was. Bee Pollination Syndrome or something? I can't remember. The rest of the segment was on how bees came to North America, how they are used in agriculture, and they couldn't leave out talking about killer bees. That's it. Nothing more on the cause or possible solution. They just named the problem.

Normally this bee story irritation would have just blown by me, but it reminded me that a short time earlier that day I was sucked into watching a report on a new and innovative approach to increase the effectiveness of plastic recycling. In short, San Francisco banned the sale of water bottles in their buildings. I noted my discontent to my wife whose response was: "What do you want? Everything is like that now. Phony promo to suck you in, then a rehash of some material they have in the archives." That started me thinking: Is our industry doing the same thing?

Staying "in the know" and being "on the in" is important to me and a major factor in making my livelihood. So my "confuser" is set to accept most email newsletters, announcements for Webinars, and so on. Even with high-speed Internet access, when you start to go through this stuff it takes a lot of time. Most times after I get through just skimming things I've killed a lot of my day. I don't know what *COTS Journal*'s readers do when they're developing and producing a system. They can't be putting as much time into checking all this out as I do or they wouldn't get any work done. They must pick one or two of these "Web info sources" out of the dozens—and I'm being conservative—of embedded sources available as their staple.

There are many different levels of Web info sources steering me to a particular type of Web site. Some are corporate, some are affiliated with a publication, and some are stand-alone unaffiliated properties. Getting back to my bee story experience, most of these Web info sources are getting me hooked by the promo. But when I get to the story I'm in the midst of nothing more than an "advertorial" written by a supplier trying to sell their product. Don't get me wrong, not all contributed stories/articles are advertorials. Some companies and most experienced editors know how to present a reader with a valuable article. The problem is now there are so many Web places popping up looking for material to fill their space. As a result there's no necessity for suppliers of product to do anything but supply advertorials to these Web sites.

Prior to my current vocation I was in marketing, and writing news releases meant that we had to write them in a way that an editor could just pick out segments and print it as if it were an unbiased piece of news. Most companies did the same. Now that I've been on the receiving end of news releases for over ten years, I've been able to notice a change. Our editorial team can no longer just extract segments of a product news release, verify it with a data sheet and print it. Instead, we now have to consider a news release more as a notice that the company is introducing a new product. We then extract the salient technical points of the product from the release and data sheet followed by an extensive re-write—throwing out all the sales talk, otherwise we would in essence only be printing a quarter-page product ad.

All that said, I suppose I should be glad that there are only dozens of "Web info sources" and not hundreds, although I think it's heading that way. How long before I have to dump them all? Enough of my whining. When's the next episode of *Deadliest Catch* on?

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
COPY EDITOR
Rochelle Cohn

Art/Production
CREATIVE DIRECTOR
Jason Van Dorn, jasonv@rtcgroup.com
SENIOR GRAPHIC DESIGNER
Kirsten Wyatt, kirstenw@rtcgroup.com
GRAPHIC DESIGNER
Christopher Saucier, chriss@rtcgroup.com
DIRECTOR OF WEB DEVELOPMENT
Marke Hallowell, markeh@rtcgroup.com
WEB DEVELOPER
Brian Hubbell, brianh@rtcgroup.com

Advertising
WESTERN REGIONAL ADVERTISING MANAGER
Lauren Hintze, laurenh@rtcgroup.com
(949) 226-2014
EASTERN REGIONAL ADVERTISING MANAGER
Nancy Vanderslice, nancyv@rtcgroup.com
(978) 443-2402
EMEA SALES MANAGER
Marina Tringali, marinat@rtcgroup.com
(949) 226-2020
BUSINESS DEVELOPMENT MANAGER
Jessica Grindle, jessicag@rtcgroup.com
(949) 226-2012
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

DDC®

©Data Device Corporation

LEADERSHIP BUILT ON OVER 40 YEARS OF INNOVATION

Four decades of quality manufacturing, design innovation, and process control has earned us the time-honored trust and confidence of a global network of customers.

DDC IS YOUR DATA NETWORKING SOLUTION

- MIL-STD-1553 COTS Boards and Components
- Fibre Channel
- Gigabit Ethernet
- High Speed 1760
- Enhanced Bit Rate 1553 (EBR)
- ARINC 429

Toll Free: 1-800-DDC-5757 **www.ddc-web.com**

IT TAKES A LOT OF SMARTS TO BE THIS DENSE.

Now a Complete Software Radio System in a Single PMC!

Experts in our industry call us dense. It's a compliment. That's because our 7140 PMC/XMC transceiver is a complete software radio solution packed with a multitude of features designed to maximize performance.

Easy-to-use, fully supported and extremely flexible, this software radio system will give you the edge you need.

Everything is on board – A/Ds, D/As, up and down converters, FPGA and a high-speed XMC interface. Available in commercial and conduction-cooled versions, you can choose just what you need for your application.

Especially well-suited for JTRS and other software radio applications, clever design features include a built-in, multi-board sync bus, 512 MB of user memory and 9 DMA channels.

All of Pentek's 50+ software radio board and system solutions come complete with ReadyFlow board support libraries to jump-start your application and GateFlow design resources to simplify FPGA development.

Count on Pentek for lifetime technical support, complete, application-ready solutions and something more – an invaluable edge against your competitors!

- PMC, XMC, PCI & cPCI Versions
- Five Levels of Ruggedization
- Two 105 MHz 14-bit A/Ds
- Two 500 MHz 16-bit D/As
- Four Digital Downconverters
- One Digital Upconverter
- 512 MB of DDR SDRAM
- Xilinx Virtex-II Pro FPGA
- Synchronization up to 80 boards
- Serial Rapid I/O, Xilinx Aurora® PCI Express
- Linux®, Windows® and open-source eCos OS

PENTEK

www.pentek.com/go/cotsmart for Pentek's "*Putting FPGAs to Work for Software Radio*" handbook and to request a full product catalog.

Pentek, Inc., One Park Way, Upper Saddle River, NJ 07458 Phone: 201.818.5900 Fax: 201.818.5904 e-mail:info@pentek.com www.pentek.com
Worldwide Distribution and Support

The Inside Track

Lockheed Martin Selects GoAhead Software for Aegis Open Architecture

Lockheed Martin has selected GoAhead Software's SelfReliant product as the high-availability (HA) and systems management solution in the Aegis Weapon System Open Architecture program. This program is a cornerstone for the modernization of the Navy's Aegis-equipped cruisers and destroyers. As part of a successful transition from Aegis' previous proprietary systems to those comprised of open standards-based, off-the-shelf components, Lockheed Martin sought a solution that included stringent availability, schedule and cost reduction requirements. A new product line by GoAhead called GoAhead SAFfire includes the sophisticated HA and management capabilities found in the company's flagship product, SelfReliant. Lockheed Martin is among the companies evaluating SAFfire.

The Aegis Weapon System is the world's premier naval surface defense system and is the foundation for Aegis Ballistic Missile Defense, the primary component of the sea-based element of the U.S. Ballistic Missile Defense System. The Aegis Weapon System includes the SPY-1 radar, the Navy's most advanced computer-controlled radar system. When paired with Lockheed Martin's MK-41 Vertical Launch System, it is capable of delivering missiles for every mission and threat environment in naval warfare.

The evolution to open architecture will enable the Navy to readily incorporate software updates and the latest computing hardware in its Aegis systems, ensuring that those systems are maintained at the highest level of capability while employing low-cost, off-the-shelf solutions. Aegis Open Architecture will be introduced to the fleet beginning with the USS Bunker Hill (Figure 1) in 2008. The Aegis Weapon System is currently deployed on 83 ships around the globe, with more than 20 additional ships planned.

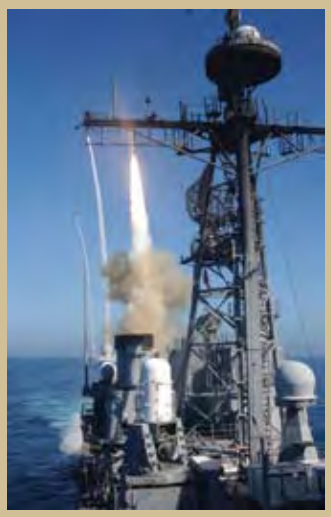


Figure 1

USS Bunker Hill (CG-52) is a Ticonderoga class guided missile cruiser. The Aegis Open Architecture will be introduced to the fleet beginning with the USS Bunker Hill in 2008.

GoAhead Software
Bellevue, WA.
(425) 453-1900.
[www.goahead.com].

DDC Awarded Raytheon IDS Supplier Excellence Award

Raytheon Integrated Defense Systems has awarded Data Device Corporation (DDC) its IDS Supplier Excellence Award. This is the second year (2005 and 2006) DDC has been honored by Raytheon for exemplary performance. Raytheon expressed their appreciation for DDC's consistent quality, service, on-time delivery, safety and process improvement initiatives, acknowledging that DDC was one of a small group of suppliers to receive the award.

Data Device Corporation (DDC) is an international supplier of high-reliability data interface products, motion control and solid-state power controllers for military and industrial applications. DDC's product line consists of advanced data bus technology for high-speed Ethernet and Fibre Channel networks, MIL-STD-1553 and ARINC 429 data bus boards and components, Synchro/Resolver interface components, and solid-state power controllers and motor drives.

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

Army Awards General Dynamics "Command Post of the Future" Contract

The U.S. Army has awarded a contract to General Dynamics C4 Systems for contractor support and engineering services for the Command Post of the Future (CPOF) (Figure 2). The initial delivery order is for $18.4 million on the Indefinite Delivery/Indefinite Quantity (ID/IQ) contract, which has a potential value of $200 million over five years.

CPOF is part of the Army's Battle Command System (ABCS) and enables commanders and their staffs to jointly plan, prepare, rehearse, execute and assess operations over tactical networks from geographically dispersed locations. One CPOF system can support more than 300 simultaneous users while running on a commercial off-the-shelf computer workstation with multiple screens. The system is managed by the U.S. Army Program Executive Office Command, Control, Communications, Tactical of Fort Monmouth, N.J.

Figure 2

One Command Post of the Future (CPOF) can support more than 300 simultaneous users while running on an off-the-shelf computer workstation with multiple screens. The CPOF is part of the Army's Battle Command System (ABCS).

More than 1,000 CPOF systems are deployed with the U.S. military. Users describe the system as "always on," allowing commanders a quick view at a course of action and the ability to collaborate with subordinates. The idea is to give warfighters a quicker, more accurate under-

standing of the commander's intent.

General Dynamics C4 Systems
Scottsdale, AZ.
(877) 449-0600.
[www.gdc4s.com].

OIS's Middleware Selected for NASA Software Radio Research Program

The NASA Glenn Research Center has selected Objective Interface Systems' ORBexpress RT middleware to research the viability and optimization options for a lightweight Software Communication Architecture (SCA) as a potential software architecture solution for NASA's next-generation software defined radios (SDRs).

With the most rigorous requirements for size, weight and power (SWAP)—factors critical to space-based advanced radio communications—NASA selected ORBexpress RT, a small-footprint product that optimizes the use of scarce resources. A DoD standard for the next generation of software defined radios, the SCA provides several benefits. Among them are software re-use; common hardware and software platforms to reduce production costs; and field upgradeability. SCA-based SDRs use Common Object Request Broker Architecture (CORBA) for the design and deployment of their radio application. ORBexpress RT is a real-time CORBA object request broker (ORB). ORBexpress RT is the industry's first SCA-certified CORBA ORB.

Objective Interface Systems
Herndon, VA.
(703) 295-6500.
[www.ois.com].

Thales JTRS Handheld Radio Tapped for U.S. Military

Thales Communications has been awarded a firm, fixed price, indefinite-delivery/indefinite-quantity (IDIQ) contract to provide its AN/PRC-148 Joint Tactical Radio System (JTRS) Enhanced Multiband Inter/Intra Team Radio, or JEM (Figure 3), system to all services of the U.S. Military. The consolidated, interim, single-channel, handheld radio (CISCHR) award was the result of a competitive procurement.

The JTRS Joint Program Executive Office (JPEO), through the Space and Naval Warfare Systems Command (SPAWAR) procurement authority, has consolidated handheld radio purchases for the U.S. Department of Defense, significantly reducing unit costs and allowing all participating agencies to purchase JTRS equipment. Under the contract Thales will compete for future awards of formal delivery orders, which will ultimately determine contract value. CISCHR has a one-year contract period with four additional one-year options.

Figure 3

Thales' AN/PRC-148 JEM has been tested, evaluated and validated by the U.S. Government. The JEM's powerful Software Communications Architecture is capable of hosting future waveforms, making it both an interim and long-term solution in the battlefield.

As part of this contract, Thales will also be supplying its dual radio AN/VRC-111 Vehicle Adapter Amplifier (VAA) and its Base Station. The VAA consists of two Thales Vehicle Adapters, two JEM handheld radios and a SINCGARS interface tray. The VAA provides multiband, multimode capability beyond basic SINCGARS and offers unique, one-second, cable-free radio dismount that enables a seamless transition from mounted to dismounted operations.

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

ATV Intros Prowler Rugged Terrain Vehicle to Homeland Security Market

The All Terrain Vehicle (ATV) division of Phoenix International Systems is offering its Prowler RTV to the U.S. homeland security communities. The Prowler was introduced to security, law enforcement and emergency response personnel on the federal, state and local levels at the combined GovSec, U.S. Law and Ready! 2007 Conference and Exposition held earlier this year in Washington, D.C.

Figure 4

The Prowler RTV is in use worldwide by U.S. military forces that require an Internally Transportable Vehicle platform. The Prowler is easily configured as a platform for perimeter patrol, surveillance, reconnaissance and/or logistic support.

Introduced to the military in 2002, the Prowler RTV (Figure 4) is in use worldwide by U.S. military forces that require an Internally Transportable Vehicle platform. The Prowler is purpose-built to meet these requirements and designed to be easily configured as a platform for perimeter patrol, surveillance, reconnaissance and/or logistic support.

The Prowler RTV, known for its ability to perform in any terrain or climate, features a 4-stroke, liquid-cooled engine; fully automatic 4 wheel drive transmission; low center of gravity, tight turning radius and high ground clearance; front and rear extended range independent wishbone suspension system; and automotive-style controls and engineering for minimal maintenance.

Phoenix International Systems
ATV Division
Orange, CA.
(800) 203-4800.
[www.atvcorp.com].

COTS Journal Wants Your Input

COTS Journal is fortunate to have hands down the best set of readers in the industry. No other publication's readers can boast the same blend of technical savvy and management-level perspective (including both program and engineering management). With that in mind, we've decided to tap that resource by asking you three questions each month. E-mail us your answers and in the next issue we'll pick the best, most insightful answers and print them in the magazine. Runners up will have their answers posted on our website. E-mail your answers to me at jeffc@rtcgroup.com.

-Jeff Child, Editor-in-Chief

Question 1. They have a long way to go before they achieve anywhere near the acceptance of traditional military favorites like VME and PC/104. But the emerging embedded computing form-factors ATCA and MicroTCA are starting to gain a foothold in some military system applications. Are you evaluating ATCA or MicroTCA for any current or future military system designs? Whether or not you are, what are the factors weighing for or against those solutions versus other alternatives?

Question 2. Compute density ranks as among the top concerns in lot of military applications including radar, sonar, SIGINT and UAV control systems. To what extent is the need for greater compute density driving you to revamp system architectures in terms of modular form-factors, enclosure configurations and so on? What role are dual-core and multicore computing modules in these efforts?

Question 3. Serial switched fabric technologies were once considered too risky for the design cycles of military programs. Now they're considered a vital tool for enabling today's lightening fast processors to function at their fullest without I/O and inter-processor links bottlenecking the system. How do you position PCI Express, RapidIO and Switched Gbit Ethernet in terms of their strengths as switched fabric interconnects for military applications?

Special Feature

Rugged Storage

Rugged Disks Wrestle with Speed, Density Trade-Offs

Flash solid-state drives now offer performance and capacity levels in the same ballpark as magnetic hard disks. But high capacities and networking features of traditional hard drives keep them squarely in the game.

Jeff Child
Editor-in-Chief

Because flash-based solid-state disks (F-SSD) targeted for military and aerospace apps use the same fundamental flash components as the consumer realm, the price advantages can be leveraged across all markets. The list of applications where F-SSDs are attractive continues to broaden, now including submarines, space vehicles, aircraft carriers, high-altitude balloons, weapons systems and combat aircraft.

Traditional drawbacks of flash-based disks are quickly falling by the wayside. Random access speeds rival and will soon beat other media, retention and re-writing cycles have dramatically increased and many systems offer a single-control erase-all function with or without power for security-sensitivity applications. All those factors have moved F-SSDs closer to the forefront as the lead option for rugged mass storage. Responding to the growing demand for F-SSDs, the major vendors of F-SSD products continue to ramp the capacity, performance and security features of their products.

Figure 1

Shock-resistant solid-state flash drives developed by Memtech are used on several Navy ships, including the Nimitz Class nuclear-powered aircraft carrier Ronald Reagan. Memtech's flash drive was selected to run the fuel-control system of the Ronald Reagan.

Judging by the dynamics in the flash memory chip market and the roadmaps of flash chip vendors, it's clear that F-SSDs are well positioned to nix any arguments for staying with traditional rugged hard drives. Throw in the major advantages in ruggedness and security that F-SSDs enjoy, and the contrast becomes even more vivid.

With no moving parts, F-SSDs are able to operate under the harshest conditions, unlike magnetic hard disk drives. In a rugged environment, the rotating mechanisms of a hard drive can fail, and

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

are subject to partial and sometimes even total loss of data. Severe conditions including high shock, vibration, altitude, humidity and extreme temperature ranges increase failure rate percentages of hard disk drives, which is unacceptable for mission-critical systems.

For example, shock-resistant solid-state flash drives developed by Memtech are used on several Navy ships, including the Virginia Class nuclear-powered attack submarines (SSNs) and the Nimitz Class nuclear-powered aircraft carrier Ronald Reagan (Figure 1). Memtech's compact 3.5-inch 14-gigabite drive being installed on the Virginia Class SSN provides more computing power than is available on the entire current fleet of SSNs. The drives are suited to the rough movement of ocean travel because they have no spinning or other moving parts. They also are resistant to electromagnetic pulses, and are security-friendly because only five seconds are required to erase their memory. The flash drive was also selected to run the fuel-control system of the aircraft carrier USS Ronald Reagan.

Serial ATA Moves into Dominance

Serial ATA technology is quickly becoming the dominant interface for data storage devices migrating from the parallel ATA interface. The latest SATA offer from Targa Systems Division of L-3 Communications is its SATA Data Transfer Systems. The Series 3 version of the PC Card SATA DTU offers capacities to 16 Gbytes and transfer rates to 5 Mbytes/s. Typical airborne platform application systems include flight management, cockpit instrument display, terrain awareness and warning, map systems, radar systems, cockpit/ground communications, navigation positioning and satellite communications.

In those applications requiring higher storage capacity and/or greater read/write speeds than PC Cards can offer, Targa offers its Series 4 Removable Disk SATA DTUs. The Series 4 SATA DTU offers capacities up to 96 Gbytes in a compact, rugged and removable 2.5-inch flash disk. The removable disk feature of the Series 4 product line allows for easy updating of files. Data Transfer rates of up to 50 Gbytes/s are available.

Figure 2

Phoenix International features a Dual Removable Hot-Swap Disk Drives option to its line of Rugged Mass Storage VME plug-in modules. The new VF1-250-SC-RHD model allows portability in transporting a data storage device (by itself) for secure or archival storage off line or for transferring data files to operating storage arrays, servers or host platforms.

SCSI interface drives also enjoy a niche in mission-critical airborne applications. BiTMICRO Networks makes a military-grade version of its E-Disk 3S320, an Ultra320 SCSI F-SSD. Designed for extreme environments, the E-Disk Ultra320 SCSI can operate from -60° to +95°C and is designed to handle operating shock of up to 1500g's, making it an ideal storage solution for scientific missions and reconnaissance flights where data recording opportunities are critical.

The pure solid-state/non-volatile drive is OS-independent and is targeted to provide up to a 42 microsecond access time, 12,500 IOPS (max) and 2 million hours MTBF. Sustained read/write rate is 44 Mbytes/s (max) and burst read/write rate is 320 Mbytes/s (max). Available in a 3.5-inch form-factor, maximum capacity for the E-Disk Ultra320 SCSI is pegged at 155 Gbytes. The completely bootable drive comes with either a half pitch DB68 or SCA-2 ANSI-compliant connector and does not require any device driver for proper operation.

Removable VME Storage

Portability has become a sought after feature as military systems continue to focus on modular system architectures. Feeding such needs, Phoenix International has added a Dual Removable Hot-Swap Disk Drives option to its line of Rugged Mass Storage VME plug-in modules. The new VF1-250-SC-RHD (Figure 2) model allows portability in transporting a data storage device (by itself) for secure or archival storage off line or for transferring data files to operating storage arrays, servers or host platforms. The dual device configuration is ideal for host-based RAID 1 (data mirroring) applications as it is designed to allow the user to hot-swap either or both hard disk drives from a standard single-slot (4HP) 6U plug-in VME module.

Other features of the VF1-250-SC-RHD include transparency to any operating system, Ultra-320 LVD SCSI I/O, 10,000 RPM spindle speed and an average Seek Read/Write time of 4.1 and 4.5 msec respectively. SCSI connect is done via front panel and/or back plane P2 connectors. The unit supports automatic internal bus termination and sports front panel device ID select and activity indicator. The device features rugged steel construction with internal heat sink. MTBF is rated at 1,400,000 hours.

Meanwhile, the more warfighters depend on communications networks, the more important it becomes to secure

those networks and their data, as well as protect equipment from harsh environments. For its part, General Micro Systems offers a first conduction-cooled Network Attached Storage (NAS) system, the INDEX VCNAS. It supports up to 200 Gbytes of rotating media or a flash drive of up to 128 Gbytes in a single slot (4HP) VME form-factor. The unit's operating temperature range is -40° to +85°C and it complies with MIL-STD-810-F. Embedded error correction and detection algorithms are employed for the solid-state drive that yield a data error rate of less than 1 bit in 1014 bits read. Rapid Purge, MilPurge and Intelligent Destructive Purge modes provide advanced content protection.

The VCNAS is based on General Micro Systems' STRONGHOLD VC266 VME 6U SBC, powered by a 1.8 GHz Intel Pentium M processor with up to 2 Gbytes of memory for protocol and packet work, and up to 266 MHz DDR SDRAM and ECC. Dual Gigabit Ethernet ports may be configured as fiber on the front panel, or via rear I/O or VITA 31.1. Dual video for RGB or LCD monitors is supplied. The VCNAS supports Windows XP/2000, VxWorks-Tornado II, Solaris x86, QNX and Linux. ▮▮

Adtron
Phoenix, AZ.
(602) 735-0300.
[www.adtron.com].

BiTMICRO Networks
Fremont, CA.
(510) 623-2341.
[www.bitmicro.com].

General Micro Systems
Rancho Cucamonga, CA.
(800) 307-4863.
[www.gms4sbc.com].

M-Systems
Sunnyvale, CA.
(408) 470-4440.
[www.m-sys.com].

Memtech
Livermore, CA.
(925) 294-8483.
[www.memtech.com].

Phoenix International
Orange, CA.
(800) 203-4800.
[www.phenxint.com].

Targa Systems
L-3 Communications Canada
Ottawa, Ontario
Canada.
(613) 727-9876.
[www.targasystems.com].

What's on your RADAR?

Thompson-CSF
ASTERIX
TPS-43
Marconi 10-Bit
TADIL-B
Raduga-2
NEXRAD
HDLC
X.25
Synchronous BitStream Interface
CD-2
TPS-75

Performance Technologies' WAN protocol software provides a seamless connection to a broad range of communications, aerospace and defense, and commercial applications for both emerging and legacy networks.

Managed WAN Gateways, Radar Extraction and Recording Servers, and Lawful Intercept Platforms are a few examples of applications utilizing our broad software offering. Available on a suite of highly reliable hardware platforms in PCI, CompactPCI®, PICMG® 2.16 and stand-alone form factors, our WAN protocol solutions can accommodate a single port or hundreds.

