Tech Focus: FPGA Processing Boards Roundup

COTS JOURNAL

The Journal of Military Electronics & Computing

MODULAR STRATEGIES DRIVE MIL VEHICLE MODERNIZATION

PLUS:

CompactPCI and MicroTCA Thrive in Military Comms

Display Innovations Change Game for Command Control

Volume 13 Number 5 May 2011

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On The Cover: Recent upgrades to the M2A3 Bradley Fighting Vehicle include a system that provides 360-degree panoramic surveillance capability. The vision system provides the commander with a 360-degree battlefield view and includes enhanced capabilities for early threat detection from longer stand-off ranges. Here a U.S. Army staff sergeant guides an M2A3 onto a flatbed trailer at Forward Operating Base Warrior in northern Iraq. (DoD photo by MC Specialist1st Class Steven King, U.S. Navy)

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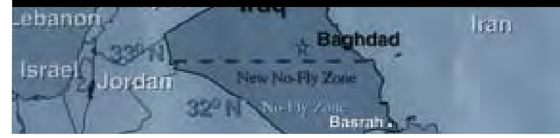
LOW POWER

Publisher's Notebook



Back to More DoD Budget Drivel

I take one month off from not discussing the DoD budget in some form and I get calls and emails asking why. Talking or thinking about the budget is mind boggling. There are so multiple opposing forces at work that even a crystal ball can't help in producing anything useful.

First, we have the military that internally can't really decide what it needs. Some of that is caused by old school generals and admirals seeing the military's mission differently than reality. They desire budget items that fulfill their doctrine, putting them at odds with new school leaders more in line with future mission needs. We have Congress and the Administration as polarized political entities—acting as individuals focused more on doing what is best for themselves.

Then there's the economy and weakening dollar mandating some constraints on the total U.S. budget. Iraq and Afghanistan still require significant funding. And now we have the new mideast crisis. We may not have any boots on the ground, but you can be assured we have dollars on the ground—funds that will come out of the DoD budget, or supplementals that have been proclaimed never to be used again. These are just a few of the larger nebulous issues that encompass the climate in which a DoD budget has to be created—and all that's even before someone gets down to actually making prudent decisions on a budget.

Let's shift gears just a little away from all those big issues that keep us from having a budget before the year starts. Consider the top ten most expensive weapons systems: F-35, BMDS (Ballistic Missile Defense System), Virginia class submarine, Arleigh Burke Destroyer, C-17A, F-22, V-22, F/A-18E/F, Gerald R. Ford aircraft carrier and the Trident II ballistic missile. These are only the top ten, there are dozens after these. These are programs that have been ongoing for years or decades and are far from completion. Some of these systems may or may not now be as relevant to the needs of the military in the future as when they were when conceptualized or started.

Without even looking at financial details, I can say with confidence that every one of these programs is much more costly now than when they started—even after adjusting for inflation. We managed to sort of kill one major program: Future Combat Systems—easier to do in the first five to ten years of a program. It's doubtful that there is much enthusiasm in the military or Congress to kill any of the current top ten…well most of the top ten. There are some basic issues involved in the reluctance to kill these programs. We've already thrown a pile of money into each bringing them to the current state of incompletion. It therefore seems a shame not to throw just a little more to see them to conclusion. Then there's the consideration of the "cancellation fees" due suppliers. These can almost equal the cost of completing the most minimal portion of the existing contracts. Moreover, there are the job losses and political implications the cancellations cause.

So everyone—most everyone—in the DoD budget process thinks that taking a little from every item each year is the best solution causing the least repercussions to the "deciders." They can just lower the 2012 originally requested $120 billion for new weapons by $7 billion and adjust contract schedules and quantities again. That will result in an increase to the total cost to us, but solves their 2012 issue. The original requested increase to new systems procurement request of $120 billion was conceived to offset the 2011 procurement cut to a low of $104 billion. Moving right along in 2012 we'll cut the requested $80.4 billion R&D budget by $4.7 billion. Hey, what the heck? It's only research right? We'll let some future "deciders" resolve any problems created by this action.

The tighter the squeeze on the DoD budget the greater the interest the bigger players will have in giving up what is to them the less rewarding elements within the contracts. Many of those elements are items that can be provided by suppliers that focus completely on embedded electronics development—items that can be highly rewarding to them. Buying these subassemblies instead of building them enables the big players to propose a significant cost savings to the PEO with minimal if any impact on their profit.

My comments haven't changed anything other than providing assurance that the sky isn't falling. Supplying electronics to primes and sub-primes for military programs is still going to be good business. Once again, I'll harp on the fact that when there is any change—small or large—there will always be some casualties and there will always be some benefactors. As a company or as an engineer, hard work, common sense and a little luck will help and go a long way in making sure you are not a casualty. ▮▮

Pete Yeatman, Publisher
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The Inside Track

Army TARDEC Contracts International Battery to Develop Vehicle Solutions

International Battery received a $730,441 contract from the U.S. Army's Tank Automotive Research, Development and Engineering Center (TARDEC) to develop a hybrid energy storage solution for combat tanks and Stryker armored vehicles (Figure 1). This multi-year contract, if all development options are exercised, could total $6.7 million. This contract, which is the second TARDEC award for the company, is funding work for advanced level testing and delivery of energy storage system prototypes for Silent Watch. The program requires battery systems that are ruggedized, have no heat signature, can withstand wide temperature variances and are lighter weight than lead-acid batteries.

In addition, International Battery will develop a hybrid battery system that will incorporate lithium iron phosphate cells (for energy) and ultracapacitors (for power). International Battery's new NATO 6T-compatible battery is a hybrid 12-volt system. The goal is to develop a battery that can deliver more power and energy to ultimately replace heavier lead-acid batteries as their reliability is greatly reduced in harsh environments, requiring frequent replacement. Lead-acid batteries can compromise mission effectiveness as they are sensitive to wide variances in temperatures—further accelerating degradation—creating supply and logistic issues resulting in a higher total cost of ownership.

International Battery
Allentown, PA. (610) 366-3925. [www.internationalbattery.com].

Figure 1

The TARDEC contract calls for the development of power solutions that are lighter weight than lead-acid batteries for Army vehicles like the Stryker.

ISSI and Micross Components Team Up to Provide MIL Temp Memory

Integrated Silicon Solutions and Micross Components have announced an agreement to supply MIL Temp memory to benefit military and other harsh environment applications. Under the agreement, Micross will offer selected ISSI SDRAM, asynchronous SRAM and synchronous SRAM parts under the Micross brand as Mil Temp memory, after certifying their operation to the extended military temperature range (-55° to +125°C). This agreement will increase the availability of MIL Temp COTS product in the marketplace. Micross will be ISSI's exclusive provider for Mil Temp memory.

Copper lead frames offer significant benefits for high-temp, harsh environment applications. As component engineers and system designers know, copper enhances the long-term reliability of both parts and systems because of its superior thermal conductivity and its greater compatibility with the coefficient of thermal expansion (CTE) of most printed circuit boards. The first offerings were released in early April—with both companies committed to providing long-term product support to the line.

Micross Components
Orlando, FL.
(407) 298-7100.
[www.micross.com/cotsipems].

Lockheed Martin TRACER System Completes Flight Tests on UAV

Lockheed Martin's Tactical Reconnaissance and Counter-Concealment-Enabled Radar (TRACER) has completed flight testing aboard a Predator B MQ-9 (Figure 2) Unmanned Aerial System. TRACER is a dual-band (UHF and VHF) synthetic-aperture radar capable of detecting and geo-locating objects that are buried, camouflaged or concealed under foliage. Classified as a queuing sensor, TRACER processes images in real time, and can immediately down-link captured images to multiple ground stations. Prior to the MQ-9 UAS flight testing, TRACER had successfully completed 100 test flights on manned platforms.

During the flight tests aboard the Predator B MQ-9, TRACER focused on identifying targets of interest that would be relevant to multiple theatres—including CENTCOM, PACOM, AFRICOM and SOUTHCOM. Over the course of the four month testing, the TRACER team validated the radar's performance in the harsh environment of a UAS configuration, thus mitigating risk for eventual installation on a tier IV UAS or other platforms, such as the YMQ-18A unmanned aerial helicopter. During the tests the team also demonstrated satellite data link control of both the vehicle and radar system. The TRACER

Figure 2

Tested aboard an MQ-9 UAV, TRACER is a dual-band (UHF and VHF) synthetic-aperture radar capable of detecting and geo-locating objects that are buried, camouflaged or concealed under foliage.

system's design is predicated on Lockheed Martin's operationally proven foliage penetration (FOPEN) system, which was developed specifically to detect vehicles, buildings and large metallic objects in broad areas of dense foliage, forested areas and wooded terrain.

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

Navy and Northrop Grumman Accomplish Successful At-Sea Demo of Maritime Laser

The U.S. Navy and Northrop Grumman have successfully demonstrated high-energy, solid-state laser defenses at sea by completing a "counter-materiel" test of the Maritime Laser Demonstrator (MLD) against small boats. Northrop Grumman designed and built the MLD for the Office of Naval Research, leveraging a laser the company built for the U.S. Army Space and Missile Defense Command /Army Forces Strategic Command and the High Energy Laser Joint Technology Office. Open ocean tests were conducted between October 2010 and April 2011 at the Pacific Ocean Test Range near San Nicolas Island off the Central California coast. For these tests, the laser system was installed on the Navy's Self Defense Test Ship, the USS Paul Foster (Figure 3).

While underway, the MLD system initially tracked and lased land targets. The solid-state, directed energy system then tracked and damaged moving, remotely piloted, unmanned small boats traveling at representative speeds and ranges, company executives said. The results show that all critical technologies for an operational laser weapon system are mature

Figure 3

The Office of Naval Research successfully disables a small target vessel using a solid-state, high-energy laser mounted onto the deck of the Navy's self-defense test ship, former USS Paul Foster (DD 964). (US Navy Photo).

enough to begin a formal weapon system development program, according to Steve Hixson, vice president, Space and Directed Energy Systems at Northrop Grumman's Aerospace Systems sector. "Solid-state laser weapons are ready to transition to the fleet." Hixson said the MLD team accomplished several notable firsts. It was the first Navy laser system to go to sea, installed on a decommissioned Spruance-class destroyer, for the program's culminating demonstration; first Navy laser system to be integrated with a ship's radar and navigation system; and first electric laser weapon to be fired at sea from a moving platform.

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Military Market Watch

Defense Communications Ready to Shift to High Gear over the Next Few Years

The link between global defense and technology is inseparable—particularly communications technology, according to analysis from Frost & Sullivan entitled Defense Communications: Funding Trends and Prospects. The report finds that defense communications technologies such as tactical radios and military satellite and network-centric communications are the key technologies driving funding in the defense communications market. The next generation of technological development for military communications will be greatly influenced by the goal of a fully interoperable solution, wherein data can be obtained from various sources irrespective of the solution. Network-centric warfare, enhanced situational awareness and increased use of commercial COTS technology are witnessing increasing technological development and funding activities.

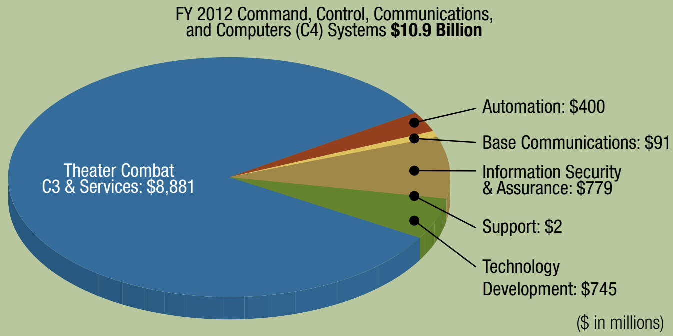

Figure 4

The United States continues to invest heavily in military communications technology and C4 systems. The 2012 DoD budget request asked for $745 million in C4 system technology development. (Source: DoD FY 2012 Budget Overview).

The market for defense communications is likely to be supported by a number of demand drivers, notably the need for allied information advantages in large-scale operations such as those in Iraq and Afghanistan. The defense industry is entering into a new phase where huge R&D efforts are being concentrated on defense communications, as an increasing number of defense establishments realize the need for empowering their defense forces with the latest communications technologies available.

Despite the bright outlook for the market (Figure 4), there are some challenges clouding the landscape. Lack of funding remains a key factor in Europe, and for its part Asia has not been able to match up to the capabilities of the United States. Trends in Asia-Pacific and the Middle East point to procuring radios either from the U.S. or Europe as opposed to indigenous R&D. Some of the issues faced by communications technologies include interoperability, bandwidth, multilevel security, scalability, electronic counter measures and collaboration across multiple weapons. Defense Communications: Funding Trends and Prospects, a part of the Frost & Sullivan Technical Insights subscription, provides a preview of the process of private equity, venture capitalists and other corporate funding. Further, this research service includes detailed technology analysis and industry trends evaluated following extensive interviews with market participants.

Frost & Sullivan. San Antonio, TX. (210) 348-1000. [www.frost.com].

Special Feature

Military Vehicle Modernization

Ground Vehicle Modernization Looks to Modular Solutions

With a new ground vehicle design still in the very early stages, the military is moving ahead on a variety of upgrade and modernization efforts across a wide range of Current Force vehicles. Modularity and interoperability are at the forefront of these initiatives.

Jeff Child, Editor-in-Chief

Changes by the DoD and U.S. Army to vehicle requirements have spawned a rethinking of previously planned electronics. A few years back, the DoD scrapped the vehicle portion of the Army's Future Combat Systems and moved its funding to successor programs including the Ground Combat Vehicle (GCV) and the Early Infantry Brigade Combat Teams (E-IBCT). Electronics and computing will factor big in upgrades to vehicles like the Abrams, Bradley, Stryker and others. It's all about modularity and upgradability as onboard communications and control electronics multiply in sophistication for both next-generation and Current Force fighting vehicles. These changes are sure to be influenced by technology and the latest board- and box-level embedded computing products available.

Modernization and upgrade of selected core systems is a continuous process. Some of the existing programs targeted for upgrades include Stryker vehicles, M1 Abrams, Bradley Fighting Vehicle and the Light Armored Vehicle (LAV). Meanwhile, the Army is focused on developing a Ground Combat Vehicle (GCV) to provide a new infantry fighting vehicle to the warfighter. The GCV was conceived to have the design growth to adapt to capabilities as the operational environment changes and technology matures to position soldiers for long-term success. For its part, the Marine Corps is developing the Marine Personnel Carrier (MPC), an advanced generation armored personnel carrier that would provide general support lift to the marine infantry in the ground combat element based maneuver task force.

Many Factors in Play

There are a variety of forces that drive the military's current vehicle modernization strategy. The Army's plan, for example, takes into account nearly a decade of persistent conflict, the uncertain operational environment, the increasing cost of labor and material, and constrained funding. The focus is on equipment that's adaptable, scalable and interoperable. With a budget request of $5 billion for ground combat vehicles, the Army is working on not only the development efforts for the Ground Combat Vehicle, but also a replacement to the M113 family of vehicles. The budget also calls for procuring Nuclear, Biological, Chemical Reconnaissance Stryker vehicles; upgrading the engine and armor on the Abrams tank, and improving the lethality, survivability and sustainability of the Bradley Fighting Vehicle.

Just what the GCV will end up looking like is far from certain. Progress toward an RFP last year got derailed as decision makers rethought the program. And that RFP went through a couple rounds of cancellations. While the GCV program is expected to eventually produce multiple vehicles with varying capabilities, the focus for the first block of GCV development is an infantry combat vehicle variant.

Figure 1

Employees at TACOM Anniston Army Depot (ANAD) guide a repaired turret to its upgraded hull into a M1A2 System Enhancement Package Version 2—the latest M1 Abrams tank variant to be inducted into the depot production line.

GCV Source Selection and Abrams Upgrades

Right now the GCV program is in Source Selection mode, and spokespersons for the Army's PEO Ground Combat Vehicle told *COTS Journal* that it's too early to talk at all about any electronics that would be in the vehicle. And because they're in Source Selection mode they're currently not able to talk about the program overall. That's expected to change by around summer, according to the Army spokesman.

With that in mind, the GCV is far from the technology development phase where any electronic subsystem prototypes come into play. When it does however, the timing is good for technologies like OpenVPX to be involved in the GGV. With the priority on survivability for these vehicles, the pressure will be on to spend any weight budget on vehicle armor and defensive gear and not on electronics. That will in turn mean keeping the size, weight and power of onboard electronics and computing as low as possible. And OpenVPX was designed with that in mind and for the extreme temperature and shock/vibration profiles called for in military vehicle systems.

Upgrade details for the M1 Abrams (Figure 1), the Army's main battle tank, include a modernization effort supporting two variants: the M1A1 Situational Awareness (SA) and the M1A2 System Enhancement Program (SEP). With General Dynamics as the prime contractor, the M1A1 SA modernization includes steel encased depleted uranium for increased frontal and turret side armor protection, suspension improvements, an advanced computer system with embedded diagnostics, a second generation thermal sensor, and a laser rangefinder to designate targets from increased distances. The M1A2 SEP tank modernization includes a commander's independent thermal weapons station, position navigation equipment, improved fire control system, and an improved AGT1500 turbine engine.

Marine Corps Vehicle Changes

Switching gears to the Marine Corps vehicle situation, the major change is the plan to terminate the Expeditionary Fighting Vehicle. A technically advanced next-generation amphibious assault vehicle, the EFV was a platform packed with computing and network electronics. But the EFV has already consumed more than $3 billion to develop and will cost another $12 billion to build. If fully executed, the EFV—which costs far more to operate and maintain than its predecessor—would essentially consume the Marine Corps' entire vehicle budget and most of its total procurement budget for the foreseeable future. The decision instead is to fund development of a more affordable and sustainable amphibious tractor to provide the Marines a ship-to-shore capability for the future.

Proposed funding also will upgrade the existing amphibious vehicle fleet with new engines, electronics and armaments until the next generation of systems is brought on line. Along those lines, Parvus last year won a contract to install its DuraMAR 1000 routers and DuraNET 2955 Ethernet switches in the Amphibious Assault Vehicle (AAV) (Figure 2) in support of a SPAWARSYSCEN Atlantic/U.S. Navy technology refresh program to enhance onboard vehicle network-centric capabilities. Both the DuraMAR and the DuraNET 2955 Ethernet switch subsystems are ruggedized versions of COTS Cisco Systems 3230 and 2955 Series products.

C4 Vehicle-Mounted Systems

The area of military vehicle modernization that will make the most use of embedded computing and electronics is C4 (Command, Control, Communications and Computer Systems). This is part of the DoD's overall shift to network-based interconnectivity. The idea is to allow dispersed forces to communicate, maneuver, share a common user-defined operating picture, and successfully complete assigned missions more efficiently. The three major programs that form that infrastructure include JTRS, BCT Modernization and WIN-T—all of which have vehicle mounted components to them.

