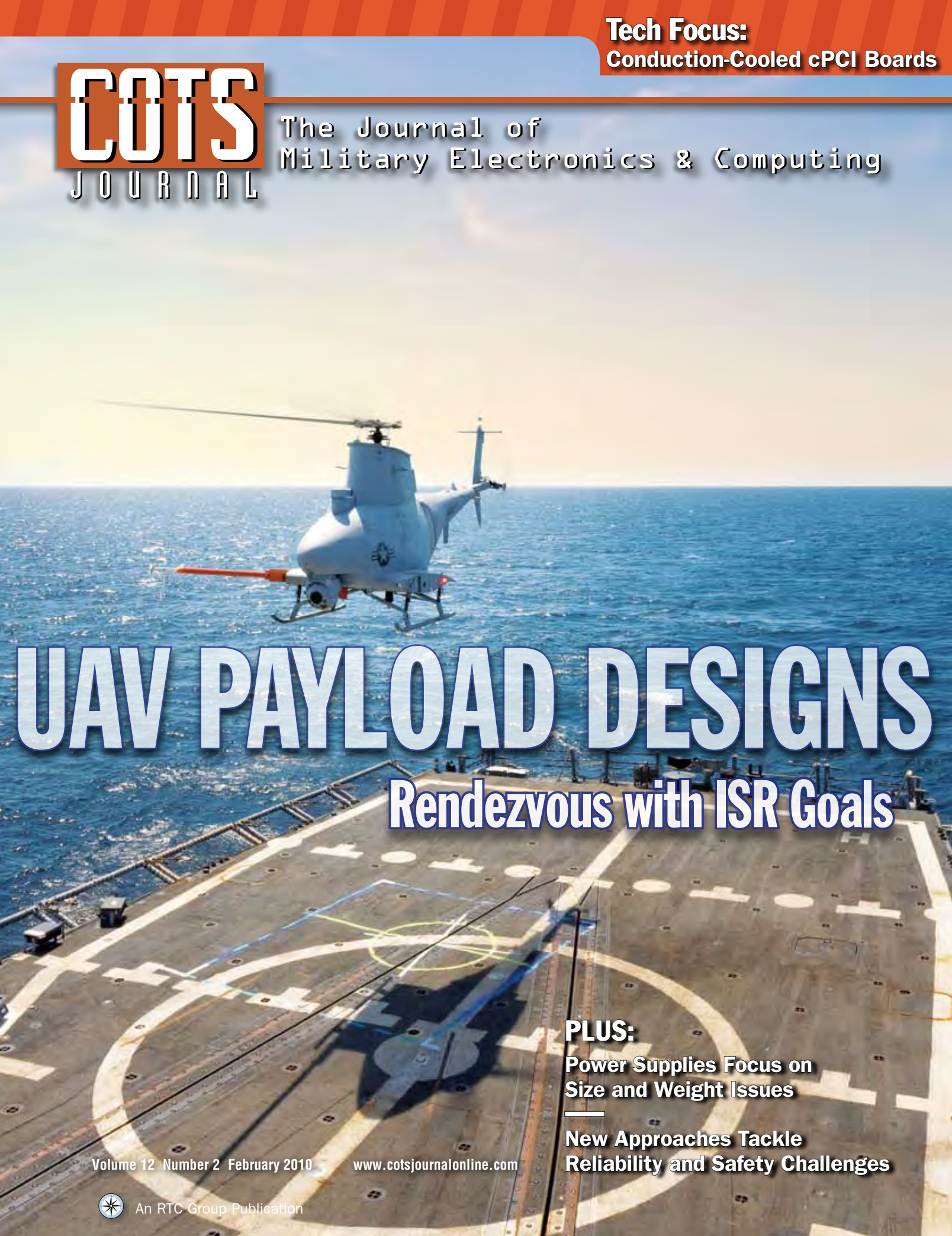
COTS JOURNAL
The Journal of Military Electronics & Computing

Tech Focus:
Conduction-Cooled cPCI Boards



UAV PAYLOAD DESIGNS

Rendezvous with ISR Goals

PLUS:

Power Supplies Focus on Size and Weight Issues

New Approaches Tackle Reliability and Safety Challenges

Volume 12 Number 2 February 2010 www.cotsjournalonline.com

An RTC Group Publication

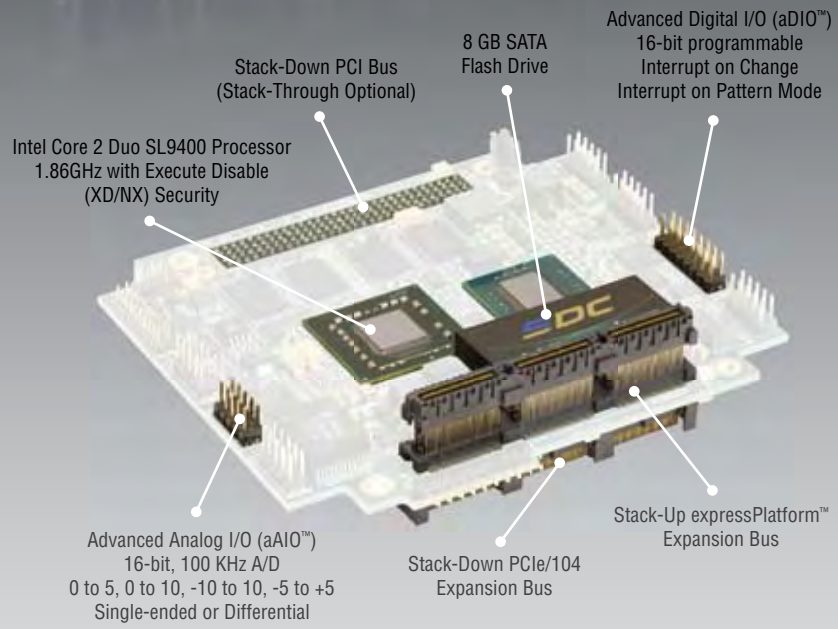
RTD Embedded Technologies, Inc.

"Accessing the Analog World"

PCI/104-Express

CMA & CMX22MVD1860HR

PCI/104-Express
Intel® Core™2 Duo CPU



Intel Core 2 Duo Processor	1.86 GHz – 1.20 GHz
Soldered DDR2 SDRAM	2 GB
Onboard SATA Flash Disk	8 GB†
External SATA	2
PCIe x1	8 links
PCIe x16	1 link
Gigabit Ethernet‡	2
Advanced Digital I/O	14†
Advanced Analog I/O	8†
USB 2.0 Ports‡	8
Serial Ports (RS-232/422/485)	4
Analog VGA	1
Panel	LVDS
Audio‡	1
Operating Temperature‡	-40 to 85°C

†*See figure on left for details*
‡*See web site for details on each model*

Leading the way in Stackable PCs

COTS JOURNAL
The Journal of Military Electronics & Computing

Features

February 2010 Volume 12 Number 2

Special Feature

ISR Programs and Payloads in Large UAVs

Tech Recon

Power Supplies Attack the SWaP Challenge

System Development

System Safety and Reliability Trends

Technology Focus

Conduction-Cooled cPCI 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.*

Departments

Coming in March...
...See Page 64

Cover Story ..... Page 12

The MQ-8B Fire Scout tactical Vertical Unmanned Aircraft System exemplifies the benefits of a modular payload architecture and the associated easy integration of off-the-shelf payloads. In December, the Fire Scout successfully completed maritime sensor demonstrations flying equipped with the Telephonics' radar and FLIR's Electro Optical Infrared system.

(Photo courtesy of Northrop Grumman)

COTS JOURNAL
The Journal of Military Electronics & Computing

Publisher
PRESIDENT
John Reardon, johnr@rtcgroup.com
PUBLISHER
Pete Yeatman, mail@yeatmangroup.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
GRAPHIC DESIGNER
Maream Milik, mareamm@rtcgroup.com
DIRECTOR OF WEB DEVELOPMENT
Marke Hallowell, markeh@rtcgroup.com
WEB DEVELOPER
James Wagner, jamesw@rtcgroup.com

Advertising
WESTERN REGIONAL SALES MANAGER
Stacy Mannik, stacym@rtcgroup.com
(949) 226-2024
WESTERN REGIONAL SALES MANAGER
Lauren Trudeau, laurent@rtcgroup.com
(949) 226-2014
EASTERN REGIONAL SALES MANAGER
Shandi Ricciotti, shandir@rtcgroup.com
(949) 573-7660
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 OFFICE
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

Portability
Versatility
Longevity

Put a new tool in your pocket.

USB - Powered Avionics Databus Interfaces

One small tool does it all – databus test, analysis, and simulation. Use it around the lab or in the field. Simply connect it to any available PC – it's fully powered by the USB port. You'll want it for all your interface applications. Add Ballard's CoPilot® interactive software for extra versatility and ease-of-use. Discover the long-lasting benefits of Ballard's new USB interfaces for MIL-STD-1553 and ARINC 429 and 717.

Call us today at 425.339.0281.

MIL-STD-1553
ARINC 429
ARINC 717

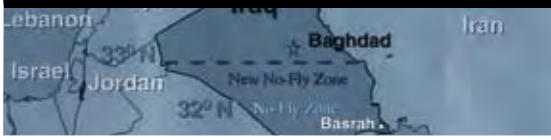
Ballard TECHNOLOGY

The Avionics Databus Innovators

AS9100 / ISO 9001 Registered

www.ballardtech.com

Publisher's Notebook



Finally an End to the 20-Year Bus War

The Navy has always been at the forefront of open systems and commercially available products. In the late 80s they were instrumental in pushing for the development of a high-performance nonproprietary bus architecture that would be adopted and used throughout the Navy for decades. It was determined that the yet-to-be-completed Futurebus would probably be what the Navy wanted; but until the completion of the Futurebus specification and development of a market for it, the Navy would use Multibus II. After some lobbying by the VME community (lucky for the Navy), that policy was mostly rescinded or ignored. But the concept of using open architecture systems was not. Today you may have to go to a museum of electronics, or Intel to find any Multibus II products.

While digging into Navy programs—both new and restructured—I was reminded of the Navy's commitment to using Open Architecture (OA) commercially available technology in as many systems as possible. Back on August 5, 2004, then Assistant Secretary of the Navy John J. Young Jr. issued a memorandum formalizing the Navy OA Enterprise initiative. This memorandum pulled all of the Navy's domain PEOs together and stated how they would work to maximize the use of OA.

The Navy probably has implemented OA bus board systems more than any of the other services. The fact that the majority of Navy electronic systems coexist within the environment of their human operators, enables the Navy to incorporate office-grade or industrial-grade hardware into racks and chassis that require only a minimal amount of protection from shock and vibration. In contrast, a major portion of the Army, Air Force and Marines' systems has to operate in more severe environments than the Navy's. As a result, we quietly hear of contracts for electronic systems awarded by the Navy, but rarely hear about technical issues. Meanwhile, we frequently hear about a whole lot of technical challenges that need to be overcome for products going into the other services.

The Navy, along with the other services, may finally be getting the bus architecture that they strived for back in the 80s: OpenVPX. Before OpenVPX can claim victory it still has one major hurdle to overcome: it needs to reach a "critical mass." I'm going to assume that all VPX products—except any that are currently being delivered to a mil program—will be converted to OpenVPX products. Even this process is no minor issue for suppliers who have already made major development commitments. OpenVPX/VPX is still not a market, and users need to at least see the light at the end of the "critical mass" tunnel before putting a lot of eggs in this basket. Of all the recent efforts to introduce a new technology into the embedded market, OpenVPX/VPX has the best chance for success. The twin facts that the embedded military market has growth potential and offers better gross margins than most commercial markets, makes it a big carrot for suppliers.

Today's level of silicon density enables us to put almost anything you may need on either a 3U or a 6U size board. That mitigates some, but not all, of the necessity for a library of products; especially through the use of mezzanine modules that enable you to tailor a board to specific needs. OpenVPX/VPX still needs to develop an array of available products in order to be a market. This means a major financial commitment by a number of suppliers for product development. Based on the normal time the military uses to go from evaluation to production, it will be some time before suppliers start to get a real return on investment. In an environment where company shareholders are more nervous than usual, it's extremely important for a company's marketing staff to get as many design wins as quickly as they can to provide some reassurance of a return. We can expect a strong effort by every OpenVPX supplier to educate their potential market about the merits of OpenVPX/VPX and to get their product message out. Expect to see suppliers at more trade conferences and sales shows.

Not since the bus wars of the 80s has the media—now including electronic media—been so focused on a bus technology. First it was VPX versus OpenVPX. Now that this issue is resolved, we're focusing on the accolades for producing the technology and keying in on its potential. OpenVPX has a great opportunity to provide an OA technology for high-end multiboard military systems—an area that was mostly being filled by proprietary products in the past. No one is willing to provide, or even guess at the size of the OpenVPX market. Nor is anyone willing to guess what year we will get the upturn in the normal sales bell curve for technology. The military needs OpenVPX so we need suppliers to stay the course and make this a market—and claim an end to the bus war. ▮▮

Pete Yeatman, Publisher
COTS Journal

Some Storage Applications Have It Really Tough!

Mission Critical Storage Solutions

Tracked vehicles move over some pretty rough terrain. Talk about a tough environment:

High shock
Constant vibration
Rapid acceleration/deceleration
Pressure and temperature changes

Adtron flash-based solid state drives (SSDs):

Designed for defense applications
Tested to MIL-STD-810F Standards
Employ EraSure® data declassification

Highly Experienced Design and Deployment Support

With over 15 years of global defense industry experience, we can assist your program team in meeting their development schedules and provide technical and migration support during deployment.

You can depend upon SMART's Adtron SSDs to provide reliable, durable and secure solutions for your mission critical applications. Learn more about tough storage at http://www.smartm.com/tough or call 602-735-0300.

SMART® Modular Technologies

ADTRON™
a SMART Modular Technologies company

U.S. Army imagery used in illustration without endorsement expressed or implied.

The Inside Track

Northrop Grumman Demos Scalable Agile Beam Radar (SABR) Aboard F-16

Northrop Grumman in conjunction with the U.S. Air Force has successfully completed a series of demonstration flights of its Scalable Agile Beam Radar (SABR) (Figure 1) installed in an F-16 fighter aircraft at Edwards Air Force Base, CA. The demonstration was in support of a U.S. Air Force F-16 Active Electronically Scanned Array (AESA) feasibility study. This officially marks the first time a retrofit AESA has ever flown in a legacy F-16.

SABR is designed to be an affordable and scalable AESA radar designed for retrofit in current F-16s and other legacy fighter, attack and training aircraft. Compared to mechanically scanned array radars, SABR will provide the increased performance, multi-functionality and greater reliability inherent in AESA radars. In terms of combat capability, SABR provides improved situational awareness, greater detection, high-resolution SAR maps, interleaved air-to-air and air-to-surface mode operations, and an all-environment precision strike capability.

Figure 1

The Scalable Agile Beam Radar (SABR) installed in an F-16 fighter aircraft.

Northrop Grumman
Los Angeles, CA.
(310) 553-6262.
[www.northropgrumman.com].

Army and Navy Labs Team Up for 'No-Knob' Radio Development

U.S. Army engineers in collaboration with their Navy counterparts hope to open the gates of cognitive radio development to academia, industry and other DoD organizations by building a universal radio test-bed this year. The Communications-Electronics Research, Development and Engineering Center's Software Defined Radio lab will work with the Navy Research Lab to transfer previous development done on the Joint Tactical Radio System to the GNU Radio's open source, free software environment.

Through the GNU platform which is inexpensive and universally accessible, universities, contract companies and government agencies can use a common platform to advance the state of cognitive radio software. Additionally, the GNU platform will enable the SDR lab to conduct large lab tests and field tests, rather than having to simulate larger-scale network testing. Through funding provided by the Office of the Secretary of Defense, Director of Defense, Research and Engineering, the SDR lab team will collaborate with the Navy Research Lab, to start building a universal GNU radio test bed this year. Once the test bed is completed, they will work together to make it remote-accessible using the Defense Research Engineering Network to house the software platform, allowing DoD organizations and external research partners to test their software on it from any location.

CERDEC-Fort Monmouth
Fort Monmouth, NJ.
(732) 532-9000.
[www.monmouth.army.mil].

Raytheon-Boeing Team Completes First JAGM Captive Flight Test

Raytheon and Boeing Company completed a series of captive flight tests for the Joint Air-to-Ground Missile competition. The tests prove the system is ready for guided test shots. JAGM (Figure 2) will replace three legacy missiles currently in the U.S. Army, Navy and Marine Corps inventory. The Raytheon-Boeing team's JAGM features a Boeing body, a Boeing warhead and a Raytheon tri-mode seeker. The tri-mode seeker leverages

Figure 2

The JAGM features a Boeing body, a Boeing warhead and a Raytheon tri-mode seeker. The tri-mode seeker enables JAGM to attack a variety of fixed and moving targets regardless of weather conditions.

REAL TIME

22,000,000 field hours matter when
DOWNTIME COSTS $200/MINUTE

OCTAGON SYSTEMS

www.octagonsystems.com

RMB-C2 Rugged Computer

-40°C to 75°C fanless
MIL-810F, MIL-1275B tough
Total thermal integration
Built-in shock & vibration plate
Best-in-class "Hedgehog" power supply
Rated for tracked vehicles
GPS, WiFi, GSM, CAN Bus
Win XPe or Linux preinstalled

technology used on the Raytheon GBU-53/B Small Diameter Bomb II and improved Precision Attack Missile.

The tri-mode seeker enables JAGM to attack a variety of fixed and moving targets regardless of weather conditions. Boeing has experience in integrating weapons on platforms like the Super Hornet and AH-64D Apache Longbow. When combined with Raytheon's expertise in developing seekers for guided weapons, the JAGM solution provides the low-risk system for operations on rotary- and fixed-wing aircraft and operations at very cold temperatures.

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

Presagis Tools Delivered on Four Boeing F-15C Eagle Simulators

Presagis announced that Lyra, along with other Presagis tools, was delivered as part of a Boeing-developed solution for the United States Air Force F-15C Eagle tactical fighter (Figure 3) training program. In November 2009, Boeing fielded the four F-15C Visual Systems Trainers. Presagis Lyra and Lyra Sensors

Figure 3

The F-15C Eagle aircraft has a pulse-Doppler radar system that can detect and track aircraft and small high-speed targets at distances beyond visual range down to close range, and at altitudes down to treetop level.

COTS Visual Runtime software were integrated into the training system to provide realistic out-the-window, infrared sensor, and night vision goggle views for the fighter jet scenarios. The Presagis Technical Services team also supported the development of the simulator's Visual Database.

Depicting visual cues—exactly the way a pilot would see it if they were looking at the landscape through night vision goggles or from the cockpit—is critical to a positive training experience and success in the actual aircraft. With Presagis tools, Boeing can efficiently create the immersive and high-fidelity

Military Market Watch

Worldwide UAV Expenditures to More than Double over Next Decade

Unmanned Aerial Vehicles (UAVs) have been the most dynamic growth sector of the aerospace industry this decade. A recently released Teal Group market study estimates that the market will more than double over the next decade from current worldwide UAV RDT&E and procurement expenditures of about $4.9 billion in 2010 to over $11.5 billion in 2019. If operations and maintenance expenditures are added, these totals would be even greater.

The most significant catalyst to this market has been the enormous growth of interest in UAVs by the U.S. military, tied to the general trend toward information warfare and net-centric systems, as well as peacekeeping operations in Iraq and Afghanistan. UAVs are a key element in the intelligence, surveillance and reconnaissance (ISR) portion of this revolution, and they are expanding into other missions as well with the advent of hunter-killer UAVs. The study suggests that the U.S. will account for 76% of the RDT&E spending on UAV technology over the next decade and about 58% of the procurement (Figure 4).

These represent higher shares of the market than for defense spending in general, with the US accounting for about 64% of total worldwide defense RDT&E spending and 38% of procurement spending according to Teal Group's International Defense Briefing country forecasts. These discrepancies are due to the heavier U.S. investment in cutting-edge technologies, and the marked lag time in such research and procurement elsewhere, especially major aerospace centers such as Europe. This follows trends in other cutting-edge technologies observed over the past decade by Teal Group analysts in such areas as precision guided weapons, information and sensor technology, and military application of space systems.

Teal Group expects that the sales of UAVs will follow recent patterns of high-tech arms procurement worldwide, with Europe representing the second largest market, followed very closely by Asia-Pacific. Indeed, the

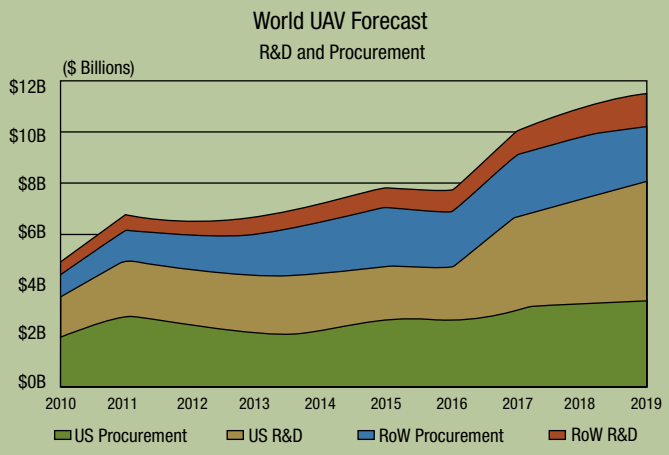


Figure 4

The Teal Group market study suggests that the U.S. will account for 76% of the RDT&E spending on UAV technology over the next decade and about 58% of the procurement.

