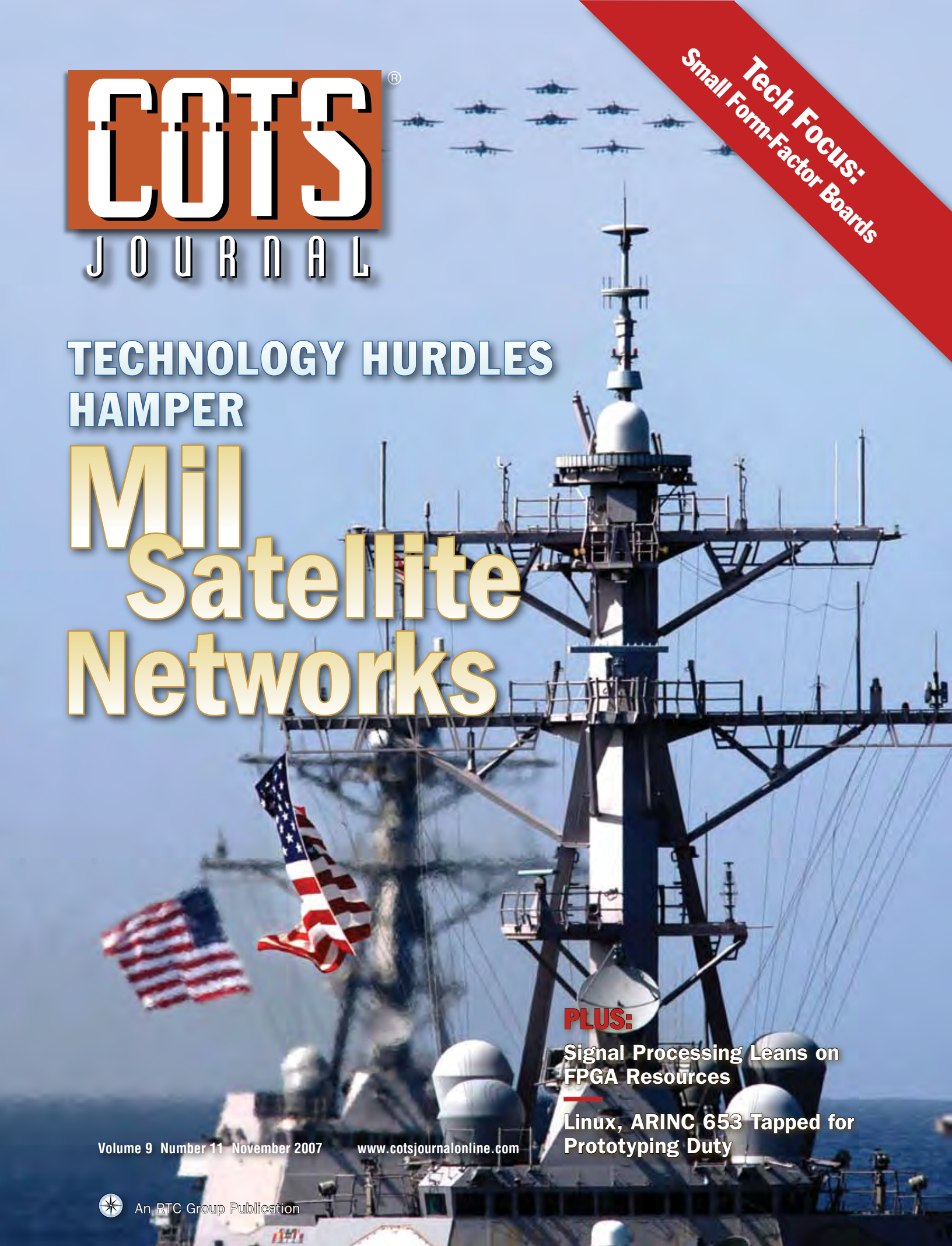


COTS JOURNAL

Tech Focus: Small Form-Factor Boards

TECHNOLOGY HURDLES HAMPER

Mil Satellite Networks

PLUS:

Signal Processing Leans on FPGA Resources

Linux, ARINC 653 Tapped for Prototyping Duty

Volume 9 Number 11 November 2007 www.cotsjournalonline.com

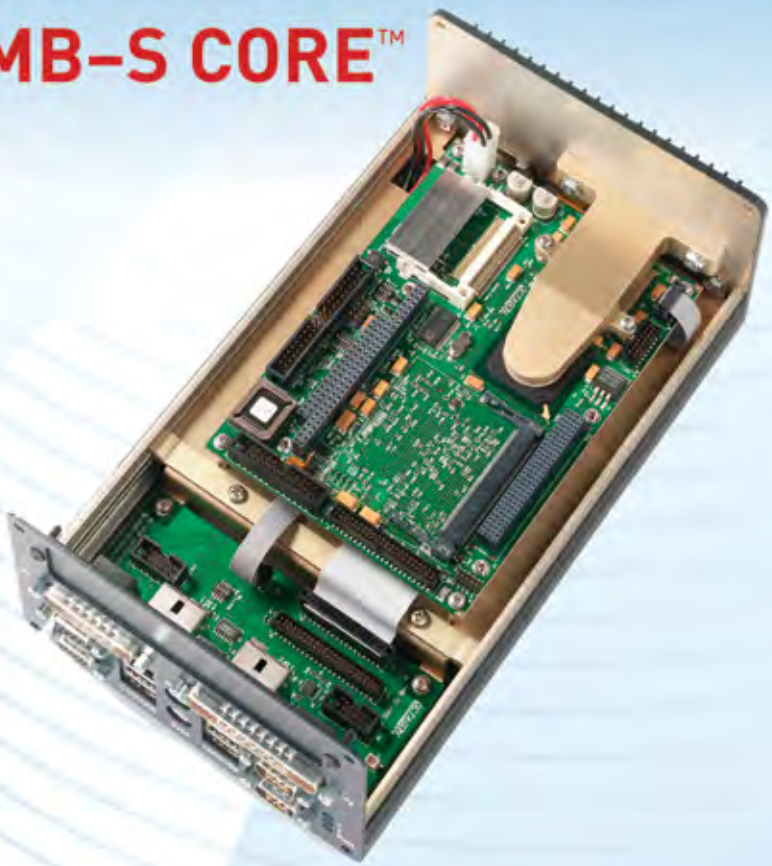
An RTC Group Publication






Fanless mobile server with I/O expansion

XMB–S CORE™



CORE SYSTEMS™ are for industrial applications where reliable operation is paramount. The XMB–S CORE is a no–compromise design that optimizes the electrical, thermal and mechanical components for maximum reliability. Yet they are easily expanded using PC/104 or PC/104–*Plus* modules. The result is a powerful, yet fanless system in a rugged extrusion.

Basic unit includes processing power, memory, a mobile power supply and I/O for most applications. Option panels allow rapid prototyping of system with custom I/O for proof–of–concept. Software drivers for Linux and Windows® XPe included.

Rugged mobile server

RMB–S CORE™

The RMB–S CORE enclosure system performs over a wide temperature range with a 1.5 GHz CPU. A no–compromise design optimizes the electrical, thermal and mechanical components for maximum reliability. Easily expanded using Mini PCI and PC/104 modules. The Pentium platform operates equally well under a Windows or Linux environment. The built–in, mobile power supply operates over a four–to–one input range with dependable protection from transients and reverse voltage.

The basic unit includes processing power, mobile power supply, memory, connector card and I/O for most applications. Option panels allow rapid prototyping of system with custom I/O for proof–of–concept. Software drivers for Linux and Windows XPe included. Software on a CORE SYSTEM is easily ported to other applications.

RME

Standa

We offe
mounti
tion. Th
buses,
vibratio
provide
from a







for extreme environments

3 & XMB mounting options


rd mounting plate


Shock and vibration dampening system


Quick–release mounting system

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

Where severe environment

RMB–COTS™

The RMB–COTS is an advanced mobile computer/server system with the most efficient fanless system available. This allows true industrial temperature range operation at CPU speeds of 1.5 GHz at temperatures to 85° C.

The RMB–COTS is a part of Octagon's growing family of CORE SYSTEMS™ that offer both reliability and versatility in harsh environments. The tightly integrated design intimately combines the electrical, thermal and mechanical components into a complete system with no compromise to any one segment. The Pentium platform operates equally well under a Windows or Linux environment. The built–in, mobile power supply operates over a five–to–one input range with dependable protection from transients and reverse voltage. It also affords the critical brown–out protection, often missing in mobile supplies.

The RMB–COTS was designed for applications where severe environment and high performance meet, requiring a COTS–level solution. The interior electronics use high reliability interconnects rather than cables to minimize complexit and maximize reliability. Various heat–producing components a directly coupled to the case for maximum heat transfer. The F COTS is designed to absorb the shock and vibration in transp marine and aeronautical environments.

The mobile power supply exceeds SAE J1113–11/ISO–7637–2 requirements and meets the C Class A requirements for emis

GE Fanuc
Intelligent Platforms

Photo courtesy of the U.S. Navy

The power to succeed. You want it. We've got it.

Performance. Productivity, Portability. AXIS from GE Fanuc Intelligent Platforms.

You're almost certainly planning to develop the kind of high performance, sophisticated multiprocessor systems that are demanded by network-centric warfare. You may be looking at the limitations imposed on you by proprietary architectures, and considering a move to commercial off-the-shelf (COTS). And you're likely wondering whether VPX is the way to go.

You need to find out more about AXIS from GE Fanuc Intelligent Platforms. AXIS is a powerful yet easy to use software development environment that allows leading edge multiprocessor applications to be developed rapidly, to be deployed sooner – and to perform brilliantly. Even better: it's supported by not only our VME-based COTS systems, but also by our VPX-based COTS systems – meaning that your application will stand the test of time over a multi-year deployment.

If state of the art DSP systems are what you're developing, and performance and portability are important to you, you'll find that nothing else comes close to what AXIS can do.

www.gefanucembedded.com/axis

AXIS

GE FANUC

COTS JOURNAL

Features

November 2007 Volume 9 Number 11

Departments

Coming in December...
...See Page 69

Special Feature

Satellite Networking

Tech Recon

Advanced Signal Processing

System Development

Simulation & Test

Technology Focus

Small Form-Factor Boards

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.*

Cover Story ..... Page 14

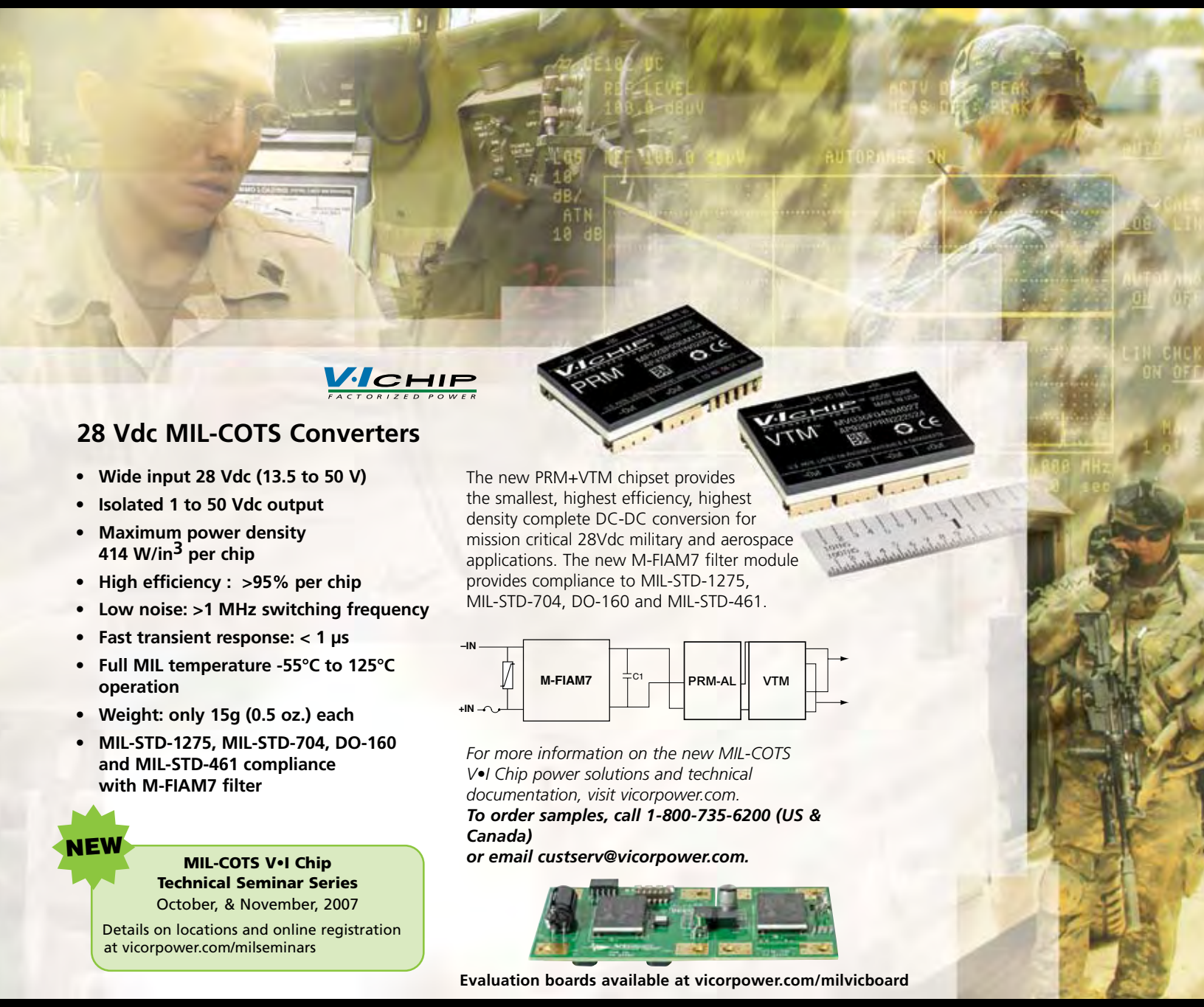
Aircraft assigned to Carrier Air Wing Five (CVW-5) fly over a group of 18 U.S. and Japanese Maritime Self-Defense Force ships, at the conclusion of the two nations' exercise ANNUALEX last year. The exercise is designed to improve both forces' capabilities in the defense of Japan. Approximately 8,500 U.S. Sailors are taking part aboard 13 ships, submarines and various shore-based aircraft.

U.S. Navy photo by Mass Communication Specialist Seaman Adam York

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.

NEW

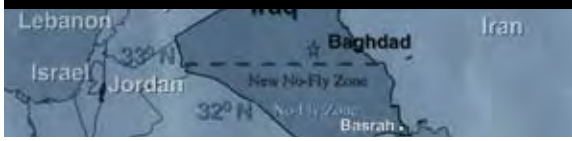
MIL-COTS V•I Chip Technical Seminar Series
October, & November, 2007
Details on locations and online registration at vicorpower.com/milseminars

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



Rethinking Conferences

Here we are at the height of the conference season again, which gets me started on what have become age-old questions: Why are some very successful when there's so much Internet "stuff" around? Why isn't there a major conference for the "embedded military" industry? What conferences do military electronic designers and suppliers attend? I don't know which of these issues to tackle first, but I just returned from MILCOM, which was very successful, and it provided our editorial team the opportunity to talk to both paid attendees and suppliers.

My recent experience tells me that—with the possible exception of ESC—the most successful conferences focus on specific end-use markets. In contrast, broad-range conferences are of declining interest to attendees. Take for example MILCOM and I/ITSEC, two very successful conferences that focus on communications and simulation/training for the military respectively. Meanwhile, ESC—clearly more of a broad-range than an end-use conference—is not in a growth cycle. At best it's stagnant.

What motivates attendees to invest time and money to travel to and pay to attend some conferences? Why don't they just glean all the information off the Internet? Surely the Web has everything you ever wanted—or didn't want to know—about almost everything on it? Casual conversations with paid attendees at MILCOM probably reinforced what could be surmised before talking with them. Attendees get something of value and that's why they make the investment of time and money. This may be an over simplification, but taking all the comments I heard and trying to create a general model leads me to this analogy: It's a little like staring at all the stars in a galaxy and all the attendee really wants to do is investigate stars that have planets around them. Using the Internet they may find one, then go look for another—wading through the galaxy never knowing if they've found the critical number or the best ones for their investigation. At a quality end-use conference, someone lumps all the star systems with planets together. The conference organizers do some screening of the sessions to weed out 90% of any corporate sales pitch, and attendees get to interact directly with speakers and fellow attendees who share the same issues.

Where does all that leave suppliers of embedded electronics that want to connect with those investigators? Carrying the galaxy analogy a step further, suppliers within our galaxy supply the gases, minerals and complex compounds—all of which can be found in and around all the stars in our galaxy. All these elements are critical to the existence of the galaxy and needed by stars with planets and the other areas within the galaxy. In order to get their message out, our suppliers now need to participate in conferences that focus on red giants, pulsars, stars with planets, and so on and so on. Our attendee on the other hand needs the information on gases, minerals and complex compounds in order to perform their mission, and they can get enough of this information at an end-use conference, compelling suppliers to be at many more end-use conferences.

Okay, enough with the galaxy analogy for now. If I'd written about one specific example anyone who wasn't involved in it would have just zoned out. As noted earlier, we recently sent a cadre of our editorial staff to MILCOM. Although that show really only deals with the communications segment of our market, it was an impressive conference. Prior to leaving to travel to the show, I had requests from more than forty companies to stop by and talk about the technology they were targeting and products they offer. As a Publisher dealing more with global issues, I usually don't get that many invitations. The exception was the Bus and Board conference—which I hear has been put off until late spring at the earliest. To me that's just another verification of traditional embedded suppliers and end-use suppliers merging in an effort to communicate to the marketplace about the importance of detailing the use of specific embedded technology.

Is there a place for an embedded military electronics conference? I still think there is. This market segment has a host of unique issues and requirements that affect the foundation of every end-use system—issues that every end-use designer needs to cope with. Unlike designers of consumer goods that only have a 12- to 18-month life span, military equipment still needs a much greater life cycle. The complication of having product runs of less than tens of thousands, power and heat dissipation issues, and so on—all these are core problems for the military system designer. While such topics may be casually addressed at conferences like MILCOM and I/ITSEC, they're treated as side issues without any in-depth focus on the underlying technology trends and solutions. The bottom line is that, like any conference, one that focuses on embedded military electronics needs to provide a reason for a paid attendee to invest their time and money. It's that notion that got lost in many of the conferences that are now in the conference graveyard. ■■

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
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
ART DIRECTOR
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
Stacy Gandre, stacyg@rtcgroup.com
(949) 226-2024
WESTERN REGIONAL ADVERTISING MANAGER
Lauren Hintze, laurenh@rtcgroup.com
(949) 226-2014
EASTERN REGIONAL ADVERTISING MANAGER
Nancy Vanderslice, nancyv@rtcgroup.com
(978) 443-2402
INSIDE SALES MANAGER
Carrie Bowers, carrieb@rtcgroup.com
(949) 226-2029
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

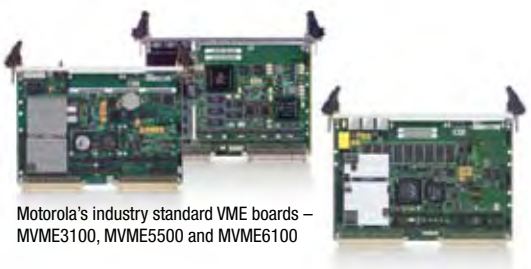
Jeff Child, Editor-in-Chief
20A Northwest Blvd., PMB#137, Nashua, NH 03063
Phone: (603) 429-8301 Fax: (603) 424-8122

Published by THE RTC GROUP

THE ADVANTAGES ARE CLEAR

Motorola is the clear choice for your critical systems. The world's leading original equipment manufacturers trust Motorola to help them make better products faster and more cost effectively – while increasing flexibility and protecting their technology investment. That's why our VMEbus, CompactPCI®, Processor PMC, MicroTCA™ and AdvancedTCA® products have long been the foundation of a wide range of applications across telecommunications, industrial, defense, aerospace and medical industries. Looking for a clear advantage over the competition? **HELLOMOTO™**

See why Motorola should be your first choice for embedded communications computing solutions at: motorola.com/computing/vme



Motorola's industry standard VME boards – MVME3100, MVME5500 and MVME6100

ROCKET SCIENCE AT ROCKET SPEED.

At 2 GHz, it's not just fast. It's simply brilliant!

Blast off with the new Model 6826 A/D board. It's fully loaded with dual 2 GHz 10-bit A/D converters, powerful FPGA resources, plenty of memory and fast interfaces—all ready to tackle your toughest high-speed wideband signal processing tasks.

Capture. Digitize both continuous or burst signals and pulses with flexible clocking, gating and triggering resources plus advanced multiboard synchronization. Store real-time data in dual 512 MB DDR memory buffers.

Crunch. Process real-time data in the Xilinx XC2VP100 Virtex-II Pro FPGA with nearly 100,000 logic cells and 444 hardware multipliers—perfect for DSP algorithms.

Connect. Stream data through FPDP-II or VXS using Serial RapidIO, PCI Express, or Aurora and 3.125 Gbit/sec RocketIO® gigabit serial interfaces.

- Dual 10-bit 2 GHz A/D Converters
- Dual 4x Full-Duplex VXS Links
- Xilinx Virtex-II Pro XC2VP100 FPGA
- 1 GByte of DDR SDRAM
- FPDP-II, LVDS, VXS, Aurora®, Serial RapidIO, & PCI Express
- Multiboard Synchronization, Gating & Triggering
- ReadyFlow® Board Support C Libraries
- SystemFlow™ API & Libraries
- GateFlow® FPGA Design Resources
- Commercial, Rugged & Conduction-Cooled Versions

The 6826 is the latest VME addition to over 60 Pentek I/O products. From stand-alone VME/VXS, PMC/XMC, cPCI or PCI boards to application-ready solutions, Pentek offers you lifetime technical support and a priceless extra: the power to outrun, outsmart and out-process your competitors!

Also check out our RTS2503 Wideband Recording System. Complete with SystemFlow API and Development Libraries!

PENTEK

www.pentek.com/go/cotsrocket for Pentek's "*Critical Techniques for High-Speed A/D Converters in Real-Time Systems*" 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

Army Contracts DRS Technologies for Bradley Test Gear

DRS Technologies was awarded a $13.6 million contract from the U.S. Army to continue manufacturing Direct Support Electrical System Test Sets (DSESTS) and Test Program Sets (TPS) for the U.S. Army's M2A2 and M3A3 (Figure 1) Bradley Fighting Vehicle Systems. The contract was awarded to DRS by the Army's Tank Automotive and Armaments Command Life Cycle Management Command's (TACOM LCMC) Joint Manufacturing and Technology Center at U.S. Army Garrison, Rock Island Arsenal in Illinois.

As part of this contract DRS will produce Bradley A3 Test Program Sets; Bradley tube-launched, optically tracked, wire-guided (TOW) missile Test Program Sets; and components for Bradley Fighting Vehicle Systems and DSESTS kits. Product deliveries are expected to start immediately with completion expected by August 2008. DRS produces a variety of automatic test equipment designed to diagnose the condition of electronic components and systems installed on the Army's Abrams Main Battle Tanks, Bradley Fighting Vehicle Systems and on U.S. Marine Corps Abrams Tanks and Light Armored Vehicles. The company's DSESTS are used at 89 military bases in the U.S. and are deployed internationally. The DSESTS are designed to support the Army's vehicles as part of their modular transformation from existing division-sized units into brigade-sized combat teams.

Figure 1

The A3 upgrade version of the Bradley features an advanced digital architecture that integrates communications equipment, digital sensors, battle management systems, embedded diagnostic and training systems.