The Joint Tactical Radio System (JTRS) program encompasses ground, airborne, vehicular, maritime and small form factor variants of the radio hardware, 17 Increment 1 waveforms for porting into the JTRS hardware, and network management applications. All JTRS products are being developed in a joint environment, enhancing hardware and software commonality and reusability. The FY 2012 budget plan funds the design, development and manufacture of JTRS engineering development models (EDMs) and low rate initial production (LRIP), to include hardware and software, as well as sustainment of fielded radios

Even though the Future Combat System (FCS) was cancelled, the Army is leveraging its technologies by accelerating the incremental fielding of capabilities to all BCTs. The Army intends to transition the E-IBCT program of record (POR) to Capability Package-based modernization. Following the acquisition of these LRIP quantities, the E-IBCT program will be completed and further SUGV acquisition delegated to the Army.

Network Kits for BCTs

In place of the E-IBCT program, the transition calls to continue development and sustainment of the right equipment in

Figure 2

The Amphibious Assault Vehicle (AAV) is an armored assault amphibious full-tracked landing vehicle. With the EFV to be terminated, modernization upgrades to the AAV will allow Marines to accomplish their missions while a new vehicle design is implemented.

Figure 3

Warfighter Information Network-Tactical (WIN-T) Increment 2 test vehicles move in convoy during a WIN-T technology demonstration at Naval Air Engineering Station in Lakehurst, N.J.

an incremental and iterative manner. According to the Army, the idea is to "ensure that Soldiers and units have the capabilities worthy of continuance" and that will be successful across the full range of military operations today and into the future. The specifics of the 2012 plans include procuring one additional brigade set of the Network Integration Kit (NIK) (quantity of 100) and two additional brigade sets of the Small Unmanned Ground Vehicle (SUGV) (an additional 78 units). The additional NIKs will include E-IBCT capable Ground Mobile Radios (GMR) as NIK subcomponents. But the remaining elements of the E-IBCT program (Class 1UAV, Tactical and Urban Unattended Ground Sensors (T/U-UGS)) are cancelled.

Another key vehicle-mounted system is the Warfighter Information Network-Tactical (WIN-T). WIN-T is the Army's on-the-move, high-speed, high-capability backbone communications network, linking warfighters in the battlefield with the Global Information Grid (GIG). This network is intended to provide command, control, communications, computers, intelligence and reconnaissance (C4ISR) support capabilities. The system is being developed as a network for reliable, secure and seamless video, data, imagery and voice services for the warfighters in the theater to enable decisive combat actions.

Four Increment WIN-T Plan

The WIN-T program consists of four increments. Increment 1 provides "networking at the halt" by upgrading the Joint Network Node (JNN) satellite capability to access the Ka-band defense Wideband Global Satellite (WGS). Last Spring the Army awarded General Dynamics C4 Systems a $164 million contract that will enable a General Dynamics-led team to begin low-rate initial production of the Warfighter Information Network – Tactical (WIN-T) Increment 2 (Figure 3). Increment 2 will equip vehicles with on-the-move broadband communications enabling command and control from anywhere in the battlespace. Increment 3 provides full networking on-the-move via air tier. Increment 4 provides protected satellite communications on-the-move.

The FY 2012 DoD budget request procures and continues to field WIN-T Inc 1 to the Army, with a Ka satellite upgrade. WIN-T Inc 2 is currently in Limited Rate Initial Production (LRIP) in anticipation of its Initial Operational Test in FY 2012. WIN-T Inc 3 continues in its Engineering, Manufacturing and Development (EMD) phase to deliver the full networking on the move, including the airborne tier.

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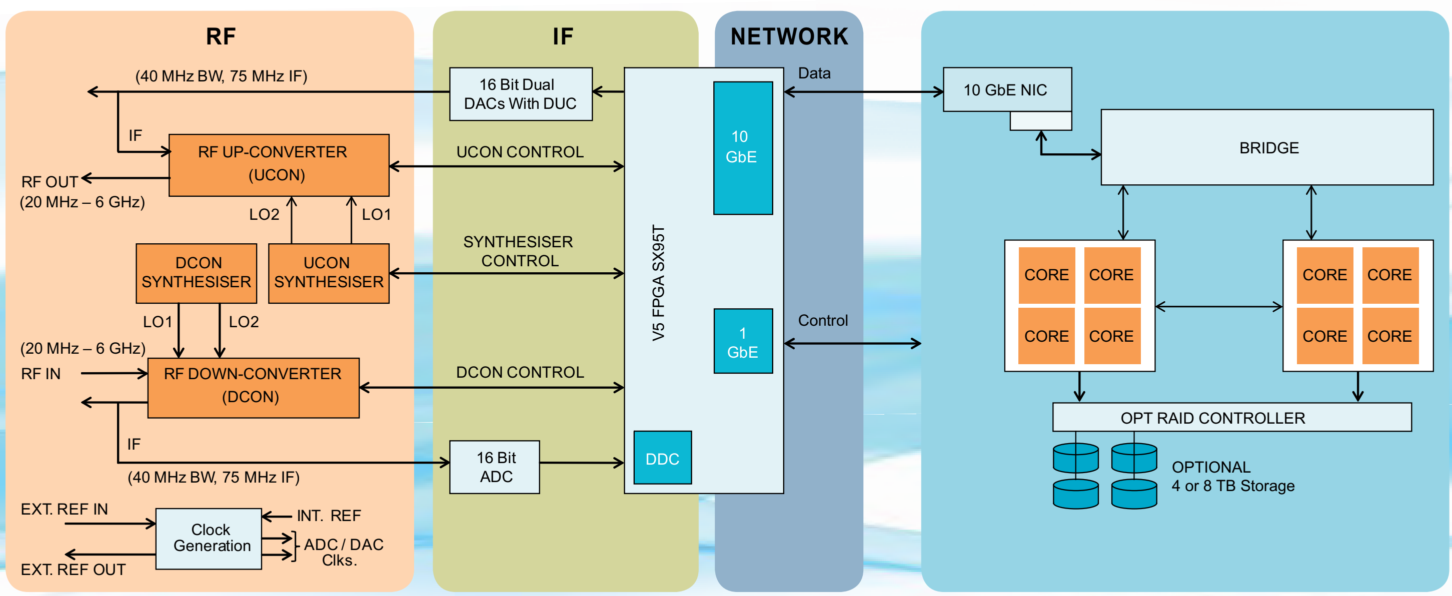

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Open Standards and Phased Approach Benefit Ground Vehicle Modernization

There's a myriad of cost, development time and interoperability benefits to taking a more modular approach to military vehicle system upgrades. New open standards help smooth the way.

David Jedynak, Technical Product Manager for Network Centric Systems
Curtiss-Wright Controls Electronic Systems

Interconnection and interoperability of systems within the vehicle is a challenging task. As operational requirements, technologies and missions change, vehicle equipment and functions need to adapt. In traditional appliqué models, physical vehicle equipment and functionality is tightly coupled and inflexible. To address these limitations and challenges, in conjunction with the U.S. Army's Heavy Brigade Combat Team (PM-HBCT), Curtiss-Wright Controls Electronic Systems researched and demonstrated open standard network technologies to enable modernization, commonality and interoperability across multiple platforms.

The core concept is to connect all subsystems to a common network fabric, as shown in Figure 1. Legacy, proprietary and discrete I/O devices are all attached to the network through cost-effective and modular network bridges to enable the phased modernization of existing vehicles. For newer vehicles, this also provides the ability to leverage and use high TRL legacy systems now, instead of needing to spend the time, money and risk to modernize those subsystems now. This allows those subsystems to be replaced at their natural end-of-life due to obsolescence or performance enhancements, instead of forcing a change in interface today.

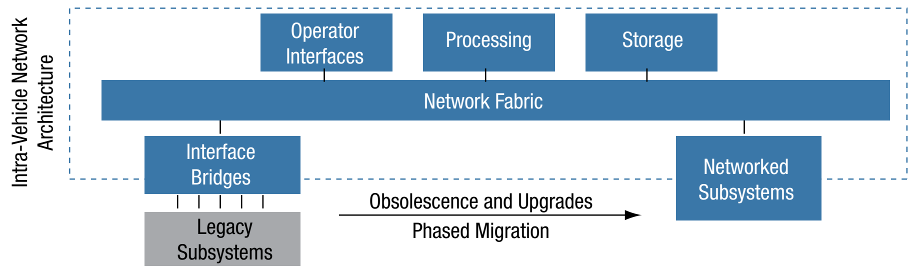

Figure 1

At the heart of the Intra-Vehicle Network Architecture concept is connecting all subsystems to a common network fabric. Legacy, proprietary and discrete I/O devices are all attached to the network through cost-effective and modular network bridges to enable the phased modernization of existing vehicles.

Decoupling Aids Modernization

By decoupling the modernization of individual subsystems through legacy bridging, the cost and risk exposure of vehicle level modernization can be kept relatively flat and controlled through incremental improvements instead of needing to scrape the vehicle clean and do everything all at once. The independent results of this research and demonstration in early 2010 significantly aligned with the emerging efforts of the U.S. Army's VICTORY Architecture, further validating the intra-vehicle network-centric approach.

The goals and tenets of the VICTORY Architecture (Vehicular Integration for C4ISR/EW Interoperability, www.victory-standards.org) lay a foundation for the common, modular and interoperable approaches to both new designs and phased modernization of existing designs. The collaboratively developed and adopted open standards of the VICTORY Architecture provide an opportunity for true interoperability between components from multiple sources, as well as the end to SWaP-C overburden due to stove-piped subsystems that often duplicate significant hardware components.

Distributed Network Approach

Key building blocks include general-purpose and specialized shared processing, displays, network switches, real-time controllers, data storage, network enabled sensors / effectors, I/O concentrators and network bridges. The distributed network-centric approach substantially reduces overall procurement and logistics costs as well as obsolescence risks because functional blocks such as computing elements are separated from the platform-specific subsystems such as I/O elements. Importantly, the architecture enables flexible optimization in various dimensions (recurring cost, NRE, risk, schedule, SWaP, performance, etc.) since the various building blocks for the architecture are individually selected for key platform and program requirements, while still providing the same overall class of functionality in the overall architecture.

The interconnecting network fabric, which provides the core of the vehicle's systems, is provided by Gigabit Ethernet (GbE) switches, ranging from low-cost basic unmanaged switches to comprehensive Layer 2/3 managed switches with advanced capabilities, such as 10 Gigabit uplinks to additional switches and other high-bandwidth nodes. Multiple switches can be connected in various standard topologies to provide redundant paths in case of a trunk failure. Distributed nodes on the network fabric can use multiple connections for redundancy. Additional redundancy can be achieved by connecting redundant links to two separate switches. Aiding in development, maintenance and rapid reconfiguration of vehicles, automatic configuration and discovery of nodes on the network is provided through standard auto-discovery methods, such as the IETF Zero Configuration Networking (Zeroconf) standard as adopted by the VICTORY standards.

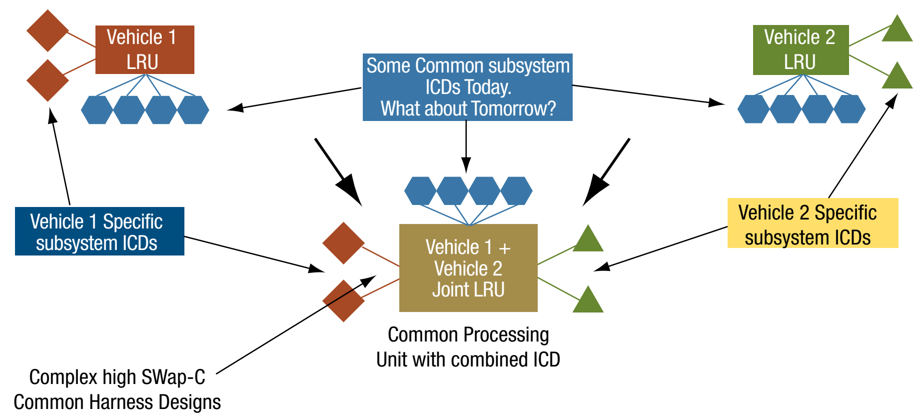

Figure 2

A traditional Federated Superset Approach merges the subsystem interfaces of multiple vehicles into a one-size-fits-all set of LRUs. The problem is that results in a high degree of complexity and instability of interfaces across the systems. It requires all the individual vehicles and subsystems to be designed, implemented and maintained in concert for the life of the vehicles.

Shared Processing

Shared processing provides SWaP-C optimized computing resources on the vehicle through the network fabric. The mix of processors would generally run commonly used operating systems (such as Linux and Windows) to run various non-real-time activities, such as mission management, analysis, data fusion, training and simulation servers. Interoperability standards, such as VICTORY, ensure that all shared processors and other nodes on the network fabric use well defined "on-the-wire" interfaces to communicate with each other over the network. Higher-level middleware connectivity (specific to service, program and platform requirements) is provided independent of the on-the-wire interfaces in the same way that e-mail, web, instant messaging, VoIP, video streaming and various other applications and frameworks are built above the ubiquitous Internet Protocol and TCP or UDP layers.

Optimized for particular platform needs, connection to sensors / effectors and other I/O devices is through native Ethernet connections. Localized I/O concentrators provide optimized SWaP-C area-of-use interfaces for various types of digital and analog I/O. A significant benefit of these devices is reducing lengths of complex mixed-signal cabling and removing the tight coupling of platform-specific I/O and high value computing clusters, allowing for a platform to change I/O without requiring changes to physical vehicle computers, or costly reservation of numerous spare I/O ports on a computing cluster.

Real-time controllers, included as needed for specific platform requirements (such as turret drive), provide segmented and dedicated real-time control-laws integrating sensors, effectors and controls. These SWaP-C optimized nodes on the network fabric provide both flexibility and opportunity for localized customization depending on platform needs, performing both vehicle-specific real-time applications, while communicating over open-standard interfaces to the rest of the vehicle.

Storage Issues

High capacity storage is provided by Network Attached Storage (NAS). The storage device can contain removable storage modules, allowing fast offload and upload of digital map, mission, maintenance and other critical data. As an alternative to replacing an entire storage device, storage modules provide a clear upgrade path to the infrastructure as higher density modules become available. Storage capacity, removability and performance (throughput) can all be optimized for the particular platform requirements—cost, data rates, operational concepts and so on.

Operator interfaces are provided by shared displays on the network fabric, integrating touch screen, bezel soft keys, with processing provided by tight integration of low-cost small form factor com-

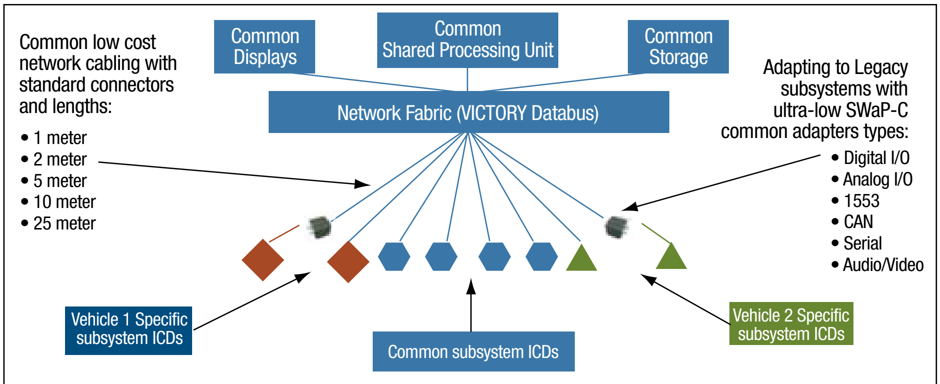

Figure 3

The Distributed Subset Approach builds upon well defined and well selected interfaces between well defined subsystems. This modular approach creates commonality around well defined subsets of interfaces in all vehicles using standardized distributed network interfaces, such as VICTORY.

puting boards, or scalable and modular integration of computing elements such as 3U VPX Single Board Computers and XMC mounted Graphics Processing Unit (GPU). Shared displays will receive video and sensor data over the network from the various other nodes. The capabilities of the shared display allow a highly optimized Warfighter Machine Interface including GUI, physical controls and data fusion.

In conjunction with a training and simulation server running in the shared processors, the shared displays will provide locally rendered synthetic video and simulated data inputs for a comprehensive and high-performance training environment. The specific shared display resolutions, sizing, temperature range and visibility (night, sunlight readable, etc.) requirements will drive the creation of a specific optimized crew station, ranging from readily available very low-cost displays to highly engineered specialized units.

Federated Superset Approach

Commonality across ground vehicles requires the proper segmentation of subsystems and interfaces to allow for commonality. A traditional Federated Superset Approach, merging the subsystem interfaces of multiple vehicles into a one-size-fits-all set of Line Replaceable Units (LRUs), results in a high degree of complexity and instability of Interface Control Definitions (ICDs) across the family of systems. An illustration of the problems, complexity and instability of this approach is shown in Figure 2.

This approach is not recommended since it requires all the individual vehicles and subsystems to be designed, implemented and maintained in concert for the life of the vehicles in order to ensure required changes for one vehicle or subsystem do not affect the commonality with the other vehicles. Furthermore, the central LRUs with common interfaces for all the subsystems of the entire set of vehicles will be SWaP-C overburdened in order to meet the specific requirements of all vehicles.

The modern, scalable and interoperable approach is the Distributed Subset Approach, which builds upon well defined and well selected interfaces between well defined subsystems, as shown in Figure 3. This modular approach creates commonality around well defined subsets of interfaces in all vehicles using standardized distributed network interfaces, such as the VICTORY standards.

Distributed Subset Approach

In this approach, modules such as common processing, displays and storage only need network connections in any vehicle. Common and specific vehicle subsystems attach using standardized interfaces and cabling. Key to this approach is sets of open standard interfaces between the subsystems, allowing the vehicle integrators to build upon these well defined interfaces

between standard building blocks.

Open standards, such as the emerging U.S. Army's VICTORY Architecture Standards,, provide the Department of Defense, vehicle integrators and subsystem vendors the path forward for both modernization, growth and scalability, as well as reduced integration costs. Furthermore, given a marketplace of standards-compliant and interoperable solutions from multiple vendors, products and technologies will compete to optimize SWaP-C, performance, lead-times and availability at various price-points, similar to other high technology markets. Similar to the open standards of VITA (VME, VPX, OpenVPX), vendors can focus on subsystem innovation, instead of expending valuable time and resources on defining non-valued-added interface protocols and message sets.

This will provide the warfighter with rapid access to emerging technologies at a pace similar to these other high technology markets. In these adjacent markets, the common interface standards of technologies such as USB, HDMI and various mobile phone standards allow hardware vendors to innovate and users to select the right mix of technology for use without technical interface constraints.

