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September 2012
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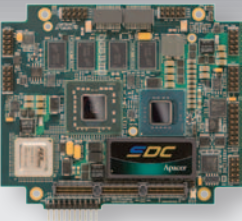


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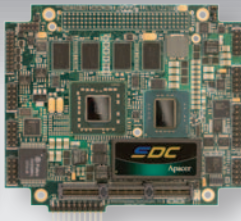
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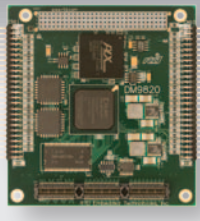
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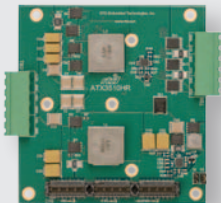
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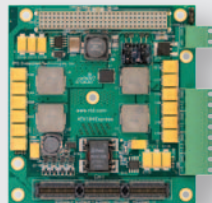
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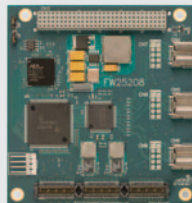
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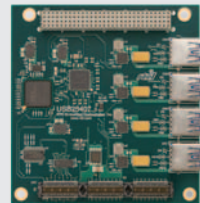
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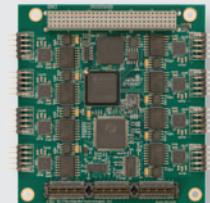
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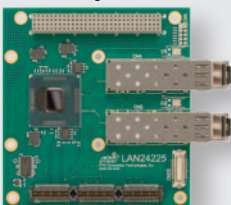
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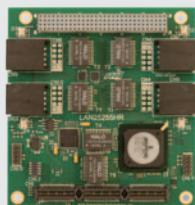
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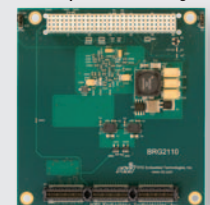
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ON THE COVER:

Top photo: The F-35 Joint Strike Fighter program, led by Lockheed Martin, is beginning to ramp up production, which is good news for the avionics industry. The F-35 program consists of the F-35B Short Takeoff/Vertical Landing variant (pictured), the F-35A Conventional Takeoff and Landing variant, and a Carrier variant. Photo courtesy of Lockheed Martin

Bottom photo: The rugged Modular Tactical System wearable computer platform from Black Diamond Advanced Technologies is used by U.S. Special Forces. Photo courtesy of Black Diamond Advanced Systems



September 2012 | Volume 8 | Number 6

COLUMNS

Editor's Perspective

- 8 Sequestration and COTS
By John McHale

Field Intelligence

- 10 Managing obsolescence
By Charlotte Adams

Mil Tech Insider

- 12 Digital video and GbE backbones keep pace with video sensor proliferation
By Curtis Reichenfeld

Legacy Software Migration

- 14 New technology innovations offer huge cost savings through software reuse
By John Blevins, LinuxWorks

DEPARTMENTS

- 16-17 Defense Tech Wire
By Sharon Hess
- 60-61 Editor's Choice Products

RESOURCE GUIDE

- 63 Communications Tech
- 64 COTS Collection
- 104 Mass Storage
- 110 Obsolescence/DMSMS
- 111 Packaging/Mechanical Chassis
- 116 Power Conversion
- 117 Rugged Computer Systems
- 124 Sensors and RF
- 124 Software/Middleware

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20

SPECIAL REPORT | Defense electronics market analysis

- 20 Military unmanned systems, C4ISR, avionics, and vetronics markets are COTS markets
By John McHale

MIL TECH TRENDS | Rugged computing trends for the warfighter

- 28 Rugged, wearable computers tailored for the warfighter
By John McHale
- 34 AFT cools high-power COTS modules for military applications
By Jacob Sealander, Curtiss-Wright Controls Defense Solutions
- 38 Case study: Rethinking rugged subsystem computing design to accommodate military budget cuts
By Michael Smith, Parvus Corporation
- 42 Rugged handheld computers suit up with Android on the battlefield
By Mark Wilson, DRS Technologies



28

INDUSTRY SPOTLIGHT | Software security trends

- 46 Net-centric security and CWE
By Chris Tapp, LDRA
- 50 Mitigating security risks early in the development life cycle
By Jane Goh, Coverity
- 54 Adding real-time Java to a MILS operating system
By Dr. Kelvin Nilsen, Atego Systems



46

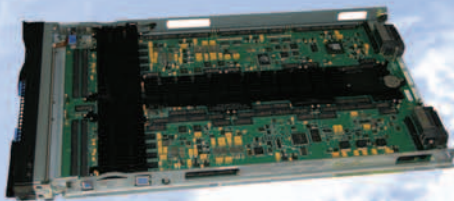
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127	GE Intelligent Platforms, Inc. – You can't see them – but there are 300,000 people standing behind this display
126	General Micro Systems, Inc. – Rugged computing systems for OEM
31	Hartmann Elektronik – OpenVPX
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35	Phoenix International – Solid or spin ... we go both ways
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18-19	RTD Embedded Technologies, Inc. – PCI Express, PCI, and ISA experts
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Sequestration and COTS

By John McHale, Editorial Director



Sequestration is coming, and with it more than \$500 billion in cuts to the U.S. defense budget in addition to almost half a trillion dollars in defense cuts already being proposed by the Obama Administration. The thought is quite scary to those employed by prime contractors and system integrators, who have already made drastic layoffs just to meet the current funding reductions. Yet suppliers of Commercial Off-the-Shelf (COTS) technology might see some opportunity in this environment.

The single greatest challenge to the U.S. defense industry is the looming threat of sequestration, says Bob Stevens, Chairman and CEO of Lockheed Martin. "Sequestration is a meat axe ... a blunt force trauma ... tearing the fabric of the supply chain and industrial base in a significant way. Cutting across the board is an inefficient way to manage a business. The budget ought to be aligned with the mission to be accomplished – this goes for civil budgets as well."

Some industry analysts disagree with the doom and gloom scenario, saying the defense industry has been through worse. They also see growing opportunities for COTS suppliers even with sequestration. The Department of Defense (DoD) will be forced to embrace an 80 percent solution, getting what they need to keep programs running and getting industry to pick up the development cost – which is essentially what COTS providers have been doing for years.

"I think to a degree, the primes and most people in the industry have factored sequestration into the equation," says Michel Merluzeau, Managing Partner of G2 Global Solutions. "Those who see sequestration as doomsday are incorrect. The COTS guys should do well because they are naturals at bringing to market low-risk, high-value solutions. That is what military users are looking for – proven solutions, proven technology, and low risk as far as integration is concerned."

"There are a number of scenarios that can happen," says Ron Stearns, Research Director at G2 Global Solutions. "At one level, Congress will cleanse its hands of the issue by essentially saying, 'We didn't do this; it just happened.' That's one possibility. Another is that they punt somehow or pass a continuing resolution to keep funding at [an] approximate level if it does. There is a cycle to defense funding going back all the way to World War II based on peacetime versus wartime conditions. The smart people in the industry know that and anticipate these cycles."