Asia-Pacific region may outpace Europe in UAV development, but several significant players in the region, namely Japan and China, are not especially transparent about their plans compared to Europe. As in the case of many cutting-edge aerospace products, Africa and Latin America are expected to be very modest markets for UAVs. For more information please contact Teal Group at custserv@tealgroup.com.

Teal Group
Fairfax, VA.
(703) 385-1992.
[www.tealgroup.com].

scenarios the Air Force needs to train their personnel. Presagis Lyra, a multichannel visualization system delivering 60-hertz image generation out of the box, provides out-the-window scenes with complex weather and environmental special effects. Lyra Sensors provides simulated views from the aircraft's infrared sensors as well as accurately replicating the pilot's night vision goggles system.

Presagis
Montreal, Quebec, Canada.
(514) 341-3874.
[www.presagis.com].

GoAhead Software and GTS Team for CPS Solution for Navy Combat Systems

GoAhead Software is partnering with Global Technical Systems (GTS) and their teammate Northrop Grumman to support the Navy's Common Processing System program. GoAhead's solution for Dynamic Resource Management (DRM) is a foundational component of the

Figure 5

Barge testing for GTS's Advanced COTS Enclosure (ACE), which will be used to house the mission-critical CPS system.

overall infrastructure solution provided by GTS and NGC. The DRM requirement is significant to the combat system because it ensures continuous service of warfighter systems without loss of service or data. GoAhead's SAFfire solution delivers on one of the key goals of the CPS architecture by ensuring the high availability of mission-critical applications. GoAhead offers a proven combat-ready and operationally proven Service Availability Forum (SAF)-compliant solution in the commercial market, and SAFfire adheres to the open standards of the U.S. Navy's Objective Architecture (OA). GTS built the Advanced COTS Enclosure (ACE) that will be used to house the mission critical CPS system (Figure 5).

The CPS team conducted a rigorous evaluation, led by Northrop Grumman, to choose the right solution for the DRM requirement. In addition to the CPS program, GoAhead recently announced a major milestone in its support of the Aegis Weapon System. The GoAhead solution is the first commercial-off-the-shelf (COTS) resource management solution to be part of a successful Navy combat operational test.

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

Event Calendar

February 24-26
AUSA Winter
Ft. Lauderdale, FL
www.ausa.org

March 9
RTECC
Chicago, IL
www.rtecc.com

March 11
RTECC
Minneapolis, MN
www.rtecc.com

April 13
RTECC
Melbourne, FL
www.rtecc.com

April 15
RTECC
Eglin AFB, FL
www.rtecc.com

April 26-29
ESC Silicon Valley 2010
San Jose, CA
www.esconline.com

May 25
RTECC
Boston, MA
www.rtecc.com

May 27
RTECC
Philadelphia, PA
www.rtecc.com

To list your event, email: sallyb@rtcgroup.com

Special Feature

ISR Programs and Payloads in Large UAVs

UAV Payloads

Focus on Autonomy, ISR & Comms

Developers of Medium and Large UAV payloads continue to advance their system designs, outfitting UAVs with new ISR solutions for the warfighter.

Jeff Child,
Editor-in-Chief

As the use, design and planning of military UAVs matures, the DoD has adopted a strategy of closely pairing its intelligence, surveillance and reconnaissance (ISR) programs with its UAV programs. This goal of increasing "mission autonomy" is becoming integral to today's large UAV system planning. According to a recent market report by the Teal Group, UAVs continue to be the most dynamic growth sector of the world aerospace industry. The 2010 market study estimates that UAV spending will more than double over the next decade from current worldwide UAV expenditures of $4.9 billion annually to $11.5 billion, totaling just over $80 billion in the next ten years.

The study suggests that the U.S. will account for 76 percent of the worldwide RDT&E spending on UAV technology over the next decade, and about 58 percent of the procurement. According to the report, the UAV electronics market will grow steadily, with especially fast growth and opportunities in SAR and SIGINT/EW. A wide range of UAV payload design activity under the general umbrella of ISR continues including Electro-Optic/Infrared Sensors, Synthetic Aperture Radars (SARs), SIGINT and EW Systems, C4I Systems and CBRN Sensors.

At a deeper technology level, next-generation Large UAV payloads are replacing the multiprocessing of big, power-hungry boards based on general-purpose processors, with more integrated boards sporting FPGAs. This section looks at how this system consolidation is impacting the radar, imaging processing and communications capabilities of next-gen large UAVs. Meanwhile, stand-alone function-specific box-level systems are in some cases replacing traditional slot-card implementations.

Appetite for Compute Density

Large and Medium UAV platforms—like Global Hawk, Hunter, Fire Scout and others—have a seemingly endless appetite for greater onboard compute density. The payloads aboard those systems are enabling ever greater autonomy for the UAV and its mission. The movement is toward more capable radar systems that fit into the same space, and in some cases more compact radar electronics to make room for other payload electronics.

Last fall, the Air Force awarded Northrop Grumman a contract for five RQ-4 Global Hawk high-altitude, long-endurance (HALE) unmanned aircraft systems (UAS). Under the Lot 7 production contract, the company will build two Block 30 systems and three Block 40 systems for the 303d Aeronautical Systems Group at Wright Patterson AFB in Dayton, Ohio. The award also includes a ground station consisting of a launch and recovery element and a mission control element, plus two additional sensor suites that will be retrofitted into previous production aircraft.

The two Block 30 UAVs will be equipped with the Enhanced Integrated Sensor Suite (EISS) that provides electro-optical/infrared and synthetic aperture radar imaging capabilities. These aircraft will also be retrofitted to incorporate the production of Airborne Signals Intelligence Payload (ASIP). The Lot 7 contract also includes the first production of Multi-Platform Radar Technology Insertion Program payloads, which will be contractually awarded later this year. The company will also deliver two EISS suites for use on aircraft delivered earlier.

One of the most significant new capabilities on Global Hawk is the addition of a Northrop Grumman-developed signals intelligence (SIGINT) sensor. Last summer, SprayCool's liquid-cooled enclosures were included in the first test flight of Northrop Grumman Airborne Signals Intelligence Payload (ASIP) aboard a Block 30 Global Hawk UAV. SprayCool enables ASIP's critical electronics to be installed in the unpressurized compartments of the Global Hawk UAS. The completed flight test of an ASIP sensor on the U-2 aircraft verified the successful application of SprayCool technology in a high-altitude environment. Global

Figure 1

Designated AF-18, the first Block 40 Global Hawk unmanned aircraft successfully completed its maiden flight on November 16, taking off from Northrop Grumman's manufacturing facility in Palmdale, CA.

Hawk testing further supports the use of this technology on a high-altitude, long-endurance platform.

Meanwhile, the first Block 40 configuration of the RQ-4 Global Hawk (Figure 1) successfully completed its first flight last fall. Designated AF-18, the advanced capability aircraft flew for approximately two hours from the Northrop Grumman manufacturing facility in Palmdale, CA, to Edwards Air Force Base, CA. The AF-18 will carry an advanced, all-weather multi-platform radar technology insertion program (MP-RTIP) sensor. Flying at altitudes up to 60,000 feet for more than 32 hours per sortie at speeds approaching 340 knots, the MP-RTIP-equipped Block 40 Global Hawk can persistently see through most types of weather, day or night. As the world's first fully autonomous HALE UAS, Global Hawk is the platform that exemplifies the trend toward persistent ISR. Northrop Grumman is the prime contractor for the Global Hawk and MP-RTIP programs.

Modular Payloads on Fire Scout

The unmanned helicopter Fire Scout meanwhile continues to show the success of its modular payload architecture and its flexibility in integrating off-the-shelf payloads. In December the Fire Scout successfully completed maritime sensor demonstrations using a Northrop Grumman-owned MQ-8B Fire Scout tactical Vertical Unmanned Aircraft System (VUAS) (Figure 2). Fire Scout was equipped with the Telephonics' radar and FLIR Electro Optical Infrared system. The demonstration was performed under a contract awarded in September by ABS Group, a Systems Engineering Technical Assistance (SETA) contractor for the U.S. Coast Guard Research and Development Center.

Last fall, a land-based MQ-8B Fire Scout designated P7, successfully demonstrated interoperability with the Army's One System Remote Video Terminal (OSRVT) at the Yuma Proving Ground, AZ. Fire Scout's OSRVT demonstration was designed to illustrate its readiness to support Brigade Combat Teams. Designed and produced by AAI Corporation, the OSRVT provides direct receipt of full-motion video and targeting metadata by capturing the Omni broadcast from UAVs that are within a unit's area of operations. This demonstration is one in a series to prepare Fire Scout for participation in the Army Expeditionary Warrior Experiment (AEWE) at Fort Benning, GA in January and February 2010. According to Northrop Grumman, Fire Scout will perform many important Army UAS missions during AEWE in support of the Infantry Brigade Combat Team. The OSRVT video and data system enables warfighters to remotely downlink live surveillance images and critical geospatial data. AAI recently demonstrated the OSRVT situational awareness architecture as a manned/unmanned aircraft teaming tool.

Hunters Get TCDL and ATLS

New capabilities have been added to the U.S. Army Hunter MQ-5B UAV. In December a Hunter was equipped and fielded with Tactical Common Data Link (TCDL) and deployed in support of the Afghanistan surge. The TCDL increases data transfer rates and doubles the communications range on the MQ-5B Hunter, enabling additional payload capabilities. With the addition of the TCDL, Hunter now complies with requirements for all modern UAS aircraft to have encrypted data and video links. The TCDL also serves as a foundation of establishing interoperability among different U.S. DoD air vehicles and ground stations. Such in-

novation also allows for manned aircraft to use unmanned aircraft, their sensors and weapons as an extension of their own capabilities, keeping aviators out of harm's way.

TCDL also allows for smoother integration of present and future Hunter payloads that exchange digital data using airborne ground computers. With additional digital payloads in the future for Hunter, the warfighter can expect an air vehicle that can bring multiple sensors to bear on an area of interest to the battlefield commander allowing for more rapid intelligence gathering, monitoring and even targeting of enemy forces. The MQ-5B version of Hunter is distinguished by its heavy fuel engines, its fuel-carrying extended center wing with weapons-capable hard points and a modern avionics suite. The MQ-5B Hunter system uses the Army's One System ground control station and remote video terminal. It also carries a communications relay package to extend the radio range of warfighters.

Figure 3

The addition of Tactical Common Data Link (TCDL) increases data transfer rates and doubles the communications range on the MQ-5B Hunter, enabling additional payload capabilities.

In another example of increased UAV autonomy, Northrop Grumman last fall equipped and fielded its Hunter Unmanned Aircraft System (UAS) with an Automatic Takeoff and Landing System (ATLS) to the Army's UAS Training Battalion, Fort Huachuca, AZ, where it successfully completed its first launch and recovery. Hunter was originally designed using an External Pilot (EP) for take-offs and landings. Like a radio-controlled airplane, the EP required someone manually controlling Hunter during approach and landing as well as take-off. Using differential GPS, ATLS eliminates the need for an EP and allows Hunter to take off and land automatically and do so precisely at pre-surveyed points on the runway. ▮▮

Figure 2

A Northrop Grumman-owned MQ-8B Fire Scout UAV, equipped with the Telephonics' radar and FLIR Electro Optical Infrared system, successfully completed maritime sensor demonstrations.

Special Feature

ISR Programs and Payloads in Large UAVs

Ethernet Switches Connect with Military Needs

Unmanaged and managed switches are an integral component of the military's net-centric warfare initiatives, and consistent upgrades need to take place to ensure switch technology continues to meet the military's networking needs.

Martin Sweeney, Senior Electrical Engineer
Mike Southworth, Director of Marketing
Parvus

The success of net-centric warfare is dependent on fast, secure communications technology—specifically Ethernet. To meet the military's demands for Ethernet-enabled vehicles, there is an increased focus on developing a variety of Ethernet switches and routers to help the military achieve mission success. Currently, there is a rich set of rugged COTS board-level and box-level Ethernet switching and routing LRUs (Line Replaceable Units), which is a clear testament to the demand for vehicle-based networking options.

While port density and bandwidth are definite considerations, one of the first decisions when choosing a network packet processor for any military application is the degree of management capabilities. Several factors need to be evaluated to ensure that the switch will meet the user's current and future needs while not adding unnecessary complexity and costs. Today, there are a variety of switches with varying levels of management capabilities ranging from a basic unmanaged switch to completely managed switches that include advanced enterprise features.

Figure 1

Unmanaged Ethernet switches are often used in helicopters to improve situational awareness and connect onboard computing devices. Two UH-60 Black Hawk helicopters are shown here in action with support from AH-64D Apache helicopters.

Unmanaged Switches Play Important Role

For some military applications, an unmanaged switch could be the ideal solution. Since unmanaged switches require no configuration and are designed for simple plug-and-play operations, in applications when this is all that is required, a managed switch may add a lot of unnecessary complexity and expense to the equation. Unmanaged switches can also be helpful when a Virtual Local Area Network (VLAN) has already been defined and there's a need to merely expand the port count on the edge of the network.

Unmanaged switches are also ideal

Kicking Open
the Door to OpenVPX

OpenVPX NOW

Break through to higher performance and interoperability

Customers are demanding better interoperability to reduce customization, testing, cost, and risk. Ensemble™ Series OpenVPX™ 3U/6U solutions are scalable from simple switchless to complex configurations using board types such as SBCs, switch and I/O modules, and HCD boards.

Why OpenVPX

- Interoperability ensures scalable, flexible solutions
- Migration with Mercury maintains high performance
- Mercury leadership kick-starts standard technology
- Extensive product line is available today

MERCURY COMPUTER SYSTEMS

Visit www.mc.com/openvpxleader

OSI Model			
	Data unit	Layer	Function
Host Layers	Data	7. Application	Network process to application
		6. Presentation	Data representation and encryption
		5. Session	Interhost communication
	Segment	4. Transport	End-to-end connections and reliability
Media Layers	Packet	3. Network	Path determination and logical addressing
	Frame	2. Data Link	Physical addressing
	Bit	1. Physical	Media, signal and binary transmission

Figure 2

The need for managed switches, along with Layer 2 data link and Layer 3 network layer support (per the OSI model), is becoming a strong preference for many military applications.

for scenarios where the network traffic is light and data simply needs to pass from one device to another. Rather than giving the user the ability to configure link parameters, unmanaged switches use a procedure called "auto-negotiation" to agree upon certain communication parameters. One parameter they negotiate is the data rate—generally 10, 100 or 1000 Mbits/s. Another is whether to use half-duplex or full-duplex mode. Full-duplex allows communications to exist in both directions at the same time, while half-duplex allows for only one way communication at a time. However, in today's networking environments, half-duplex might only be used where older, legacy systems are in place.

Although managed devices are more common now in military usage, unmanaged switches still play an important role as a piece in the overall networking architecture, including within many rotary aircraft modernization programs. The U.S. Army's Aviation Applied Technology Directorate (AATD), for example, specifies an unmanaged Ethernet switch subsystem into the AH-64 Apache helicopter (Figure 1) to improve situational awareness and connect onboard computing devices. Multiple unmanaged Ethernet switch cards are integrated into the Light Airborne Multi-Purpose System (LAMPS) technology insertion for the U.S. Navy SH-60 Seahawk. Similarly, the UH-60 Blackhawk integrates a combination of unmanaged and managed devices.

Managed Switches Dominate in Military

Managed switches are often required when the number of devices in a network increases and more control and flexibility are needed. By providing users with options for monitoring and configuring networks, managed switches can provide the armed forces with greater control and security over their data. There has been an increasing demand of late within military technology refresh programs for "lightly managed" rugged COTS switches. These devices support a core networking feature set and provide some basic management capabilities, which makes them well suited for many situational awareness upgrade applications. Additionally, the "lightly managed" variety of switch

Figure 3

The DuraNET 1268 Rugged 10-Port Ethernet Switch is a "lightly managed" switch option for manned or unmanned vehicle and aircraft platforms.

is much less costly than fully managed switches—a very attractive feature for budget sensitive military groups.

The need for a switch that includes many of the functional advantages of a fully managed switch without the hefty price tag or complexity prompted Parvus to develop the new lightly managed DuraNET 1268 rugged 10-port Ethernet switch subsystem. By offering powerful Layer 2 features such as IPv6 Class of Service (CoS) prioritization, Simple Network Management Protocol (SNMP), IEEE-802.1Q tagged or port-based VLANs, a Serial Command Line Interface (CLI) and Web management, among others, the DuraNET 1268 is primed for insertion into demanding network-centric manned and unmanned vehicles and aircrafts. A handful of airborne, maritime and ground vehicle programs have already specified this device since it was recently introduced to the market.

The need for managed switches, along with Layer 2 data link and Layer 3 network layer support, is becoming a strong preference for many military applications. In the Open Systems Interconnection (OSI) model of computer networking (Figure 2), Layer 2 refers to the node-to-node frame delivery on the same link, whereas Layer 3 refers to the end-to-end (source to destination) packet delivery including routing through intermediate hosts. A Layer 3 switch blurs the line between routing and switching, permitting a more efficient networking architecture while including more optimized protocols—such as Internet Protocol or IP. Additionally, many fully managed switches and routers can now support Layer 3 protocols and beyond.

Features for Military's Needs

Maintaining situational awareness through the use of video, maps, radio and satellite technologies requires a networking infrastructure that can manage and prioritize data packets to ensure mission safety and success. This type of network management is often performed by a managed switch, which includes the necessary features to meet the military's stringent efficiency and security demands.

Such features include Quality of Service (QoS), which allows users to prioritize network traffic by assigning a higher priority to traffic from particular MAC address, VLANs, IP classes, tags, etc. This helps ensure consistent network performance for critical, time-sensitive data. QoS is especially critical for military users in a mixed-traffic environment where large data files such as map images can delay important voice packets or flash messages that need to reach the vehicle operator. QoS allows the user to tag certain traffic as high priority to ensure delay-sensitive data is delivered in a timely manner.

Similarly, VLANs featured on managed switches allow the device to logically group devices together to isolate traffic between these groups, even when the traffic is passing over the same physical switch. This segmentation and isolation of network traffic helps reduce unnecessary traffic and provides maximum bandwidth to devices that need to communicate to each other. This allows better network performance, and in many cases, provides an additional level of security.

Another common feature of managed switches is support for redundancy. Redundancy provides the ability to safeguard a network in case a connection or cable fails, by providing an alternate data path for traffic. Many switches incorporate what is called Spanning Tree Protocol standard (STP), to provide path redundancy in the network. Using the spanning-tree algorithm, STP provides redundant paths while preventing loops that are created by multiple active paths between switches. STP allows for one active path at a time between two network devices, preventing loops and establishing the redundant links as a backup to keep integrated systems available and preventing expensive downtime.

Rapid Spanning Tree Protocol

With the IEEE's introduction of a newer protocol called Rapid Spanning Tree Protocol (RSTP), networking devices can now provide for faster spanning tree convergence after a topology change. All the basic concepts of STP are included with RSTP, with the main difference being convergence time. While it may take STP 30 to 50 seconds to re-converge, RSTP does it in dramatically less time. Further, Multiple Spanning Tree Protocol (MSTP) extends RSTP for grouping multiple VLANs into a single Spanning Tree topology. It is not uncommon for redundant flight-critical electronics on board manned and unmanned aircraft to be networked by Ethernet switches supporting some form of STP. In this way, onboard mission computers have multiple potential data paths and can quickly recover if critical hardware fails.

Monitoring functions of network switches can provide additional control and efficiency. Through the use of SNMP, a protocol that facilitates the exchange of management information between network devices, users can determine the health of the network or the status of a particular device. This includes the number of bytes and/or frames transmitted

and received, errors generated and port status. By displaying this data over a standard Web browser, administrators can monitor the performance of the network and quickly detect and repair network problems without having to physically interact with the switch.

In addition to these key management features, when designing network devices, Parvus often includes a non-destructive zeroization feature to provide additional security for military users. Now a requirement in many military vehicles, zeroize capabilities can sanitize a switch or router should the military platform be compromised, clearing out system firmware, as well as network addresses and configuration settings.

Ruggedizing Switches for the Military

As with most computer hardware destined for military vehicle use, rugged switches must be small and lightweight in form factor, yet robust in mechanical design. The DuraNET 1268 switch (Figure 3), for example, weighs less than 5 lbs and integrates a conduction-cooled, aluminum chassis with sealed MIL-38999 connectors and MIL-STD-1275/704 power supply. This fully immersible subsystem is designed for harsh MIL-STD-461E EMI/EMC and MIL-STD-810F thermal, shock, vibe, humidity, altitude and ingress conditions with an operating temperature of -40° to 71°C fanless. These rugged accommodations enable defense contractors to specify such devices into programs to benefit from managed switches without having to compromise reliability and durability.