Open Standards at Work

Use of open standards defining the outward interfaces of technology modules allows vendors to innovate and compete with proprietary methods, designs, technologies and software to provide differentiation in value (performance, cost, SWaP), while ensuring interoperability and compatibility within the marketplace of similar components. This key differentiation between open standard interfaces and proprietary internal design of modules is critical for fostering and encouraging the continual improvement of industry solutions in terms of both cost and performance.

Curtiss-Wright Controls Electronic Systems' approach to vehicle modernization, in harmony with the VICTORY Architecture, focuses on key architectural goals while leveraging enabling technologies from multiple industries. It provides a clear path forward to high value interconnections on vehicles, whether through incremental modernization efforts or new fully native network designs. Proper application of the concepts, interfaces and standards such as VICTORY allows for rapid development of applications for multiple vehicle types, which in turn allows for the rapid discovery and leveraging of commonality, both at the sub-component and architectural building-block level. Ultimately, this allows for faster and low-risk systems integration with SWaP-C and performance optimization appropriate to the class of vehicle, while providing the warfighter the newest technologies now.

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Tech Recon

Military Success Stories for cPCI and MicroTCA

CompactPCI and MicroTCA Secure Their Roles in Net-Centric Designs

Driven by the military's need for secure rugged networks, CompactPCI and MicoTCA form factors have carved out a solid niche in comms-oriented military programs.

David Pursley, Field Applications Engineer
Kontron

High-bandwidth communications that need to be managed across secure environments is a common theme in military computing. Driven largely by requirements of WIN-T, the Army's cornerstone tactical communications system, designers are facing increasingly diverse computing challenges with greater demands for flexibility, mobility and ruggedness. Against a backdrop of persistent military conflict, armed forces leaders are required to strike a balance between investing in the future and sustaining or enhancing capabilities of deployed troops. To support these objectives, designers must be able to accelerate delivery of successful products quickly—and at the same time, maximize what has been learned during extended and varied conflicts that will help them develop the right tools for battles ahead.

Figure 1

Soldiers work on the network during the Brigade Combat Team Modernization Limited User Test at White Sands Missile Range.

Tasked with building smaller form factors offering greater performance, bandwidth and mission-critical reliability, designers are turning to tried and true platforms such as CompactPCI. CompactPCI's years of proven implementation are characterized today by a broad range of specialized board functions, conduction-cooled designs and high-speed interface options. Relative newcomer MicroTCA is becoming established as a complementary platform option, ideal for many of the same reasons but delivering optimal rugged performance when higher bandwidth is required.

Secure Military Networks

Processing challenges lie in sharing information in real time, and linking warfighters and command through a network-centric information system. This involves data from any number of separate enclaves, or network security domains; as a result, the data itself takes on various classifications. Network traffic may include secret data, non-secret data and data that has yet to be classified, and

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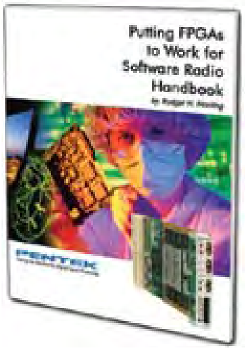

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Figure 2

The CP3002-RC is a 3U CompactPCI system controller board based on Intel's latest 32nm Core technology. The rugged, conductive-cooled board features a heat spreader and rear I/O.

all must be processed quickly and add value to an integrated network intended to share information effectively. This is a complex process in a secure network connected to multiple enclaves, yet the sheer volume of available data requires ongoing processing in order to move only potentially relevant information. Many times, this compute-intensive process happens in a small form factor system, resulting in greater processing challenges in limited physical space.

Support for WIN-T provides a single framework for an integrated battlefield network. This effectively illustrates the need for high-bandwidth, standards-based solutions—in turn delivering hardware and programming that enables a true "system of systems" within the Brigade Combat Team (BCT) Modernization Network (Figure 1). Incrementally fielding capability packages that best meet the needs of warfighters, and also modernizing the network to take advantage of technology upgrades, means designers are focused on COTS technologies that can position military networks to handle expanding bandwidth and secure data needs.

CompactPCI Thrives in Military Design

For network-centric applications, many designers consider standards-based

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Figure 3

The OBSERVO 3U CompactPCI Raid Data Server is specifically designed for surveillance data recording applications requiring integrated mass storage and data integrity.

CompactPCI to be ideal for managing multiple blades communicating over Gigabit Ethernet in a single backplane for a self-contained network implementation. CompactPCI is normally thought of as a bus-based architecture; however, it also supports Gigabit Ethernet backplane communication and multiple Gigabit or 10 Gigabit Ethernet links and connections. Its niche is solid, based on its ability to deliver high processing capabilities and huge I/O throughput in a proven small, scalable and rugged 3U or 6U Eurocard form factor. Even extremely data-hungry applications can be accommodated by using multiple quad core CompactPCI processor boards. Figure 2 shows an example cPCI board.

Pin-based connectors and locking handles further enhance CompactPCI's inherent ruggedness and reliability. In contrast to card-edge or slot-based connectors, CompactPCI incorporates gas-tight, high-density pins and socket connectors—these pins provide a strong and reliable link between boards and backplane, and minimize PCI signal reflections by means of low induction and controlled impedance. CompactPCI connectors represent a large number of ground pins (220), offering still another boost in reliability based on grounding and shielding for low ground bounce and operation in noisy environments. Card-edge and slot-based systems may be equally ideal for high-performance non-mobile apps. However, CompactPCI's high-density pins provide greater tolerance to environmental extremes and ultimately enable the platform to perform in more rugged environments.

Rear I/O is a feature of CompactPCI that offers design advantages for a wide range of military applications, and is of particular value in the smaller 3U form factor. Instead of being limited to the front panel, systems can implement multiple communication interfaces using backplane connectors, such as serial ports, Ethernet, or field buses including all board-to-board communications as well as all external connections. External connections are typically realized with rear transition modules or flex circuits connecting to the I/O panel.

Further, PCI-compatible software is widely available, and PCI-based programming is familiar to many military embedded designers. Combined with high bandwidth and reliability, CompactPCI's familiar computing model is often recognized as an ideal solution for demanding data capture and processing

applications such as border or electronic surveillance.

Surveillance Applications Exploit CompactPCI

Compact PCI's advantages are illustrated by its usefulness in specific military applications, for example, a telecommunications surveillance system used within U.S. intelligence settings. The system executes high-capacity analysis and measurement of wireless systems, gathering signals intelligence and threat warnings for agencies such as the Department of Defense and the Department of Homeland Security. The high-bandwidth and real-time processing required by this compute-intensive application may have once demanded multiple systems to achieve, however today it is available in a single portable product based on 3U CompactPCI.

Hardened Conduction Cooled MicroTCA Spec Adopted

PICMG recently announced the adoption of the Hardened Conduction Cooled MicroTCA (MicroTCA.3) specification. This specification defines the requirements for systems that meet more stringent levels of temperature, shock, vibration and other environmental conditions. It addresses military—and some commercial systems—with no airflow at all in sealed environments. MTCA.3 does this by placing the AMCs inside of a metal "clamshell" with wedge locks to stiffen the board and also provide a conductive path for thermal dissipation through the chassis. Typical applications include military systems hard-mounted to a mobile platform (an ATR is one example), or military communications systems deployed outdoors.

Application-ready platforms offer modularity and longevity in a robust design, and can be configured with specific features and performance options such as integrated mass storage and data integrity. Surveillance systems may require a high-speed RAID array incorporating a range of SATA-II hard disks and Solid State Drives (SSDs), including data scalability, supervisory and recovery functions supported by RAID levels 0, 1, 5, 10 or Just a Bunch Of Disks (JBOD) (Figure 3). If the implementation needs even more flexibility, CompactPCI can oblige. For instance, the same system can instead be configured to RAID 5 with four disk carriers to enable project-specific hardware functions via up to four dedicated CompactPCI boards. A high-performance backplane eliminates the need for internal cabling, and hot swappable hard disks and SSD carriers minimize system maintenance—this type of high availability is essential in demanding deployments

Ideally, systems are configurable to accommodate extended temperatures of -40° to +85°C, enduring fault-free performance in the environmental extremes common to non-stop military operations, particularly in a variety of deployments such as mobile systems that battle heat, dust, shock and vibration.

In pure convection fanless systems such as these, the Kontron CP307 CompactPCI processor board can serve as a system controller with a passively cooled 1.06 GHz Intel Celeron M processor and 512 Mbytes of soldered RAM providing an optimal cost-performance ratio at minimum power consumption. Flexibility is the name of the game, and the controller board can be swapped as needed. For example, it can be swapped with the Kontron CP305 with Intel Atom processor when it is desirable to implement up to 1.6 GHz processing speed and 1 Gbyte RAM. Onboard Ethernet switching handles communications to external devices such as CCTV cameras or intelligent IP-based HMIs; inter-system communication is managed through a 4HP carrier equipped with conventional UMTS, GSM, GPS, LTE and Wi-Fi modules.

If higher processing or ruggedization is needed, a conduction-cooled system with Core i7 CPUs would be the preferred solution. This would generally increase all of the parameters of SWaP (size, weight and power), but it may be a necessary design choice to meet the goals of the application and its environment.

Evolving Military Networks and MicroTCA

MicroTCA steps in for secure network applications that require extremely high bandwidth, for example, government systems that need to be upgraded to better manage data moving between terrestrial networks and then link to satellite networks. Designers must first determine the level of inbound and outbound data, as well as what tasks must be performed while the data is moving through the network. Once the performance environment indicates that data processing is approaching the demands of 10 Gigabit Ethernet, MicroTCA may be an ideal option.

Network-centric systems being used in military settings have many of the same demands and characteristics of commercial telecommunications implementations, making MicroTCA a very effective mission-critical platform that offers high processing capacity and high availability with an even smaller 2U or 4U board. Meeting the need for high bandwidth and high-end processing in a standards-based small form factor is attractive to military designers seeking advantages in size, scalability and extremely high network connectivity. Further growth of MicroTCA in military deployments is fueled by add-on specifications that make the most of its rugged family tree. Certified by PICMG, these new specifications for rugged air-cooled and conduction-cooled derivatives leverage the ANSI/VITA 47 specification and define the environments where these certified boards will perform.

MicroTCA meets a very important need for size, weight and power (SWaP) reduction in high-end military designs, enabling high processing capacity in systems as small as a 1U form factor. Compliance to NEBS (Network Equipment Building Systems) Level 3 requirements, which validates thermal margins, fire suppression, emissions and the ability to remain operational during a severe earthquake, makes this platform ideal for implementing secure high-bandwidth systems in extreme settings such as rugged vehicle applications. NEBS-certified MicroTCA boards and systems are validated to withstand extreme heat, humidity, altitude and up to zone 4 earthquake shock (7.0 Richter scale and higher) as well as an extensive range of other extreme environmental conditions.

MicroTCA essentially delivers the performance advantages of AdvancedTCA in a smaller and more energy-efficient platform. While AdvancedTCA uses Advanced Mezzanine Cards (AMCs) specifically as mezzanine cards, MicroTCA allows AMC functionality on a common backplane without a carrier board, ideally plugging in AMCs on the backplane without modification. A single system can implement significant performance—up to 12 AMCs, each enabling up to 21 high-speed serial connections on the backplane, and each ready to deliver bandwidth up to 2.5 gigabits per second. Further, each of these 12 compute blades on a single backplane could potentially all be using multicore processors. A 3U or 4U system could integrate as many as 24 cores within MicroTCA's very small footprint. Communications bandwidth capacities are highly varied and flexible—ranging from 40 Gbits/s to more than 1 Terabit/s—and depend primarily on how each system is implemented.

Secure Military Comms Advance

CompactPCI and MicroTCA each are proven military computing workhorses, particularly as the move toward secure network communications and higher bandwidth data grows more steadily throughout military operations. Military leaders are under constant pressure to choose the right technology path—investing in the future versus maintaining and expanding current systems. Designers, in turn, find it necessary to quicken the pace, developing systems that work flawlessly today while taking that existing knowledge to develop more advanced systems for tomorrow's combat. The role of CompactPCI and MicroTCA continues to contribute to highly reliable network-centric military designs, and gives designers the platform choices they need in such critical applications. ■

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Display Tech Advances Overhaul Command Control Systems

Driven by demands for sophisticated graphical and video-based situational data, military displays and display systems are offering ways to present and process a deluge of tactical and strategic information.

Jeff Child
Editor-in-Chief

Command and control for the U.S. military is evolving as it transforms itself to Network-Centric operations. The grand scheme of a networked military means that every vehicle, every aircraft, every ship, every UAV and every soldier on the ground will be able to quickly share data, voice and even video with almost any level of the DoD's operation. A variety of technology areas are part of the overall puzzle to make that happen. But where the network meets the users is on the displays and the display subsystems that drive them, and as such those technologies are becoming critical enablers. Command centers—both facility-based and mobile-based—along with UAV control stations, are making use of advanced display systems that do an unprecedented level of real-time situational awareness and command control.

An example along those lines are the Ground Control stations for the U.S. Central Command's Persistent Ground Surveillance System (PGSS). PGSS is a rapidly fielded system that includes a sensor-equipped, helium-filled aerostat platform. The system increases intelligence, surveillance and reconnaissance capabilities and provides a more complete surveillance picture through inclusion of information from new sensor systems. Last fall Sarnoff was awarded a subcontract by NEANY issued under a prime contract with the Naval Air Systems Command to provide TerraSight Ground Stations (TGS) for use in the PGSS. The TerraSight Ground Stations will run Sarnoff's TerraSight video exploitation software. TerraSight is an advanced C4ISR-enabling solution that provides the theater with a common operating picture that fuses multiple real-time video and data feeds from a variety of sensors. Video and data feeds are then overlaid onto a 3D terrain map in real time (Figure 1).

Figure 1

At the Association of the U.S. Army show, Editor-in-Chief Jeff Child is briefed on Sarnoff's TerraSight solution. TerraSight is a C4ISR-enabling solution that provides the theater with a common operating picture that fuses multiple real-time video and data feeds from a variety of sensors.

Displaying Realistic Imagery

Operating training is another key area where advanced display technology features are in high demand. Exemplifying that trend, RGB Spectrum's DGy high-definition digital recording and streaming systems were selected earlier this year for Northrop Grumman's advanced Ground Control Station (GCS) operator training system for the BAMS UAS program. A key requirement is recording video at up to 1920x1200 pixels resolution for after-action-review. To maximize effectiveness, Northrop Grumman devised realistic imagery making the simulated ground stations indistinguishable from the real thing.

Safety in Command and Control Systems

There are many types of command and control systems being used throughout the embedded industry. These can range from an operator sitting in a control room watching meters and gauges, and making decisions based on them, to fully automated systems completely controlled by computers and sensors. In general, command and control systems are composed of various compute platforms and sensors connected to a communications network. The system allows the operator or system of operators to monitor the current state of the system and transition the system to the next required state within the allow constraints.

In today's world, with a desire to become more efficient and lower costs, we have moved to systems where computers and software are used to control almost everything from factory automation and refineries to medical devices and transportation systems. All of these systems have a common requirement for a command and control system to support the accomplishment of a particular mission or goal.

These systems have become increasingly complex and they are controlling more and more functionality. In the beginning, the movement from manual or mechanical environments to a computer-driven environment was mainly done for financial reasons. As this type of command and control becomes more prevalent, it becomes necessary to design the system not just for cost-effectiveness but also with safety requirements in mind. This would include making sure the system is highly reliable and available.

The design for a safety-critical command and control system is well known in the transportation industry. In the avionics industry, for instance, the DO-178B standard for software and DO-254 for hardware define the requirement to guarantee the airworthiness of systems in flight. The main goal of these standards is to design the system taking into account all the functional requirements of the system as well as all the possible failure modes. Safety certification is about the process of requirements-based design where all software functions have complete traceability back to the requirements documents and through functional test used to verify that function. Using this methodology has proven valuable to the FAA in the fact that all incidents that have occurred can be traced back to missing, wrong, or incomplete requirements. This information can then be fed back to check for the same conditions in any existing systems.

As software-intensive systems become more pervasive, a large number of safety issues are being uncovered. Although the goal is to improve productivity, performance and cost-effectiveness, we need to make sure we pay close attention to potential safety issues as well. LynuxWorks provides both partitioned safety-critical operating systems such as LynxOS-178, and also security separation kernels like LynxSecure, which can help protect the key command and control infrastructure that our world is dependent on.

– Gary Gilliland, Director, Safety Critical Systems, LynuxWorks

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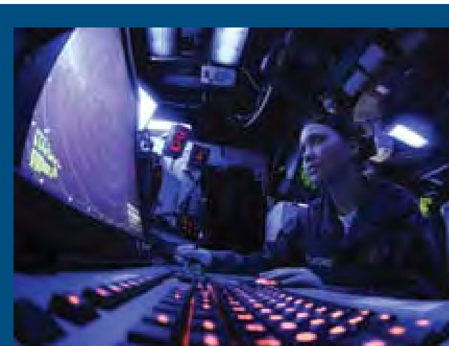

Safety certification focuses on the process of requirements-based design where all software functions have complete traceability back to the requirements documents and through functional test used to verify that function. By using that methodology the FAA can take any incident and trace it back to missing, wrong, or incomplete requirements.

The GCS training system uses three DGy 201HD codecs, each recording one of three PCs generating the simulated visuals, including complex telemetry, avionics, navigation, radar, HD video, geo-specific terrain imagery and other related information. The DGy system achieves near lossless image compression with a leading-edge JPEG2000 wavelet-based codec. The operator training system simulates aircraft performance, communications systems, sensors, datalink operations, video feeds and environmental conditions as encountered in real-world operation. The system provides scenarios to enhance operator decision making, image analysis skills and task proficiency.

Following a training session, instructors convene trainees for after-

Figure 2

The Any-Image-Anywhere processes multiple video streams at 30 frames per second in real time, with zero latency, and supports full 1080p high-definition video. It routes any video source through processing algorithms, then outputs the stream to any monitor, network, recorder, or device.

action-reviews. Recordings are replayed from the DGy system for debriefing and analysis using the DGy's flexible playback capabilities, including event marking, instant random access, variable speed and frame-by-frame jog/shuttle. The U.S. Navy's new intelligence, surveillance and reconnaissance (ISR) program, the Broad Area Maritime Surveillance Unmanned Aircraft System (BAMS UAS), is the next generation of the Defense Department's high-altitude, long-endurance system for coverage of oceanographic and littoral areas.

Full Motion Video

One of the trickier challenges for today's command and control systems is handling massive amounts of video data and moving it where it needs to go across the military network. One of the most comprehensive solutions aimed at that problem is Z Microsystems' Any-Image-Anywhere system. AIA is an advanced image enhancement and routing system for full-motion video. It's especially vital to the success of UAV and Intelligence, Surveillance and Reconnaissance (ISR) missions. By enhancing video images in real time, it allows any video source to be routed to any combination of displays.