With over 25 years experience developing highly reliable and scalable solutions, you'll know what's on your radar with Performance Technologies.

Platforms. Blades. Software. Support.
Many solutions. One vendor.

PERFORMANCE TECHNOLOGIES

Learn more about our WAN protocol software at:

www.pt.com/rad

Special Feature

Rugged Storage

Storage for Harsh, Harsher and Harshest Mil Environments

Trade-offs abound when it comes to marrying the right storage solution to a military application. Cost, packaging, media technology and ruggedness specs must all be factored in.

Tom Bohman
Vice President for Business Development, VMETRO

Mass storage for military systems demands robust approaches to survive in harsh applications. Rotating media performs reliably in many applications if packaged appropriately, while flash media is required in the most extreme environments. While commercial commodity storage technology continues to improve in cost and density, most of it is practically useless in a typical military application beyond the lab or ground shelter without some proactive packaging innovation.

When looking at ground or air environments, systems can be divided into four main categories, each with their own set of environmental parameters: Labs, or fixed ground installations; C4ISR aircraft in-cabin; C4ISR aircraft out-of-cabin; and tactical combat platforms.

Storage technology is available for reliable operation in all those environmental classes. But that reliability comes at some price—mostly in supporting the required packaging. Figure 1 illustrates these costs as approximate multiples of commodity storage. Before looking deeper at these last three environments—progressing from harsh, through harsher, to harshest—it's helpful to examine the potential problems with using hard disk drives in these environments without proper packaging.

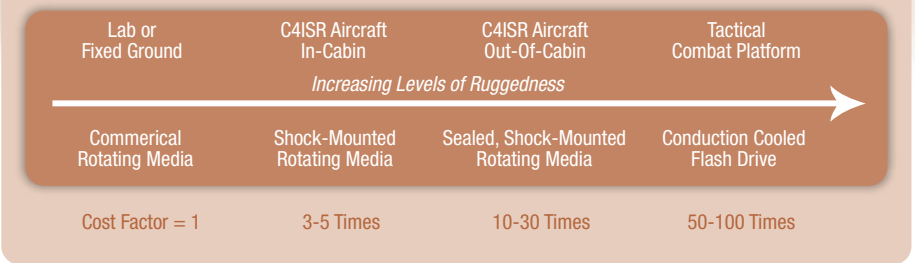


Figure 1

In rugged storage technology, reliability comes at some price. This graphic illustrates these costs as approximate multiples of commodity storage.

Hard Disk Drive Dynamics

In most cases when deployed in labs or fixed sheltered ground installations, commercial storage technology does the job inexpensively. This commercial-grade technology typically includes commodity hard disk drives organized as JBODs ("just a bunch of disks"). Beyond those benign environments, three environmental hazards exist that most hard drive technology doesn't get along with: shock and vibration, altitude and temperature.

Hard drive read/write heads float in very close proximity to the spinning media, close enough for an electromagnetic force to operate but not close enough for physical contact. Drives have improved in their capability to handle not-so-gentle bumps, but the margin for error is still small, and damage happens quickly at today's high rotational speeds of 7200, 10,000 or 15,000 rpm. In moderate to high shock and vibration scenarios, heads subjected to those forces impinging on an inopportune axis can literally crash. In a hard disk crash, the head makes physical contact with the media, damaging itself or the media and rendering some or all of the data on the drive inaccessible.

At altitudes where insufficient air pressure exists, the head doesn't have enough air pressure to float and the hard drive won't spin up properly, with similar ramifications for potential damage. Meanwhile, most hard disk drives are rated for operation starting at 0°C, and many environments don't offer such a warm climate. Packaging solutions are available to tackle all three of these prob-

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

The Ultimate **SOLID STATE DRIVE**

for embedded military and aerospace storage applications

Zeus Solid State Drive

- PATA/IDE, Serial ATA and Fibre Channel interfaces
- 2.5" and custom form factors
- 8-128 gigabyte capacities with data rates up to 72MB/sec
- Advanced industrial security features
- Industry leading 5-year warranty

Rugged Zeus Solid State Drives (SSDs) are ideal for battlefield military and aerospace systems that require high reliability and high tolerance to shock, vibration, humidity, altitude and temperature.

For more information, contact our SSD specialists at **SSD@stec-inc.com**, call **1-800-796-4645** or visit our website at **www.stec-inc.com.**

STEC

Figure 2

A typical "harsh" environment for rugged storage are C4ISR wide-body aircraft designed to carry large numbers of crew and large amounts of sophisticated equipment on missions. An example of an aircraft in this class is the E-3 Airborne Warning and Control System (AWACS) aircraft shown here. The E-3 Sentry is a modified Boeing 707/320 commercial airframe with a rotating radar dome.

Figure 3

The VMETRO SANcab is an example of a semi-rugged storage subsystem using commercial drives with semi-rugged packaging. It contains up to twelve 3.5-inch hard disk drives. Each drive is mounted on shock and vibration isolation pads within a shelf holding up to six drives. The unit also has an optional backplane with four 6U card slots for installation of VME and/or cPCI hardware.

lems in moderate shock and vibration environments, mitigating the forces a hard disk drive is subjected to and allowing it to operate reliably, avoiding crashes.

Harsh: C4ISR Aircraft In-Cabin

Many C4ISR aircraft are wide-body platforms designed to carry large numbers of crew and large amounts of sophisticated equipment on missions. Examples of aircraft in this class are the E-3 AWACS, Airborne Stand-off Radar (ASTOR), or C-130, which functions in the C4ISR role in several variants. These aircraft present moderate levels of shock and vibration such as that from air turbulence, jet or turboprop engines and their spinning blades or propellers, and landing gear contact with a runway. Cabins in these aircraft are pressurized, typically to an altitude of 8,000 to 10,000 feet above sea level, and temperature controlled to enable the human crew to work comfortably.

In-cabin use is a good example of an application where hard disk drives can be used. As long as the equipment is mounted inside the cabin, hard disk drives are able to operate because the required pressurization needed to float the drive head exists, and the ambient temperature is above freezing. With steps to isolate the hard disk drives from the moderate amounts of shock and vibration encountered during flight, they can function very reliably.

An example of a semi-rugged storage subsystem using commercial drives with semi-rugged packaging is shown in Figure 3. The VMETRO SANcab contains up to twelve 3.5-inch hard disk drives. Each drive is mounted on shock and vibration isolation pads within a shelf holding up to six drives, and two shelves can be installed in the unit, again each mounted with shock and vibration isolation. The unit also has an optional backplane with four 6U card slots for installation of VME and/or CompactPCI hardware. For these low-altitude, semi-rugged applications, the environment is somewhat harsh but hard disk drives with shock and vibration mitigation work well.

Harsher: C4ISR Aircraft Out-of-Cabin

Some C4ISR aircraft don't have large crew complements, and carry their equipment outside of the crew cabin. The newest C4ISR platforms, UAVs, dispatch with the need for pressurization entirely since they are unmanned. Good examples of this application are payload on the WB-57, NASA's high altitude weather research aircraft, or equipment onboard the Global Hawk ISR UAV. On such platforms, data-gathering equipment is carried in an external pod, or on a pallet in an unpressurized bay. Shock and vibration mounting is required just as in the in-cabin applications, but attention to pressurization and temperature is also required.

In that scenario, pressurization is not fully controlled or does not exist where the equipment is located, and equipment may be subject to temperatures as low as -40°C at altitude. These conditions allow use of

hard disk drives only with a self-contained pressurized chamber and heating elements to bring them within operational range.

An example of a sealed, ruggedized storage subsystem using hard disk drive technology is the VMETRO SANbric. Six drives are mounted in a small rugged sealed canister with total capacity up to 1.8 Terabytes, which is in turn installed in a shock isolation unit for further protection. In Figure 4, note the black rubber isolation bumpers on the corners of the canister, and the rubber shock mounts on the side of the isolation unit. To address the problem of possible low temperature extremes, 300W of heating elements that can be cycled in any combination are provided in the canister to bring the hard drives into operational range above 0°C before the drives are spun up.

The SANbric platform is very rugged, able to operate in environments harsher than what one would normally associate with using hard drives. It has been tested to RTCA/DO-160D specifications, including 20g 11 msec operational shock, and has been shown to operate at an altitude of 72,000 ft. BAE Systems has recently performed operational flight testing of the SANbric, collecting imaging systems data on a pallet within an aircraft cargo bay. Each SANbric canister weighs 22 lbs and measures 11.5 x 5.1 x 7.5 inches. This type of high-altitude, rugged solution takes hard drives into places where they have not been able to operate before, with two levels of shock and vibration mitigation, pressurization and heating to deal with a harsher environment.

Figure 4

VMETRO's SANbric is an example of a sealed, ruggedized storage subsystem using hard disk drive technology. Six drives are mounted in a small rugged sealed canister with total capacity up to 1.8 Terabytes, which is in turn installed in a shock isolation unit for further protection.

Harshest: Tactical Combat Platforms

Even with packaging augmentation, hard disk drives have their limits. When most engineers think of rugged applications, fighter aircraft such as the F-22 Raptor, helicopters like the AH-64D Apache Longbow, or tanks such as the M1A2 Abrams immediately come to mind. In most cases, extreme conditions of shock, vibration, temperature, dust, humidity and other conditions these platforms are subjected to rule out use of hard disk drives.

For extreme conditions like these, the best alternative is use of solid-state drives with no moving parts. Solid-state drives, like most ruggedized electronics, can withstand relatively high shock and vibration forces and don't require pressurization to operate. Also, drives can be mounted into a conduction-cooled package, making cooling simpler and further reducing SWaP requirements.

An example of a solid-state ruggedized storage subsystem using flash technology is the VMETRO VMDRIVE. Based on a 6U card in either VME or CompactPCI, the VMDRIVE storage capacity is 40 or 80 Gbytes using flash-based drives. Versions are available in either air-cooled or conduction-cooled, as shown in Figure 5. The conduction-cooled units are operationally rated for 40g shock, -40° to +75°C temperature and up to 75,000 feet altitude. The unit weighs 2.2 lbs and consumes less than 2.5W total. Tests to MIL-STD-810F show these units suitable for helicopter environments. While not offering the capacity of hard disk drive solutions, solid-state drives can definitely deal with the harshest environments, and offer advantages in SWaP with their compact size and lower power consumption.

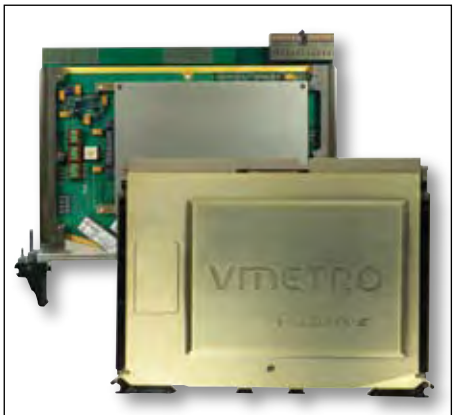


Figure 5

An example of a solid-state ruggedized storage subsystem using flash technology is the VMETRO VMDRIVE. With capacities of 40 or 80 Gbytes using flash-based drives, the conduction-cooled versions (shown) are operationally rated for 40g shock, -40° to +75°C temperature and up to 75,000 feet altitude.

Packaging Makes it Possible

Storage for off-the-shelf platforms has taken exciting new directions, with higher capacity, better survivability and improved SWaP characteristics. Most of the breakthrough is creative packaging for commodity disk technology. Taking commodity hard disk drives and packaging them to survive in harsh and harsher environments is a robust, cost-effective solution. Hard drives with the right shock and vibration isolation can operate at low altitudes and temperatures above freezing. Adding pressurization and heating takes hard drives into higher altitudes and out-of-cabin applications. For the harshest environments, flash technology in solid-state drives has reached capacities making their use feasible, and eliminates moving parts making them extremely rugged. As flash continues to improve in density and cost, the solid-state solution becomes even more attractive. ▮▮

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

Special Feature

Rugged Storage

High-Capacity Storage Remains a Challenge in Rugged Apps

Ever climbing demand for greater data storage is putting a squeeze on rugged disk drive vendors. They're bringing all their tricks into play to support higher capacities while meeting extreme environmental requirements.

Sam Carswell, Chief Technical Officer
Gene Lovely, Director Business Development
Formation

Today's military system designers and integrators need to provide increasing amounts of rugged mass data storage for a myriad of applications. From airborne computing and surveillance devices to UAVs, submarine communications systems and ground vehicles, there is an insatiable appetite for collecting and storing far more data.

Gone are the days when only small amounts of video and sensor data were collected and then compressed to be easily stored and transmitted elsewhere for processing. Today lossy compression is avoided since it interferes with reliable analysis and threat assessment. Required storage capacities have therefore risen to the multi-terabyte level.

For military systems in particular, data storage solutions must perform without fail in extreme environmental and handling conditions. In choosing rugged storage, the design engineer has three main goals. The first is to design the most cost-effective solution. The second is to satisfy system requirements such as minimum capacity, performance, altitude, operating temperature range, humidity, vibration, operating shock and handling ruggedness. If the system is not designed properly, either some data may not be captured or data may be entirely lost. The third goal is to design a solution that maximizes capacity, since this both simplifies the recorder design and lengthens the system mission time.

Figure 1

Formation's ToughDisk Rugged Hard Disks are an example of a solution that bridges the gap between conventional hard disks and expensive solid-state solutions. It provides much of solid-state's performance in a conventional 3.5-in. disk form-factor.

The key question for military system designers is, "What's the greatest storage capacity that will fit into the smallest space at the lowest cost and power dissipation?" Designers also do not want to pay more than necessary for a storage solution that meets their needs, so they must be innovative in finding a solution.

Emerging Rugged Storage Technology

There are two approaches a designer or integrator can use to meet rugged storage needs for military applications. The first is to use military-grade materials and components that can operate in harsh environments. The second is to use high-quality, off-the-shelf equipment in a commercial 19-in. rack and isolate it from those harsh environments.

For example, servers can be isolated within an aircraft cabin by creating a vibration-isolated, semi-pressurized operating environment. But even in an isolated environment, traditional commer-

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

Acromag I/O. Customize It.

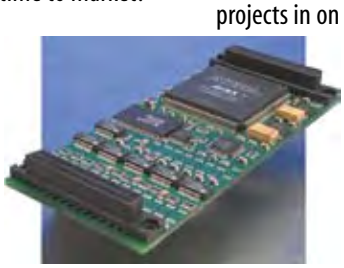
Acromag introduces affordable FPGA I/O. For ALL your projects.

As an engineer, your projects are unique, ever-changing, and budget-bound. That's why our new PMC modules give you an affordable solution to create custom I/O boards.

But if you thought FPGA computing was only for top-end applications, think again. Our PMCs are ideal for protocol conversion, simulation, in-circuit-testing, and much more.

So, why settle for generic I/O when you can design exactly what you need while staying in budget and reducing your time to market?

- Virtex®-II, Virtex-4, Acex®, and Cyclone®-II FPGAs
- Large DRAM buffers and dual-ported SRAM
- Conduction-cooled models available



Industry Pack FPGA I/O also available

Cost-effective custom I/O
Choose from a variety of I/O configurations:

- Digital I/O: TTL, CMOS, RS422, or LVDS I/O
- Analog I/O: 16-bit 100MHz A/D, 900KHz D/A

Faster time to market
Why waste precious time building a board from scratch? Our new FPGA modules let you process your I/O signals any way you want. Quickly.

Flexibility to meet unexpected challenges
Acromag FPGA I/O will help you bring your projects in on time and under budget. And with FPGAs, you'll be ready to adapt to all the inevitable changes.

Thinking about FPGA I/O?
Think flexible. Think affordable.
Think Acromag.

Call or visit our website today – for VME, CompactPCI, PMC, and Industry Pack solutions.

Acromag®
THE LEADER IN INDUSTRIAL I/O

www.acromagembedded.com
877-295-7085 or 248-295-0310

ANALOG I/O DIGITAL I/O SERIAL I/O FPGA COUNTER/TIMER QUADRATURE

Manufactured in Wixom, Michigan, USA

cial power supplies, fans and hard disks are likely to fail. This can be corrected by augmenting the system with redundant fans and power supplies to shore it up for military applications. That leaves potential hard disk failure as the last issue to be resolved.

into terabyte arrays.

Solid-state disks (SSDs) are inherently rugged, making them the logical choice for systems that need fewer than 100 Gbytes of storage capacity. These small SSDs lose their size, power and cost advantages above 160 Gbytes, since

	Commercial 2.5-in. solid-state disk	TD3500-SATA	TD vs. SSD
Per 1.2 Terabyte System			
Number of Disks	38	4	34 fewer disks
Average Read/Write (watts)	36	26	10 fewer watts
Volume (cubic inches)	156	92	64 cubic inches smaller
Weight (lbs.)	8	5	3 lbs. lighter
Per Disk			
Capacity	32	320	10x more
Gbytes/watt	34	48	44% better
SATA/SAS Interface	150	300	2x faster
Gbytes/cubic inches	8	14	79% denser
Average Read/Write (Mbytes/s)	57	69	21% faster
Vibration (Gs peak-to-peak)	2.17	2	About the same
Operational Shock (2 milliseconds)	500G	350G	Meets most requirements
Operating Temperature	0° to 70°C	-40°C to +70°C	Wider range

Table 1

Compared here are two storage systems designed with the best-of-breed low-cost disks: 2.5-in. commercial solid-state disks and Formation's TD3500SATA.

Typical 3.5-in. hard disks come in desktop-class and enterprise-class styles. Desktop-class disks are commodity units that deliver high capacity by maximizing the diameter of their disk platters. The physics of large platters yields poor performance, in terms of low revolutions per minute (rpm), and poor reliability in rugged environments.

By contrast, enterprise-class disks maximize performance and reliability through the use of small-diameter, high-rpm platters. Although excellent in computer rooms, their high rpm's yield heat and gyroscopic forces that make them poor choices for military environments, especially when ganging multiple disks five 2.5-in. 32 Gbyte SSDs drawing more than 4W total are required to match the capacity of a single 2W 160 Gbyte 2.5-in. hard disk.

Another decision point for disk storage is choosing an electrical interface: ATA, Fibre Channel (FC), Serial ATA (SATA) or Serial-Attached SCSI (SAS). As more data must be processed in real time, this has meant a requirement for faster interfaces, including serial interfaces.

Although ATA is suitable for legacy systems, new low- and medium-performance systems have moved to the faster, low-pin-count SATA interface, since it is "free" with processor chipsets. However, high-throughput systems will need RAID arrays. Full-featured RAID controllers are offered with FC and SAS interfaces. Forecasts by market research firms favor SAS RAID controllers, since they interoperate with both SAS disks and the market-dominating SATA disks.

Breaking Limitations of SATA Drives

SATA SSDs are good choices for systems with modest capacity requirements. But to deliver realistically priced rugged systems with terabytes of storage, hard disks are still required. Although SATA would be the preferred common denominator because of its ubiquity, it is only found on the lower-performing 3.5-in. desktop hard disks. SAS enterprise-class disks deliver performance but have the previously mentioned design risks and only interoperate with high-end SAS RAID controllers. What's needed is a SATA 3.5-in. hard disk that delivers the performance of enterprise disks, but without their heat and mechanical limitations.

An example along those lines is Formation's ToughDisk. The unit is designed to perform reliably in environments that would destroy conventional hard disks, at a fraction of the cost of SSDs (Figure 1). The system encompasses both hardware and software to "wrap" hard disks with active thermal management, shock and vibration protection. It employs a sealed internal enclosure to protect against high altitude, dust and humidity, while a sturdy external case maximizes cooling and provides positive mechanical coupling to the host.

The overall package guards the hard disk both when mounted in the host platform and when removed for transportation or storage. A built-in processor independently monitors, controls and logs the environmental subsystem. Optional system software can manage the disk via an I^2C interface.

The most recent version of this approach is the TD3500 SATA hard disk. Using the same principle that gives dual-core processors high performance with fewer watts of power dissipation, this 3.5-inch SATA disk contains two 2.5-inch

platters bonded together with RAID. The independent actuator arms and read/write heads double the media transfer rate normally available from these rugged, low-power, small-diameter platters. The resulting disk gives designers the preferred 3 Gbit/s SATA interface in a standard 3.5-in. package that draws 1/3 the power of the equivalent 3.5-in. SAS hard disk and less power than an equivalent capacity built from SSDs, as depicted in Table 1.

Rugged Disks Take Flight

Disks built with this approach are used in all branches of the U.S. military, as well as foreign military services, for all types of rugged storage needs. For example, the U.S. Coast Guard has deployed these hard disks with standard hard disk carriers in modified 4U chassis for storing system software and data on CN-235 aircraft. They are being integrated by Deep Development, a division of Gatekeeper Systems, into Viperfish ASX high-resolution digital video recorders for use in Air Force AC130H/U gunships (Figure 2), which record planes in action as they escort convoys, protect air bases and facilities, and carry out air strikes. These disks also comprise the key component of the multi-server systems ISR provides to the Army and Marine Corps for use in mobile command-and-control operation centers during ground warfare.

With the 10x or better price advantage per Gbyte of hard disk storage over solid state, military users will continue to demand more storage for less cost. This imperative will challenge disk manufacturers to keep investing in technologies that enable new ways of increasing data storage, for example, developments such as storing bits on the disks perpendicularly rather than horizontally. This is good news for military system designers who rely on these technologies to achieve the greatest rugged data storage performance at the lowest cost. ▮▮

Figure 2

Deep Development, a division of Gatekeeper Systems, integrated Formation's ToughDisk 3500 rugged hard disks into its Viperfish ASX high-resolution digital video recorders for use in U.S. Air Force AC-130H/U gunships.

Formation
Moorestown, NJ.
(856) 234-5020.
[www.formation.com].

Special Feature

Rugged Storage

Blade-Level NAS Brings Network Rugged Storage

Networked-attached storage is becoming a vital building block as the DoD migrates toward a net-centric paradigm. Blade-level NAS solutions bring those capabilities to the harshest of mil/aero environments.

Steve Gudknecht, Product Manager
ACT/Technico

With the introduction of new integrated 6U products, network attached storage (NAS) is gaining acceptance in the military embedded computing industry as a cost-effective and reliable shared storage solution. New designs now bring together multiple drives, RAID controller, processor and dual Gigabit Ethernet links into a single 6U VME or cPCI slot. This compact design lends itself to a new level of rugged applications that demand high reliability and redundant operation where the benefits of shared storage are most cost-effective. New conduction- and convection-cooled products leverage cost declines in solid-state flash storage to produce rugged solutions that can match the overall cost and exceed the capability of systems based on rotating storage.

In the embedded space traditional mass storage solutions typically fall into three categories, each with its own set of pluses and minuses. In the familiar direct attached storage (DAS) model, drives are attached to the host CPU in a space-saving, single-slot brick with the drive(s) mounted directly to the board or on a PMC mounted to the board. DAS, however, is not a shared storage model. Failure of either the drive or the host CPU results in both components being out of action, and today's minimum drive capacities often far exceed the storage needs of the particular host.