As the military's need for more management capabilities increases, manufacturers must continue to innovate switch technology to meet impending demands. An example of this is the number of ports available on managed switches. Presently, many military vehicle applications require 8-10 ports; however, with the military's "future-proof" stance on acquiring technology, manufacturers need to have roadmaps in place to deliver switches with more port density to support a larger number of devices. Parvus has witnessed program requirements for as many as 64 ports on rotary aircraft.

Additionally, managed and unmanaged switches will need to support greater bandwidth requirements. Although bandwidth doesn't currently present much of an issue because few applications require more than 1 Gigabit per second, the military is increasingly requesting 10 Gigabit Ethernet switches in preparation for more bandwidth-intensive applications, particularly those associated with signal intelligence, radar, sonar and high-performance communications systems.

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

Tech Recon

Power Supplies Attack the SWaP Challenge

Power Supplies and Converters Tackle SWaP Issues

With size, weight and power constraints now high on the list of military system design priorities, power supplies and power converter solutions are doing their part to keep pace.

Jeff Child,
Editor-in-Chief

In tandem with the military's drive toward greater compute density, there's a growing demand to reduced size, weight and power (SWaP) of system electronics. And the two go hand in hand. More and more programs are pushing for as much computer processing muscle as can possibly fit into a board-level solution. Driving those demands is a desire to fit more functionality in the same space or into a smaller footprint. In the air, this means smaller and longer endurance for systems like UAVs. On the ground, this means more weight can be allocated to the all important armor of ground vehicles.

Reducing size, weight and power cuts across all aspects of system design, but power supplies and power conversion electronics play a direct role in a system's power consumption and power management. At the same time, power components vendors continue to shrink the size and weight of their power supply and power converter offerings, while at the same time enhancing those features critical to military systems such as good shock and vibration performance.

Figure 1

R1S/R1D and R2S/R2D series 1-watt and 2-watt SMD Miniature DC/DCs offer a low weight of around 1 gram and in tests have withstood continuous 20G random vibration for over six hours.

DC/DC Converter Bricks

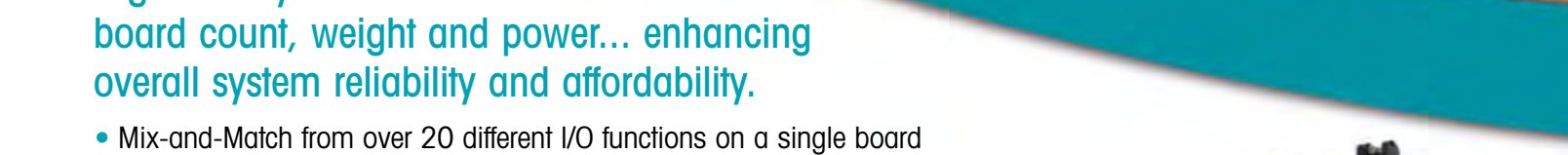
In the realm of high-power-density DC/DC converters, the modular form factor, commonly referred to as a brick, continues to be the preferred building block approach component for any applications, commercial and military. That said, bricks are especially well suited for military applications. DC/DC converter brick modules are available in a range of sizes and formats—half bricks, quarter bricks and so on. These converters—usually characterized by high-frequency operation allowing them to achieve their small size, high power density and efficiency—come in thousands of combinations of input voltage, output voltage and power level.

An example along those lines is the MI-Series of DC/DC converter bricks from Vicor. The family is designed for applications using distributed power architecture and is based on Vicor's VI-200 / VI-J00 series of zero-current switching, component-level DC/DC converters. Operating at frequencies up to 1 MHz, the MI-Series offers state-of-the-art performance in terms of power density, efficiency, noise, ease of use and reliability.

All units are manufactured in ISO 9001-registered facilities. Vicor's industry standard package enables the MI-Series to meet MIL-STD-810 environmental requirements for humidity, fungus, salt, fog, explosive atmosphere, acceleration, vibration and shock. Standard features such as wide output trimming / programming, current limiting, remote sense, logic enable / disable, and latching OVP and OTP combine to offer a high degree of protection, versatility and reliability for military power systems.

Multifunction I/O Boards

You select the functions. We save you space.



Proudly made in the USA.

High density COTS I/O solutions reduce board count, weight and power... enhancing overall system reliability and affordability.

- Mix-and-Match from over 20 different I/O functions on a single board
- MIL-STD-1553, CANBus, ARINC 429/575, RS232/422/485, GbE Switch; Discrete, Differential, TTL; A/D, D/A, Synchro, LVDT, RTD; Local Processing
- Continuous background BIT monitors health and status of each channel
- User configurable I/O parameters, per channel
- Available Bus Architectures include VME, VPX, cPCI and PCI
- Access and control board via Bus Architecture or Gigabit Ethernet
- Modified COTS solutions also available

COTS Solutions tailored to meet your system requirements.
Visit **www.naii.com** or call us at 631-567-1100 today.

North Atlantic Industries
Excellence in ALL we do

Embedded Boards | ***Power Supplies*** | ***Instruments***

631-567-1100 • Fax: 631-567-1823 • www.naii.com • email: sales@naii.com

Low-Weight Solutions

Offering compact, low-weight converter solutions is one thing, but doing so with high temperature resistance is more of a challenge. Along such lines, RECOM offers its R1S/R1D & R2S/R2D series 1-watt and 2-watt SMD Miniature DC/DCs (Figure 1). They have an "enclosed open frame" design and the same pinout as standard SMD converters, but also offer an extended ambient operating temperature range of up to +100°C without derating or fan cooling.

The R1S/R1D & R2S/R2D series have been designed for fully automated manufacture, so they are suitable for use with vapor phase soldering and can withstand soldering temperatures of 245°C for the maximum 30 seconds as defined by the JEDEC STD-020C standard. Input voltages ranging from 3.3V up to 24V are standard, as are single or dual output voltages of between 3.3V and 24V or ±3.3V to ±24V, so they can be used as voltage isolators, dual-rail generators, step-up or step-down converters. Two isolation grades are available: 1 KVDC or 3 KVDC—the latter making them also suitable for medical applications.

The low weight of around 1 gram makes these converters particularly suitable for high vibration and mechanical shock environments—in tests they have withstood continuous 20G random vibration for over six hours. The internal design is not only thermally and environmentally optimized, but the careful PCB layout means that the converters have extremely low EMC emissions and meet EN55022 Class A levels without any external components. The external filter components required for Class B compliance are also simple and 50% size and 60% cost of conventional Class B EMC filters.

Figure 2

The 200UFR converters are fully isolated low-noise/low-ripple DC/DC converters in a low-profile SIP package that measures 0.86" x 0.36" x 0.49.

Meeting Space-Constrained Needs

Another new product going for space-constrained applications is Martek Power's 200UFR series (Figure 2) of compact 2W onboard DC/DC converters. The 200UFR series is designed to address the low noise and tight space requirements for data communication equipment, mobile battery-driven equipment and distributed power systems for the military. The 200UFR converters are fully isolated low-noise/low-ripple DC/DC converters in a low-profile SIP package that mea-

sures 0.86" x 0.36" x 0.49. The series features a rated output power of 2W, 1500 VDC isolation, wide operating temperature range of -40° to +85°C, short circuit and over current protection, remote on/off, internal SMD construction and typical full-load efficiency up to 80 percent. The series consists of 14 single and dual output models with 12 and 48V inputs and regulated output voltages of 3.3V, 5V, 12V, 15V, ±5V, ±12V and ±15V.

Parallel Function for High Power

By using DC/DC converters as building blocks, system designers can scale up their implementation by putting devices in parallel. Supporting that approach, TDK-Lambda offers its latest high-density, DC/DC converter family with the introduction of the new CC-P-E Series. These are ultra-compact, fully isolated converters that feature wide range DC inputs (24V or 48V nominal), which makes them ideal for distributed power, battery-operated devices, FPGA and applications. Available with output voltages of 3.3V, 5V, 12V or 15 VDC, with output power ratings of 15 or 30 watts, these fully regulated, high-efficiency (92% typical) converters can be paralleled for higher power applications.

Figure 3

The 3.15.1000 provides a low-noise, highly regulated +5V and +/-15V output for a total of 8 watts of output power.

The CC-P-E modules are available in through-hole or SMT packages, with or without a shielded metal case and are suitable for extended temperature range applications from -40° to +85°C. DC OK, Sequencing (for up to 20 paralleled units), Remote On/Off and Parallel Alarm pins are among the standard signals and controls. In addition, overvoltage and overcurrent protection circuits are built in. These converters are available with a nominal 24 VDC input that can operate from 18 to 36 VDC or a 48VDC input that will operate from 36 to 76 VDC. Ideal for limited-space applications, the 15-watt units measure only 29.6 x 38.4 mm and are 6.8 mm high. And the 30-watt converters measure 33.5 x 38.4 mm and are just 8.3 mm high. The designer can simply parallel two of more or these converters for higher power requirements.

Designing for Rugged Apps

Military applications demand more from power supplies than other systems. They must work reliably under some of the toughest environment conditions. Calex has announced the availabil-

ity of the 3.15.1000 linear power supply. The 3.15.1000 (Figure 3) provides a low-noise, highly regulated +5V and +/-15V output for a total of 8 watts of output power. The rugged, epoxy potted construction of the 3.15.1000 makes the unit ideal for use in a wide variety of sensitive analog circuitry applications utilizing operational amplifiers, function modules and data conversion circuits.

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

Tunable Loop Capabilities

At one time, power conversion devices forced system designers to reserve large amounts of board space for them. Bucking that trend, Lineage Power has introduced its MegaTLynx DC/DC 30, a power converter for distributed power architectures and intermediate bus voltage applications. The new power module is a high-efficiency, non-isolated, DC point-of-load (POL) converter. The MegaTLynx POL delivers exceptional thermal performance with full load capability at an ambient temperature of 85°C with only 200 linear feet per minute (LFM) airflow.

The Tunable Loop feature delivers leading density at the lowest cost implementation, leveraging standards-based Distributed-Power Open Standards Alliance (DOSA) footprints. Tunable Loop functionality allows design engineers to optimize the dynamic response of a DC POL power solution to match load requirements—reducing the quantity, type and size of the capacitors required for any given application. This DC power module operates over a wide range of input voltage from 6V to 14V and provides a precisely regulated output voltage from 0.8V to 2.75V, programmable via an external resistor. Available immediately worldwide, the Lineage Power MegaTLynx 30A POL is also available for multi-sourcing through licensees of the Tunable Loop technology. A ruggedized version for industrial and military applications will also be available.

VME for Hi-Rel Avionics and Mil Apps

VME may be getting long in the tooth, but there's a ton of installed, deployed military programs that make use of it. The latest power supply solution for that market is the new VPTVME Series (Figure 4) power supply from VPT. Delivering up to 500W and multiple out-

Figure 4

The VPTVME Series power supply delivers up to 500W and multiple outputs per unit and is aimed specifically for rugged avionics and military applications.

puts per unit, this new commercial-off-the-shelf (COTS) VME power system is designed specifically for rugged avionics and military applications

A wide input voltage range accommodates nominal 28V inputs including avionics, mobile, ground systems and other applications. VPT's proven design and rugged packaging ensures long-term reliability for mission-critical programs. Product features include a single slot 6U VME form factor, IEEE Std. 1101.2-1992 compatibility, conduction cooling, 28 VDC input per MIL-STD-704 and MIL-STD-1275 compatibility. ▮▮

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

Lineage Power
Plano, TX.
(972) 244-9288.
[www.lineagepower.com].

Martek Power
Torrance, CA.
(310) 202-8820.
[www.martekpower.com].

Pico Electronics
Pelham, NY,
(914) 738-1400.
[www.picoelectronics.com].

RECOM Power
Brooklyn, NY.
(718) 855-9710.
[www.recom-power.com].

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

Vicor
Andover, MA.
(978) 749-8359.
[www.vicorpower.com].

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

Tech Recon

Power Supplies Attack the SWaP Challenge

Case Study: Li-Ion Polymer Battery Approach Meets Mobile Military Needs

The size, weight and power demands of today's military vehicle electronics calls for rethinking of battery backup power. A Li-Ion Polymer approach solves many of the issues of traditional lead-acid technology solutions.

Michael A. Stout, V.P. of Engineering
Falcon Electric

Due to IEDs, RPGs and the penetrating power of the AK47, the military is installing a higher level of armor on vehicles to offer as much protection for the soldier as possible. This makes every pound removed from the shelter's contents by the equipment contractor valuable. With that in mind, around two years ago, a major prime contractor tasked Falcon Electric to design a lightweight, rugged UPS and Frequency Converter system to provide power backup and protection for their electronics to be installed in a military Humvee-mounted shelter.

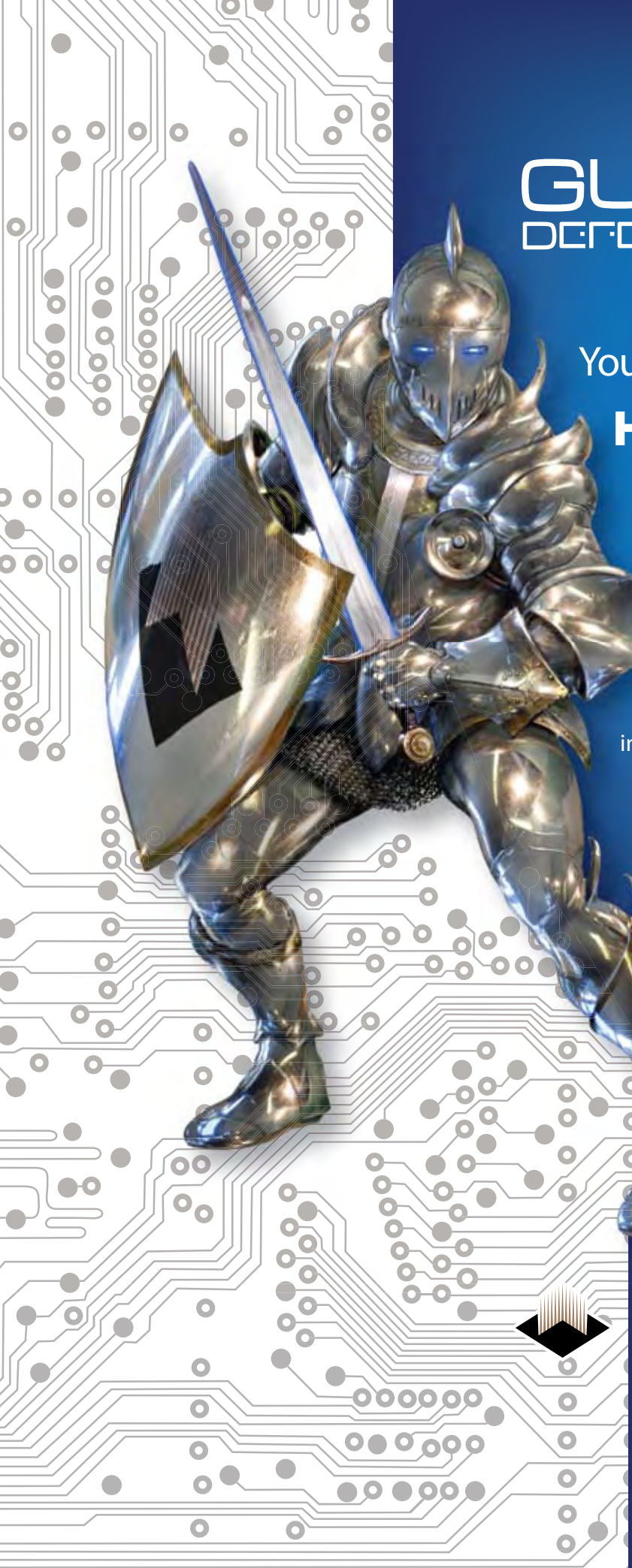
The contractor wanted a minimum of 15 minutes of battery backup power, which meant the standard 120-pound lead-acid battery system was out of the question. They further requested that the entire battery bank, containing the batteries, charger and battery management system, be packaged inside a 3.5-inch high (2U) rackmount enclosure. The UPS and battery system needed to withstand a large amount of shock and vibration, as well as pass the Army's Munson Road Test and other military standards.

Figure 1

The military now requires installing a higher level of armor on vehicles—such as this Humvee—to offer as much protection for the soldier as possible. This makes every pound of electronics gear removed valuable.

Lithium-Ion Polymer Technology

After researching the available battery technologies compatible with our UPS technology, the Falcon engineers determined that the Lithium-Ion Polymer battery offered the best solution. The team had a mature UPS/Frequency Converter technology that, with some minor redesign and major repackaging, would exceed the requirements and provide up to a 5 kVA output while weighing only 75 pounds. This part of the project was



GUARDIAN™
DEFENDER OF DATA

Your data is under attack.

Help is on the way.

Our new **Guardian**™ solid state disk drive protects sensitive data from both environmental and human threats.

It's designed specifically to provide outstanding reliability, performance and security for defense applications in rugged environments. AES encryption and anti-tamper techniques, plus our own **Armor**™ management processor set this drive apart from any others on the market.

Join the ranks of the Defenders of Data. Learn more at **www.whiteedc.com/guardian**

602.437.1520 TEL | **602.437.9120** FAX

Armor™ Processor Inside

WHITE ELECTRONIC DESIGNS

Securing the Future Through the Power of Design

WWW.WHITEEDC.COM

Figure 2

The ED Series UVS Plus is a lightweight 5 kVA three-phase power conversion system with a special lightweight battery pack. This system will be used on board a shelter system mounted on a Humvee.

completed in about six months to product qualification. Since the Lithium-Ion Polymer battery system would take substantially longer to complete, the UPS was qualified using the standard Valve Regulated Lead-Acid (VRLA) battery bank.

Obtaining the batteries was the first roadblock encountered in designing the Lithium-Ion Polymer battery system. The leading manufacturer of this battery technology is located in China, and all of their available cell production was allocated for a substantial period of time. To compound the problem, the Army planned to purchase only a few hundred systems, so the battery manufacturer had little incentive to pull the battery cells required from their existing large quantity customer orders. Going to a second manufacturer was not an option as the required battery cells were single source. After meeting with the battery manufacturer many times, they finally recanted, but required that all battery cells for the entire contract be purchased on a one-time buy. They were willing to supply the engineers with enough battery cells for development purposes before we purchased the remainder of the cells.

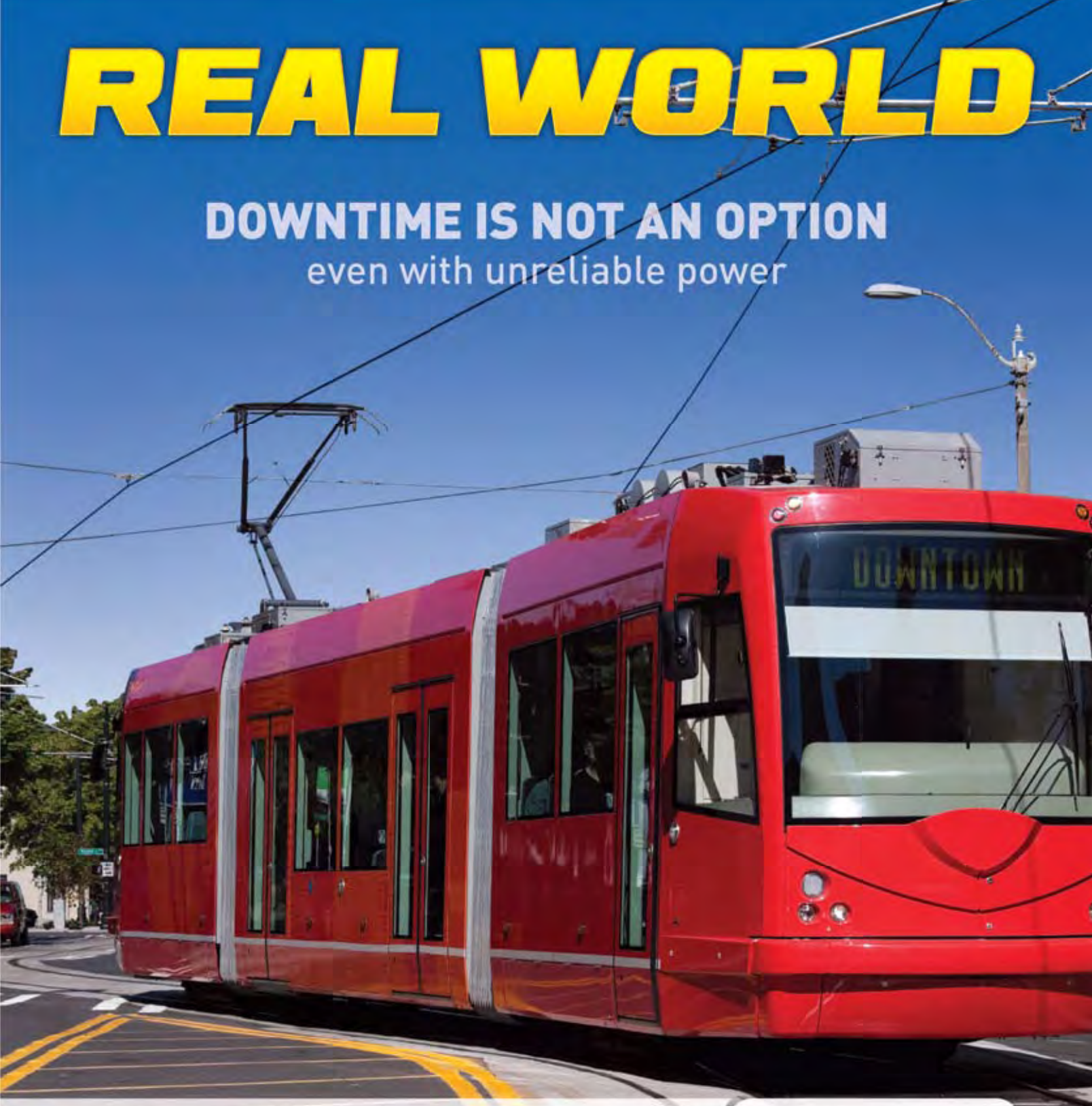
Saving Space with Flexible Packaging

The Lithium-Ion technology is based on Lithium-Ion Polymer battery design. The lithium salt electrolyte is not suspended in an organic solvent like the lithium-ion design, but is contained in

REAL WORLD

DOWNTIME IS NOT AN OPTION

even with unreliable power



OCTAGON SYSTEMS

www.octagonsystems.com

RMB-C2 Rugged Computer

-40°C to 75°C fanless
MIL-810F, MIL-1275B tough
Total thermal integration
Built-in shock & vibration plate
Best-in-class "Hedgehog" power supply
Rated for tracked vehicles
GPS, WiFi, GSM, CAN Bus
Win XPe or Linux preinstalled

a solid polymer composite. This makes the battery much safer than the typical Lithium-Ion design. The individual battery cells are typically packaged in flat, flexible packs and are easily packaged into a small portion of the battery bank, allowing space for the charger and battery management system (BMS) PC board.