DRS Technologies
Parsippany, NJ.
(973) 898-1500.
[www.drs.com].

Raytheon Taps Performance Tech for Navy SSDS Program

To be used as part of its SSDS Mk 2 (Ship Self-Defense System) program, Raytheon has selected Performance Technologies' Advanced Managed Platform IP-comms products.

Raytheon's SSDS Mk 2 is the only surface combat direction system with off-the-shelf hardware and software that has been delivered for tactical certification. SSDS Mk 2 Open Architecture will advance the existing design to meet the U.S. Navy's OACE (Open Architecture Computing Environment) Category 3 requirements. OACE is the Navy's initiative to standardize infrastructure requirements that will permit mission-critical data to be easily transmitted between multiple systems for improved combat and operational responses.

The Performance Technologies IP-based platform solution features an Intelligent Shelf Manager (a self-contained computer) that provides sophisticated remote monitoring capabilities, and an IP-based networking platform for the SSDS system. The remote management capabilities enable accurate system monitoring and remote diagnostic capabilities to pinpoint any potential system problems. The Advanced Managed Platform is also programmable—enabling system designers to add more features and functionality to their system's capabilities.

Performance Technologies
Rochester, NY.
(585) 256-0200.
[www.pt.com].

Boeing Selects Raytheon for F-15E Radar Modernization Program

….and in other Raytheon news, Boeing has selected Raytheon's active electronically scanned array (AESA) radar to be used as part of the next-generation capabilities on the U.S. Air Force's F-15E Strike Eagle (Figure 2). The source selection award covers AESA radar development, the production of test assets for the system design and development program and production options for retrofit of the 224 F-15Es in the U.S. Air Force fleet.

Raytheon's AESA technology is expected to take the F-15E to a new operational level of simultaneous air-to-air and

Figure 2

An F-15E Strike Eagle performs a low-level training mission over the Sawtooth Mountain Range in Idaho.

air-to-ground capabilities that will keep the aircraft a critical part of the U.S. Air Force's force structure through 2035. The development program is expected to start in 2008 and will run parallel with the United States Air Force and Air National Guard F-15C AESA program already in progress.

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

DataPath Awarded Contract for U.S. Army Satellite Terminals

DataPath has been awarded $56 million to reset, repair and upgrade DataPath Satellite Transportable Terminals (STTs) and Unit Hub SATCOM Trucks used in the U.S. Army's Joint Network Node (JNN) program, also known as Increment One of the Warfighter Information Network-Tactical (WIN-T) program. DataPath's contract with the Army includes a base year and three additional years of work that could total up to $270 million in awards for the company.

DataPath has built and delivered more than 800 STTs as well as provided Unit Hub SATCOM Trucks, software and extensive services for the JNN/WIN-T program since 2004. STTs are rugged, mobile, trailer-based terminals that enable high-bandwidth connectivity as far down as the battalion level at forward-operating military bases. Work under the delivery order includes resets and repairs to terminals returning from the battlefield, upgrades that include compatibility for Ka-band, and the addition of MaxView network control software for managing the terminals. The work will be performed both in DataPath facilities and through DataPath field engineering teams at various Army unit locations.

DataPath
Duluth, GA.
(678) 597-0300.
[www.datapath.com].

JPEO JTRS Orders Almost 40,000 Thales JEM Radios

Thales Communications has announced two awards for its AN/PRC-148 JTRS handheld radio by the Joint Program Executive Office Joint Tactical Radio System (JPEO JTRS) under the Consolidated, Interim, Single-channel, Handheld Radio (CISCHR) contract. These delivery orders will field almost 40,000 AN/PRC-148 JTRS Enhanced MBITRs (JEMs) (Figure 3), as well as ancillaries, with an aggregate total contract value exceeding $128 million. The most recent JPEO award was on behalf of the U.S. Army and was the first delivery order for the U.S. Army under the CISCHR contract.

Figure 3

Thales' AN/PRC-148 JEM (JTRS Enhanced Multiband Inter/Intra Team Radio) has an SCA-compliant platform that hosts all of today's key waveforms and ensures compatibility with the critical JTRS waveforms of the future.

Thales' AN/PRC-148 JEM (JTRS Enhanced Multiband Inter/Intra Team Radio) has a Software Communications Architecture-compliant platform that hosts all of today's key waveforms and ensures compatibility with the critical JTRS waveforms of the future. Further, the AN/PRC-148's programmable cryptography meets the requirements of the National Security Agency's crypto modernization program and is certified to protect the confidentiality of voice and data up through the Top Secret level. The only JTRS handheld radio to be designed, developed and manufactured under a U.S. Department of Defense program of record, the AN/PRC-148 JEM has been tested, evaluated and validated by the U.S. Government.

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

Army Adds Sniper-Detection Capability to Land Warrior System

General Dynamics C4 Systems has received a task order from the U.S. Army to integrate BBN Technologies' "Boomerang" sniper-detection system with the Land Warrior system, enabling Land Warrior-equipped soldiers to identify and respond to a sniper's shot within seconds. The new capability, requested by Land Warrior-equipped troops serving in Iraq, improves soldiers' ability to detect and respond to enemy sniper fire.

The $250,000 task order funds integration and delivery of six sniper-detection systems to a Stryker Brigade Combat Team, which is currently serving in Iraq. Initial deliveries are scheduled for the fourth quarter of 2007. The task order is a modification to the Land Warrior contract awarded in 2003.

Figure 4

The new "Boomerang" capability, requested by Land Warrior-equipped troops serving in Iraq, improves soldiers' ability to detect and respond to enemy sniper fire.

Land Warrior is an integrated ensemble worn by dismounted soldiers that greatly enhances their warfighting combat efficiency and reduces risk of fratricide.

Developed by BBN Technologies and integrated at the General Dynamics-sponsored EDGE Warrior Innovation Center in Scottsdale, AZ, the Boomerang system comprises a group of small microphones and a digital display. The system detects and analyzes the muzzle blast and shock wave from a speeding round to display the precise distance and direction of the sniper. Once delivered, Land Warrior soldiers will automatically receive sensor input in their digital displays. Work is also ongoing in the EDGE Warrior Innovation Center to make size, weight and power improvements to the next-generation system based on feedback from soldiers.

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

COTS Websites

www.cirvibe.com

CirVibe Site Has the Goods on Vibration Issues

For a variety of military and aerospace applications, vibration testing of electronics is a vital part of the development cycle. CirVibe is a supplier of state-of-the-art software for thermal and mechanical analysis of printed circuit boards. But it also excels as a resource for educating the industry on advanced testing methods for rugged and/or reliable electronics such as ESS, HALT and HASS. It offers software, consulting and training in vibration of electronic assemblies. It also offers direction on fixturing, instrumentation, profile development and damage control. This includes improving the ability to develop and produce reliable electronic products,

and to develop high-reliability products faster in the development cycle.

ESS (environmental stress screening) and HASS (highly accelerated stress screening) are "processes" that improve after time, based on field failures and process adjustments. These adjustments are a result of product understanding gained through product failure. CirVibe's methods start with higher product and process understanding—resulting in less service life failures. CirVibe's training options include open courses and on-site private courses. Attendees come from all industries worldwide, including military, aerospace, industrial, commercial, academia and medical.

CirVibe, Plymouth, MN. (763) 559-5166. [www.cirvibe.com].

Special Feature

Satellite Networking

Tech Barriers Fall for Military Satellite Networking

In support of the DoD's lofty vision for global satellite linked networking, technology providers large and small are making advances in modem, radio and laser comms, and mobile networking solutions.

Jeff Child
Editor in Chief

The U.S. Military has some aggressive goals when it comes to its future plans for satellite communications systems. These plans will play a critical role in the fully realized vision of Network-Centric Operations. One of the key enablers of Network-Centric Operations is the Air Force's Transformational Satellite Communications System (TSAT). TSAT (Figure 1) is a satellite program using laser communications intersatellite links to create a high-data-rate backbone in space. A visual image from a UAV that would take several minutes to process with existing satellites, would take less than a second with TSAT. And the warfighter receiving it could be mobile and using a relatively small receiver, anywhere in the world. Over the past 12 months, a variety of military satellite communications programs, proposals and products have reached important milestones, several of which were showcased at last month's MILCOM conference in Orlando, FL.

The Air Force is expected to announce the winner of the multibillion-dollar TSAT space segment contract in January 2008. Progress on TSAT technology development was particularly crucial. Even before TSAT began its formal acquisition phase in 2004, the program had been under pressure to focus on maturing the needed technology for the program.

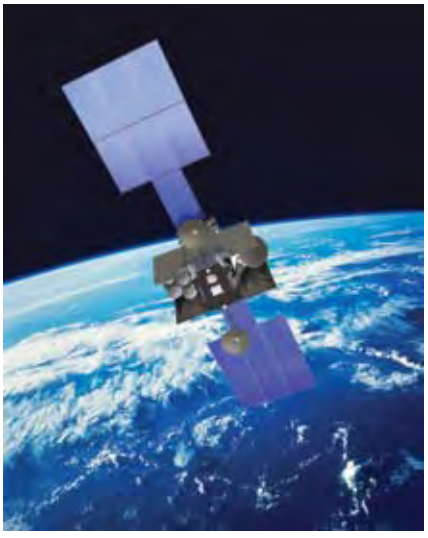


Figure 1

The Air Force's Transformational Satellite Communications System (TSAT) is a satellite program using laser communications intersatellite links to create a high-data-rate backbone in space.

Making progress along those lines, a TSAT team of vendors led by Boeing this summer demonstrated that its Transformational Satellite Communications System Space Segment hardware and software could function in simulated operational environments. Boeing's TEAM TSAT consists of Cisco Systems, Hughes, IBM, Harris Corp., Ball Aerospace & Technologies, LGS Innovations, Raytheon, General Dynamics C4S, L-3 Communications, BBN Technologies, EMS Technologies, SAIC and Innovative Communications Engineering (ICE). For details on those efforts see the sidebar "TSAT Tightens Grip on Technology Maturity."

One-Button Start for Ground Stations

Earlier this month, Boeing and its TEAM TSAT partners successfully demonstrated the "one-button" start-up feature of its U.S. ground station, an essential element of its TSAT offering. The feature allows a ground station technician or a remote command center operator to use one button on a control panel to go from a full "off" condition to full communications operation within minutes, even under adverse operating conditions. The hardware also supports a U.S. Air Force requirement that TSAT spacecraft operate without constant monitoring and adjustment. The high-bandwidth Continental United States (CONUS) Ground Gateway Element (CGGE) connects the U.S. terrestrial communication network and TSAT satellites, providing instant Internet-like connectivity between in-theater assets and command authority throughout the world.

Earlier this year, TEAM TSAT demonstrated the full operational performance of the CGGE Data Processing Center (DPC), which compares two identical high-speed communication streams from different sources in real time and

Figure 2

Spectrum Signal Processing and its partner L-3 Communications Nova Engineering has ported the WNW OFDM PHY to Spectrum's 3U cPCI flexComm SDR-4000 rugged wireless modem. WNW is the next-generation high data rate military waveform that is being integrated under the JTRS Ground Mobile Radio (GMR) program.

forwards the best-quality data to the terrestrial information network.

WIN-T Rolls Forward

Recent months have also seen progress in the military satellite networking aspects of the Army's Warfighter Information Network-Tactical (WIN-T) program. In September the Army awarded General Dynamics SATCOM Technologies a contract to provide specialized satellite communications earth terminals and support services for the Joint Network Node-Network (JNN-N) program, now known as Increment One of the Warfighter Information Network-Tactical (WIN-T). Under the contract, General Dynamics will provide 33 Satellite Transportable Terminals (STT) and two Unit Hub SATCOM Trucks (UHST). General Dynamics will also supply Ka-band upgrade kits, training and logistics services. WIN-T Increment One builds on the former JNN-N and will be used by soldiers in the field to securely access communications services using an enhanced Internet Protocol-based satellite communications network for flexible and reliable transmission and reception of high-bandwidth video, voice and data.

The next-generation STT terminal can be configured to operate over Ku- or Ka-band satellite frequencies. The lighter weight design allows for additional enhancements over previously fielded units. The new UHST provides Ku- or Ka-band operation and increased modem capacity. The new STTs and UHSTs are interoperable with previously fielded JNN-N Lots 1-9 baseband STT and UHST units. In June, the Army announced that it would restructure and accelerate the WIN-T program to have a single program for all Army battlefield networks.

Bringing several elements of the "network-centric" concept together, Harris provided a demo at MILCOM that showcased a number of communications elements interoperating. At its exhibit, Harris showed mobile networks, advanced tactical radio systems, military satellite communications systems, information technology services and digital asset management solutions linked through real-time networks to transfer secure voice, data, images and video.

The Harris Falcon III RF-300M manpack radio has a software-defined architecture that is interoperable with currently fielded radios, and incorporates SINCGARS, Havequick II and the High Performance Waveform (HPW), as well as MIL-STD-181B Tactical Satellite (TACSAT) capability. Meanwhile, Harris' Highband Networking Radio (HNR) is the first radio

TSAT Tightens Grip on Technology Maturity

Making progress toward maturing the critical technologies for TSAT, a team of vendors led by Boeing this summer demonstrated that its Transformational Satellite Communications System Space Segment hardware and software could function in simulated operational environments at Technology Readiness Level-6 (TRL-6) for payload, antenna, information assurance and gateway technologies.

Among the critical components reaching the TRL-6 level or greater include the TSAT laser communications system's telescope, optical bench and communications electronics; the Next-Generation Processor Router technologies for packet processing, based on Boeing-built systems already on-orbit; the antenna hardware, which includes the critical Communications-on-the-Move antenna that enables warfighter mobility; and the bandwidth allocation and protected waveform technologies. TEAM TSAT also reduced information assurance risks for Internet protocol and transmission security, achieving the TRL-6+ level. Enabling technologies for the ground gateway and Data Processing Center—developed on internal R&D investments by Boeing, Harris and SAIC—also have attained TRL-6.

to provide wireless, long-range, high-bandwidth, on-the-move communications to the warfighter through the use of a Harris-developed waveform that enables the network to select the best communications route.

Army's Next-Gen SATCOM: HC3

Another program focused on advanced satellite nets is the High Capacity Communications Capability (HC3), which is the Army's next generation of satellite communications. At MILCOM last month, Raytheon announced its intention to team with a number of vendors to pursue the program. Teaming with Raytheon on the pursuit are L-3 Communications, Northrop Grumman Corporation and Agile Communications, Inc. Lockheed Martin will also work with Raytheon on Army networking and logistics. Lockheed Martin is also the prime contractor for several of the satellites required for HC3 communications.

HC3 is a family of reconfigurable communications terminals that will provide soldiers with high-capacity, multiband, multimode connectivity. HC3 will use current and future satellites and will be integrated into the Army's future force communications architecture. Raytheon's Secure Mobile Anti-jam Reliable Tactical Terminal is a precursor to HC3 and was the first of the military's Advanced Extremely High Frequency, or AEHF, terminals to go into production in April of this year.

Another interesting program is the Air Force's HDR-RF Ground Modem. The modem will provide high data rate capabilities on next-generation Wideband Global SATCOM (WGS) satellites. The HDR-RF Ground Modem is expected to be an important component of future high-speed satellite communications on the Government's Global Information Grid (GIG) network.

Last month—also at MILCOM—Raytheon announced its selection of Mercury Computer Systems to provide the wideband modem subsystem platform as part of Raytheon's recent HDR-RF Ground Modem contract from the U.S. Air Force. Mercury will provide Raytheon with its Waveform-Ready WBDLS modem platform and SCA-compliant Component Portability Infrastructure (CPI) middleware for the software radio. Mercury Waveform-Ready processing platforms combine the processor, transceiver and interconnect technologies with CPI. CPI extends component-based architectures and waveform portability across FPGAs, DSPs and GPPs to decrease development costs and time-to-market through code portability, reuse and ease of integration. Availability of demonstration hardware for the HDR modem is scheduled for late spring '08.

WNW Linking IF to Ethernet

In another example of SATCOM modem technology advancement, Spectrum Signal Processing at MILCOM last month rolled out the first commercially available software defined radio platform with the WNW OFDM PHY (Figure 2). With its partner L-3 Communications Nova Engineering, the company successfully ported the Wideband Networking Waveform (WNW) Orthogonal

PXI The Test Platform of Choice for Thousands of Companies Worldwide

Microsoft
Boeing
BAE Systems
Lockheed Martin
United States Air Force
Honeywell
Saab
Johns Hopkins University
Pyrex
DePuy, a Johnson & Johnson Company
Samsung
Stanford University
National Institute of Oceanic Technology
Lund Institute of Technology
Sandia National Laboratories
Lexmark
Magneti Marelli, a Fiat company
Renault
Summitek Instruments
United States Navy
United States Army
Toshiba
Flextronics
Fiat
Niksar Australia Pty Ltd.
NEC Aerospace Systems
Siemens
SELEX Sistemi Integrati
Huari Telecom
Soliton Technologies
Active Signal Technologies

PC-Based Controller | Modular Instruments DC to 6.6 GHz | Rack Mount or Portable Chassis

PXI is a modular, software-defined platform for measurement and automation systems.

- Open industry standard supported by more than 70 vendors and 1,200 products
- Highest-accuracy instruments, including the highest-resolution digitizer with -120 dBc typical SFDR
- Industrial-grade, cost-effective system based on standard PC technologies
- Direct connectivity to existing instruments using GPIB, Ethernet/LAN, USB, CompactPCI, PCI, and PCI Express
- Software-defined configuration and automation with National Instruments LabVIEW and LabWindows™/CVI, C/C++, NI TestStand, and Microsoft .NET

Choose from a complete set of PXI chassis, controllers, and modular instruments from NI.

PXI Chassis	3U, 6U, rack-mount, 4 to 18 slots
PXI Controllers	Remote or embedded
Digitizers/Oscilloscopes	Up to 24 bits, 250 MS/s
Signal Generators	Up to 16 bits, 200 MS/s
High-Speed Digital I/O	Up to 400 Mb/s
RF	Up to 6.6 GHz, 20 MHz RTB
Digital Multimeters	Up to 7½ digits, LCR, 1,000 V
Programmable Power Supplies	Up to 20 W, 16 bits
Audio Analyzers	Up to 24 bits, 500 kS/s
Switches	Multiplexers, matrices, RF, relays
Multifunction I/O	Analog I/O, digital I/O, counters

To learn why each of these customers chose PXI, visit **ni.com/pxi**.

(800) 891 8841

GSA Contract Holder
FSS Contract GS-24F-0007K

NATIONAL INSTRUMENTS™

Frequency Division Multiplexing physical layer (OFDM PHY) to Spectrum's flexComm SDR-4000 rugged wireless modem. The SDR-4000 is a 3U CompactPCI form-factor board. Spectrum and L-3 Nova have entered a partnership to offer WNW system integrators and radio providers a single, integrated solution that is available for commercialization and deployment. The solution consists of a field-proven WNW OFDM PHY operating at up to 10 Mbits/s of sustained throughput implemented on a production-ready "IF-to-Ethernet" modem platform. WNW is the next-generation high data rate military waveform that is being integrated by Boeing under the Joint Tactical Radio System (JTRS) Ground Mobile Radio (GMR) program. L-3 Nova's WNW PHY is currently used in several military applications.

The waveform can be configured for multiple bandwidths (1.2 MHz, 3 MHz, 5 MHz and 10 MHz) and a host of modes are selectable that vary modulation order, FEC, spreading and diversity. Users can pair the OFDM physical layer with their own networking protocols to address a wide range of requirements. WNW OFDM supports Time Division Multiple Access (TDMA) and Carrier Sense Multiple Access (CSMA), and can support other access schemes. The waveform supports dynamic link adaptation, where the radio senses the channel condition and adjusts its operating mode for optimal performance. This adaptation happens automatically, allowing throughput to adjust quickly to optimize quality of service in a large-scale, ad hoc network. ▮▮

Boeing Integrated Defense Systems
St. Louis, MO.
(314) 232-0232.
[www.boeing.com].

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

Harris
Melbourne, FL.
(321) 727-4000.
[www.harris.com].

Lockheed Martin
Bethesda, MD.
(301) 897-6000.
[www.lockheedmartin.com].

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

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

Spectrum Signal Processing
Burnaby, B.C.
Canada
(604) 421-5422.
[www.spectrumsignal.com].

UP HERE YOU NEED A SYSTEM THAT WON'T LET YOU DOWN.

Whether it's reliability in the moment or reliability over a lifetime, no one takes it more seriously than Curtiss-Wright. That's why we design and fully test all of our rugged products to the most stringent standards. It's also why we provide a full range of support services and programs to ensure both consistent performance and product availability over the life of your defense and aerospace program. That's reliability that goes above and beyond.

The CHAMP-AV6 DSP Engine is our latest VPX-REDI format board that combines the power of eight processor cores with local and off-board I/O options providing 10x the bandwidth of VME. It's available with a variety of support options that ensure both outstanding performance and technology longevity.

CURTISS WRIGHT Controls
Embedded Computing

www.cwcembedded.com

RELIABILITY... *ABOVE & BEYOND*

Special Feature

Satellite Networking

Comms on the Move:
A Systems Perspective

Implementing reliable military satellite communications on a moving vehicle, aircraft or ship is no trivial matter. Antenna configuration, spectral density and modulation schemes all require special attention.

Karl G. Fuchs, Director, Systems Engineering
iDirect Technologies

Communications on the Move (COTM) has gained a great deal of attention recently. The need for broadband connectivity from a moving vehicle has increased dramatically in the past few years for both commercial and military applications. Whether the platform is marine, terrestrial or airborne, there are a number of physical, operational and security considerations that must be taken into account. Internet Protocol (IP) over satellite has become the dominant protocol for newly deployed voice and video applications. Since communications links of individual terminals in a network will vary based on applications, antenna size and traffic profile, it is assumed that a COTM network must simultaneously support star, mesh and SCPC links. The more challenging side is COTM systems designed to be global as opposed to regional in nature. A global COTM network has much greater complexity than a regional network since it will require beam switchover and IP routing re-convergence as a vehicle moves from one satellite beam to another. iDirect provided a demostration of its COTM technology (Figure 1) at last month's MILCOM conference in Orlando.

Figure 1

Communications-on-the-move technology has enabled warfighters to maintain momentum in battle, extending visibility of commanders and increasing the volume of data that can be transmitted to and from mobile units. iDirect Government Technologies offered this a demonstration its COTM technology at last month's MILCOM conference. iDirect is the only satellite provider that is TRANSEC compliant and FIPS certified.

Physics of Small Antennas

With few exceptions a moving vehicle will require a small antenna. The flight characteristics of an aircraft would be negatively impacted if a 3.8m antenna were deployed to facilitate video conference calls and VoIP sessions. To accommodate market demand, antenna manufactures have been working diligently on developing either stabilized parabolic antennas or phased array antennas with very, very small apertures and profiles.

These remarkably small and agile antennas, while a triumph of technology, are still limited by fundamental laws of physics

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

With over 25 years experience developing highly reliable and scalable solutions, we can provide you with integrated hardware and software that can meet your product needs today and allow for future migration tomorrow.

Managed WAN Gateways, Radar Extraction, Recording Servers, and Lawful Intercept Platforms are a few of the many applications that utilize our broad software offering. Available on a suite of hardware platforms in PCI, PCI Express, CompactPCI®, PICMG® 2.16, and stand-alone form factors, our flexible WAN protocol solutions can easily accommodate a wide range of data and communication network requirements.

Explore the limitless possibilities for your programs by calling Performance Technologies today.

Platforms. Blades. Software. Support.
One company – many solutions.