"The primes got bloated because of programs like Future Combat Systems and needed to be slimmed down, but the government is not stupid enough to destroy the supply chain," says Ray Alderman, Executive Director of VITA. "While the big money that goes into platforms such as weapons systems may be diminished, more money will shift to advanced radar and sonar systems, electronic warfare, signals intelligence, and communications," all of which means growth for COTS suppliers. All of these applications need supercomputing-like performance – radar especially – Alderman adds. New high-performance radar systems are going to take advantage of VPX technology, which is "becoming supercomputing in a box."

It also helps that COTS is not a four-letter word among prime contractors as it was 15 years ago. Back then COTS carried a "sold at Radio Shack" connotation, and many questioned its reliability for military applications. That is no longer the case, as many suppliers of COTS VPX systems or other standards-based products have proven track records, meet MIL-STDs for ruggedization, and have high Technology Readiness Levels (TRLs). This trust

level and history of success also make it unlikely the DoD will go back to the old way of procurement when funding levels increase again.

Yet, while COTS suppliers will have opportunities in a sequestration environment, there is no doubt the prime contractors will take a major hit. The impact of sequestration on the defense industry will be significant layoffs resulting in a loss of learning and talent as well as an erosion of quality, Stevens says. Lockheed Martin has already reduced their workforce by 18 percent because of the economy, budget cuts, and the additional cuts being proposed by the Administration, he adds.

"For suppliers it will be key how they manage internal resources to match the reductions in procurements," Merluzeau says. "Preserving the knowledge base is very important because eventually the economy will regain strength and defense contractors need to ensure they are not letting go of talent and expertise they will not be able to regain down the road."

For more on the defense electronics market and forecasts from industry analysts, including Stearns and Merluzeau, see our Special Report on page 20.

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Managing obsolescence

By Charlotte Adams

A GE Intelligent Platforms perspective on embedded military electronics trends



Old-timers in the military's logistics establishment wax nostalgic about the good ol' days of MIL-SPEC, when the U.S. Defense Department was a power in the semiconductor market and could depend on long-term supplies of its own made-to-order chips. But those days are gone.

The coming ascent of the consumer-driven semiconductor market was recognized in 1994 by that prescient Defense Secretary, William Perry, who helped drive the military's acceptance of mass-produced, Commercial Off-the-Shelf (COTS) parts. Sixteen years later, the defense and civil aerospace sector's share of this market reportedly had fallen to just over 1 percent.

But COTS is a double-edged sword. COTS life cycles are measured in months, while cycles for major military systems are measured in decades. The best known example of this clash of cycles is that Methuselah, the B-52. Activated in 1955 and out of production by 1962, the Stratofortress is expected to keep going through the 2040s. It has run the gamut from major upgrades to component-level obsolescence management. But it is still flying.

Insurance

Smart managers know they cannot just keep their fingers crossed and hope they will come up with a Plan B when the inevitable occurs. Informing themselves of the risks, monitoring supply channels, and making contingency plans have to be part of their Plan A. This type of "insurance" will raise total ownership costs, but only compared with costs in a perfect world where nothing ever changes.

COTS is manageable if customers plan ahead. Chip generations can come and go, but costs can be controlled, risks contained, and investments protected. An example of this approach is GE Intelligent Platforms' Product Life-cycle Management service, which includes options such as obsolescence early warning, end-of-life buys, storage, and technology insertions using products such as the PPC10A, the latest in a form/fit/function-compatible SBC family that stretches back to the mid 1990s (Figure 1).

Data driven

Life-cycle management is a data-driven strategy emphasizing engagement with suppliers, communicating with customers about changing conditions, educating customers about options, and flexibly supporting customer choices. This allows program managers to make informed and intelligent decisions.

Sitting on one's thumbs is not really an option. Among the outcomes could be unplanned redesigns, requalifications

Figure 1 | PPC10A rugged 6U VME SBC from GE Intelligent Platforms



and recertifications of parts or assemblies, expensive reverse engineering projects, and cannibalization of other systems. These alternatives can easily produce cost spikes, fielding delays, downtime, or worse, depending on when they occur.

Life-cycle management can include monitoring all the items on a product's bill of materials and sending out alerts when obsolescence issues are detected. The service supplier can make end-of-life buys, locate and purchase compatible replacement parts, or do partial board redesigns or board replacements. Or if the problem is widespread, the supplier can support movement to a larger technology refresh.

If the customer decides to make an end-of-life purchase of a specific part, the board or subsystem supplier sometimes provides secure, long-term, environmentally controlled storage service, so that the part does not deteriorate before it is needed. It is also important to maintain test equipment as systems age. That means not only managing components, but supporting operating systems and compilers when software designers have declared them obsolete.

"Flexibility" is the watchword. "Defensive," "progressive," or hybrid plans can be developed, based on the customer's sensitivity to change. A defensive approach protects the customer against obsolescence by stockpiling parts after the design is frozen. The customer calculates how many parts the system will need during its projected life and buys accordingly.

A progressive approach, by contrast, reduces obsolescence risk by building in technology refreshes at regular intervals. It focuses on upgradeability by choosing components with reliable histories and solid road maps into the future. Hybrid approaches combine elements of both defensive and progressive strategies.

Silver lining

So "obsolescence" is not a dirty word. In this day of consumer dominance, it is a basic fact of life. The question is not how to fight it but how to accommodate it, even exploit it, to minimize potentially adverse effects on customer programs.

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Digital video and GbE backbones keep pace with video sensor proliferation

By Curtis Reichenfeld

An industry perspective from Curtiss-Wright Controls Defense Solutions



The use of legacy analog and newer digital multispectral, daylight, infrared, and HD video sensors continues to proliferate at a rapid rate on military platforms such as ground vehicles. The demands of new multisensor video-intensive applications – such as 360° situational awareness display systems that enable uninterrupted visual display of the external environment – have increased the importance of open-architecture-based Video Management Systems (VMSs). Today's VMS technologies are helping system designers keep pace with sensor proliferation by embracing digital video switching techniques and high-bandwidth data backbones such as GbE and faster, to provide operators with greater flexibility and optimal use of greater amounts of incoming data.

More sensors equals more video channels

Typical system requirements expand from 2 or 3 video channels to designs that now demand as many as 12 or more channels. In the meantime, high-resolution HD video displays have become common. As sensors multiply, system architects are confronting a mix of analog and digital interfaces. Some sensors are driven directly to a dedicated single-mode display while others are displayed on demand on multifunction consoles. To handle the confusion of cables, sensor standards, and multiple displays, the COTS market has worked to develop open-standards-based architectures that leverage technologies such as digital network-based switches. Sensor vendors are now starting to add native support for digital networking interfaces, making it easier to add sensors into a digital switch.

Moving to a digital backbone

The move from traditional analog video switched architectures to Ethernet is speeding and simplifying video acquisition and transmission, while providing a common infrastructure for data and control. With GbE backbones in vehicles and the increasing use of high-speed HD serial digital interfaces – such as the 1.485 Gbps High-Definition Serial Digital Interface (HD-SDI) and 2.970 Gbps 3G-SDI – digital sensor data, together with analog video after conversion, can be handled by an internal common digital video data standard.