The battery charger design process was straightforward and accomplished in a couple of months. The charger design incorporated an off-the-shelf AC to DC and two DC/DC converter modules that provided the necessary 72 VDC charge current. Since these small, readily available modules were used, the battery charger circuit board only required a small space down one side of the enclosure.

Lithium-Ion Polymer batteries demand that a sophisticated microprocessor-based, BMS be incorporated to precisely monitor and control the charging of each individual cell used inside the system. The system contained 80 batteries. The BMS also continuously monitors for over-current conditions and switches the individual cells, or the battery bank output off, in the event of a short circuit. Without the proper battery management system protection, over-charging or a direct short across an unprotected high-capacity lithium-polymer battery system could result in igniting the lithium inside the batteries.

DOT Regulations

Lithium burns at a very high temperature and requires special fire fighting and safety techniques. As a result, the Department of Transportation (DOT) has implemented regulations governing transportation of Lithium-Ion polymer battery cells and packs having lithium content over a specified amount. The regulations governing lithium battery transportation are DOT TITLE 49 CFR and UN ST/SG/AC.10/11. To meet DOT requirements and receive DOT approval to ship or transport the system, the BMS must be active and monitoring the system whether it is in storage or transport.

After some research, the team decided that the BMS portion of the project required knowledge of lithium batteries that they did not have in house, so they outsourced the BMS development. The Falcon engineers worked with the outsourced team and within several months came up with what initially appeared to be a working BMS board. It then took several more months to get the bugs out and archive the performance demanded.

At this point the engineers at Falcon finished a battery system product that they could not ship anywhere until they conducted all required DOT and UN testing on 16 finished units, the shipping container and its packing materials. The testing and subsequent DOT certifications took about three more months. The lithium-ion polymer battery systems along with Falcon's UPS were then shipped to the contractor for all of the required Army testing and approvals. ■■

Falcon Electric
Irwindale, CA.
(626) 962-7770.
[www.falconups.com].

DATA BUS PRODUCTS

Mil-STD-1553 Solutions

Flight Ready
Proven Reliability

If the Grumman Avenger had a databus . . .
it would have featured Mil-Std-1553
components from Data Bus Products,Corp.

If your project is expected to live on for many years, then there is only one clear choice for Mil-Std-1553 Components - Data Bus Products! From our Couplers, Bus Switches, Cable Assemblies to our hardware and custom components, Data Bus Products delivers proven reliability.

Need 1553 Customization?

Do your requirements dictate a completely new product, or repackaging of an existing unit? Maintaining the electrical characteristics of Mil-Std-1553, we regularly customize couplers, LRU switches and cable assemblies to meet your specific interface, environmental, service duration, and weight reduction requirements.

Interfacing to any manufacturer's test cards to satisfy your specific test or simulation scheme is a daily part of our customer assistance. From simple point-to-point cables to complex harness assemblies, or any avionics hardware challenge, give us a call and let our experts transform your ideas and requirements into a high quality solution that saves your program time and money.

Two stub box coupler

Two stub inline coupler

Call/E-mail for Our Latest Catalog

Couplers • Terminators • Connectors • Cable Assemblies • Relays • Custom Parts • Kits

Customer Service That Doesn't End When the Part is Shipped

Patch panel to Cat 5 adapter

With Data Bus Products, customer service is not limited to simply filling an order.

Collaborative, insightful, and often invaluable customer assistance is available via the phone or e-mail.

1553 Interface board adapter cable

With thousands of test and flight applications of our hardware in service, Data Bus Products Engineers are confident in assisting you every step of the way.

1 x 4 LRU Switch

DATA BUS PRODUCTS

Phone: 516.365.8464

Fax: 516.365.3946

customerservice@databusproducts.com

www.databusproducts.com

RTD Embedded Technologies, Inc.

The Stackable PC Company™

Intel® Core™ 2 Duo 1.86 GHz

Intel® Pentium® M 1.4 GHz

AMD Geode™ LX 500 MHz

cpuModules™

-40 to +85°C

		Intel Core 2 Duo		Intel Pentium M						Intel Celeron				AMD Geode LX	
		CMA & CMX22MVD1860HR	CMA & CMX22MVD1200HR	CMA157886PX1400HR	CMX158886PX1400HR	CMX158886PX1400HR-ECC	CMD158886PX1400HR	CMX158886PX1400HR-BRG	CMD158886PX1400HR-BRG	CME146786CX650HR	CME147786CX650HR	CML147786CX650HR	CMX147786CX650HR	CME136686LX500HR	CME137686LX500HR
Expansion Bus	PC/104 ISA Bus			✓						✓	✓	✓	✓	✓	✓
	PCI-104 PCI Bus	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓
	PCIe/104 Express Bus	✓	✓												
CPU and BIOS	CPU Max Clock Rate (MHz)	1860	1200	1400	1400	1400	1400	1400	1400	650	650	650	650	500	500
	Intel SpeedStep Technology	✓	✓	✓	✓	✓	✓	✓	✓						
	ACPI Power Management	3.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	2.0	2.0
	Max Onboard DRAM (MB)	2GB	2GB	512	1GB	512	1GB	1GB	1GB	256	256	256	256	256	256
	RTD Enhanced Flash BIOS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Nonvolatile Configuration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	RTD Quick Boot	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	USB Legacy (Keyboard & Boot)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Peripherals	Watchdog Timer	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Solid State Hard Drive Disk Chip	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB
	Audio	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓		
	Analog Video	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA
	Digital Video	LVDS	LVDS	LVDS	LVDS	LVDS	LVDS	LVDS	LVDS			TTL	LVDS	LVDS	
	PS2 Mouse/Keyboard/Utility Port	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	USB Mouse/Keyboard	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
I/O	RS-232/422/485 Ports	4	4	4	4	4	2	4	2	2	2	2	2	2	2
	SATA	2	2												
	USB 2.0	6	6	4	2	2	4	2	4	2	2	2	2	2	2
	Gigabit Ethernet	1	1												
	10/100Base-T Ethernet			1	1	1	1	1	1	1	1	1	1	2	1
	Parallel Port				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	aDIO (Advanced Digital I/O)	14	14	14	18	18	18	36	36	18	18	18	18	18	18
	aAI (12-bit Advanced Analog Input)	8	8												
	multiPort (aDIO, ECP, FDC)				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SW	ROM-DOS Installed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DOS, Windows, Linux	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

visit www.rtd.com for complete product listing

ECC Memory available.

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
- Express Dual 1G Ethernet
- Copper or Fiber Ethernet
- USB 2.0 and FireWire™
- CAN Bus & CAN Spider
- Dual Synchronous Serial
- Octal PCI Serial

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

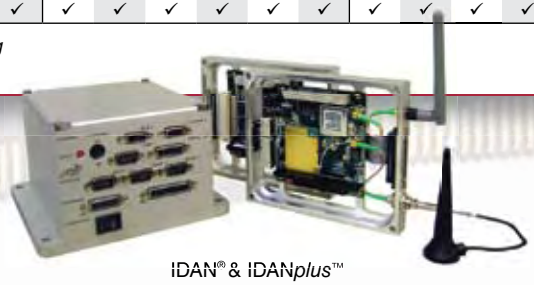
Motion Controllers
- DC Motor Controllers
- Synchro, Resolver, LVDT

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

Bridge Modules
- expressMate™
- PCIe to PCI
- PCI to ISA

Power Supplies
- PC/104 & PC/104-*Plus*
- PCI/104-Express™ Family
- 50/75/83/88/100 Watts
- ATX Power Supplies
- UPS Backup
- MIL-STD-704/461

Full Bandwidth Regeneration or Reorganization of stackable PCIe and PCI Busses with peer-to-peer communication enabled and PCIe-over-Cable Ports



IDAN® & IDAN*plus*™

Conduction-cooled IDAN® cpuModule

A Founder of the PC/104 Consortium
ISO 9001:2000 Certified

RTD Embedded Technologies, Inc.

103 Innovation Boulevard • State College, Pennsylvania • 16803 • U.S.A.
Phone: 814-234-8087 • Fax: 814-234-5218 • www.rtd.com • sales@rtd.com

www.rtd.com

HighRel PC/104 ISA, PCI & PCIe Modules and Systems

-40 to +85°C

Data Acquisition

Wireless Telematics

TI 8000 MIPS dspModule™

dataModules®
-40 to +85°C

			Smart A/D		Analog I/O				Digital I/O						
			SDM7540HR	SDM8540HR	DM6420HR	DM6425HR	DM6430HR	DM7520HR	DM6812HR	DM6814/16HR	DM6888HR	DM7820HR	DM8820HR	DM9820HR	FPGA7800HR
Bus		Active Bus	PCI	PCI	ISA	ISA	ISA	PCI	ISA	ISA	ISA	PCI	PCI	PCIe	PCI
		Passthrough Bus	ISA					ISA				ISA		PCI	ISA†
		DMA or PCI Bus Master	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓
		McBSP Serial Ports	✓	✓				✓							
ANALOG	Analog Input	Single-Ended Inputs	16	16	16	32	16	16							
		Differential Inputs	8	8	8	16	8	8							
		Max Throughput (KHz)	1250	1250	500		100	1250							
		Resolution (bits)	12	12	12	12	16	12							
		Input Ranges/Gains	3/7	3/7	3/4	3/4	1/4	3/6							
		Autonomous Calibration	✓	✓											
		Data Marker Inputs	3	3	3			3							
	Analog Out	Analog Outputs	2	2	2	4	2	2							
		Max Throughput (KHz)	200	200	200	200	100	200							
		Resolution (bits)	12	12	12	12	16	12							
		Output Ranges	4	4	3	3	1	4							
		D/A FIFO Buffer	8K	8K				8K							
	Advanced Features	Channel-Gain Table	1K	1K	1K	1K	1K	1K							
		Scan/Burst/Multi-Burst	✓	✓	✓	✓	✓	✓							
		A/D FIFO Buffer	8K	8K	8K	8K	8K	8K							
		Sample Counter	✓	✓	✓	✓	✓	✓							
		SyncBus	✓	✓				✓							
DIGITAL	Digital I/O	Total Digital I/O	16	16	16	16	16	16	48	18/9	64	48	48	48	48
		Bit Programmable I/O	8	8	8	8	8	8	24	6/0		48	48	48	✓†
		Input FIFO Buffer	8K	8K	8K	8K	8K	8K							
		Opto-Isolated Inputs									48				
		Opto-Isolated Outputs									16				
		User Timer/Counters	3	3	2	2	2	3	3	3		10	10	10	6
	Advanced Features	Advanced Interrupts	2	2	2	2	2	2	2			2	2	2	✓†
		Versatile Memory Buffer										4M	4M	4M	8MB
		External Trigger	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓†
		Incr. Encoders/PWMs								3/9		4/8	4/8	4/8	✓†

visit www.rtd.com for complete product listing

† User-defined, realizable in FPGA

PCIe/104 cpuModule™ featuring Intel® Core™ 2 Duo processor, with eight PCIe x1 links, one PCIe x16 link, 8 analog inputs, 2 SATA, LPC, 6 USB 2.0 and Dual Ethernet. Shown here with Analog dataModule® and ATX Power Supply

Conduction-cooled, Hybrid RF/Embedded System

- VHF/UHF receiver
- Multi-band synthesizer
- FPGA Coprocessor
- High-end GPS receiver
- Pentium M cpuModule
- Isolated Power Supply

HiDAN*plus*™

HiDAN® Systems

- Rugged, watertight enclosure
- Integrated tongue & groove O-ring
- Environmental sealing & EMI suppression
- Structural heat sinks & heat pipes
- Milled aluminum frames with optional heat fins
- MIL cylindrical I/O connectors
- MIL-SPEC paint & shock-mounts optional

IDAN® — Intelligent Data Acquisition Node

- Rugged PC/104 stackable framed modules
- Quick interchangeability and expansion
- Structural heat sinks, cooling fins & heat pipes
- Milled aluminum frames
- Standard PC connectors
- Optional MIL-SPEC paint & shock mounts

HiDAN*plus*™

Radar System Application

- High-end FPGA Board
- MIL-SPEC A/C Power Supply
- Synchro to Digital Converter
  - cpuModule, relayModule and dataModules

HiDAN*plus*™ Systems

- HiDAN with IDAN modularity
- Stackable signal raceway

rtd®
"Accessing the Analog World"

"MIL Value for COTS prices"™

System Development

System Safety and Reliability Trends

Revamping Methods for Rugged Equipment Testing

Gone are the days when sequential shock and vibration testing were sufficient. The benefits of multi-axis testing bring a host of advantages to military system development and test.

Wayne Tustin, President
Equipment Reliability Institute

Consider any electronic or mechanical piece of equipment intended for military use. Stating that the equipment is "rugged" is not sufficient. There's no neat category that defines what rugged means. It has to be quantified in terms of the laboratory test intensities at which the equipment has continued to operate satisfactorily. This means the whole gamut of climatic environments including high temperature, low temperature, humidity, altitude and depth. Also important are the dynamic, man-made environments of vibration, shock and sound pressure.

All those potentially damaging climatic environments "come at" hardware simultaneously from all directions. Take temperature, for example. In the "real world" and therefore in the lab, most if not all surfaces are warmed simultaneously or cooled simultaneously. Take altitude for another example. In the real world as in the lab, most if not all surfaces are exposed to partial vacuum simultaneously.

Figure 1

Multi-EH shaking of platform representing automobile transport.

Last-Century Methods: Sequential Axis Shaking

The problem today is that while climatic test is by nature simultaneous, testing of dynamic vibrations and shocks often isn't. Why should procurement agencies continue to condone last-century testing? Why should laboratories continue to waste time and money shaking test hardware first in its X axis, then its Y, then finally in its Z axis? That common sequential-axis testing, familiar to generations of test engineers and

technicians, is time consuming and labor intensive. It's detrimental on a number of levels. It means paying for three tests and paying for three fixtures. Further, it necessitates much potentially harmful handling. Worse, sequential-axis testing is not as effective nor as quick at finding product weaknesses as simultaneous multi-axis testing.

Two words—"simultaneous" and "multi-axis"—are very important when specifying a dynamic (vibration and shock) test for equipment intended for use aboard military and commercial land, sea and air vehicles. The new Test Method 527 (multi-exciter testing) in the late-2008 "G" revision to the venerable MIL-STD-810 was overdue, but certainly is welcome.

Land Vehicle Simultaneous Multi-Axis Shaking

Only single-axis-at-a-time shaking was possible with mechanical shakers prior to 1950, limited typically to 10 to 55 Hz. Wider frequency range (typically 10 to 200 or to 500 Hz) EH or electrohydraulic (servohydraulic) shakers also are single axis. However, automotive test engineers long ago combined three or more EH shakers for multi-axis shaking, replicating, for example, damaging railroad transport inputs. So did seismic test engineers, replicating multi-axis earthquake inputs to buildings.

In Figure 1 are multiple EH shakers creating realistic simultaneous multi-axis railroad transport vibrations on a laboratory vibrating platform. Nearly every automobile manufacturer has such a vibrating platform. Why? Because new automobiles suffered railcar-induced damage (surprises) en route to dealer showrooms. It is far cheaper to find railcar-induced weaknesses before a new model automobile goes into production.

Nearly every automobile manufacturer also has a setup in which multiple EH shakers drive the four wheels in a manner that represents various road inputs that relate to various road and off-road conditions and various vehicle maneuvers at various speeds. It is far better to find roadway-induced weaknesses before a new model automobile goes into production. Reductions in warranty expense far more than pay for testing.

Figure 2

Three electrodynamic shakers at Army Research Lab.

Higher Frequency Simultaneous Multi-Axis Shaking

Testing to 2,000 Hz is desired for aircraft and missile hardware, also for engine-mounted hardware. This necessitated the development of ED or electrodynamic shakers. In operating principle these resemble electrodynamic loudspeakers. ED shakers are driven by power amplifiers under specialized computer control.

At relatively few U.S. military establishments, three or more ED shakers have been on-site combined for simultaneous multi-axis shaking. Figure 2 was taken at the Army Research Lab, Adelphi, Maryland, after two ED shakers were added. Earlier, with just one shaker, some field failures could not be replicated in the lab. After adding two more shakers, those field failures were replicated. More recent multi-exciter ED shaker systems include White Sands Proving Ground in New Mexico, Hill Air Force Base in Utah (Figure 3) and Keyport Naval Undersea Warfare Center in Washington State. Experience at those facilities led to the new Test Method 527 (Multi-Exciter Testing) mentioned earlier.

The system at Hill AFB in Utah involves eight ED shakers. The four vertical-thrusting units provide thrust-axis translation, also pitch and yaw, to the aerospace load above them. The two pairs of horizontal-thrusting units (one shaker omitted) provide vertical and lateral translation. Note that each pair is deliberately misaligned in order to provide rotation to that load.

At those military facilities, individual ED shakers were contractor on-site combined, at considerable engineering development and much labor expense, over many months.

Multi-Exciter Systems

At least two Japanese firms are supplying factory-assembled arrays of three ED shakers to Japanese automobile manufacturers. One such system, Figure 4, was purchased by Spectrum Technologies, a commercial environmental testing laboratory at Redford, Michigan; their multi-axis shaking service is being used by Detroit-area firms that provide on-en-

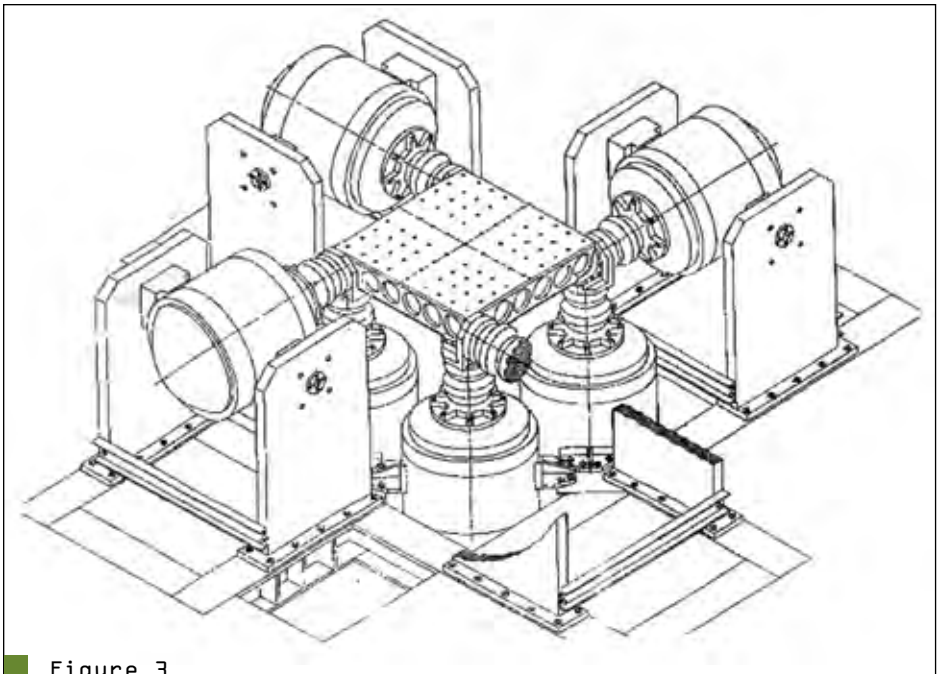


Figure 3

Eight electrodynamic shakers combine to provide three orthogonal and three rotational vibratory motions to aerospace load. *(Courtesy Boeing and USAF Hill AFB).*

Figure 4

Multi-axis system of three ED shakers. *(Courtesy of IMV and Spectrum Technologies).*

gine electronics and other hardware.