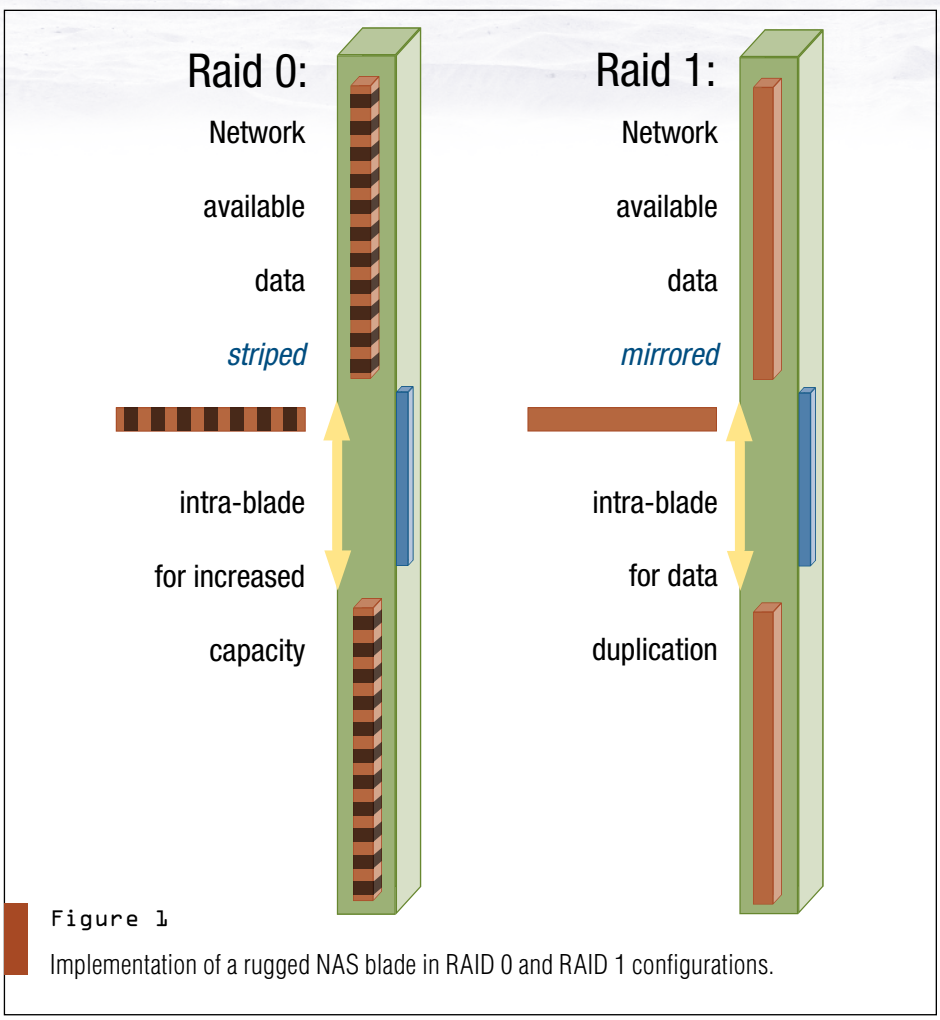


Figure 1

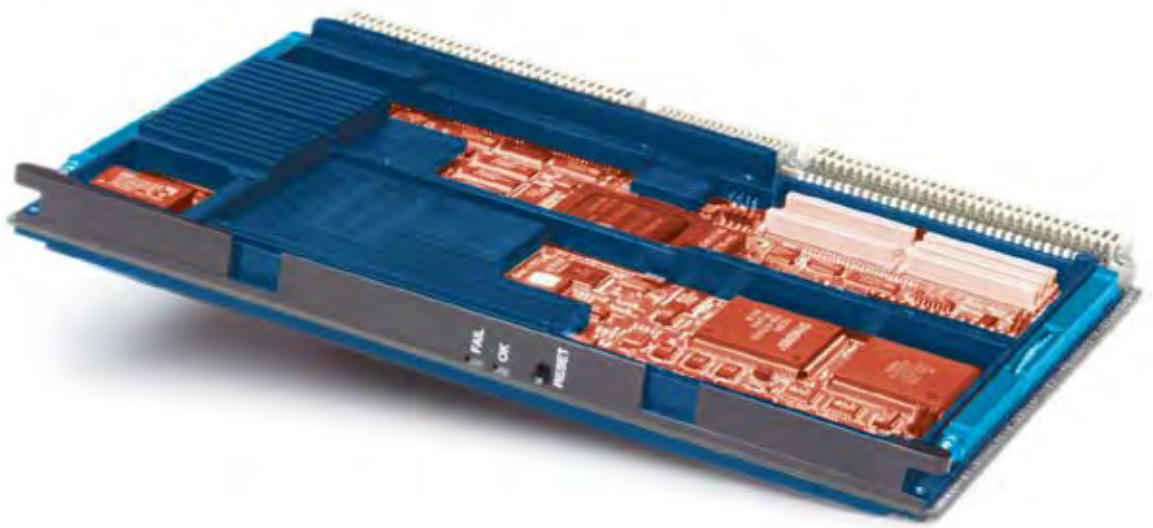
Implementation of a rugged NAS blade in RAID 0 and RAID 1 configurations.

NAS and SAN Dominate

For global (shared) storage needs, NAS and storage area networks (SANs) dominate. The global storage paradigm typically conjures up images of an external chassis interconnected via a SCSI or Fibre Channel interface. This type of architecture with its hefty appetite for space combined with added hardware and cabling needs often proves cumbersome or even unworkable in

When your mission is critical...

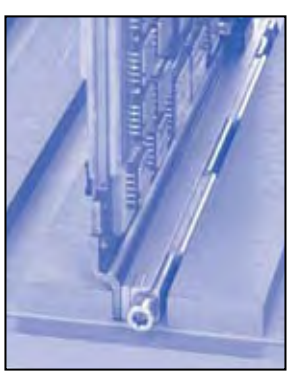
...DEPEND on Birtcher Card Guides & Conduction Cooled Assemblies



Wedge-Tainer™

- Designed to comply with MIL-STD-810D and MIL-STD-901D in addition to MIL-E-5400

Wedge-Lok®



- Meets the requirements of drawing 84103, Defense Supply Center, Columbus

For 46 years, Birtcher's rugged card guides, Wedge-Loks®, and conduction cooled products have been the keystone of electronic systems. Birtcher products secure electronics with robust clamping and a protective cooling path regardless of vibration or G-loads. Whether deployed in spacecraft, aircraft, watercraft, or all-terrain vehicles, when your application is mission-critical, look no further than Birtcher.

Birtcher

HOLDING IT ALL TOGETHER

www.birtcherproducts.com • 888-957-8291

Figure 2

ACT/Technico's conduction-cooled NAS blade incorporates dual solid-state SATA hard drives in 1.8- or 2.5-inch form-factors. Dual drives on one 6U NAS blade yield a respectable 128 Gbyte capacity in RAID 0 (data striping) implementations.

harsh military environments. Benign military "enterprise-like" applications make up the majority of military storage installations using SANs, where each host may access a fixed address space; overall storage space is measured in the multi-terabytes and data access rates are high.

Enterprise hardware is typically rated for ambient temperatures well within the operating range of standard hard drives. Many applications simply don't require the capacity of an enterprise installation nor do they carry excessive data rate requirements. They do however benefit from the shared access and data availability attributes of NAS in the chassis with RAID management. The small footprint of 6U NAS blades opens the door to their use across many different types of applications including conduction-cooled installations where operation in the most extreme environments is a requirement.

Two NAS Standards for Embedded

Two specifications have emerged enabling more compact and rugged system area networking. The PICMG 2.16 and VITA 31.1 specs specify embedding Ethernet into 6U cPCI and VME backplanes, respectively. These specs allow designers to build loosely coupled systems using physical network connections embedded in the system chassis where boards exist as network addressable nodes. PICMG 2.16 and VITA 31.1 support scalable systems to incorporate a dual star network topology (Figure 1) with redundant 6U Ethernet switches connecting individual 6U nodes slots. Each node accesses the 6U NAS blades via the backplane using redundant data paths. As loosely coupled nodes on the network, NAS fits in nicely with the DoD's Network Centric systems movement. At the blade level, the NAS is viewed as the storage server using CIFS (common Internet file system) and NFS (network file system) file system protocols.

RAID overlays allow redundancy within each blade—drive to drive—or between blades over the network. NAS blades can either be single slot with two drives or dual slot with four drives. Network complexity ranges from single star/single NAS blade with RAID 0 or RAID 1 to dual star/dual slot NAS blades with RAID 0+1, 1+1 or 5+1 and cross network redundancy (see Figure 1 again).

When analyzing storage needs, usage must also be considered and can be broken down into categories such as event logging, application image load, data storage and operating system boot. The end of any NAS solution is system reliability as the value of shared data increases with the number of host connections. To address this, data duplication and synchronization with automatic failover is provided in NAS blades with advanced RAID controllers and network failover utilities.

Such redundancy schemes address reliability in the manner described above. Building in redundancy and the necessary management is only part of the overall approach to optimizing system performance and availability; there is also underlying hardware. Dependable system performance cannot be achieved, no matter how fool-

SMARTStorage Solutions

Secure. Scalable. Rugged.

For more than 30 years, General Dynamics Advanced Information Systems has been a trusted provider of rugged data storage solutions for a variety of military applications.

SMARTStorage offers security through NSA Type 1 embedded encryption, rapid discovery of data through meta-data tagging, and many-to-many data exchanges.

General Dynamics' SMARTStorage solutions ensure that critical information is visible, available, and usable to help accelerate decision-making in the net-centric operational environment.

GENERAL DYNAMICS
Advanced Information Systems

www.gd-ais.com/datastorage

proof the management strategy, without the correct hardware. Rugged NAS solutions should include solid-state flash drive technology and should consider conduction-cooled packaging where necessary.

Rugged NAS for Airborne Apps

In airborne applications, end users require conduction-cooled solutions to deal with extended temperature and high levels of resistance to excessive shock and vibration. Storage solutions, now in use for airborne applications, include solid-state SCSI drives mounted externally to the main chassis and connected via cables through host bus adapters. This discrete architecture adds a layer of complexity and cost for any shock absorption and cooling scheme.

By contrast, conduction-cooled 6U NAS blades can reside in the ATR chassis, and as a result, can significantly reduce cost and complexity without sacrificing performance. Properly designed 6U conduction-cooled VME systems can include processing nodes, Ethernet switches and 6U conduction-cooled NAS blades in the same chassis.

ACT/Technico's conduction-cooled NAS blade (Figure 2) incorporates dual solid-state SATA hard drives in 1.8- or 2.5-inch form-factors. Industrial drives are capable of -40° to +85°C temperature operation with shock and vibration resistance exceeding military requirements using the MIL-STD 810F testing methods where shock survivability levels are in excess of 10 Gs at 11 msecs. Solid-state drive capacities currently sit at 64 Gbytes for the common 2.5-inch form-factor. Dual drives on one 6U NAS blade yield a respectable 128 Gbyte capacity in RAID 0 (data striping) implementations.

Extreme Temperatures

Temperature extremes are the primary reason solid-state drives are needed in conduction-cooled systems, since even the most advanced cooling schemes fail to reduce temperatures to levels where rotating drives are likely to survive. Many convection-cooled applications, however, require operation in lower temperatures, but carry shock and vibration requirements that exceed the specifications of even the toughest hard drives.

Traditionally, these applications have used rotating hard drives involving elaborate and expensive shock isolation mounting hardware. Such systems required lengthy and costly environmental testing to ensure reliable drive operation, yet despite these efforts field failures still occur at rates higher compared to solid-state drives. Add up all these secondary expenses and compare it to the cost of solid-state drives that require no such extreme measures, and it still made economic sense to go rotating—that is until recently.

Solid-state drive costs have dropped by as much as 70 percent in the past year and are at the point now where, with reasonable cost assumptions, rotating drives in certain harsh environments may be more trouble than they're worth. As a result, ground and shipborne storage applications will steadily shift to solid-state drives. Solid-state drive endurance is impressive with up to 10-year data retention capabilities and MTBF (mean time between failure) rates as high as 4 Mhours with little or no downside due to the effects of extended temperature operation. Wear leveling in solid-state drives has advanced to the point where drive failure due to excessive usage is a non-factor with read/writes capped at over 2M. Rotating drives by contrast are rated at about 500 khours at lower temperatures, and then derated in high-temperature applications.

Convection-cooled 6U VME NAS blades include the same feature set as conduction-cooled versions with front panel removability and hot swap. In addition, convection-cooled models allow for dual slot/four drive offerings. Total capacity in a dual slot NAS can reach 256 Gbytes using current 64 Gbyte drives. The four drive brick can serve as a stand-alone RAID 5 or RAID 0 volume or with a redundant cross network companion.

Several inflection points are beginning to converge that will enable a true paradigm shift in shared storage; the introduction of Ethernet embedded backplanes with the VITA 31.1 and PICMG 2.16 standards; the development of single-slot, integrated 6U NAS/RAID solutions and, finally; the precipitous decline in solid-state storage pricing. The offshoot of this convergence is the development of highly reliable, rugged storage solutions with footprint and cost reductions to meet or exceed most system requirements. ▮▮

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

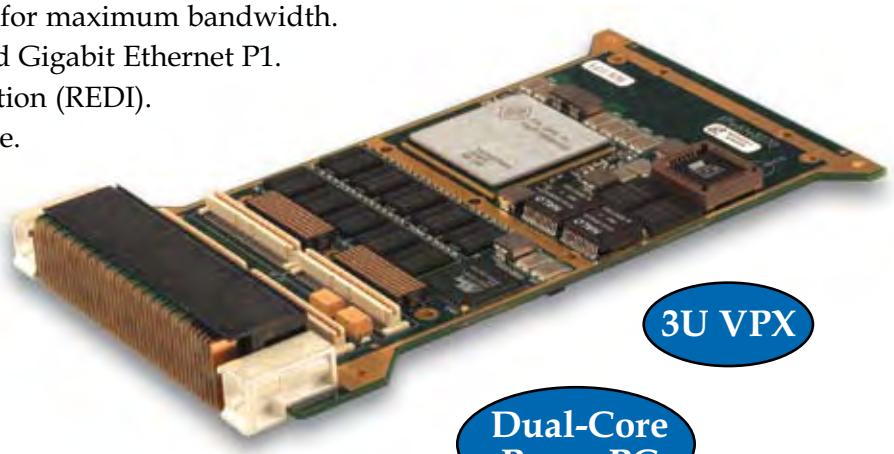
Some Things Just Can't Be Ruggedized...

...And Some Are Designed Rugged From Day One

Bringing P.A. Semi to VPX, Extreme Engineering Solutions introduces the **XPedite8070**, a high-performance 3U VPX-REDI single-board computer. With the P.A. Semi PA6T-1682 integrated platform processor, the **XPedite8070** offers:

- Dual 2.0-GHz Power Architecture processor cores.
- Two independent DDR2 SDRAM channels for maximum bandwidth.
- PCI Express, 10 Gigabit Ethernet XAUI, and Gigabit Ethernet P1.
- Ruggedized Enhanced Design Implementation (REDI).
- XMC and Processor PMC (PrPMC) interface.
- 3U VPX-REDI conduction or air cooling.
- Linux, VxWorks, and QNX support.

For customers looking for one vendor to provide the complete system solution, X-ES provides full component selection, operating system support and integration services.



X-ES
Extreme Engineering Solutions

www.xes-inc.com 608-833-1155 sales@xes-inc.com

Ethernet Shines as Fabric for Sensor Nets

1 Gbit and 10 Gbit Ethernet technologies have emerged as ideal solutions for networking multiple sensors to data processing, recording and instrumentation gear in military systems.

Greg Bolstad, Chief Systems Architect
Critical I/O

As a command and control technology, Ethernet has been used in military systems for many years. But as Ethernet continues to evolve to higher and higher levels of performance and capability, it's now taking on much more data-intensive and time-critical applications. Both 1 Gbit and 10 Gbit Ethernet can now—when properly implemented with offload technology—provide a highly deterministic, high-performance fabric suitable for the most demanding real-time applications.

10 Gbit Ethernet in particular will have a greater impact on real-time systems than any prior advancement. It holds the promise to displace niche data network fabrics, providing an order of magnitude increase in performance, yet maintaining full compatibility with prior variants of Ethernet. In particular, both 1 Gbit and 10 Gbit Ethernet technologies are finding a home in the implementation of flexible Sensor Data Networks that are used to connect multiple sensors to data processing, recording and instrumentation systems in a variety of sea, land and airborne military systems. Examples of sensor subsystems that can leverage Ethernet sensor networks include radar and sonar sensors, digital imaging systems, digital receivers, video systems and many others.

Sensor-to-processor connectivity has typically been the domain of proprietary interface implementations, or narrowly adopted standards such as Front Panel Data Port (FPDP) or Serial FPDP. These types of technologies have the advantage of simplicity and relatively low latency. They have the strong disadvantage of extremely limited network capabilities—typically none—and they require the use of special-purpose interface hardware and software in the processor system that is receiving the sensor data.

Ethernet for Sensor Data

While many system designers would not automatically think of using Ethernet as a sensor data network, there are many advantages in doing so. Ethernet provides a true general switched network, with

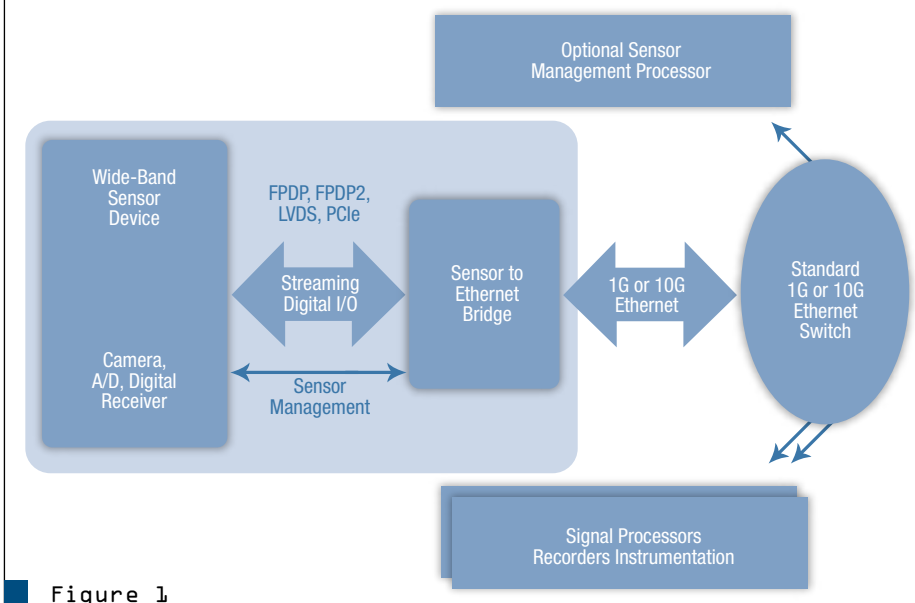
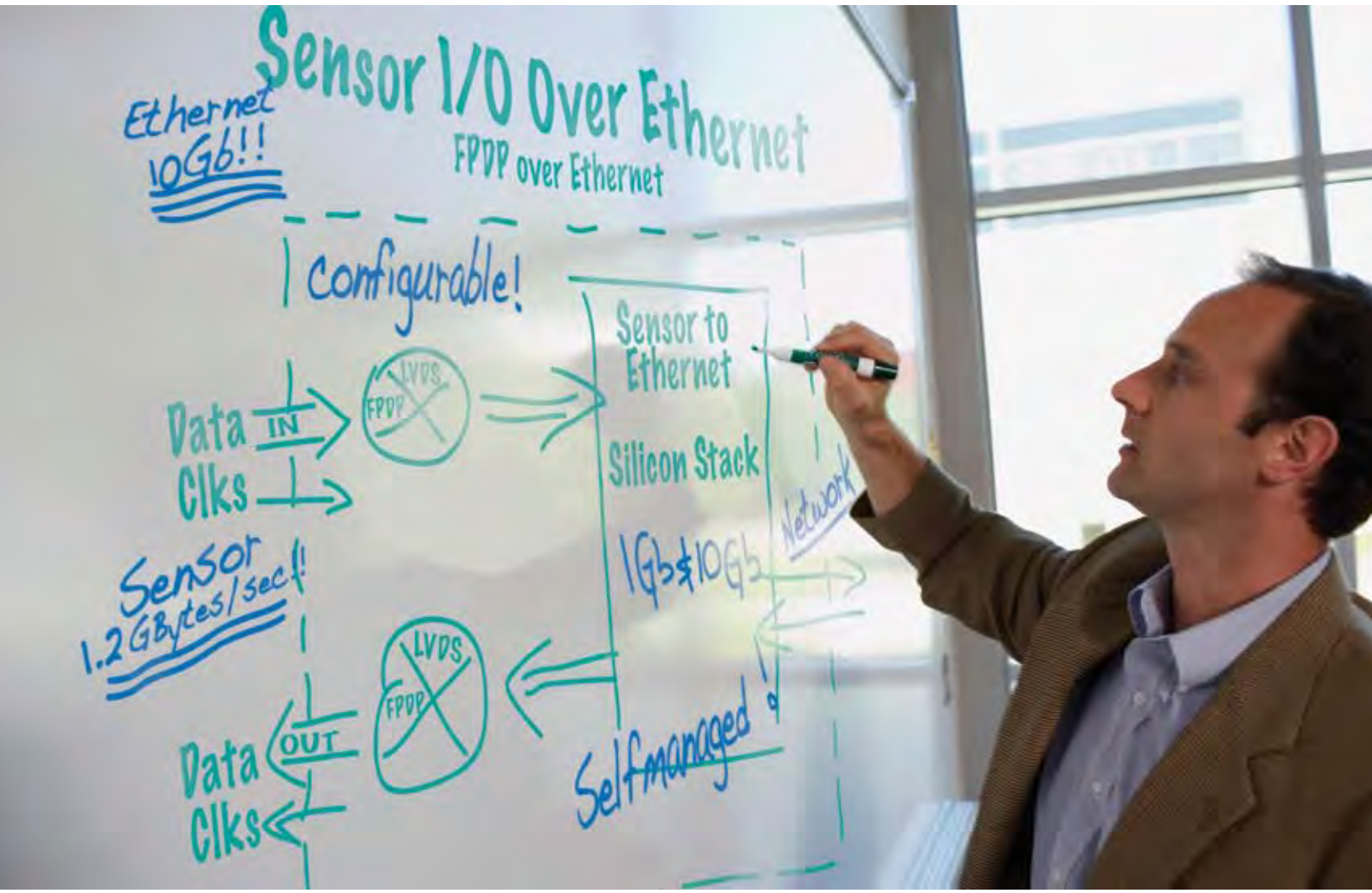


Figure 1

Because of Ethernet's capabilities to route data to multiple destinations, to multicast and to broadcast, it's a great solution for sensor networking. Since Ethernet always provides a bidirectional path, it can be used to communicate with and control the sensors. Shown here is an example of a sensor-to-processor system connected via Ethernet.

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

We've Given Your Sensor I/O Some Serious Thought



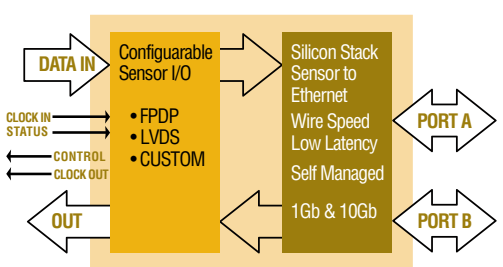
Introducing SensorLink
Stream Your Wideband Sensor Data Over Ethernet

Imagine connecting all your wideband I/O devices to standard 1 or 10 Gigabit Ethernet networks and still be able to stream at wire-speed with very low latency to processors, storage devices or even other SensorLinks. Finally, an Ethernet Sensor Fabric made possible by SensorLink.

No more proprietary interfaces or pseudo-standard technologies for your real-time sensor I/O. Now, you can have the power of Ethernet networking and use cost-effective standard interface hardware and application software. See the payoff immediately in reduced costs, improved efficiency and faster time to market.

There has never been anything like SensorLink. Contact Critical I/O today to learn what it can do in your designs.