PERFORMANCE TECHNOLOGIES

Phone: 585.256.0200 ◆ www.pt.com/rad ◆ E-mail: info-request@pt.com

CDMA vs. TDMA for Comms on the Move

There are a number of Spread Spectrum techniques available for consideration. The most prevalent Spread Spectrum technique is Code Division Multiple Access (CDMA). CDMA Spread Spectrum is used in many of today's cellular networks. In CDMA the bandwidth of a given phone conversation is spread by a large factor and appended with a unique code. The demodulators used in a handset can identify its unique code from the rest of the simultaneous calls and demodulate its own unique signal. Since CDMA Spread Spectrum is used in so many cellular systems throughout the world, one could leverage the economies of scale and build very cost-effective Spread Spectrum demodulators for the satellite market.

Unfortunately, CDMA is unsuitable for satellite communications and ultimately will not solve the adjacent satellite interference, spectral density problem. The reason CDMA Spread Spectrum will not solve the adjacent satellite interference problem is quite straightforward. Since each remote in the network is transmitting a certain spectral density Φ dBM/Hz defined by the transmitted power and spread factor, the total spectral density reaching the adjacent satellites will be (N x Φ) dBM/Hz where N = number of remotes in the network. Clearly, the coordinated adjacent satellite interference spectral density could quickly be exceeded as remote terminals acquire into the network. This problem could be overcome by spreading the bandwidth further or limiting the number of remotes in the network, but neither of these is a cost-effective solution.

The more practical approach to Spread Spectrum, and the approach adopted by iDirect Technologies for a COTM network, is to apply Direct Sequence Spread Spectrum in a TDMA architecture. In Direct Sequence Spread Spectrum (DSSS), the stream of information to be transmitted is divided into small pieces, each of which is allocated to a frequency channel across the spectrum. A pseudo random number is applied to data entering a carrier modulator. The modulator therefore sees a much larger bit rate, which corresponds to the chip rate of the pseudo random code number sequence. The spectrum is therefore spread by the chip factor. By utilizing DSSS in a TDMA architecture, only one remote terminal will be transmitting at a time thereby lowering the required spread factor and yielding a much more resource efficient system. The iDirect Technologies spreading factor is adjustable between 2 and 16 times. This will enable a satellite engineer to use just the minimum amount of bandwidth to support his unique COTM network.

and antenna gain. As a result, a link budget will dictate increased transmission powers and satellite bandwidth usage. Some of the limitations of the small gains available from sub-one meter antennas can be offset by new Forward Error Correction techniques—Low Density Parity Coding or Parallel Concatenated Convolutional Codes. That said, those techniques have limits and ultimately they require more power to close a given link.

Focus on Spectral Density

In addition to gain, other fundamental characteristics of an antenna include its ability to focus a beam and its side lobe characteristics. In general, the larger the antenna the tighter the beam can focus on the satellite. We would expect the sharper the focus the better. However, there is a downside to very sharp focus on large antennas. Very large antennas, typically found at hub teleports, have a focus so sharp that antenna must employ a mechanical tracking mechanism to move the antenna as the satellite moves in its station keeping "box." Conversely, sub-one meter antennas have a tendency to spread RF energy over a very wide area.

Since satellite spectrum is so limited, adjacent satellites will often utilize the same frequency and polarization, relying on the physical two-degree separation of satellites to minimize interference. The amount of interference allowed from adjacent satellite communications is specified by the International Telecommunications Union and the FCC, as well as coordinated agreements between the satellite operators. The interference is characterized in units of dBW/Hz and is known as spectral density.

Based on international or coordinated agreements, a remote satellite terminal may not unintentionally transmit energy to an adjacent satellite greater than a given Φ dBW/Hz. A COTM remote utilizing sub-one meter antennas and transmitting at high power to close a given broadband link could, in many cases, exceed the coordinated agreement for adjacent satellite interference. The satellite engineer's challenge then becomes how to provide ubiquitous broadband connectivity on a moving platform without causing or being affected by, excess adjacent satellite interference. Fortunately, there is a widely accepted, time-proven technology known as Spread Spectrum, which can solve the adjacent satellite interference problem.

Quite simply, Spread Spectrum takes an RF signal of a given bandwidth Ψ MHz and spectral density of Φ dBW/Hz and spreads it by a factor Z, resulting in an RF signal (Z x Ψ) MHz and spectral density of (Φ/Z) dBW/Hz. Given a large enough spreading factor, a satellite engineer can overcome virtually any adjacent satellite interference problem. The cost of course is in the increased amount of satellite bandwidth required to support given applications.

Beam and Teleport Switchover

Fast moving and long distance COTM terminals such as aircraft and ships will have the need to be handed from one beam to another and from one teleport to another. Mobility poses a number of challenges for IP networks and network management systems. Basic IP network design assumes core network devices like routers and switches will remain at a fixed location even if host devices come in and out of the network. Dynamic routing protocols like OSPF, RIP v2, ISIS, BGP and others are designed to accommodate subnets being added to and deleted from a network and for interconnecting links to come in and out based on backhoes and power outages. The new mobility in the satellite market allows for IP routers, built into remote terminals, to move from beam to beam, from teleport to teleport and from continent to continent. COTM requires a new approach to the design and management of mobile networks.

To address this challenge iDirect Technologies has developed a global NMS, within which a single COTM remote may have multiple instances in teleports around the globe. The iDirect global NMS

What if it rains? Would it matter?

Hop on and drive. Up winding mountain roads. Across wide open plains. Darting through city traffic. Feel the engine hum, the sun, wind, dirt, and yes, even the rain.

Now consider the fact that a fully functional, ultra-mobile PC powers the all-digital dashboard and controls the Intel® Chopper's mechanical functions. Are you beginning to get the idea? This is not just a really cool bike – it's a marvel of Intel® embedded technology in an amazing form factor.

What would you do with high-performance technology that rugged, that durable? What kind of form factor would you use?

To learn more go to: http://developer.intel.com/design/info/905.htm

Intel Embedded Technology. Igniting Innovation.

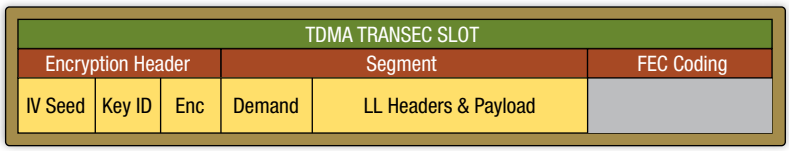


Figure 2

iDirect Technologies' Transmission Security (TRANSEC) for TDMA-based COTM systems has a number of components that prevent an adversary to from infering useful information based on activity levels. The TRANSEC TDMA slot is a fixed size, again to obfuscate any traffic characteristics.

is flexible enough to allow IP addresses to remain fixed but also allows for differences in configuration across different beams including varying out-route and in-route sizes as well as different QoS profiles.

One of the most challenging aspects of COTM remotes involves switching from one beam to another. Beam switchover requires both the ability of the remote to determine when and to which beam to switch as well as integration with the COTM antenna. To determine the optimal point at which to switch beams and the most appropriate beam to switch to, iDirect has developed an EIRP map server. The iDirect EIRP map server holds the familiar contoured EIRP satellite maps. The remote, having access to latitude and longitude information from a GPS, is coordinated with the EIRP map server and determines the appropriate place and time to switch beams. To facilitate beam switchover iDirect Technologies has integrated with a number of stabilized antenna manufacturers including SeaTel, Orbital and others.

COTM Security Challenges

COTM and itinerant terminals pose new challenges from a security perspective as well. The need for advanced encryption over the satellite link is obvious. As a remote moves from location to location and beam to beam, one never knows who may be listening to the link. Satellite service providers will need to offer strong encryption such as 256-bit keyed AES, and for government users FIPS 140-2 certified encryption will be required. For very high security requirements iDirect Technologies has developed Transmission Security (TRANSEC) for TDMA-based COTM systems. TRANSEC has a number of components to it including, among others, the ability to obfuscate any traffic volume or remote terminal activity information that may allow an adversary to infer useful information based on activity levels. It is doubtful any commercial applications will require the level of security TRANSEC provides.

There is one aspect of TRANSEC, however, that may prove beneficial in a commercial network. The more mobile and dynamic a network is, the more vulnerable it becomes to rogue remote terminals gaining access to the network. Most satellite NMS systems authenticate a remote terminal by verifying a physical hardware address in the remote terminal, similar to a MAC address

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

in Ethernet. It is theoretically possible for an adversary to change the hardware address of a remote. Once a remote's hardware address has been changed it could be acquired into a restricted network. There is a component of TRANSEC for TDMA VSAT systems known as X.509 certificates, which could be employed in both commercial and military networks that would stop such intrusions.

X.509 certificates are a standard RFC 2459, and are simply a digital certificate issued by Certificate Authority (CA). The X.509 certificate uses the Public Key Infrastructure and leverages RSA public key encryption. In this way, a remote can be authenticated to a teleport and a teleport to a remote. By employing X.509 certificates, a network operator can be assured all remotes acquiring into the network are authorized and that remotes in the field will not acquire into an adversary's network. The iDirect Technologies NMS has the capability to accept third-party certificates or to generate its own.

Future Network Architectures

Today, most deployed VSAT networks are not homogeneous. In the future, deployed networks will consist of fixed and mobile remotes, some applications will require mesh connectivity, some terminals will be mobile and some links will require high-bandwidth SCPC links. Varying terminal characteristics will necessitate different modulation techniques and in-route link types. The ideal VSAT platform will simultaneously provide all of the above. Furthermore, the system will ideally be a software defined radio. This will enable the operator to simply upgrade software as new technologies are developed and deployed.

The iDirect Technologies iNFINITY platform and Global NMS satisfies all these requirements. The 5IF hub chassis can simultaneously support multiple star, star/mesh and SCPC links operating over up to as many as five RF chains. iDirect Technologies iNFINITY remotes can operate at 8PSK, QPSK, BPSK or spread spectrum with a wide variety of TPC Forward Error Correction rates. The iDirect Technologies global NMS allows a remote to be defined in multiple networks simultaneously around the world. A network operator can protect the entire network and user data by employing TRANSEC, or by simply encrypting user data.

The advent of COTM technology has opened new opportunities and new markets for satellite service providers and hardware manufacturers. These new COTM opportunities present a number of new physics, operations and security challenges. A holistic approach to COTM network design is needed. A network will be of little utility if it is designed to provide high data rates operational on an 18-inch dish but it does a poor job of switching beams when necessary and takes an entire transponder to support a small number of terminals. The tight integration of the remote terminal, NMS and antenna may make a best of breed approach problematic. ▮▮

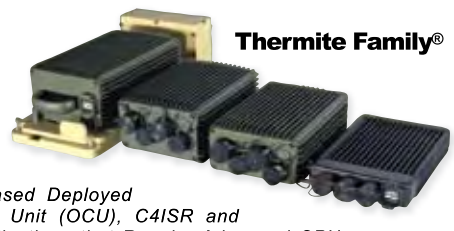
iDirect Technologies
Herndon, VA.
(703) 648-8000.
[www.idirect.net].

COTS Mil-Spec Platforms and DO-178B Development Software for Man-Wearable and Vehicle-Based UV OCU

Thermite®

Quantum3D® Thermite® Tactical Visual Computers (TVC)

Family of COTS, Open-Architecture, Small Form Factor, Mil-Spec Tactical PCs


Thermite Family®

Optimized for Man-Wearable & Vehicle-Based Deployed Unmanned Vehicle (UV) Operator Control Unit (OCU), C4ISR and Embedded Training/Mission Rehearsal Applications that Require Advanced CPU, Graphics, Video Capture/Display and I/O Capabilities

Farsight®

Quantum3D® Farsight® Handheld Tactical Touch Screen Displays

Family of COTS, Small Form Factor, Mil-Spec Tactical Daylight Readable/NVG Compatible Displays with Integrated Touch Screens and User Controls—Companion Display for Thermite TVC

Ideal Companion Display for Thermite-TVC Based C4ISR, UV OCU and Maintenance Applications for Man-Wearable & Vehicle-Based Deployments


Farsight®

IData®

Quantum3D® IData® DO-178B Level-A Certifiable Visual Computing Foundation

Patent-Pending COTS, Open-Architecture, Cross-Platform Visual Computing Framework Enables Rapid Development and Deployment of 2D, 3D and Video-Intensive Embedded Human Machine Interface Applications

Optimized for Safety-Critical Primary Flight Display, Mission Processing, Unmanned Vehicle Control, Weapons System Control, VMF/Mil-Std-2525 2D and 3D C4ISR and Embedded Training Applications on Windows, Linux and RTOS-Based Embedded Systems

CALL +1 (408) 361-9815 OR EMAIL salesinfo@quantum3d.com FOR MORE INFORMATION.
www.quantum3d.com

Quantum3D®
THE LEADER IN REALTIME VISUAL COMPUTING SOLUTIONS
SALESINFO@QUANTUM3D.COM - WWW.QUANTUM3D.COM

ATI · FalconView · intel Leap ahead · Windows · SYSGO EMBEDDING INNOVATIONS · TOPSCENE Lockheed Martin

Case Study:
Cryptography Computing Cluster Blends FPGAs, Quad CPUs

Designed for military cryptography applications, a cluster computing design marries an array of FPGA computing resources and power control processors tied together over PCI Express.

Steve McReynolds, Technical Support Manager
Trenton Technology
Mark Hur, Director of Marketing
Pico Computing

Choosing the right architecture can make a huge difference in how complex signal processing computing applications perform. Applications such as weather predication, bomb blast analysis and financial modeling, for example, require floating-point computations. Meanwhile, other similarly complex applications such as the Smith Waterman algorithm, military cryptography and image processing do not typically require floating-point computations. For non-floating-point applications, large arrays of FPGAs can dramatically speed up the computation of the overall solution algorithm.

This case study takes a look at how an array of up to 84 FPGAs managed by a PICMG 1.3 System Host Board (SHB) communicating to the FPGA boards over PCI Express links on a PICMG 1.3 backplane, enables 10,000:1 speed improvements in typical hardware cryptography applications.

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

Figure 1

Unlike general-purpose processor arrays—in which a very large number of gates must switch to perform even the simplest decisions—FPGA computing modules, such as this Pico Computing E-16, use a minimal set of gates to make basic logic decisions.

FPGA Acceleration with Intel Processors

General-purpose processor arrays—including graphics processors—are effective and easy to use. But many such processors are burdened with extremely high power requirements. In such processors, a very large number of gates must switch when performing even the simplest decisions. In contrast, FPGA modules, such as the Pico Computing E-16 shown in Figure 1, use a minimal set of gates to make basic logic decisions.

The high-performance computing system described here requires approximately 500W of system power. Over half of that power is consumed by the PICMG 1.3 System Host Board (SHB) with its two Quad-Core Intel Xeon Processors E5335. The Trenton MCXT system host board shown in Figure 2 takes full advantage of the capabilities of the Quad-Core Intel Xeon Processors to manage the complex data traffic flow needed by the high-performance computing system.

In cluster computing designs, equally important as the processing elements is the flexibility of the interconnect that links processing elements together. Rarely can any one military application justify its own purpose-built hardware optimized for a particular algorithm. Typically a machine designed for one military application does not have the optimal interconnect strategy for another algorithm. With that in mind, the PCI Express (PCIe)-based interconnect strategy

Boldly go where no system has gone before....

EPIA PX-Series Pico-ITX Mainboard

- Revolutionary Form Factor for Embedded Applications
- VIA C7 1.5GHz Processor
- Pin Header I/O for System Design Flexibility

15 Independent 16-Bit Counter / Timers

16 Isolated Digital Inputs
16 Relay Outputs

16-Bit Analog Input 16-Channels 500kHz

8-Channel 125kHz Waveform D/A Output

VIA Technologies' tiny PICO SBC combines with ACCES I/O Products' PC/104 size embedded USB boards for OEM data acquisition and control.

With 4 USB ports, dozens of USB/104 I/O modules to choose from, and extended temperature options - Explore the Possibilities!

Saving Space, The Final Frontier

VIA embedded in your success

To find more information on EPIA mainboards, please visit
www.VIAembedded.com
or call 510 683 3300. Come visit us at
940 Mission Court Fremont CA 94539

ACCES I/O PRODUCTS, INC.
The source for all your I/O needs

To learn more about our Embedded USB/104 I/O boards visit
www.accesio.com
or call 800 326 1649. Come visit us at
10623 Roselle Street San Diego CA 92121

VIA C7 Processor
VIA VX700 IGP Chipset
ROHS COMPLIANT

used in this system allows tremendous flexibility connecting the processing elements (PE). The PEs may be connected to their nearest neighbors, to other processing elements hosted in the same box, and even across boxes with no change to the FPGA algorithms and minimal impact on speed. Unless a PE is capable of performing significant amounts of processing independently, the potential for high levels of parallelism is limited. The PCIe interconnect strategy used in the Pico Computing SC3 Super Cluster overcomes this inherent limitation.

Figure 2

In the SC3 SuperCluster, Trenton's MCXT system host board shown here takes full advantage of the capabilities of the Quad-Core Intel Xeon Processors to manage the complex data traffic flow needed by the high-performance computing system.

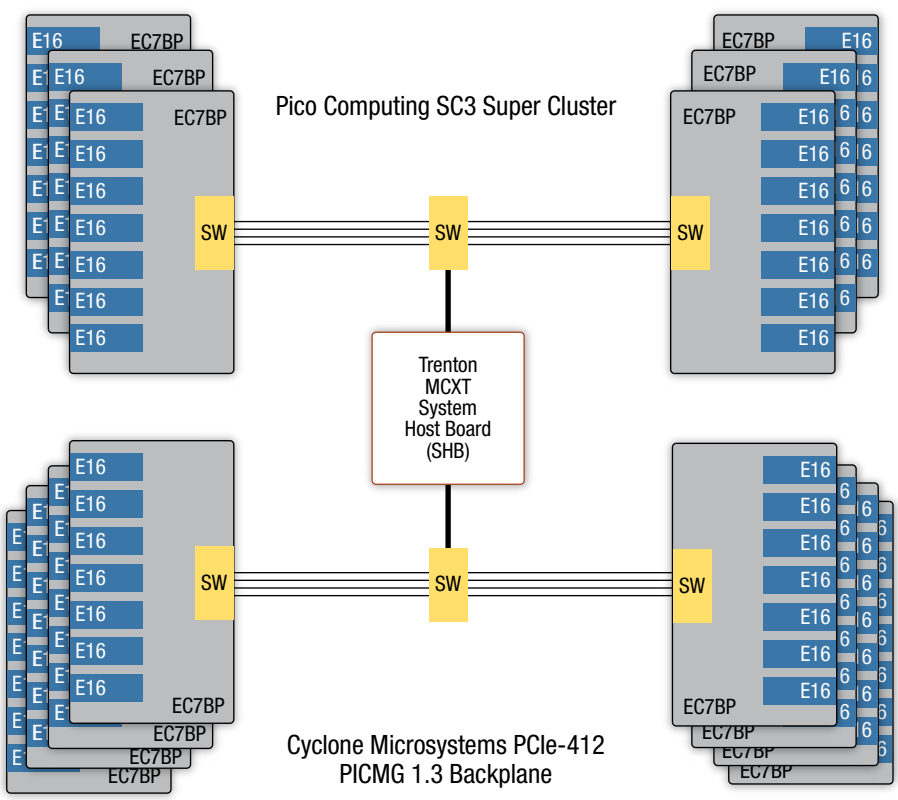


Figure 3

Illustrated here is the system architecture of the Pico Computing SC3 SuperCluster. The SC3 is the third generation of FPGA-based cluster computers from Pico Computing. The Cyclone Microsystems model PCIe-412 backplane is used and features fourteen PCI Express option card slots, one SHB slot and two PCI-X slots. A Pico Computing EC7BP PCI Express backplane plugs into the PCIe card slots on the backplane.

FPGA-Based Cluster System Architecture

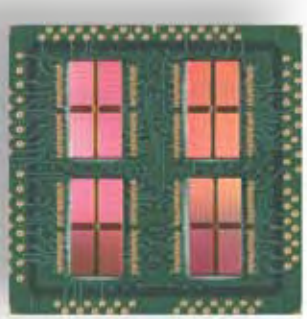
The block diagram in Figure 3 illustrates the system architecture of the Pico Computing SC3 SuperCluster. The SC3 is the third generation of FPGA-based cluster computers from Pico Computing. A central element of the SC3 is the PICMG 1.3 system host board from Trenton Technology, featuring two long-life Quad-Core Intel Xeon Processors. The Cyclone Microsystems model PCIe-412 backplane is used and features fourteen PCI Express option card slots for the FPGA backplane boards, one SHB slot and two additional PCI-X option card slots. A Pico Computing EC7BP PCI Express backplane plugs into the PCIe card slots on the backplane. Figure 4 illustrates how each EC7BP is capable of supporting up to seven standard FPGA cards such as the Pico Computing E-16 card, and each E-16 card features a Virtex-5 LX50 FPGA with 46,080 Logic Cells. Using this combination of off-the-shelf components enabled the system to be developed, manufactured and tested in a very short period of time.

The PCI Express serial links between the SHB slot and the individual E-16 FPGA cards are managed by a PCI Express fan out switch on each EC7BP backplane card and four 32-lane PCI Express fan out switches on the Cyclone PCIe-412 PICMG 1.3 backplane. A PCIe-to-PCI-X bridge chip on the backplane manages the link between the SHB and the two 64-bit/100 MHz PCI-X option card slots. These standard PCIe fan out switches can simultaneously coalesce multiple PCIe lanes. This provides considerable bandwidth overlap while keeping any inherent latency penalties down to a minimum. Granted, the PCIe lane architecture is not as fast as some gate-to-gate FPGA technologies that have been built. But PCIe-

LOCATING...

Advanced microelectronics solutions partner *with*:

- MIL-PRF-38534/38535 **Class H & K certified facility**
- Semiconductor products for specific **circuit board density, weight** and **environmental** requirements
- **Enhanced** and **ruggedized** active matrix liquid crystal displays (AMLCDs)
- **RAD tolerant & RAD hard** capabilities



TARGET LOCATED

White Electronic Designs has expertise and experience in constructing extended environment, high-reliability, high-density semiconductor products and enhanced AMLCDs that deliver on time — over time — every time.

Proceed directly to: **www.whiteedc.com/delivers**

Alternate routes include **info@whiteedc.com** or **602.437.1520.**

WHITE ELECTRONIC DESIGNS
WWW.WHITEEDC.COM

based FPGA clusters can be expanded to include very large arrays where cluster computing is used to satisfy the requirements of complex applications.

The SC3 runs under Linux and naturally exploits the 64-bit architecture of that operating system. For algorithm development, any particular card may be run under Windows (XP or Vista), as would be most likely available on any laptop. Loading the FPGA image is managed entirely through the PCIe bus (in either architecture). The choice of host operating systems is, of course, not binding on the operating system that runs on the FPGA. On the SC3 there is no processor on the FPGA card so an operating system on the card was not a choice. That said, the PE can be replaced with the FX part, which includes a PPC 440 processor.

Engineering Challenges and Solutions

As shown in Figure 5, the Pico Computing SC3 SuperCluster has five EC7BP PCI Express backplane cards installed with seven E-16 FPGA cards plugged into each board. The PCI Express architecture is built on the same logical addressing model developed years ago with the PCI bus and as such, PCIe is subject to similar limitations on the number of supported device segments. Given the architecture of a typical PICMG 1.3 passive backplane and the BIOS configuration of a system host board, the number of allowable PCI buses was exceeded in the initial system

Figure 4

Each EC7BP is capable of supporting up to seven standard FPGA cards such as the Pico Computing E-16 card, and each E-16 card features a Virtex-5 LX50 FPGA with 46,080 Logic Cells.

Acromag I/O. Depend on it.

If you need dependable I/O, Acromag has your board.