AIA combines high-performance parallel processing, high-speed video switching and open architecture algorithms to enhance full motion video in real time. Offering unprecedented image clarity, AIA provides access to multiple views from a single display station and the ability to route video streams on demand. In addition, AIA has an open architecture that supports a wide variety of commercially available image processing algorithms. These image enhancement algorithms filter out visual distractions, while adjusting contrast and color to aid the eye in focusing on elements of interest.

AIA processes multiple video streams at 30 frames per second in real time, with zero latency, and supports full 1080p high-definition video. It routes any video source through any number of image processing algorithms, then outputs the video stream to any monitor, network, recorder, or similar device. The technology provides the ability to route multiple sources to one monitor or to virtual screens within a monitor. It allows operators to turn image functions on or off or swap the primary and picture-in-picture (PIP) windows using the touch screen. Users can select new video streams on demand using touch sensitive areas on the display, called virtual buttons.

Special Needs of Military Displays

The bulk of today's military display systems are leveraging display ad-


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vances in the general consumer market. Flat screen displays—of all sizes—are available at very low costs. That said, a variety of display breakthroughs have emerged that serve the special harsh environment needs of military field applications. One example is Dontech's Optical Fine Wire (OFW) and Micro EMI-Mesh (MEM100) conductive optical grids that provide optical EMI/RFI shielding of electronic displays, instrumentation and enclosures. The OFW mesh is constructed of woven and conductively plated fine-wire stainless steel and copper; the MEM100 series is made of etched and blackened copper.

The OFW and MEM100 conductive optical grids combine excellent shielding effectiveness with optical performance, making them particularly well suited for electronic displays and optics applications, including military. It meets that need for military systems that require the attenuation of radiated EMI/RFI emissions and susceptibility per MIL-STD-461 and MIL-STD-464.

Dontech's grid counts typically range from 50 to 255 openings per inch (opi). Standard unplated wire width/diameter for most mesh counts is 0.0011 inches, 0.0022 inches for woven and 0.0005 inches for etched mesh. The OFW and MEM100 conductive optical grids are typically embedded in glass or plastic substrates such as acrylic, polycarbonate or polyester (PET) or triacetate (TAC). Dontech woven fine wire mesh is available unplated, blackened, or silver plated and conductively blackened. ▮

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Open Approach Enables Cost Reduction for Naval Radar Displays

By using general purpose hardware and a flexible open software structure that is open to change, systems integrators can develop advanced, flexible real-time radar displays while reducing lifetime costs.

David Johnson, Technical Director
Cambridge Pixel

A modern military command and control display system typically combines the graphical elements of a user interface with the need for complex mapping and real-time sensor display such as radar video (Figure 1). A system integrator needs to consider a broad range of functional, environmental and performance criteria when designing a naval radar display system. An effective system architecture is one that loosely connects well-defined software interfaces and is based on standardized hardware components that are available from multiple vendors. By exploiting the computing potential of the CPU/GPU combination, special purpose hardware can be minimized and, to the dismay of the hardware vendor, the system integrator has choices for the supply of processing hardware, thereby reducing costs.

However, as support and maintenance account for the majority of lifetime costs in military command and control displays, it's vital that the system integrator avoids getting "locked-in" to a proprietary architecture, as this will mean that future enhancements are vendor-specific, and therefore expensive. As always in engineering design, the goal is the simplest solution that meets the requirement. But it's good practice to think of the "requirement" as not just the functional, performance and environmental specifications, but also the ability to respond to changing needs in a cost-effective and timely way. It's what good design is about, but it's also hard to measure and test.

One approach to the provision of solutions for naval radar display is to provide cost-effective and enhanced capability using general-purpose hardware and a flexible software structure that is open to change. This has the combined benefit

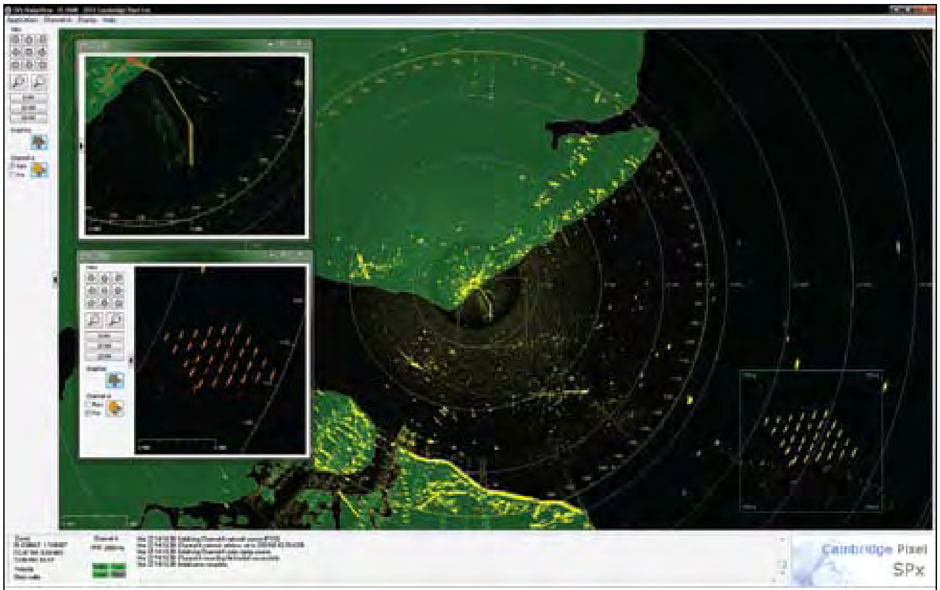

Figure 1

Radar imagery is combined with map and overlay graphics to provide a situational awareness display.

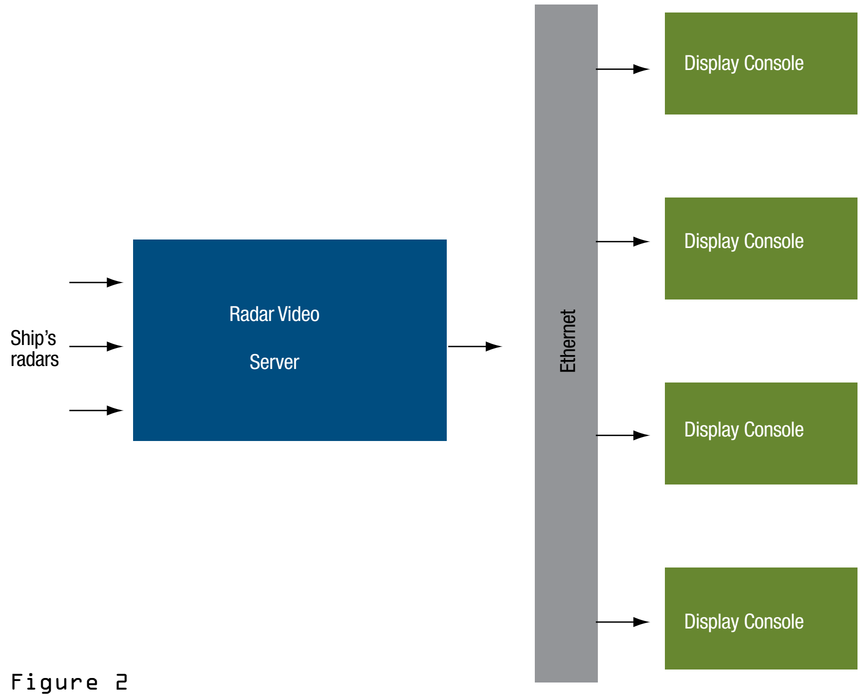

Figure 2

This naval radar display system comprises server application and multiple client consoles connected through Ethernet networks and switches.

of reducing initial procurement costs and enabling the system integrator to support, expand and modify the solution across the project lifetime.

From Sensor to Display

For example, the modern implementation of a naval radar display system has a centralized server that receives video from one or more sensors on the ship (Figure 2). These sensors may provide analog or digital signals that are captured by signal acquisition hardware in the server, or alternatively the server may receive network data direct from the sensor.

The sensor information is processed in the server, which combines multiple data sets into a common format, with standardized format, timing and network structure. The data can then be compressed for distribution across Ethernet networks to multiple client displays. On the client, the display scan converts the radar video and combines with maps and other tactical data sources.

However, the trend is to reduce the complexity and hence the cost of the client console by moving to "thin clients" that offer the benefit of being smaller, cheaper and more adaptable. Advances in processor (CPU) and graphics (GPU) capabilities have enabled the steady reduction in specialized hardware, so that sensor data (radar, sonar, video) can be received into a general-purpose computing platform and processed and displayed in a mission-dependent way. The same hardware platform can now fulfill a range of applications, and can easily be reconfigured to a different operational role, with the connected network providing access to the sensor and tactical data as needed.

With a common hardware display platform there are fewer variants and hence the greatest potential for competitive supply and reduced prices. It is no surprise that ruggedized Linux and Windows PCs now appear as workhorse consoles in many worldwide naval programs. They are cheap to deploy, maintain and eventually replace. So with a simplified hardware platform using modern multicore CPU and graphics processing engines, the emphasis is moved to the software architecture. The desired goal remains to receive sensor data and present a complex multilayered real-time display.

Software Architectures

A hardware processing architecture based around industry-standard buses, backplanes and connections provides well-defined interfaces between functional components. It's common practice to buy a single-board computer from one vendor and install a graphics card from another. Software though can be a very different situation. At the application level, one can be confident that a program built for Windows or Linux will work, but at lower levels, the ability to build a system solution using "functional modules" is less dependable and the silver bullet of software reuse is hard to realize in practice.

A key factor in providing software for any advanced requirement is to recognize that the solution must evolve. This arises because the requirements change—perhaps they were never fully defined, or perhaps the final customer needs something new, or perhaps the platform changes. Changes will occur. Good software design is recognized not by its ability to meet a functional or performance requirement, which can, eventually at least, be met by poorly written code, but rather by its ability to respond to requirement change.

Sometimes the nature of change can be predicted—it's possible to build in the capability to adapt parameters of a process through configuration rather than making coding changes. Good software design is about forecasting changes. As changes to the requirements of a system occur, well-designed system architecture will remain robust. This will ensure that changes will be cost-effective, since they have only a local effect, which can be more easily verified through regression testing. A poorly designed system cannot easily accommodate changes, which are only achieved at the price of coding complexity and substantial verification testing.

Cost and Quality

For a complex software application that needs to evolve and meet changing requirements, the cost of support will be defined by the quality of the design. The engineering process of software development will quantify performance against requirements, but measuring the quality of the design, and hence the resilience to change as the principal component of the lifetime cost, is not so easily handled with simple metrics.

Software that can be successfully maintained, enhanced and adapted needs to be structured into a collection of modules that encapsulate logical grouping of capabilities. These modules need clearly defined interfaces, allowing for replacement or upgrade, akin to hardware modules. The limited board space on a computer interface card forces a board-level structure and the need for interfacing. Software design isn't forced by necessity, but good design demands a similar organization of components with loose-coupled interfaces. These principles of good software design have been long promoted, and they remain the key criteria of a successful solution that can be supported in software that runs the real world.

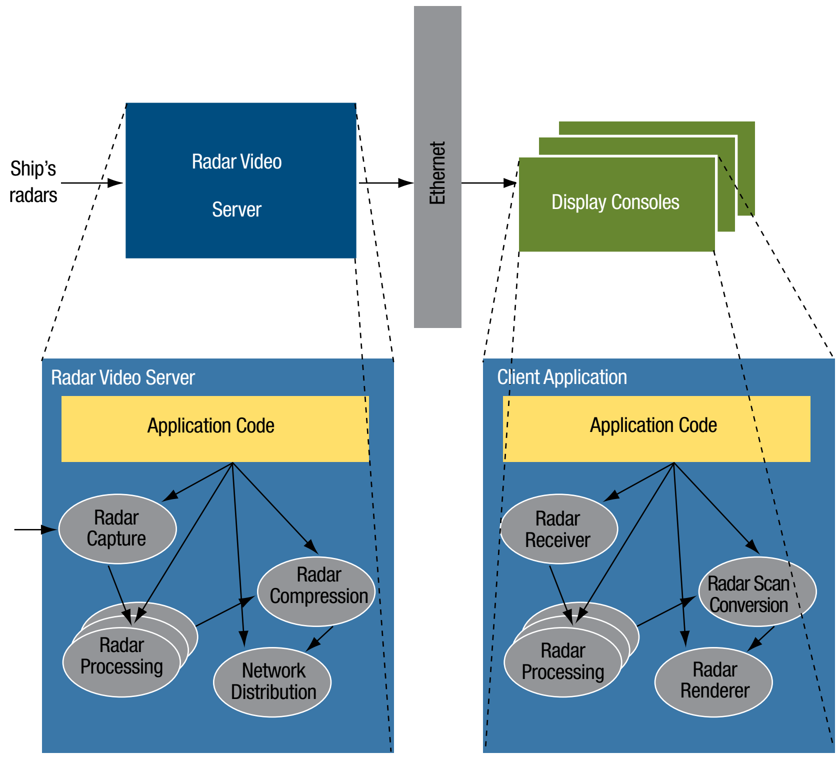

Figure 3

Modular software running in a server and client application improves ease-of-maintenance for radar distribution and display solution.

Two Key Factors

To achieve the much sought lifetime cost benefits for naval displays, two conditions must be met. First, the system is built from industry-standard hardware components available from multiple suppliers, minimizing the use of vendor-specific features and maximizing the use of software for sensor processing using CPU/GPU processing. This approach reduces the initial cost, reduces the number of system variants and reduces the dependency on a specific vendor.

Secondly, the software must be modularized, open and extensible. This partitioned approach allows modules to be upgraded or replaced in isolation. It allows for an application to be built from a combination of modules that may be provided by a specialist company, or may be custom written. Since each module has a well-defined interface, each module can be upgraded in isolation.

Cambridge Pixel's SPx Software library is an example of an open, extensible toolkit approach to the receipt, processing and display of radar video for military command and control. It is architectured to run on standard processing platforms (multicore CPUs and standard GPUs) thereby giving the vendor maximum choice for the hardware. The modular software can be configured by connecting functional units to form processing chains from sensor acquisition through to display. In the case of a server-client configuration, the server is built by combining acquisition, processing, compression and distribution components.

Each of these modules may be maintained and upgraded in isolation, ensuring the solution can be evolved as requirements change. For a client, the solution uses a network receive module, decompression and software-based radar scan conversion.

Radar and Tactical Imagery

Significantly, the software scan converter is able to combine the radar image with the tactical imagery from the application, allowing a weak-coupling and hence easier maintenance of the graphics and radar components. The solution works using Windows graphics (Direct-X, GDI, GDI+) or with Linux (X Windows, GTK etc.) and is able to exploit multiple processor cores to run operations in parallel. Capabilities of the graphics processor (GPU) are deployed to allow the radar image to be blended with application graphics.

The use of general-purpose hardware processing (x86/AMD multicore processing) and graphics processors (AMD or Nvidia) ensures that the solution is portable and easily adaptable to hardware from multiple vendors. There are no vendor-specific features used by the solution, so the choice of hardware ensures the most competition and best economy in the choice of hardware.

The modular software allows the development of server and client applications that build on the functional modules in the library, while permitting custom software to handle project-specific requirements. The proprietary software modules with their well-defined interfaces may be individually upgraded, enhanced (for example using established object-oriented principles of sub-classing to adapt capabilities without fundamen-

Figure 4

SPx radar processing software has been used in the command and control client software for deployment on the British Royal Navy's Type 45 destroyers.
(Photo courtesy of BAE Systems)

tal changes) or even replaced.

A system integrator can use this approach to build a complex radar server or client application, gaining the benefits of using cost-effective hardware, while retaining design control of the application and the capability for first-line support, local customization and long-term enhancement. As the requirements of the application evolve, as they inevitably will, the framework of software will be available to support variants of the solution. The cost of software change is therefore reduced from an implementation based on a tightly coupled software structure or one based on proprietary hardware.

Application Study

For example, BAE Systems Mission Systems, in New Malden and Portsmouth, England, has integrated Cambridge Pixel's software-based SPx radar processing software into its command and control client software (Figure 3) for deployment on the British Royal Navy's Type 45 destroyers (Figure 4) and the Queen Elizabeth Class aircraft carriers. This solution allows radar video to be received from multiple radars on board the ships into a server application and then distributed over Ethernet networks to command and control displays across the ship.

The server application is built from Cambridge Pixel's HPx-100 radar acquisition cards and modular SPx software for compression and network interfacing. The application software in the server remains the responsibility of BAE Systems. The new client-side software-based radar video rendering provides enhanced flexibility and capability at reduced cost over previous generation hardware rendering solutions.

BAE Systems Mission Systems opted for Cambridge Pixel's solution for these programs because of the advanced software solution and flexible product architecture. Also, BAE Systems software engineers were able to work with Cambridge Pixel to integrate the SPx capabilities into its own server and client software solution. ▮

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Military Display Systems Leverage PCI Express Backplane Architectures

Display systems used for today's command and control programs can do amazing tasks. But it's the data processing and data movement behind the scenes that makes it all possible.

Mark Lovett, Chief Marketing Officer
Brad Trent, Director of Engineering
Trenton Technology

Many factors are at play in both training and live combat situations, but Situational Awareness (SA) continues to be a defining factor in executing successful battlefield missions. The warfighter is tasked with making decisions in the field based on the data at hand, while military command and control centers are designed to attain a far more thorough understanding of the operational landscape by aggregating, analyzing and integrating large volumes of data collected from a wide range of sources. In either case, sophisticated display technology is increasingly being called upon to present a combination of images and raw data in such a way that the decision-making process is significantly improved by having access to more accurate and timely information.

Figure 1

With advancements in ruggedization, durability, resolution and performance, displays have fueled a wide variety of military systems including the Panoramic Cockpit Display (PCD) aboard the F-35 Lightning II Joint Strike Fighter (JSF).

The history of electronic displays in military operations goes back to WWII and the early incarnations of CRT-based radar screens. Revolutionary in its time, radar capability proved pivotal to the Allies winning that war, but the more recent advent of powerful computers and enhanced communications capability, combined with advances in video processing technology and display systems, has spawned the age of visualization and collaboration—a paradigm shift that is promoting situational awareness to an entirely new level by creating a more precise Common Operational Picture (COP) that is dynamically generated and can be shared with anyone in the world possessing a network connection.