An example of an advanced VMS is Curtiss-Wright Controls Defense Solutions' VRD1, a turnkey technology that combines A/D video conversion, digital switching, scaling and windowing, compression, networking, and recording onto solid-state storage in a "configure and go" rugged enclosure (Figure 1).

New ICs bring better video switching performance

Semiconductor vendors are increasingly adding support for high-density digital video switching. The emergence of GbE as the vehicle's data backbone enables system designers to take advantage of this enabling technology via highly



Figure 1 | The VRD1 from Curtiss-Wright Controls Defense Solutions

dense digital matrices that can support multiple video inputs simultaneously, which, after conversion into digital formats if originally analog, can then be sent out to multiple outputs and display stations. Another semiconductor trend that is helping to improve VMS performance is the trend of the past couple of years to use FPGAs rather than the specialty, dedicated ASICs traditionally used for advanced functions. A common digital environment enables greater availability of these desirable functions such as video scaling, windowing, quad display, and picture-in-picture. As FPGAs have become more powerful, they have provided VMS designers more flexibility. For example, rather than just rescaling a single video input, FPGAs enable multiple video inputs to be combined. Today it's not unusual to support as many as eight video inputs on a single FPGA, which can then simultaneously perform various windowing and scaling functions.

The flexibility of digital video

As the number of video sensors increases, so does the amount of video data. This raises the risk of "information overload" as human operators try to manage the multiple displays and flood of real-time data. The move to a digital switched architecture helps minimize this problem by making it easier to move to multifunction displays, making data more useful and manageable for the user. The digital approach also makes the configuration of video stations more flexible, because the move away from dedicated one-to-one sensor/display interfaces makes it much easier and faster to add additional operator consoles or to display in a platform. The move to digital video switching also results in very scalable architectures because the VMS separates the sensors from the displays, making it effortless to add additional sensors without adding displays.

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New technology innovations offer huge cost savings through software reuse

By John Blevins



As new systems are being designed, software developers are using open-standards-based programming languages and OSs, such as C/C++ and POSIX, to ensure portability for the future.

But for existing deployed legacy systems, the same considerations and design methodology were not necessarily available or followed. When a refresh of the system is needed, either for a change in hardware or to add new functionality, there is often a dilemma as to how to migrate or update the existing software without having to go through the costly exercise of rewriting the software. In certified systems, this cost is even greater as recoding = recertification.

However, the good news is that a new virtualization technology enables the reuse of existing software applications, including the OSs that they run on, without having to change or rebuild the software.

Evolving legacy systems

Systems engineers today face difficult challenges when confronted with the task of evolving legacy systems based on aging hardware onto more modern equipment. When hardware fails, becomes obsolete, and is no longer available, designers must move to newer, more complex hardware. In most cases the legacy software has dependencies on an OS version that might not support the new hardware without being upgraded. The task of moving a legacy application to both a new OS and a new hardware platform can be quite costly in terms of both time and money.

This is where modern virtualization technology comes to the rescue and allows the reuse of existing software applications and their OSs with little to no code changes. Imagine a technology where a small piece of code runs directly on new modern hardware and allows multiple "guest" OSs to run concurrently on top, each with its own "virtual" set of resources (virtual machines). Each OS believes it sees a full set of hardware, complete with dedicated CPU, memory, disk, graphics, mouse, keyboard, network devices, and so on. When these virtual machines are configured to look similar to legacy hardware, it makes the task of running legacy software applications and OSs simple.

Separation kernel and hypervisor

The small piece of code that makes this possible is a Separation Kernel and Hypervisor (SKH). An SKH runs directly on the new modern hardware and allows an engineer to assign either physical or virtual resources to various guest OSs. The SKH then enforces the separation of those resources to provide hardware-level security for each guest. Legacy OSs run fully virtualized on their assigned virtual machine without any

modifications. LynxSecure from LinuxWorks is an example of a highly secure, modern SKH.

In addition to the savings in redevelopment time achieved by using virtualization to run legacy applications, the SKH can also allow applications to benefit from huge performance increases. Multiple, faster CPUs and larger amounts of RAM can now be assigned to legacy OSs and applications, increasing their performance beyond anything possible with their original hardware. Moore's Law predicts a doubling in transistor density every two years, so a 15-year-old legacy system could see an exponential (200x) increase in performance from new hardware.

Applications

Many complex military, aviation, and medical systems must undergo stringent certification processes before they can be deployed in the field. The effort to certify an application and its OS on a given hardware target can easily exceed the cost of actual development of the application itself. Virtualization can significantly reduce certification costs by allowing legacy applications and OSs to run unmodified on newer hardware. Less code changes equates to both reduced testing costs and certification reusability.

Virtualization benefits

Virtualization provides other added benefits to legacy systems. A systems engineer can now consolidate multiple legacy systems onto a single, more powerful hardware platform and reduce overall system cost. In fact, legacy systems can run alongside other newer applications and OSs to provide more functionality than before. Imagine a legacy real-time GPS application on an RTOS such as LynxOS running next to a Windows XP-based email application, all on the same hardware platform. Not only is this possible today, it can be done securely with the help of a separation kernel and hypervisor. The separation kernel guarantees that one guest cannot affect the other guests in any way. In the example provided, if the Windows XP guest picks up a "virus," it cannot affect the RTOS guest or its performance.

Virtualization brightens legacy systems' future

The use of a modern separation kernel and hypervisor can now add years of life into legacy systems, allowing for migration to new hardware, the addition of new features, and the consolidation of multiple physical systems into one. All these benefits help decrease costs and reduce risks when fielding new safety and security systems into the aerospace and defense industry.

John Blevins is Director of Product Marketing at LinuxWorks. He can be contacted at jblevins@lnxw.com.

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Photonics mast imaging systems to ride aboard Navy subs

The SSN 774 (Virginia class), SSN 688 (Los Angeles class), and SSN 21 (Seawolf class – see Figure 1) submarines are standing in line (figuratively, of course) to potentially receive one of the two “integrated submarine imaging system augment low profile photonics masts” recently procured in a \$7.5 million U.S. Navy/Lockheed Martin Maritime Systems and Sensors contract modification, according to the DoD website. The imaging system is designed to render all-weather, mission-critical, electronic, and visual search capability, in addition to digital image management and platform architecture interfacing abilities. The imaging system, once integrated, is designed to be upgradeable as capabilities emerge, “including items leveraged from the Virginia-class photonics program.” Eighty percent of the modification’s work takes place in Northampton, MA, while the remaining 20 percent occurs in Manassas, VA. Completion is slated for June 2014. The contracting activity is the Naval Sea Systems Command in Washington Navy Yard, D.C.