With more than 45 years of I/O experience and an unmatched selection of Industry Packs and I/O boards, Acromag is the one to trust. Our boards deliver uncompromising performance supported by time-saving software tools and cost-cutting high channel density — to ensure your projects stay on schedule and within budget.

Industrial-strength designs with extended temperature ranges make Acromag I/O ideal for COTS and manufacturing applications. And with actively managed product life cycles, you're ensured of long-term availability.

Count on us for PMC, too.
Our newest boards deliver impressive performance and outstanding value to PMC, PCI, and CompactPCI formats. Whatever your I/O need, Acromag has an I/O answer — depend on it.

www.acromag.com/dependable.cfm
800-881-0268 or 248-624-1541

Call us or visit our website today — for proven solutions in VME, PCI, CompactPCI, Industry Pack, and PMC.

Acromag®
THE LEADER IN INDUSTRIAL I/O

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

Manufactured in Wixom, Michigan, USA

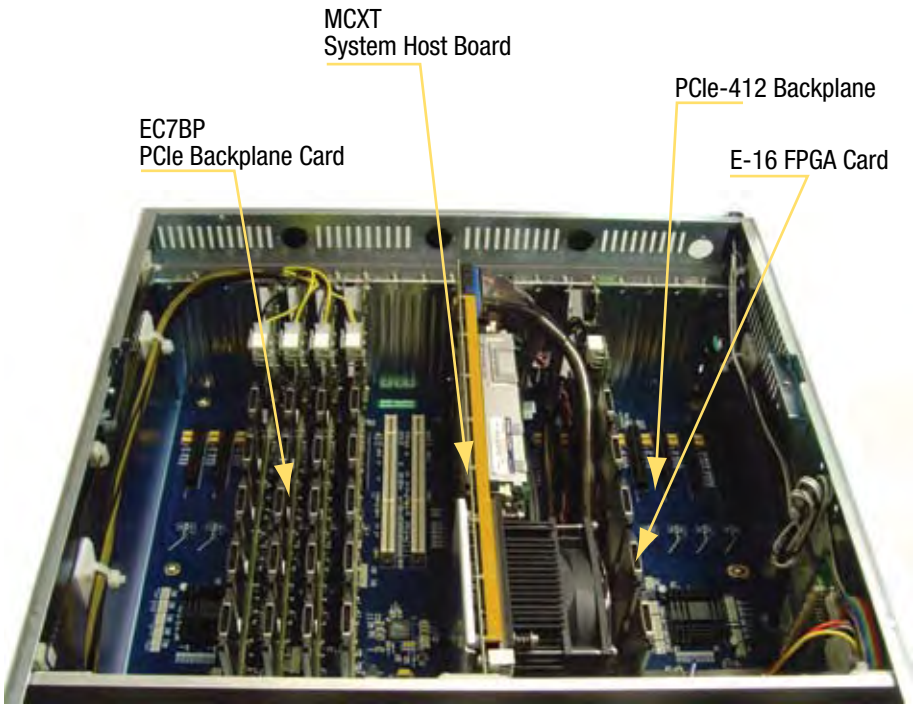


Figure 5

The SC3 SuperCluster has five EC7BP PCI Express backplane cards installed with seven E-16 FPGA cards plugged into each board.

design with the maximum number of FPGA cards installed.

To correct this condition, engineers at Trenton Technology made several modifications to the MCXT board's BIOS to allow up to 256 segments on the PCIe bus. Each Pico Card requires approximately 3 1/7 segments when allowances are made for all of the supporting devices contained in the system. With 256 segments managed by the BIOS, a maximum of 84 Pico Cards can be used effectively in this SC3 SuperCluster.

Particular care was paid to cooling the SC3 SuperCluster. The standard fans were replaced with higher-volume fans; however, it was not necessary to deviate from the standard air-cooled chassis design. Each FPGA has a temperature sensor built in, and the chip will shutdown if it overheats. The same is true with the Quad-Core Intel Xeon Processors used on the Trenton MCXT system host board. Care must taken to guard against FPGA overheating since the internal algorithms are open to the user design and it is possible to drive the FPGA so hard that it will overheat. Design steps are taken to find the point where the increased FPGA clock speed will cause the FPGA to "burn up" and then the clock speed is adjusted downward to avoid this condition. While this additional step in the design process must be taken, it does illustrate the inherent FPGA flexibility and acceleration capability to fine-tune the FPGA clock speed to maximize processing efficiency of a particular algorithm.

Future Development Directions

Having the FPGA card as a separate unit with its own power regulation, memory, clocks and PCIe interface, opens up the possibility of using different processing elements. Among these possibilities under active development are: an FPGA with a PPC processor, a larger FPGA, and special coprocessors such as the MathStar chip. Single instances, or clusters, of such components can be integrated with no change to the overall system cluster architecture. The Pico E-16 card is a 34 mm wide card. The same footprint will accommodate a card with a 54 mm width, which will in turn permit a larger FPGA to be mounted on the card such as the Virtex-5 LX85 or possibly the LX110.

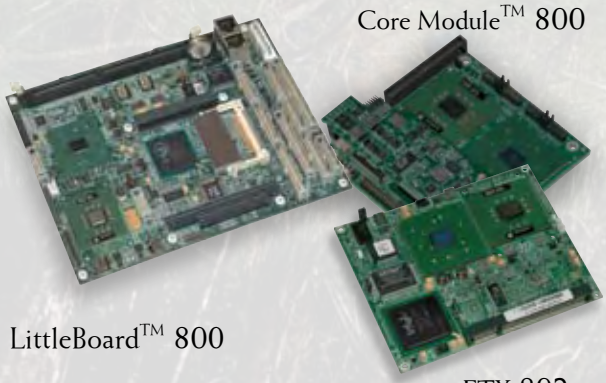
Both FPGAs and general-purpose processors have an impressive breadth of available development tools and a long and established track record of delivering superior system performance. General-purpose processors represent 50 years of maturity, and FPGAs have been used in advanced computing applications for over 20 years. Tools, algorithms and applications for both of these technologies have made tremendous strides. Needless to say, there are high levels of engineering and development activity at work advancing the capabilities of both of these product technologies.

An FPGA is an intrinsically parallel device and implements well with the kind of algorithm that can be divided into relatively watertight sub-processes. FPGA architectures can be expanded, more or less at will, to incorporate many diverse processing elements. This capability enables very flexible FPGA solutions in a wide variety of computing applications. The SC3 SuperCluster is a great example of how complete off-the-shelf FPGA and quad-core processor technology can be merged together by virtue of PCI Express and the PICMG 1.3 architecture, to provide the robust, high-performance computing platform needed for military cryptography and applications like it. ▮▮

Pico Computing
Seattle, WA.
(206) 283-2178.
[www.picocomputing.com].

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

We've got your Back.



Ground Force Systems Specialists and communications experts must think clearly under fire, and respond with lightning speed. The rigorous physical and mental challenges of combat demand field equipment built to ensure mission success because the data captured, analyzed and transmitted helps make split-second decisions that save lives.

It's no wonder so many manufacturers choose Ampro SBCs and modules for rugged embedded applications. Ampro has always been the leader in modular embedded technology. And with their established rugged ETX, EBX LittleBoard™ and PC/104 CoreModule™ families, Ampro continues to out-rank ALL others in the field.

Ampro. Because more than your reputation is at stake.

Call today: (408) 360-0200 or toll free: (800) 966-5200 or visit: www.ampro.com

AMPRO®

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"®

Tech Recon

Advanced Signal Processing

FPGAs Shine In Defense Signal Processing Apps

Everyone knows FPGAs are good for high-speed signal processing. But they also shine as a mechanism to intermix high-speed efficient data flows and lower speed control traffic.

Andrew Reddig, President and CTO
TEK Microsystems

Military systems integrators have embraced the use of FPGAs for high-performance streaming processing within the tight size, weight and power constraints of military embedded systems. The combination of performance and in-system reconfigurability offered by off-the-shelf products that incorporate FPGA technology now makes previously unrealizable systems possible. In addition to the benefits of pure number-crunching performance, FPGAs also offer flexibility through the use of IP cores for internal and external communications interfaces. Unlike CPUs and ASIC-based solutions, FPGAs can easily be adapted to use different protocols for different parts of a system, increasing the range of options available and allowing a more optimum solution to be developed.

An application that exemplifies the benefits FPGA technology brings for flexibility in both processing and intra-system communications is Software Defined Radio (SDR). In its simplest form, a Software Defined Radio Processor has one or more A/D inputs, some form of processing capability, and one or more D/A outputs. When used as a receiver, the A/D inputs are digitized, processed, and the resulting information provided to a downstream system. When used as a transmitter, information provided to the SDR Processor is processed to generate the required waveforms using D/A outputs. The use of reconfigurable processing technology such as FPGAs allows the same set of hardware to support both requirements.

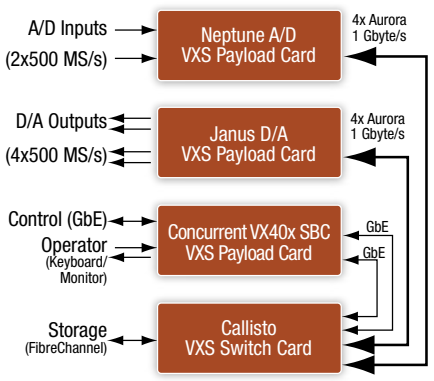


Figure 1

The block diagram for the SDR Processor is shown here and consists of a mix of FPGA processor cards providing A/D, D/A and switch fabric functionality, along with an SBC and data recording subsystem.

Adapting to Input Data Streams

A number of applications in SDR and other related fields such as Electronic Warfare (EW) and Electronic Support Measures (ESM) have similar requirements with different processing algorithms. In particular, EW and ESM applications often require a high-speed and low-latency connection between the A/D inputs and the D/A outputs, allowing the transmitted signal to adaptively respond to received inputs. Memory resources are also required to allow the output to reflect a modified version of the input signal after a desired time delay.

The SDR Processor described here is designed to support a wide range of SDR, EW and ESM requirements in the 500 Msample/s sampling range with a combination of FPGA and general-purpose processing resources. FPGA processors are used for the high-speed A/D and D/A interfaces, and a general-purpose processor is used for high-level algorithms and control/status functions.

SDR Processor Building Blocks

To meet the system requirements, the SDR Processor requires very high-speed data

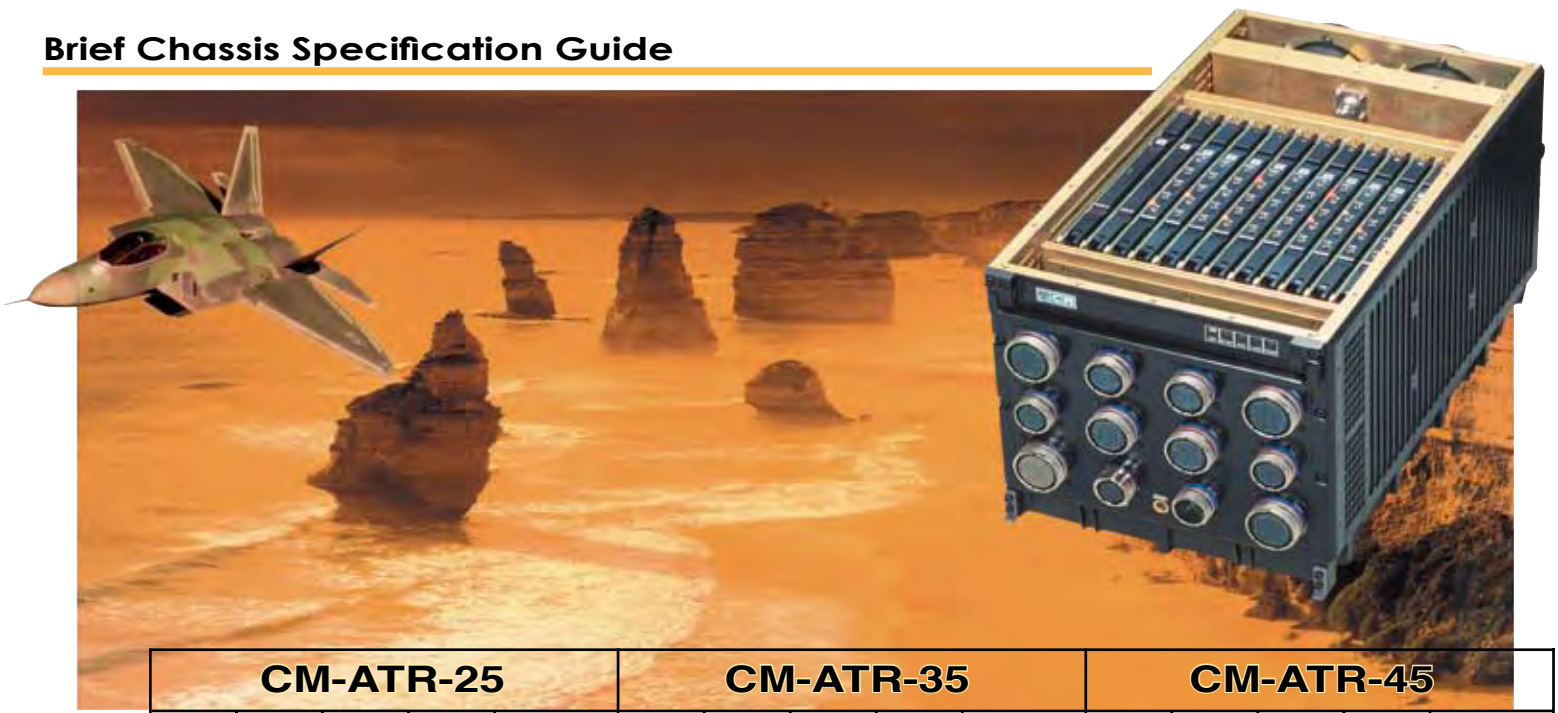
Get Connected
with companies mentioned in this article.
www.cotsjournalonline.com/getconnected

Discover Chassis COTS Standards with CM COMPUTER

and enter into another world with our new CM-ATR-25/35/45 Series. Up to 15 enclosure models offering outstanding Performance, oversized Power Capacity, optimum Heat Management and a wide range of Accessories & custom Options.

Decidedly well suited for critical Defense & Aerospace systems requiring premium quality that can be provided only by leading-edge technology.

Brief Chassis Specification Guide



	CM-ATR-25					CM-ATR-35					CM-ATR-45				
(*)	FAC	S	SEF	HES	SIXHEX	FAC	S	SEF	HES	SIXHEX	FAC	S	SEF	HES	SIXHEX
Size / Slots	½ ATR - Long / 5 Slot 6U VME64x or cPCI					¾ ATR - Long / 7 Slot 6U VME64x or cPCI					1 ATR - Long / 12 Slot 6U VME64x or cPCI				
Power Supply	400 Watts				575 Watts	500 Watts				775 Watts	1050 Watts				1450 Watts
+5 / +3.3 VDC	20 Amp / 23 Amp				40 A / 23 A	40 Amp / 23 Amp				80 A / 23 A	80 Amp / 45 Amp				160 A / 45 A
±12 VDC	12 Amp each					12 Amp each					20 Amp each				
Chassis Vin	All PSU models accept: 28 VDC; 48 VDC; 270 VDC; Autorange 90-264 VAC @ 47-880 Hz and 200 VAC 3-Phase @ 47-880 Hz														
Board Format	Slot-by-slot user configured card-cage allows intermixing conduction-cooled IEEE-1101.2/ANSI-VITA 30.1 and air-cooled IEC-297/IEEE-1101.1 boards														

(*) Cooling Options: FAC - Flowthrough Air Cooled; **S** - Sealed; **SEF** - Sealed, Extended Fins; **HES** - Sealed, Heat Exchanger Sidewalls; **SIXHES** - Sealed, Six Heat Exchangers

CM Computer
True Military COTS Products

All our ATR products are delivered Tested and Certified by independent authorized Labs per MIL-STD-461E & MIL-STD-810F for immediate deployment in US Navy & US Air Force military Fighters and Helicopters.

For more information visit **www.cmcomputer.com** or contact us at **info@cmcomputer.com** to request our Chassis Catalog

New VXS Standards Activity

The existing ANSI/VITA 41 (VXS) standard defines a high-speed "data plane" that interconnects the payload and switch cards within a VXS system. The VXS base standard is fabric agnostic, supporting InfiniBand, Serial RapidIO, PCI Express and Gigabit Ethernet switched fabrics and also Xilinx Aurora point-to-point links, but does not explicitly provide any secondary interface within a chassis other than the legacy VME bus.

Based on the market's requirements for VXS systems, two new standards that build upon the existing standards have been moving through the VITA standardization process.

VITA 41.6 adds a separate control plane connection using previously undefined pins on the P0 connector. This standard provides redundant Gigabit Ethernet links between each payload card and a switch card, supporting a Gigabit Ethernet control plane option that is supplemental to the existing data plane options. Once VITA 41.6-enabled products appear on the market, it will be easier to intermix Single Board Computers with GbE links with higher-speed data fabrics.

VITA 41.8 expands the Gigabit Ethernet data plane to include 10 Gigabit Ethernet using the IEEE 10GBASE-CX4 standard. The existing VITA 41.4 Gigabit Ethernet protocol standard is typically limited to one or two GbE links with a maximum throughput for each payload card of 200 Mbytes/s. By supporting two 10 GbE links per payload card, VITA 41.8 will support throughputs comparable to Serial RapidIO and InfiniBand with the interoperability advantages of Ethernet.

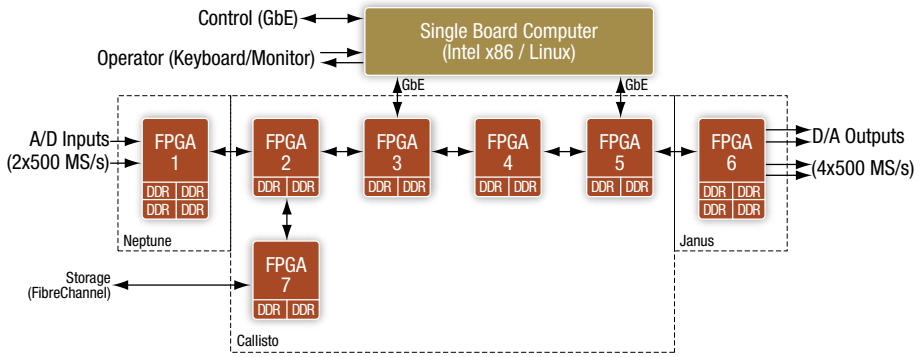


Figure 2

The SDR Processor contains a total of seven Xilinx FPGAs organized as shown. Six of the FPGAs are used for data flow and processing, and the seventh FPGA is used to support an optional connection to Fibre Channel storage.

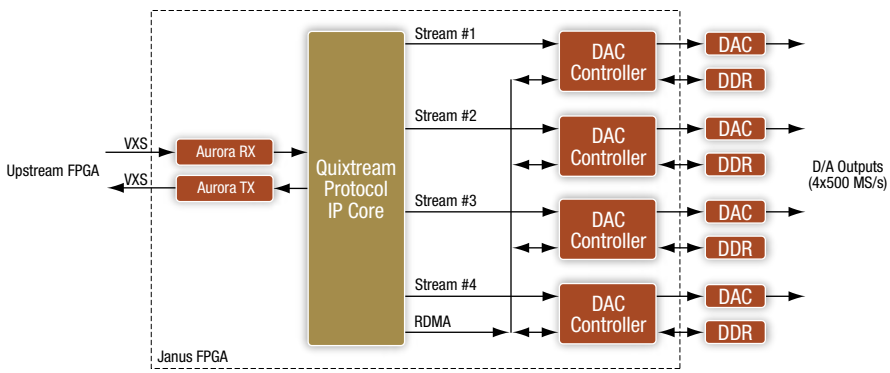


Figure 3

The Quixtream protocol enables a single physical link to be used for both high-speed data and control information and also allows multiplexing of multiple channels of A/D or D/A data within the same physical link. A diagram of the Quixtream data flow within the D/A card FPGA is shown here.

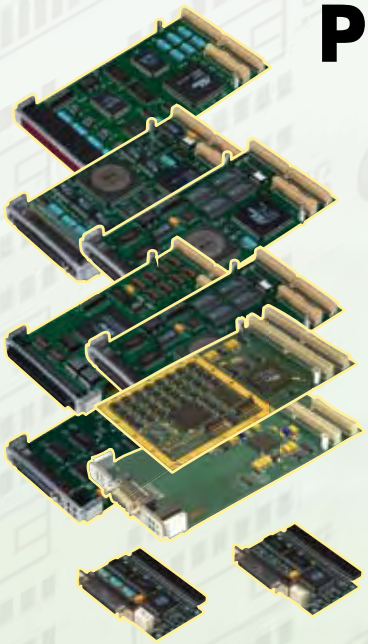
transfers between the A/D inputs, FPGA processors and D/A outputs. The SDR Processor also needs lower-speed interfaces to move processed data and control information between the embedded FPGA processors and the general-purpose processor.

One approach to solving these requirements is to use a high-speed fabric such as RapidIO for both types of traffic. However, this would require that the general-purpose processor support RapidIO connectivity, which would substantially limit the options available. A more flexible solution is to use standard Gigabit Ethernet interfaces for low bandwidth traffic and dedicated high-speed Aurora interfaces for high-speed traffic, allowing a wide range of choices for the general-purpose processor. With more choices, the systems integrator can better optimize the selection of building blocks for the overall system's size, weight and power constraints.

The SDR Processor presented in this article is based on the ANSI/VITA 41 (VXS) standard and uses several off-the-shelf cards as building blocks to provide the necessary I/O interfaces, FPGA processing, control processing and operator interface. The block diagram for the SDR Processor is shown in Figure 1 and consists of the following off-the-shelf cards:

- *Neptune A/D card.* This card provides two channels of high-speed A/D input with 10 bits of resolution at sample rates between 400 Msamples/s and 2.2 Gsamples/s. The A/D input data is transferred to a Xilinx FPGA for preprocessing and buffering. The

PCI-to-PMC

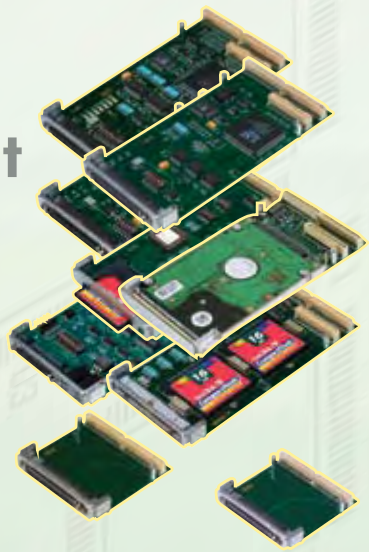


Serial

Ultra320

FPGA

Quad Ethernet



Adapters

SCSI

Async

SATA

Reconfigurable

RoHS

CardBus

IDE

Digital I/O

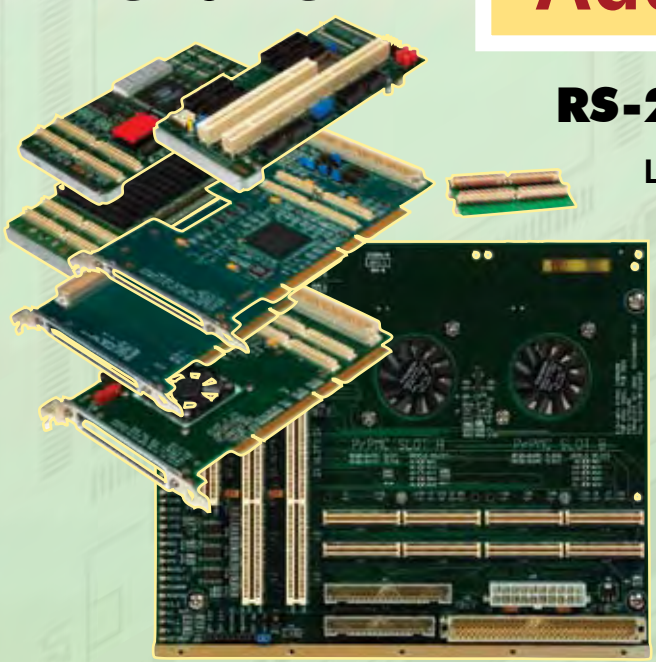
CompactFlash

Fast/Wide

PrPMC

SAS

PMC-to-PCI



RS-232/422/485

LVD/SE

PIM

PMC-X

Test Access & Bus Analysis

Carriers

Extenders

Technobox produces **custom** and **off-the-shelf PMCs**. Our extensive range of solutions includes versatile FPGA-based digital I/O, async I/O, SATA, Ethernet, and IDE controllers. Plus a variety of **adapters, extenders, and tools** for PMC development or integration.