SensorLink: Sensor I/O over Ethernet



CRITICAL I/O

www.criticalio.com

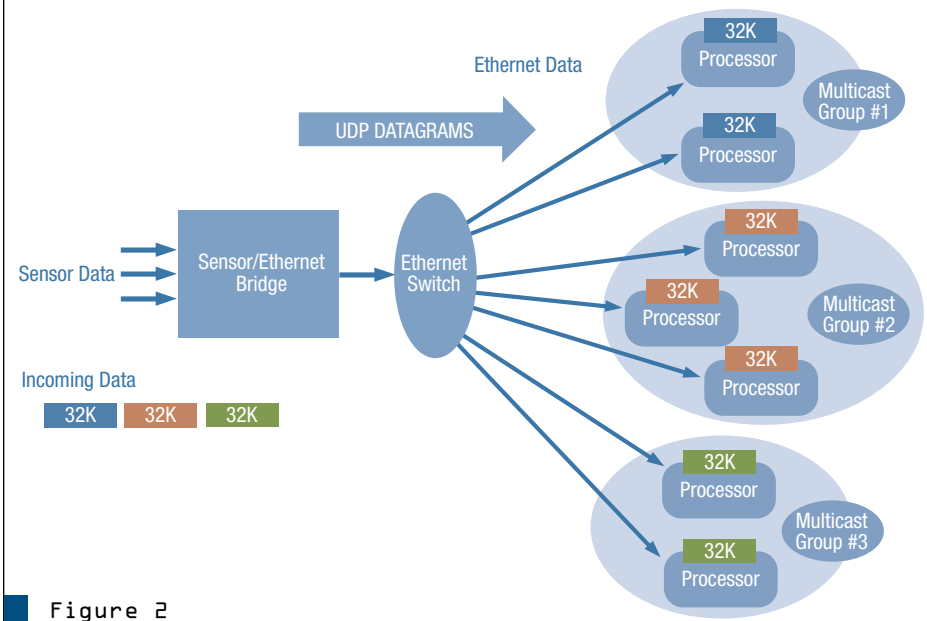


Figure 2

Shown here is an example of sensor data replication using multiple UDP multicast groups. When a multicast UDP datagram containing sensor data is received by the switch, it will automatically be forwarded to every member of the appropriate multicast group.

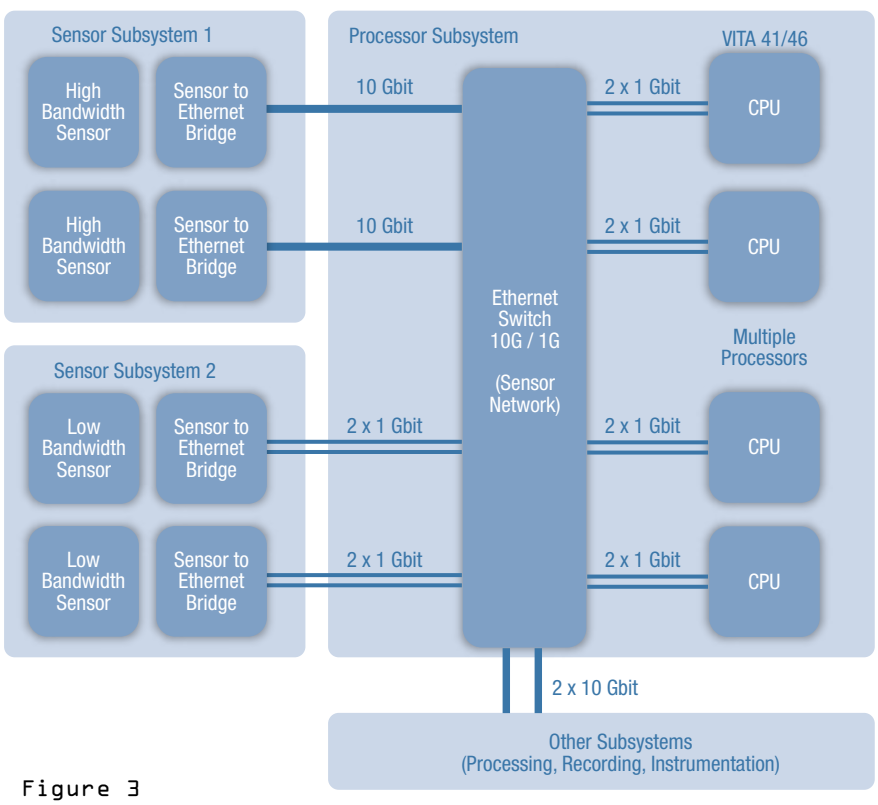


Figure 3

In this example 10 Gbit Ethernet is being used to connect a sensor subsystem to a signal processing system comprised of multiple SBCs. The sensor system is connected using a switched network, which can also be used to provide inter-SBC communications for the processing system.

capabilities to route data to multiple destinations, to multicast and to broadcast. And since Ethernet always provides a bi-directional path, it can be used to communicate with and control the sensors. Figure 1 shows an example of a sensor-to-processor system connected via Ethernet.

Because of the ubiquity of Ethernet, the processing subsystems that are receiving the sensor data can use standard Ethernet interface hardware—perhaps with offload capability—, and the application software that is processing the sensor data can leverage the well understood, standard socket APIs. And most importantly, the latest generation of Gigabit Ethernet technology is extremely fast and efficient and is well suited to moving high volumes of mission-critical real-time sensor data in military systems.

The strength of Ethernet has always been the use of rock-solid, broadly adopted interface standards and protocols, including UDP, TCP, IP, the Sockets API and a host of others. While the physical interface technology has progressed dramatically, the interface protocol standards have remained relatively unchanged. These stan-

Life-Cycle Cost Benefits of Ethernet

Reduced system development and maintenance costs… due to broad protocol support and standardization, mature and inexpensive tools, broad-based existing know-how
Reduced production costs… due to wide availability and commoditization of components and mature test tools
Reduced field support and maintenance costs… due to user familiarity with networks and software and mature and readily available test tools
Reduced upgrade costs… due to the leveraging of scalable commercial technology and standards, which will be supported and enhanced for decades
Reduced obsolescence management costs… due to the leveraging of commercial technology and standards, which will be supported for decades

Table 1

Listed here are some of the key inherent advantages of Ethernet. The common theme here is controlling system costs by minimizing development and support complexity and avoiding obsolescence.

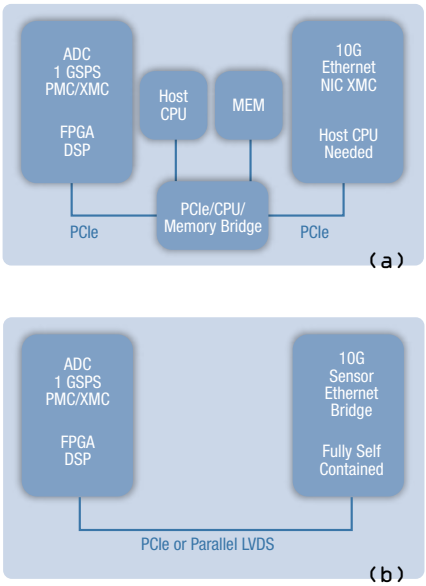


Figure 4

There are a number of ways to craft sensor-to-Ethernet bridging functionality. One option (a) is the use of a VME or CPCI processor board, which hosts a sensor A/D and a standard PCI or PCIe Ethernet NIC. A simpler approach (b) uses self-contained sensor/Ethernet bridge modules. Since these bridges are completely self-managed, with internal control and data buffer capabilities, there is no need for general-purpose processor boards.

dards ensured interoperability, straightforward development and integration, and protection against obsolescence; things that are as important in military systems today as they were 30 years ago.

Some other inherent advantages to Ethernet are listed in Table 1, but the common theme of all of these advantages is controlling system costs by minimizing development and support complexity and avoiding obsolescence. The factors are especially important in military systems that may have 20- to 30-year life cycles with multiple system upgrades throughout the system life.

Leveraging Ethernet's UDP Features

There are multiple inherent advantages in using Ethernet as a sensor network, and one very useful capability is UDP multicast. UDP multicasting allows sending the same sensor data to multiple receivers simultaneously. UDP multicast allows receivers to register to join one or more multicast "groups." Standard Gigabit Ethernet switches recognize these multicast groups, and when a multicast UDP datagram—containing sensor data—is received by the switch, it will automatically be forwarded to every member of the appropriate multicast group. Figure 2 shows an example of sensor data replication using multiple UDP multicast groups.

In a typical military system, this means that same data can be sent simultaneously to multiple processing nodes, plus recording nodes and instrumentation nodes, and so on, without the need to do repeated sends of the same data. These multicast groups and distribution patterns can be easily and instantaneously changed as the environment and processing scenarios change.

RTD Embedded Technologies, Inc.

"MIL Value for COTS prices"™

Geode cpuModules™

PC/104-*Plus* 1.4GHz Pentium® M cpuModules™

8000 MIPS dspModules™

On Board 4GB 32-Pin ATA/IDE Flash Disk SSD

Stackable ISA & PCI Expansion Buses

cpuModules™
–40 to +85°C

		Pentium® M				Intel® Celeron®						AMD Geode		
		CMA157886PX1000HR	CMA157886PX1400HR	CMX158886PX1400HR	CMD158886PX1400HR	CME147786CX400HR	CME147786CX650HR	CML147786CX400HR	CML147786CX650HR	CMX147786CX400HR	CMX147786CX650HR	CMC26686CX333HR	CME26 686CX333HR	CME27686CX333HR
Bus	AT Expansion Bus	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
	PCI Universal Expansion Bus	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
	PCI Bus Masters	4	4	4	4	4	4	4	4	4	4			4
	APIC (add'l PCI interrupts)	9	9	9	9	9	9	9	9	9	9			
CPU and BIOS	CPU Max Clock Rate (MHz)	1000	1400	1400	1400	400	650	400	650	400	650	333	333	333
	L2 Cache	512KB	2MB	2MB	2MB	256k	256k	256k	256k	256k	256k	16K	16k	16k
	Intel SpeedStep Technology	✓	✓	✓	✓									
	ACPI Power Mgmt	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0			
	Max Onboard DRAM (MB)	512	512	1024	1024	512	512	512	512	512	512	256	256	256
	RTD Enhanced Flash BIOS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Nonvolatile Configuration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Quick Boot Option Installed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	USB Boot	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Peripherals	Watchdog Timer & RTC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	EIDE Controller (MB/sec)	100	100	100	100	100	100	100	100	100	100	33	33	33
	ATA/IDE Disk Socket, 32 DIP	4GB	4GB	4GB	4GB	4GB	4GB	4GB	4GB	4GB	4GB	4GB	4GB	4GB
	Audio			✓	✓	✓	✓	✓	✓	✓	✓			
	Digital Video	LVDS	LVDS	LVDS	LVDS			TTL	TTL	LVDS	LVDS	TTL	TTL	TTL
	Analog Video	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA
	AT Keyboard/Utility Port	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	PS/2 Mouse	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	USB Mouse/Keyboard	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
I/O	RS-232/422/485 Ports	2	2	2	1	2	2	2	2	2	2	2	2	2
	USB 2.0 Ports	4	4	2	4									
	USB Ports					2	2	2	2	2	2	2	2	2
	10/100Base-T Ethernet	1	1	1	1	1	1	1	1	1	1		1	1
	ECP Parallel Port			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	aDIO(Advanced Digital I/O)	14	14	18	18	18	18	18	18	18	18	18	18	18
	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

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

Video Controllers
- Analog VGA
- TTL and DVI panels

Communication Modules
- Copper or fiber Ethernet
- USB 2.0 and Firewire
- CAN Bus & CAN Spider
- Dual Synchronous Serial
- Quad Serial w/ Ethernet
- Octal PCI Serial

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

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

Power Supplies
- 50/75/83/88/100 Watts
- Wide input range
- ATX Power Supply
- UPS backup
- MIL-STD-704/461

Mass Storage
- 1.8/2.5" IDE & PCMCIA
- CompactFlash

IDAN™— Intelligent Data Acquisition Node
- Easily build your PC/104 system
- Rugged PC/104 stackable framed modules
- Quick interchangeability and expansion
- Structural heat sinks and heat pipes
- Optional cooling fins
- Milled aluminum frames
- Standard PC connectors
- Optional MIL-SPEC paint & shock mounts
- –40 to +85 °C

Full Product Line and Pricing Online

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

www.rtd.com

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						
		SDM7540HR	SDM8540HR	DM6210HR	DM6420HR	DM6430HR	DM7520HR	DM6620HR	DM6812HR	DM6814/16HR	DM6856HR	DM6888HR	DM6956HR	DM7820HR	FPGA7800HR
Bus	AT Expansion Bus	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	PCI Expansion Bus Master	✓	✓				✓							✓	✓
	McBSP Serial Ports	✓	✓				✓								
Analog Input	Single-Ended Inputs	16	16	16	16	16	16								
	Differential Inputs	8	8		8	8	8								
	Max Throughput (kHz)	1250	1250	40	500	100	1250								
	Max Resolution (bits)	12	12	12	12	16	12								
	Input Ranges/Gains	3/7	3/7	3/1	3/4	1/4	3/6								
	Autonomous SmartCal	✓	✓												
	Data Marker Inputs	3	3		3		3								
Conversions	Channel-Gain Table	8k	8k		8k	8k	8k								
	Scan/Burst/Multi-Burst	✓	✓		✓	✓	✓								
	A/D FIFO Buffer	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	48	18/9	32	64	32	48	48
	Bit Programmable I/O	8	8		8	8	8	8	24	6/0				48	✓‡
	Advanced Interrupts	2	2		2	2	2	2	2					2	
	Input FIFO Buffer	8k	8k		8k	8k	8k							4M	8M
	Opto-Isolated Inputs										16	48	16		
	Opto-Isolated Outputs										16	16			
	User Timer/Counters	3	3	3	2	3	3	3	3	3				10	6
	External Trigger	✓	✓		✓	✓	✓	✓	✓					✓	
	Incr. Encoder/PWM									3/9					✓‡
	Relay Outputs												16		
Analog Out	Analog Outputs	2	2		2	2	2	4							
	Max Throughput (kHz)	200	200		200	100	200	200							
	Resolution (bits)	12	12		12	16	12	12							
	Output Ranges	4	4		3	1	4	4							
	D/A FIFO Buffer	8k	8k				8k	8k							

‡ User-defined, realizable in FPGA

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**
- MIL I/O connectors
- Optional MIL-SPEC paint
- Shock-mounts 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"®

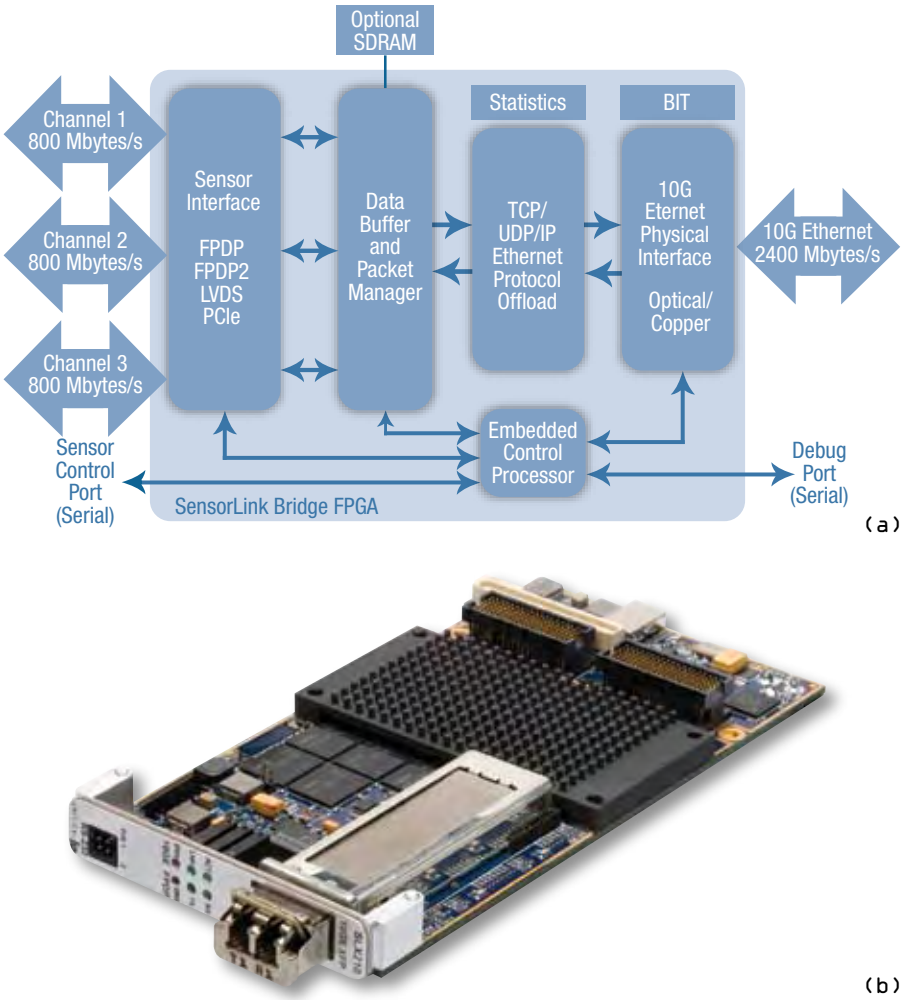


Figure 5

Critical I/O's SensorLink 10 CXMC Mezzanine Card is an example of an FPGA-based fully self-contained sensor-to-10 Gbit Ethernet bridge. It bridges multiple parallel sensor data ports to standard 1 Gbit or 10 Gbit Ethernet, without need for a host processor at the sensor.

Ethernet as a High-Performance Interface

Ethernet in its early days was essentially a bused technology, with multiple nodes tied onto 1/10/100 Mbit/s common lines or hubs. In addition to low bit rates, the common line approach led to severe problems with collisions and flow control in even moderately loaded systems. This, of course, led to the common (and correct, at the time) view that Ethernet was hardly useful as a performance networking technology, and especially not for mission-critical systems.

The Ethernet performance picture has changed dramatically with the introduction of fully switched Gbit Ethernet, which completely eliminates the collision and flow-control problems of older Ethernet, as well as supplying a theoretical 250 Mbyte/s bidirectional bandwidth on a single 1 Gbit link and up to 2500 Mbytes/s on a single 10 Gbit link. The Gigabit Ethernet performance picture has further improved through the introduction of hardware-based protocol offload technologies. These technologies can provide more than a 1000 to 1 efficiency advantage over non-offload Ethernet, providing low CPU loading, very low message latencies and highly deterministic operation.

Figure 3 shows a typical system architecture that incorporates Ethernet as a Sensor Network. In this example, 10 Gbit Ethernet is being used to connect a sensor subsystem to a signal processing system comprised of multiple SBCs. In this example, the sensor system is connected using a switched network, which can also be used to provide inter-SBC communications for the processing system. The sensor subsystem consists of carrier modules that host sensor/Ethernet bridge mezzanine modules as well as the sensor A/D or digital receiver mezzanine modules.

Bridging Low-Level Sensor Interfaces to Ethernet

Low-level sensor interface technologies currently in broad use include FPDP, FPDP2 and parallel LVDS. The use of PCI Express is growing, especially in higher performance sensor XMC modules. These are examples of the low-level interface that sensors currently use that must be bridged to the Ethernet sensor network.

There are a number of options for realizing sensor-to-Ethernet bridging functionality. One commonly considered option is the use of a VME or CPCI processor board, which hosts a sensor A/D, and a standard PCI or PCIe Ethernet NIC. Such an architecture is shown in Figure 4a. The advantage of this approach is that it provides a programmable processor at the sensor interface, for situations where additional processing of sensor data is needed prior to sending it out on the Ethernet network. But if preprocessing of sensor data is not needed, then this approach becomes overkill and actually limits the sensor data bandwidth due to multiple copies of data in and out of the CPU memory.

A simpler approach uses self-contained Sensor/Ethernet bridge modules, as illustrated in Figure 4b. Since these bridges are completely self-managed, with internal control and data buffer capabilities, there is no need for expensive, power-hungry general-purpose processor boards and the associated software complexity.

A Self-Contained Sensor-to-Ethernet Bridge

Self-contained sensor-to-Ethernet bridges—one example being Critical I/O's SensorLink product family—allow users

to easily connect simple wide band sensor I/O devices to standard 1 and 10 Gigabit Ethernet Networks. The bidirectional bridges convert sensor data streams to/from standard UDP or TCP Ethernet data, at rates of up to 2400 Mbytes/s. They can be controlled, managed, monitored and data streams dynamically rerouted through the same Ethernet Network by any processor attached to the Network, and thus does not require a processor, software or intelligence at the sensor. This type of bridge is typically provided in a mezzanine card form-factor, but other form-factors and embedded versions are also available.

Though these bridge modules are hardware-based, they still comply fully with normal Ethernet Standards, both from physical and protocol points of view. This means that they can be connected to any normal Ethernet network, and can send data to any normal Ethernet NIC—on a processor board, for example—using standard TCP/IP or UDP/IP, and they provide for standard Ethernet capabilities such as routing, multicast, broadcast, auto-negotiation and flow control. Although the standard TCP and UDP protocols are used, they are augmented with features such as data sequence tags and timestamps. Optionally, extended protocols such as reliable UDP may also be used. Hardware-based bridge modules adapt well to sensor integration, as they require very little control, initializing themselves automatically upon power up, then responding to simple commands received over the Ethernet network.

Self-contained sensor/Ethernet bridges may be implemented using FPGA technology, which offers the advantage of reconfigurability. The Ethernet protocols and sensor interface protocols used may easily be customized to meet specific system needs. In addition, it is possible to incorporate sensor data preprocessing functionality directly in the sensor data path within the FPGA. Preprocessing may be as simple as reformatting or rearranging of data—corner turning, for example—or as complex as DSP functions such as filtering or quadrature conversion.

The Critical I/O SensorLink 10 CXMC Mezzanine Card (Figures 5a and 5b) is a specific example of an FPGA-based fully self-contained sensor-to-10 Gbit Ethernet bridge. It bridges multiple parallel sensor data ports—that can be configured as industry standard parallel FPDP and FPDP2, high-speed parallel LVDS, or PCIe—to standard 1 Gbit or 10 Gbit Ethernet, without the need for any host processor at the sensor.

Ethernet for Next-Generation Systems

There are many advantages in using 1 Gbit and 10 Gbit Ethernet as a sensor network technology in data-intensive military systems. The use of Ethernet allows interoperability with a wide variety of standard, low-cost Ethernet hardware and protocols. While Ethernet has long been discounted as a high-performance fabric, the introduction of 1 Gbit and 10 Gbit Ethernet switches and high-performance offload technologies now make Ethernet an excellent choice as the sensor network fabric for the next generation of high-performance, mission-critical systems. Self-contained sensor-to-Ethernet bridges enable the use of 1 Gbit and 10 Gbit Ethernet as a standard, low-cost, yet ultra high-performance sensor networking technology. ■■

Critical I/O
Irvine, CA.
(949) 553-2200.
[www.criticalio.com].

Tech Recon

Networking the Battlespace

Rugged MicroTCA, WiMAX Get in Tune for Military Nets

With work underway to spec a ruggedized flavor, MicroTCA is weighing in as an attractive choice for battlefront applications like wireless tactical networks.

Bob Sullivan, Vice President of Technology
Hybricon
Bob Tufford, System Architect
Embedded Communications Computing, Motorola

There's no doubt that two trends rank high in today's military concerns: to move to open standards-based embedded computing technologies, and to transition to a network-centric paradigm. Migration to open standards-based technologies is driven by cost and time-to-market. Using open standards technologies can significantly reduce program development costs and schedules, while improving interoperability.

Meanwhile, the network-centric paradigm transition is evident across all of the U.S. Military's advanced programs—such as the Army's Warfighter Information Network-Tactical (WIN-T) program and the Army's Future Combat Systems (FCS) program. These net-centric programs rely on a mobile network to link soldiers to a wide range of weapons, sensors and information systems. This enables joint interoperability, shared situational awareness and highly synchronized mission operations.

Combining these two trends requires the integration of open standards-based subsystems on many different mobile platforms into a high-performance network and ruggedizing these platforms for the military/aerospace environment. Feeding those needs, broadband wireless standards such as IEEE 802.16 (WiMAX) and Micro Telecommunications Computing Architecture (MicroTCA) can be applied to create an integrated solution to address these new trends in military applications.

Figure 1

This Hybricon Rugged MicroTCA Chassis was developed for WiMAX demonstration.

As an advanced, commercially based wireless networking standard, WiMAX is garnering significant interest and early implementation in military applications for IP transmission of voice and data. Of particular interest is the new Mobile WiMax (IEEE 802.16e) version of WiMax designed to provide high-speed broadband connections for users while they are on the move.

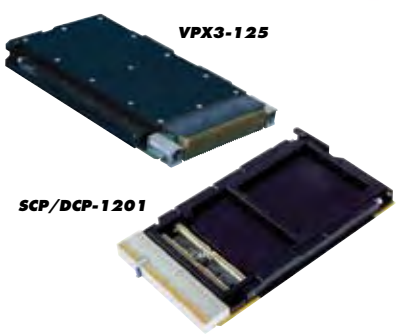
CERDEC Evaluating WiMAX

A recent press release in April 2007 reports that the U.S. Army's Communications Electronics Research and Development Engineering Center (CERDEC) is evaluating Mobile WiMax off-the-shelf products for possible military use. According to news reports, the center will study whether the Army can use mobile WiMax equipment in a military environment and measure, among other things, the performance of the system with both mobile users and mobile base stations.