Figure 1 | The SSN 21 (Seawolf class) submarine is one of three U.S. Navy submarine classes slated for suiting up with a new photonic mast imaging system, per a \$7.5 million U.S. Navy/Lockheed Martin contract modification. U.S. Navy photo of SSN 21 by Lt. Cmdr. Greg Kuntz

Russia to provide Mi-17s to U.S. Army

The U.S. Army Contracting Command in Redstone Arsenal, AL, recently awarded Rosoboronexport FGUP of Moscow, Russia a \$171 million contract modification for 10 Mi-17 helicopters. Created in the 1970s by the Russians, the Soviet Army used the Mi-17 in the Afghanistan/Soviet Union war at that time. The Mi-17 soars at up to 19,860-foot altitudes and has also been used by the Afghan military in subsequent years. This recent contract modification’s work occurs in Russia, with completion expected in December 2016.

SDB II conquers moving target in flight test

In the conundrum of the battlefield, everything’s a moving target. Thus, the Raytheon Company-incarnated Small Diameter Bomb II (SDB II) was designed to hit moving targets, and recently successfully exhibited said moving-target capability at a White Sands Missile Range flight test. The test consisted of a USAF-flown F-15E releasing a GBU-53/B. The SDB II was then able to identify, track, and hit the moving target, thanks to SDB II’s tri-mode seeker. Featuring a small explosive footprint and resultant relatively low collateral damage, SDB II performs successfully from stand-off ranges and includes six engagement modes. Additionally, a two-way, dual band weapon data link capability provides both target updates and control after launch, in-flight, via a Joint Terminal Attack Controller (JTAC), the launching aircraft, or a third party.

U.S. Army follows the mobile app trend

Try to access nearly any website these days on your iPad, iPhone, or other smartphone or tablet and a popup will undoubtedly ask if you want to download the website’s mobile app ... not to mention the countless number of apps available at the iTunes store. Following suit is the U.S. Army, which recently contracted with By Light Professional IT Services Inc., in Arlington, VA, to provide mobile device application services – to the tune of nearly \$46 million (Figure 2). Specifically, the company will render quick mobile device application adaptation, to ensure the applications provide ground soldiers with time-sensitive information and facilitate real-time, battle-sensitive, squad-to-battalion level information transfer capability. Work is expected to take place in Afghanistan by June 2013. The contracting activity is the U.S. Army Contracting Command at Research Triangle Park, NC.

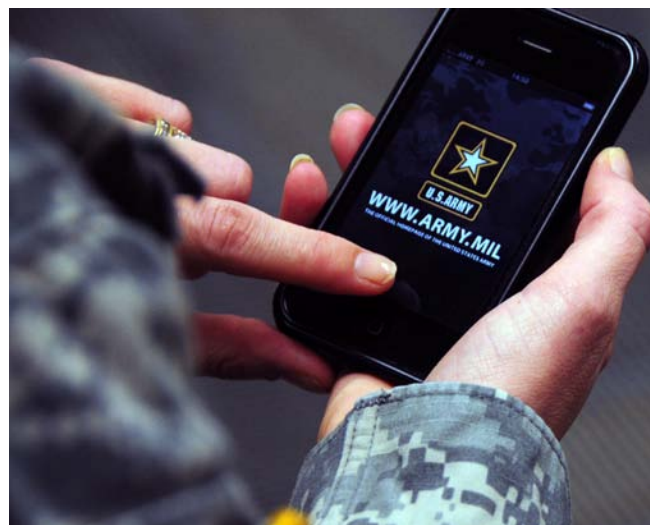


Figure 2 | A U.S. Army/By Light Professional IT Services Inc. contract stipulates quick mobile device application adaptation, to facilitate real-time, battle-sensitive, squad-to-battalion level information transfer capability. U.S. Army official iPhone app photo courtesy of the U.S. Army (www.army.mil)

Navy orders research on image storage, false alarms

Research is vital to success when it comes to mil tech (or most anything else), and the U.S. Navy is a good case in point, having recently put pen to paper with Logos Technologies Inc. for an \$11 million "order against a previously issued basic ordering agreement." Accordingly, the Small Business Innovation Research (SBIR) Phase III order supports the "False Alarm Mitigation" and "Wide Area Video Image Storage Techniques" topics, the DoD reports. Specifically, the order calls for "services in support of lightweight expeditionary airborne persistent surveillance-overseas contingency operations systems," in an effort to grant ground users access to real-time imagery via enhanced wide area persistent surveillance (Figure 3). With an anticipated completion of January 2014, the order's work is slated to occur in Arlington Heights, IL; Thousand Oaks, CA; Fairfax, VA; Cypress, CA; Raleigh, NC; and Afghanistan.



Figure 3 | A U.S. Navy-issued \$11 million order stipulates that Logos Technologies renders SBIR services supporting "lightweight expeditionary airborne persistent surveillance-overseas contingency operations systems." Pictured: Naval helicopter surveillance images taken off the coast of Columbia, photo courtesy of the U.S. Navy

USAF's dual contract mods extend BACN

The USAF has issued two contract modifications to Northrop Grumman Corporation, in continuance of maintenance and operation of the Battlefield Airborne Communications Node (BACN), benefitting overseas contingency missions. The first modification is \$106 million and provides continued BACN payload operation and deployment in three EQ-4B Block 20 Global Hawk UAVs and a triad of E-11A Bombardier Global Express BD-700 aircraft, through June 2013. The second contract modification is \$50 million and provides No. 9001, 9358, and 9355 E-11A aircraft with platform maintenance support through February 2013. The BACN information gateway/airborne comms system is high-altitude savvy and provides commanders and warfighters with command and control coordination and situational awareness. Initially deployed as part of Operation Enduring Freedom, BACN extends and links multisource battlespace information and voice comms capabilities via its radio systems and computers.

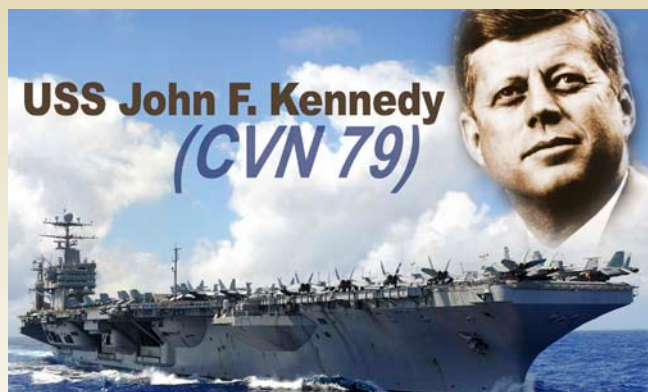


Figure 4 | A recent \$43 million contract modification has Huntington Ingalls rendering all materials and services necessary for CVN 79's construction, to prepare for the ship's detail design and manufacture. U.S. Navy photo illustration by Mass Communication Specialist 2nd class Jay M. Chu

Final prep underway for John F. Kennedy/ CVN 79 incarnation

The U.S. Navy and Huntington Ingalls Incorporated of Newport News, VA are doing what they can to fully prepare for the incarnation of the USS John F. Kennedy (CVN 79 – see Figure 4) aircraft carrier. The evidence: A recent \$43 million contract modification stipulating that Huntington Ingalls renders all materials and services required for CVN 79's construction, in support of the ship's detail design and manufacture. Services called for under the modification consist of research, design/development, planning, and procurement of long lead materials and a detailed design; also ordered are life-cycle support, advance construction, and data including logistics and otherwise, to get design and construction off the ground. Said modification work occurs in Newport News, VA, slated for October 2015 completion.