Make us your **first stop** for PMC Solutions.

www.technobox.com

Your Source for PMCs, Adapters, and Tools.

Technobox, inc.®

140 Mount Holly Bypass – Unit 1
Lumberton, NJ 08048
Tel. 609-267-8988
Fax 609-261-1011

Xilinx FPGA has four banks of DDR memory and eight serial links to the VXS P0 connector.

- *Janus D/A card.* This card provides seven channels of high-speed D/A output with 10 bits of resolution at output rates up to 500 Msamples/s. The back end is identical to the A/D card, again using a Xilinx FPGA to provide the interface between the VXS P0 connector, four banks of DDR memory, and the D/A outputs.
- *Callisto switch card.* This card provides connectivity between all of the VXS payload cards in the system using five Xilinx FPGAs. Each FPGA has two banks of DDR memory for buffering, and three of the FPGAs also have four additional SFP ports on the front panel for external connections to storage or network interfaces.
- *Concurrent VX40x SBC.* The SBC provides an Intel Core Duo processor running at 2 GHz along with a full set of peripheral interfaces including keyboard, mouse, graphics and Gigabit Ethernet (GbE) networking interfaces. Two of the GbE interfaces are connected to the switch card through the VXS P0 connector and the third is connected at the front panel of the SBC.
- *Enclosure.* The enclosure is a rack-mounted chassis with a 5-slot VXS backplane. The backplane provides four VXS payload slots and one VXS switch slot, leaving one spare slot for future expansion. Although the SDR Processor only uses one 4x link for each of the A/D and D/A cards, the backplane provides two 4x links between each payload slot and the switch slot, allowing for higher-speed data transfer if required in the future.

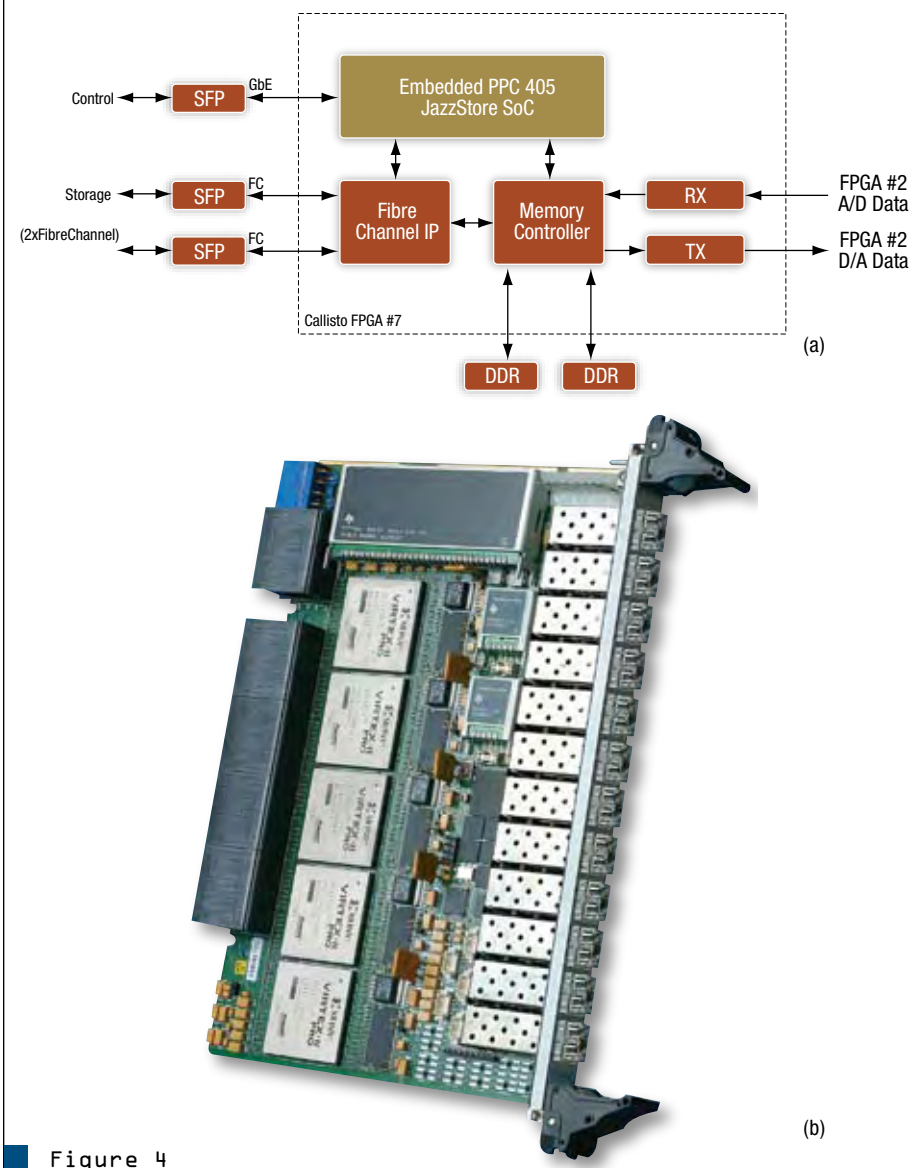


Figure 4

The JazzStore SoC core uses one front panel SFP port to provide Gigabit Ethernet control of the recording process and two front panel SFP ports for Fibre Channel connections to storage devices. In the SDR Processor, the integrated data recorder (a) is implemented using FPGA #7 on the Callisto card (b).

Data Flows Over Aurora Links

The SDR Processor contains a total of seven Xilinx FPGAs organized as shown in Figure 2. Six of the FPGAs are used for data flow and processing, and the seventh FPGA is used to support an optional connection to Fibre Channel storage. Each FPGA has its own communications and memory resources that are used as required by the application IP. All high-speed data flows across the backplane use the Xilinx Aurora protocol as standardized in VITA 41.5 using 4x bidirectional links at a raw speed of 2.5 Gbits/s. This results in full duplex data flow of up to 1 Gbyte/s for the A/D-to-Switch interface and the Switch-to-D/A interface.

Each Aurora link is connected inside the FPGA to a Quixtream endpoint for multiplexing and demultiplexing the data stream. The Quixtream protocol implements multiple virtual channels of data flow along with an RDMA mechanism for control and status traffic. This allows a single physical link to be used for both high-speed data and control information and also allows multiplexing of multiple channels of A/D or D/A data within the same physical link. A diagram of the Quixtream data flow within the D/A card FPGA is shown in Figure 3.

Gigabit Ethernet links are used to transfer data and control information

All the cards...

...for all the solutions

Bringing P.A. Semi to PMC, Extreme Engineering Solutions introduces the **XPedite8000**, the highest-performance, lowest-power PrPMC (Processor PMC) solution available today. With the P.A. Semi PA6T-1682 integrated platform processor, the **XPedite8000** offers:

- Dual 2.0-GHz Power Architecture processor cores.
- Two independent DDR2 SDRAM channels for maximum bandwidth.
- Two front-panel Gigabit Ethernet ports.
- Two PTMC-compliant P14 Gigabit Ethernet ports.
- PCI / PCI-X PMC interface operating at up to 133 MHz.
- 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 sales@xes-inc.com

between the FPGA processing elements and the Single Board Computer. Each Gigabit Ethernet link uses the Quixtream protocol layered on top of basic UDP/IP processing. Within the FPGA, the Quixtream endpoint IP core again divides the physical stream into virtual channels of data along with RDMA traffic. On the SBC side, Quixtream is implemented using a software library that runs on top of standard UDP socket APIs.

Streaming Data Storage

The baseline SDR Processor streams the A/D data through the system and provides the processed data to the SBC and also to the D/A output. During test and debug efforts, it is helpful to have the ability to acquire snapshots of the raw A/D data for post-processing and analysis. This is implemented using one of the FPGAs on the switch card and the JazzStore System-on-Chip (SoC) IP core.

JazzStore SoC provides an FPGA-based data recording capability using the PowerPC 405 processor embedded within the FPGA along with a Fibre Channel IP core. The JazzStore SoC core uses one front panel SFP port to provide Gigabit Ethernet control of the recording process and two front panel SFP ports for Fibre Channel connections to storage devices. Storage can use single drives or RAID arrays with either magnetic or solid-state media. In the SDR Processor, the integrated data recorder is implemented using FPGA #7 on the Callisto card, as shown in Figure 4.

FPGAs for Signal Processing

The use of FPGA processors for high-performance signal processing is widely recognized as the best choice for implementing streaming processing solutions with severe size, weight and power constraints due to the raw performance of FPGAs for repetitive calculations.

The flexibility of FPGAs, particularly in terms of interfaces and protocols, also provides significant advantages when building heterogeneous systems that combine FPGAs with general-purpose processors. By having a wide range of intercommunications protocol options available, the systems integrator can construct systems that combine the best of all worlds, using general-purpose processors where appropriate and leveraging FPGA technology for processing, communications and storage. The end result is a optimum set of off-the-shelf hardware choices and minimum size, weight and power for the required capability. ▮▮

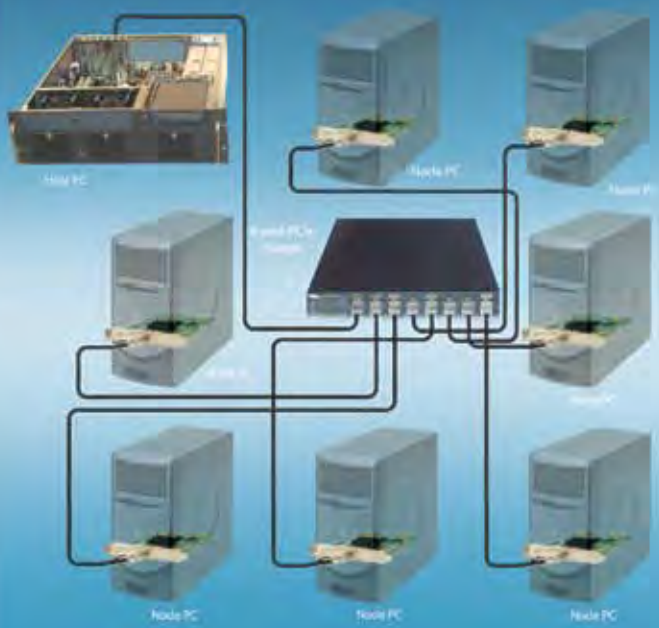
TEK Microsystems
Chelmsford, MA.
(978) 244-9200.
[www.tekmicro.com].

PCIe over Cable

I/O EXPANSION

- PCIe x1, x4 and x8 adapters
- Transfer rate up to 20Gb/s
  Gen 2 up to 80Gb/s
- Software transparent

HIGH-SPEED NETWORKING
with SuperSwitch™



- x4 at 10Gb/s
  Gen 2 up to 80Gb/s
- ExpressNet™ Software
  Direct data transfer
  TCP/IP

MAX EXPRESS™

ONE STOP SYSTEMS
2235 Enterprise, Suite 110
Escondido, CA 92029
Tel (760) 745-9883 Fax (760) 745-9824
(877) GET-CPCI
(438-2724)

Linux, ARINC 653 and OpenGL Team Up for Avionics Prototyping

Migrating Integrated Modular Avionics applications to a deployable partitioned system presents many challenges. Linux, OpenGL and an ARINC 653 platform solution help ease the way.

Larry M. Kinnan, Senior Engineering Specialist
Wind River

Linux offers a low-cost, rapid-prototyping capability for Integrated Modular Avionics applications, but moving these prototypes to a deployable ARINC 653 partitioned system presents many challenges to a developer. Integrated Modular Avionics (IMA) are real-time computer network airborne systems that consist of a number of computing modules capable of supporting numerous applications of differing criticality levels. Modern fighter jets such as the F-35 Joint Strike Fighter, the F/A-22 Raptor (Figure 1) and France's Rafale, are examples of aircraft that employ an IMA architecture.

The availability of Linux and Open Source libraries for graphics provides the developer a rich and highly adaptable development environment to prototype solutions for demonstrations and evaluations. This, coupled with low-cost, high-performance hardware on a PC platform, offers an unbeatable method to demonstrate quickly solutions for various feasibility studies and program bids. The challenge to the developer is to take these prototype solutions and migrate them to a certifiable and deployable solution on flight-ready hardware in as efficient a manner as possible in order to maximize reuse of the prototype code and thereby reduce overall costs for the development effort.

Figure 1

The F/A-22 Raptor is an example of an aircraft that uses an Integrated Modular Avionics (IMA) scheme. IMAs are real-time computer network airborne systems that consist of a number of computing modules capable of supporting numerous applications of differing criticality levels.

Linux Processes and GLUT

In order to provide a realistic example of migration, it's helpful to examine a sample implementation. For this sample implementation, Wind River engineers chose a common Linux distribution and made extensive use of Open GL as the graphical programming environment in order to implement a Synthetic Vision Information System (SVIS). This example made use of Linux processes and the Open GL Utility Library (GLUT) to implement the display on a standard PC platform using GNU development tools.

The choice of GNU tools provided significant advantages when moving to the IMA environment, since GNU tools are also used in the ARINC 653 environment provided with Wind River's VxWorks 653 real-time operating system, that provides a compliant ARINC 653, Supplement 1 APEX. Additionally, the prototype offered example hardware in order to provide air data inputs as well as positional information in order to provide a high-fidelity simulation of the aircraft deployed system. That portion of the prototype was not migrated but simulated.

The Linux prototype made extensive use of GLUT in order to hide the underlying process implementation needed to support input functions, window display/redisplay and idle loop processing. GLUT provides these functions as well as a rich set of helper functions in order to consolidate Open GL primitives to speed coding and simplify the implementation. GLUT works quite well in the prototype environment but was the main area of concern when migrating to a certifiable environment.

Tackling Migration Issues One by One

Since the original prototype was written in a relatively monolithic manner, a number of issues presented themselves when moving the prototype to an IMA environment. Each of these issues is broken down in order to treat them separately.

Partitioning: Typically an IMA system is separated into partitions by application functionality. This means the portions of the application that deal with display, navigation and analog data input need to be physically separated in order to reside in their own space that is time and space partitioned. This immediately creates issues of input/output and how to interconnect the separate applications. In order to simplify the initial migration, it is feasible to place the monolithic application into a single partition space in order to avoid the changes needed to support I/O in the ARINC environment.

Subset API: A common approach to achieve DO-178B certification at Level A and B is to provide a subset of the application programming interface (API). This reduces the amount of code that is required to be reviewed, tested and certified. It also eliminates those functions whose operation may require memory allocation or exhibit other nondeterministic behavior that would make certification too costly or impossible. This subsetting of APIs requires a review of the application code to identify those APIs being used that are not present in the certifiable subset. In the case of the graphical APIs, this meant that the calls making use of GLUT were not available. This required finding alternative API calls in order to migrate the application. These alternatives may be the primitive the GLUT calls used to implement their functionality or the creation of "look-alike" functions using the primitives supplied. Each case must be handled separately.

Drivers and Hardware: The use of Linux on a PC platform offers a wide variety of choices for display adapters. Adapters available for a certifiable flight environment are far fewer and they also require significant restrictions on the operation of their drivers in an IMA environment. The drivers must operate in a safe and robust manner in order to achieve certification. This means their operation must be certifiable to the highest level of the platform being deployed, usually Level A as is the underlying RTOS. Care must be taken to ensure the driver does not violate the time and space partitioning of the system. In order to implement this example system, a GE Fanuc Intelligent Platforms (formerly Radstone) Processor Mezzanine Card (PMC) card, the PMCGA4 (Figure 2), was used. The PMCGA4 meets the necessary criteria for heat and power usage for a flight system as well as provides the needed functionality to implement the prototype display functions. Seaweed Systems provided the

Figure 2

Wind River's example IMA implementation uses GE Fanuc Intelligent Platforms' (formerly Radstone) PMCGA4. This PMC card meets the necessary criteria for heat and power usage for a flight system.

Example ARINC 653 IMA System Configuration

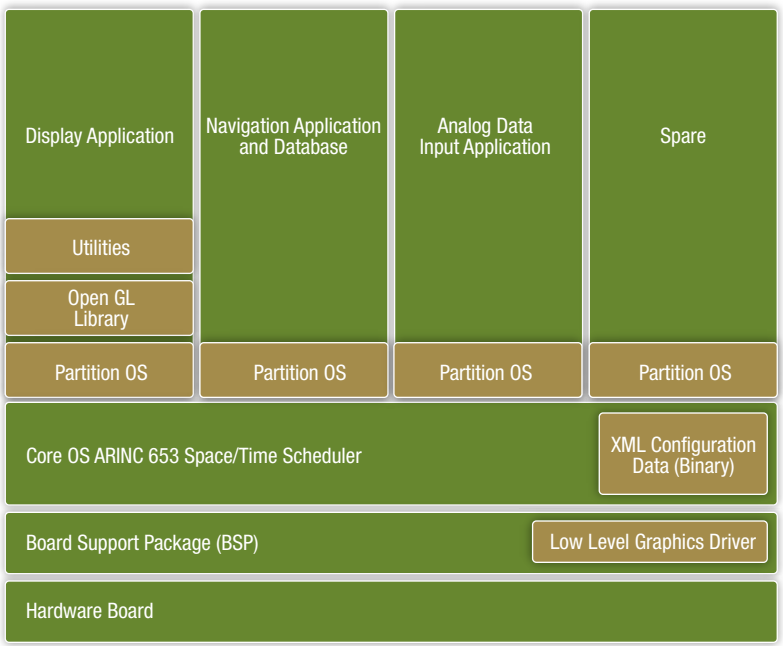


Figure 3

The example IMA system is comprised of four ARINC 653 partitions. In order to communicate both position and analog data to the graphical display partition, the Linux prototype used direct reads of the underlying device drivers to obtain data and then feed it via GLUT function callbacks to the main display process loop.

software driver as part of the certifiable Open GL library used.

Other Considerations: In order to rapidly prototype the certifiable system, a hardware reference platform was used in place of actual flight-ready hardware. The reference board provides a similar hardware environment to platforms used in actual aircraft, but was more readily available and cost-effective. This reference hardware was a PowerPC-based processor with a single PMC. The PMCGA4 card was plugged into this slot and access to the video output was provided via a front panel interface connector. The reference board was operating at a clock speed of 500 MHz with a 100 MHz bus speed to the memory and I/O.

Four-Partition System Configuration

As shown in Figure 3, the system is comprised of four ARINC 653 partitions, one of which is a spare for future expansion. In order to communicate both position and analog data to the graphical display partition, the Linux prototype used direct reads of the underlying device drivers to obtain data and then feed it via GLUT function callbacks to the main display process loop.

In a certifiable system, these direct calls are replaced with calls using standard ARINC Sampling ports that are connected to the low-level device drivers that read the physical input device. The use of ARINC ports ensures that partitioning is not violated by guaranteeing that reads of the physical device are accomplished only during the requesting partition's minor frame. The input data is then formatted and sent to the Display application again by ARINC ports for display. Configuration of these ports is accomplished through the use of XML, which is then converted to binary and stored in a read-only region of memory for access by the Module OS and the partition applications. This configuration data establishes the port channel connections, which are completed when the applications call the appropriate function.

Time Partitioning

While processes within a partition are scheduled using priority preemptive scheduling and can be either periodic or aperiodic in nature, the partitions themselves are scheduled using a time slice mechanism according to ARINC 653. This mechanism defines a period and duration for each partition known as the minor frame time. Each partition can then be scheduled one or more times with the total sum of all minor frames being the major frame duration as shown in Figure 4.

While the ARINC 653 scheduler that resides in the Module Operating Systems enforces the predefined partition schedule, it is possible to create situations of non-robust time partitioning due to the interaction of low-level device drivers and the hardware they interact with. This is true whether the devices are operated in a polling mode or use interrupts. In order to assure verifiability of the platform, the platform provider and system integrator must ensure proper behavior of the low-level driver in their interactions with the partition-based applications. This assurance can be gained in one of two meth-

PMC AND SMALL FORM-FACTOR GALLERY

Featuring the latest in PMC and Small Form-Factor technology

Connect Tech Inc.
Industrial Strength Communications

FreeForm - Reconfigurable FPGAs

- PC/104 and PCI-104 form factors
- Uses the Xilinx Spartan-3E or Virtex-5 reconfigurable FPGAs
- Standard or custom cores available
- Features include; up to 3 million gates, 96 digital I/O or 64 single ended 32 LVDS I/O, flash memory, industrial temperature, counter/timers

Connect Tech Inc.
Phone: (519) 836-1291
Fax: (519) 836-4878
E-mail: sales@connecttech.com
Web: www.connecttech.com

Connect Tech Inc.
Industrial Strength Communications

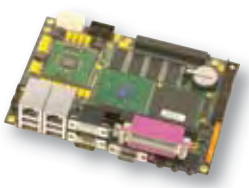
FlashDrive/104 - Rugged Solid State Drive

- Flash based solid state drive
- 4, 8, 16 or 32GB storage
- Read/write-10MB/second
- Withstands shock, vibration and extreme temperatures (-40°C to +85°C)
- Driverless operation — any operating system, any time
- ATA/IDE interfaces with standard and 2.5" hard drive connectors

Connect Tech Inc.
Phone: (519) 836-1291
Fax: (519) 836-4878
E-mail: sales@connecttech.com
Web: www.connecttech.com

Fastwel
Creating the Future!

The highest performance Pentium M Industrial Temperature EPIC board available today.



Widest selection of features including:

- Intel Pentium M to 1.8GHz
- 1 GB DDR SDRAM ECC soldered onboard
- Two Gigabit Ethernet ports
- Four USB 2.0 ports
- Two SerialATA channels
- PC/104Plus module support
- 50G/5G – shock/vibration resistance
- Operating temperature:
  –40°C to +85°C — industrial
  0°C to +70°C — commercial

Fastwel Corporation
Phone: (718) 554-3686
Fax: (718) 797-0600
E-mail: DSanchez@fastwelcorp.com
Web: www.fastwel.com

Red Rapids

Channel Accelerator XCVR 16-bit (130 MSPS)

- Available in PMC/PCI form factors
- Dual 16-bit 130 MSPS A/D and D/A converters
- Minimum 90 dB SFDR on all channels
- Xilinx Virtex-4 LX or SX FPGA
- Optional 32 Mbytes of QDR SRAM
- PCI/PCI-X (133 MHz) DMA bus master
- Includes FPGA reference design with source code
- Prices start at $5,840 (LX40-11, no memory)

Red Rapids
Phone: (972) 671-9570
Fax: (972) 671-9572
E-mail: sales@redrapids.com
Web: www.redrapids.com

ods, verification by analysis or verification by design.