Over-the-road vibration data is acquired from three accelerometers, one sensing fore-and-aft motions, one sensing left-right motions, and one sensing vertical motions (almost always the most severe. Alternately, one three-axis (or "triax") accelerometer can be used. X, Y and Z accelerometer signals are recorded, later edited and still later fed to a specialized computer that controls the motions of the X, Y and Z shakers that together drive hardware being tested. A three-shaker system will be approximately three times the price of a one-shaker system. But finding just one weakness in the lab, rather than having an influential customer find it later, in service, can more than pay for the system.

Is there a less-expensive way to get simultaneous multi-axis vibration? One approach is to use multiple inexpensive pneumatic hammers, on various compass headings, angled up into a softly sprung rather flexible platform that forms the bottom of a thermal chamber. Devices to be tested (DUTs) are mounted on to the top of that platform. They thus receive not only multi-axis vibration but also varying-temperature stress. A major drawback is lack of vibration intensity control, in the wide variation in vibration intensity received by the units being tested.

Breaking Some Hardware

Rugged hardware is not developed overnight. Early units must have failed, in service or in the test lab. Root causes of those failures must have been sought, found and eliminated, as proven by subsequent tests. Much can be learned from failures. Just passing a spec or a standard is not sufficient. The industry needs to go further and be surprised. It is far better to be surprised in the lab than in the field, perhaps in combat.

It costs little to "go beyond the standard." When a system developer has already paid for the use of the shaker, paid for the fixture and installed your DUT (device under test) in the fixture, on the shaker, why not apply more force? Or extend the frequency range? Perhaps both, until something fails? Not only will root cause failure analysis identify the weak link, but it will also provide the data on the intensities at which the hardware survived. ▮▮

Equipment Reliability Institute
Santa Barbara, CA.
(805) 564-1260.
[www.equipment-reliability.com].

Memory Allocation Strategy in Safety-Critical Mil Systems

Military system developers are prone to either over- or underestimate memory requirements. Dynamic allocation helps right-size such efforts and keeps the system on schedule and on budget.

Steve Graves, Co-founder and CEO
McObject

Developers of embedded software for military and aerospace projects often lack the luxury of knowing the exact amount of memory that program variables will require at runtime. In C/C++, this usually doesn't matter. These languages popularized dynamic memory allocation, a powerful feature that hands out memory "as needed" at runtime. In its absence, static memory must be declared prior to compilation. Developers often underestimate memory requirements, putting unreasonable restrictions on what the program can handle, or overshoot, which wastes memory. By avoiding this, dynamic allocation provides both convenience—which contributes to meeting defense projects' tight development schedules—and economy. The economy of it helps in completing work at or under budget.

But dynamic memory allocation is also risky, carrying the threat of memory leaks and fragmentation that are unacceptable in safety-critical military embedded code. Because of these threats, the DO-178B standard, developed by the Radio Technical Commission for Aeronautics (RTCA), mandates that "Software Design Standards should include… constraints on design, for example, exclusion of recursion, dynamic objects, data aliases and compacted expressions." The "dynamic objects" in this quote refers to objects created in the application through dynamic memory allocation, and thus bans the technique.

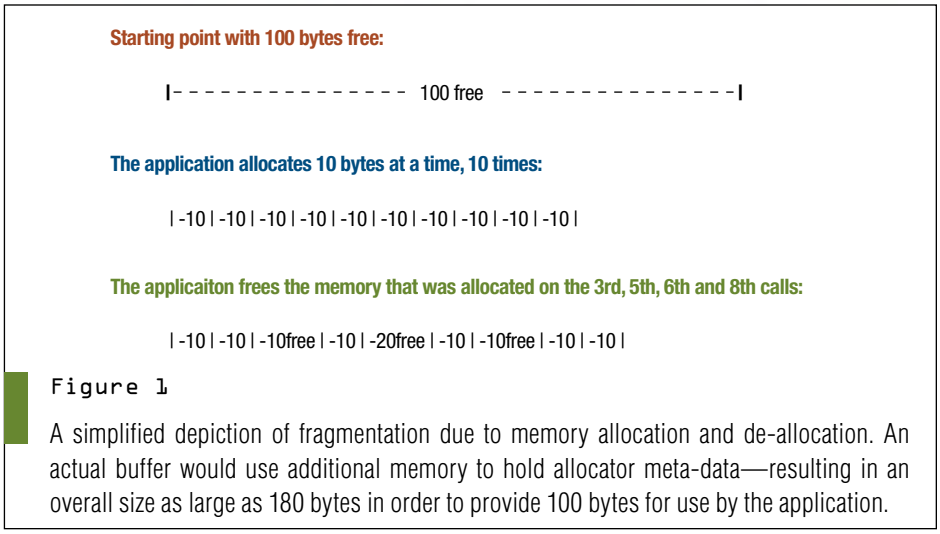


Figure 1

A simplified depiction of fragmentation due to memory allocation and de-allocation. An actual buffer would use additional memory to hold allocator meta-data—resulting in an overall size as large as 180 bytes in order to provide 100 bytes for use by the application.

DO-178B Compliance

DO-178B compliance is a requirement for many civilian and military software projects, specifically in avionics, such as navigation, communications, collision avoidance, monitoring, flight control and other systems of military aircraft. The question is: Does a ban on dynamic memory allocation—in order to comply with DO-178B, or simply out of concern for safety and reliability—relegate developers of safety-critical code for fixed- and rotary-wing aircraft to the "dark ages" of static allocation? Presented here are solutions that enable military embedded systems applications to gain the benefits of dynamic memory allocation—simplified programming and more efficient memory

TALON 4

RUGGED, HIGH-PERFORMANCE RAID STORAGE

WITH INNOVATIVE, REMOVABLE DRIVE PACKS AND SBB 2.0 COMPLIANT CONTROLLERS.

- Two easily removable drive packs, each capable of transporting up to 6TB of data (using 1TB SATA drives)
- Hermetically sealed drive packs to ensure operation to altitudes of 41,000 feet (12,496 Meters)
- Rugged and fully field deployable in harsh environments
- Sustained data transfer rates of over 300 MB/s per controller

Part Number: OSS-TALON4

ROBUST DATA PROTECTION AND MANAGEMENT

TALON 4 offers multiple levels of user-selectable RAID configurations, which provide the highest level of protection and performance. A host-based management utility with remote management provides detailed configuration and status monitoring options.

ONE STOP SYSTEMS

CALL TODAY

(877) 438-2724

www.onestopsystems.com

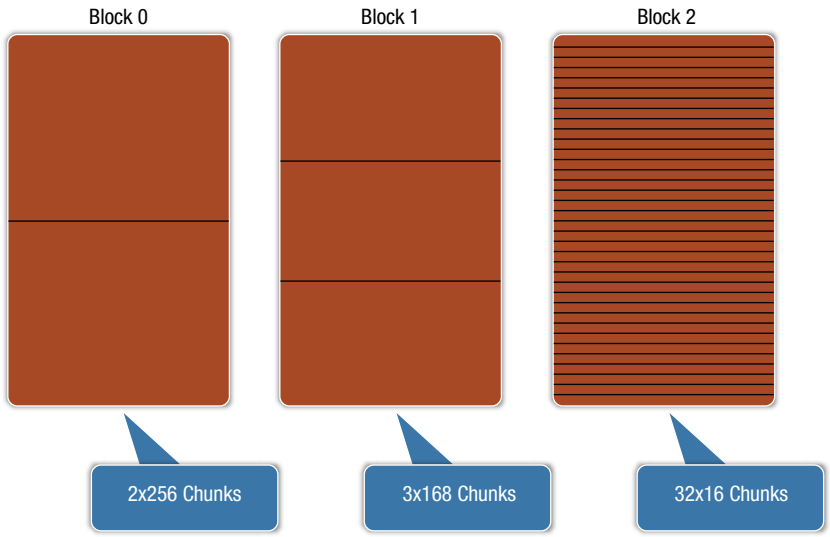


Figure 2

A block allocator can maintain lists of different-sized elements.

use—while eliminating the risks of relying on the C/C++ runtime's implementation of the feature.

Normally, the C runtime library provides malloc() and free() APIs that allow applications to allocate and release memory. Application developers tend to use these functions liberally. The greatest risk is failure to diligently free allocated memory when it is no longer needed, resulting in growing areas of unavailable memory (leaks). Fragmentation is a related problem, illustrated in Figure 1. The application starts out with 100 bytes free, allocates 100 bytes, and de-allocates 40 bytes.

Because of fragmentation, if the application needs to allocate 30 bytes, it can't. There is no free section that large, even though 40 bytes are free in the aggregate. Standard memory management routines in C/C++, which are typically limited only by the amount of physical memory available, can bring this about on a wide scale. Both fragmentation and leaks can cause the system to bog down and eventually fail as it tries (sometimes unsuccessfully) to find memory resources.

'Boxing In' Memory Management

Developers can head off risks by taking away responsibility for memory management in safety-critical tasks from malloc and free and assigning it to the application. The developer replaces the

standard allocator with a custom allocator that sets aside a buffer for the exclusive use of that task, and satisfies all memory allocation requests out of that buffer. If the memory reserved for this buffer is exhausted, the application is informed, and can then free up memory within the buffer or find more memory to devote to the task. Exhausting the memory in this dedicated pool has no impact on other parts of the system.

In fact, avoiding general-purpose allocators is a good strategy for military embedded systems generally (and not just for the avionics projects covered by DO-178B), because such allocators often introduce unpredictability, use memory inefficiently and are too slow. They're usually based on a list allocator algorithm that organizes a pool of contiguous memory locations—often called free holes—into a singly linked list.

To service a request, the allocator traverses the list looking for a large enough hole, using lookup strategies such as first-fit—walking the list from the beginning to find the first available hole; next-fit—searching from where a previous search left off; best-fit—searching for the smallest block large enough to satisfy the request; and quick-fit—the allocator uses its own list of common memory sizes to quickly allocate a block. These strategies are designed to satisfy many application scenarios, but in the end, they all introduce fragmentation.

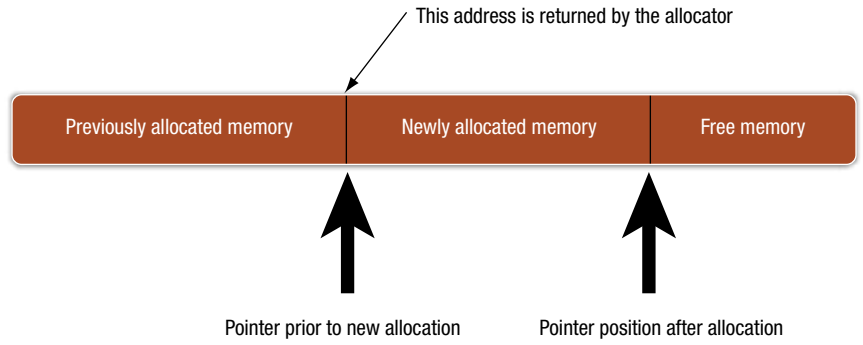


Figure 3

With a stack allocator, the address of the current position of the stack pointer is returned with each allocation, and the pointer is advanced by the amount of the allocation request.

Block Allocation

In contrast, custom allocators typically focus on the specific allocation patterns used by the system. For example: block allocators. The allocator is given a quantity of memory, divides this block into equal-size pieces, and organizes them in a linked-list of free elements. To serve a request for memory, the allocator returns a pointer to one piece and removes it from

Figure 4

In-memory embedded database technology running on Wind River's VxWorks real-time operating system (RTOS) is part of an avionics upgrade for the high-profile Panavia Tornado GR4 multi-role combat jet.

the list. When there are no more elements in the "free list," a new large block can be selected from the memory pool. Freed elements are placed back into the original block's "free list." Since allocated objects are of the same size, there is no need for the block allocator to "remember" each element's size, or to aggregate smaller chunks into larger ones. This minimizes overhead and conserves CPU cycles.

To satisfy several allocation patterns, a block allocator can be combined with some other techniques into a hybrid memory manager. For example, a block allocator can maintain multiple lists of different-sized elements, as in Figure 2. Meanwhile, the blocks themselves, and objects that exceed the lists' maximum "chunk size," can be allocated using a general-purpose allocator. Such techniques can achieve a processing rate that is orders of magnitude higher than the general-purpose malloc().

Stack-based allocators should not be confused with the application's call

Solid-State Disk Drives & Small Form Factor Boards Gallery

Featuring the latest in Solid-State Disk Drives & Small Form Factor Boards technology

USB-AI Series, up to 128 Differential Analog Inputs

- High-speed USB 2.0 device, up to 500kHz sampling rate
- Up to 128 signal conditioned analog inputs, 12 or 16-bit
- Eight input ranges, unipolar or bipolar
- Real-time hardware auto-calibration and oversampling for accurate data
- Wide range of signal conditioning types per channel
- A/D Starts via software, timer or external trigger
- 16-bit programmable counter/timer

ACCES I/O Products, Inc.
Phone: (858) 550-9559
Fax: (858) 550-7322
E-mail: contactus@accesio.com
Web: www.accesio.com

USBP-DIO16RO8: Tiny 16 TTL/LVTTL Digital I/O and 8 Relay Outputs

- 16-channel TTL/LVTTL digital I/O
- Pico-I/O™ module size (60mm x 72mm) & mounting capability
- All 16 I/O lines buffered with 32mA sink/source current capabilities
- 8 Form C electromechanical relays switch 1A
- Custom high-speed function driver
- Alternate embedded USB connector
- All required power drawn from USB port, no external power adapter required

ACCES I/O Products, Inc.
Phone: (858) 550-9559
Fax: (858) 550-7322
E-mail: contactus@accesio.com
Web: www.accesio.com

COMX-CORE Series
COM Express Modules

- Intel® Core™ i5 and i7 mobile dual-core processors
- Up to 8GB DDR3 memory with ECC option
- Gigabit Ethernet, SATA and USB ports
- Dual graphics outputs
- Multiple PCI Express lanes for high speed expansion
- Ideal for high performance applications

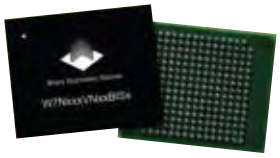
Emerson Network Power
Toll Free: (800) 759-1107
Phone: (602) 438-5720
E-mail: EmbeddedComputingSales@Emerson.com
Web: Emerson.com/EmbeddedComputing

256GB Solid State Drive (SSD)

- 16mm tall package
- SATA 3Gbps interface
- High reliability, single-level cell (SLC) flash
- Ruggedized for high shock, vibration and temperature applications
- Tested to MIL-STD-810F
- DoD, NSA, Army, Navy, Air Force and IRIG erase procedures

SMART Modular Technologies
Phone: (602) 735-0300
Fax: (602) 735-0349
E-mail: customers@smartm.com
Web: www.adtron.com/landing/COTS.html

Secure NAND SSD PBGA



- 4GByte SLC NAND SSD provides fast data erase
- Compact 22mm x 27mm PBGA
- Secure and reliable data storage for embedded military applications in rugged environments
- Supports various PATA interface protocols
- Hardware and software triggered security erase
- Extended temperature environment operation
- 32-bit RISC processor

White Electronic Designs
Phone: (602) 437-1520
Fax: (602) 437-9120
E-mail: info@whiteedc.com
Web: www.whiteedc.com

Structure definition: **(a)**

```
typedef struct_Sensor {
    unsigned int s_id;
    Char sub_nbr [16];
}Sensor_t, *Sensor_p;

Function:

foo()
{
Sensor_p Sensor;

// instantiate a Sensor structure
Sensor = (Sensor_p) malloc (sizeof (Sensor_t) ;

// use it...
Sensor -> s_id = 9999;
strcpy (Sensor -> sub_nbr, "something");

//destroy it when you're done
free (Sensor);
}
```

Class definition **(b)**

```
class Sensor (
    uint4  s_id;
    char <16> sub_nbr;
);

Function:
foo ()
{
MCO_RET rc;
Sensor theSensor:
mco_trans_h t;// transaction handle

// begin a transaction
rc = mco_trans_start (db,
                MCO_READ_WRITE,
                MCO_TRANS_FOREGROUND,
                &t);

// instantiate a Sensor object
// in the in-memory database
rc = Sensor_new ( &t, &theSensor );

// use it...
rc = Sensor_s_id_put ( );
rc = Sensor_sub_nbr_put ( );

// destroy it when you're done
rc = Sensor_delete ( &theSensor );
rc = mco_trans_commit (t);
}
```

Figures 5a and 5b

5a illustrates allocation/de-allocation of sensor data using malloc() and free(). 5b illustrates the same process using an in-memory database system.

stack, but they use a similar concept. With each allocation, the address of the current position of the stack pointer is returned, and the pointer is advanced by the amount of the allocation request (Figure 3). When the memory is no longer needed, the stack pointer is rewound. Overhead is minimized because there is no linked-list (chain) of pointers and it is not necessary to track the size of each allocation or free hole. An important by-product is improved safety: it is impossible to accidentally introduce a memory leak through improper de-allocation, because the application does not have to track individual allocations. Other custom allocators that might be chosen also include a bitmap allocator, a thread-local allocator and others.

Allocation Using an IMDS

The design strategy discussed above—turning responsibility for memory allocation over to the application, replacing the standard allocator with a custom allocator, and satisfying all memory allocation requests out of a dedicated buffer—can also be achieved via third-party code that is integrated with a radar, mapping, flight control and other military electronics. For example, McObject's eXtremeDB in-memory database system (IMDS), used in the example below, was designed to operate in resource-constrained embedded systems, with efficient custom algorithms for allocating precious memory and no reliance on the general-purpose C runtime allocator.

Last fall, BAE Systems chose McObject's eXtremeDB in-memory embedded database running on Wind River's VxWorks real-time operating system (RTOS) as part of an avionics upgrade for the high-profile Panavia Tornado GR4 multi-role combat jet (Figure 4). The database will help the aircraft improve its ability to perform a wide variety of missions, during day or night, through advanced radar, mapping and navigation technology that allows low-level flying even when poor weather prevents visual flight.

Figure 5a illustrates allocation/de-allocation of sensor data using malloc() and free(). Figure 5b illustrates the same process using eXtremeDB. Sensor data plays a key role in military avionics—today's aircraft have been accurately referred to as "sensor platforms" for the profusion of such technology—and also can figure prominently in more general military applications such as battlefield surveillance and enemy tracking.

At the start of Figure 5a, a C program defines a structure, usually in a header file. Within a function, the program declares a pointer to an instance of that structure and allocates memory for it via malloc(). When the program/function is done with the structure, memory is returned to the heap with a call to free().

Defining Classes

With eXtremeDB, the programmer defines a class or classes in a database schema file, and pre-processes the file with a schema compiler that produces a .C and a .H file. The .H file contains type definitions (typedefs) and function prototypes for working with the defined classes. The code in Figure 5b defines a class called Sensor and declares an instance of Sensor (theSensor) in the function body, along with a variable to hold return codes, and a handle to a transaction.

If the program that uses malloc/free is multi-threaded and threads will share the Sensor object, the developer must implement concurrency control to regulate access to that object. With an in-memory database, concurrency control is automatic: interaction is carried out in the context of a database transaction, which guarantees atomicity (everything within the scope of the transaction succeeds or fails together) and isolation (transactions execute separately).

In Figure 5b, the function mco_trans_start begins a transaction. mco_trans_start is given a handle to a database (returned from mco_db_open, not shown), the transaction type (in this case read-write), priority level, and the address of the transaction handle to be returned to the program.

Upon beginning a transaction, the program calls Sensor_new(), which creates space in the in-memory database for a new Sensor object. The arguments are the transaction handle returned from mco_trans_start and the address of a handle to a Sensor object. This is the functional equivalent of malloc() in the C program.

Leveraging Interfaces

Unlike malloc(), Sensor_new() returns a handle to an object in the database. So whereas the C program works directly with the structure's member fields, the eXtremeDB-based program works through the interfaces generated by the schema compiler, for instance Sensor_s_id_put() and Sensor_sub_nbr_put().

When the C program in Figure 5a is finished with the Sensor structure, free() returns memory to the heap. When the eXtremeDB-based program is finished, the space in the database is relinquished by the call to Sensor_delete(), which passes in the handle of the object to be removed from the database, and ends the transaction (mco_trans_commit()). (Both examples omit error handling, for brevity.)

While the database, like the program as a whole, can run low on memory, this would result in a "database full" error message that can be dealt with programmatically, rather than the much more dangerous and unpredictable scenario of heap memory fragmentation and leakage—which is obviously unacceptable in safety-critical military systems. Meanwhile, the allocation/de-allocation accomplished by the IMDS relies on custom allocators optimized for the given pattern of allocation.