Upgraded CV-22 comms system gets some NRE

The CV-22's beyond-line-of-sight communications system is slated to benefit from Non-Recurring Engineering labors, thanks to a recent \$22 million contract modification issued to the Bell-Boeing Joint Project Office in Amarillo, TX (Figure 5). In conjunction with the CV-22's Block 20 Upgrade Program, modification services comprise design, integration, and testing rendered to an upgraded USAF CV-22 communications system. The system proffers tactical communications and transoceanic air traffic control. Meanwhile, 99 percent of the work will occur in Philadelphia, PA, while the remaining 1 percent happens in Amarillo, Texas, with an anticipated completion date of December 2015. The contracting activity is the Naval Air Systems Command in Patuxent River, MD.



Figure 5 | A recent \$22 million Naval Air Systems Command/Bell-Boeing Joint Project Office contract modification means more engineering support for an upgraded CV-22 comms system. Photo courtesy of the U.S. Air Force



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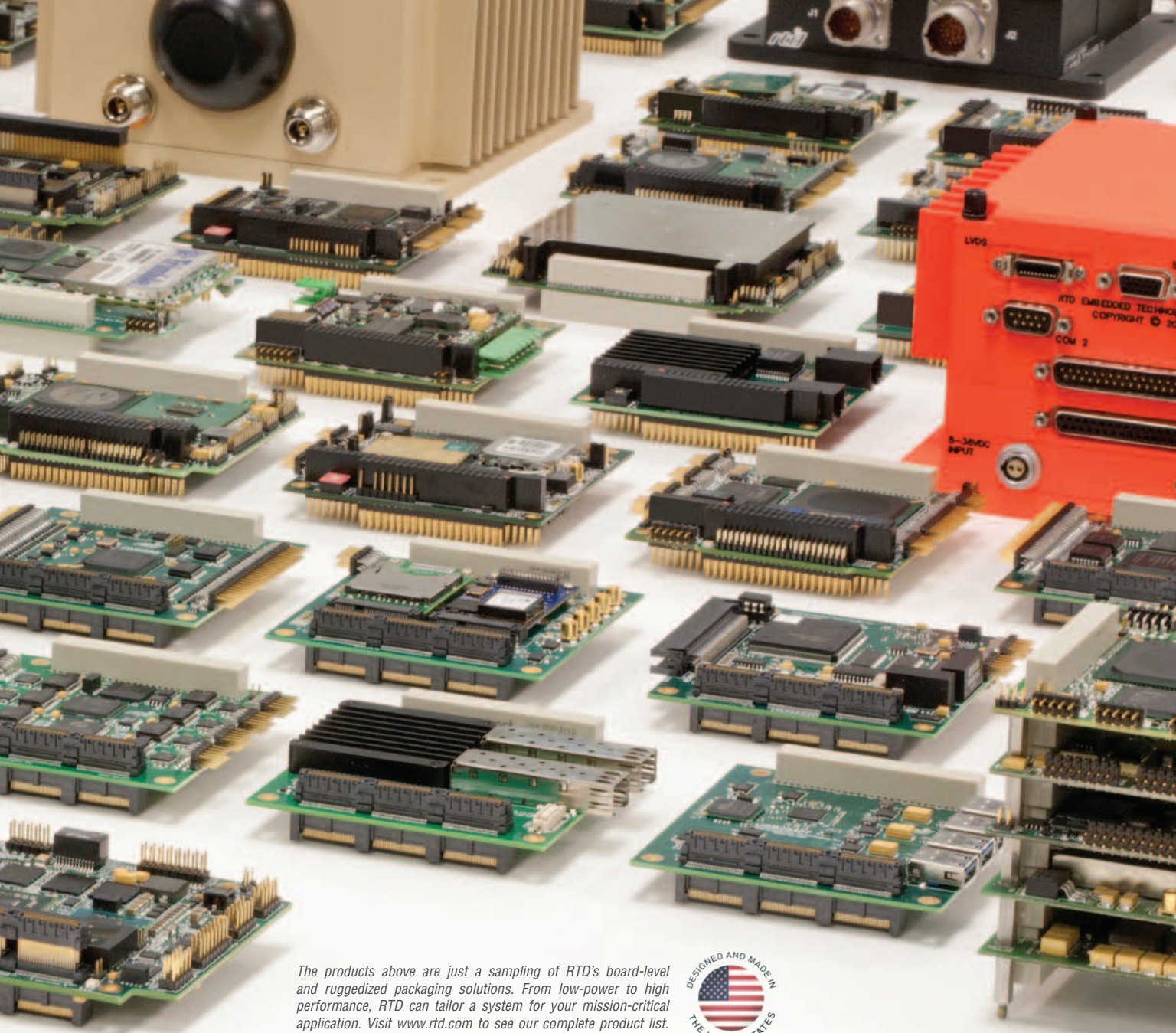
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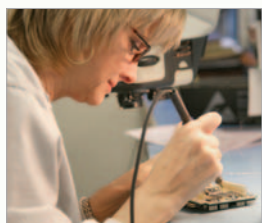


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Military unmanned systems, C4ISR, avionics, and vetronics markets are COTS markets

By John McHale, Editorial Director

Budget cuts and sequestration are casting a dark cloud over military funding, but market analysts see sunlight for COTS suppliers over the next five years.



The F-35 Joint Strike Fighter program, led by Lockheed Martin, is beginning to ramp up production, which is good news for the avionics industry. The F-35 program consists of the F-35B Short Takeoff Vertical Landing variant (pictured), the F-35A Conventional Takeoff and Landing variant, and a Carrier variant. Photo courtesy of Lockheed Martin

The U.S. Department of Defense's (DoD's) budget has been hit with extensive cuts in recent times and more are around the corner if sequestration comes to pass and 10 percent cuts are made across the board. The industry has seen many layoffs, and sequestration would likely force military prime contractors to make even more workforce reductions. In terms of procurement, the DoD and industry will more and more embrace the 80 percent solution, acquiring enough technology to keep current platforms running and meet immediate needs as opposed to long-term research and development projects.

Under this scenario, "the COTS guys should do well because they are natural at bringing to market low-risk, high-value solutions," says Michel Merluzeau, Managing Partner of G2 Global Solutions (www.g2globalsolutions.com). "That is what military users are looking for – proven solutions, proven technology, and low risk as far as integration is concerned. It is about procuring systems that are low risk, low cost, and quick to market."

COTS products are already prevalent in avionics, vetronics, and unmanned systems platforms, as well as Command,

Control, Communications, Computer, Intelligence, Surveillance, and Reconnaissance (C4ISR) applications. Each of these markets will see slow growth or no growth, and some will shrink over the next five years; however, market analysts see COTS suppliers gaining a larger share of the shrinking market as the primes are forced to outsource for embedded electronics technology.