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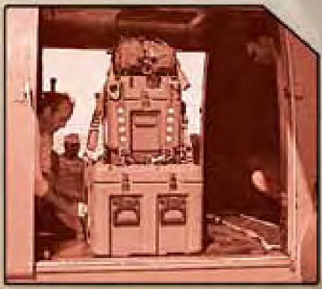

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Figure 2

The Activu system, operating on an IP network, enables any data source to become part of the display. Shown here is an Activu installation at Barksdale Air Force base.

Command and Control Centers

Benefiting from continuous improvements in ruggedization, durability, resolution and performance, displays of various sizes and capability have continued to proliferate within land-based vehicles, ships, aircraft and submarines, as well as in the hands of soldiers. Examples include the Panoramic Cockpit Display (PCD) aboard the F-35 Lightning II Joint Strike Fighter (JSF) (Figure 1), the upgraded Combat Information Centers (CIC) aboard the Navy's Aegis guided missile cruisers, and prototypes of wrist-mounted flexible Organic Light Emitting Diode (OLED) displays. As beneficial as these application-specific solutions have proven to be, nowhere is the influence of display technology more evident than the deployment of video walls in command and control centers.

In contrast to dedicated display systems, which tend to deal with limited data sets and serve individuals or small groups, centralized video wall systems can present multiple image, video and data feeds from sources throughout a theatre of operation to large audiences, both captive and remote. The size and scope of these implementations continue to grow as LED-based DLP cubes hit the market achieving 1920 x 1200 WUXGA resolution and 1920 x 1080 HDTV LCD panels now exceed 80" in diagonal viewing area. Driven by a new generation of video controllers loaded with multi-headed graphics cards, a matrix of LCD or DLP displays provides the viewer with a large virtual desktop that can be easily manipulated in response to rapidly changing situations.

Fundamental Changes

While the visual aspect of building large multi-unit arrays that can fill a conference room is impressive, a fundamental change is underway with regards to managing the overall system. "The new paradigm in video wall technology represents a fundamental shift from being hardware-based to software-based," says Paul Noble, CEO of Activu. "The old way of AV (Audio Visual) thinking has given way to a far more robust IT (Information Technology) mindset, similar to the transition that occurred when communication technology migrated from circuit switching to packet switching."

Rather than building standalone AV solutions, the approach Activu has taken is to use the existing IP network for the transmission, storage and management of information from all sources, which further enables the concept of visualization and collaboration (Figure 2). Operating on the network, any data source can become part of the display. For example, in addition to images and live motion video feeds, real-time data from systems such as access control programs, intrusion detection devices, SCADA management systems or chemical, biological and radiological sensors can be integrated into the view. New content streams can be reviewed on workstations before being pushed to the wall and manipulated on the fly, and bypassing the need for any operator intervention, preset alert parameters can be programmed to trigger automatic content inclusion when specific events occur or limits are exceeded.

Network-Based Sharing

Use of the network for data exchange also enables sharing of displayed information outside the center in a secure manner based on user authentication. When information is only available at one location, remote personnel are forced to spend valuable time in transit to reach the operations center. However, with video images distributed via broadband connections, the entire wall display, or any segment, can be replicated on a personal computer, laptop or wireless mobile device, thus accelerating and improving the decision-making process. When integrated into the network domain, user security is handled via Active Directory authentication.

This combination of network distribution based on user-level security allows segmentation of the data so that different people can each view a subset of the overall picture on a strictly need-to-know basis with detailed log files tracking user activity. In the case of Activu's implementation, Federal Information Processing Standard (FIPS) encryption standards such as 192-bit Triple DES encryption between software modules, 256-bit AES encryption between agent and system server and 160-bit SHA-1 hash password protection are utilized.

Mobile Device Integration

In the past few years mobile devices, such as rugged laptops, smartphones and

Figure 3

With Activu, a video wall can be displayed on a smartphone. In that way the software can push images like these into the field.

tablets, have become increasingly sophisticated with regards to capturing, viewing and editing images or Full Motion Video (FMV) and transmitting such data by way of cellular networks or Wi-Fi connections to the command center when using Activu's Mobility smartphone client (Figure 3). Using a device's built-in GPS, GeoTagging of photos and video in real time allows location coordinates to be included in the metadata along with other critical information such as date, time, annotations and user ID.

Accessing this metadata within a command and control center enables the images or video to be overlaid on a physical or topographic map. Multiple video feeds of an ongoing military operation from different points of view can also be displayed in a coordinated fashion. In addition to operating in transmit mode, these mobile devices can be switched to receive mode, allowing the user to see the same aggregation of information that is present on the command center's wall display, and using dual-touch technology, the device's screen image can be zoomed and scrolled.

Enabling Backplane Technology

Network-based video wall software and the integration of mobile devices create new opportunities for collaboration, but at some point all that data needs to be processed within a video controller. Taking a look inside the box reveals the need for backplane designs that employ a high-speed bus architecture such as PCI Express Gen 2, and provide support for higher video channel density. This requirement was brought to Trenton Technology as a challenge to design and build a backplane that could mount inside a ruggedized 19-inch rackmount enclosure, provide at least sixteen x16 PCI Express Gen 2 slots, and support other I/O such as multiple Gigabit Ethernet connections, standard USB I/O and an optional RAID array.

Supplying sixteen Gen 2 x16 PCI Express slots is not a native capability of any processor or chipset on the market today, as most CPU/chipset combinations support only one downstream x16 PCI Express port. The solution arrived at during the design of Trenton's BPG8032 backplane was to expand that single port using PCI Express switches that take the upstream x16 Gen 2 link from the CPU and multiplex that link to several downstream x16 Gen 2 devices or slots.

The largest readily available switches have 96 lanes of Gen 2 PCI Express, pro-

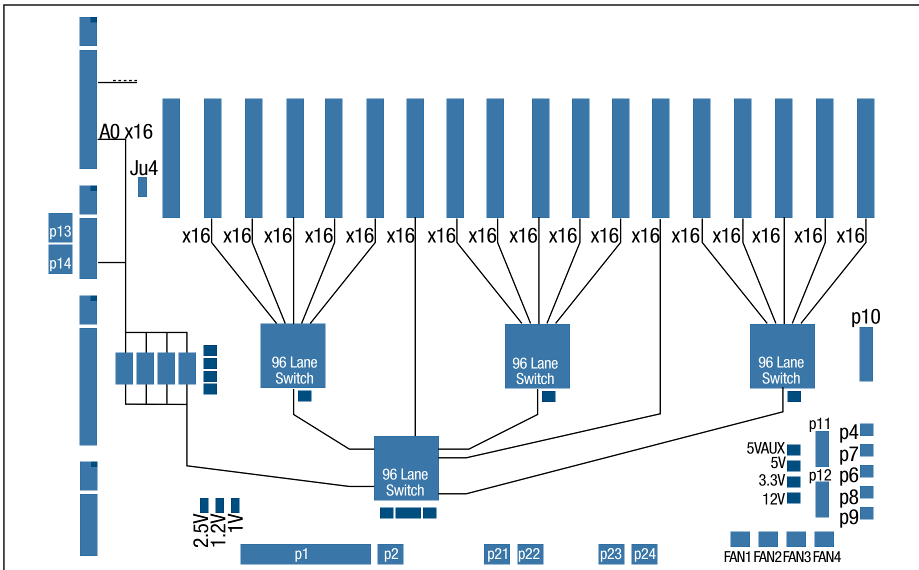

Figure 4

This backplane design supports a PICMG 1.3 system host board and contains four 96 lane Gen 2 PCI Express switches.

viding six x16 Gen 2 ports. One port on each switch is used for an upstream link to the host while the remaining five ports are able to support downstream devices or slots. With an objective of sixteen slots on the backplane, the answer was to cascade three additional switches below the first. With each of these three switches sacrificing one port for an upstream link, five ports remain available for slots, thus providing a total of fifteen slots. The primary switch in the layout used one port for the upstream CPU link and three ports downstream—one for each of the subordinate cascading switches. So out of the original six ports available, two ports remained to support additional x16 PCI Express slots on the backplane for a total of seventeen slots (3 x 5 + 2), exceeding the design objective.

Benefits of Cascade Approach

Implementing a cascade approach—as opposed to simply daisy chaining the switches in a downstream fashion—has advantages. It provides the benefit of reducing the total number of switches that data packets from any one slot must flow through—either upstream to the CPU or to another PCIe slot on the backplane. This can be an important factor in overall system design, as each hop through a switch adds latency and can adversely affect bandwidth. With this design, the maximum number of hops routed through switches was reduced to a maximum of three.

Creating a block diagram of a backplane that supports a PICMG 1.3 system host board and contains four 96 lane Gen 2 PCI Express switches is relatively simple, but translating that diagram into an actual design presented a number of technical challenges (Figure 4). Over half of the backplane's PCB real estate is consumed by the PICMG system host board and device slots. The switches themselves are physically large and also require supporting voltage regulation circuitry. In addition, each device and slot requires PCI Express clocks that are generated by other devices and their supporting circuitry, which means routing room must be available for all of the data signals to each switch and slot.

From the standpoint of board layout, placing these devices wherever there is empty space is not a viable option, as there are stringent requirements for routing Gen 2 PCI Express data and clock lines that must be met in order to ensure functional reliability. For example, at 5 GHz the PCI Express signals must be kept below certain maximum lengths to minimize signal loss, and the transition of these signals between circuit board


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layers must be kept at an absolute minimum in order to reduce noise and jitter in the signal. Therefore, placement of the switch devices to provide the most optimal routing was a critical design objective. In addition, each PCI Express lane is comprised of a differential transmit pair of signals and a differential receive pair of signals. The lines within the differential pair must be carefully matched for length and width and the spacing between them must be accurately maintained throughout the entire length of the signal. The signal pairs must also maintain a significant separation from other signals and ideally should maintain a solid reference to a ground plane without discontinuities.

Power Delivery Issues

Power delivery to the system host board, PCI Express slots and the PCI Express switch circuitry is an integral part of the design process. PICMG 1.3 system host boards can take well over 200W while the x16 PCI Express slot connectors need to provide up to 75W each, and the PCI Express switch circuitry itself needs significant power. Delivering that amount of power into and through the backplane without compromising the signal integrity can be tricky. Thermal issues also come into play as each device must be cooled effectively without the thermal solution interfering with cards that may be plugged into the PCI Express slots. And at the system level, the entire environment must be effectively cooled for long-term reliable operation.

Once video wall cards are plugged in and are ready to run, the next challenge is to make sure that the host board can properly provision the cards for operation in the hierarchical PCI Express environment. PCI Express as an architecture is designed to be backward compatible with PCI and inherits some of the limitations of PCI. When a computer initializes, one of the tasks of the BIOS is to discover each PCI or PCI Express device in the system, query these devices for the system resources required, then allocate those resources if possible. In a dense system with a large quantity of high-end cards, such as multiple output video wall cards, resource requirements can be significant, and in such situations, it is often necessary to modify the BIOS to overcome legacy shortcomings and properly support the configuration.

The evolution of display technology will continue unabated, as will the sophistication of visualization and collaboration software and the ubiquity of mobile devices. To drive it all, the release of PCI Express 3.0 will foster a new generation of video controllers and multiheaded graphics cards by mid-2012. ▐▐

Special thanks to Paul Noble, and Jason Jaworski of Activu for the input and insights they contributed to this article.

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Steve Wozniak

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TUESDAY

JUNE 7 @ 8:30 - 10:00am

MEGATRENDS DRIVING EMBEDDED MULTICORE INNOVATION

Lisa Su

Freescale Semiconductor, Inc.

WEDNESDAY

JUNE 8 @ 11:00am - 12:00pm

THE IMMINENT EDA TRANSFORMATION

Gadi Singer

Intel Corp.

THURSDAY

JUNE 9 @ 11:00am - 12:00pm

COGNITIVE COMPUTING: NEUROSCIENCE, SUPERCOMPUTING, NANOTECHNOLOGY

Dharmendra S. Modha

IBM Research

FPGAs Push the Signal Processing Envelope Further Still

FPGA processing and I/O boards have expanded their roles from ancillary system duties toward primary roles in general-purpose control and data movement.

Jeff Child
Editor-in-Chief

As the signal processing capabilities of FPGAs continue to climb, they've become key enablers for waveform-intensive applications like sonar, radar, SIGINT and SDR. Faster FPGA-based DSP capabilities combined with an expanding array of IP cores and development tools for FPGAs are enabling new system architectures. No longer used merely as glue-logic, FPGAs are now complete systems on a chip. In fact, since many of them even have general-purpose CPU cores on them, the military is hungry to use FPGAs to fill processing roles. Devices like the Xilinx Virtex-5 and -6 and the Altera Stratix IV and V are example FPGAs that have been redefined as complete processing engines in their own right. That means complete systems can now be integrated into one or more FPGAs. Using those FPGAs, board-level subsystems are able to quickly acquire and process massive amounts of data in real time.

Figure 1

The BAMS UAV (artist's rendering) uses a maritime derivative of the RQ-4 Global Hawk equipped with a 360 degree Multi-Function Active Sensor (MFAS) active electronically scanned array along with Navy-specific ground stations.

Board-level product developers continue to exploit those FPGA advances to create powerful compute engines that perform signal processing computation on the FPGAs themselves. At the same time, FPGAs are enabling a new class of I/O board solution that lets users customize their I/O as well as do I/O-specific processing functions. The product roundup in the following pages shows a representative sample

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Extremely Versatile
Complete chassis & embedded PC solutions available! Adapt to VPX, Cabled PCI-Express, PCI-Express, 64-bit PCI, and CompactPCI with our high-quality carriers.
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FrameWork Logic
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of FPGA processing boards on a variety of embedded form factors—including PMC, PCI Express, XMC, VME/VXS, VPX, CompactPCI and FMC.

Exemplifying that trend is military radar. System developers can now use FPGA chips and boards to build radar receiver systems with a higher instantaneous bandwidth thanks to the converters, and can handle the corresponding increase in compute power required to process the received data streams. In contrast, the ASIC-based radar design approaches of the past could achieve the performance needed, but that approach lacked the flexibility inherent in designs based on FPGA technology.

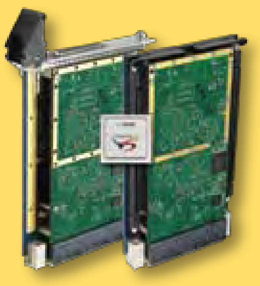
An example program that relies heavily on FPGA processing is the U.S. Navy Broad Area Maritime Surveillance (BAMS) Program. Last summer Mercury Computer Systems was contracted by Northrop Grumman to provide its PowerStream 7000 multicomputer and a heterogeneous operating system for the BAMS UAV. Used for processing of synthetic aperture radar (SAR) images on the BAMS UAV, Mercury's PowerStream multicomputers—deployed on some of the world's largest radar platforms—combined FPGA processors with massive I/O and real-time reconfiguration. BAMS UAV (Figure 1) uses a maritime derivative of the RQ-4 Global Hawk equipped with a 360 degree Multi-Function Active Sensor (MFAS) active electronically scanned array along with Navy-specific ground stations.

FPGAs meanwhile have also become an ideal way to combine multiple I/O functions and their associated conversion and processing functions on the FPGA. Providing a platform for this approach, the VITA FPGA Mezzanine Card (FMC) specification made its debut a couple years back. The spec defines an I/O mezzanine module designed to work intimately with an FPGA. FMC modules enable I/O devices that reside on an industry standard (VITA 57) mezzanine card to be attached to and directly controlled by FPGAs that reside on a host board. About half the size of a PMC mezzanine module, FMCs provide a small footprint, reduced I/O bottlenecks, increased flexibility and reduced cost through the elimination of redundant interfaces. As the product roundup on the following pages shows, FMC slots are showing up on a variety of embedded form factors including AMC, VPX and others. ▮

Technology Focus:
FPGA Processing Boards Roundup

VPX Boards Marry Virtex-5 FPGA with PCI Express

Acromag's new VPX FPGA boards deliver maximum performance for accelerated algorithm processing or execution of complex logic routines in embedded computer systems. Acromag's VPX-VLX series of 3U VPX FPGA boards features a configurable Xilinx Virtex-5 FPGA enhanced with multiple high-speed memory buffers and a high-throughput PCIe



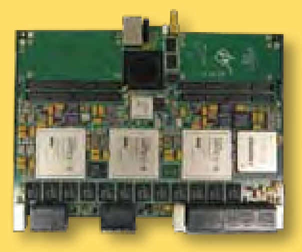
interface. Field I/O interfaces to the FPGA via the rear P2 connector and/or with optional front mezzanine plug-in I/O modules.

Three models provide a choice of logic-optimized FPGAs to match the performance requirements. Cards can be ordered with a Xilinx VLX85T, VLX110T, or VLX155T FPGA featuring up to 155,000 logic cells and 128 DSP48E slices. Each model is available in a format designed for use in air-cooled or conduction-cooled systems suitable for -40° to 85°C operation. Large, high-speed memory banks provide efficient data handling. Dual-ported 1M x 64-bit SRAM enables high-speed DMA transfers to/from the CPU while simultaneously writing data to memory. Generous 32M x 32-bit DDR2 SDRAM buffers give the FPGA fast access to I/O port data. FPGA code loads from the PCIe bus or from onboard flash memory. A double fat pipe 4-lane PCIe interface ensures very fast data throughput. 64 I/O lines are accessible through the rear (P2) connector. A series of AXM extension modules are available to provide additional front-end A/D, RS-485, CMOS, or LVDS I/O channels through a mezzanine connector on the front of the board. Pricing for the boards starts at $7,100 with several options for FPGA logic capacity and conduction-cooled extended temperature operation.

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

OpenVPX Board Sports Three FPGAs and PowerPC CPU

Defense applications such as radar, SIGINT, software radio, image processing and encryption all have something in common: they all have a big appetite for FPGA-based processing. Serving those needs, Annapolis Micro Systems offers its WILDSTAR 6 OpenVPX Card, with up to three Xilinx Virtex 6 FPGAs and one MACC 460Ex PowerPC. The FPGAs can be XC6VLX240T, LX365T, LX550T, SX315T, or SX475T versions of the Virtex 6. The board provides up to 3.1 Gbytes of DDR2



DRAM, 3.1 Gbytes of DDR3 DRAM or 192 Mbytes of DDRII+ or QDRII

SRAM in 5 or 6 memory banks for the computational FPGA on board. Meanwhile, up to a board total of 4 Gbytes DDR2 DRAM, 4 Gbytes DDR3 DRAM or 256 Mbytes DDRII+ or QDRII SRAM is arranged in 4 memory banks for each of two I/O FPGAs on board. The host AMCC 460EX PowerPC has clock speeds up to 1 GHz and 512 Mbytes of its own dedicated DRAM. Flash on board consists of 64 Mbyte NOR flash in addition to 4 Gbytes of NAND flash to store FPGA images and for application data.