To ensure that the application can update the display in a safe manner, the timing of the thread of the application must be timed to always ensure that it completes prior to the end of the minor frame time. This can be done by use of Rate Monotonic Analysis to ensure the worst-case execution time of that thread completes within the minor frame time. This guarantees that any operation at the hardware level executed on behalf of the partition application is also complete before the end of that partition's minor frame time.

The low-level driver itself can be designed to take advantage of available system services and verify via programmatic calls that sufficient time remains in the calling partition's minor frame to complete the requested operation. If it is found that insufficient time remains, the driver needs to inform the calling partition that the call will be deferred until the next minor frame in which sufficient time is provided to complete the call and return.

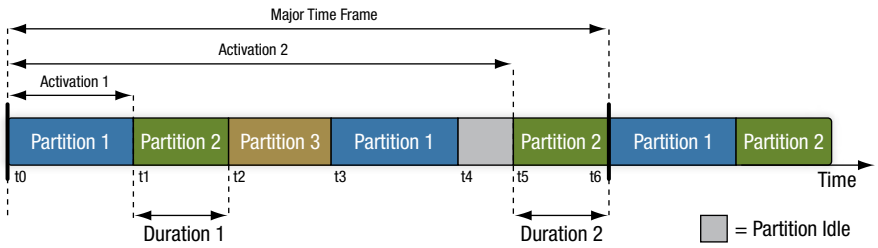


Figure 4

Timing partitions are scheduled using a time slice mechanism according to ARINC 653. This mechanism defines a period and duration for each partition known as the minor frame time. As shown here, each partition can be scheduled one or more times with the total sum of all minor frames being the major frame duration.

System-Level Architecture Analysis

While both methods listed can accomplish the desired goal, a system-level architecture analysis should be performed to ensure overall performance and that deadlines are satisfied. In some cases, deferring completion of I/O operations can result in undesired side effects such as "deadline missed" errors in applications, invalidation of data in sampling ports due to timeout or undesirable flicker in graphical displays. While use of DMA and its associated interrupt mechanisms is discouraged in the ARINC 653 environment, well designed and architected systems and drivers can make use of this mechanism and still be able to achieve a high level of certification as has been demonstrated in a number of existing programs.

Beyond the issues of migrating the graphical portion of the application, there are numerous other factors involved in migration of Linux-based prototype software into a certifiable platform for use in an avionics system. In general, as more DO-178B-qualified development tools that can generate code for either the certifiable or noncertifiable environment become available and affordable, this level of manual migration will no longer be needed. That said, no tools can substitute for a solid system-level architecture design. ▮▮

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

Boldly go where no system has gone before....

EPIA PX-Series Pico-ITX Mainboard

- Revolutionary Form Factor for Embedded Applications
- VIA C7 1.5GHz Processor
- Pin Header I/O for System Design Flexibility

15 Independent 16-Bit Counter / Timers

16 Isolated Digital Inputs
16 Relay Outputs

16-Bit Analog Input 16-Channels 500kHz

8-Channel 125kHz Waveform D/A Output

VIA Technologies' tiny PICO SBC combines with ACCES I/O Products' PC/104 size embedded USB boards for OEM data acquisition and control.

With 4 USB ports, dozens of USB/104 I/O modules to choose from, and extended temperature options - Explore the Possibilities!

Saving Space, The Final Frontier

VIA embedded in your success

To find more information on EPIA mainboards, please visit
www.VIAembedded.com
or call 510 683 3300. Come visit us at
940 Mission Court Fremont CA 94539

ACCES I/O PRODUCTS, INC.
The source for all your I/O needs

To learn more about our Embedded USB/104 I/O boards visit
www.accesio.com
or call 800 326 1649. Come visit us at
10623 Roselle Street San Diego CA 92121

VIA C7 Processor
VIA VX700 IGP Chipset
ROHS COMPLIANT

Technology Focus

Small Form-Factor Boards

Small Boards Put Function Over Form

Leveraging the onward march of chip integration, a variety of standard and non-standard small form-factor boards are enabling a key niche of space-constrained military applications.

Jeff Child
Editor-in-Chief

Fueled by Moore's Law, the magic of semiconductor integration continues to force a rethink of what constitutes a "system." Gone are the days when a military embedded computer by definition meant a rack of board-level systems. Now complete computing systems easily fit on the area of a coaster or a napkin. These small single board computers—in both standard and non-standard form-factors—are finding a growing niche in applications characterized as extremely space- or weight-constrained or where traditionally only a fully custom solution would do the job. Small UAVs, robotics, mission-specific heldhand systems, and even intelligent munitions are prime examples along those lines. The soldier-launchable Raven UAV (Figure 1) is an example along those lines.

What impact these small standard and non-standard architectures will have in the military remains to be seen. What has become clear, however, is that non-standard boards tend not to take market share away from established standards such as VME, CompactPCI or PC/104. Rather, small form-factor boards seem to be targeting very different applications areas—areas where slot-card backplane or PC/104 stacks wouldn't be practical.

The "Small Form-Factor Boards Roundup" on the following pages showcases some examples of such products. Included are boards in form-factors such as mini-ITX, StackableUSB, COM Express, MicroETXexpress along wth a variety of small non-standard boards. Since *COTS Journal* covers PC/104 and its younger cousin EPIC as dedicated Roundup topics in other issues, this Roundup is restricted to form-factors other than PC/104 and EPIC. Stay tuned to next month's *COTS Journal* for a Roundup on PC/104 boards.

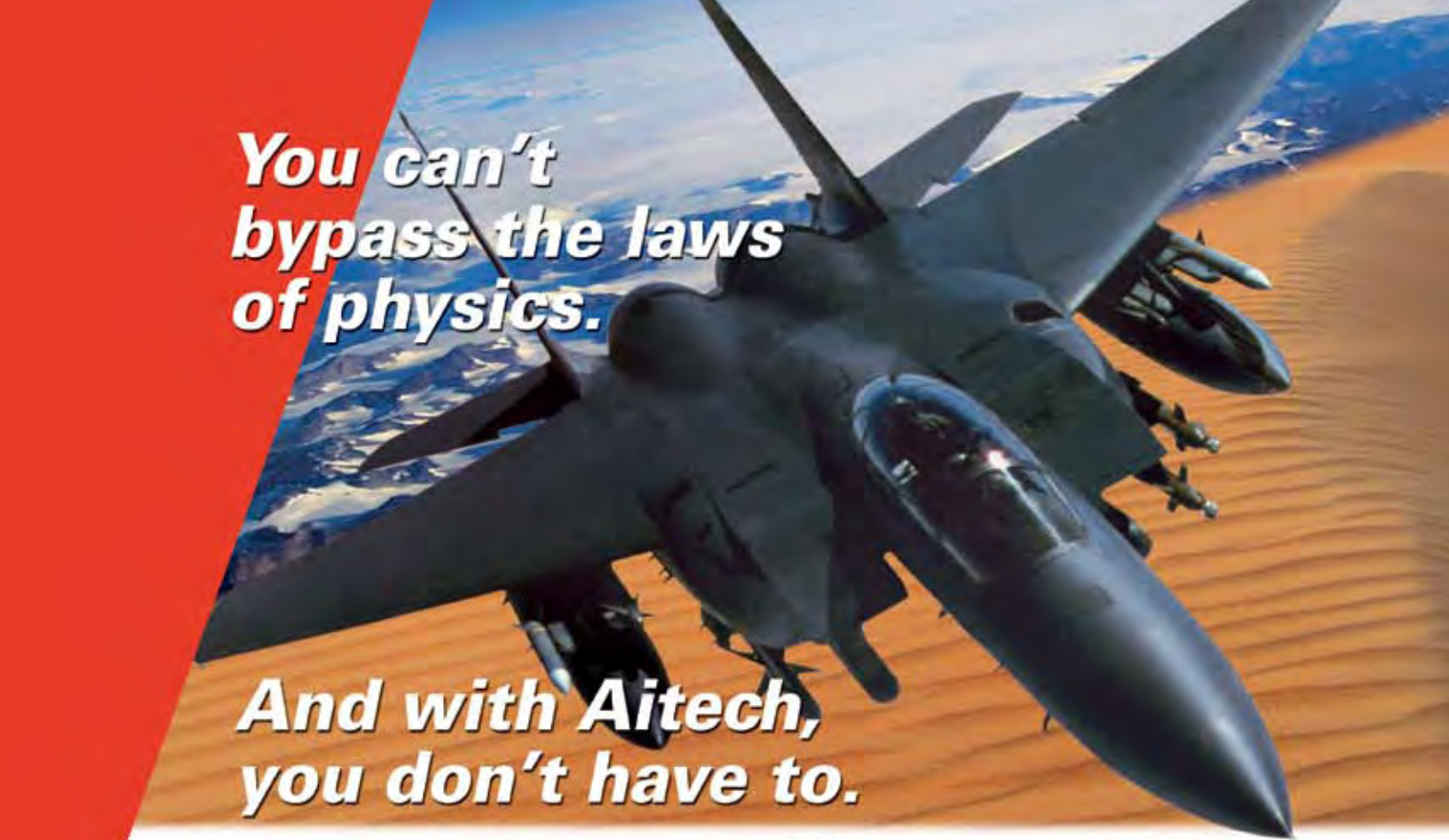
Figure 1

Exemplifying the class of applications suited to small form-factor boards is the Raven UAV. Shown here, an Army corporal assembles a RQ-11 Raven in order to conduct aerial tactical reconnaissance. The Raven has video cameras located in the nose cone and can relay live video back to the operator in real time.

(DoD photo by Tech. Sgt. Russell E. Cooley IV, U.S. Air Force.)

New small form-factor specs continue to emerge. In July, Kontron announced a new footprint variant of the popular Computer-On-Modules (COMs) standard: nanoETXexpress. The nanoETXexpress specification is targeted to provide extremely power-saving COMs with mid- to high-performance x86 technology on a footprint that is a mere 55 mm x 84 mm. The specification and documentation for nanoETXexpress are expected to be made available under a non-disclosure agreement this fall. Kontron plans to launch its first nanoETXexpress-based COM in Q2 2008.

Further uping the ante on small form-factor specs, a group of vendors recently formed a Small Form Factor Special Interest Group (SFF SIG) (www.sff-sig.org). With Octagon, Samtec, Tri-M, VIA and WinSystems as its initial members, the group's purpose is to develop, adopt and promote circuit board specifications and related technologies that will help electronics equipment manufacturers and integrators reduce the overall size of their next-generation systems. They plan to embrace the latest technologies, as well as maintain legacy compatibility and enable transition solutions to next-generation interfaces. Examples of enabling technologies along those lines include lower-power and highly integrated processors, chipsets and memory based on 90 nm and 65 nm processes; higher density connectors with improvements for ruggedness; and high-speed serial interfaces such as PCI Express, Serial ATA (SATA) and USB 2.0, which replace slower and space-consuming parallel interfaces. ▮▮



True -55°C to +85°C operation... Standard!

Aitech continues to provide industry standard open systems architectures such as VMEbus and CompactPCI products, designed and tested to -55°C to +85°C as standard, because you can't bypass the rules of engagement either.

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 there... Aitech subsystems have been proven in the world's most demanding mission-critical mil/aero applications – from complex ground, air and sea platforms to rad-tolerant solutions for the Space Shuttle, International Space Station and now earth orbiting satellites!

We've done that... 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.

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

Technology Focus:

Small Form-Factor Boards Roundup

Module Is FPGA-Based Reconfigurable System

The advent of logic-dense FPGAs has brought advanced reconfigurable computing capabilities to the smallest of military embedded systems. Along such lines, Advanced Knowledge Associates (AKA) offers a high-performance and hardware-reconfigurable, highly integrated system on a module, designed to enable and accelerate advanced embedded system design. Packaged in a 656-pin PGA with a footprint

of just 3.0 x 3.0 inches, the PRISM200 features the Xilinx Virtex-4FX platform FPGA and leverages the device's two embedded PowerPC 405, 32-bit RISC processor cores, two Tri-mode Ethernet MACs, 622 Mbit/s to 6.2 Gbit/s serial transceiver blocks, dedicated hard DSP blocks, onboard high-speed clock management circuitry, more than 160 high-speed general-purpose input/outputs (GPIO), and numerous other hard-IP core blocks.

The PRISM200 has a modular architecture that allows for easy integration of user logic and custom peripheral sets. The product features an onboard programmable clock-generation unit as well as onboard voltage regulation and power-monitoring circuits for simpler and more complete system development and integration. The PRISM200 is suitable for a wide variety of military embedded applications due to its high-performance, built-in native interfaces and low power consumption. The interfaces include Dual 1553 Remote Terminal, CAN, USB, UART and Gigabit Ethernet. The module allows the user to harness SERDES technology to transfer multi-gigabits of data per second per differential trace pair.

Advanced Knowledge Associates
Santa Clara, CA.
(408) 986-1807.
[www.advancedknowledgeassociates.com].

2.8 GHz Mini-ITX Board Sports Six Serial Ports

Today's level of computer integration allows a tremendous amount of computing power to fit in a stand-alone board. That's driven some military applications to consider form-factors like the Mini-ITX motherboard form-factor. Serving that need, the eAutomation Group of Advantech introduces the AIMB-240, a Mini-ITX motherboard with 2.8 GHz processing power and six serial communication ports. It's equipped with a 82852GME chipset, supports Pentium 4 and Celeron processors, and has 400/533 MHz FSB and 1 Gbyte of DDR 266/333 SDRAM. With Intel's integrated Extreme Graphics 2 controller, the AIMB-240 delivers integrated 3D graphics and video capability without adding expensive graphic cards. There are multiple display interfaces such as LVDS, DVI, TV-out and CRT as well as multimedia features including 5.1 multi-channel audio and DVI transmission of 135 mega-pixels per second.

The AIMB-240 uses the Intel ICH 4 to enable expandability. There's one 32-bit/33 MHz PCI slot and one 32-bit/33 MHz mini-PCI slot that enables flexible expansion. The six serial communication ports and six USB 2.0 ports offer connectivity for keyboards, mice and other peripherals. The motherboard also supports dual 10/100Base-Tx Ethernet. Pricing for the AIMB-240 starts at $219.

Advantech, eAutomation Group
Cincinnati, OH.
(513) 742-8895.
[www.eAutomationPro.com].

Core 2 Duo-Based Mini-ITX Board Has Dual Video Outputs

In response to demand in high-performance applications for a simplified system board combining robust computing power, a smaller footprint, lower power and increased product longevity, American Portwell Technologies has released the WADE-8056, an Intel Core 2 Duo-

based Mini-ITX embedded system board (ESB). The 170 mm x 170 mm board's dual video outputs can drive two displays simultaneously at 2048 x 1536 maximum resolution (1920 x 1080 for HDTV). The board utilizes the Intel Q965 GMCH and 8280 1HB ICH8DO chipset to support Intel's 1.066 GHz Core 2 Duo and Pentium 4/Celeron D processors.

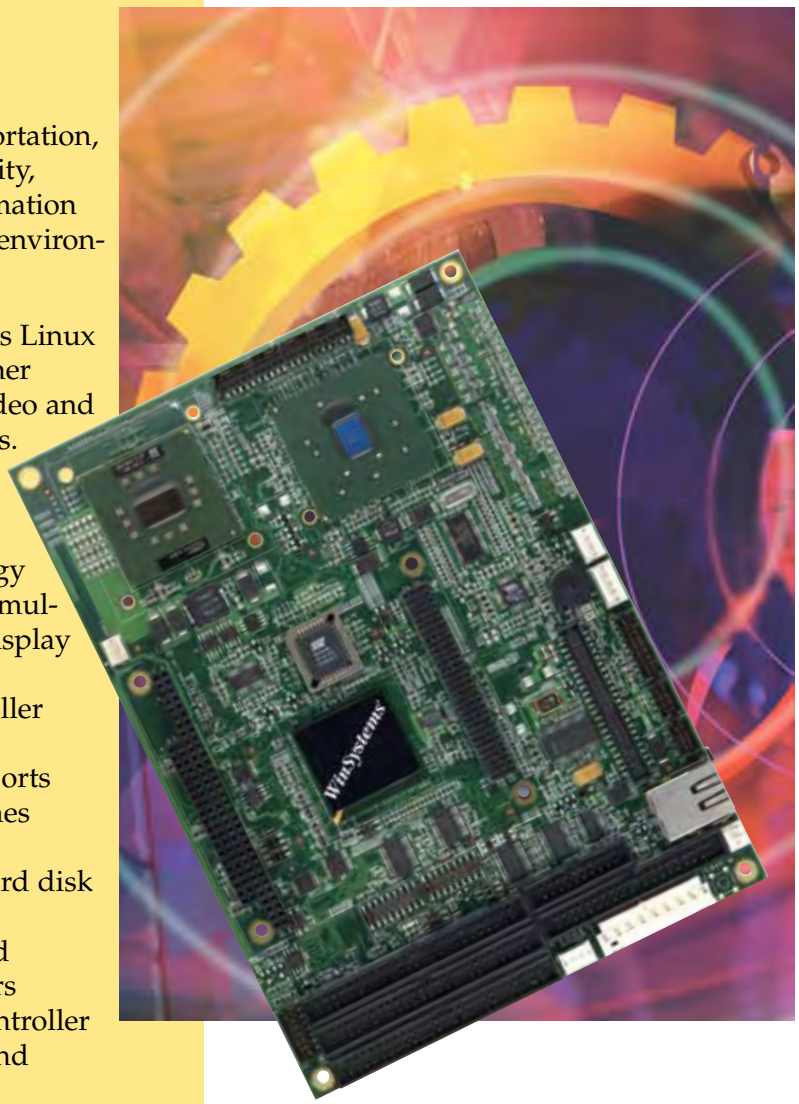
The Q965 chipset includes the fourth-generation Intel integrated graphics controller and a Graphics Media Accelerator 3000 that supports widescreen LCD displays and accelerated DirectX 9.0c. System memory is up to 4 Gbytes of 533/667/800 MHz dual-channel DDR2 SDRAM. Other features include a Gigabit Ethernet LAN port, PCI and mini-PCI expansion slots, four SATA ports with data transfers of up to 3 Gbits/s, four COM ports, GPIO, RAID (0,1,5,10) and six USB 2.0 ports. Linux and Windows are supported. Pricing is $330 per unit.

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

-40º to +70ºC Fanless 1GHz Industrial SBC. List Price $595

Applications such as robotics, transportation, pipelines, MIL/COTS, medical, security, machine control, and industrial automation that must work in harsh, demanding environments need WinSystems' EBC-855.

This x86, PC-compatible SBC supports Linux and Windows® XP embedded and other popular RTOS along with popular video and wired and wireless network standards.



- Intel® 1 GHz ZCD CPU or 1.8 GHz Pentium® M with fan
- Intel® Extreme Graphics 2 technology supports CRT & LVDS flat panels simultaneously with dual independent display
- Custom splash screen on start up
- 10/100 Mbps Intel® Ethernet controller
- 802.11a/b/g wireless supported
- 4 serial COM ports and 4 USB 2.0 ports
- 48 bi-directional TTL digital I/O lines
- Bi-directional LPT port
- Two EIDE ports (UDMA100) for hard disk
- 3.5-in. floppy disk drive supported
- CompactFlash (CF) cards supported
- PC/104 and PC/104-*Plus* connectors
- Onboard AT keyboard and FDC controller
- AC97 six channel 5.1 surround sound
- +5 volt only operation
- EBX-size: 5.75" x 8.0" (146mm x 203mm)
- Industrial temperature operation
- Long-term product availability
- Quick Start kits for software development
- Off-the-shelf delivery

Contact us for additional information or OEM pricing. Our factory application engineers look forward to working with you.

epic™ Linux Extended Temperature

Call 817-274-7553 or Visit www.winsystems.com/EBC-855

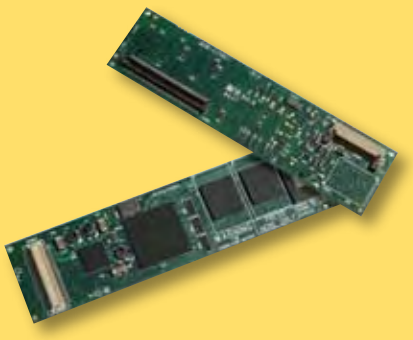
Ask about our 30-day product evaluation

WinSystems®

715 Stadium Drive • Arlington, Texas 76011
Phone 817-274-7553 • FAX 817-548-1358
E-mail: info@winsystems.com

600 MHz SBC Is as Small as a Stick of Gum

Military applications such as tiny UAVs and mini-Robots are looking for very small, very low-power computing solutions. Feeding that need, this summer Gumstix launched the third generation of its gumstick-shaped SBC line. The size of a stick of gum, Gumstixs are highly functional open source Linux miniature computers. Sporting the Marvell (formerly Intel) PXA270 processor, clocked at up to 600 MHz, the Verdex SBC integrates up to 128 Mbytes of RAM and 32 Mbytes of flash memory soldered on board. Other enhancements over previous Gumstix SBCs include support for



USB host interfaces, inputs for CCD (charge-coupled device) cameras and better power management. Also available is an option for on-board Bluetooth, complete with antenna connector. The Verdex maintains the 3.2 x 0.8 x 3.2-inch (80 x 20 x 8 mm) size of Gumstix's earlier SBC generations.

In addition to matching the dimensions of its predecessors, the Verdex retains the 60-pin board-to-board connector of the first generation SBCs, enabling it to support existing 60-pin expansion cards; these include audio I/O, digital I/O, various microcontroller coprocessors for robotics applications, and serial and USB expansion. The Verdex replaces the 92-pin I/O expansion connector introduced with the second-generation SBCs (the Connex line), however, with a pair of connectors. The combination of a 24-pin flex connector and separate 120-pin connector will support a range of new expansion boards, including much sought-after USB host ports.

Gumstix
Portola Valley, CA.
(888) 427-3428.
[www.gumstix.com].

Credit Card-Sized SBC Marries DSP and GPP

Combining signal processing or video processing with general-purpose computing used to mean a multi-board solution. Such functions can now reside on the same board. Taking that trend to the extreme, iVeia's Titan-V4 integrates a high-performance DSP, FPGA and General Purpose Processor (GPP) on a single chip delivered in a credit card-sized form-factor board.

The board embeds iVeia's Velocity-SoC and iScale-DSP FPGA cores into a Xilinx Virtex-4 FPGA. The iVeia cores take full advantage of the hardened PowerPC processors and XtremeDSP blocks of the Virtex-4 to create an exceptionally resource-efficient architecture. iVeia's FPGA application framework simplifies the user FPGA design by abstracting interfaces such as the GigaFlex I/O Module, the memory banks, and the Velocity-SoC and iScale-DSP data conduits. The Titan-V4 measures 2.125 x 3.375 inches. There are three banks of DDR2

SDRAM with up to 128 Mbytes per bank. Two Ethernet interfaces are provided using the Virtex-4 TEMAC PHY.

GigaFlex I/O Modules provide the external signal and video I/O for the Titan-V4. By mounting a GigaFlex I/O Module to the Titan-V4, a solution can be created targeted to a specific application and I/O requirement. The solution can be scaled by inserting multiple Titan-V4 and GigaFlex I/O Modules into an optional multi-slot backplane. For stand-alone solutions, use one of iVeia's single-slot micro backplanes or plug the Titan-V4 directly onto a custom board as a daughter card.

iVeia
(410) 858-4560.
Annapolis, MD.
[www.iveia.com].

MicroETXexpress SBC Measures 95 mm x 95 mm

Targeting especially small Computer-on-Module mobile applications, Kontron crafted the 95 mm x 95 mm microETXexpress form-factor. Kontron's microETXexpress-PM is the first COM (Computer-on-Module) based on the new microETXexpress form factor. MicroETXexpress is 100-percent compliant to the ETXexpress form-factor, which is COM Express (PICMG) conformant, because the plug design and pinout are identical, only the size has been reduced.