C4ISR outlook

"Overall C4ISR is still a good, strong market," says Brad Curran, Industry Analyst at Frost & Sullivan (www.frost.com). "C4ISR spending is about 6.9 percent of the total DoD budget. However, overall numbers may be declining with all western nations cutting back on defense spending by trying to find efficiency. The U.S. C4ISR market – including electronic warfare – is about \$43 billion, which is a decrease of 10 percent from last year. My estimate is that the U.S. is half the global market, so you will see a pretty good reduction in the United Kingdom and France as well. In Japan, South Korea, Taiwan, Turkey, UAE, and Australia, they are about even. They're basically in the geographic influence of China and Iran, who are jacking up C4ISR significantly. India also has an increase."

"The C4ISR Negative Compound Annual Growth Rate (CAGR) for Research, Development, Test & Evaluation (RDT&E) is 4.5 percent," Curran continues. "For procurement overall, the CAGR is 3.9 percent. By 2017 the market will be \$41 billion for the U.S. (Figure 1). Globally it is flat. The big western powers' reductions will be offset by the countries that are running scared of Iran and China. None of these estimates include China. I think were going to see RDT&E go down still. The DoD will rely more and more on commercial technology, having industry pick up the RDT&E tab and then leverage the technology they develop. This can be risky for defense-focused firms because the government doesn't always give firm plans or commitments. It will be tough for companies to spend billions of their own dollars for something the government might not use. They are basically letting small innovative companies do R and D, then applying it to military applications where it fits. The DoD will eschew high-end platforms in favor of proven and reliable designs that afford maximum flexibility."

COTS and C4ISR

"Another factor driving down numbers is the increasing use of COTS and



standards-based technology as much as possible," Curran says. "This cuts down on spending because the technology is more affordable but just as effective. The trend is toward smaller and more responsive systems and away from large theater-level assets. The U.S. military will still maintain the big platforms to keep an eye on China and Russia, for counter-terrorism efforts, and helping western countries combat Al Qaida and other threats. I think sequestration will put even more opportunities in COTS suppliers' hands. The financial imperative will guarantee more and more COTS as well as the fact that [the] military market is a niche market [for] computers and communication technology. As a result, more and more commercial technology will be adopted for military use."

"Apple and Android products are already making headway into military applications," he continues. "The Air Force and Marine Corps are using iPads for their electronic flight bags. Instead of having a big stack of maps and thick books for flight checklists, they have all that data on off-the-shelf iPads. Maintenance personnel are using iPads to house all their instruction manuals. These technologies matured in [the]

commercial world, and now integrators and primes such as Lockheed Martin, Boeing, [and] ITT Exelis are integrating these products into military systems."

The DoD is leaning toward multipurpose technologies that fuse different collection disciplines and standardize reporting, Curran says. Processing and dissemination of full-motion video also will continue to be a robust growth area, he adds. The adoption of practical, rapid, inexpensive platforms such as aerostats and COTS tools like Wireless Fidelity (Wi-Fi) is surging, Curran continues. "C4ISR services such as language and cultural skills, maintenance, engineering, integration, training, project management – especially for cloud computing and cyber security and applications – are growing in demand. What the military really needs the commercial world to develop are batteries that last a long time. If someone can make

a battery that can last a week, they're going to be quite wealthy."

Unmanned systems will present a large growth area for C4ISR technology. Large platforms like Predators require good EO/IR targeting systems and laser designators. The Army also is making a big push for Unmanned Ground Vehicles (UGVs) for logistics functions such as unmanned vehicle convoys and to support troops on patrol. They also can detect Improvised Explosive Devices (IEDs) by carrying ground-penetrating radars to get a closer look at the ground for anomaly detection.

UAV market

"In the UAV industry I see (overall DoD Program of Record spending) being flat for a couple years and then anticipate it to grow to a certain extent by 2017 for Programs of Record," says Ron Stearns, Research Director at G2 Solutions (Figure 2). "This is not a function of what

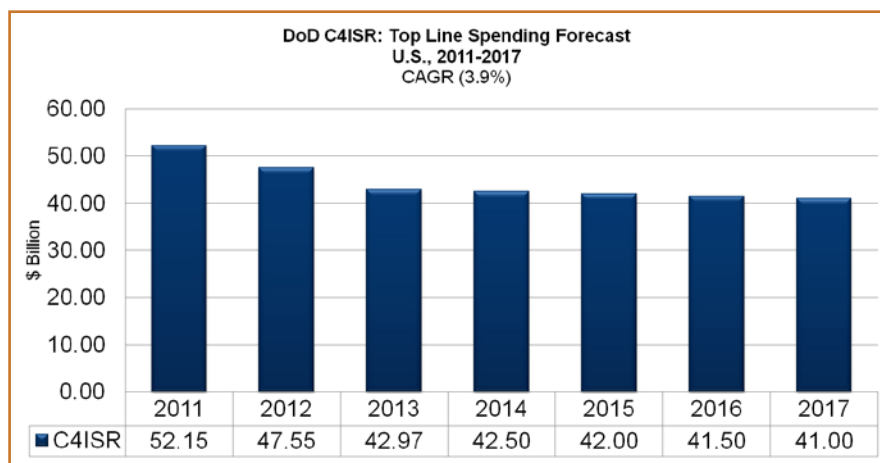


Figure 1 | U.S. DoD C4ISR top line spending forecast for 2011 to 2017 with a CAGR of 3.9 percent. Chart courtesy of Frost & Sullivan

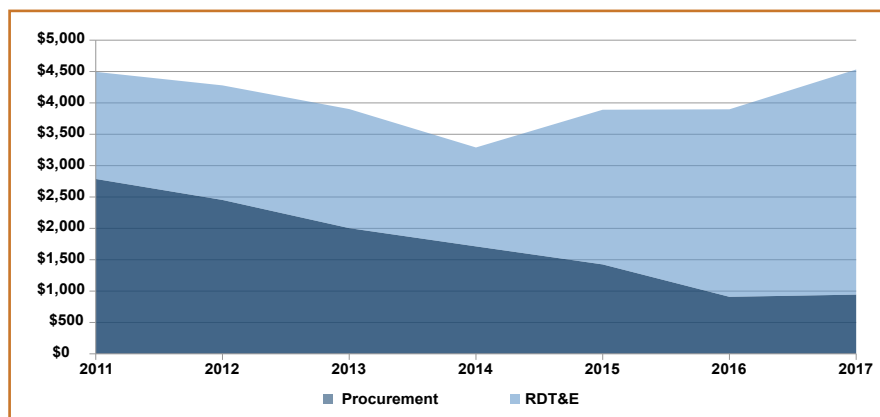


Figure 2 | U.S. DoD Programs of Record spending for both procurement and RDT&E through 2017. The numbers are taken from the FY 2013 Budget Justification Documents (dollars in millions on the left axis). Chart courtesy of G2 Global Solutions

the budget says; rather, it's a function of maintaining Programs of Record. The MQ-1C Gray Eagle, MQ-8 Fire Scout, and MQ-9 Reaper will wind down production. GA-ASI will deliver 240 MQ-9s from 2011 to 2017. The U.S. Air Force already has a Predator C Avenger in theater."