A 4X PCI Express Gen 1 link connects the PowerPC and PCI controller. Host software includes Linux, VxWorks APIs and device drivers. A full CoreFire Board Support Package provides fast and easy application development. Open VHDL Models including Source Code is available for hardware interfaces and chip scope access. An Open VHDL IP package supports communication interfaces. Application software can access current, voltage and temperature monitoring sensors via API software interface. The board accepts standard Annapolis WILDSTAR 4 / 5 / 6 Family I/O modules. The card has an integrated heat sink and full IPMI chassis management support.

Annapolis Micro Systems Inc
Annapolis, MD.
(410) 841-2514.
[www.annapmicro.com].

AMC Board Serves Up Dual Stratix IV FPGAs

Stratix IV FPGAs offer a high-density compute solution for military applications. Bringing that to the AdvancedMC form factor, BittWare offers a solution that provides two Altera Stratix IV FPGAs making it the densest AdvancedMC on the market in terms of FPGA

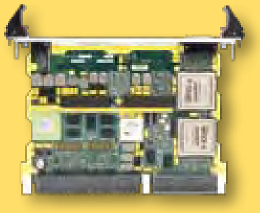
processing power. Ideal for those applications requiring high-speed communications coupled with high-density reconfigurable processing, the D4-AMC (D4AM) combines an Altera Stratix IV E (Enhanced) FPGA, with an Altera Stratix IV GX FPGA optimized for serial I/O-based applications. A VITA 57 FMC site is provided for I/O and processing expansion with options available for high-speed data conversion enabling designers to adapt the D4AM to their complex and changing requirements.

Two Stratix IV FPGAs on a single AMC board translates into 1,350K logic elements in a single slot. The D4AM is a mid- or full-size, single wide AdvancedMC that can be attached to ATCA carriers or other cards equipped with AMC bays, and used in MicroTCA systems. A Stratix IV GX FPGA paired with a Stratix IV E FPGA makes the D4AM an extremely high-density, flexible board. The FPGAs are connected by two full-duplex 2 Gbyte/s lanes of parallel I/O for data sharing. Each FPGA supports BittWare's ATLANTiS FrameWork to greatly simplify application development and integration. Providing enhanced flexibility is a VITA 57-compliant FMC site, which connects directly to the Stratix IV E FPGA for LVDS and to the Stratix IV GX FPGA with SerDes. The board also provides an IPMI system management interface and a configurable 18-port AMC SerDes interface supporting a variety of protocols. Onboard memory includes up to 1 Gbyte of DDR3 and 128 Mbytes of flash, and Ethernet is available via the AMC front and rear panels. The D4AM is available today priced at under $7,000 in OEM quantities.

BittWare
Concord, NH.
(603) 226-0404.
[www.bittware.com].

VITA 46/VITA 48 Board Features Dual Virtex-6 FPGAs

FPGAs are causing a true revolution in military embedded processing. The latest version 6 of the Xilinx Virtex line is feeding that flame. Riding that wave, Curtiss-Wright Controls Embedded Computing (CWCEC) has announced the CHAMP-FX3, the first rugged, high-performance FPGA OpenVPX 6U VPX board that features dual Xilinx Virtex-6 FPGAs. Available in both conduction-cooled and air-cooled versions, the CHAMP-FX3 provides dense FPGA resources combined with general-purpose processing, I/O flexibility



and support for multiprocessing applications. It speeds and simplifies the integration of advanced digital signal and image processing into embedded systems designed for demanding Radar Processing, Signal Intelligence (SIGINT), ISR, Image Processing and Electronic Warfare applications.

The CHAMP-FX3 combines the dense processing resources of two large Xilinx Virtex-6 FPGAs (SX475T or LX550T) with a powerful AltiVec-enabled dual-core Freescale Power Architecture MPC8640D processor on a rugged 6U OpenVPX-compatible (VITA 65) form factor module. The CHAMP-FX3 complements this processing capability with a rich assortment of rear-panel I/O and memories, including a Serial RapidIO (SRIO)-based switching fabric, 16 high-speed serial links per FPGA, and 20 pairs of LVDS links to the backplane that can be used to support high-speed parallel interface such as Camera Link. For system expansion, the board also provides two FMC sites (or a single FMC/VITA 57 site) and a PCI Express (VITA 42.3) or Serial RapidIO (VITA 42.2) XMC site. The FMC sites have been enhanced to support the next generation of FMC cards with 80 pairs of differential signals. Early Access Units will be available in Q1 2011.

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

Wideband Digital Receiver/Exciter Module Suits Anti-IED Apps

IEDs represent the largest cause of casualties in current U.S. conflicts. Electronics to defeat such devices are therefore extremely key. GE Intelligent Platforms has announced the SPR870A 3U VPX Wideband Digital Receiver/Exciter Module. Building on GE's legacy of industry-leading digital receiver families and extending still further the growing ecosystem

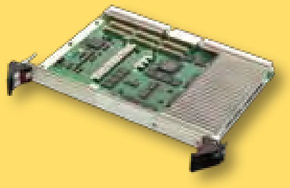
of GE 3U VPX solutions, it features Xilinx Virtex-6 FPGA technology to enable its deployment in wideband signal acquisition and conversion applications such as radar ECM (electronic counter measures), pulse intercept and analysis (ELINT) and RF (radio frequency) test applications. The type of highly demanding, sophisticated ECM applications for which the SPR870A is ideal include spoofing hostile radar—allowing the host to change its perceived characteristics, for example, to confuse enemy intelligence—or for jamming remote control IED (improvised explosive device) signals, enabling bombs to be defused more safely.

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

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

6U FPGA-Based VME SBC Boasts Triple Redundancy

For some military embedded control applications, a step above the usual levels of reliability is required. Along such lines, MEN Micro offers the A602, a 6U FPGA-based, triple-redundant 64-bit VME SBC that employs a lock-step architecture keeping software development at a minimum. With this redundant lock-step system that increases system reliability, the SEU-resistant A602 runs the same set of operations in parallel to ensure that the programming only views the hardware components once, making the new board ideal for mission-critical applications including those in the avionics market. The single-slot, COTS-



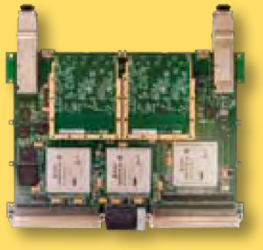
based A602 developed according to DO-254 offers incomparable reliability and economical implementation with high reliability up to Design Assurance Level (DAL) A (catastrophic) in avionics and up to Safety Integrity Level (SIL) 4 in trains, the most stringent level in each class.

To ensure the highest safety standards, the 900 MHz PowerPC 750, the 512 Mbyte main memory and the internal structure of the FPGA are triple-redundant. Critical functions, like voters implemented as IP cores in the FPGA, monitor at least two of the three redundant components to provide the same result to guarantee system reliability. In the event one of the three redundant components fails, the system remains completely operational providing the required availability for highly critical systems. Standard I/O contained in the FPGA is accessible via the rear. This includes a sextuple UART, an I^2C bus and an RS-232 interface that can also be led to the front. The A602 also provides two PMC slots, one accessed via the front or rear I/O that can be used with all standard PMC modules, and the other for an AFDX PMC connection via rear I/O. Operating temperature is -40° to +50°C with qualified components. Pricing for the A602 is $12,994.

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

VXS Digital Receiver Boards Sport Three FPGAs

FPGAs are a critical technology for today's sensor data processing applications. Feeding such needs, Mercury Computer Systems has announced two Echotek Series products, both using three Xilinx Virtex-5 FPGA processors, two high-speed fiber transceivers, and two FPGA Mezzanine Card (FMC) sites for high-bandwidth I/O. As integrated components, they extend the functional range of Mercury's VXS and RACE++ Series systems with digitization and FPGA processing of sensor-based data streams.



The Echotek Series DCM-V5-VXS digital receiver features the latest in A/D and D/A technology via converters mounted on the FMC sites, allowing for high-speed/high-resolution data conversion while still preserving the quality of the original signal. The module couples this data conversion capability with market-leading processing power delivered by a set of three Virtex-5 SX240T or LX330T FPGAs, which can be programmed by the end user for customer-specific application features. Moreover, these FPGA processors provide up to 3,156 DSP slices. Each Virtex-5 FPGA is accompanied by both DDR-II-SDRAM and QDR-II-SRAM chips and is connected by multiple high-speed data paths to the FMC sites, to the system backplane interface, and to two fiber transceivers.

Mercury Computer Systems
Chelmsford, MA.
(978) 967-1401.
[www.mc.com].

AMC Module Features FMC I/O Expansion

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

The FPGA has an embedded Xilinx Microblaze processor core for application control and management including Petalogix Linux OS. A development kit includes FPGA IP framework with cores for processor node and all FPGA peripherals. A high pin count FMC site enables the addition of FPGA I/O including network, analog, digital and video interfaces.

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

Reconfigurable Controllers Offer Extended Temp Operation

FPGA technology has changed the way measurement and control systems are designed. National Instruments offers two CompactRIO programmable automation controllers (PACs), which offer engineers and machine builders an ideal solution for high-performance measurement and control applications operating at extended temperatures. The NI cRIO-9023 and NI cRIO-9025 (shown) real-time controllers also are available with conformal coating for additional protection of components and circuitry within harsh conditions.

The CompactRIO controllers provide even more processing for advanced measurement and control applications ranging in temperatures between -40° and 70°C. The NI cRIO-9023 controller has a 533 MHz PowerPC processor, and the NI cRIO-9025 controller has an 800 MHz PowerPC processor, as well as dual Ethernet ports for network programming, communication and expansion I/O. Both controllers work with the existing CompactRIO reconfigurable chassis, which includes field-programmable gate arrays (FPGAs) that are programmed using the NI LabVIEW graphical system design platform. Using LabVIEW and CompactRIO, engineers can quickly implement custom analog and digital control loops, along with high-speed signal processing algorithms to meet their advanced measurement application needs. In addition to an extended operating temperature, the CompactRIO controllers are available with conformal coating. This coating is a specially formulated thin film material applied directly to circuit boards or circuit card assemblies and provides an impermeable seal to protect circuitry from humidity, moisture, mold, mildew, fungus, dust and corrosion caused by exposure to extreme environments.

National Instruments
Austin, TX.
(888) 280-7645.
[www.ni.com].

VPX Board Family Packages Virtex-6 FPGAs for Mil Apps

The OpenVPX ecosystem has grown leaps and bounds over the past 12 months. In synch with that trend, Pentek offers a family of ruggedized boards for high-performance military and avionics applications utilizing the industry's most advanced FPGA technology. Pentek's 53xxx Cobalt board family incorporates Xilinx's Virtex-6 FPGAs for onboard signal processing, delivering digital sampling rates to 1 GHz in a compact 3U VPX form factor. By combining processing, data conversion and preconfigured functions, the 53xxx family is suitable for such applications as

UAV, CommINT (Communications Intelligence) transceivers, airborne communications recorders, airborne radar countermeasures, shipboard diversity transceivers and armored vehicle anti-IED systems.

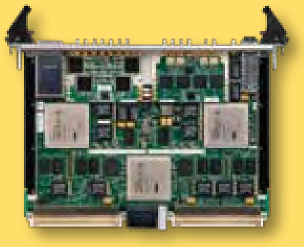
Pentek's 53xxx Cobalt family is the first to bring Virtex-6 FPGA technology to the VPX format. With more than twice the resources of previous Virtex generations, including new enhancements in digital signal processing, logic and clocking, the Virtex-6 family provides developers with a previously unavailable level of customizable processing power. Pentek gives the FPGA full access to all data and control paths and then harnesses its raw processing power by pre-configuring boards with key functions. This strategy provides a wealth of useful turn-key operations, while leaving enough unused FPGA capacity for adding customer-developed IP.

All Cobalt VPX products are available with a choice of Xilinx Virtex-6 LXT or SXT FPGA devices to match the application. Other common features of Cobalt boards include PCI Express (Gen 2) interfaces up to 8 lanes wide, synchronous clocking locked to an external system reference, and an LVPECL synch bus for synchronizing multiple modules to increase channel count. The Cobalt 53xxx 3U VPX module pricing starts at $14,490.

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

VME/VXS Board Offers Highly Connected Virtex-6 FPGA Processing

For today's advanced FPGAs it's not just about the on-chip signal processing. Getting data off and on the FPGAs is just as important. With all that in mind, TEK Microsystems has announced the first platform based on its next-generation QuiXilica-V6 architecture, bringing Xilinx's Virtex-6 FPGA technology to VME and



VXS-based applications. The new QuiXilica-V6 VME/VXS baseboard combines three Xilinx Virtex-6 FPGAs with two QuiXmodule sites, supporting the industry's widest range of Analog-to-Digital Converter (ADC) and Digital-to-Analog Converter (DAC) resolutions and bandwidths using a common hardware architecture. Like previous generations of QuiXilica products based on Virtex II Pro and Virtex 5 technology, the QuiXilica-V6 VME/VXS is compatible with legacy VME systems as well as newer ANSI/VITA 41 VXS-based systems in both laboratory and deployed / rugged applications.

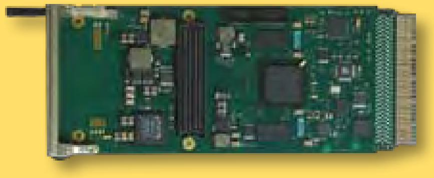
The two front-end FPGAs are attached directly to the QuiXmodule sites, providing a simple and direct high-speed connection between the ADC and DAC devices and the FPGA. The third FPGA can be used to support additional processing and also any required protocol support for either front panel or backplane interfaces. All of the FPGA sites use the FF1759 package, which supports both LXT devices, optimized for high density logic, as well as SXT devices, optimized for digital signal processing.

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

FPGA-Based AMC Boasts FMC Module Slot

TEWS Technologies has introduced a standard single mid-size or full-size AMC.1 module TAMC631 with a user-programmable XC6SLX25T-2 or XC6SLX75T-2 Spartan-6 FPGA. Designed for COTS applications where specialized I/O or long-term availability is required, the TAMC631 provides a number of advantages including a customizable interface for unique applications and an FPGA-based design to extend product lifecycle.

For flexible front I/O solutions, the TAMC631 provides a VITA 57 FMC module slot with a low-pin count connector, allowing active and passive signal conditioning. All FMC



I/O lines are directly connected to the FPGA, which maintains the flexibility of the Select I/O technology of the Spartan-6 FPGA. The low-pin count interface includes one multi-gigabit link. In addition, the FPGA is connected to two banks of 128 Mbyte, 16-bit wide DDR3 SDRAM.

The FPGA is configured by a platform flash. The flash device is programmable via a JTAG header. The JTAG header also supports readback and real-time debugging of the FPGA design using Xilinx ChipScope. A programmable clock generator provides up to three different clock output frequencies between 5 kHz and 200 MHz. The clock generator settings are programmable via JTAG and are stored in an EEPROM. In addition, two differential reference clocks are available from the FMC slot to the FPGA. User applications can be developed using the design software ISE WebPack, which can be downloaded free of charge from www.xilinx.com. Extensive software support for major operating systems such as Windows, LynxOS, Linux, Integrity, VxWorks and QNX is available.

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

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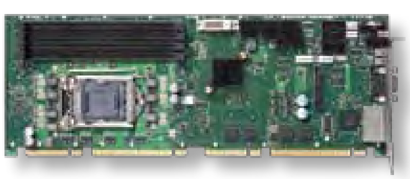
Compact Baseboard Works with Any COM Express Module

COM Express is becoming a much sought after solution for rugged mobile computer applications such as Androids, Robots, UAV and wearable computers, where extended temperature, shock and vibration are critical factors of the environment. Feeding those needs, New Embedded Technology has announced the A-Brain mobile compact computer baseboard. Compatible with COM Express compact size standard computer modules, the A-Brain features a baseboard only 95 mm square and includes on the top I/O side two low profile RJ45 Gigabit LAN connectors, Mini-PCIe I/O board socket with hard screw/nut mounting and standard Type II CF IDE Flash for diskless booting. Also available are two SATA ports with one standard and one locking connector. Included on multiple locking connectors are eight USB 2.0 ports, four RS-232 ports, VGA, eight digitally buffered GPIO, and RESET/POWER/External LEDs multi-use connection. The fourth serial port can also become a RS-422/485 interface as a factory option.

The A-Brain is unique due to the capability of using any embedded COM Express CPU module that meets the PICMG standard for its processing while providing additional I/O expansion particular to the mobile and military market. The unit is ideal when used with a passive cooling plate with compact size 95 mm by 95 mm SBC modules. Whether the application requires a high-end dual core processor, a low power Intel Atom processor or an Arm processor, New Embedded Technology can provide a system solution to match a specific requirement. Power can be provided to the A-Brain through a small locking 12-pin power connector with a cable adapter available, able to be connected to any ATX power supply. New Embedded Technology can also provide internal DC-DC mounted ATX power supplies, the size of a quarter coin, with models available to be powered by 12V regulated, 24-28V and 12V battery power sources and up to 120W of ATX output. Prices range from $249 to $569 depending on features and options.

New Embedded Technology, Encinitas, CA. (760) 845-1699. [www.newembedded.com].

Single Board Computer Marries Xeon Processor E3-1200 CPU and Rich I/O



The Trenton TSB7053 incorporates the new Intel Xeon processor E3-1200 family and the latest Intel Platform Controller Hub (PCH) technology into a PICMG 1.3 single board computer (SBC) design. The TSB7053 features the Xeon processor E3-1275 and the Intel C206 chipset. Direct PCI Express 2.0 links out of the processor provide superior interface support for the PCIe 2.0, PCIe 1.1 and PCI option card slots used in a typical high-performance rackmount computer system design. Trenton's TSB7053 supports key Intel technology enhancements such as Intel vPro technology, Advanced Vector Extensions (Intel AVX) and HD Graphics P3000. The board provides four DDR3 DIMMs (32Gbyte max. system memory), six SATA ports, Integrated TPM 1.2 and onboard storage. For I/O the board offers ten USB ports, three Gbit Ethernet interfaces, dual video ports, an RS-422/585 port and an RS-232 port.

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

USB to RS-485 Serial Adapter for Extreme Environments

A new single-port USB to RS-485 serial adapter incorporates a ruggedized, overmolded enclosure to offer fast, reliable serial communication for even the toughest environments, including factory floor, mobile and outdoor applications. The serial port appears as a standard COM port to the host computer enabling easy setup and providing compatibility with legacy software. The SeaLINK+485-DB9 from Sealevel Systems features programmable baud rate and data formats with 128-byte transmit and 384-byte receive buffers for fast, error-free communication. Each adapter includes a removable terminal block adapter (Item# TB34) that simplifies field wiring. Thumbscrews on the TB34 secure the terminal block adapter to the serial port and prevent accidental disconnection. The SeaLINK+485-DB9 operates over an extended temperature range of -40° to +85°C. Single unit pricing is $89.