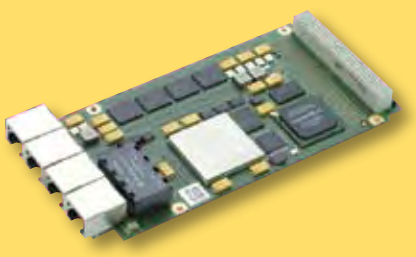
The new Kontron microETXexpress-PM module is based on the Intel Pentium M or Intel Celeron M processors and is equipped with the Intel 855GME chipset. The first versions are manufactured with Intel 800 MHz, 0KB L2 cache up to Intel Pentium M 738 LV (1.4 GHz). The COM supports the Pentium M featured Enhanced Speed Step technology and offers up to 1 Gbyte of DDR-SDRAM, so that memory bandwidth no longer represents a performance bottleneck. The integrated Intel Extreme Graphics 2 Video Controller with 2D and 3D accelerator supports resolutions up to 2048 x1536 pixels and Dual Independent Graphics Support. Thanks to the standardized JILI Display Interface Technology, video controller parameters can be set automatically according to the connected LCD panel. Standard interfaces include 2x SerialATA II, 6 x USB 2.0, Ethernet, PCI 2.1, IDE and audio.

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

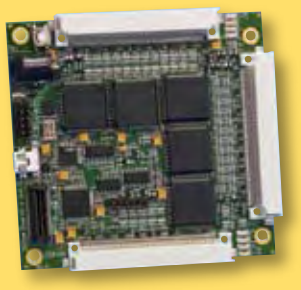


specific function; and board support packages for various operating systems. Front I/O of the module comprises two Gbit Ethernet controlled via PCI Express as well as two COM interfaces via RJ45 connectors. The fast DDR2 SDRAM memory comes in directly soldered on the EM6 against shock and vibration. 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].

StackableUSB SBC Boasts Extended Temp Range

Marrying the tried and true size and stacked concept of PC/104 with the fast, ubiquitous USB interconnect, the emerging StackableUSB specification seems to have hit a home run. Military developers are eyeing this technology as a migration path from ISA-based PC/104. Creator of StackableUSB, Micro/sys, has rolled out the newest addition to its StackableUSB line of SBCs. Called the SBC1496, the board operates from -40° to +85°C and provides I/O expansion via StackableUSB peripherals. In addition to PC-compatible features, such as



SVGA and dual serial ports, the new model also includes four USB 2.0 high-speed (480 Mbit/s) ports, two USB 1.1 full-speed ports and 100BASE-T Ethernet support.

With up to 64 Mbytes of SDRAM, CompactFlash and full AT-compatibility, high-performance control systems can be implemented on this stackable embedded form-factor (PC/104-size) SBC. The SBC1496 is implemented with the STPC Atlas processor, which offers speeds up to 133 MHz, on-chip cache, 64-bit DRAM access and hardware floating point. When I/O expansion is needed, the StackableUSB interconnect architecture enables the control of up to five StackableUSB peripheral devices in a rugged, bolt-together platform. The basic SBC1496 starts at $385 in single quantity. The extended temp version is available starting at $435. Significant OEM discounts are available.

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

COM Express Card Boasts Server-Class Performance

Compute density ranks as one of the major watchwords 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].

Processor Module Links Ethernet With Serial I/O

Equipped with 10/100 Ethernet connectivity, GPIO with onboard analog input and serial flash memory, a new module family from Rabbit Semiconductor is powered by the Rabbit 4000 microprocessor running at up to 58.98 MHz. The RCM4200 RabbitCore features hardware DMA, quadrature decoder, up to 35 GPIO lines shared with up to five serial ports and four levels of alternate pin functions. It targets applications such as embedded data-logging, remote device monitoring and control and serial-to-Ethernet communications.

The RCM4200 comes in two flavors, the RCM4200 and the RCM4210, with varying processor speed, analog availability and serial flash size. The RCM4200 version has 8 Mbytes of onboard serial flash memory (4 Mbytes for the RCM4210), optional 8-channel analog input for simple interfacing to a wide variety of sensors and an operating temperature range of -40° to +85°C for applications in mobile or industrial environments. The RCM4200 Development Kit includes the higher-speed RCM4200, a development board, and the latest Dynamic C integrated development software with samples and libraries. In quantities of 100, the RCM4200 is priced at $89, and the RCM4210 at $81. Pricing for the RCM4200 development kit is $269.

Rabbit Semiconductor
Davis, CA.
(530) 757-8400
[www.rabbit.com].

806 MHz PXA320 Module Sleeps at 2 mW

In most small form-factor military embedded applications, low power is just as critical as size. Feeding such needs, Strategic Test provides a System on Module (SOM) called the TRITON-320, which measures just 67.6 x 26 x 4.2 mm (2.6 x 1 x 0.16 in.). Using 1.8V ultra-low-power memory, the module consumes only 2 mW in sleep mode. The TRITON-320 includes a high-efficiency programmable CPU power supply that, together with Intel Wireless SpeedStep Power Manager Technology, ensures minimum power consumption while maintaining the highest levels of processor performance.

The card's processor is coupled with 64 Mbytes of SDRAM and 128 Mbytes of flash. The module uses a 200 pin SODIMM connector and has an extended temperature range of -25° to +85°C. First shipments are slated to start in November, together with a complete Development Kit running Linux 2.6.17 and Microsoft Windows CE 6.0. Other notable features include RoHS lead-free compliance, 16-bit A/A/D multiplexed external memory

interface so that additional memory can be placed on the carrier board, and a DS1339 Real Time Clock. The module can be driven by a single 3.3V to 5V power supply and includes a regulator on board to supply 3.3V components located on the carrier board to further simplify carrier design. The TRITON-320 uses a 200-pin SODIMM connector to bring out most of the PXA320's internal signals.

Strategic Test
Woburn, MA.
(617)621-0080.
[www.strategic-test.com].

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 the 1 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. This power-efficient board runs standard applications at under 13W, thanks to the combination of VIA's energy-efficient processor and core logic platform and the significantly lower power DDR2 system memory. The VIA EPIA PX Pico-ITX mainboard also supports flexible hard drive storage options, with one SATA and one UltraDMA 133 connector, as well as 10/100 Mbit/s Fast Ethernet through the RJ-45 LAN port.

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

1.8 GHz Pentium M EBX SBC Runs at -40° to +70°C

Compute density seems to be the watchword these days in all manner of embedded autonomous military computing applications. The EBX form-factor has a lot to offer for such applications. WinSystems has launched their EBX-compatible Intel 1.8 GHz Pentium M single board computer. The EBC-855-G-1.8-1 is a RoHS-compliant, processor- and I/O-intensive board offering -40° to +70°C temperature operation. Based on Intel's 855GME chipset with the ICH 4 communications controller and integrated Extreme Graphics 2 video 3D controller, the EBC-855-G-1.8-1 offers long-term product availability and full x86-Pentium compatibility. It supports up to 1 Gbyte of industry-standard PC2700 SDRAM and up to 8 Gbytes of CompactFlash. It also supports rotational floppy and hard disk drives.

The EBC-855-G-1.8-1's I/O interface features include a 10/100BaseT Ethernet port (with remote boot capability), VGA and dual channel LVDS flat panel video, a miniPCI connector for an 802.11 wireless networking module, four USB 2.0 ports, four serial COM ports, AC97 audio (5.1 codec), LPT and a PS/2 port for keyboard and mouse. A software-programmable 48-line digital I/O controller provides input, output or output with readback for each I/O line. More I/O expansion is possible by self-stacking modules plugged onto the PC/104 and PC/104-Plus connectors. The EBC-855-G-1.8-1 is priced at $895.

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

Products

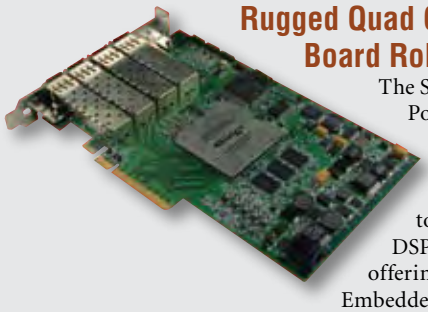
Get Connected with companies and products featured in this section.
www.cotsjournalonline.com/getconnected

Trio of Storage Systems Target RAID and SBOD

Applications such as Intelligence, Surveillance and Reconnaissance (ISR), Electronic Intelligence (ELINT), COMINT, SIGINT, Synthetic Aperture Radar (SAR), Moving Target Indicators (MTI) and Software Defined Radio (SDR) all share something in common: They all hunger for ever more robust digital signal analysis and data collection. VMETRO announced the availability of three storage devices for use with its Vortex data recording solutions.

The VS-SBOD 3U (shown), 16-disk (up to 6.4 Terabytes) storage system offers a very flexible solution with high performance through the use of a switched topology backplane and redundant quad 4 Gbit Fibre Channel initiators to the drives. The VS-FY5x 2U, 12-disk (up to 9.0 Terabytes) RAID storage system utilizes FC to SAS/SATA single or dual RAID Controllers to provide high performance and scalability at affordable pricing. The VS-FY5x supports various RAID levels and has an optional 2U expansion chassis that doubles the storage up to 18.0 Terabytes. The VS-F48D 4U, 48-disk RAID storage system utilizes FC to SAS/SATA dual RAID Controllers to provide up to 36 Terabytes of storage capacity with low power consumption per Terabytes. It supports various RAID levels and has an optional 4U expansion chassis that doubles the storage up to 72 Terabytes.

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



Rugged Quad Channel Serial FPDP Board Rolls

The Serial Front Panel Data Port (sFPDP) interconnect has become the industry standard for high-speed serial communication in today's advanced sensor-to-DSP systems. For its latest sFPDP offering, Curtiss-Wright Controls Embedded Computing has introduced a new rugged, high-performance, quad channel Serial FPDP card that delivers sustained data rates up to 247 Mbytes/s on each of its four channels. The new FibreXtreme SL100/SL240 Serial FPDP card, based on Altera's Stratix II GX FPGAs, connects distributed devices through a highly specialized communications protocol (VITA 17.1-2003) optimized for maximum data throughput.

The cards, available in both PCI and XMC mezzanine formats, are designed for use in applications that require high data rates such as digital signal processing, radar and sonar, medical imaging, range and telemetry systems. The sFPDP card off-loads the host processor, enabling data transfers to occur without the CPU overhead and non-deterministic latencies associated with many layers of complex software protocols. Availability of the FibreXtreme SL100/SL240 card is off-the-shelf in first quarter 2008.

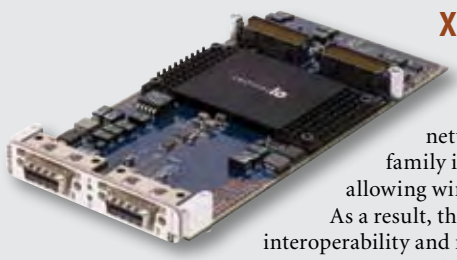
Curtiss-Wright Controls Embedded Computing, Leesburg, VA. (703) 779-7800. [www.cwcembedded.com].

Multi-Function cPCI Card Blends D/S Converters and Gbit Ethernet

Highly integrated multi-function cPCI solutions are having a huge impact in several military and commercial programs, including airborne, shipboard, ground mobile and C3I applications. Serving those needs, North Atlantic Industries (NAI) has announced the availability of a 2nd generation, five-module, multi-function, single-slot cPCI card. This universal and highly flexible card eliminates the complexity and size constraints of using multiple, independent, single-function cards. The 78CS2 cPCI card can accommodate up to five independent function modules.

It can be configured with NAI's new highly efficient D/S converters—10 channels at 2.2 VA or 5 channels at 5.0 VA. The 78CS2 also incorporates a Gigabit Ethernet interface that can be used to transfer data to and from the board, without using the backplane bus. This Ethernet port allows the board to be used as a stand-alone remote sensor interface, without the need for a separate computer board. The 78CS2 is available with operating temperature ranges of -40° to +85°C and 0° to +70°C. Conduction-cooled versions with wedgelocks are also available. Pricing for 100 pieces of the 78CS2 starts at $3,500 each.

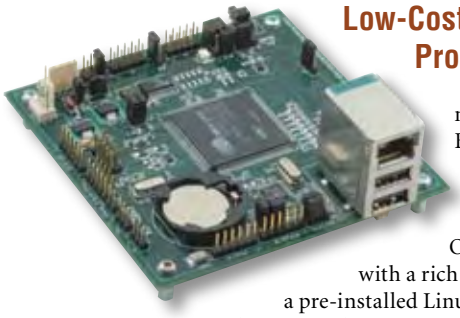
North Atlantic Industries, Bohemia, NY. (631) 567-1100. [www.naii.com].



XMC Board Brings 10 Gbit Ethernet into Embedded Sphere

Today 10 Gbit Ethernet is almost a commonplace technology in the IT and enterprise world, but the challenge is taking advantage of its performance potential in the real-time embedded space. Doing just that, Critical I/O has announced the industry's first 10 Gbit Ethernet (10GbE) networking interface for embedded, military and avionics applications. The new XGE 10GbE interface family incorporates Silicon Stack technology that offloads TCP/IP protocol stack processing to hardware, thus allowing wire speed transfers, minimal host processor overhead, very low latency and rock-solid determinism. As a result, the 10GbE XGE interfaces permit users of high-performance systems to benefit from the low cost, interoperability and networking capabilities of Ethernet, even in such demanding applications as radar, sonar, flight simulation and scientific applications. The XGE 10GbE family is currently available in an XMC form-factor with dual 10GbE ports, and employs an eight-lane PCI Express host bus interface. AMC and PMC versions are also planned. Native support for IPv4 and IPv6 is included. The XGE 10GbE XMC interfaces are available now.

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



Low-Cost Linux Controller Is Easy to Program

In large, complex software development projects, military organizations love to leverage Linux. Because Linux is so familiar and accessible, they tend to use it during the development process, even when the final deployed system targets another OS. JK Microsystems introduces their Omniflash controller, which provides the user with a rich array of I/O devices seamlessly supported by a pre-installed Linux 2.4 kernel. The controller comes furnished with 10/100 Ethernet, two serial ports, battery backed clock/calendar, USB, digital I/Os and stereo audio line level outputs. The 200 MHz ARM9 processor handles complex multitasking operations efficiently. Onboard memory includes 16 Mbytes of flash memory organized as an Ext2 filesystem and 32 Mbytes of SDRAM.

The Linux operating system also includes over 150 standard Linux/Unix system utilities including ftp, tftp, telnet and vi. Also included in the development kit is a bootable Knoppix CD-ROM preconfigured with development tools to support the Omniflash. Quantity 100 price for the Omniflash controller is $129. Development kits are available for $199.

JK Microsystems, Davis, CA. (530) 297-6073. [www.jkmicro.com].

XMC Board Sports Four Virtex5 FPGAs

FPGAs play a crucial role is applications such as WiMax front ends, radar, electronic warfare and high-speed data recording and playback. Along those lines, Innovative Integration's new X5-210M product is an XMC I/O module featuring four 14-bit 210 Msamples/s A/Ds with a Virtex5 FPGA computing core, DRAM and SRAM memory, and eight lane PCI Express host interface. Xilinx Virtex5 LX110T (SX95T when available) with 512 Mbyte DDR2 DRAM and 4 Mbyte QDR-II memory provide a very high-performance DSP core for demanding applications such as emerging wireless standards. The close integration of the analog I/O, memory and host interface with the FPGA enables real-time signal processing at extremely high rates exceeding 300 GMACs per second.

The X5 XMC modules couple Innovative's Velocia architecture with a high-performance, eight-lane PCI Express interface that provides over 1 Gbyte/s sustained transfer rates to the host. Module functionality can be fully customized using VHDL and MATLAB using the FrameWork Logic toolset, which includes full source code for user FPGA logic device, manuals, documentation and instructions for simulation under ModelSim and recompilation under Xilinx ISE. The X5-210M quantity one pricing is $9,995.

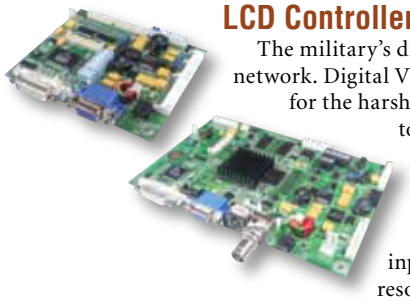
Innovative Integration, Simi Valley, CA. (805) 578-4261. [www.innovative-dsp.com].

USB Simulation Platform for 1553 and ARINC 429

A lot of test and instrumentation tool functions that once required a big rack of boards are now available in small USB-based solution. An example is a multi-protocol USB 2.0 interface from Data Device Corp. that has enhanced graphical bus analysis tools. It combines with a Windows-based integrated software package to let users simulate, monitor and troubleshoot MIL-STD-1553 and ARINC 429 data buses simultaneously or independently without the need for time and cost-prohibitive custom software coding.

The BU-65590U from Data Device Corporation (DDC) is a small, lightweight, rugged USB 2.0 interface that provides two dual-redundant 1553 channels, four ARINC 429 receive channels, two ARINC 429 transmit channels, seven user-programmable Digital Discrete I/Os, an IRIG-B time synchronization input and a +5V output. Powered directly from the computer's USB port, the BU-65590U eliminates reliance upon a dedicated power source, providing a truly portable solution suitable for use with virtually any laptop, desktop, or tablet computer. Based on DDC's Enhanced Mini-ACE Architecture, the BU-65590U includes high-level C API library software that supports all advanced architectural features, and driver support for Windows 2000 and Windows XP for MIL-STD-1553 and ARINC 429 functionality.

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



LCD Controllers Are Ready for Rugged Duties

The military's drive toward net-centric operations is driving up demands for display terminals throughout the DoD's network. Digital View has introduced the HE Series of LCD controllers designed to comply with the strict standards required for the harsh environments encountered in military and rugged industrial applications. Both controllers feature wide tolerance power supplies, locking connectors and low-mass tantalum capacitors for maximum tolerance to shock and vibration, Mil-spec silicon resin conformal coatings, laboratory-certified operating temperature ranges of -40° to +80°C, and calculated MTBF in excess of 150K hours (HE-1600) and 200K hours (HE-1400).

The HE-1400 Series is a small footprint (4.2 x 3.6 inches), highly integrated controller with DVI and ARGB inputs. It supports both LVDS and TTL panels and is capable of supporting 4:3 format panels at up to SXGA resolution and 6:9 panels at up to WXGA resolution. The HE-1600 Series is a fully buffered, multi-sync interface controller providing direct analog and digital connection to a wide range of TFT panels up to UXGA resolution. Pricing for Digital View's new HE Series controllers is $110 for the HE-1400 and $180 for the HE-1600 in 1,000-piece quantities.

Digital View, Morgan Hill, CA. (408) 782-7773. [www.digitalview.com].

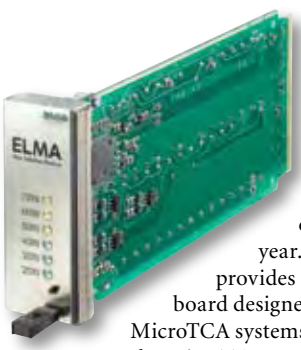
Get Connected with companies and products featured in this section.
www.cotsjournalonline.com/getconnected

GPS Reference Design Includes Dead Reckoning

It was the DoD—DARPA specifically—that first brought us GPS. And the military is a power user of the technology. A new reference design from U-blox shortens time-to-market and reduces the risk of GPS integration for applications that require accurate, uninterrupted positioning regardless of GPS signal conditions. The GPS dead reckoning system from U-blox integrates a gyroscope sensor from Epson Toyocom, a leader in the design and manufacture of crystal-based electronic products, into the reference design for the product. U-blox' dead reckoning solution, powered by its LEA-4R dead reckoning GPS module, is suitable for applications that require continuous positioning. An odometer calculates distance traveled and a gyroscope determines turn rate. This data supplements the GPS data to provide continuous positioning in tunnels, indoor parking facilities, urban canyons and other environments in which it may be difficult to obtain a GPS satellite signal.

The LEA-4R dead reckoning GPS module enables 100% road coverage while Epson's XV-8000-CB gyroscope offers improved temperature, shock and vibration stability designed to significantly speed up the design cycle and ease GPS integration. The AEK-4R dead reckoning reference design Evaluation Kit is available and reference design schematics are available upon request.

U-blox, Reston, VA. (703) 483-3180. [www.u-blox.com].



Load Board Aids MicroTCA System Development

It may be too soon to judge how fast MicroTCA will gain acceptance among military system designers, but one thing's for sure: a huge wave of support hardware for MicroTCA system development has emerged over the past year. Exemplifying that trend, Elma Electronic provides a new Advanced Mezzanine Card (AMC) board designed for testing the cooling and power of MicroTCA systems. The AMC Load Board is compliant to the MicroTCA.0 and AMC.0 Advanced Mezzanine Card specifications. The unit comes standard in the single module/full size with options for double modules and compact or mid-sizes. Hot-swap pluggable, the board incorporates a JTAG interface and IPMI support.

The load board is configurable to seven wattages: 0W, 20W, 30W, 40W, 50W, 60W and 70W. Six LEDs on the front panel indicate which power level is activated. Custom wattages and access management is available upon request. The power level can be changed by repeatedly pressing the front panel button, cycling through all power levels. Also, the power is controlled using IPMI commands that allow each level to be controlled independently. The blink mode is also supported to set a dynamic load. Pricing for the AMC Load Board is under $300 depending on volume.

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

Dual Core Xeon Security Platform with Modular I/O

Dual core processors have truly moved into the mainstream of embedded computing, and military applications are reaping the rewards. An example is a 1U rack-mount high-performance platform called the PL-01039 from Win Enterprises. The system's motherboard, the MB-09042, is also available for OEM purchase. These products support single Intel Dual Core Xeon LV/ULV processors with 667 MHz FSB and offer a broad selection of connector cards to meet an OEM's specific I/O requirements.

The standard PL-01039 features two Ethernet modules with eight GigE ports. Win offers LAN modules with four to eight ports of copper, fiber or mixed media. The PL-01039 supports 4 GigE (Intel 82571EB PCI-E x 4) and 4 GigE (Intel 82573L PCI-E x 1). The eight GigE SFP or Copper ports with optional bypass function on four ports are easily accessible from the front panel. Easy front-panel access is also provided for a USB 2.0 port, a RS-232 serial port, LCM and a 4-button keypad. A 32-bit PCI connector and Mini PCI socket are also featured. The PL-01039 is available in two enclosed platforms and in the MB-09042 motherboard version. Prices in OEM quantities range from $333 to $948.

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

3U cPCI USB Drive Boasts 64 Gbytes of Flash

When it comes to mass storage, today's military systems seem to have an endless appetite. That's not surprising considering the ongoing trend toward larger embedded software, and software controlling more and more of a system's functionality. With that in mind, Targa Systems offers a 3U CompactPCI Flash Disk Mass Storage equipped with a USB Interface to meet the increasing military and aerospace demands for high capacity, extreme reliable and small size. 3U USB cPCI cards are available in both convection-cooled and conduction-cooled form-factors.

Targa's cPCI Solid State USB Flash Disk has been specifically designed to replace hard disk drives in rugged and environmentally demanding applications. The board's main features include a USB 1.1 and USB 2.0 mass storage device and bulk transport, USB interconnect via backplane J2 and a single slot capacity of up to 64 Gbytes.

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

Solid-State Storage System Supports Many Interfaces

Designed for operation in extreme environments, the conduction-cooled TornadoX is the appropriate onboard data storage system for simultaneous support of management systems, intelligence, surveillance and reconnaissance (ISR) systems, communications systems and instrumentation systems. In addition to its high-speed data transfer capability, the TornadoX is designed to accommodate demanding solid-state storage mass requirements.