The PICMG MicroTCA specification provides a platform that is a natural for mobile communications equipment deployment. MicroTCA leverages the proven PICMG AdvancedMC (AMC)

IN THE HEAT OF BATTLE WE'LL HELP YOU KEEP YOUR COOL.

Temperature extremes on the battlefield can be brutal. They play havoc with the thermal limits of today's high-performance electronics and make aerospace and defense system integrators fight a two-front challenge – maximizing performance while beating the heat. We can help. We're experts in power management and thermal design. From intelligent component selection process to innovative, patented board and system cooling technologies, we knock-out heat so you can take full advantage of today's cutting-edge processing power.



Our new 3U VPX and CompactPCI Single Board Computers utilize ultra-low power processors from P.A. Semi™ and Intel® to maximize performance-per-watt in weight and space-constrained environments.

CURTISS WRIGHT Controls
Embedded Computing

www.cwcembedded.com

POWER MANAGEMENT... *ABOVE & BEYOND*

form-factor and management infrastructure. Hot-swappable small form-factor AMC modules support high-speed serial fabric interconnect, and are currently aimed at communications applications. MicroTCA defines a family of small, low-cost, flexible, high-bandwidth and highly scalable platforms comprised entirely of AdvancedMC modules.

The MicroTCA specification defines a number of possible chassis form-factors, but does not preclude alternatives, as long as the platform can accommodate a standard AdvancedMC module (one that is compliant to the PICMG AMC.0 specification) and MicroTCA-specific modules (such as MCH and Power Modules (PM)).

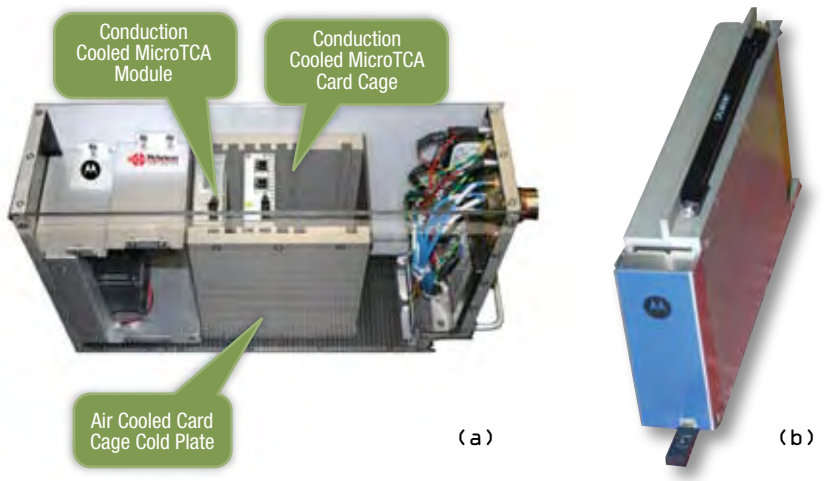


Figure 2

Shown here are a Conduction-Cooled MicroTCA Chassis (a) and an AMC (b) proof of concept developed by Hybricon and Motorola.

MILCOM Demo

The combination of standardized communications modules and ruggedized MicroTCA holds great promise as an attractive open standards wireless solution for many military applications. Motorola, Intel and Hybricon developed a ruggedized MicroTCA-based WiMAX demonstration platform that was unveiled at MILCOM in October 2006 in the Intel booth.

The demonstration platform consisted of a rugged ATR chassis with a shock-isolated MicroTCA card cage and military I/O connectors for electrical and optical I/O (Figure 1). The platform supports various types of power inputs, including MIL-STD-704 for aircraft or MIL-STD-1275 for vehicles, with MIL-STD-461 EMI containment. The ATR chassis supports up to 10 AdvancedMC modules, with a mix of double (150 mm) and single (75 mm) AdvancedMCs. The corresponding payload consists of one Intel NetStructure WiMAX Baseband Card double module, one Pentium M Processor module, one SATA storage module, one MCH and one MicroTCA DC Power Module (PM).

Ruggedizing MicroTCA

MicroTCA is an open standards-based technology, but it has a number of limitations to overcome in order to make it suitable for use in military/aerospace environments. These limitations include shock and vibration tolerance; EMI/EMC emissions and immunity; operating temperature ranges; and power input and conditioning.

The MicroTCA Ruggedization Special Interest Group (SIG) was formed and co-chaired by this article's two authors. The objective of the SIG was to develop concepts and draft specifications for air-cooled and conduction-cooled MicroTCA applications, focused on requirements for defense applications. The SIG concluded that Commercial MicroTCA is not sufficiently rugged for many defense applications as well as mobile and outdoor commercial applications.

In April of this year, the SIG transitioned its work into the recently formed PICMG Rugged MicroTCA subcommittee. This included concepts and draft specifications for rugged air-cooled and conduction-cooled MicroTCA that have been used to jump-start the PICMG Rugged MicroTCA subcommittee effort.

Conduction-Cooled Proof of Concept

The MicroTCA Ruggedization SIG has shown that commercial MicroTCA can be ruggedized using conduction-cooled methods. As a proof of concept, Motorola and Hybricon showed a conduction cooled MicroTCA ATR chassis at the recent MicroTCA summit conference in May/June 2007 (Figure 2). The PICMG Rugged MicroTCA Subcommittee effort is the vehicle for Industry Standardization of rugged air cooling and conduction cooling for MicroTCA. The MicroTCA Ruggedization SIG Forced Air Cooled and Conduction Cooled Draft Specifications have provided a jump-start to this effort.

Although a relatively new industry standard form-factor, MicroTCA is certain to become widely used in communications edge applications. Building on a large commercial base of applications, it will be highly cost-effective, and with its communications focus, it will provide cost-effective, advanced networking technology—such as WiMAX—that can be applied to the needs of the military. The MILCOM and MicroTCA Summit demonstrations show that ruggedized MicroTCA can be utilized to address network-centric applications for today's military/aerospace markets. ▮▮

Hybricon
Ayer, MA.
(978) 772-5422
[www.hybricon.com].

Embedded Communications Computing
Motorola
Tempe, AZ.
(800) 759-1107.
[www.motorola.com/computing].

GE Fanuc
Embedded Systems

We walk the talk.

Real world, deliverable VPX from GE Fanuc Embedded Systems.

While others were talking about their commitment to VPX, we were walking the talk. And as a result, we can now offer you an impressive selection of VPX products. Not words, products. Like our Intel®- and PowerPC®-based single board computers, graphics processors, switches and full VPX systems. With more in the pipeline.

Take, for example, the MAGIC1 Rugged Display Computer. Because it's VPX-based, it is able to connect a 2.0 GHz Intel® Core™ Duo to an NVIDIA® G73 with 16-lane PCI Express®. The result is an integrated graphics subsystem that leads the market in performance, flexibility and ruggedness. And because it is so small and lightweight, it's perfect for embedded training, simulation and mission rehearsal.

To us, VPX isn't just cool technology. It's technology that solves problems for our customers. For more information about VPX and our real world products, give us a call or visit our site. No one knows more about how VPX can solve problems for you.

www.gefanucembedded.com/vpx

MAGIC1
3U VPX system with leading edge graphics performance

VPX

GE FANUC

RADSTONE EMBEDDED COMPUTING

Now a part of GE Fanuc Embedded Systems

System Development

Java in Defense Apps

Appetite for Real-Time Java Climbs in Defense Systems

Demand for real-time Java continues to rise, as software becomes more complex and critical in embedded military systems.

Kelvin Nilsen, CTO
Aonix

Several important trends within the defense software industry have combined to motivate ever increasing use of Java in real-time systems. Today's warfighters must be equipped with state-of-the-art computer systems supporting easy-to-use graphical user interfaces, connectivity to the Global Information Grid, access to local and remote databases along with coherency mechanisms to maintain consistency between the two, and sophisticated local data processing capabilities.

Among real-time mission-critical defense applications that have elected to use the Java language are mission planning software for the unmanned J-UCAS aircraft (Figure 1), application software for a helmet-mounted PDA for the French military (Figure 2), Aegis weapons system software modernization, DDG-1000 command and control software and Future Combat Systems (FCS). In these systems, Java has offered improved software developer productivity, increased software flexibility and generality, and reduced costs for software maintenance.

Figure 1

The mission planning software for the J-UCAS X-45C unmanned aircraft was written in the Java language and deployed on a real-time virtual machine. The code was developed as a collaboration between engineers at Boeing and British Aerospace Engineering (BAE).

For FCS, the planned software architecture is named System of Systems Common Operating Environment (SOSCOE). This architecture supports the integration of software components written in Ada, C, C++ and Java, running under soft real-time, hard real-time and safety-critical constraints. The FCS program supports a complete family of next-generation artillery, including unmanned land and air vehicles.

Amount of Deployed Software Multiplies

As computer and communication hardware evolves, so also do the algorithms and protocols that are designed to make effective use of available hardware capacity. In order to empower effective coordination among joint forces and with

allies, while always remaining one step ahead of the "enemy," defense software systems operate under continuous evolution. In such systems, it is common for the amount of software deployed in each new release of a system to double every 18 to 36 months.

To leverage mass-market economies of scale, defense systems strive to use off-the-shelf hardware instead of implementing custom hardware for each deployed system. With the choice to use mass-market hardware comes the difficulties associated with the short life cycles that are typical of this hardware. Typical mass-market processor chips, for example, often have market life times of less than five years. With large defense initiatives, the software development effort spans five to ten years, while the resulting weapons systems are expected to serve in the field for multiple decades. Often, the state-of-the-art processors available when development begins cannot even be purchased by the time of the initial system deployment.

Standard languages have become more attractive because of the challenges in recruiting competent developers. As the demand for creation of new software functionality expands, defense contractors find themselves competing with commercial interests for the attention of skilled software engineers. In many cases, the defense industry's ability to compete has been hobbled, first by U.S. citizenship requirements, and second by demands for specialized and esoteric skills that are only relevant to defense industry projects. To compete more effectively in their recruiting efforts, defense contractors have in recent years shifted their focus away from proprietary languages and tool chains that have limited relevance outside the defense sector.

Increased Reuse of Software Components

In previous years, it was common to develop all real-time software from scratch for each real-time system to be deployed. Developers of real-time software shared the belief that it was necessary for all real-time software to be custom-tailored to the hardware on which it would be deployed. Because of the frequent need to replace hardware, the end customer's insatiable appetite for ever-increasing software functionality, budget pressures and calendar constraints on delivery of new functionality, it is not practical to rewrite real-time software components for each new system deployment.

When defense software systems were much smaller, it was more practical for all of the software that comprises the system to be custom-developed for each particular system. However, today's software systems comprise tens of millions of lines of code. Even the incremental new functionality that must be added to each new release of the software typically consists of hundreds of thousands, if not millions, of lines of new code. Many real-time defense systems now integrate off-the-shelf software

Spec for Safety-Critical Java Moves Forward

In July 2006, with the official formation of the Java Specification Request (JSR)-302 (Safety-Critical Java Technology) Expert Group, work began on a specification for safety-critical Java. This work builds upon several years of preparatory meetings that had been hosted by The Open Group on this same topic, and The Open Group is the Specification Lead for this JSR.

Since formation of the Expert Group, progress has been steady. The group meets every other week by teleconference, and at least once a quarter in a common meeting room. Consensus has been reached on a large number of issues, including restrictions on the scoped memory allocation model, restrictions on initialization of class data, and a simplified thread scheduling model. Having resolved various issues during the past year of meetings, the Expert Group has now begun drafting the safety-critical Java specification.

Though some minor details remain to be resolved, the general structure of the safety-critical specification is now in place. This specification will be structured as a subset of traditional standard edition Java and of the Real-Time Specification for Java. Unlike the full Real-Time Specification for Java, safety-critical Java only supports threads that have no access to the garbage-collected heap. All memory allocation for temporary objects will be taken from a stack of scopes associated with the currently executing thread.

The objective of JSR-302 is to create a Java specification that is appropriate for development of safety-critical code that must be certified according to DO-178B Level A standards. The JSR-302 expert group will not safety certify the Java implementation, nor applications written to use the safety-critical specification. Rather, vendors and application developers will be responsible for certifying the safety of the applications they develop.

To support the breadth of diverse requirements of safety-critical developers, the safety-critical Java specification will support three different deployment models. Level-zero deployments are based on a static cyclic executive. The level-zero implementation has only one thread, which executes in sequence, the blocks of code associated with each task that needs to execute. The level-one deployment model supports multiple tasks and fixed-priority task scheduling. All of the tasks are structured as a single mission, which has a start-up phase, a mission execution phase and a termination phase.

The level-two deployment model is designed to be the most general. It supports multiple tasks and multiple nested missions. All three deployment models can be certified to the highest levels of safety—such as DO-178B Level A. However, the expert group anticipates that the effort required to certify a DO-178B Level-A application will be higher with a Level-2 deployment than with Level-0 systems. The choice to use Level-2 is driven by needs for greater software generality and flexibility.

Figure 2

The FELIN project is a helmet-mounted personal digital assistant to help infantry communicate with each other and with commanders, and to provide navigation and situational awareness aids. This application software, developed in France by Sagem, was written in Java and deployed on a real-time virtual machine.

components to provide functionality that does not need to satisfy real-time constraints.

In the past, when large defense contractors like Boeing, Lockheed Martin, Northrop Grumman and Raytheon were awarded large government contracts, it was common for these companies to build all of the hardware and software required to fulfill the contract in-house. This is no longer the case. Today, the government awards contracts to a designated "Lead System Integrator." This Lead System Integrator subcontracts the development of individual components, and takes responsibility for integrating the independently developed components into a working system.

The strength of this model is that each component can be implemented by the specialist company that is best qualified to manufacture that component. A challenge introduced by this model is that the Lead System Integrator who is responsible for assembling the various components may no longer have the in-house expertise to understand the internal operation of the components that it is integrating. Thus, they need to be able to port and integrate software components without necessarily understanding the theory of operation that governs the behavior of those components.

The Role of Java

The Java platform has risen to meet the challenges represented by the convergence of all those defense industry trends. The benefits offered by the Java platform represent a combination of market and technical strengths. Adoption of Java by the commercial software engineering community has been universal. Java is now the language of choice for custom development of enterprise software solutions. This means the language is supported by many tool and third-party software component vendors, and this is the language of instruction for most U.S. universities.

The Java language is much easier to learn and much easier to use than Ada, C and C++. Typical developers find they are approximately twice as productive developing with Java than developing with more traditional languages. Programs written in Java are much more portable than programs implemented in Ada, C or C++. Portability is key to enabling a strong third-party market for reusable Java software components. Portability also enables reuse of customer-written software in new applications that target different hardware or different operating systems.

Another advantage of Java is that programs written in it are much more scalable than programs implemented in Ada, C or C++. The scalability benefits of Java make it possible to easily add incremental new functionality to an existing system without compromising the integrity of that existing system. It also makes it possible to combine two large software systems into a new larger software system that offers the combined capabilities of both of the smaller systems. Many developers find that they are five to ten times more productive when integrating independently developed Java software components than performing the same activity with components written in C or C++.

Special Java virtual machines are now available that address the needs of both soft real-time and hard real-time developers. A specification for safety-critical Java is under development and multiple vendors are already working on commercial implementations of this specification (see sidebar "Spec for Safety-Critical Java Moves Forward"). Increasingly defense contractors are choosing the Java language for development of new functionality. In some cases this new functionality represents completely new applications. In other cases the new functionality represents incremental improvement to existing applications that were originally implemented in other languages. Both approaches lend themselves to Java.

Aonix
San Diego, CA.
(858) 457-2700.
[www.aonix.com].

ONE STOP SYSTEMS

Introduces a world of new products.

MAX EXPRESS™

PCI Express-over-Cable

10Gb per second!

One Stop Systems provides complete PCI Express expansion solutions for motherboard, SHB (System Host Board), and CompactPCI Express architectures.

PCIe Host Motherboard System

RAID Array

PCIe SHB Expansion Chassis

8-port PCIe Switch

CPCI/CPCIe Expansion Chassis

Communication Boards

WAN

Single, dual, or quad port PCI, PMC, and PTMC T1/E1/J1, and T3/E3 interfaces. Channelized and Clear Channel available.

Carriers

Available for PCI and CompactPCI platforms. Intelligent carriers for PMC & PTMC.

LAN/Ethernet

Single, dual, or quad port PCI, PMC, and AdvancedMC Gigabit Ethernet ports with copper or fiber interfaces.

Encryption

Security offload engine for PMC IPsec and SSL encryption.Copper and fiber GIGE interfaces available.

CPCI/CPCIe Development Systems

Cable from a Host PC to One Stop Systems' Hybrid CPCI/CPCIe System at 10Gb per second. Ideal platform for CPCI and CPCIe board and software development at highest performance available.

8U CPCI/CPCIe Hybrid System

Interface Board to Host PC

5U CPCI/CPCIe Hybrid System

One Stop Systems introduces a world of communication and PCI Express-over-Cable products. Imagine initializing 120 IO boards and accessing 6 terabytes of data from a single PC at 10Gigabits per second.

ONE STOP SYSTEMS

2235 Enterprise, Suite 110
Escondido, CA 92029
Tel (760) 745-9883 Fax (760) 745-9824

(877) GET-CPCI (438-2724)

www.onestopsystems.com

System Development

Java in Defense Apps

Ada "Reloaded" a Winner for High-Integrity Real-Time Apps

Despite some challenges from C++ and Java, Ada is still the technology to beat in high-integrity real-time military applications. New features in Ada 2005 help sweeten the deal.

Robert Dewar, President and CEO
Ben Brosgol, Senior Technical Staff
AdaCore

Programming languages, like living organisms in a Darwinian jungle, need to adapt if they are to survive in a changing technological landscape that can bring challenges, surprises and occasional major climatic disruptions. Ada has been around for more than 25 years and has undergone one major revision, in the mid-1990s. Its most recent update, known as Ada 2005, was published as an ISO standard earlier this year. This version of the language brings improvements in several areas, including new facilities for Object-Oriented Programming and some additional libraries. But what may have even greater impact are a number of relatively small enhancements that increase Ada's support for high-integrity real-time systems.

Figure 1

Ada is successfully used by a wide range of major systems developers on projects including air traffic control, commercial aviation and military aviation programs—such as the Eurofighter. The Eurofighter Typhoon is a twin-engine multi-role canard-delta strike fighter aircraft, designed and built by a consortium of European aerospace manufacturers. (photo by Geoffrey Lee)

High Integrity Means What?

A high-integrity application is one where safety, security, or both are essential requirements. In the safety-critical arena each application domain tends to have its own specific requirements standard that a system must satisfy in order to be certified, for example, RTCA DO-178B for commercial avionics. In the security area the situation is somewhat less fragmented, with the Common Criteria and Common Evaluation Methodology generally accepted as certification requirements standards in a domain-independent fashion. Tables 1 and 2 summarize the various criticality levels of the two standards. Generally systems at DO-178B

Level A or B would be considered safety-critical, and systems at EALs 5 through 7 would be considered high security.

Although safety and security standards evolved independently, their common goal is to offer assurance that the delivered system is free from vulnerabilities that could lead to safety hazards or security breaches. Not surprisingly, they make basically the same demands on the programming language—or languages—used for development: the language must support reliable, predictable and analyzable code, yet be expressive enough to capture the processing and data structures characteristic of the application domain.

Ironically, some of the features that in general help developers produce robust and maintainable software—such as Object-Oriented Programming, generic templates and exceptions—complicate analyzability, especially for systems that need to comply with the highest levels of DO-178B or the Common Criteria. The key for the developer is to choose an appropriate language and then to restrict feature usage to a subset based on the kinds of analyses that are to be performed.

Level	Consequence of failure
A	Catastrophic failure condition
B	Hazardous/severe failure condition
C	Major failure condition
D	Minor failure condition
E	No effect on aircraft operational capability or pilot workload

Table 1

Listed here are the software levels in RTCA DO-178B.

Ada Does the Job

Ada is an experienced player in the field of high-integrity software, and Ada 95—indeed Ada 83—already provides a sound language foundation. For example, Ada's lexical and syntactic rules avoid the confusion found in C-based languages and also in Java for things like octal literals (the leading 0 might better be called the misleading 0) and "if" statements (dangling else). Ada's parameter passing modes, which reflect the data flow direction (in, out, or in out) make it easier for tools to analyze information flow: dependencies between the inputs to and the outputs from a subprogram.

One of the most notable milestones during Ada's history was the production of an ISO Technical Report (Table 3) on feature usage for high-integrity systems. That report is basically a matrix that identifies, for each type of analysis that might be desired—such as control flow, data flow, formal proofs of correctness—whether or not a given language feature is permitted.

In short, that report showed that there is no such thing as "the high-integrity" subset of Ada, or for any other language, and indeed what is needed is a language mechanism that allows the programmer to identify which features are to be excluded. Among other things, this means that there will be no run-time libraries for the excluded features, thus simplifying the job of certification against standards such as DO-178B. Ada is unique in supplying a feature called Pragma Restrictions that allows the programmer to specify those features that the program is not using.

High Integrity Systems Annex

The High Integrity Systems Annex of the Ada standard specifically addresses the needs of safety-critical and high-security systems. Among other things, this section of the reference manual, originally called the Safety and Security Annex, identifies a number of features that can be specified with Pragma Restrictions. These include restrictions prohibiting dynamic allocation, exceptions and nested tasks.

The subject of tasking in high-integrity systems is interesting. Concurrency features significantly complicate the job of certifying high-integrity systems, since they make possible new kinds of hard-to-detect errors: race conditions, where the effect of the program may depend on the relative speed with which the concurrent tasks execute, and deadlock, where several tasks are mutually holding resources that are needed by some other tasks, and thus all are waiting.

These sorts of errors are not always deterministically reproducible. Ada addresses this issue in several ways. First, it has a high-level tasking model that makes it easier to express concurrent algorithms. This is in contrast with Java, whose low-level mechanisms (synchronized code, wait/notify) are rather error prone. Second, a subset of the Ada tasking model—the so-called Ravenscar Profile—is simple enough that it can be used in systems where high certification levels are required, but powerful enough to be usable in real systems.

All of these features have been in Ada for some time. Ada 2005 has added a number of improvements that make Ada even better for high-integrity applications. Here are some of the enhancements:

- **Pragma Profile** is a new mechanism that allows bundling a set of restrictions and giving it a name. This has been done with the Ravenscar restric-

Level	Description	Assurance
EAL 1	Functionally tested	Low
EAL 2	Structurally tested	
EAL 3	Methodically tested and checked	
EAL 4	Methodically designed, tested, and reviewed	Medium
EAL 5	Semiformally designed and tested	
EAL 6	Semiformally verified design and tested	
EAL 7	Formally verified design and tested	Highest

Table 2

Summarized here are the Evaluation Assurance Levels in the Common Criteria.

tions: by specifying pragma Profile (Ravenscar) the programmer is identifying the full set of tasking restrictions that will be enforced. Another potential candidate for pragma Profile is the SPARK subset. SPARK is an Ada subset augmented with annotations in the form of comments. SPARK programs are amenable to various forms of static analysis that make it possible and practical to prove that a program complies with its formal specification.

- **Ada's access type "pointer"** facility has been enhanced so that the programmer can more precisely specify various properties. For example, a formal parameter to a subprogram can be marked as "access constant," meaning that the parameter has "read only" access to the object that it points to. This is an important feature, making information flow analysis easier. Another enhancement is that an access type can be marked as "not null," such as values of the access type must always point to some existing object, they can never be null. This helps efficiency—since there is no need for a run-time check that a pointer is null—and also facilitates analysis and avoids certain kinds of pointer errors.
- **Pragma Assert** has been added, with an argument identifying a Boolean expression that is asserted to be true. If the condition is false, an exception is raised—and an optional argument to the pragma can specify a string that can be retrieved when the exception is handled. The programmer can control whether the assert condition is checked at run-time.