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

CompactPCI Serial Gigabit Ethernet Switch Boasts Integrated Self-Test

The CompactPCI Serial spec has captured great interest right out of the gate. MEN Micro continues to expand its CompactPCI Serial offering with the G301, a rugged 3U Ethernet Switch that features four Gigabit Ethernet ports via RJ45 or M12 connectors in the front, complying with the PICMG CompactPCI Serial standard fully ratified at Embedded World 2011. An optional fifth Gigabit Ethernet port can be made accessible at the rear via the J6 connector as well.

Thanks to its integrated self-test mechanisms, the G301 proves very reliable in communication systems and supports full and half duplex, fast non-blocking store-and-forward switching and autonegotiation as well as Layer-2 switching. The robust switch is fault-tolerant and restores itself automatically: If a link is temporarily unavailable, it will work again after the disturbance without any restart or reset. The Ethernet switch has especially been developed for mobile communication in harsh environments and is certified for operation in the extended temperature range of -40° to +70°C with +85°C possible for up to ten minutes according to railway standard EN 50155. All components are soldered to withstand shock and vibration and are prepared for conformal coating. Pricing for the G301 is $553.

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

Rugged Sub-½ ATR Box Is Convection-Cooled

Extreme Engineering Solutions has announced the immediate availability of the XPand5200, a convection-cooled sub-½ ATR box that provides both convection-cooling and conduction-cooling to conduction-cooled payload cards. Both 3U CompactPCI and 3U VPX backplanes are supported by the XPand5200. Meeting the rigorous MIL-STD-810 standards, the XPand5200 is a sub-½ ATR solution for deployed systems in the harshest environments. The XPand5200 features include a ½ ATR natural convection-cooled and conduction-cooled chassis (reduced height and length) and four conduction-cooled 0.8-inch slots. Its physical dimensions are 4.88 in. (W), 5.65 in. (H), 10.30 in. (L). Both 3U VPX and cPCI backplanes and available and the system supports up to three D38999 front panel I/O connectors (configurable). A MIL-STD-704-compliant, 28 VDC power supply comes integrated in the unit.

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

Rugged 3U cPCI Data Recording Server Targets Harsh Environments

Mission-critical applications like surveillance need data recording solutions that can survive harsh environments and provide data integrity. Feeding such needs is the application-ready Kontron rugged RAID Data Server OBSERVO. The server is based on 3U CompactPCI technology, which offers modularity and longevity in a robust design. The Kontron OBSERVO can be configured to meet the specific application needs for video, radar or sonar data recording.

Kontron's rugged RAID Data Server OBSERVO boasts a high-speed RAID array comprising up to eight SATA-II hard disks or Solid State Drives (SSDs). The server also features high availability and high shock and vibration resistance to fulfill the requirements of mobile and naval-based surveillance applications, for example.

The OBSERVO can be configured with several different performance options such as Ethernet switch integration, extended duty (24/7) drives and a range of communication options. If required, conformal coating can also be included to protect the system against humidity and dust, which is especially relevant for EN50155 compliancy and deployment in railway applications such as railway platform edge observation or video recording in local trains to prevent vandalism. The Kontron rugged RAID Data Server OBSERVO can be configured to accommodate the extended temperature range of -40° to +80°C to deliver trouble-free 24/7 operation under extreme environmental conditions, for example in borderland surveillance applications. The rugged CompactPCI design with the high-performance backplane eliminates the need for internal cabling. Also, the hot swappable hard disk and SSD carriers minimize system maintenance.

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

10W DC/DC Converters Support -40° to +90°C Temp Ranges

Designed as a turn-key solution for applications requiring input to output isolation, the EW from Calex offers three input ranges with five output voltage combinations. This 10 watt EW Single Output Series of DC/DC converters offers available input ranges of 9 to 18V, 18 to 36V and 36 to 75 VDC. The output voltage options are 2.5, 3.3, 5, 12 and 15 VDC. The input to output isolation is 1500 VDC. All outputs are tightly regulated for problem-free operation. The EW is housed in a five-sided shielded metal enclosure. Case size is 1.25" x 0.80" x 0.4"H. All models are fully encapsulated for improved thermal performance.

The operating temperature range of the EW is -40° to +90°C. The switching frequency of all models is 400 kHz with efficiencies as high as 87%. Output noise is as low as 50 mV peak to peak. Output voltage accuracy is +/-0.6%. Line and load regulation is +/-0.3% and +/-0.5% respectively. Temperature coefficient is +/-3% and all models are protected through continuous short circuit protection.

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

PATA SSD Series Boasts 32 and 64 Gbyte Capacities

Apacer has announced a series of PATA SSDs, such as 2.5- and 1.8-inch high-speed and high-capacity AFDs (ATA Flash Drives) and the compact ADM 3G (ATA Disk Module 3G). Both standardized and customized products come available in all specifications. The newly unveiled standardized AFD (ATA Flash Drive) SSDs consist of highly stable SLC (Single-Level-Cell) chip. The AFD 255 with 2.5-inch 44-pin connectors comes in 32 and 64 Gbyte capacities, while the 1.8-inch AFD 185 supports ZIF connectors, offering a maximum of 32 Gbyte capacity. With sequential read and write speeds of up to 125 and 110 Mbytes/s, respectively, both can enhance computer performance and meet user needs for highly stable and reliable storage solutions. To save motherboard space, the new ADM (ATA Disk Module) 3G has been reduced in size by about 58% from its previous generation, measuring only 6.45 mm in thickness.

Apacer Memory America, Milpitas, CA. (408) 586-1291. [www.apacer.com].

FMC Card Serves Up Quad Channel 250 MSPS ADC

The FPGA Mezzanine Card (FMC/VITA 57) has emerged as an ideal technology for bringing FPGA-centric functions to military embedded computing. Curtiss-Wright Controls Embedded Computing (CWCEC) has introduced a new rugged FPGA Mezzanine Card (FMC/VITA 57) module, the FMC-516, which is a quad channel 250 MSPS 16-bit analog input card that enables I/O devices to be directly coupled to a host FPGA. By providing direct ADC connection to the host FPGA, this compact card ensures maximum throughput and enables multiple channels and boards to be synchronized. The FMC-516 speeds and simplifies the integration of FPGAs into embedded system designs. The low-latency, high-bandwidth module eliminates data bottlenecks. The card is designed for use in demanding military applications such as Signal Intelligence (SIGINT), Electronic Counter Measures (ECM) and RADAR that require high-speed ADC components as part of a digital receiver.

The FMC format is supported on a wide range of CWCEC FPGA-based host boards, which are designed to process the FMC-516's I/O data with high-bandwidth, low-latency paths. The FMC-516's four ADC devices connect through the module's high-bandwidth FMC connector to an FPGA-based host board to maximize data throughput and minimize latency. The FMC-516 supports an onboard programmable sample clock generator as well as an external reference input. Multiple FMC-516 boards can be synchronized to increase the number of input channels through the use of trigger input/output signals directly under the control of the FPGA. The FMC-516 is available in both air-cooled and conduction-cooled rugged versions.

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

Solution Turns USB Port into an Avionics 1553/429/717 Interface

Data Device Corp. has introduced a new Multi-I/O Advanced Avionics Tester that connects to any USB port to provide comprehensive avionics test, simulation and analysis support. The BU-67211UX combines up to two dual redundant MIL-STD-1553 channels, with up to eight user programmable Receive/Transmit ARINC 429 channels, and up to two user programmable Receive/Transmit ARINC 717 channels, while providing support for IRIG-B, CANbus, Serial I/O and Discrete I/O interfaces. The 1553 channels provide unique features and functionality such as concurrent BC + Multi-RT + MT, real-time intermessage event/data modification, error injection, advanced error sampling and many others. Each ARINC 429 channel is programmable to be a transmitter or receiver, which allows for maximum flexibility and is ideal for systems integration labs.

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

AMC Sports FPGA and TI Eight-Core DSP

CommAgility announced the AMC-2C6678, its latest AdvancedMC module, which includes two high-performance TMS320C6678 digital signal processors (DSPs) from Texas Instruments Incorporated (TI). The module also includes a Xilinx LX240T Virtex-6TM FPGA for additional I/O and coprocessing flexibility. The TMS320C6678 integrates eight TMS320C66x advanced processing cores with fixed and floating point capability running at 1.0 to 1.25 GHz. The TMS320C66x delivers exceptional performance of up to 320 GMACS and 160 GFLOPs on a single device. A range of high-speed I/O options is provided. Serial RapidIO (SRIO) V2.1 at speeds of up to 20 Gbits/s per port is supported by an IDT CPS-1848 SRIO Gen2 switch and the module includes a Gigabit Ethernet interface. As standard, three front panel SFP+ optical interfaces to the FPGA are fitted. The optical interfaces offer flexible high-speed links and are configurable as CPRI, OBSAI, Gigabit Ethernet, SRIO or other standards.

CommAgility, Loughborough, UK. +44 1509 228866. [www.commagility.com].

Rugged Managed Ethernet Switch Offers 12 Ports

Aaxeon Technologies has announced its new LNX-1212GN-SFP-T Industrial 12-port Managed Gigabit Ethernet Switch. The LNX-1212GN-SFP-T is a managed redundant ring Ethernet switch with 8 x Gigabit combo ports and 4 x 1000BaseX SFP ports. With complete support of Ethernet Redundancy protocol, Redundant Ring and MSTP/RSTP/STP (IEEE 802.1s/w/D), the LNX-1212GN-SFP-T can protect your critical applications from network interruptions or temporary malfunctions with its fast recovery technology. It can provide advanced IP-based bandwidth management that can limit the maximum bandwidth for each IP device. Users can configure IP cameras and NVR with more bandwidth and limit other device bandwidth.

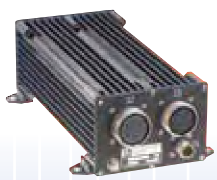
The LNX-1212GN-SFP-T also supports application-based QoS. Application-based QoS can set the highest priority for data streams according to the TCP/UDP port number. The IP police function can permit only allowed IP addresses with MAC addresses to access the network. Hackers cannot access the IP surveillance network without permission. It can prevent hackers from stealing private video data and from attacking IP cameras, NVRs and controllers. The LNX-1212GN-SFP-T also provides advanced DOS/DDOS auto prevention. If an IP flow becomes too big in a short period of time, the switch will lock the source IP address for a set amount of time to prevent the attack.

Aaxeon Technologies, Brea, CA. (714) 671-9000. [www.aaxeon.com].

VME, VXS and OpenVPX SBCs & Ethernet Boards Gallery

Featuring the latest in VME, VXS and OpenVPX SBCs & Ethernet Boards technologies

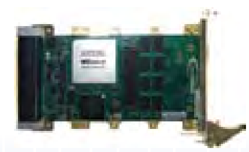
NightHawk RCU



Aitech's NightHawk RCU, a 1.6 GHz Intel Atom-based, self-contained control unit weighs only 4.5 lbs. This weight reduction, slimmer profile and natural convection/radiation cooling that dissipates up to 22 W at +55°C in still air, make the rugged control unit ideal for a variety of military, aerospace and commercial environments.

Aitech Defense Systems
Phone: (888) 248-3248
Fax: (818) 350-6888
E-mail: sales@rugged.com
Web: www.rugged.com/nighthawk.htm

S4-3U-VPX Commercial & Rugged Altera Stratix® IV GX 3U VPX Board



- VITA 57 FMC site for processing and I/O expansion, available with high bandwidth A/D and/or D/A
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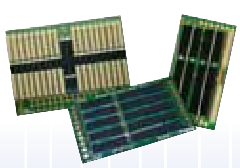
Web: www.bittware.com

VITA Backplanes



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Fax: (937) 324-2425
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Web: www.hartmann-electronic.com

VX3035 - 2nd Generation Intel® Core™ i7 Single Board Computer

Kontron expands its VPX ecosystem with 3U VPX CPU board VX3035 based on the 2nd generation Intel® Core™ i7 processor. Integrating the Intel® Core™ i7 2655LE processor, Intel® HD graphics and features such as Intel® Turbo Boost technology and Intel® Advanced Vector Extensions (Intel® AVX), VX3035 defines a new performance class for SWaP (size, weight and power) optimized VPX applications. For more information – www.kontron.com/vpx.

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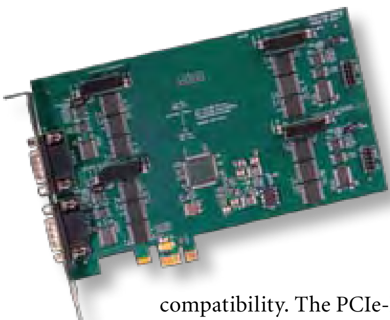


Isolated PCIe Serial Comms Boards Offer Speeds up to 3 Mbits/s

A new family of isolated PCI Express serial communication cards features a selection of 4 or 2 ports of isolated, software-selectable, RS-232, RS-422 and RS-485 serial protocols. 2 kV isolation is provided between channels and between the PC and bus lines on ALL signals. The cards from Acces I/O Products feature a x1 lane PCI Express connector that can be used in any available x1, x2, x4, x8, x12, or x16 PCI Express expansion slot. The PCIe-ICM product line has been designed for use in retail, hospitality, automation, gaming, shipboard and defense industries along with applications such as point of sale systems and kiosk design.

The PCIe-ICM cards were designed using type 16C950 UARTS and use 128-byte transmit/receive FIFO buffers to decrease CPU loading and protect against lost data in multitasking systems. New systems can continue to use legacy serial peripherals, yet benefit from the use of the high-performance PCI Express bus. The cards are fully software compatible with current PCI 16550 type UART applications and allow for users to maintain backward compatibility. The PCIe-ICM Series is especially useful in applications where high common-mode external voltages are present. Isolation is required to guard electronics from transient voltage spikes and offers greater common-mode noise rejection in electrically noisy surroundings containing industrial machinery and inductive loads. In addition to protecting industrial applications from accidental contact with high external voltages, the isolation provided eliminates troublesome ground loops.

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

Instrument Simultaneously Measures Temp, Velocity and Pressure

A new thermal analysis system precisely and simultaneously measures the temperatures of solid materials and the surrounding air, as well as tracking air velocity and air pressure at multiple points to comprehensively profile heat sinks, components and PCBs.

The iQ-200 from Advanced Thermal Solutions simultaneously captures data from up to 12 J-type thermocouples, 16 air temperature/velocity sensors and 4 differential pressure sensors. Temperature data is recorded from -40° to 750°C. Air temperature is tracked from 20° to 65°C and air velocity is measured from 0 to 6 m/s (1200 ft/min). The differential transducers capture pressure drop data along circuit cards, assemblies and orifice plates. Pressure measurements are taken from 0 to 0.15 psi (0 to 1,034 Pa). The iQ-200 can be factory modified at ATS to measure higher airflows, up to 50 M/s (10,000 ft/min), and air temperatures to 85°C. List price is $24,500.

Advanced Thermal Solutions, Norwood, MA. (781) 769-2800. [www.qats.com].

COM Express Module Boasts Rugged RS-DMM Memory

A new COM Express module boasts one of the first implementations of the rugged RS-DMM memory specification. The Toucan-QM57 from Lippert Embedded Computers is a COM Express revision 2.0 Type 2 module with an Intel Core i7 processor. The module is specifically built for applications exposed to rugged environments and hence the integration of the highly rugged RS-DIMM memory module. The memory module is fastened by screws. The COM Express module offers 4 Gbytes of soldered RAM and another 4 Gbytes of RAM by way of RS-DIMM card, which optimizes board space and ruggedness. The module also supports interfaces including dual channel LVDS, 2 DisplayPorts, Gigabit LAN and eight USB 2.0 host ports. In addition, there are four SATA ports with RAID support and one PATA interface plus six x1 PCI Express lanes and one x16 lane.

LiPPERT Embedded Computers, Mannheim, Germany. +49 621 4 32 14-0. [www.lippertembedded.com].

VPX Boards Pair Virtex-5 FPGA with PCIe Interface

A new series of 3U VPX FPGA boards features a configurable Xilinx Virtex-5 FPGA enhanced with multiple high-speed memory buffers and a high-throughput PCIe interface. Field I/O signals interface to the FPGA via the rear P2 connector and/or with optional front mezzanine plug-in I/O modules. The result is a powerful and flexible signal processor card. Three models provide a choice of logic-optimized FPGAs to match the performance requirements. Cards can be ordered with a Xilinx VLX85T, VLX110T, or VLX155T FPGA featuring up to 155,000 logic cells and 128 DSP48E slices.

Each model is available in a format designed for use in air-cooled or conduction-cooled systems suitable for -40° to 85°C operation. 64 I/O lines are accessible through the rear (P2) connector. A series of AXM extension modules are available to provide additional front-end A/D, RS-485, CMOS, or LVDS I/O channels through a mezzanine connector on the front of the board. Acromag's Engineering Design Kit provides utilities to help users develop custom programs, load VHDL into the FPGA, and to establish DMA transfers between the FPGA and the CPU.

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

Managed OpenVPX 10 Gbit Ethernet Switch for High Performance Apps

A rugged 6U OpenVPX data plane switch module is targeted at demanding high-performance computing (HPC) and networking applications such as communications, ISR and radar. The GBX460 from GE Intelligent Platforms now offers customers a choice between the fully managed switch with the flexibility, versatility and functionality provided by the OpenWare suite of protocols and switch management software, or the alternative time-to-operation of the unmanaged version.

The GBX460 with OpenWare supports high throughput interprocessor communication (IPC) between 10GigE-enabled processing nodes for deployed network-centric defense and aerospace applications. Its non-blocking 10GigE ports provide high-performance throughput across the VPX backplane; the non-blocking feature means that the GBX460 can pass traffic across all 10GigE ports at wire speed without bottlenecks.

The GBX460 can support multiple OpenVPX slots/module profiles for maximum flexibility and throughput. The standard build provides 20 x 10GigE data plane fat pipes and 16 x 1 GigE control plane ultra-thin pipes to support multi-board 6U VITA 65 (OpenVPX) system configurations. Multi-board systems can be configured by using the GBX460 together with GE processor cards such as the SBC622 Intel Core i7-based single board computer and IPN250 and NPN240 NVIDIA CUDA GPGPU processors to scale to extraordinary levels of performance for size, weight and power (SWaP)-constrained applications such as deployed image, radar, sonar and signal processing.