"FY 2013 procurement forecast dollars take us to 2017, and I see some erosion along the way. RDT&E dollars will make up for the procurement short fall," Stearns continues. "The market will be steady through 2017 with a high of \$4.5 billion Program of Record spending in 2011, dropping to \$3.2 billion then getting back to around \$4.4 billion in 2017, but a dip in the interim for Programs of Record. Year over year, the budget shows a steady market, but there are always special cases that do not fall into the budget cycle. Funding for other programs can occur that [is] not expected, such as that for Boeing's re-usable space plane, the

X-37B, or Special Operations programs. These programs add substantially to the Program of Record budget dollars, and should continue to do so through 2017."

"The legacy decade of 2010 to 2020 will give way to an evolutionary leap, with a new generation of UAV combat systems owing advancements to 4.5- and 5th-generation fighter development," he says. "Emerging RDT&E UAV programs between now and 2030 include the Next-Gen Bomber/Long-Range Strike concept. This optionally manned program is a must-have for a company desiring direct and indirect R&D outputs. It could be a \$100 billion program through 2030. Another is the UCLASS, or Carrier Launched Surveillance and Strike, which could be a "Mini E-2" with missiles where the sensor is the shooter. It can bridge the gap between asymmetric and conventional conflict. CVN basing makes the capability more expeditious. Initial operating capability is expected in the 2020 timeframe."

Military avionics

"The avionics market is shaping up to be the most dynamic and strengthening market in probably in the next 20 to 30 years – especially with the F-35 Joint Strike Fighter (JSF) forward fit production ramping up," Merluzeau says. "The market should be between \$10 to more than \$14 billion annually through 2017. We are looking at potentially \$160 billion in avionics spending expected through 2020, [which] presents a good market. The industry will be pumping five to six thousand new aircraft, which is a huge number. Yes, these numbers could change if the JSF falls further behind or if the EF Typhoon and Rafale deals encounter more delays. There are a lot of what-ifs, and we could see an entirely different scenario. However, right now it is shaping up strongly and there are aircraft that will continue to get retrofits so they can fly a bit longer. Avionics retrofits for F-16 fighter aircraft in particular and KC-10/135 and C-130/C-17 cargo aircraft are on the way."

U.S. Air Force photo by Airman 1st Class Laura Goodgame

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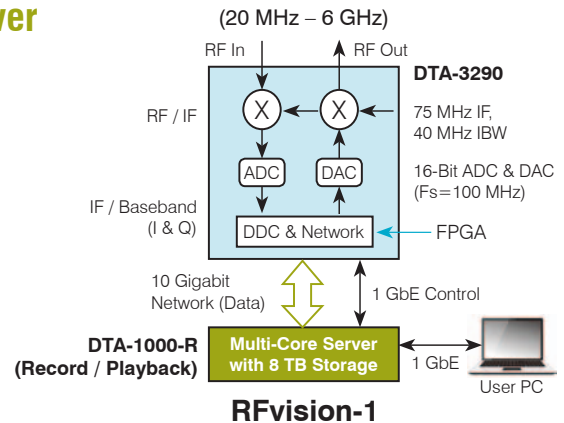


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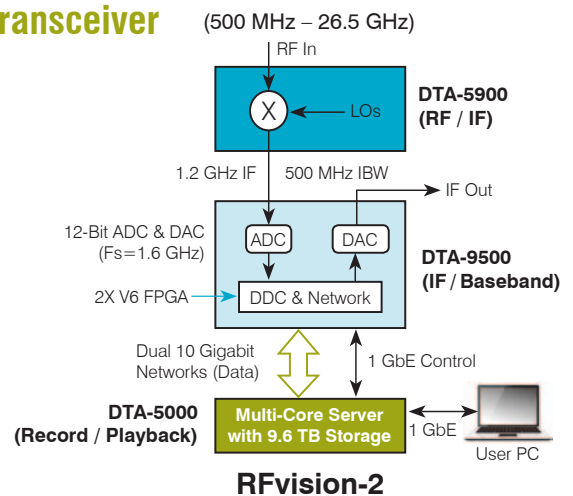
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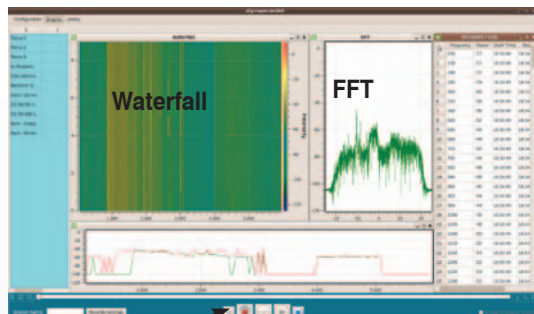
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"There is some activity in the U.S. and in other parts of world with most of the activity in [the] sensor domain being in radar and data-links upgrades," Merluzeau continues. "In Europe they are doing more with what they have rather than procuring entirely new systems; budgets are a significant issue and will not get any better for at least five years. Most of the work being done is in upgrades to current solutions to keep older generation aircraft flying longer."

"In terms of new aircraft production, the P-8A Poseidon maritime and patrol aircraft seems to have its own issues," Merluzeau says. "We're going to see the P-8 kind of be a high-end market solution only. Boeing's proposing an intermediate market or entry-level market solution based on a business jet. P-8 is a lot of aircraft for an elite group of nations with unique maritime surveillance and antisubmarine warfare requirements. The low- to medium-end market is a highly fragmented segment; therefore, Boeing needs to be prepared to face-off on price, support, and technology solution[s] and value over time. We feel comfortable they can do all that really well, with perhaps the exception of pricing the aircraft right and getting past the Foggy Bottom red tape."

Vetronics outlook

The vehicle electronics, or vetronics, market looks to be steady as the military will be maintaining current programs, while not rolling out any major new platforms except elements of the Stryker family.

"I set the value of the vetronics market at \$900.3 million," says Wayne Plucker, Industry Manager at Frost & Sullivan. "It is effectively a retrofit market with no new programs in the mix except Stryker. The Army is effectively done building new ground vehicle platforms. I don't see this changing any time soon either. Regardless of sequestration, vetronics will likely be a retrofit market for the next few years. By 2017 the market will grow to \$928.9 million, a small total uptake from the 2013 level of \$900.3 million. There is small growth in between with a soft 2014

where it drops down to just below \$700 million, \$850 million for 2015, and more than \$1 billion for 2016 (see figure on next page). In 2016 there will be a slight uptick for Special Forces operations."

"We look for it to be a down market, but not appreciably down," Plucker continues. "It really depends on what happens with sequestration and how aggressively individual programs will be pursued. If you talk with Tank and Auto-

motive Command (TACOM) officials, it is a 2 to 3 percent up market, but if you speak with folks that drive the budget in the Pentagon, it is a 2 to 3 percent down market. TACOM is always asked to give their best shot if you will, but while they come up with all the plans, the Pentagon ultimately is going to face the budget reality."