Beyond those features, which relate to high-integrity programming, a number of new features have also been added that assist in real-time programming. There are some new task dispatching policies, a mechanism that allows different dispatching policies to be used for different sets of tasks based on their priority level, additional functionality associated with task termination, and a mechanism for monitoring processor usage on a per-task basis.

In short, Ada is building on its strengths for high-integrity systems. It has been and continues to be successfully used by a wide range of major systems developers on projects including air traffic control, commercial aviation, military aviation programs—such as the Eurofighter (Figure 1) and other defense programs at Honeywell, MBDA, Raytheon and more. Moreover, new projects are starting up and choosing Ada: a notable example is the iFACTS project in the United Kingdom, a next-generation air traffic control system sponsored by NATS that is using the SPARK Ada subset.

Ada vs. Other Languages

There are two other major technologies that users might consider for high-integrity real-time systems. One is the C family, including C++, and the other is Java. It is certainly possible to use these; the questions are more whether the language is fit for the purpose, and whether its technology and tool support are mature.

C and C++ have the benefit of a large user community. However, C was not designed with high reliability in mind, and it has become necessary to define "safe" subsets such as MISRA C to overcome this significant shortcoming. Adhering to the MISRA C subset indeed does help avoid the major traps and pitfalls, but not all of the rules are checkable by automated tools, and indeed some rules (such as prohibition against dangling references) might be enforced differently by different tools. Further, C does not scale up to very large systems; the general migration path is then to move to C++.

But C++ has the same issues as C, plus the complexity of features such as templates, exceptions and Object-Oriented Programming. Different organizations have tried to mitigate these shortcomings by defining "safe" subsets, but these vary from one developer to another. There is an attempt to define a safe subset, MISRA C++, but this is still in progress. Further, C++ does not support concurrency, a major omission in a language that is to be used for real-time programming.

Java is another option, and it is certainly reasonable to consider this language for applications where high reliability is important. Java's semantics, with few exceptions, are well defined; it is seriously concerned with security issues; run-time checks avoid the well-known "buffer overflow" problem in C; "dead code" and potential references to uninitialized local variables are detected; and dangling references are prevented.

However, these do not imply that Java—the full language—is appropriate for either real-time or high-integrity applications. Some major issues are: Java is too slow, its semantics for thread scheduling are underspecified and can lead to priority inversions, it lacks functionality for low-level processing, the clock granularity is too coarse, garbage collection means unpredictable latencies, there is no safe way to terminate an application—as might be needed for example in a "mode change." Furthermore, one of Java's main attractions for general-purpose software development—Object-Oriented Programming (OOP)—has never been considered necessary for real-time systems, and another main attraction—Java's extensive class library—is diminished because the library would need to be rewritten for real-time predictability.

Real-Time Java

Those are significant problems with Java, but one person's problem is another person's challenge, especially when there is a potential market to be exploited. Indeed, there have been some serious efforts to come up with a viable approach. The first was the Real-Time Specification for Java (RTSJ), under the auspices of Sun Microsystems' Java Community Process. It originated in early 1999 and was formally approved in November 2001.

The RTSJ was intended for real-time applications, but not necessarily for ones that need to meet high-integrity standards such as DO-178B. Indeed, the RTSJ is not a subset of Java that is restricted to provide real-time predictability, but rather an extension of the full Java platform with additional classes that give real-time behavior. It is thus too large to be practical for safety-critical systems, and there is no analog to Ada's Pragmas Restrictions and Profile to allow the user to cut out the unneeded parts.

In light of all those issues, an effort is underway to define Safety-Critical Java Technology by subsetting the RTSJ. This work was conceived in 2003 and was begun in earnest in July 2006 under The Open Group. Like the RTSJ, this is being done under Sun Microsystems' Java Community Process. A challenge to this effort is that there are currently two commercial offerings for safety-critical Java solutions, from different vendors.

Approach	Group Name	Technique
Static Analysis	Flow Analysis	Control Flow
		Data Flow
		Information Flow
	Symbolic Analysis	Symbolic Execution
		Formal Code Verification
	Range Checking	Range Checking
	Stack Usage	Stack Usage
	Timing Analysis	Timing Analysis
	Other Memory Usage	Other Memory Usage
	Object Code Analysis	Object Code Analysis
Dynamic Analysis (Testing)	Requirements-based Testing	Equivalence Class
		Boundary Value
	Structure-based Testing	Statement Coverage
		Branch Coverage
		Modified Condition/ Decision Coverage

Table 3
Listed here are analysis techniques from "Guide for the Use of the Ada Programming Language in High-Integrity Systems."

Low-Risk Technology

Ada is an established and low-risk technology for real-time high-integrity systems, and Ada 2005 continues this tradition. One of Ada's unique benefits is its recognition of the need for programmers to define subsets, so that the appropriate analysis techniques can be performed. For example, OOP either in its entirety or in part can be excluded. Products are available from a variety of vendors, targeted to widely used RTOSs. C and C++ are also candidate technologies and have the benefit of popularity in other domains—and thus a good supply of programmers who know the languages—but they lack the reliability underpinnings of Ada.

Java is attracting interest in the real-time high-integrity marketplace, but it is nowhere near as mature a technology as Ada in this domain, and it has some intrinsic issues—such as its role as a "pure" Object Oriented language—that will continue to raise challenges for both implementors and users. Memory management is a difficult problem, and both real-time garbage collection and RTSJ-style scoped memory raise thorny issues for high-integrity systems.

AdaCore
New York, NY.
(212) 620-7300.
[www.adacore.com].

Technology Focus

VME SBCs

Legacy and Future Fly Side-by-Side in VME SBCs

Traditional VME still has a long life ahead, but the newer fabric-based VITA technologies, VPX and VXS, are staking out new territory.

Jeff Child
Editor-in-Chief

Now that the newer fabric-based VITA specs—VPX and VXS—are finally in a "productizing" phase of their development, the industry is starting to ponder a break with traditional VME and its long legacy of complete backplane backward compatibility. This won't happen overnight by any means. VME board vendors say that old VME64 remains the dominant flavor of VME shipped today, and that won't change for some time. But this year is shaping up to be the year of VPX, and now even the most entrenched military system designer is considering making the leap to the VPX switched fabric-based backplane.

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

A dramatic long-term example of VME as a technology refresh platform is the mission computer aboard the Air Force's B-52H (Figure 1) heavy bomber. Lockheed Martin won a contract a few years ago to increase the performance and memory of the mission computer in the B-52H.

Just a few years ago, and well into last year, the landscape of next-generation VME was quite different. The debate was split fairly evenly in the industry between those that believed VITA 41 (VXS) was the best "here and now" performance follow-on to VME, and those that preferred to skip over an interim solution like VXS and move directly forward with VITA 46 (VPX). With ANSI approval in place for the base VXS spec ANSI/VITA 41.0, ANSI/VITA 41.1 InfiniBand, and for ANSI/VITA 41.2 RapidIO, VXS certainly had a good jump on VPX. And several vendors have first and second rounds of VXS products already on the market and doing well.

Behind all three of the form-factors, of course, is VITA, one of the industry's most effective trade association, and its standards organization. And in January, VITA submitted revised patent disclosure policies and standards procedures to ANSI. The revisions ensure that VSO participants disclose patents that are essential to implementing a new standard and that the participants openly declare the most restrictive terms required to license any such patents. ANSI has approved these revised standards procedures with minor modifications. ANSI's approval of the procedure changes completed the process for ANSI re-accreditation of the VITA standards efforts. In May VITA announced that it has been re-accredited by ANSI, effective May 22 of this year. ▮▮

Figure 1

A B-52 bomber is a long-term example of VME as a technology refresh platform. Lockheed Martin won a contract a few years ago to increase the performance and memory of the mission computer in the B-52H. The VME-based Avionics Control Unit replaced the older AP-101C computers aboard the aircraft. Shown here, a B-52 receives fuel from a KC-135 Stratotanker from the 506th Expeditionary Air Refueling Squadron. (U.S. Air Force photo)

All the Right Stuff for Avionics and UAV Applications:

COTS Compliant Solutions from Aitech.

Designing and building board-level products and integrating sub-systems for today's advanced avionics and UAV applications is tough enough. Doing it in a true COTS environment is even tougher. But Aitech is more than equal to the challenge. Aitech delivers more than two decades of harsh environment, open systems architecture expertise and proven solutions in UAV and avionics applications such as Predator, Global Hawk, C-130, F-18, F-16, UCAV/J-UCAS, and many more...

And Aitech continues to provide advanced VMEbus and CompactPCI products designed, built and tested to -55°C to +85°C as standard. Because when it comes to manned or unmanned air vehicles, you can't bypass the laws of physics! And when it comes to light weight, low power, extreme reliability, ease of maintenance, minimized development costs, ease of technology insertion and upgrades, Aitech delivers every time.

We can't change the physics... but we can ensure your COTS sub-systems are designed, built, and tested to perform reliably at the temperature extremes of your specification – without custom development, "work-arounds", or compromises.

We take the extra steps... including pre-screened parts qualification, HALT, and 100% HASS/ESS testing to ensure that every standard Aitech product meets all your temperature and rugged performance specifications...standard.

We've been doing it... meeting full temperature-range specifications with standard products is just part of our 20+ year heritage and commitment to COTS advancements – from the first conduction-cooled Mil-Spec VME board in 1984, to today's highest functionality MIPS/Watt boards, multi-Gigabyte mass Flash mass memory cards, and high-speed mezzanines...for manned and unmanned applications.

We have the proof... visit our web site or call for more information and our catalog of proven solutions.

Aitech

Aitech Defense Systems, Inc.
9301 Oakdale Avenue
Chatsworth, CA 91311
email: sales@rugged.com
Toll Free: 888-Aitech8 - (888) 248-3248
Fax: (818) 718-9787
www.rugged.com

Pump Up Your ARM Powered® Design!

ARM Developers' Conference and Design Pavilion

October 2-4 2007 Santa Clara Convention Center

Strengthen your skills and speed your time-to-market

Only the ARM Developers' Conference offers:

- Over 90 track sessions providing a complete end to end design tutorial for leveraging ARM IP in advanced embedded applications
- Combined tutorials with Portable Design Conference
- Design Centers and exhibitions from leading ARM licensees and Connected Community members offer a full complement of workshops and presentations
- Forums and analyst presentations on industry trends

Plus: through the combination of track sessions, presentations and company design centers you will be fully immersed in leading strategies and methodologies for building complex designs with the ARM architecture.

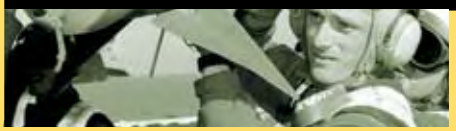
And Finally-- Conference Delegates who pre-register before September 10 receive the conference proceedings on a 4 GB iPod Nano to take home!

Register early and save!

www.arm.com/developersconference

Co-Located with the Portable Design Conference & Exhibition

Technology Focus:



VME SBCs Roundup

Boot-Ready VME SBC Shrinks Development Time

Long gone are the days when developers had the luxury of spending time loading operating systems. Today, systems developers can no longer afford the time or man-hours on such basics. For its part, ACT/Technico is offering a complete VMEbus-based "Boot and Go" application SBC solution. Called the AppliPak, the solution is an integrated SBC, incorporating

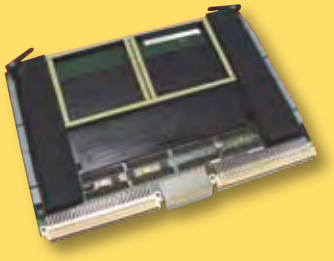
a customer-selected operating system, which provides significant timesavings to the user. The basic AppliPak consists of a PowerPC or Pentium-based VMEbus SBC preloaded with VxWorks, Windows or Linux, and OS-specific device drivers.

By specifying integrated mass storage, transition modules and other accessories, the customer receives a fully tested integrated embedded SBC. The system includes a choice of mass storage devices and other options such as transition modules or break out boards, Ethernet and Built-In Self Test (MBIT) with a Web-based GUI interface. Motorola-based AppliPaks are available for MVME51xx, MVME5500 and the new MVME6100. Pentium-based AppliPaks are shipping with Intel Pentium III low-power and Intel Pentium M processors. A rugged version of the AppliPak includes the same options, but adds extended operating temperature range, conformal coating and/or parts lifecycle management, as required by the customer. The AppliPak is available now and pricing starts at $3,500.

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

SBC Serves Up Asymmetrical Distributed Processing

Dual processing is becoming a fixture in today's embedded military market. Processor and board vendors alike are in the thick of the trend toward maximizing the effectiveness of multiple CPUs in a system. Offering a unique approach to dual-processing, Aitech Defense Systems offers a rugged 6U VME single-slot SBC that maximizes functionality and power by incorporating dual processors that operate independently of one another, yet communicate over a high-speed PCI-X interconnecting bus. The new C102's processors use an asymmetrical distributed architecture so that each of the processing nodes functions as a complete subsystem complete with local memory resources and basic I/O interfaces, eliminating data flow bottlenecks. The C102's improved processing power and I/O functionality make it ideally suited to function in harsh environment applications such as mission management computers, heads-up display controllers,



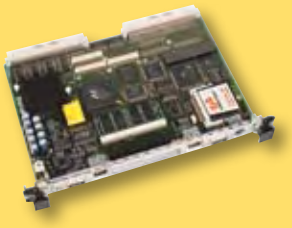
radar and sonar processors, and advanced IED automatic protection subsystems.

The C102 incorporates one or two high-performance PowerPC G4+ MPC7448 processors operating at 1.42 GHz that feature on-chip 32 Kbyte L1 and 1 Mbyte L2 caches. The board provides up to 2 Gbytes of DDR SDRAM with ECC, 256 Kbytes of NVRAM, up to 256 Mbytes of boot flash memory and up to 1 Gbyte of user flash memory (512 Mbytes per processor node), as well as up to 16 Gbytes of NAND onboard flash file memory for mass storage. The C102 is available in both conduction- and air-cooled models, per IEEE 1101.2 and ANSI/VITA 1-1994 specifications, respectively. Pricing for the C102 starts at $6,750.

Aitech Defense Systems
Chatsworth, CA.
(888) 248-3248.
[www.rugged.com].

Dual PMC Sites Enhance PowerPC Board

Using PMC modules is one way to provide flexible expansion for VME CPUs. American ELTEC offers a powerful 1 GHz version of its BAB 760 PowerPC board with state-of-the-art CPU design including PCI architecture,



VMEbus and expansion through PMC modules. It offers the power of the PowerPC 750 GX CPU. The BAB 760 board can even be used for such complex tasks as image processing when combined with PMC frame grabbers. A PMC extender card permits one or two PMC modules to be fitted.

The Discovery I chip set used on the board—as well as the PCI architecture in combination with the FPGA-based VME interface—guarantees long-term availability. The BAB 760 requires only one VMEbus slot and has a double Eurocard format. A PowerPC 750 GX with a 1 Mbyte on-chip cache is used as the CPU, achieving a clock rate of up to 933 MHz; the CPU is clocked at only 933 MHz to ensure reliable operation throughout the full temperature range.

The board is equipped with an 8 Mbyte flash EPROM, providing storage for a stand-alone operating system or applications. A 512 Kbyte Boot ROM contains the initialization and test routines for start-up. Support is provided for OS-9 and VxWorks (on request) real-time operating systems, as well as ELinOS embedded LINUX. Pricing for the new 1 GHz BAB 760 Power PC board is $3,995 in single-piece quantities.

American ELTEC
Las Vegas, NV.
(702) 878-4085.
[www.americaneltec.com].

VME/VXS SBC Sports Core 2 Duo Processor

The age of dual-core processors has come into full swing, and military system designers are riding the wave. Concurrent Technologies has released an Intel Core 2 Duo processor-based VME/VXS SBC as a performance upgrade from the VX 405/04x released earlier in the year. The VX 407/04x uses the latest mobile dual core processor from the Intel embedded roadmap, the 2.16 GHz Intel Core 2 Duo T7400 processor, giving an even greater improvement in measured performance/watt. The VX 407/04x can access up to 4 Gbytes DDR2-667 soldered SDRAM

at up to 10.6 Gbytes/s. The VXS switched serial standard—VITA 41.3 (1000 Mbit/s baseband IEEE802.3)—is optionally supported to provide fast data transfer between other compatible boards in the system.

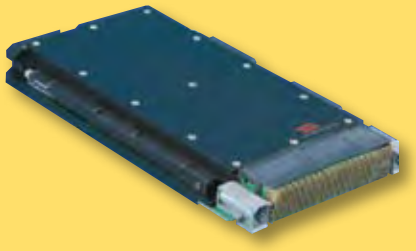
To enable easy, fast transfer of data between the VX 407/04x board and other components in the system there are two networking options available: dual 10/100/1000 Mbits/s Ethernet interfaces (via P2) or an optional VITA 41.3 interface (via VXS P0) giving dual 1000 Mbits/s baseband IEEE 802.3 serial links onto a VXS backplane fabric. List prices for the 2.16 GHz Intel Core 2 Duo T7400 processor version starts from $4,375.

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

SBC Brings VPX Benefits to Size-Constrained Apps

Designers of space- and weight-constrained defense and aerospace systems can reap several benefits from VPX, including high bandwidth, serial switched fabric support and rugged ESD protection. The VPX3-125 from Curtiss-Wright Controls Embedded Computing delivers those benefits and is the company's first VPX SBC in a compact, lightweight 3U form-factor. A VPX-REDI version is also available. The card features the P.A. Semi PWRficient PA6T-1682M, a single- or dual-core, low-power, Power Architecture Platform processor running at 1.5 GHz. This processor is especially well suited for driving new platforms, such as the VPX3-125 SBC, with support for high-speed serial switched interconnects, such as PCI Express and 10 Gigabit Ethernet, with outstanding performance per watt.

The card also includes 512 Mbytes/1 Gbyte of 400 MHz DDR2 memory, 128 Mbytes of NOR flash, 1 Gbyte of NAND flash and 512 Kbytes of NVRAM. An XMC/PMC site, two x4 lane PCI Express egress ports off board, two 10/100/1000 Ethernet ports, RS-232 and RS-422 serial channels, a USB 2.0 host port and discrete digital I/O are provided for connectivity and expansion. The VPX3-125 conforms to Curtiss-Wright's Continuum Software Architecture (CSA) interoperability



initiative. Drivers for VxWorks/Tornado 6.x and Linux are included. Pricing starts at $6,919.

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

Ruggedness, Low Power Blend on Pentium M SBC

A mix of ruggedness with low power consumption are required in many embedded military applications. The RPM from Dynatem, equipped with the Intel Pentium M processor, is ideal for this situation. Its high-speed 855GME and 6300ESB chipset supports a 66 MHz PCI-X expansion bus. Onboard CompactFlash permits single-slot booting. I/O routed to the backplane includes an EIDE port, two Serial ATA ports, two Gbit Ethernet ports,

DVO/VGA, two USB 2.0 ports and a COM port configurable for RS-232/422/485. A PMC expansion site permits I/O tailored to users' applications. In compliance with IEEE 1101.2, the RPM comes with top and bottom cooling plates that are bonded to the major components through thermal conduction and to the heat-conducting printed circuit board mechanically. Wedgelocks secure the RPM in the chassis and bring the module's heat from the cooling plates and the PCB to a heat plate in the chassis. The RPM has no socketed components other than the optional CompactFlash drive, so the RPM remains rugged in high shock and vibration environments.

The 855GME and 6300ESB chipset includes DRAM controller, PCI bus arbitration logic and interface, high-performance PCI, USB 2.0 interfaces, RTC, NV-RAM, standard PC timers, Ultra DMA and interrupt logic. Ultra ATA 100/66/33 IDE protocol and Serial ATA are also provided. The RPM comes populated with 512 Mbytes or 1 Gbyte of DDR-266 SDRAM with ECC and a memory bandwidth of 2.1 Gbytes/s. The 855GME offers integrated, high-performance graphics, supporting resolutions up to 1600 x 1200 at 85 MHz. Pricing for the RPM starts at $6,700 in single quantity.

Dynatem
Mission Viejo, CA.
(949) 855-3235.
[www.dynatem.com].

portabledesign conference & exhibition

santa clara convention center

october 3rd - 4th 2007

Connect with the leaders in portable design

Don't miss the show with the strongest signal strength in the industry

Unmatched Performance
This event is produced by Portable Design magazine, the largest and most influential publication in the US handheld and portable industry

A Wide Range
of topics will be presented in over a dozen tracks at the conference, including two industry keynote addresses

Great Connections
Interact with industry leaders in special panel discussions, presentations and exhibitions

Superior Networking
opportunities at our receptions and Birds of a Feather events

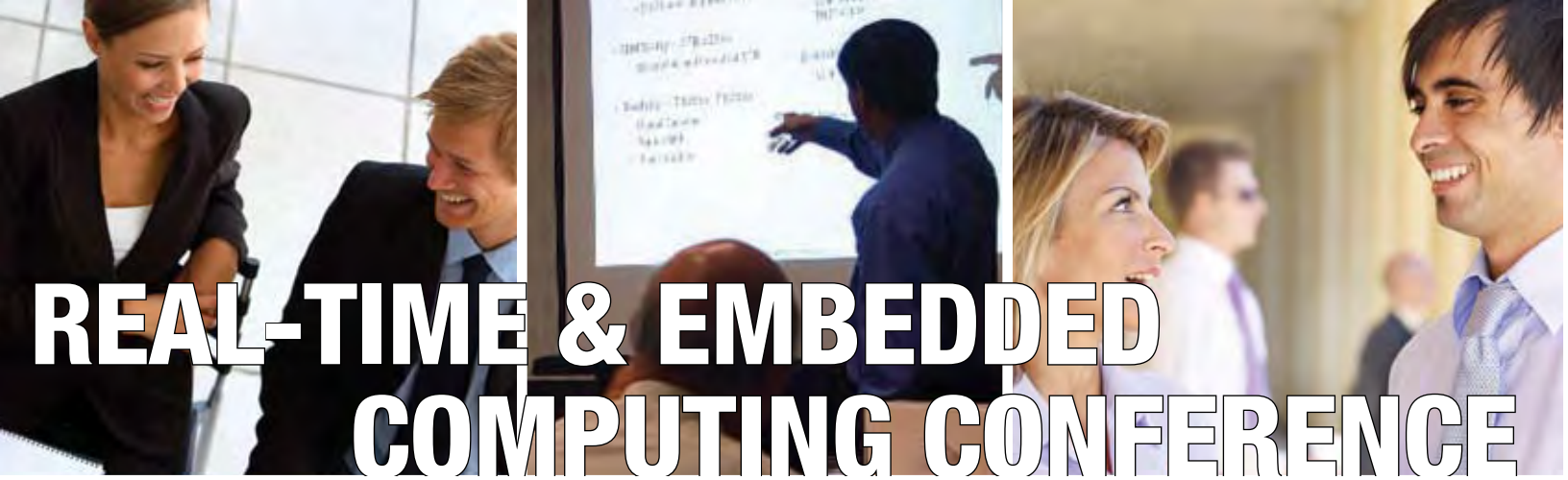
Send a Clear Signal
to your boss that this is the one show you want to attend

registration

portabledesignconference.com

Co-located with the **ARM Developers' Conference and Design Pavilion**-- come for one event and experience both!

sponsored by PORTABLE DESIGN™ an RTC Group Publication
the engineer's resource for portable applications



REAL-TIME & EMBEDDED COMPUTING CONFERENCE

Real-Time & Embedded computing conference

NEW TRAINING WORKSHOPS & SEMINARS

Register Today at www.rtecc.com

Enter a World of Embedded Computing Solutions

Attend open-door technical seminars and workshops especially designed for those developing computer systems and time-critical applications. Get ahead with sessions on Multi-Core, Embedded Linux, VME, PCI Express, ATCA, FPGA, Java, RTOS, SwitchFabric Interconnects, Windows, Wireless Connectivity, and much more.

Meet the Experts

Exhibits arranged in a unique setting to talk face-to-face with technical experts. Table-top exhibits make it easy to compare technologies, ask probing questions and discover insights that will make a big difference in your embedded computing world. Join us for this complimentary event!