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

14-Bit PCIe Digitizer Offers High Dynamic Performance

A PCI Express digitizer provides 200 MS/s sampling rate of 14 bits of data across one channel. The PCIe-9842 from Adklink Technology is designed for applications such as light detection and ranging (LIDAR) tests, optical fiber tests and radar signal acquisition. Its 100 MHz bandwidth analog input is designed to receive ±1V high-speed signals with 50Ω impedance. With this simplified front-end design and highly stable onboard reference, the PCIe-9842 provides not only high-accuracy measurement results but also delivers high-dynamic performance. For applications that require data to be acquired and transferred in real time, the PCIe-9842 is designed on the PCI Express x4 bus interface to provide adequate bandwidth for real-time transfers. As the signal is converted from analog to digital, the data will be transferred directly and continuously at a sustained 400 Mbyte/s rate to the host system memory. Current l list price is $3,000.

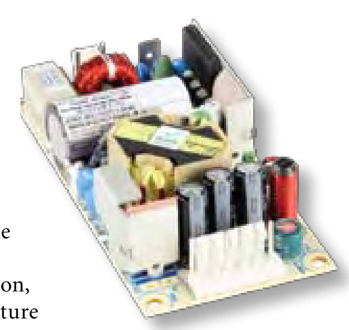
ADLINK, San Jose, CA. (408) 360-0200. [www.adllinktech.com].

Modular Chassis Kit Speeds Compact Embedded Designs

A specially designed chassis kit for Em-ITX form factor boards enables the rapid and easy assembly of a wide variety of robust fanless embedded system designs. Measuring 35.2 mm high and 231 mm wide, the AMOS-5001 from Via Technologies is slim enough to fit in most space-constrained environments. Systems built using the AMOS-5001 are also shock resistant and can withstand extreme temperatures. The AMOS-5001 chassis kit features a unique modular design comprised of only four mechanical parts that ensures the easy integration of Via's EITX-3001 series mainboards. An optional 2.5" HDD storage subsystem chassis is also available. The kit makes it easy to assemble robust x86 embedded systems that can withstand a wide temperature range of -20° to 55°C and are capable of sustaining a g-force of up to 50G.

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

Compact 60W Convection-Cooled Power Supplies Feature Safety Approvals



Two new convection-cooled open-frame AC-DC power supplies are each capable of delivering 60W. Offered by Emerson Network Power, the new NPS62-M has a 5 VDC output and can deliver up to 11A, while the NPS65-M has a 24 VDC output and can deliver up to 2.5A. The output voltage of each power supply can be adjusted by plus or minus 20 percent.

Both the NPS62-M and NPS65-M power supplies carry a comprehensive set of worldwide IT equipment (ITE) and non-patient contact and non-patient-critical medical safety approvals. They have a safety ground leakage current not exceeding 275 µA when operating from their maximum input voltage. Both models have a compact 2 x 4 inch (51 x 102 mm) footprint and a height of just 1 inch (26 mm). An optional enclosure kit (LPX50) is available for maximum protection. NPS62-M and NPS65-M power supplies have a full load operating temperature range of zero to 50 degrees C, and can be used at up to 80 degrees C with suitable derating. They both provide tight regulation, maintaining the output voltage to within plus or minus 2 percent for all standard line and load conditions, and feature optional remote sense capabilities to compensate for a 0.5V drop in the output cables.

Emerson Network Power, Columbus, OH. (614) 888-0246. [www.emersonnetworkpower.com].

High Channel Count Software Radio Module Targets Rugged Mil Apps

UAVs, radar systems and IF/RF communications rely on DSP tasks such as demodulation and decoding. Feeding those needs, Pentek has announced its latest addition to the popular Cobalt family of Xilinx Virtex-6 FPGA boards, the Model 71662 four channel, 200 MHz, 16-bit data acquisition board with built-in digital down converters (DDCs). With an input bandwidth from 300 kHz to 700 MHz, the 71662 provides four transformer-isolated input channels that each supply a Texas Instruments ADS5485 16-bit, 200 MHz ADC. The ADC outputs pass to an input multiplexer that supports four Acquisition IP modules factory-installed in the Xilinx Virtex-6 FPGA. Each IP module can receive data from any of the four ADCs, or from a test signal generator, providing highly flexible input and antenna assignments.

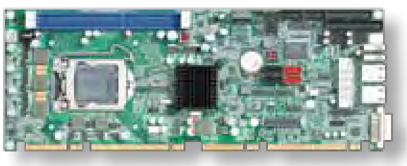
Four 512 Mbyte DDR3 SDRAM memory banks, one for each IP module, can buffer data in a FIFO mode or store data in a transient capture mode. All memory banks have DMA engines for streaming data at up to 1600 Mbytes/s through the PCIe interface to off-board storage or additional processing. Also contained within each of the four Acquisition IP modules is an 8-channel digital downconverter bank. Each DDC bank has its own decimation setting from 16 to 8192, providing a wide range of independent output signal bandwidths. The decimation FIR filter within each bank accepts a unique set of 18-bit user-supplied coefficients for custom channel shaping.

The installed Acquisition IP modules in the 71662's onboard Virtex-6 FPGA allows users to implement their own logic designs. A variety of FPGA sizes are available for the 71662 so that users can obtain as much, or as little, capacity as they need. The SXT devices, for instance, offer up to 2016 DSP slices for applications such as real-time signal demodulation, decoding and forwarding by a UAV monitoring communications in hostile areas. For applications with less-demanding requirements, the lower-cost LXT series is available. The Model 71662 XMC pricing starts at $12,750.

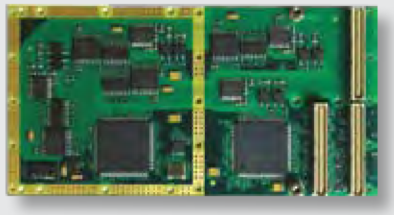
Pentek, Upper Saddle River, NJ. (201) 818-5900. [www.pentek.com].

PICMG 1.3 System Host Board Based on Xeon E3-1200 Family

A full-size PICMG 1.3 System Host Board provides high-performance and flexible PCI Express expansion. The ROBO-8110VG2AR from American Portwell is based on the latest Intel Xeon processor E3-1200 family. The card offers dual channel DDR3 long DIMMs up to 16 Gbytes and ECC support on the new Intel Xeon E3-1275 and E3-1225 processors. The PCI Express 2.0 available on the new Intel Xeon processors provides flexible x16, x8 or x4 lanes for versatile applications. ROBO-8110VG2AR is based on the Intel C206 chipset, integrates dual Intel Gigabit Ethernet controllers and features four SATA ports (two ports at 6 Gbits/s and two ports at 3 Gbit/s), which support RAID 0, 1, 5, 10 mode. Legacy device support such as serial ports (one RS-232 and one RS-232/422/485 selectable) for traditional factory automation applications is also provided by ROBO-8110VG2AR.



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



PMC Module Boasts Extended Temps and Isolated Serial Comms

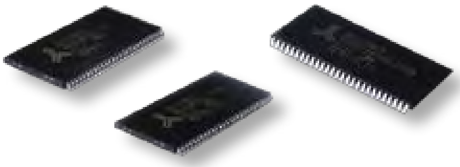
A high-density isolated serial communication controller is packaged as a conduction-cooled single-width 32-bit PMC module. The TPMC377 from Tews Technologies can operate with 3.3V and 5.0V PCI I/O signaling voltage. It provides four channels of RS-232/RS-422/RS-485 selectable serial connectivity with P14 I/O. Each of the serial channels is isolated from the system and against each other by a digital isolator and an onboard integrated DC/DC converter. The cannels can be individually programmed to operate as RS-232, RS-422 or RS-485 full/half duplex interfaces. In addition, programmable termination is provided for the RS-422/RS-485 interfaces. After power-up, all serial I/O lines are in a high impedance state for critical applications.

Each serial channel of the PMC module has separate 64 byte receive and transmit FIFOs to significantly reduce the processing overhead required to provide data to and from the transmitters and receivers. The FIFO trigger levels are programmable, and the baud rate is individually selectable up to 921.6 Kbits/s for RS-232 channels and 5.5296 Mbits/s for RS-422 channels. The UART offers readable FIFO levels. The TPMC377 offers an operating temperature range of -40° to +85°C.

TEWS Technologies, Reno, NV
(775) 850-5830. [www.tews.com].

Line of High-Speed CMOS SDRAMs Offer Densities up to 256 Mbits

A full line of new, high-speed CMOS synchronous DRAMs (SDR) with densities of 64 Mbits (AS4C4M16S), 128 Mbits (AS4C8M16S) and 256 Mbits (AS4C16M16S) is optimized for industrial, communications, medical and consumer products requiring high memory bandwidth. The devices introduced by Alliance Memory are particularly well suited to high-performance PC applications. The SDRs are internally configured as four banks of 1M, 2M, or 4M word x 16 bits with a synchronous interface, operate from a single +3.3-V (± 0.3V) power supply and are lead (Pb) and halogen free. Packaged in a 54-pin, 400-mil plastic TSOP II, the new SDRs offer a fast access time from clock down to 4.5 ns at a 5-ns clock cycle, and clock rates from 143 MHz to 200 MHz. The devices provide programmable read or write burst lengths of 1, 2, 4, 8, or full page, with a burst termination option. An auto pre-charge function provides a self-timed row pre-charge initiated at the end of the burst sequence. Pricing ranges from $0.90 to $1.80 in 1,000-piece quantities.



Alliance Memory, San Carlos, CA. (650) 610-6800. [www.alliancememory.com].

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Coming Next Month

COTS JOURNAL

Special Feature: Avionics Databus Options 1553, ARINC 429, Ethernet and More Tried and true I/O schemes such as MIL-STD-1553 and ARINC 429 remain popular for pure control applications, but they're bandwidth-limited by today's standards. A slew of multipurpose communications protocols provide options to suit emerging needs, and Ethernet is a top contender among them. Articles in this section compare today's crop of I/O schemes relevant to avionics and other military users.

Tech Recon: Space-Qualified Electronics Adjust to New System Era With the Space Shuttle program reaching its end of life and the commercial space industry taking the baton, the space electronics industry is certainly in a period of transition. Feeding those systems, space-based semiconductors and board-level systems must be capable of withstanding everything from intense radiation due to high-energy atoms to bombardments from neutrons and other particles. Articles in this section explore the radiation concerns facing space designers, and update readers on radiation-hardened boards and subsystems as well as ASICs, FPGAs and power components designed for those applications.

System Development: COM vs. VME/cPCI Slot-Card System Architectures COM boards provide a complete computing core that can be upgraded when needed, leaving the application-specific I/O on the baseboard. COM Express adds high-speed fabric interconnects to the mix. As complete systems become more doable using those technologies, they're beginning to replace some platforms that once relied on slot-card systems like VME and cPCI. But for many military applications, the advantages of a slot card approach take precedence. This section compares the tradeoffs between busless COM systems versus the slot-card VME/cPCI kind of approach.

Tech Focus: PC/104 and PC/104 Family Boards PC/104 has become entrenched as a popular military form factor thanks to its compact size and inherent ruggedness. Sweetening the deal, a number of special enclosure techniques are used to outfit PC/104 for extremely harsh environments. This Tech Focus section updates readers on these trends, along with a look at the new PC/104 follow-ons: EPIC, PCI-104, PCI/104-Express and PCIe/104. Also provided is a product album of representative boards.


MILESTONE

COTS

Editorial

Jeff Child, Editor-in-Chief

Good News and Good Intel

As I write this, only a few days have passed since the news of the successful intelligence-driven U.S. operation in Pakistan that killed al-Qaida leader Osama bin Laden was announced, and my emotions are running strong. There are times to be objective, but this isn't one of them. I am extraordinarily relieved that justice was finally brought to the leader of al-Qaida, who for more than 20 years plotted attacks against the United States and its allies. Moreover, I am immensely proud of the outstanding skill of all those involved that made this happen—from the Administration to every intelligence agency and DoD planner—but especially the team of Navy SEALS that performed so courageously and skillfully on the ground.

The operation is a vivid reminder that advanced military technology—though a great benefit to us as a combat force multiplier and indispensible for intelligence gathering—depends so much at the end of the day on the decisions and actions of people. All that said, the impact of technology over the whole spectrum of the operation is not trivial. And, as a technology journalist, that's where my knowledge is, so indulge me to share my insights in that vein. Reports haven't been confirmed yet as to specific equipment used. It's clear that operations such as this can now leverage the ability to network large amounts of digital imagery capture by UAVs and transmit real-time images instantly to situation rooms and command posts on the other side of the world.

Many have speculated that the attack was preceded by hundreds of hours of aerial surveillance combined with perhaps thousands of hours of analyst time. Again, the combination of technology and the information it captures blended with human expertise is what it's all about. In a broader view, this ability via Satellites and SIGINT to monitor areas and movement with such scrutiny is also what kept Bin Laden from being able to effectively use any communications technology—a situation that experts say must have limited his ability to plan attacks.

Clearly military embedded computing and networking technology is a major part of today's food chain of intelligence gathering gear—from UAV-based image capture to SIGINT recording platforms and such. The challenge today is about taking the vast amount of incoming Intelligence, Surveillance and Reconnaissance (ISR), and organizing and presenting it in ways that don't have to be interpreted manually by experts in signals analysis. An end-to-end network-centric military depends on providing information that many different levels of warfighter can access and act on—both for real-time tactical use and for long-term strategic use.

In contrast to the specific end-game phase of the operation to eliminate Bin Laden, many of today's military and counterterrorism efforts are about casting a wide net for information and sifting through it to find the threats. When an avalanche of ISR data is coming in from multiple sources, it is actually causing a serious challenge for situational analysis systems. In its pure raw form, that data is comprised of massive amounts of signal and imagery data. The problem is the intelligence processing and exploitation capability of that data is usually limited to highly trained analysts and often applicable only after the threat occurred.

What that means is that it's not so easy for non-technical individuals to connect the dots and pass it on to warfighter experts to affect mission outcomes in real time. Fortunately that's changing as advanced applications are emerging to process and sort the data for the warfighter so he can use it in real time. Companies like IvySys, for example, have been able to apply deep domain expertise in signals intelligence (SIGINT), measurement and signature intelligence (MASINT) techniques, and cyber security. By applying signal processing algorithms to the problem, it's possible to detect potential threats as they surface.

It can't be denied that electronics and computing technology continues to be a vital factor in today's military operations, but now more than ever it's clear that its true value comes in by helping the warfighters do their job. In response to the news about Bin Laden, a friend of mine in the military said today that he's feeling the high right now of a sports team that's won the championship after a long and difficult season. My congratulations and a heartfelt thank you to him and all those who serve in the United States armed forces.

On p.14 of our April issue the photo is wrong. The TRACER system is flying aboard a Predator B MQ-9, and not a Reaper UAV shown in Figure 1. The mention of the Reaper in both the caption and at the end of the first paragraph is in error. In both places it should say 'Predator B MQ-9'. We apologize to SRC Computers for our mistake.


Enhanced situational awareness is not new. But until now, getting the full picture meant bolting on a tangle of equipment, or sticking one's neck out. Literally. With ITT's Visual Situation Awareness System (VSAS), warfighters benefit from a 360° display of hostile surroundings while integrating a full spectrum of complementary technologies, such as sniper detection, Google Maps™, communications, night vision, and more. Now warfighters can see more and risk less, thanks to VSAS. More at **itt.com/vsas.**
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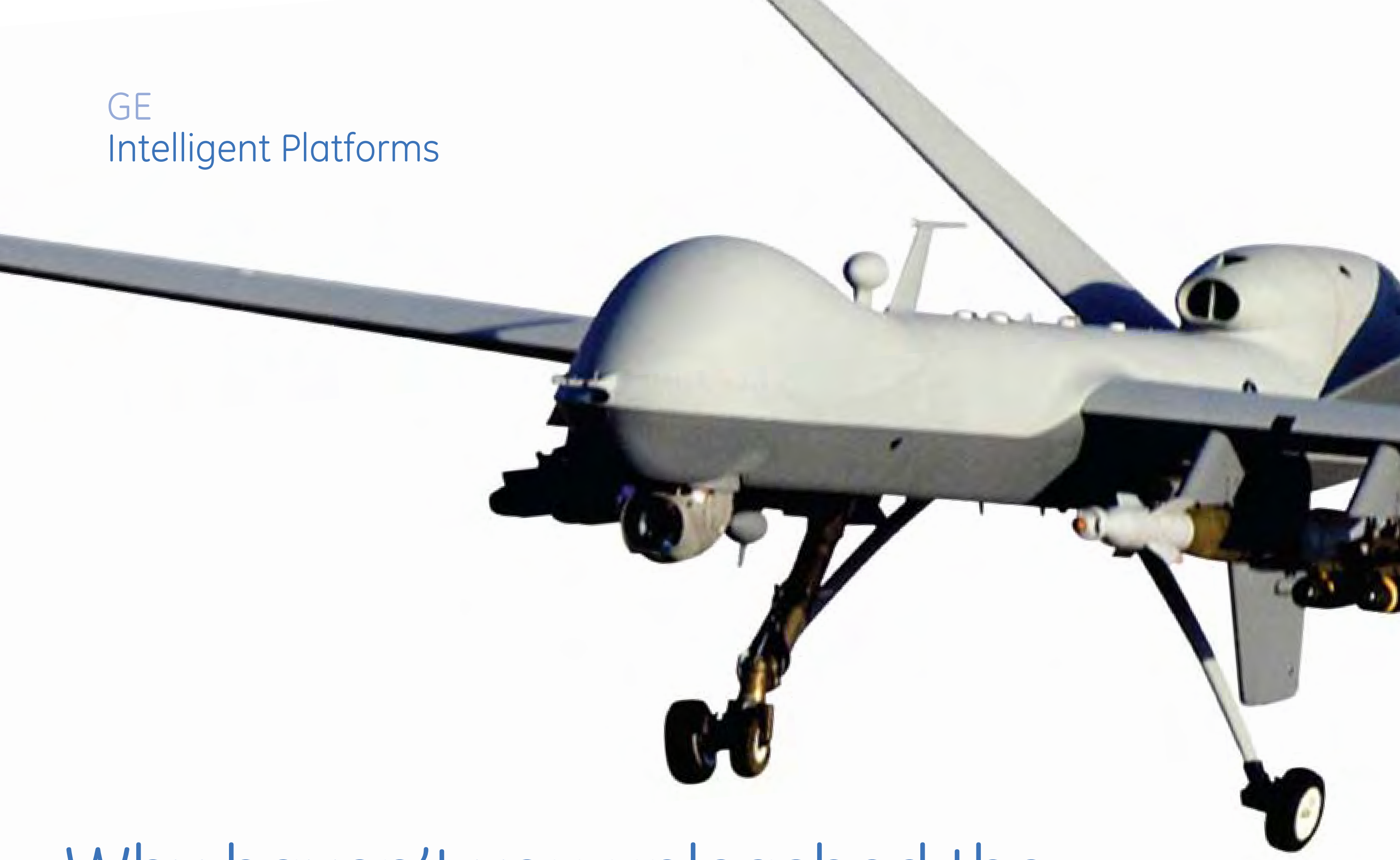

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