The custom allocators work with memory that was dedicated to the in-memory database, but eXtremeDB doesn't care how the memory is obtained. It could be global memory, heap memory, or in a flat memory model architecture (such as VxWorks 5.5), just a dedicated region of memory in a fashion similar to a video buffer or keyboard buffer. Using the IMDS retains the advantages of dynamic memory allocation while avoiding the DO-178B proscription on it. ■■

McObject
Issaquah, WA.
(425) 888-8505.
[www.mcobject.com].

Technology Focus

Conduction-Cooled cPCI Boards

Conduction-Cooled cPCI Lands a Secure Place in Military Systems

Firmly established now as a here-to-stay option for embedded military computing, CompactPCI continues to maintain a secure market niche. Like VME, cPCI's ecosystem has grown to offer a wide set of board-level solutions.

Jeff Child,
Editor-in-Chief

Now with over eighteen years of experience under its belt, CompactPCI can claim to offer all the factors that attract military decision makers. An expanding set of conduction-cooled CompactPCI boards has emerged, some even from outside the usual crowd of conduction-cooled board makers. These include a vast and growing collection of cPCI products that are available from a variety of vendors in every category including single board computers, I/O boards, slot-card power supplies, storage subsystems, mezzanine carriers, DSP engines and many others. The "Conduction-Cooled cPCI Boards Roundup" on the following pages showcases some examples of the current crop of conduction-cooled cPCI single board computer products. While cPCI isn't ever expected to eclipse the legacy of VME in the military market, its niche remains solid.

Meanwhile, the PCI Industrial Manufacturers Group (PICMG) continues to develop performance upgrade paths for cPCI, such as PICMG 2.16 and CompactPCI Express. Most recently, PICMG last month adopted the PICMG 2.30 specification, called CompactPCI PlusIO. This new specification adds PCI Express, Ethernet, SATA, SAS and USB extensions to the CompactPCI family of specifications, while preserving PCI bus connectivity. The specification defines the use of previously reserved rear I/O pins for the 64-bit CompactPCI system slot with new high-speed serial signals to preserve interoperability with existing CompactPCI standards.

The attraction to CompactPCI—particularly in its 3U size—is striking in military applications where the mix of size constraints and demand for sturdy slot-card-style ruggedness is called for. In many case, 3U CompactPCI is delivered to customers in complete integrated systems—a trend that melds nicely with the emergence of "stand-alone rugged box systems" as a product category among military embedded board vendors. Also fueling that trend is consolidation in this industry to the point were the larger corporations can provide the entire computer, I/O and enclosure needs themselves.

In the past couple years, a growing number of vendors have made public announcements of military and aerospace design wins for their conduction-cooled cPCI products. And considering that many such wins aren't made public, it's clear that cPCI is enjoying a lot of adoption in military and aerospace system designs. Embedded computers and the payload interface unit aboard the MQ-8B Fire Scout (Figure 1) are 3U CompactPCI boards supplied by GE Intelligent Platforms.

Figure 1

Embedded computers and the payload interface unit aboard the MQ-8B Fire Scout are 3U CompactPCI boards supplied by GE Fanuc Intelligent Platforms.

CompactPCI is also playing a major role in the Navy's Aegis Modernization (AMOD) program. The effort involves both software and technology insertion hardware upgrades running through fiscal year 2012. General Micro Systems' 2.16 GHz conduction-cooled cPCI board was chosen as a processor for the program. AMOD is an upgrade to the Aegis Weapon System (AWS), the automated segment of the Aegis Combat System (ACS), which will satisfy the anti-air warfare and ballistic missile defense (BMD) mission requirements on Aegis cruisers and destroyers. ▮▮

New Aitech NightHawk RCU™ Controller:

Better SWaP with fewer tradeoffs.

Harness improved processing and SWaP efficiency in the free air-cooled Aitech NightHawk RCU™. The NightHawk is a PC-based, rugged processing and I/O controller unit ideal for demanding defense, aerospace or rugged commercial environments including manned/unmanned ground or airborne vehicles, as well as Data Concentrator Unit (DCU) or Remote Interface Unit (RIU) applications.

*Minimize weight...*at just 4.5 lbs., this space-saving unit delivers exceptionally efficient SWaP performance in a slim-profile 195-in.^{3} package.

*Expand I/O versatility...*including 18-36 vdc input, a complete set of standard PC I/O interfaces, video camera input and dual independent video outputs for true hi-def XGA and standard TV displays, plus extensive internal expansion support to add peripheral I/O interfaces for military/industrial embedded apps.

*Enhanced processing efficiency...*with a low-power Intel® Atom™ (Navy Pier) 1.6 GHz RISC microprocessor, 2 GB DDR2 SDRAM and 8 GB SSD memory, plus optional CompactFlash or 250 GB Solid State Disk (SSD) storage.

*Take rugged to greater extremes...*with an environmentally sealed, extruded aluminum housing in an innovative convection/radiation cooling design that dissipates more than 22 W at +55°C. Along with military standard 38999 connectors, the sealed NightHawk protects against windblown fine dust and sand particles, while numerous EMI/RFI features meet MIL-STD 461 emission and susceptibility limits, in a shock-, vibration-, and corrosion-resistant design for harsh mechanical, climatic, chemical and electrical environments.

*Maximize your options...*with the flexibility to configure the NightHawk RCU™ into the control unit you need it to be. Contact us today for detailed power and I/O specifications.

Photography Courtesy of Lockheed Martin

Aitech Defense Systems, Inc.
19756 Prairie Street
Chatsworth, CA 91311
email: sales@rugged.com
Toll Free: 888-Aitech8 - (888) 248-3248
Fax: (818) 407-1502
www.rugged.com

Technology Focus:
Conduction-Cooled cPCI Boards

6U cPCI Blade Does Extended Temps and Conduction Cooling

The Core2 Duo processor quickly became the most widely used multicore processor, and the military embedded space was quick to join the party. The cPCI-6880 from Adlink Technology is a series of 6U CompactPCI blades featuring the 45 nm Intel Core2 Duo processor T9400 with a 2.53 GHz core speed, 6 Mbyte L2 cache, 1066 MHz FSB and a 40W typical total power consumption. The board uses the latest Mobile Intel GM45 Graphics Memory Controller Hub, supporting dual-channel DDR2-800 SDRAM on one SO-DIMM socket and an optional 4 Gbytes of soldered onboard memory for a maximum of 8 Gbytes.

By balancing computing performance and power consumption in a CompactPCI blade for the embedded market, the cPCI-6880 is targeted for transportation, military and mission-critical applications thanks to its soldered memory and optional extended operating temperature range of -20° to +70°C. To meet the needs of applications in harsh environments with extreme thermal range, vibration, shock or other stresses, a rugged conduction-cooled version, the CT-60, with the same electronic design as the cPCI-6880 will be available in Q4 of 2009. The cPCI-6880 Series accommodates a 2.5-inch Serial ATA hard drive directly mounted on the SBC and RTM, an optional CompactFlash slot and built-in 4 Gbyte USB NAND flash for additional storage options. The cPCI-6880 is available at a list price of $2,299.

ADLINK Technology

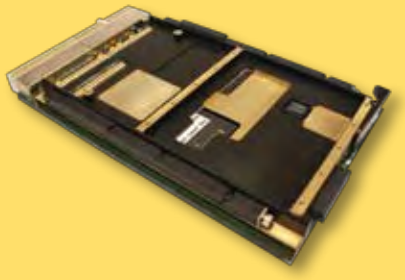
San Jose, CA.

(408) 360-0200.

[www.adlinktech.com].

Rad-Hard 3U cPCI Board Does 1 GHz under 10W

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



To protect onboard memory resources from radiation effects, the S950-02 incorporates 128 Mbytes of triple-redundant SDRAM with three bits per cell. On the rad-tolerant FPGA, a voting mechanism performed only on the read cycle allows for data correction before sending to the CPU or PowerPC bus. One Mbyte of dual-redundant boot flash stores the onboard Boot firmware and ensures full data integrity in the event of corruption during the boot-up sequence.

Aitech Defense Systems

Chatsworth, CA.

(888) 248-3248.

[www.rugged.com].

DSP Card Marries TigerSHARCs and FPGA

FPGAs and DSPs working together form a powerful weapon for advanced signal processing applications. Exemplifying that trend is BittWare's GT-3U-cPCI (GT3U), a ruggedized 3U CompactPCI board that has been designed for demanding multiprocessor-based applications. The GT3U features a large Altera Stratix II GX FPGA, one cluster of four ADSP-TS201S TigerSHARC processors from Analog Devices, a front panel interface supplying four channels of high-speed SerDes transceivers, and a back panel interface providing RS-232/RS-422 and 10/100 Ethernet. Simultaneous on-board and off-board data transfers can be achieved at a rate of 2 Gbytes/s via BittWare's ATLANTiS framework implemented in the Stratix II GX FPGA. The board also provides a large amount of onboard memory including 1 Gbyte of DDR2 SDRAM or 64 Mbytes of QDR SDRAM, as well as 64 Mbytes of flash memory for booting the FPGA and DSPs.

The GT3U features a single cluster of four ADSP-TS201S TigerSHARC DSPs, which are interconnected by a 64-bit cluster bus running at up to 100 MHz. The ADSP-TS201 processor operates at up to 600 MHz, providing 3.6 Gflops of peak processing power. Because of its superscalar architecture, the ADSP-TS201 is also efficient at fixed-point processing, with each DSP supporting 14.4 Bops of processing. Along with 24 Mbits of on-chip RAM, each DSP also boasts four high-speed LVDS link ports. Each full-duplex link port is comprised of a 4-bit transmit and a 4-bit receive channel, and can support up to 500 Mbytes/s in each direction for a total maximum throughput of 1 Gbyte/s.

BittWare

Concord, NH.

(603) 226-0404.

[www.bittware.com].

6U SBC Serves Up 2.26 GHz Core 2 Duo processor

The multicore processor trend has quickly entrenched itself into military embedded system design. Feeding that need, Concurrent Technologies offers its 6U CompactPCI SBC based on Intel's 45nm process technology. The PP 531/06x, a single slot 6U CompactPCI processor board ,uses the latest high-performance mobile dual core processor from the Intel embedded roadmap, the 2.26 GHz Intel Core 2 Duo processor SP9300 or the 1.86 GHz Intel Core 2 Duo processor SL9400. The board is ideal for CPU-intensive processing applications whereby the processor's dual cores can access up to 8 Gbytes of onboard soldered DDR3 dual channel SDRAM at up to 16 Gbytes/s.

The PP 531/06x is based on a platform consisting of the 2.26 GHz Intel Core 2 Duo processor SP9300 or the 1.86 GHz Intel Core 2 Duo processor SL9400, the Intel GS45 Graphics Memory Controller Hub and the Intel I/O Controller Hub 9M-E. The dual core processors offer a large shared last level cache (6 Mbytes), 1066 MHz Front Side Bus, improved power management and support 64-bit operating systems.

The Mobile Intel GS45 mobile class chipset accesses up to 8 Gbytes DDR3-1066 soldered dual channel SDRAM. For I/O, control and data processing flexibility, the PP 531/06x supports two high-performance PMC/XMC sites with front and rear I/O, PICMG 2.16 (Ethernet fabric), PICMG 2.9 (IPMI) and PICMG 2.1 (hot swap). Each PMC site supports up to 100 MHz PCI-X operation as well as x4 PCI Express XMC interfaces; XMC site 1 can also support x8 PCI Express.

Concurrent Technologies

Woburn, MA.

(781) 933 5900.

[www.gocct.com].

Flexible I/O Scheme Enhances 3U Board

Space and weight constraints for embedded technology in military and aerospace applications have created difficult compromises between size and a full complement of I/O. The SCP/DCP-124P from Curtiss-Wright Controls Embedded Computing takes advantage of the compact 3U CompactPCI SBC format and I/O flexibility to overcome these challenges. Utilizing PICMG 2.3, the SCP/DCP-124P routes I/O signals and supports mapping of PMC I/O through the backplane. It features Freescale's Altivec-enhanced 7448 PowerPC supported by 1 Mbyte of internal ECC L2 cache running at core processor speed and up to 1 Gbyte of ECC DDR SDRAM.

The board's cPCI bus operates at 33/66 MHz and supports both 3.3V and 5V signaling. System expansion is provided by an onboard 64-bit, 100 MHz PCI-X-capable PMC site. The SCP/DCP-124P is available in both conduction-cooled and air-cooled versions with optional rear transition cable sets to facilitate system integration and development. Conduction-cooling is rated up to -40° to +85°C (Level 200). Ruggedization levels available include L0 and L100 air-cooled, and L100 and L200 conduction-cooled. Storage temperature is -50° to +100°C, and humidity rating is 10 to 95 percent RH non-condensing. Software support includes BSPs for VxWorks 5.5.x/Tornado 2.2.x and 6.x/Workbench 2.x for PowerPC, CWCEC Linux and Integrity. Support is also provided for SSSL, Curtiss-Wright's Altivec-optimized signal processing library. Pricing starts at $6,030.

Curtiss-Wright Controls

Embedded Computing

Leesburg, VA.

(703) 779-7800.

[www.cwcembedded.com].

6U SBC Delivers 2.16 GHz Core 2 Duo

Compute density is the goal of many of the latest military embedded computer applications. Along those lines, Dynatem is now shipping the Intel Core2 Duo-based CRD CompactPCI/PICMG 2.16 SBC. The CRD is a 6U single-slot CompactPCI-compatible platform based on the Intel low-power Core2 Duo processor. The CRD takes advantage of the L7400 Core2 Duo's low power consumption as a rugged SBC. Versions supporting the T7400 2.16 GHz Core2 Duo are also available. The CRD is a conduction-cooled module with wedge locks and a full-board heat sink for high shock/vibration environments and temperature extremes. Extended temperature and versions with conformal coating are available.

The CRD comes installed with 2 Gbyte or 4 Gbyte DDR2-400 memory, supporting ECC. Memory is BGA for the best shock/vibration spec. The E7520 Memory Controller Hub (MCH) and 6300ESB I/O Controller Hub (ICH) chips support PCIe and PCI-X expansion, respectively. Two or four onboard Gbit Ethernet ports are controlled by two PCI Express-based 82571EB dual 10/100/1000BaseTX controllers. Two Ethernet PICMG 2.16-compliant Gbit Ethernet ports are routed to the backplane. Standard conduction-cooled CRD boards have no front panel I/O due to the cooling plates. A special version has been developed with additional 2 Gbits of Ethernet routed through the front cooling-plates. The two onboard PMC mezzanine card interfaces are accessed through the 6300ESB's 64-bit PCI-X bus. One of the two PMC sites also accommodates an XMC module supported by x8 PCIe. Pricing for the CRD starts at $6,938 in single quantity.

Dynatem

Mission Viejo, CA.

(949) 855-3235.

[www.dynatem.com].

SBC Sports Core2 Duo Processor, Dual PrPMC/XMC Interfaces

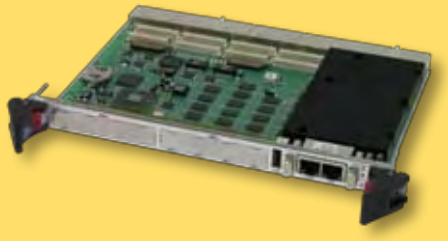
The multicore trend has hit every corner of embedded computing, and the military is no exception. Extreme Engineering Solutions is now shipping the XCalibur4101, a 6U CompactPCI single board computer featuring the Intel Core2 Duo processor and a ruggedized, conduction- or air-cooled design, making it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

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

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

2.53 GHz Intel Core i7 Climbs Aboard CompactPCI

Not long ago, there was a significant gap between when the latest and greatest desktop processors hit the streets and when the military embedded market started to design them in. That gap is gone now, the latest example being the Intel i7 CPU. Along just those lines, GE Intelligent Platforms has announced its CT12 6U CompactPCI high-performance single board computer. Based on the latest 2.53 GHz Intel Core i7 (Arrandale) processor technology and featuring up to 8 Gbytes of DDR3 memory, it is designed to bring high throughput computing and leading-edge performance/watt to a broad range of applications including telecommunications, industrial control, test equipment, server blades, supervisor and monitoring systems, security and surveillance.



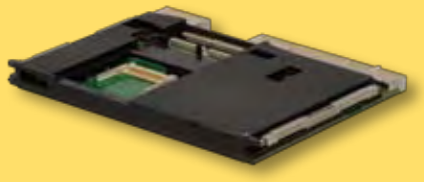
The CT12's high-performance processor is complemented by up to 8 Gbytes of soldered, DDR3 SDRAM. Compared to SO-DIMM solutions, soldered memory offers higher levels of mechanical shock and vibration immunity as well as a higher MTBF figure for the overall assembly, contributing to the high reliability of the CT12. Also provided is up to 16 Gbytes of soldered non-volatile flash memory, which is able to hold complete operating systems or application code, substantially increasing overall system speed.

Four Gbit Ethernet ports (two front, two rear) are provided by the CT12 to support intensive networking without the need to add mezzanine modules, reducing cost. Also provided are two PMC/XMC sockets, five USB 2.0 ports, two VGA and DVI ports, three COM ports, and three SATA interfaces, giving maximum connectivity and configuration flexibility.

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

6U 2.16 GHz Core 2 Duo Board Boasts Health Monitoring

An increasing number of military applications are requiring computing that can operate autonomously. That means the system has to monitor its own health. With that in mind, General Micro System's "2nd Coming" is the industry's first 6U, 2.16 GHz Core 2 Duo, Conduction-Cooled cPCI SBC to provide full System Health Monitoring and reporting to meet all PICMG 2.9 specifications, while adding a slew of additional health monitoring and reporting system status to an external device.



The CC276 supports up to 4 Gbytes of 667 MHz DDR-2 memory and vast onboard I/O. The standard I/O included are dual Gbit Ethernet on PCIe bus with TCP/IP Offloading Engine, dual IDE, quad SATA with RAID (0, 1, 5, 10 and 50) capabilities, five USB-2.0, 1 Mbyte of user/Boot flash and two serial ports. Additional standard I/O included are: one PMC/XMC site with rear I/O, 16 bidirectional Digital I/O lines and dual COM ports with RS-232/422 buffers (jumper selectable). The C276 module is fully compliant to IEEE Std. 1101.2 and ANSI/VITA 2-0 2001. The 2nd Coming operates from -40° to +85°C at the rails with relative humidity of 5-95 percent at 40°C, and may be exposed to shocks of up to 100g for 5 ms, or 40g for 11 ms in 3 axis. The 2nd Coming supports extremes; vibrations range from 5 Hz to 2 KHz for up to 30 minutes at 15g RMS in each axis.

General Micro Systems

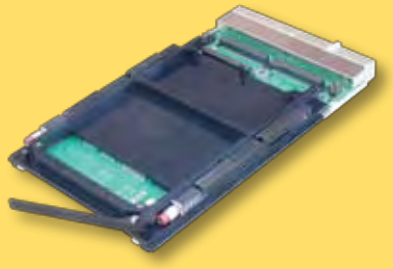
Rancho Cucamonga, CA.

(909) 980-4863.

[www.gms4sbc.com].

Rugged Conduction-Cooled 3U cPCI Board Sports PowerPC

CompactPCI, particularly in its 3U flavor, is now entrenched as an accepted military embedded computer form factor. Kontron offers a new PowerPC-based Rugged Conduction-Cooled (RC) board. The Kontron CP3210 provides a faster clock rate of 733 MHz, accelerated DDR SDRAM (266 MHz, + 33.3 %), double the amount of system and user flash and a Gigabit Ethernet port for faster data throughput and overall greater system performance. The Kontron CP3210 CompactPCI CPU board is an enhanced version of the highly reliable and powerful Kontron PowerEngineC7.



The Kontron CP3210 CompactPCI CPU board offers an extensive range of standard functions and expansion options including the new powerful PowerPC G3 750FX RISC processor clocked at 733 MHz, onboard user memory of 512 Mbytes DDR SDRAM with ECC clocked at 266 MHz, 128 Mbytes of system flash memory, 256 Mbytes of user flash memory and 128 Kbytes of nvSRAM with realclock. It also offers two onboard serial lines, two Ethernet channels—one Gigabit and one 10/100 as well as one 33/66 MHz PMC expansion slot. The Rugged Conduction-Cooled (RC) design of the Kontron CP3210 enables reliable operation in temperatures ranging from -40° to +85°C according to VITA 47 recommendations.

Kontron America

Poway, CA.

(858) 677-0877.

[www.kontron.com].

3U cPCI SBC Provides MPC8548 and Conduction Cooling

Power architecture processors like the MPC8548 enjoy a strong legacy in military applications. MEN Micro provides a 3U CompactPCI board with conductive cooling. Particularly designed for application in harsh environmental conditions, the new F50C is based on Freescale's MPC8548 with clock frequencies between 800 MHz and 1.5 GHz. The 3U CompactPCI single board computer supports rear I/O and comes with a specially designed CCA frame for conductive cooling by standard. This frame gives the card 5 HP in size and allows the SBC to be used in MEN's conductive-cooling housing in a temperature range of -40° to +85°C. With front I/O and a heat sink for convection cooling, the F50P sister board is also available for application in common 19-inch systems.