Be sure to enter the drawing on-site for an iPod Video

AdvancedIO ADVANTECH ELMA Green Hills SOFTWARE, INC. intel

LYNUXWORKS™ NATIONAL INSTRUMENTS PENTEK QNX WIND RIVER

Join Us In...

January
Copenhagen, Denmark
Santa Clara, CA

February
Melbourne, FL

March
Huntsville, AL
Atlanta, GA
Phoenix, AZ
Albuquerque, NM

April
Boston, MA
Bethesda, MD

May
Milan, Rome Italy
Dallas, Austin, Houston, TX

June
Chicago, IL
Minneapolis, MN

July

August
Longmont, CO
Colorado Springs, CO

September
Beijing, Shanghai, China
Ottawa, ON
Montreal, PQ
Shenzhen, Xi'an, China
San Diego, Long Beach, CA

October
Tyson's Corner, VA

November
Detroit, MI
Toronto, ON
Vancouver, BC

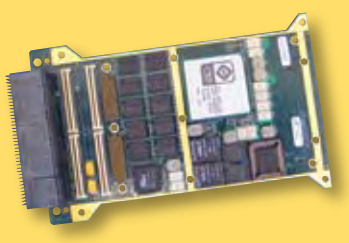
December
Seattle, WA
Portland, OR

www.rtecc.com

VPX Board Sports Dual 2 GHz PA Semi CPUs

High compute density is top priority for a variety of today's advanced military programs. This year will probably see many compute-intensive offerings in the VPX-REDI form-factor. An early offering along such lines is Extreme Engineering's XPedite8070, a high-performance 3U VPX-REDI single board computer that is ideal for ruggedized systems requiring high-bandwidth processing and low power consumption. With two PA Semi PA6T cores running at up to 2.0 GHz while dissipating less than 17W, the PA6T-1682 delivers optimum performance per watt. The PA Semi PA6T-1682 PWRficient integrated platform processor combines dual PA6T cores and high-performance communication with two DDR2 SDRAM channels and a plethora of network interfaces.

XPedite8070 supports two separate channels of up to 1 Gbyte each of 400 MHz DDR2 ECC SDRAM, as well as up to 1 Gbyte of NAND Flash. XPedite8070 provides the option of utilizing PCI Express, 10 Gigabit Ethernet XAUI and Gigabit Ethernet P1 interconnects. XPedite8070 also supports dual Gigabit Ethernet, GPIO, I2C, PMC I/O, XMC I/O, and dual RS-232/RS-422 ports out the P2 connector. To the system designer, XPedite8070 provides a feature-rich solution to support the next generation of rugged embedded applications. Both a VxWorks Board Support Package (BSP) and a Linux

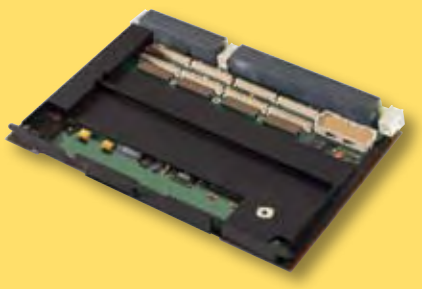


2.6 LSP are available. Single quantity pricing for XPedite8070 starts at $7,800 with large program/OEM pricing closer to $5,000, depending on volume, memory and processor configurations. The XPand1000 development chassis is available for $2,000.

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

6U VPX Card Packs 2 Gbytes DRAM and Flexible I/O

One by one, board vendors are rolling out their first round of VPX products this year. Among GE Fanuc's initial offerings is the SBC610 6U VPX, a single board computer based on the Freescale 8641D processor and, like the DSP230, supports both Serial RapidIO and PCI Express. With two Gbytes of memory, the SBC610 achieves significant configuration flexibility through the provision of two XMC or PMC sites, together with a site for Radstone's unique AFIX (Additional Flexible Interface Extension) daughter card. The four fabric ports



on the SBC610 can be individually set to be either PCI Express or Serial RapidIO.

GE Fanuc's AXIS Advanced Multiprocessor Integrated Software enables the rapid development of the sophisticated multiprocessor systems that characterize many defense computing applications today. For its enabling fabric, GE Fanuc chose Serial RapidIO (sRIO). While PCI Express is featured to provide customers with state-of-the-art, industry standard peripherals, sRIO is, according to GE Fanuc, the fabric of choice for multiprocessing systems with its inherent scalability, flexibility, high performance and low latency. Serial RIO is also naturally complementary to the Freescale 8641 processor, eliminating the need for bridge silicon that would compromise performance. Availability of the SBC610 is scheduled for mid-2007.

GE Fanuc Embedded Systems
Billerica, MA.
(800) 368-2738.
[www.gefanucembedded.com].

VXS SBC Functions as Two Boards in One Slot

Redundant computing nodes are vital for many mission-critical defense applications. That used to mean two or more separate boards, taking up extra backplane slots. General Micro Systems offers a way to do that using just a single board. A VXS 4.3-based processor board, the new V469 Patriot, replaces anywhere from two to four VME boards. This 6U board is a true dual-processor architecture, with each processor sharing absolutely nothing with the other processor, as if they were in two different VME slots.

The two processors are linked together with the Gigabit Ethernet or may be linked via VITA 41.3 VXS, thus providing a massive server density unlike any other technology. To provide even more processing muscle at lower power, the new dual core processors will be used to provide quad-processing capabilities. The V469 utilizes two of the new M-760

Pentium M processors, each operating at 2.0 GHz with 2 Mbytes of L2 Cache and 533 MHz FSB. The V469 provides up to 8 Gbytes of 266 MHz RDDR memory with ECC. Standard I/O functions on each side of the Patriot include: dual Gigabit Ethernet ports with Copper or Fibre interface, 2 Gbit, full duplex Fibre Channel with 2 Mbytes of SRAM buffer and Flash BIOS to support Boot capabilities, quad USB 2.0, dual Serial ports, XVGA Video and UDMA IDE interface. An optional I/O interface module allows one Compact Flash and one USB 2.0 device to be added to each side. Pricing for the 4 Gbyte V469 Patriot starts at $4,700 (100s).

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

1.7 GHz PowerPC Rides VME64x/ 2eSST

VME and the PowerPC processor architecture together form the heart of today's installed base of military embedded computer systems. Supporting that tradition, Interface Concept has rolled out a new VME SBC based around the Freescale 1.7 GHz MPC7448 PowerPC. This low-power PowerPC design provides 1 Gbyte of SDRAM-DDR with ECC. Both fast NOR and large NAND flash memories are implemented on board.

The IC-e6-VMEa runs as a system controller or a standard single-slot board. An automatic detection can be used with the VME64x backplane. The VMEbus interface is based on a

combination of the Tundra Tsi148 VME bridge and the latest generation of Texas Instruments transceivers. The 2eSST bus protocol capabilities provide up to 300 Mbyte/s transfer rates across the VMEbus. The board supports three Gbit Ethernet channels, one console port and one USB 2.0 controller. A quad UART provides four additional asynchronous channels available on the P2 connector. The 64-bit PCI/PCI-X bridge allows the VME SBC to control two PMC mezzanine boards with the PnIO routed according to the VITA 35. Thanks to its SATA controller, the IC-e6-VMEa can manage directly four storage devices. The IC-e6-VMEa board can operate from -40° to 75°C. The conduction-cooled version runs at 1.4 GHz. Prices start at $4,800.

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

3U VME PowerQUICC SBC Sports Dual Ethernet Links

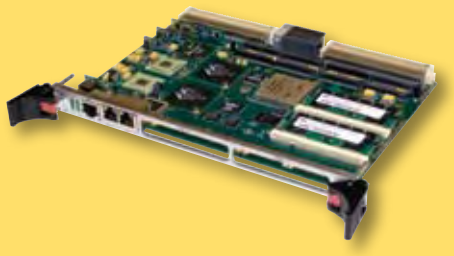
The 3U flavor of VME offers a compact solution for space-constrained military applications. And with today's level of integration, the same functionality that used to require one or more 6U cards can be offered in a 3U solution. Along those lines, the VMP3 from Kontron Modular Computers sports a Freescale PowerQUICC III RISC processor, MPC8541. This PowerPC board, with a maximum clock-rate of 660 MHz, offers two integrated Gigabit Ethernet ports. The challenges of network bandwidth and security are met by the Hardware Security Engine, which is integrated into the processor and supports encryption in accordance with IPSec, DES, 3Des and AES. These features, along with the very fast DDR SDRAM, make the VMP3 a universal processor card for computing-intensive real-time military applications.

The 100 x 160 mm board has up to 256 Mbytes of directly soldered DDR SDRAM, 16 Mbytes of flash, 1 Mbyte of buffered SRAM and E²Prom for user and configuration data. A slot for CompactFlash memory cards is optional. A Fast Ethernet interface and a serial port supplement two Gigabit Ethernet ports. Additional features are: watchdog, real-time clock and a temperature sensor. The VMP3 is designed for temperature ranges from 0° to 60°C and is optionally available for -40° to +85°C. Pricing for the VMP3 starts at $1,295 in OEM quantities. Single piece pricing starts at $1,995.

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

Two Dual-Core ULV Xeons Fit on Single-Slot 6U SBC

Top performance density and ease of programming for symmetric multiprocessing are two things really needed by military engineers developing computationally challenging applications. Both are now available in a family of SBCs from Mercury Computer Systems that incorporates one or two 1.66 GHz Dual-Core Intel Xeon ULV processors in a 6U single-slot module. The board's density is made possible by the ULV processor, with



a thermal design power of only 15W. First in the family of CompactPCI or VME boards is the cPCI Momentum Series CX6-200. On each board, both dual-core processors are connected in a symmetric multiprocessing (SMP) configuration, so each processor core has easy access to 8 Gbytes of shared memory.

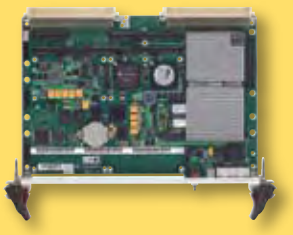
PCI Express technology minimizes internal data-flow bottlenecks and maximizes external I/O throughput for onboard interconnects. I/O includes quad Gigabit Ethernet, RS-232 serial I/O, high-speed serial ATA-150, USB 2.0 and SVGA, with most available at the front panel for easy connectivity. A single-wide PMC/XMC expansion site supports both front and rear I/O. Pricing for the Momentum Series CX6-200 starts at $6,295 each. Discounts are available for higher volumes.

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

VME Solution Provides PowerPC Growth Path

VME users are often looking for faster, more powerful processors to upgrade their systems or implement new ones while retaining their software investments. For them, Motorola offers a VME upgrade or growth path with the MVME3100 family of SBCs featuring the system-on-chip MPC8540 from Freescale. This SoC implementation provides power/thermal, reliability and life cycle advantages not typically found in other architectures. The MPC8540 comes with a PowerPC processor core, integrated memory controller, PCI-X interface and 667 MHz and 833 MHz options. Now, customers can keep their VMEbus infrastructure—chassis, backplanes and other VMEbus and PMC boards—while improving the performance and extending the life cycle of their systems.

Two versions of the MVME3100 are offered. The MVME3100-152 provides a 667 MHz processor, 256 Mbytes of DDR ECC SDRAM and 64 Mbytes of flash. The MVME3100-1263 has an 833 MHz processor, 512 Mbytes of DDR ECC SDRAM, 128 Mbytes of flash and a PCI expansion connector. Both boards provide Gigabit Ethernet ports for connection to enterprise and real-time networks, serial ports, USB 2.0 and SATA controllers. A Tundra Tsi148 PCI-X to VMEbus bridge supports the VME64 and 2eSST protocols. For expansion, these Motorola boards also have dual PMC-X sites with front panel access supporting

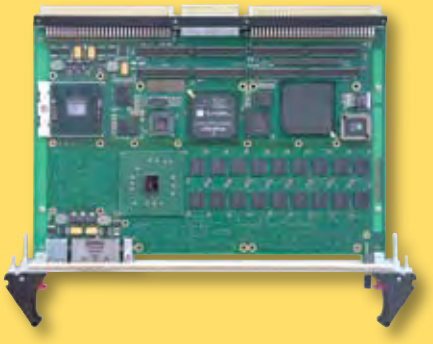


PCI-X bus speeds of 33, 66 or 100 MHz. An optional MVME721 rear transition module (RTM) allows I/O routing through the back of the VMEbus chassis. Board support packages for VxWorks and Linux are available. Pricing ranges from $1,800 to $2,400, depending on options.

Motorola
Tempe, AZ.
(602) 538-5720.
[www.motorola.com/computing].

Server-Class VME SBC Has Twin Dual-Core CPUs

The trend toward multicore processors is sweeping across the computing world, and the embedded computing market is riding that wave. The military's desire to pack in as much compute density as possible couldn't be happier with this technology direction. The first server-class, manageable, 6U single-slot VME SBC that features a dual-core processor and board management controller has just doubled its processing power. The PENTXM4 from Thales Computers has two dual-core Intel 1.67 GHz Xeon ULV processors, compared to the



company's PENTXM2 board, introduced last year. It comes with the Intel E7520 server-class memory controller hub, 2 Gbytes of DDR2-400 SDRAM and an onboard 4 Gbyte flash disk drive, and is targeted toward symmetrical processing systems.

The board's VITA 38 intelligent platform management interface (IPMI) feature provides for easy scaling into a multiprocessing system. Interfaces include a dual SATA-150 port, a triple USB 2.0 port and EIDE. The PENTXM4 runs Red Hat Linux and features an extensible firmware interface (EFI) BIOS/firmware that boots Linux 2.6, VxWorks, LynxOS, Microsoft Windows and Red Hat Linux Enterprise.

Thales Computers
Edison NJ.
(732) 494-1011.
[www.thalescomputers.com].

Sparc Upgrade Path Provided with Turion64-Based SBC

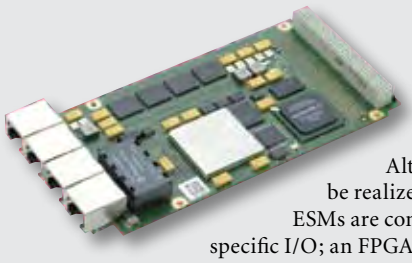
AMD has been a leader in 64-bit processor offerings. In the VME space, the AMD's Turion 64 Mobile processor serves as a natural upgrade path for legacy Sparc-based Solaris designs. Serving that need, Themis Computer offers its TA64 board, the first in a series of 6U VMEbus computer boards and is based on AMD's Turion 64 Mobile processor. The TA64 is backward compatible with Themis' USPIIe SBC, at the application source code level, and features front panel and backplane compatibility, including all I/O, switches and indicators. The TA64 runs 32-bit Sun/Solaris 8 and 9, and 64-bit Solaris 10, Windows and Linux.

The TA64 has an onboard PMC Slot and inter-board stacking connector that allows expansion for graphics and PMC carrier cards. It includes a high-performance Universe II VME64x interface, dual Ultra320 interface, two

10/100/1000 Ethernet ports, two or more USB ports, AC97 audio, two serial ports and one PS/2 port. These VME64 boards are available in one, two and three slot configurations that offer a wide range of I/O and performance options. The TA64 single-slot configuration features a single Gigabit Ethernet port, support for Dual Ultra320 SCSI drives and a single 64-bit PMC slot. Memory is expandable to 4 Gbytes of DDR333 memory. The board has 45W power dissipation, which is low for a board of its class. OEM pricing for the board is below $5,000.

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

Embedded Module Serves Up 1.67 GHz Core Duo



The Intel Core Duo seems to be usurping the Pentium M's position as the most widely used processor on new embedded board products. The processor fits nicely into the increasing demand for high compute density in military applications like UAV payloads. Along just those lines, MEN Micro has announced another Embedded System Module (ESM)—the EM6, based on Intel's 1.67 GHz Core Duo—or alternatively Celeron M processor—and the Intel 3100 chipset, the EM6. Combined with Altera's Cyclone FPGA, the board is much more flexible than traditional PCs as the required system I/O can be realized individually for each application using IP cores.

ESMs are complete computers on a plug-on module. They consist of the hardware (CPU, chip set, memory); board-specific I/O; an FPGA, which is not fixed to any application-specific function, and board support packages for various operating systems. Front I/O of the module comprises two Gbit Ethernet controlled via PCI Express as well as two COM interfaces via RJ45 connectors. The fast DDR2 SDRAM memory comes in directly soldered on the EM6 against shock and vibration. The also soldered-on 1 Gbyte flash memory can replace a rotating mass storage device in many applications.

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

Pentium M Board Boasts Six Gbit Ethernet Ports

The military continues to embrace Ethernet as a means of system connectivity. Exemplifying that trend, WIN Enterprises has announced the MB-06067, a high-performance control board designed for Unified Threat Management (UTM) and other networking applications. Using either the Intel 82541PI or Intel 82551ER Ethernet controller, the new board supports six Gbit Ethernet copper or 10/100 LAN ports with optional bypass function on two ports. The control board uses an Intel Pentium M or Celeron M processor with Intel 852GM express chipset and ICH4 I/O controller. It supports system memory up to 1 Gbyte with one DDR memory socket. Both CompactFlash and memory can be replaced.

OEMs can work with WIN Enterprises to develop purpose-built security appliances based on the MB-06067. Standard chassis and unique bezel designs for product branding enable fast time-to-market with individual products or entire product lines. The board also features two serial ports, one parallel port, three USB 2.0 ports, one E-IDE connector and one CompactFlash type II socket. The PCI golden edge fingers support two PCI slots. Digital I/O support includes four input and four output lines. The MB-06067 versions are available now and pricing ranges from $356 to $395 for one unit, depending on configuration and options.

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

COM Express Card Boasts Server-Class Performance

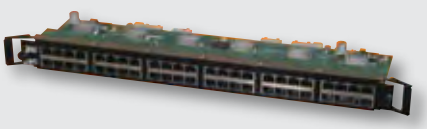
Compute-density ranks as one of the major watch words in military system design today. The more computing power that can be packed into a UAV radar or similar system, the better. Along such lines, server-level performance and features are built into an embedded COM-Express-compliant form-factor from PFU Systems. The Plug-N-Run E1 module from PFU Systems combines Intel Core 2 Duo performance, server-class I/O support and data reliability in a PICMG standard form-factor.

The company says it addresses a class of embedded applications that require more than just CPU performance; they also require substantial data throughput with high reliability.

The Plug-N-Run E1 offers Core 2 Duo processors at 2.16 and 1.5 GHz. CPU performance is augmented with the E7520 and 6300ESB I/O controllers. These server-class components provide a FSB at 667 MHz, support for dual channel access to up to 4 Gbytes of ECC memory, two x8 and one x4 lanes of PCI Express, and two Serial ATA channels with RAID support. In addition to these major throughput features, the E1 includes Gigabit Ethernet, eight USB ports, and much more. The module is packaged on the standard COM Express Extended 155 mm x 110 mm (6.1 in. x 4.3 in.) form-factor.

PFU Systems, Plymouth, MN. (763) 551-8261. [www.PFUsystems.com].

Ethernet Switch Card Supports 48 CAT-5 Links



Switched Ethernet is emerging as not only a popular networking technology for the military, but also as a powerful, dependable fabric solution. Curtiss-Wright Controls Embedded Computing has introduced a new Ethernet Port Card for use with its GLX4000 Physical Layer Switch products. The ET1000 supports all Ethernet speeds up to 1 Gbit Ethernet (GigE) via 48 RJ45 front panel connectors. The ET1000 port card is designed for use in Curtiss-Wright's space-saving, high-density 144- and 288-port GLX4000 switches, which provide managed layer-1 connections from any of its input ports to any of its output ports.

Each ET1000 port card brings 10/100/1000 Ethernet communication directly into the GLX4000, and supports up to 48 CAT5 cables. The incoming copper media signals can be converted to optical signals via the GLX4000's SFP port cards (RT4000 or NRT2500). The ET1000 card also supports automatic speed negotiation and cable re-wiring (MDI/MDIX). The design of the GLX4000 port cards is to support a wide range of serial protocols. All GLX4000 port cards, such as the ET1000, are designed to fit both the GLX4000 144-port and 288-port switches. This modular design provides unique scalability enabling port cards to be easily added as the customer's application grows.

Curtiss-Wright Controls Embedded Computing, Charlotte, NC. (704) 869-4600. [www.cwembedded.com].

Customizable MCUs Embed ARM7 Core

The problem of obsolescence shows no sign of going away in today's military market. In fact it keeps getting worse. One way to combat the problem is to make use of customizable FPGA-based solutions. An example is Atmel's CAP family of customizable microcontroller-based System-on-a-Chip products with an ARM7 core. The new CAP7 customizable microcontroller is architecturally compatible with Atmel's broad range of off-the-shelf ARM7-based MCUs and incorporates metal programmable cell fabric (MPCF) technology to integrate up to 450K equivalent ASIC gates in a metal programmable block for custom logic netlist conversion.

The initial CAP7 product release includes the AT91CAP7S, based on the ARM7TDMI processor core. The AT91CAP7S has 160 Kbytes of on-chip fast SRAM and either a 250K or 450K block of metal programmable ASIC gates. Peripherals include a USB device, SPI master and slave, two USARTs, three 16-bit timer counters, an 8-channel, 10-bit analog to digital converter, and a full complement of supervisory functions. There is a one-time charge of $150,000 for design, mask fees and prototypes. The CAP7 is available now for design. The AT91CAP7S250 in a 144-pin LQFP package is priced at $5.44 for 50K unit quantities.

Atmel, San Jose CA. (408) 441-0311. [www.atmel.com].

Modules Offers LIN Extension for USB/CAN II Link

Interest in the CAN bus continues to mount among military system designers. Aimed at the vehicular applications, a USB-to-CAN II in an vehicle version with integrated Local Interconnect Network (LIN) interface and switchable high/low-speed CAN interfaces has been developed by IXXAT. The device delivers an interface with its driver DLL (VCI V3), which enables time-synchronous layer 2 analysis of CAN and LIN networks for the connection to the PC and the integration into customer-specific applications.

LIN communication is supported on the USB-to-CAN II either in LIN master or slave mode. In LIN slave mode, the interface responds automatically to receive master requests. The response data is updated by means of a buffer via the PC-API. In LIN master mode, master requests are processed by the PC application. All received LIN messages are passed on to the application with time stamp, master request, response and status information. Furthermore, IXXAT offers with its canAnalyser, a versatile Windows-based tool for analyzing CAN systems.

IXXAT, Bedford, NH. (603) 471-0800. [www.ixxat.com].

Isolated USB Modules Target Rugged Duties

USB has all but taken over as the key interface bus for data acquisition. Offering a product optimized for use in harsh environments, Data Translation has announced the DT9853 Series of low-cost USB bus-powered D/A modules. Contrary to the popular use of USB modules in benign lab-type applications, the DT9853 series is galvanically isolated to +/- 300V and provides voltage as well as the industrial standard 0 to 20 mA current outputs concurrently. These modules operate as high-speed USB devices for maximum speed and accuracy.

The DT9853 Series is ideal for process control, control loop and test applications requiring stable and accurate output signals. The plug and play installation of these USB modules simplifies configuration and reduces set-up time while offering unrivaled isolation and superior accuracy. The unit provides four or eight glitchless analog outputs with 16-bit resolution for highly accurate measurements. Eight dedicated digital input lines and eight dedicated digital output lines are provided for external event synchronization. The DT9853 Series of isolated D/A modules for USB is priced starting at $495.

Data Translation, Marlboro, MA. (508) 481-3700. [www.datatranslation.com].

Quadrature Encoder Input Board Sports Four Channels

Managing complex arrays of digital I/O is no easy task. Easing the way is a four-channel quadrature encoder input board designed for use with United Electronic Industries' PowerDNA, UEILogger and UEIPAC data acquisition and control Cubes. The board provides standard A, B and Z (index) inputs for each channel and is designed to handle quadrature applications with a maximum input frequency of 16.5 MHz, and 32-bit counters.