Systems & Processes Engineering (SPEC) is producing systems with up to 1.6 Tbytes of non-volatile flash capacity. The system can be configured for storage in excess of 3 Tbyte capacity.

Providing a variety of interfaces, such as Gigabit Ethernet, Fibre Channel and SCSI, and with an AES 256 encryption card option, the TornadoX solid-state recorder/storage systems has demonstrated continuous link record rates of over 728 Mbits/s, read rates over 690 Mbits/s and aggregate concurrent read-while-write rates of over 900 Mbits/s. SPEC expects to double these rates within the next 6 months. Additional data links can be utilized to accommodate even higher data rate requirements.

Systems & Processes Engineering, Austin, TX. (512) 691-8161. [www.spec.com].

Non-Volatile Fast SRAM Family Hits 4 Mbits

Fast as SRAM but with the benefit of retaining data when powered down, non-volatile SRAM has always had the makings to be the ideal semiconductor memory technology. Feeding such needs, the 4 Mbit non-volatile memory devices in the Simtek family of 130 nm CMOS SONOS family of nvSRAM ICs deliver 40 percent better access times, four to eight times higher densities and increased system performance over their predecessors. This enables them to leapfrog alternative non-volatile memory technologies in traditional markets, while offering new benefits for emerging solid-state drives (SSDs), hard disk drives and other new system memory architectures.

Simtek's STK14EC8 (512 Kbit x 8) and STK14EC16 (256 Kbit x 16) devices deliver fast access SRAM performance at speed grades of 15, 25 and 45 ns while offering reliable and transparent non-volatile backup on any power disruption. The STK14EC8 is available in both the 44-pin thin small outline package II (TSOPII) and 48-pin ball grid array (BGA) packages. The STK14EC16 is available in the 44 and 54-pin TSOPII, as well as the 48-pin BGA package. 1,000-unit pricing for each product is $18.50. Both products are being sampled now and are scheduled for a production ramp in the first calendar quarter of 2008.

Simtek, Colorado Springs, CO. (719) 531-9444. [www.simtek.com].

Rugged Ethernet Switches Address Harsh Environments

In the realm of military system design, the welcome mat is out for Ethernet. Moxa Technologies has rolled out a series of 5-port industrial unmanaged Ethernet switches with M12 connectors, which now have IP67-rated housing and are designed for the toughest applications.

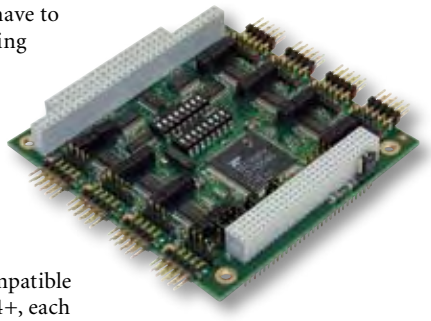
The rugged, IP67-rated design of the EDS-305-M12 switches makes them for use in harsh military environments. The EDS-305-M12 switches are water-resistant and are designed to be resistant to the effects of dust, dirt, humidity, vibration and shock.

The EDS-305-M12 switches use M12 connectors for the Ethernet interface. M12 connectors can ensure a tight connection, and keep Ethernet connections from popping loose in high-vibration applications, such as in moving vehicles. In addition, the EDS-305-M12 switches have received important industrial and safety approvals, such as UL508, Class 1, Div. 2, and will also receive DNV/GL maritime certification for specialized applications. Two models are available, both of which are IP67-rated to be waterproof. One model has an operating temperature range of 0° to 60°C, and the other model has an extended operating temperature range of -40° to 75°C.

Moxa Technologies, Brea, CA. (714) 528-6777. [www.moxa.com].

PC/104-Plus Interface Card Sports Eight Serial Ports

No matter how integrated embedded computer technology gets, there's no escaping the varied set of I/O interfaces military systems have to maintain and support. Feeding such needs for the PC/104 space, Digital-Logic offers a highly integrated interface board with eight serial PCI ports and a multiplexed 32-bit address/data bus offers a range of configuration options.



With the PC/104-Plus-compatible board Microspace MSMX104+, each port can be configured individually for TTL, RS-232 or RS-485 signals and supports high data transfer rates up to 250 Kbits/s. The board is based on the 16C550-compatible PCI Bus UART EXAR XR17C158/V with eight channels, a 64-byte transmit and receive FIFO, and automatic RTS/CTS, DTR/DSR and Xon/Xoff software flow control. It is well suited as a solution for sensor and data acquisition applications. Its typical current consumption is 250 mA. The board is also available for the extended temperature range of -40° to +85°C and resists shock up to 10g and vibrations from 5 Hz to 2,000 Hz.

Digital-Logic, Luterbach, Switzerland. +41 (0)32/ 681 58 40. [www.digitallogic.ch].

Long Life ATX Motherboard Features RAID

The problem of accommodating the defense industry's long life cycles isn't one that's going away. In fact it gets worse year by year. Embedded computer vendors help ease the burden by choosing the right long life components for their designs. Supporting Intel Core2 Quad processors, Itox offers an ATX form-factor board designed specifically for embedded applications requiring a stable revision-controlled platform. The G7B630-NRM-G motherboard from Itox uses the Intel Q965 Express chipset with ICH8DO Southbridge and has guaranteed availability through December 2011. The LGA775 socket supports a wide range of Intel Embedded Architecture processors, including the Core 2 Quad processor, the Core 2 Duo processor and the Celeron D processor.

RAID 0, 1, 5 & 10 disk configuration support is incorporated into the G7B630-NRM-G system BIOS using Intel Matrix Storage Technology. These BIOS-based configuration controls allow pre-OS RAID creation, naming and deletion of disk arrays. Maximum performance is leveraged with up to 8 Gbyte DDR2 800 MHz dual-channel memory, dual PCI Express Gbit Ethernet controllers and onboard Intel GMA 300 graphics. The product is also available without RAID and Intel AMT support under part number G7B630-N-G. Single unit price for the G7B630-NRM-G is $430 and for the G7B630-N-G $398 with volume pricing available.

Itox, East Brunswick, NJ. (732) 390-2815. [www.itox.com].

Small Core Duo Box Has PC/104 I/O Expansion

The concept of the "stand-alone rugged" box has infiltrated the military embedded market in a big way. The latest example is ACCES I/O Products' new NANO I/O Server CD (Core Duo). This fanless system is one of the smallest embedded systems available featuring an Intel Core Duo 1.66 GHz CPU. The system was designed to support an extensive collection of available PC/104 modules and external USB I/O devices. This allows for added versatility and is useful in a wide variety of applications.

The system is housed in a rugged, black anodized aluminum enclosure measuring only 5 inches wide, 6.25 inches deep and 3 inches high. The enclosure offers physical protection for industrial environments and features a bulkhead mounting provision. The unit is quietly powered by an included 12 VDC to ATX power supply with no fans. External connections provided include VGA, four USB 2.0 root ports, one RS-232 and one RS-232/422/485-selectable COM ports, PS/2 keyboard and mouse, 10/100 Ethernet and standard PC sound. This tiny system is the first fanless Intel Core Duo to highlight full PC/104, PCI-104 and PC/104-Plus I/O expansion. Systems start under $1,500. System pricing is dependent on choice of memory, disk media and I/O boards selected. OEM and volume pricing is available.

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

6U VME SBC Targets New and Legacy Systems

One of the key strengths of VME—and reasons why the military so embraced it—is its ability to maintain backward compatibility with legacy systems while folding in new technologies as they emerge. Serving both sides of that puzzle, Aitech Defense Systems has released the new high-performance C108. For newer applications, the rugged 6U single-slot VME SBC offers up to 1.4 GHz of processing power via the G4+ PowerPC (PPC) MPC7448 processor, the highest performing Freescale PowerPC. For legacy applications, the board features pin-to-pin backplane and I/O compatibility with previous Aitech processor boards employing the PPC MPC74xx processor family, allowing easy, cost-effective upgrades to newer technology.

The C108 supports new and legacy systems via a host of diverse I/O interfaces, which include a Gigabit Ethernet port, two Fast Ethernet ports, two dual-redundant MIL-STD-1533B interfaces, two USB ports, eight serial ports and 16 discrete I/O channels. Two PMC expansion slots enable standard, quick and easy increases to the board's functionality. For new programs, Aitech has added an onboard, optically isolated CAN Bus 2.0B to interface with modern vehicle electronics and major functional subsystems without sacrificing one of the onboard PMC sites as well as to reduce modern subsystems costs. Pricing for the C108 starts at $6,640.

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

Line Conditioning Module Protects Mil Power Systems

In mission-critical applications, such as a military tank, pre-conditioning modules help protect against power spikes or dropouts. This ensures that devices, such as optical systems, stay up and running to protect lives in battlefield conditions. Doing just that is VPT's new pre-conditioning power module. The new VPTPCM-12 Series works within a DC/DC power system to suppress transient voltages and create a smooth, reliable power output of up to 120W.

As part of the VPT Series of DC/DC converters, the VPTPCM-12 offers a high-reliability power solution designed for rugged military and avionics applications. The 8-40 volt steady state input range ensures that this single product protects power systems as required under the DoD's requirements of MIL-STD-1275 for vehicles and MIL-STD-704 for avionics. The device provides continual operation with input down to 6V per MIL-STD-1275. A wide input range provides dual nominal input voltages (12V and 28V) to satisfy both MIL-STD-1275 and MIL-STD-704 requirements. Transient suppression is rated up to 600 VDC. Up to 120W output power is provided from a single unit. The cost is $269 per unit in OEM quantities.

VPT, Blacksburg, VA. (425) 353-3010. [www.vpt-inc.com].

Power Supply Suits Noise-Sensitive, Rugged Apps

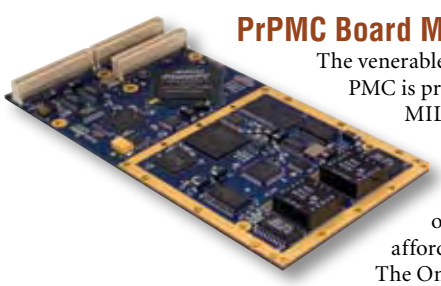
Harsh environment military applications can't settle for ordinary power supply solutions. Toss in the requirement for low noise, and you've got even more of a challenge. Meeting such needs, Bravo Electro Components has introduced its XUP Series of Modular / Configurable Power Supplies. The low noise/ripple of less than 10mV (typical) and wide operating temperature of -40° to +75°C make these ideal for sensitive equipment in harsh environments.

The XUP family of products consists of four power chassis that are 2.5 inches tall and 7.3 inches deep.

Output modules offer single and dual outputs with wide adjustment ranges to cover any voltage requirement from 1.5 to 350 VDC and around 200 Watts / 40 Amps per module. Outputs are adjustable from 5-100% using an external 0-10V trim voltage. VME/VXI signal sets, Single Wire Parallel, Remote on/off, Power Good and AC Fail Signals are available per output module or globally. Total Output Power is rated up to 700 W at 90 to 180 VAC and 1,200W at 180 to 264 VAC or total combined output power of the populated output modules.

Pricing is as low as $487 for OEM quantities of 1200W four-Bay units.

Bravo Electro Components, Santa Clara, CA. (408) 733-9090. [www.bravoelectro.com].



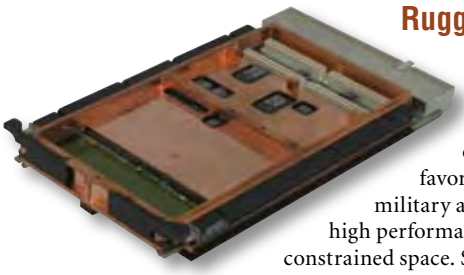
PrPMC Board Marries 1553 and PowerPC CPU

The venerable MIL-STD-1553 remains a popular interconnect technology for avionics and other defense systems. The PMC is probably the most common platform for 1553. But Ballard Technology puts a twist on that with its latest MIL-STD-1553 offering that lets users decide on one or two dual redundant 1553 interfaces and then use the PowerPC function to handle responses, interact with other cards or just have the PrPMC as back-up.

The new Ballard OmniBus PMC card offers a rugged, conduction-cooled solution for MIL-STD-1553 applications. Ballard's PMC card is available in commercial or conduction-cooled versions and offers users a monarch/non-monarch PrPMC with DMA and 1 or 2 dual redundant 1553 interfaces at an affordable cost.

The OmniBus 1553 PMC can be used as a peripheral to a host processor system, or it can operate as a stand-alone device utilizing the PowerPC embedded processor. The MIL-STD-1553 channels are implemented as hardware modules external to the processor. This results in the user having full utilization of the processor while protocol operations are autonomously performed in hardware. The OmniBus architecture ensures all schedules will be maintained and all data will be received on fully loaded 1553 databuses.

Ballard Technology, Everett, WA. (425) 339-0281. [www.ballardtech.com].



Rugged 3U cPCI Card Serves Up 1.33 GHz PowerPC

CompactPCI continues to be a favored architecture in military applications where high performance is required in a constrained space. Supporting such needs, GE Fanuc Intelligent Platforms offers the rugged CM6 3U CompactPCI single board computer. Featuring a Freescale PowerPC MPC8641 operating at up to 1.33 GHz with either a single- or dual-core processor, the CM6 supports up to 1 Gbyte of DDR2 SDRAM ECC memory.

The CM6 derives its extensive functionality from a high degree of integration, which sees the provision of two Gbit Ethernet ports and two serial ports (RS-232 and RS-422/RS-485) together with eight general-purpose I/Os and flash memory, thus freeing the user to leverage the capabilities of the 64-bit/100 MHz PMC interface for application-specific purposes. In either the single core or dual core version, AltiVec support is provided for advanced floating-point applications. To enable operation in harsh environments, the CM6 is available in three ruggedization levels with an extended temperature range of -40° to +85°C and optional conformal coating. Shock and vibration immunity is designed in with stiffener bars and wedge locks: conformal coating can also be applied on request.

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

Digital Transceiver Supports All Comms Bandwidths

When it comes to transceiver bandwidth and range, applications like SIGINT, military communications systems and radar have big appetites. Pentek has released its Model 7142-428 Digital Transceiver with a Multiband Digital Downconverter (DDC) and Interpolation Filter. A complete software radio system in a PMC/XMC module, this latest offering from Pentek combines proven hardware and a new GateFlow IP core. It is a complete software radio system in a COTS PMC/XMC module. It employs four A/D converters and one D/A converter capable of bandwidths exceeding 40 MHz for connection to HF and IF ports of communications or radar systems.

By offering a range of more than four orders of magnitude for both decimation and interpolation, the Model 7142-428 addresses an unprecedented range of commercial and military communication systems. The highly programmable bandwidths offered in the Model 7142-428 also make it ideally suited for military software defined radio systems that require flexible hardware capable of emulating multiple radio waveforms. The four down-converted DDC outputs are delivered to the PCI interface through independent FIFOs, each managed by its own DMA controller channel to simplify programming and improve data transfer rates. The Model 7142-428 PMC/XMC is priced at $15,500.

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

MVA
Communications
Ecosystem
Conference

2008

...Your Vehicle to Success in the Fast Paced Telecom Market

MOUNTAIN VIEW ALLIANCE
www.mountainviewalliance.org

The Mountain View Alliance puts you in the drivers' seat! Now you can become part of this fast-paced 2-day conference designed to accelerate the adoption of open-specification based components and platforms. Take your place in the design and evolution of commercial off-the-shelf implementations in the telecommunication and wireless infrastructure. Set your plans to include a diverse and effective conference that brings company's and individuals together from the entire COTS ecosystem.

Mountain View Alliance
Communications Ecosystem Conference
March 11 and 12, 2008
South San Francisco Conference Center

www.mvacec.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

- *Unmanned Ground Vehicles.* Unmanned Ground Vehicles (UGVs) in various sizes and formats are already a fixture in today's current operations. But while industrial and consumer robotics technologies are getting fairly mature, the segment of defense robots designed to perform tasks on the ground—whether in wheeled vehicular form or small man-portable form—appears to be still in its early days. Modular embedded computer and off-the-shelf motion control subsystems, are only beginning to make inroads into military robotic applications. Articles in this section take the pulse of this growing field of system design.
- *Power Supplies and Converters.* At one time they were an afterthought in the system design process. But today power supplies and power conversion electronics rank as a make or break technical choice in embedded military computer systems. With more and more computing stuffed into smaller spaces, power has direct implications on the size, cooling and mobility of a system. Articles in this section examine technology trends affecting DC/DC converters, power supply module bricks and slot-card power supplies (VME, cPCI and others).
- *High-Performance Processor Boards.* Compute density has become the watchword in many segments of military system design. More and more programs are pushing for as much computer processing muscle as can possibility fit into a board-level solution. Feeding such needs, embedded computer vendors are crafting single board computer products based on the newest crop of multicore microprocessors, along with interconnect technologies cable of keeping pace. This section examines the latest trends in high-performance SBCs in a variety of form-factors, including VME, VPX, VXS, ATCA, Compact PCI, PrPMC and others.
- *PC/104 and EPIC Boards.* PC/104 has become entrenched as a popular military form-factor thanks to its compact size and inherent ruggedness. Sweetening the deal, a number of special enclosure techniques are used to outfit PC/104 for extremely harsh environments. This Tech Focus section updates readers on these trends, along with a look at the new PC/104 follow-ons: EPIC and EPIC Express. Also provided is a product album of representative boards.

Editorial

Jeff Child, Editor-in-Chief

Congratulations Boss

On November 3rd a Chevy Tahoe named "Boss" rolled across the finish line of an urban race route set up on the former George Air Force Base in Victorville, California. No driver was at the wheel, but rather an embedded computer running a half million lines of code, enabling the car to use more than a dozen lasers, cameras and radars to view the world, and drive itself along the best path through a road network . The vehicle earned its developer—Carnegie Mellon University's Tartan Racing team—first place in the DARPA Urban Challenge, including a $2 million cash award.

To me the event represents another step forward in the evolution of autonomous vehicle technology—a field of great importance to today's military. Currently there are thousands of robots in use by the U.S. military in Afghanistan and Iraq for duties such as the detection and disablement of improvised explosive devices (IEDs), surveillance and many other tasks that are deemed unsafe for human intervention. But all those are small—mostly remote-controlled—robots, not full-function autonomous vehicles. Imagine, for example, the benefits of large unmanned supply convoys trekking through dangerous territory. Congress set a goal in 2001 that one-third of this country's operational ground combat vehicles be unmanned by 2015. In support of that mandate, DARPA conducted a series of races over the past couple years.

The first Grand Challenge event was held in March 2004 and featured a 142-mile desert course. Fifteen autonomous ground vehicles attempted the course and no vehicle finished. In the 2005 Grand Challenge, four autonomous vehicles successfully completed a 132-mile desert route under the required 10-hour limit, and DARPA awarded a $2 million prize to the vehicle "Stanley" from Stanford University. In contrast, the Urban Challenge saw six out of its eleven starters complete the 60-mile course at the former George Air Force Base, which is now used by the Army as an urban warfare training center. Stanford Racing's "Junior" of Stanford, CA, won the $1 million second place prize, while Victor Tango's "Odin" of Blacksburg, VA, received $500,000 for finishing third.

Calling for a considerably more complex technical feat than the previous two Challenges, the 2007 Urban Challenge involved autonomous ground vehicles maneuvering in a mock city environment. The race involved executing simulated military supply missions while merging into moving traffic, navigating traffic circles, negotiating busy intersections, and avoiding obstacles, all while obeying California traffic laws. That meant real-time, split-second decisions to avoid moving vehicles, merge into traffic and safely pass through intersections. The idea is that demonstrating safe operation in an urban situation is an effective and consolidated method of testing situations the vehicles might face even while conducting missions in less populated areas.

Team Tartan's winning vehicle was affectionately named Boss after Charles F. "Boss" Kettering, legendary inventor, automotive innovator and co-founder of DELCO. Boss is a 2007 Chevy Tahoe with GM drive-by-wire engine control and electromechanical actuation. Its "eyes" were comprised of an array of short-, mid- and long-range Lidar sensors made by Continental, IBEO, SICK and Velodyne. An Applanix mPOS-LV with dual antenna GPS and IMU was used as the vehicle's position and orientation system.

As the brains for the vehicle, Team Tartan developed a decentralized software architecture comprised of a multi-process system coordinated via a Gbit Ethernet communications layer. The software architecture's job included fusing multi-sensor input to generate moving and static obstacle objects; motion planning by evaluating over 1000 candidate trajectories per second; and performing context-centric reasoning to make tactical decisions. All this was performed using ten 2.16 GHz Intel Core2 Duo blades in a Compact PCI chassis.

One disappointing aspect to me in this year's DARPA Challenge is that, in contrast to the previous two Challenges, very few vendors from our industry sponsored the event. There were some—such as National Instruments, The Mathworks, NXP Semiconductor, Thales, BAE Systems, Lockheed Martin and Intel. Absent were the many embedded computer and enclosure vendors that sponsored the 2004 and 2005 Challenges.

I think events like these DARPA contests are important because they bring together a mix of groups that normally wouldn't work so closely with one another. From universities to corporate laboratories, these events enable thousands of people to work on solving a problem important to the DoD. Clearly military UAV technology has grown out of its infancy and is now solidly into its adolescent stage. But in contrast, the segment of defense robots designed to perform tasks on the ground—whether in wheeled vehicular form or small man-portable form—appears to be still in its early days. The good news is that activity, planning and investment in military robotics is looking strong. Overall, the Congress and the DoD are increasing in both their interest and investments in robotics technologies—approaching $1.7 billion projected over the fiscal period 2006-2012. ▮▮

All the benefits of custom power with short lead times and no NRE

Westcor leads the way with medium to high power configurable power supplies that incorporate Vicor's rugged and reliable technology. These durable, cost-effective complete power systems can meet your precise requirements with output voltage increments as small as 0.1 V.

- 1 - 400 Vout
- Up to 4 kW per supply
- Single phase, 3 phase and DC input models available

VICOR POWERBENCH™

Go to Vicor's PowerBench to use Westcor's VSPOC configurator to create your power supply just the way you want it.

For example custom enclosures for VME/VXI based military projects

Requirement: PFC with highly variable power requirements, all specific to the exact project being developed.

Solution: PFC MegaPAC

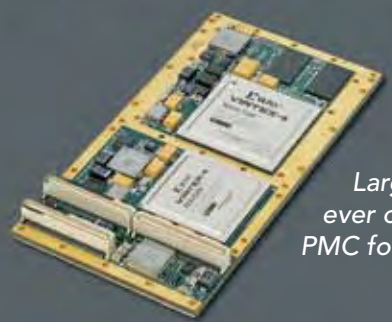
Why Westcor: Flexibility and power density. The engineers developing these custom chassis needed to be able to rapidly develop, quote, and prototype systems. The PFC MegaPAC provides all the benefits of a custom power solution with no NRE.

westcorpower.com/apps

Fill out your application details and qualify for a Vicor hand-crank flashlight that runs for 30 minutes on one minute of cranking. Or call 800-735-6200. Offer good while supplies last.

VICOR Westcor Division

- 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

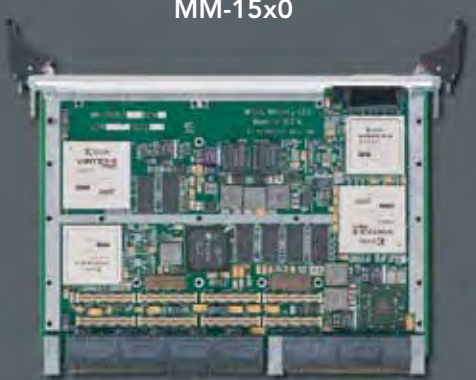
MM-71xx

- 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 41

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