The F50C has 2 Gbyte ECC DDR2 SDRAM main memory, a 16 Gbytes solid-state flash disk (SSD) for application data and an industrial FRAM and SRAM. The single board computer supports up to three Gbit Ethernet channels, four USB ports, up to 2 SATA interfaces and a multitude of user-definable functions inside its FPGA. These may include graphics, touch, serial and fieldbus interfaces as well as binary I/O—depending on the needs of each application. All of the F50C's interfaces are accessible via the J2 rear I/O connector. All components of the F50C are firmly soldered against shock and vibration. In addition, the card is ready for coating against dust and humidity.

MEN Micro

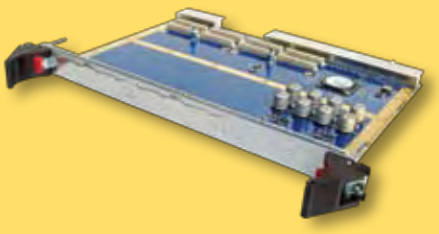
Ambler, PA.

(215) 542-9575.

[www.menmicro.com].

CompactPCI Carrier Board Supports High-Power PMCs

Mezzanine functions such as 10 Gbit Ethernet, PMC I/O or FPGA PMC modules require more power than the typical PMC mezzanine. With that in mind, Xembedded LLC, a XycomVME Company, has announced the XCPC-9200 CompactPCI Dual Carrier module. This new CompactPCI Dual PMC Carrier module provides 25 watts of power to each PMC site. The XCPC-9200 is well suited for 10 Gigabit Ethernet, PMC I/O or FPGA PMC modules requiring more than the standard 12 watts of power supply outlined in the IEEE- P1386.2001 specification. Using the industry standard PLX PCI-6540 PCI-X-to-PCI-X transparent bridge, the XCPC-9200 supports the PMC and CompactPCI interface with a 32/64-bit data path and bus speeds of 66/133 MHz on the PMC sites and 33/66 MHz on the CompactPCI bus.



The XCPC-9200 functions well in both 3.3VI/O and 5VI/O backplanes. The PMC sites support 3.3VI/O. XCPC-9200 is available in conduction-cooled, -40° to 85°C and air-cooled -25° to 70°C versions. The XCPC-9200 offers both front and rear-panel I/O support in a standard 6U CompactPCI. An optional rear transition module, XCPC-9092, is available to distribute the rear I/O to 68-pin SCSI type connectors.

Xembedded

Ann Arbor, MI.

(734) 975-0577.

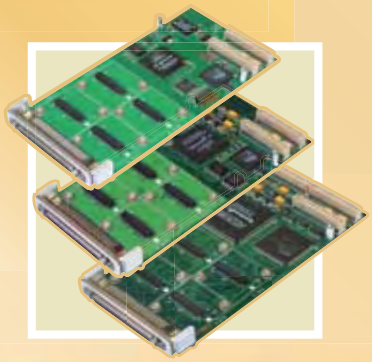
[www.xembedded.com].

Create Your Own PMCs

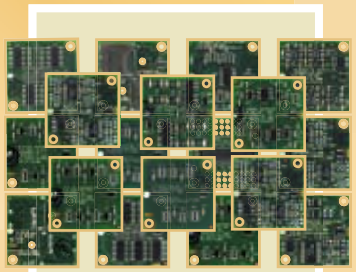
Custom I/O as Easy as 1, 2, 3!

The Technobox ***Micro Mezzanine System***™ is based on a simple idea – provide embedded systems designers with a foundation for innovation and flexibility. Provide a highly-granular, modular architecture featuring a range of configurable FPGA-based carrier boards and an extensive variety of micro mezzanine Electrical Conversion Modules (ECMs) that can be assembled in thousands of combinations. Provide an environment in which a designer can create an array of unique, *future-proofed*, board-level solutions. But without the costs normally associated with custom board development and manufacture, while speeding development and reducing time to market. It's the logical next step in mezzanine systems.

1 Select an FPGA-based Carrier



2 Choose I/O Conversion Modules



3 Assemble with IP Core and ECM Code

Patented

- ***Build Your Own Board by Mixing and Matching Modular Components***
- ***Thousands of Possible Combinations***
- ***Flexible, FPGA-based, Patent-pending Architecture***
- ***Incorporate Multiple Functions on a Single Board***
- ***Design and Build Application-specific, Future-proofed Solutions***
- ***Accelerate System Development, Reduce Time to Market***

To learn more about the Technobox Micro Mezzanine System, visit:

www.technobox.com/mmsintro-fp.htm

Technobox, inc.®

Micro Mezzanine System

Products

SBC Offers A/D Channels, PC/104 Expansion

Board-level functionality that used to require a box full of slot-cards is now possible in a board the size of a napkin. Along such lines, Diamond Systems offers a series of compact, rugged, reliable, low-power systems aimed at high-reliability data acquisition and control applications. Diamond's 2-in-1 small form factor SBCs enable complete systems with built-in data acquisition to stand just 1.7 inches tall.

The ready-to-deploy Octavio systems can be ordered with a range of standard configuration options, including processor type/speed, case height, integrated DC/DC power supply, DIN-rail attachment bracket and integrated data-acquisition subsystem. Octavio is highly shock and vibration tolerant, and operates fanless over an extended temperature range of -40° to +85°C. Its rugged enclosure was designed to eliminate most internal cables, resulting in enhanced ruggedness and reliability in both fixed and mobile environments. Octavio's optional built-in data acquisition subsystem provides sixteen 16-bit A/D channels with up to 100 KHz data conversion rate, 512 or 2048 sample FIFO, depending on model, and autocalibration for maximum accuracy. Octavio's pricing in volume starts below $550 and varies according to SBC choice, flash disk size, case height and other options.

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

Box-Level Server Offers Built-in Carrier Card for I/O

The trend toward stand-alone box systems has swept through the military market. The latest from Acromag is the Model IOS, an Industrial PC that features an internal carrier card to interface a wide selection of related plug-in I/O modules. The interface for up to 192 channels of field I/O is handled through four high-density connectors on the front panel for clean, easy cable access. Advanced thermal technology removes heat without open vents or fans for dependable operation from -30° to 75°C.

The IOS-7400 PC unit features an embedded Intel Atom N270 1.6 GHz CPU with 1 Gbyte of DDR2 RAM that runs on Windows Embedded Standard or Linux. Standard interfaces include VGA graphics, two Ethernet ports, two serial ports, four USB ports, a CompactFlash slot and audio input/output jacks. An internal 2.5-inch PATA hard disk or solid-state drive is accommodated as a user-installed option. More than 20 IOS modules are available and a reconfigurable FPGA module allows users to execute custom logic routines and algorithms on TTL, differential or LVDS I/O signals. Pricing for the I/O Server PC starts at $2,195 while the twenty-plus IOS modules begin at $325 each.

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

COM Express Card Serves Up Higher Graphics Performance

COM Express has moved past the stage of tire-kicking and now has established itself as a here-to-stay form factor. The conga-CS45 from Congatec is a high-performance COM Express compact module featuring the Intel GS45 small form factor (SFF) chipset, which enables significant performance increases despite a smaller footprint and is particularly suitable for mobile applications that require high graphics performance. Hardware implemented decompression for HDTV videos is already integrated in the chipset. In addition, the module offers a large choice of graphics interfaces ranging from SDVO, DVI and HDMI to DisplayPort.

The conga-CS45 is equipped with the latest generation of 45nm Intel processors including the Intel Celeron ULV722 with a mere 5.5W thermal dissipation power (TDP)—the maximum requirement that is rarely reached in practice—or the Intel Core 2 Duo SP9300 with 25W TDP as well as 6 Mbyte secondary cache and a clock speed of 2.3 GHz. The conga-CS45 can be upgraded to a maximum of 4 Gbytes of DDR3 memory with 1067 MHz. Compared to DDR2 memory, DDR3 technology requires approximately 20% less power. Pricing starts at $576.

Congatec, Cardiff-by-the-Sea, CA. (760) 635-2600. [www.congatec.us].

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

Virtex-6 FPGA Module Targets Radar and Telemetry Apps

The latest high-end FPGAs have been a real game-changer for radar and telemetry system designs. Pentek's 71620 module is a multichannel, high-speed data converter XMC that is designed for connection to HF or IF ports for communications, radar and telemetry. The Pentek 71620 analog front end features three Texas Instruments ADS5485 200 MHz 16-bit A/Ds delivering wide dynamic range and an input bandwidth of 350 MHz, ideal for signal intelligence, radar, beamforming and undersampling applications. In addition, a dual channel TI DAC5688 800 MHz 16-bit D/A provides two wideband analog outputs. Built-in 2x, 4x and 8x interpolation filters and a digital upconverter translate real or complex baseband input signals to any IF center frequency up to 360 MHz.

Four separate DRAM banks of 256 Mbytes each are larger than previous designs. These multiple banks offer flexibility in dedicating separate resources to I/O streams and processor requirements, eliminating the overhead associated with arbitrating for a single, shared bank. While synchronous SDRAM offers a fast, extremely dense memory, its architecture shares a data path for reading and writing. The 71620 XMC is designed for conduction-cooled assemblies, and PCIe versions are also available. The 71620 is immediately available starting at $11,500.

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

Vehicle Server Delivers Multicore Processing and Modular I/O

Box-level computers are becoming a mainstay in the defense market. Parvus has announced availability and feature enhancements for its DuraCOR 810-Duo rugged multicore mission processor subsystem. Small quantities of the DuraCOR 810-Duo are currently available for installation in technology refresh and retrofit military and aerospace platforms. The DuraCOR 810-Duo multi-platform MIL-COTS mission computer is based around the Intel L7400 Core 2 Duo processor in a modular PCI-104 expandable system architecture with non-volatile flash storage, MIL-STD power supply and environmentally sealed chassis.

The product can now be ordered with a removable Compact Flash media slot to ease secure data transfer, declassification, servicing, system software updates or storage capacity upgrades. Up to two PATA Compact Flash and one SATA 1.8" Solid-State Disk (SSD) interfaces are supported internally without occupying card slots, as well as one external eSATA interface for rugged Network Attached Storage (NAS). Locking MIL circular connectors bring out Gigabit and Fast Ethernet connections, 6 USB ports, 2 RS-232 ports, Dual Video Display (LCD/VGA), keyboard, mouse and audio signals, as well as an expansion connector for up to 79 signals from optional add-on cards.

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

Rugged Single Slot Graphics Solution Rides VME

Applications such as digital mapping need to render significant amounts of graphics data in close to real time. And distributed aperture sensors need to acquire and process substantial quantities of visual information. Those are the kinds of problems that can be addressed with GE's new high-performance 6U VME rugged graphics platform. The board combines an Intel Core2 Duo processor operating at up to 2.26 GHz, an Nvidia graphics processor (G72 or G73) and a 10 Gbit Ethernet network interface card.

Further leveraging GE Intelligent Platforms' recently announced relationship with Nvidia, the SE 2 provides a complete, self-contained single slot solution, responding to the need to minimize size and weight in space-constrained environments. Use of Intel's latest 'Penryn' processor maximizes performance/watt and allows support of larger memory, while the Nvidia graphics processor is capable of achieving its maximum rated clock speed throughout the rugged temperature range. Standard features of the SE 2 include up to 8 Gbytes of DDR2 SDRAM, four serial ports, six USB 2.0 ports and PS/2 mouse and keyboard ports. The SE 2 is optionally available with a x4 PCI Express interface, an onboard solid-state SATA disk drive and a single channel redundant MIL-STF-1553 interface. Five levels of ruggedization—from benign to conduction-cooled—are available.

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

Multicore Networking Platform Provides 10 Gbit LAN Performance

Net-centric technology is a critical aspect of today's military operations. A 2U server-grade platform uses Intel 5300 Series technology to provide 10 Gigabit Ethernet (2x) and support for a range of high-performance Intel Xeon processors for OEM solutions. Developed for network service applications, the PL-80100 from Win Enterprises features the Intel 5520 chipset (Tylersburg), which supports two socketed processors of the Intel Xeon Processor 5500 Series. The device employs Intel QuickPath Interconnect (QPI), Intel's new point-to-point interconnect technology, to provide high-bandwidth, low-latency communications between the processors and chipset. The chipset delivers up to 32 lanes of PCI Express 2.0.

As a socketed solution, the Intel Xeon processor 5000 series enables outstanding scalability and performance. The processor family ranges across two, four, six, and in 2010, eight processing cores per integrated circuit (IC) die. In the case of the quad-core processor solution, the PL-80100 provides 12 (i.e., three channels per CPU) 1333/1066/800 MHz DDR3 system memory slots that support ECC and parity protection for internal data paths. Two versions of the unit are available. One offers 10x RJ45 LAN ports with eight GbE LAN ports and two ports of 10 GbE performance. The second version offers 24x GbE LAN ports. Pricing in OEM quantities begins at $2,500, not including the processors or memory.

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

6U VME SBC Sports Freescale MPC8572E Processor

VME remains the most prevalent computing technology in today's legacy military systems. Extreme Engineering Solutions has announced the availability of XCalibur1531, a high-performance 6U VME solution with Freescale Semiconductor's dual-core 1.5 GHz MPC8572E PowerQUICC III processor. XCalibur1531 delivers enhanced performance and efficiency for today's commercial, industrial and military embedded computing applications.

XCalibur1531 features two channels of up to 4 Gbytes of DDR2-800 SDRAM with ECC and up to 16 Gbytes of NAND flash and 256 Mbytes of NOR flash. I/O ports include a SATA 3.0 Gbit/s port, three USB 2.0 ports and two PrPMC/XMC interfaces. In-house X-ES operating system support includes Green Hills INTEGRITY Board Support Package (BSP), Wind River VxWorks BSP, QNX Neutrino BSP and a Linux BSP. XCalibur1531 is available now; pricing starts at $7,985 and varies based on processor speed, memory configuration and ruggedization level. Volume discounts are available.

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

10-dB Microwave Coaxial Coupler Meets Military Requirements

A number of components need special features to be suited for military use. Along such lines, Narda has introduced the Model 4246B-10, a miniature stripline coaxial microwave coupler that delivers 10 dB of coupling from 6 to 18 GHz, has an extremely flat frequency response, and is designed to meet military requirements. The Model 4246B-10 handles 50W of average power and 3 kW of peak power, has directivity of at least 15 dB, insertion loss of 2.5 dB or less, VSWR of 1.4:1, frequency sensitivity of +/-0.5 dB or better, and maximum deviation from nominal of +/11 dB. The compact module measures 1.4 x 0.66 x 0.42 inches, weighs 0.9 oz. (25 g) and has female SMA connectors. The coupler meets military requirements for shock and vibration and has an operating temperature range of -54° to 105°C without performance degradation.

The Model 4246B-10 stripline coupler is a member of Narda's "Maximally Flat" family of coaxial couplers, which includes models in the frequency range of 500 MHz to 18 GHz with coupling values of 6, 10, 20 and 30 dB. The Model 4246B-10 is available from Narda for immediate delivery.

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

CompactPCI Embedded Board Supports DisplayPort Standard

A variety of military applications have stepped up their demand for sophisticated graphics as net-centric information sharing has become a priority. Kontron offers a 3U CompactPCI multicore board with the CP308-MEDIA extension card, which is one of the first embedded products to feature the new high-definition digital display interface standard, DisplayPort. With S/P-DIF-Out audio and the stereo audio ports for Line In, Line Out and Microphone, the processor board with the KCP308-MEDIA card from Kontron adds extensive multimedia capabilities to embedded computing.

The CP308-MEDIA features the 45nm Intel Core 2 Duo processor running at up to 2.26 GHz, the most powerful embedded Intel GS45 Graphics and Memory Controller Hub, up to 8 Gbytes of energy-efficient DDR3 RAM and the Intel I/O Controller Hub ICH9M. The CP308-MEDIA features two DisplayPort interfaces on the front for direct-drive, end-to-end communication between the board and different panels. Compared to DVI or LVDS, DisplayPort reduces cabling, connector footprint and minimizes the need for additional monitor electronics for panel control. The latching DisplayPort connector guarantees utmost mechanical stability. With conventional adapters, DisplayPort also connects to HDMI, DVI or VGA monitors.

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

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

Motor Control Tools Shrink Development Time

The number of motors that are embedded into a complex military system—such as an aircraft—continues to climb. Two new low-cost development systems enable the rapid development for motor control systems—one for the control of high-voltage motors and another for stepper motors. Created by Microchip Technology along with related applications notes and free source-code software, these development tools enable rapid designs using dsPIC digital signal controllers (DSCs).

The dsPICDEM MCHV Development System is a development tool for the rapid evaluation and design of a wide variety of high-voltage, closed-loop motor control applications using AC Induction Motors (ACIMs), Brushless DC (BLDC) motors or Permanent Magnet Synchronous Motors (PMSMs). The board includes in-circuit debugging circuitry, eliminating the need for a separate debugger for development with Microchip's dsPIC33 Motor Control DSC families. Additionally, this tool combines a proven motor-control system and Power Factor Correction (PFC) for regulatory requirements. The dsPICDEM MCSM Development Board is a cost-effective tool for creating unipolar and bipolar stepper motor applications. This board enables the rapid development of both open-loop and current-closed-loop microstepping routines using Microchip's dsPIC33 Motor Control families. The dsPICDEM MCHV Development System is $650. The dsPICDEM MCSM Development Board is $129.99.

Microchip Technology, Chandler, AZ. (480) 792-7200. [www.microchip.com].

Quad-Core Blade Server Boasts Thermal Shell Enclosure

The principle barrier to higher compute density in modular electronic packaging is the cooling and mechanical stabilization of high dissipation devices, most notably the new breed of multicore microprocessors and high-performance Graphics Processing Units. The CoolShell technology from Themis Computer provides a thermal and kinetic management system that is stable and stiff, with a conduction-cooled Processor Module "shell," complete with external air flow paths, heat exchangers and impeller assembly combined in a single, field-replaceable unit (FRU).

Themis' CoolShell CS-3U is a modularly maintainable, commercial blade server system that packs an extended complement of processing, memory and IO, into a compact 3U, 17.75-inch deep rackmountable CoolShell Subrack. All modules are replaceable from the front, increasing uptime and significantly reducing maintenance costs. All cable connections are on the FRU front panels, so no rear access is required. The CoolShell CS-3U includes five replaceable modules; a dual socket processor blade, an I/O module that accommodates up to three double high PCI Express controller cards, media plus NIC module and two power supply modules. The CoolShell CS-3U fits in a standard 19" rack. Key CoolShell CS-3U features and specifications include one or two Intel Quad-Core Xeon 5440 series CPUs, up to 64 Gbytes memory and three high-performance dual headed graphical processing units.

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

COM Express Sports 2 GHz i7 Processor

Gone are the days of a long gap between when a mainstream processor emerged and when it made its way into the military embedded board realm. Exemplifying that trend, several vendors have rolled out Intel i7-based products in the last month. The latest from ADLINK Technology is the Express-CBR. The Express-CBR COM Express module combines the latest high-performance Intel Core i7 processor running at up to 2.0 GHz with the advanced Mobile Intel QM57 Express chipset. The Express-CBR achieves hardware ruggedness by careful component selection and an extreme-rugged design methodology that gives reliable operation over a wide power supply range from 9V to 16V and over the extended temperature range of -40° to 85°C.

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

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

8 Gbit/s Fibre Channel Climbs onto XMC Form Factor

Although the PMC mezzanine form factor enjoyed a healthy run and is still popular, it can't accommodate the fast speeds of today's high-speed serial interconnects. XMC has solved that hurdle. With that in mind, Critical I/O announced the availability of its 8 Gbit/s Fibre Channel XMC interface product, which allows embedded system applications to leverage ultra-high-speed Fibre Channel technology for performance networking and storage applications. Due to Critical I/O's unique silicon-based architecture and extensive software support, the Model FCA2540 XMC achieves sustained data rates as high as 1600 Mbytes/s (1.6 Gbytes/s), 15 µsec RDMA data transfers, and up to 300,000 IOPS (IO operations per second).

The FCA2540 XMC is part of Critical I/O's 7th generation of Fibre Channel interfaces. This hardware interface dissipates only six watts but provides two independent 8 Gbit Fibre Channel ports, 8 lane PCI Express host interface and extensive integrated hardware BIT. It is supported by a full complement of library and drivers for VxWorks, Linux and Windows. It is compatible with X86, PPC and DSP-based embedded processor boards. The FCA2540 XMC product is available now.

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

On-Chip Debug Tool Supports Intel Atom Processor

The Atom processor is a real winner for military systems where size, weight and power are the priorities. Macraigor Systems has expanded their proprietary On-Chip Debug Technology (OCDemon) to support the newest x86 processor, the Intel Atom. Built with the world's smallest transistors, the Intel Atom processor was designed for low-power mobile Internet devices and simple, low-cost PCs.