The index pin may be set to perform a variety of tasks. It may be set to reset/load the counter immediately; or it can reset/load the counter on the next A/B cycle (low/low, low/high, high/low or high/high). And finally, it can generate an interrupt, or generate a Cube-wide trigger pulse. The DNA-QUAD-604 provides 4 digital inputs and 8 digital outputs. These digital I/O lines may be used as auxiliary digital inputs and outputs or configured as trigger in, trigger out, or clock out signals for each of the channels. The digital I/O is compatible with both +5 and +3.3 volt logic, and the digital outputs are rated to supply ±12 mA of drive current. The board offers 350V of isolation and 7 kV of ESD protection. Single unit pricing starts at $695.

United Electronic Industries, Canton, MA. (781) 821-2890. [www.ueidaq.com].

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

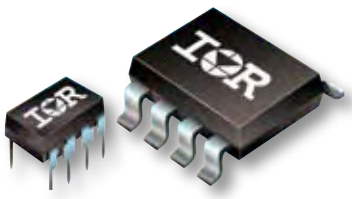
First Pico-ITX Format Card Sports Via C7 CPU

Military embedded computing needs come in all shapes and sizes. Fortunately, so do the choices of modular embedded computing products and form-factors. The latest miniature full-featured x86 form-factor is the Pico-ITX. Designed for smaller, lighter and quieter embedded systems, it measures just 10 cm x 7.2 cm. Called the Pico-ITX, the form-factor was first announced by Via Technologies and its first product is the EPIA PX mainboard, which is built around the1 GHz VIA C7 processor.

The 10-layer EPIA PX mainboard supports up to 1 Gbyte of DDR2 533 SO-DIMM system memory and features the single-chip VIA VX700 system media processor. Onboard options include four USB connectors for four ports, a COM port connector, a PS2 mouse/keyboard connector, a LVDS/DVI connector, a multimedia connector to support external TV-out, video capture port interface and LPC interface, a CPU fan connector and a Pico-ITX power connector.

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

Converter Chipset Enables Smaller Powertrain Footprint

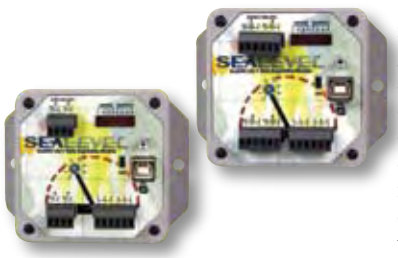


The high currents and low voltages common in today's crop of speedy microprocessors isn't making life easier for military system designers. A new generation of scalable multiphase converter chipsets provides a full-featured and flexible way to implement a complete Intel or AMD CPU power solution, and with simple six-bit voltage programming, the IR3500 control IC and the IR3505 phase IC from International Rectifier is easily configured for use in general-purpose, multiphase applications.

The latest XPhase chipset reduces external component count by 25 percent, which combined with a higher switching frequency, reduces the powertrain area by 45 percent in a five-phase design compared to previous-generation technology. The solution features the IRF6622 and IRF6628 DirectFET power MOSFETs to achieve a two percent efficiency improvement compared to competing solutions. The XPhase chipset features programmable dynamic voltage identification (VID) slew rate, programmable VID offset and load line output impedance, hiccup over-current protection with delay to prevent false triggering, and simplified power good output to indicate correct operation and prevent false triggering. In 10,000-unit quantities, pricing is $1.95 each for the IR3500MPBF and $1.65 each for the IR3505MPBF.

International Rectifier, El Segundo, CA. (310) 252-7148.
[www.irf.com].

USB I/O Modules Boast Locking USB Connector



USB ranks among the serial interconnect technologies given an official stamp of approval by the DoD. A family of USB digital I/O solutions offers system designers a compact, low-cost alternative for interfacing any USB-equipped computer with real-world signals. For maximum reliability, all SeaDAC Lite products include Sealevel's patent-pending SeaLatch locking USB connector to prevent accidental cable disconnection.

The optically isolated inputs protect the host computer from damaging voltage transients and ground loops commonly found in industrial and OEM applications. The 8111's SPST Reed relays are rated to 500 mA, and the 8112 uses high-current SPDT Form C relays to switch up to 6A loads. To simplify installation and troubleshooting, status LEDs display I/O activity and USB connection information. All SeaDAC Lite modules are powered by the USB connection to the host computer. For easy software integration, application programs or third-party software can use Sealevel's SeaMAX library or industry standard Modbus protocol. A variety of diagnostic utilities and sample programs are included. SeaDAC Lite modules are available now and prices start at $159.

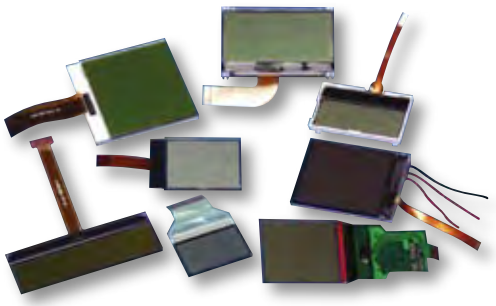
Sealevel Systems, Liberty, SC. (864) 843-4343. [www.sealevel.com].

PCIe Card Does Dual 14-bit Analog I/O at 400 Ms/s

Applications like high-speed military software radios and radar systems can't get enough when it comes to fast, precision analog I/O. Satisfying that thirst, Innovative Integration offers a mezzanine I/O module that features two 14-bit, 400 Ms/s A/D and DAC channels with a Virtex5 FPGA computing core and PCI Express host interface on a standard XMC module. The Xilinx Virtex5 SX95 FPGA with 1 Gbyte DDR2 DRAM and 4 Mbytes QDR memory provides a very high-performance DSP core for applications such as emerging wireless standards. The close integration of the analog I/O, memory and host interface with the FPGA enables real-time signal processing at rates exceeding 300 GMACs per second.

The X5 XMC modules from Innovative Integration couple Innovative's Velocia data flow architecture with an 8-lane PCI Express interface that provides over 1 Gbyte/s sustained transfer rates to the host. Private links to host cards with over 1.6 Gbyte/s capacity using J16 are provided for system integration. The X5 family can be fully customized using VHDL and MATLAB using the FrameWork Logic toolset. The X5-400M quantity one pricing is $6,995.

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



Module Displays Boast Built-in Controllers

The move toward a network-centric military is driving up demand for user displays at every node accross the network. A line of custom module displays designed for critical military and other rugged applications is now available from LXD. The Custom Module Displays can be configured for a wide variety of applications with character, custom icon and graphic capabilities. These module assemblies have built-in digital control and drivers to suit a wide variety of specialized displays. All feature a high-contrast, wide viewing angle and low power operation. Backlight type, operating temperature range and other options are available.

Three display types are available: reflective, transflective and transmissive with either positive or negative image types backlit by either LEDs or electroluminescence. The operating temperature range is from -20° to +85°C or down to -40°C with optional heater. The displays have an operating voltage range of from 3.0 to 5.0V and offer three types of connection: FPC, FFC and Heat Seal.

LXD, Cleveland, OH. (440) 786-8700. [www.LXD.com].

Board Enables High Digital I/O Channel Counts

Sensors arrays keep getting wider and more complex in today's military system designs. That leads to an ever increasing need for digital I/O connectivity for testing such systems. The MSXB 078 from Microstar Laboratories provides sixteen digital inputs and sixteen digital outputs on an HD62 connector, with headers for alternate connectors. Eight MSXB 078 boards connected to a single DAP board give it 128 digital inputs and 128 digital outputs—all operating simultaneously and with a ground isolated from the PC. More digital outputs, up to a total of 1008, can be driven by a single DAP board simply by adding more MSXB 078 boards.

MSXB 078 boards slot into a backplane in a standard industrial enclosure like other signal-conditioning products that conform to the external hardware specifications of the Microstar Laboratories channel architecture. An interface board also plugs into the backplane and connects to a DAP board controlled by a PC. A 19-inch rack-mountable industrial enclosure can hold twenty MSXB 078 boards connected to a single DAP board for a total of 128 digital inputs and 320 digital outputs. The MSXB078 board costs $330 and is available now.

Microstar Laboratories, Bellevue, WA. (425) 453-2345. [www.mstarlabs.com].

Module Does Strain Gauge Measurements via Ethernet

Ethernet has passed the litmus test for military system designers. Feeding that trend, Sensoray announced the newest addition to their 2600 series of smart I/O modules, the 2612. The 2612 allows for simultaneous measurement of up to four 350 strain gauges per module. Two voltage sense lines for the bridge input provide a true 6-wire measurement with 200 nV resolution at a 6 Hz rate. The 2612's microcontroller provides I/O services to the remote 2601 client via a category-5 cable. The CAT-5 cable supplies isolated serial communication and power to the 2612's microcontroller.

The 2612 has automatic standardization circuitry that periodically measures on-board reference standards to update the gain and offset of each channel. Subsequent readings use the newest computed gain, offset and bridge input voltage. Factory calibration constants are stored in non-volatile memory so that 2612s can be replaced without requiring field calibration. A 14-bit A/D digitizes all analog inputs and internal references at two 150 ms intervals. Each input's averaged results are stored in onboard memory. The 2612 has four A/D converters and no multiplexing is necessary. Linux and Windows drivers and demo applications are included as is a Labview software interface. The price for a single unit in an enclosure is $395.

Sensoray, Portland, OR. (503) 684-8005. [www.sensoray.com].

PCI Express Bridge Offers Flexible Interfacing

PCI Express has emerged as one of the switch fabrics that's here to stay, and that kind of longevity is just what the military hungers for. Supporting that trend, Tundra Semiconductor has introduced a four-lane PCI Express (PCIe) to PCI-X Bridge that is pin-compatible with competing PCIe bridge products. The Tsi384's PCIe Interface supports 1, 2 or 4 lanes. This enables the Bridge to offer throughput performance of up to 1 Gbit/s. In addition, the device supports a maximum payload size of up to 512 bytes to allow better throughput efficiency. Its PCI/X Interface can operate up to 133 MHz in PCI-X mode, or up to 66 MHz in PCI mode.

This interface offers designers extensive flexibility by supporting three types of addressing modes: transparent, opaque and non-transparent. Non-transparent bridging is needed for applications such as intelligent I/O adapters that have a processor on the secondary (PCI/X) bus. The Tsi384 has typical power consumption of 1.3W, and incorporates power management to minimize power consumption during operation. The Tundra Tsi384 is general sampling now and will be in volume production later in 2007. It is currently sampling in lead-free RoHS-compliant packaging and will be available in both standard and RoHS-compliant packaging. Volume pricing starts at $19.

Tundra Semiconductor, Ottawa, Ontario. (613) 592-0714. [www.tundra.com].

18-Slot Chassis and Board Family Supports PXI Express

The emerging PXI Express standard builds on commercial PCI Express technology to expand the applications served by the multivendor PXI standard, and military test and instrumentation engineers are itching to make use of it. Helping make that happen, National Instruments has announced the industry's first PXI Express high-speed instruments as well as the industry's first 18-slot PXI Express chassis. The new modular instruments include the NI PXIe-5122 100 Msamples/s, 100 MHz dual-channel digitizer and the NI PXIe-6537 and NI PXIe-6536 50 MHz and 25 MHz 32-channel digital I/O modules. The NI PXIe-1065 18-slot chassis (shown) offers up to 1 Gbyte/s per-slot dedicated bandwidth and a combination of both PXI and PXI Express slots.

The NI PXIe-1065 18-slot chassis complements the existing NI PXIe-1062 8-slot chassis to address higher-channel-density PXI Express-based systems. The new chassis includes a combination of PXI and PXI Express hybrid slots to accept a mix of both existing PXI modules and high-bandwidth PXI Express modules. All of the new products integrate with a variety of software including the NI LabVIEW graphical development environment, LabVIEW SignalExpress interactive measurement software and NI TestStand test management software.

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

Tools Support Atmel AT91SAM9263

Small UAV and small unmanned ground robots depend on high-integrated MCU-level embedded brains to perform their missions. Atmel's new AT91SAM9263 microcontroller fits nicely with that trend. That device is now supported with a complete tool chain from Hitex. The AT91SAM9263 is based on a 200 MIPS ARM926EJ-S core and employs 27 DMA channels as well as several communication interfaces. This makes it well suited for data-intensive applications with graphical user interface. Hitex's Tantino JTAG debug tool has been extended to support the whole on-chip debug functionality of the AT91SAM9263. The USB-powered Tantino is operated by the universal HiTOP user interface and provides flash programming and functions as unlimited flash breakpoints, condition-sensitive breakpoints, exception assistant and update on running.

For debugging complex designs in real time the modular Tanto emulation system is available. Supported by the HiTOP user interface, Tanto offers additional features and improved performance and can be upgraded for complete on-chip ETM-support by simply adding an optional trace module. Since all Hitex tools are controlled by HiTOP, the same universal user interface can be used for all project requirements.

Hitex Development Tools, Irvine, CA. (949) 863-0320. [www.hitex.com].

Eval Board Serves Up Low-Cost IP Control

The military has moved firmly in the direction of EOIP (Everything Over IP). That means voice, data, video—everything networked over a secure IP-based networked. Along those lines, Connect One has rolled out an evaluation board for the iChip CO2128, the company's lowest cost IP controller, which provides Internet connectivity, encryption and security in architecture and software for a host processor or device. The II EVB-630 supports integration of many upper-layer Internet protocols using either AT+i commands or the iChipConfig Utility.

The initial firmware, which is locally updateable, supports up to 10 simultaneous TCP/UDP sockets or secure sockets (SSL3/TLS1); two listen sockets; HTTP/HTTPS, SMTP, FTP/FTPS and TELNET clients; and SerialNET serial-to-IP bridging, HTTP (Web) server, MIME attachments, POP3 client and RAS. Future versions will support remotely updateable firmware. Complementing the two iChipSec CO2128 chips included for prototyping, the II EVB-630 offers two USB host and device connectors, two male-female RS-232 DB-9 connectors, RJ-45 connector, RJ-11 connector, SocketModem, WiFi daughter board with antenna, 4-pin TWI connector, two 6-pin SPI connectors, one 10-pin SSC connector, and SIM holder with either 110V or 220V power supply. LEDs provide valuable feedback. Serial cables are included. The II EVB-630 for secure WiFi, LAN, cellular or dial-up access costs $1,725.

Connect One, San Jose, CA. (408) 572-5675. [www.connectone.com].

PCI Express x4 Card for Laptops Does 2.5 Gbits/s

It used to require a big rack of boards to craft military test equipment; there was no other way to get the bandwidth and I/O breadth needed for complex system tests. Now that same functionality can be offered even at the laptop computer level. Along those lines, One Stop Systems has released its PCI Express (PCIe) x4 Express Card, enabling laptops to operate with high-speed expansion capabilities at 2.5 Gbits/s to a x4 downstream device including an expansion chassis or storage system. Other standard Express Cards on the market only allow connection to the x1 PCIe cable. The PCIe x4 cable downlink connects to all One Stop Systems' expansion chassis for additional add-in board capacity. The Express Card connects to a downstream device through a PCIe x4 cable.

Key features of the PCIe x4 Express Card include LVPECL Spread Spectrum reference clock buffer outputs, electrical isolation at cable connector, low power and a powered cable connector for cables requiring active equalization for additional distance. The Express Card does not require software drivers and supports up to 7-meter passive and 25-meter active cables based on the PCIe Cable standard. The PCIe x4 Express Card lists for $496 and is available immediately.

One Stop Systems, Escondido, CA. (760) 745-9883. [www.onestopsystems.com].

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

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

- *Stand-Alone Rugged Boxes.* A trend has been gathering momentum in the past couple years whereby traditional embedded board vendors are adding stand-alone rugged box-level systems to their military market offerings. These complete system boxes—which often support standard form-factor boards inside them—provide a complete, tested and enclosed computing solution that eliminates complex integration chores for customers. This section looks at this emerging product class and outlines the problems they solve.
- *Cooling Technologies.* There's just no avoiding the trend toward processors and other key components ramping up in wattage. And more power means more challenges dissipating heat. Exotic techniques such as spray-cooling and liquid-cooling are all on the table as possible ways to attack the cooling challenge. Articles in this section touch on all present-day and future cooling solutions.
- *Space-Qualified Systems.* Space-based systems must be built using electronics capable of withstanding everything from intense radiation due to high-energy atoms to bombardments from neutrons and other particles. Right-sizing the appropriate level of radiation hardening is somewhat of an art. Articles in this section explore the radiation concerns facing space designers and will update readers on radiation-hardened boards and subsystems as well ASICs, FPGAs and power components designed for those applications
- *Ethernet Switch Boards.* Long popular in military command and control systems, Ethernet is now gaining traction as a interconnect fabric in compute-intensive applications like sonar, radar or any application that networks sensor arrays together. This section updates readers on the product and technology trends driving board-level Ethernet switch products, and will include a product album of representative Ethernet switch board products in form-factors such as VME, cPCI, MicroTCA and more.

COTS

Editorial

Jeff Child, Editor-in-Chief

Powering Systems Large and Small

Recently I found myself talking to my seven-year-old daughter about aircraft carriers. It started with some remark I made to her like "Did you know that there is a type of ship that can launch airplanes?" It was surprisingly difficult to explain to her the idea of ship that functions as a seagoing airstrip. After a few minutes struggling to describe it, I could tell she was having trouble believing this crazy concept of ship that can launch planes. A picture is worth a thousand words, so I changed tactics and showed her a picture of the *USS George Washington*—a Nimitz Class nuclear-powered carrier—with an array of fighter jets on deck of course. Well, that picture at least convinced her that I wasn't just making the whole idea up.

Since I'm personally fascinated with aircraft carriers, I kept my diatribe going, telling her about the massive tonnage, huge crew complement and staggering operational complexity of our nation's supercarriers. But it wasn't long before her attention waned, and I was left talking to myself. The conversation got me thinking about the latest and greatest in aircraft carrier design and development—and how it fits in with today's military system design and technology trends.

The Navy's CVN 21 Program is the future aircraft carrier replacement program for the *USS Enterprise* and CVN 68 Class aircraft carriers. Starting with the lead ship, CVN 78—to be named the *USS Gerald R. Ford*—, is the first carrier class whose design and specifications occurred within this era of the COTS movement and open architecture military design approaches. The target date for CVN 78 commissioning is 2014, when it will replace the 50-plus-year-old *USS Enterprise*.

The CVN 78 Class carriers will employ an integrated warfare system designed to allow electronics to slot into a single open-architecture, scalable weapons system based on embedded computing technologies. The design also features a so-called "smart deck," equipped with redundant and flexible fiber-optic cable. This smaller deck island will accommodate the dual band radar developed by the DD(X) program. That makes it easier to move and repair than hard copper wiring, and it can be blown through the ship for installation.

The CVN 78 is also expected to provide two to three times the electrical power generation of previous carriers. That will be accomplished by blending the benefits of a new design nuclear propulsion plant and an improved electric plant. That boost in electrical power will enable other enhancements on the CVN 78 such as enabling the heftier amount of electronics and computing systems aboard as well as an Electromagnetic Aircraft Launching System (EMALS) and advanced aircraft arresting gear.

The EMALS will replace the steam-powered system used on today's carriers. Steam catapults are large, heavy, and lack any feedback control. EMALS has self-diagnostic computing systems embedded in it, simplifying maintenance. Removing the steam catapults in favor of EMALS means that the steam catapult conduits aren't needed, allowing the steam from the nuclear reactor to spend more energy on powering shipboard electronics and propulsion systems.

While naturally all that information is interesting to me—and most likely to anyone else involved in military system design—, I'm sure my daughter wouldn't have lasted through the first couple sentences. Her concept of electronics, power generation and computing is much more in the realm of portable devices—cell phones, iPods, handheld games and so forth.

With that in mind, forgive me while I shift from the topic of aircraft carriers—among the largest, most complex system designs—to the complete opposite: wearable computers. I spoke earlier this year in this column about the termination of the Army's $2 billion Land Warrior program, a soldier-wearable computing system. Power was always the biggest challenge in bringing such a system to fruition.

In an effort to tap into the wider market's portable power expertise, earlier this month John Young, the DoD's Director, Defense Research and Engineering, announced a public prize competition to develop a wearable electric power system for warfighters. The competition will take place in the fall of 2008 and with a $1 million prize for first place. The purpose of the competition is to gather and test the good ideas for reducing the weight of the batteries that service members carry. The objective is to create a wearable, prototype system that can power a standard warfighter's equipment for 96 hours but weighs less than half that of the current batteries carried. All components, including the power generator, electrical storage, control electronics, connectors and fuel must weigh four kilograms or less, including any attachments.

Prizes will be awarded to the top three teams in a final competitive demonstration planned for the fall of 2008 at a "wear-off" event. Entrants will demonstrate their prototype systems under realistic conditions. The top three competitors that demonstrate a complete, wearable system that produces 20W average power for 96 hours but weighs less than 4 kilograms (about 8.8 lbs) will win the prizes. Information is available at the Defense Research and Engineering Prize Web site: www.dod.mil/ddre/prize. My seven-year-old is probably far too young to enter the contest. But portable devices and battery-life are well within her sphere of knowledge. I'm sure that when I explain it to her I'll be more able to keep her attention than with our talk about aircraft carriers. ▮▮

Maximum power minimal profile!

TALK TO US
800-735-6200

VICOR'S MIL-COTS VIPAC power supply provides designers with mission-critical power solutions. This user-configurable power supply accepts 28 Vdc input and is available with up to three outputs and 400 W. Built for military COTS ruggedized applications, the MIL-COTS VIPAC is compliant to both MIL-STD-461E and MIL-STD-704E/F. And, all Vicor products are made in the USA.

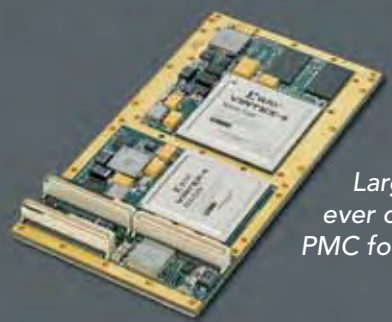
TALK TO US, and find out the benifits of using the new MIL-COTS VIPAC in your system. Experienced applications engineers will work with you and providethe world-class technical support that Vicor is famous for.

To get the data sheet, go to:
vicorpower.com/milvipac

- *28 Vdc rugged, low profile power supply*
- *Up to 400 W, multiple outputs*
- *-55˚C operation*
- *Integral MIL-STD-461E EMI & MIL-STD-704E/F filter*
- *MIL-STD-810F compliance for shock & vibration*
- *User-configurable with VCAD, Vicor's online design tool vicorpower.com/vcad*

Always COTS

vicorpower VICOR **com**



- Xilinx® V-4® LX200 FPGA
- Optional V-4 SX55 or V-4 LX160 companion device
- Up to 1GB of DDR II memory
- Device drivers for VxWorks® or Linux

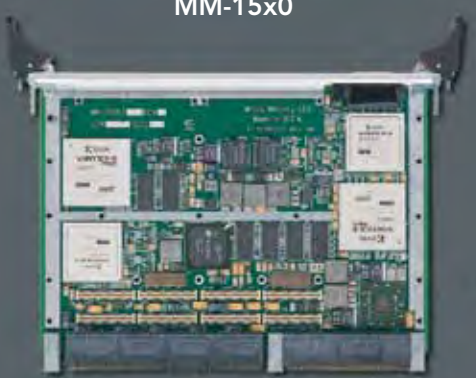
Largest FPGAs ever offered on the PMC form factor

MM-71xx

- Two V-4 SX55 or V-4 LX160 Compute FPGAs
- Two 2VP100 CoSine™ System-on-Chips
- Two PMC/XMC mezzanine sites
- Eight QDR II SRAM arrays and up to 2GB DDR
- Four PowerPC® computers with VxWorks BSPs
- Serial RapidIO® crossbar with support for VITA 41.2

VITA

MM-15x0



- Two V-4 SX55 or V-4 LX160 Compute FPGAs
- Two 2VP100 CoSine System-on-Chips
- Two PMC/XMC mezzanine sites
- Eight QDR II SRAM arrays and up to 2GB DDR
- Four PowerPC computers with VxWorks BSPs
- Serial RapidIO crossbar with support for VITA 46.3

VPX

MM-16x0

Each model board is optionally available with the preconfigured CoSine FPGA IP and offered in rugged convection or conduction cooled versions.

micro memory

MICRO MEMORY
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