Because JTAG debug solutions do not require an operating system on the device, it is ideal for firmware debugging as well as bootcode. Through the JTAG interface, the target hardware is connected to the debugger on the host system. OCDemon offers an optimized interface to these on-chip resources via a choice of communication channels. A host debugger communicates with a Macraigor Systems' device and then to the target processor. Since there is no need for any resident code, this debug method is available for hardware initialization and debug as well as kernel, driver and application software debug. OCDemon for the Intel Atom is available immediately starting at $250. The port of the GNU Tools Suite and Eclipse Ganymede/Galileo platform is being offered at no charge.

Macraigor Systems Brookline Village, MA.

(617) 739-8693.

[www.macraigor.com].

DDR3 DRAM DIMMS Offer 4 Gbyte Densities

As military embedded systems depend more and more on software-based functionality, the demand for memory in which to run that software continues to climb. Virtium Technology has added the DDR3 MiniDIMMs and DDR3 VLP MiniDIMMs to their DDR3 high-density memory modules family. These new small footprint modules are now available at densities of 1 Gbyte, 2 Gbyte and 4 Gbyte, with future expansion to 8 Gbytes. The DDR3 MiniDIMM and DDR3 VLP MiniDIMM expands the current lineup of Virtium DDR3 memory, which includes DDR3 VLP Unbuffered Mini-DIMMs, VLP Registered Mini-DIMMs, SO-UDIMMs, SO-RDIMMs, Mini-UDIMMs and MiniRDIMMs.

The high-density, small-form-factor DDR3 MiniDIMM and DDR3 VLP MiniDIMM memory modules are well suited for vertically mounted space-constrained designs. All Virtium memory modules are available using monolithic DRAM that have an extended / industrial temperature range (-40° to 85°C), which makes them ideal as rugged AdvancedTCA memory (ATCA memory), AdvancedMC memory, MicroTCA memory, PicoTCA memory, AMC memory and COM Express memory for blades, SBB canisters or PICMG SBC applications.

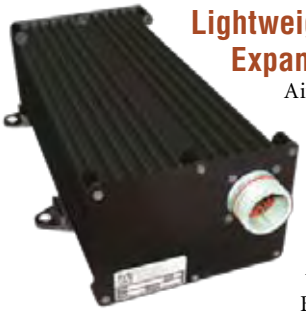
Virtium Technology, Rancho Santa Margarita, CA.

(949) 888-2444.

[www.virtium.com].

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

Lightweight Rugged Systems Blend Convection Cooling, Expanded I/O



Aitech Defense Systems offers the NightHawk RCU, an extremely rugged, compact Intel Atom-based, self-contained control unit that weighs only 4.5 pounds, almost half that of similar models currently available. This weight reduction, combined with a slimmer profile and natural convection/radiation cooling that dissipates up to 22W at +55°C in stagnant (non-flowing) air, or at up to 71°C with an optional low pressure fan or baseplate, makes the rugged control unit ideal for a variety of military, aerospace and commercial environments.

Based on the low-power Intel Atom processor operating at 1.6 GHz, the new NightHawk provides up to 2 Gbytes of DDR2 SDRAM as well as between 4 and 8 Gbytes of SSD memory with an optional expansion up to 250 Gbytes for extended and remote data collection and storage applications. With a complete set of standard PC I/O interfaces, the NightHawk also provides two Gbit Ethernet ports, six USB 2.0 ports and four multi-function RS232 serial ports, dual graphics/video ports, keyboard/mouse and stereo audio in/output ports as well as an I/O set specifically tailored for embedded military applications. Optional I/O includes MIL-STD-1553B, ARINC-429 and ARINC-708, CAN Bus, Wi-Fi and WAN ports as well as video capture and processing, discrete and analog I/O and an eight-port Gigabit Ethernet switch.

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

Secure SSD BGA Provides Fast Data Erase

White Electronic Designs has introduced a secure Single Level Cell (SLC) NAND SSD that provides compact, secure and reliable data storage for embedded military applications in rugged and extended temp environments. The product is available as a 4 Gbyte, 22 mm x 27 mm plastic ball grid array (PBGA) package and supports various PATA interface protocols. A hardware and software triggered security erase feature provides enhanced security for demanding military requirements and assurance that critical data at rest will be removed promptly when required. After the data purge command is initiated, all data is eliminated in less than 10 seconds and options are available that also perform sanitization protocols designed to be compliant to the various government agency specifications.

Constructed using a 32-bit RISC processor as its core storage controller, this SSD provides all the important flash management techniques for delivering a highly reliable solution. Incorporated wear leveling and error correction techniques extend disk operating life. The device provides data protection in the event of a sudden unplanned power loss or disturbance and operates from a single 3.3-volt power supply. The PBGA package is constructed using eutectic tin-lead solder balls on a 1.27 mm pitch with strategically placed signals to extend device life in harsh environments.

White Electronic Designs. Phoenix, AZ. (602)437-1520.[www.whiteedc.com].

High-Density 16-bit D/A PMC Board Includes FIFOs

Thanks to advanced FPGAs and powerful converter technologies, quite a bit of D/A channel functionality can be squeezed into a single card. Tews Technologies has announced the TPMC554, a new high-density 16-bit D/A PMC Module with FIFOs, for its expanding line of PMC modules. The standard single-wide 32-bit PMC module provides 32 or 16 channels of 16-bit analog outputs. The software selectable output voltage ranges are 0-5V, 0-10V, 0-10.8V, ±5V, ±10V or ±10.8V and can be individually set per channel. The conversion time is typically 10 microseconds and the DAC outputs are capable to drive a load of 2 kohm, with a capacitance up to 4000pF.

The double buffered DACs allow simultaneous update of all channels for simulation applications. A sequencer on the TPMC554 supports the periodic updating of enabled channels with a sequence timer range from 10 microseconds to 11.93h. In addition to the double buffered distributed RAM inside the FPGA, the TPMC554 provides 2 M x 16-bit external SRAM to store values that are known in advance. This feature can also be used to periodically output any kind of waveform or bit pattern. The size of the FIFO for each DAC channel is adjustable. Physical connectivity is achieved through an HD68 SCSI 3 type front I/O connector.

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

Rugged Atom-based Fanless Box PCs Is Rich with I/O

Rugged box-level computing systems are proliferating in a variety of processor platforms, and the Atom is no exception. With that in mind, the Industrial Automation Group of Advantech introduces the UNO-2173A and UNO-2173AF fanless box PCs with 1.6 GHz Atom-based CPUs. These models are equipped with Gbit Ethernet ports, rich I/Os, 1 x Mini-PCIe socket for WLAN and 3G solutions, and Moblin (Mobile Linux) support. The UNO-2173AF has dual side I/Os including all of the ports of the UNO-2173A, but also incorporating a LVDS port (low-voltage differential signaling), a backlight control port, 5.1 channel HD audio, an additional RS-422/485 port, three additional USB ports and 1 x internal USB pin head.

Advantech not only provides energy-efficient AC/DC power units, but also power-saving features such as increased DC/DC power conversion efficiency and reduced standby power consumption. Furthermore, the UNO-2713A and UNO-2713AF provide various operating efficiency modes like: off, sleep and idle. Users can experience up to 50% reduced energy consumption through these devices.

Advantech, Irvine, CA. (800) 866-6008. [www.advantech.com].

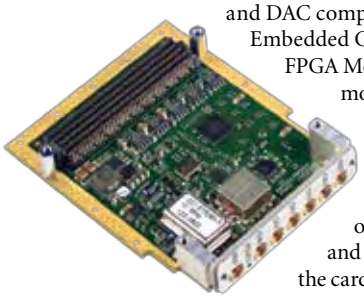
OpenVPX Development System Comes Preconfigured

OpenVPX has turned VPX technology into a more well-defined embedded computing architecture suited for military applications. Concurrent Technologies announces two low-cost, off-the-shelf, 3U OpenVPX Development Systems to complement their growing OpenVPX family of boards. A key benefit of these two systems is to speed the development of applications—in other words, software development, board prototyping and system performance testing prior to the commissioning of a fully ruggedized target.

Each Development System is a free-standing 3U VPX chassis with a backplane supporting a controller slot and two peripheral slots. The SY VPX/3x3 systems come preconfigured with either an Intel Atom or an Intel Core 2 Duo processor board, each with a x4 PCI Express fabric to the two peripheral slots. Both systems include a 3U VPX Mass Storage module, which leaves the third VPX slot available for an additional board. Each slot is 8HP (1.6 inches), which has the benefit of accommodating 0.8-inch, 0.85-inch or 1.0-inch boards while leaving easy access for test probes via the front of the chassis. The system includes a 250W universal power supply and cooling, and is compatible with the VITA 46 VPX and VITA 65 OpenVPX specifications. The installed boards are commercial grade OpenVPX boards, designed by Concurrent Technologies.

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

Quad Channel, Low Jitter Clock Generator Rides FMC



Demanding military applications such as Electronic Counter Measures, Software Defined Radio and radar have a big appetite for high-speed ADC and DAC components. Curtiss-Wright Controls Embedded Computing has introduced a new FPGA Mezzanine Card (FMC/VITA 57) module, the FMC-XCLK2, its first FMC clock generator card. The FMC-XCLK2 is a quad channel clock generator card that features low jitter and phase matched outputs. Available in both air-cooled and conduction-cooled rugged versions, the card provides the high-quality clock source required for high-frequency data sampling applications and can support RF output frequencies ranging from 50 MHz to over 2 GHz. This card provides a cost-effective, compact alternative source for clocking and synchronizing I/O, whether provided by Curtiss-Wright Controls' broad family of ADC and DAC FMC cards or the customer's own I/O.

The FMC-XCLK2 speeds and simplifies the integration of FPGAs into embedded system designs. The FMC-XCLK2's RF clocks are derived from either an onboard or external 10 MHz master reference source. The RF output frequency is defined by a build option using a narrowband, but low jitter, VCO/PLL frequency multiplier. An FMC-XCLK2 can also be used as a 10 MHz reference clock source to other system components such as clock generators. Pricing for FMC-XCLK2 starts at $4,995. Availability is Q1, 2010.

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

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

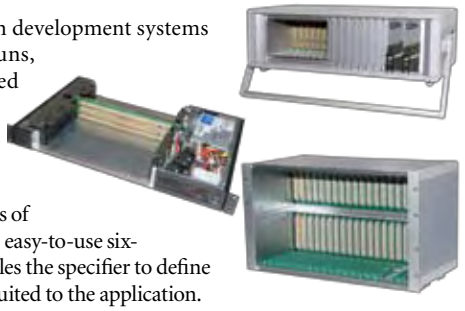
Fanless Core 2 Duo Embedded Computer Targets Harsh Environments

Cooling with fans is a deal breaker for military systems. Fans are an unacceptable point of failure as well as unsuited to harsh environments. Feeding such needs, Sealevel's Relio R5200 embedded computer offers a wealth of I/O features with the benefits of solid-state operation with no fans or other moving parts. The computer is powered by a 2.2 GHz Intel Core2 Duo CPU that is designed to run fanless up to 45°C. The compact chassis has expansion slots for one PCI Express X16 and one full-height PCI card. The system supports up to 4 Gbytes of DDR2 667 MHz RAM and is ideal for harsh, industrial environments. An optional 2.5-inch solid-state SATA hard drive can be integrated and preloaded with Microsoft Windows or Windows Embedded operating systems. Linux is also supported.

The R5200 offers a wealth of standard I/O features including dual Gigabit Ethernet, six USB 2.0 ports, four serial ports and VGA video. The system includes an external power supply and U.S. power cord that accepts 100-240V AC input and outputs 24 VDC at 120W. The metal enclosure allows for versatile mounting to walls, under counters, and on tabletops. The 2 Gbyte Relio R5200 is available from $1,499 while the 4 Gbyte version is available from $1,599.

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

Configurable Integrated Systems Support cPCI, PXI, VME and VPX



Designed for use in development systems and for production runs, Verotec has introduced a family of 1U, 2U, 3U and 6U configurable integrated systems. Based on combinations of standard products, the easy-to-use six-step configurator enables the specifier to define the exact system best suited to the application. Three enclosure styles are available: Eurotec case, Diplomat case and Verotec case, each providing a choice of 19"rack mounting, desktop or portable form factors. The second choice defines the subrack, available in 84HP (full width) and 42HP (half-width) options.

The IEEE 1101.10/11 KM6-RF subrack system supports VME64X, VPX and cPCI requirements for front and rear plug-up, injector/ejector handles, front panel coding and pre-location, ESD protection and EMC screening. The IEC297 KM6-II is optimized for VMEbus and DIN41612 connector-based applications. Cooling options range from natural convection cooling through normal and intelligent rear panel fan panels to standard and intelligent fan trays. Power supply options include 250 and 500W single embedded units, 250W single and dual pluggable supplies, all with a choice of AC or DC input. cPCI, PXI, VME, VME64X and VPX backplanes can be specified in sizes, which, depending on the architecture, range from 4-slot to 21-slot widths.

Verotec, Londonderry, NH. (603) 821-9921. [www.verotec.us].

Advertisers Index

Get Connected with technology and companies providing solutions now

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

www.cotsjournalonline.com/getconnected

Index

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

Coming Next Month

COTS JOURNAL

Special Feature: Small Form Factor Boards in Mobile Defense Apps These days complete computing systems can 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 mobile defense applications that are extremely space- or weight-constrained or where traditionally only a fully custom solution would do the job. Small UAVs, robotics, mission-specific handheld systems and even intelligent munitions are prime examples along those lines. Boards in form factors such as mini-ITX, StackableUSB, COM Express, MicroETXexpress along with a variety of small non-standard boards are broadening the choices available to system designers.

Tech Recon: Evaluating Tradeoffs: VPX Advantages vs. VME Legacy Needs VME has earned an enduring role as the most popular embedded computer form factor for defense applications. Next-generation, fabric-based flavors of VME are coming together in the form of specs such as VXS (VITA 41) and VPX (VITA 46) and the newly released refinement of VPX known as OpenVPX. This section updates readers on the progress of those implementations, and displays a sampling of the current crop of VME, VXS and VPX single board computer (SBC) products.

System Development: Annual EOL Directory Unique coverage of key military technology issues in a way that you can't find elsewhere: that's what *COTS Journal* is known for. Exemplifying that unique character is our Annual End-of-Life Directory. Now in its 11th year, the EOL Directory lists both key DoD organizations and commercial firms involved in solving the problems of component obsolescence. The section also examines how those obsolescence issues are complicated by Europe's RoHS initiative.

Tech Focus: Rugged Ethernet Switch Boards Ethernet is becoming entrenched as the favorite interconnect fabric in compute-intensive applications like sonar, radar or any application that networks sensor arrays together. This section updates readers on the product and technology trends driving board-level Ethernet switch products, and will include a product album of representative Ethernet switch board products in form factors such as VME, cPCI, MicroTCA and more.

REAL TOUGH

Total thermal, electrical, mechanical and software integration

OCTAGON SYSTEMS

www.octagonsystems.com

RMB-C2 Rugged Computer

-40°C to 75°C fanless
MIL-810F, MIL-1275B tough
Total thermal integration
Built-in shock & vibration plate
Best-in-class "Hedgehog" power supply
Rated for tracked vehicles
GPS, WiFi, GSM, CAN Bus
Win XPe or Linux preinstalled

COTS

Editorial

Jeff Child, Editor-in-Chief

OpenVPX: Hurdles and Relay Races

With the Winter Olympics now in full swing, forgive my application of Summer Olympics metaphors, but here goes. OpenVPX faces a number of hurdles ahead this year to move from its current status as an industry-backed, defined spec into a critical mass solution irresistible to the military. It also faces a relay race of sorts this year to get customers and industry thoroughly educated on the benefits, issues and the path forward that OpenVPX offers for the military.

It takes more than technical elegance for a system architecture or form factor to gain acceptance, especially in the defense market. There's a lot of "connecting the dots" with customers that's required as well as getting suppliers in sync. Moreover, the defense industry has changed dramatically since the days when, for example, VME was first spinning up as a spec. Back then, defense customers dictated to the embedded industry what they wanted and needed in terms of COTS systems that met their needs, and the industry responded. Today, the shoe is much more on the other foot. Engineers at the prime defense contractors now expect their embedded computer, backplane and enclosure suppliers to really be the experts when it comes to switch fabric technology and all the other aspects that are part of OpenVPX.

In some ways I see OpenVPX as one of the pinnacles exemplifying the success of the COTS movement and the contribution of the embedded computing industry. Remember that even when switched fabrics started to migrate into the mainstream embedded computing realm around twelve years ago, the military market expressed absolutely zero interest in them. It was considered too risky to stake any long-term development project on an interconnect scheme that wouldn't be around in a few years. Fortunately, the VME community, to its credit, started the ball rolling years ago with VXS and VPX, and then last year's race to the finish line with OpenVPX sealed the deal.

Like the embedded board-level community itself, the editors of *COTS Journal* and the RTC Group as a whole were covering switch fabrics long before they were fashionable. We can boast over the years of publishing more articles on all the various switched fabrics—and all of their ins and outs—than any other. And the RTC Group's RTECC conferences have always been leading the way as forums for discussing and displaying these kinds of technology and products. In keeping with that trend, you can expect to continue to see a wealth of OpenVPX special coverage from *COTS Journal*, the RTC Group and our RTECC conferences.

Kicking off the year last month, we presented a panel discussion on OpenVPX at our Santa Clara RTECC show—and the completely filled room was a sure sign of the audience's interest in the topic, which was "Overcoming Integration Challenges When Harnessing Next-Gen Compute Architectures with OpenVPX." We were pleased to have industry veteran Michael Munroe of Elma Bustronic as moderator. Our panel of experts included Pete Jha of Curtiss-Wright Controls Embedded Computing, Richard Kirk of GE Intelligent Platforms, David French of Kontron, and Greg Tiedemann of Mercury Computer Systems.

Figure 1

OpenVPX Panel moderated by Michael Munroe (left) of Elma Bustronic at Santa Clara, CA. RTECC show on January 26.

The panel discussion got into some nice, down and dirty exploration of OpenVPX including thoughts of 3U and 6U VPX backplane topologies, considerations of pairing primary and secondary fabrics and control planes. Also debated was which data plane fabric technologies fit best with which secondary fabric of choice and how that differs in 3U versus 6U systems. Panelists also shared their insights on how cooling, system management, and processor choices for OpenVPX compared to those of other bus structures such as CompactPCI, AdvancedTCA and VME.

Encouraged by the intense interest we saw at the Santa Clara event, we've already got plans in place for more OpenVPX events at our upcoming RTECC events thoroughout the year including at our Melbourne, FL and Boston RTECCs. Also look for a comprehensive information resource from the RTC Group called the 2010 OpenVPX Source Book. It's going to be a fun year ahead. I'm proud that *COTS Journal* has been on top of the evolution of fabrics and VPX all the way through. Now that the ever-cautious military market has finally warmed to them, it's rewarding for us to see these technologies start to move into center stage for military system designs. ▮▮

POWER BY DESIGN

Custom power solutions designed to fit your specific needs

Vicor Custom Power: Small company responsiveness, large company resources

The sole focus of Vicor Custom Power is designing and manufacturing turnkey custom power systems that meet your specific needs. Vicor Custom Power maintains the flexibility of a small entrepreneurial company while taking advantage of Vicors technical and business resources to deal effectively with your most challenging power requirements. Vicor has invested in the tools and resources to offer you full service solutions from prototype to mass production with the shortest lead times and the lowest risk.

General Capabilities:

- Electrical and Mechanical Design
- Rapid Prototyping
- High Volume Production Capacity
- MIL-STDs Compliance
- Reliability / Certification Testing:

High Temperature Operational Life	Altitude
HALT *(Highly Accelerated Life Test)*	Explosive Atmosphere
Mechanical / Thermal Shock	Temperature Cycling
Vibration	Burn In
Humidity	EMI
Acceleration	Transient Immunity

Put Vicor Custom Power to work for you today, call 1-800-496-5570 to speak with a Vicor Custom Power engineer, or email apps@vicorcustom.com

vicorcustom.com

VICOR CUSTOM POWER

PROVEN SOLID STATE DRIVES

FOR RUGGEDIZED MILITARY APPLICATIONS

- DEPLOYED UNITS IN THE HARSHEST ENVIRONMENTS
- COMPLIANCE WITH MILITARY SPECIFICATIONS
- ADVANCED MILITARY SECURITY FEATURES

Structured for reliability. Built for performance. Enabled for Military.

For over 15 years, STEC has been a trusted provider of storage products for a variety of military applications.

STEC's MACH8 Solid State Drive is revolutionizing the storage world by delivering to the users the ultimate level of reliability and performance in a fully integrated device. At the heart of the MACH8 Solid State Drive there is STEC's leading edge controller able to address multiple flash chips simultaneously for mission critical performance. In addition, the MACH8 incorporates such state of the art features as full industrial temperature range (-40°C to +85°C), military purge, and full data path protection of the entire drive.

For more information, visit our website at **www.stec-inc.com/military**, e-mail **stecmil@stec-inc.com** or call **1.800.367.7330**

STEC