"The principal growth will be in the RDT&E budget, not in procurement. In 2013 RDT&E vetronics spending is

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just under \$100 million," he says. "In 2017 it will be \$423 million. However, the RDT&E budget could decline as well. Spending in this area has been deferred before, based on mission priorities and it could very well happen again. There will be half a billion for the Stryker program over the period from 2011 to 2017. That's far and away the biggest spending in vetronics circles. One funding area that will essentially remain fluid is Special Forces operations. The Special Operations Command (SOCOM) will still have the ability to buy what they want when they want. Their program spending is dynamic, while TACOM spending is more predictable."

"Embedded COTS solutions are going to be the winners in vetronics," Plucker says. "The 80 percent solution is probably going to be the model going forward because there is a lot of great stuff available through COTS. The technology works and plays well with

military systems. Embedded computing makes a lot of sense for military vehicles because of the restrictive real estate. Displays and control boxes can be designed smarter and link to central computers for management services. The real question will be funding for UGVs, and this will be based on mission

priorities. For instance, the unmanned convoy system could come about, but once we get out of Afghanistan, is there much of a need for it? Whether or not there is a strong impetus to fund it kind of depends on how much money it will cost and how much of it will be a science project." **MES**

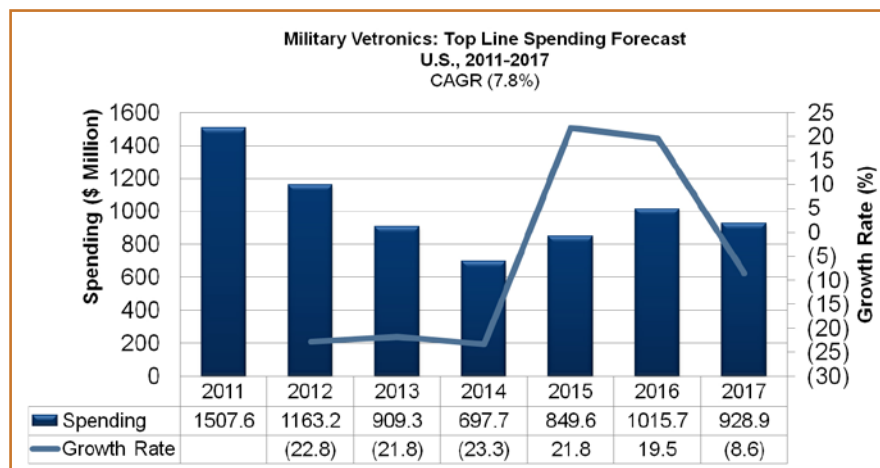


Figure 3 | DoD vetronics top line spending forecast for 2011 to 2017 with a CAGR of 7.8 percent. Chart courtesy of Frost & Sullivan

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Rugged, wearable computers tailored for the warfighter

By John McHale, Editorial Director

Designers of rugged mobile computers – tablets, handhelds, and so on – find adaptability and scalability for missions to be as important a requirement as lowering Size, Weight, Power, and Cost (SWaP-C). Meanwhile, embedded engineers continue to look for innovative ways to get rid of the heat generated by high-performance processors.



The Modular Tactical System (MTS) from Black Diamond Advanced Technology is a wearable electronics platform used by Special Forces operators for precision targeting and other dismounted missions.

Whether we're talking about desktops, laptops, tablets, wearable systems, or handheld smartphones, military rugged computing platforms face continued requirements for lower Size, Weight, Power, and Cost (SWaP-C). Market and procurement pressures are also pushing for more Commercial Off-the-Shelf (COTS) designs that leverage commercial technology.

"In the rugged tablet world, SWaP-C is still important as customers want to manage weight and power with as much processing and memory as they can get," says Steve Motter, Vice President of Business Development for IEE in Van Nuys, CA. "They are also looking for iPad-like or commercial tablet-like features in terms of touch screen, multi touch screens, swing bezels, and low weight. There is demand for lots of embedded peripherals and connectivity

balanced with desire to support drop-in-puddle, submergible requirements. We are also seeing continued requirements for resistive touch or resistive multi touch for operators to be able to use tablets with a gloved hand. Tablets are growing fast, as people want to move the applications they would typically use in a desktop PC display to a mobile device. We need to ensure that the display is large enough (8 to 10 inches) to provide more information such as weather maps, video, and other interactive applications."

"Generally in the mainstay computing world, we are seeing the push for the latest Xeon Sandy Bridge and Ivy Bridge series Intel platforms," says Jim Shaw, Vice President of Engineering at Crystal Group in Hiawatha, IA. "In the embedded and wearable space, we are seeing a huge demand for lightweight

but powerful systems. These are being applied to both the wearable computers and the Unmanned Aerial Vehicle (UAV) applications. Our most recent product offering in this market is an i7-3770S desktop quad-core plus hyperthreading CPU with 16 GB DDR3 in a 4 lb. computer for UAVs."

Black Diamond Advanced Technology engineers in Tempe, AZ incorporated a power management capability into their wearable Modular Tactical System (MTS) for warfighters that can handle a wide voltage range, and "we utilize that in the computing element of the system," says Norman Lange at Black Diamond Advanced Technology. "The system runs three boxes on one battery. We developed the power management system to get rid of extra batteries and use a single battery to pull in, regulate, and distribute power to multiple systems.



Much like commercial smartphones, it reduces power consumption when certain functions are not in use or if the device is turned off."

"The handheld device a lot of times tends to be an application-specific product, so it's easier to scale processor and memory to the application with a margin for reserve or growth," Motter says. "They do not need the fastest processor and most memory to do the job today, but want the ability to support future apps and customization. One thing about handhelds and ruggedization is that [they] will only have to handle what a human can handle as it is inhabited in the area end of a warfighter's hand. It will not need to meet temperature ranges very far beyond that which a human cannot survive. Batteries and the dimensions of the unit are dictated by size of the display; for small displays

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(3.5-inch), the packaging is challenging; at a 7-inch size there's more room for additional batteries and peripheral functionality."

Warfighters also want computing tools they can scale and adapt based on their different missions. Each mission might also call for different SWaP requirements as well as different ruggedization needs. Therefore, rugged and wearable computer designers are designing modular systems that are flexible enough to meet a variety of mission and human factor requirements (Figure 1).

"The fastest growing form factor is not really a form factor. It is delivering the optimal size, weight, and power needed for the job," says Mike Stelmat, Chief Technology Officer, Worldwide Product Sales, at General Dynamics C4 Systems in West Palm Beach, FL. "The smaller, the lighter, the more power efficient the computer, the better. Where I do see change is the need to mix and match options to deliver the right balance of ruggedness and functionality at the most competitive cost. That way, customers only pay for what they need to get the job done. Dismounted soldiers who need to text, chat, and maintain situational awareness during a mission need a lightweight, rugged computer that performs much like a smartphone, such as the GD300." GD also provides rugged computers for intelligence analysts in mobile command posts who need full levels of processing power, memory, and information security, Stelmat adds. Earlier this year, the Army 75th Ranger Regiment in Afghanistan worked the GD300 and feedback was positive, he says.

The MTS is a completely modular approach to wearable computing, Lange says. "It is a modular wearable electronics platform that is optimized for dismounted precision targeting, command and control, C4ISR, Explosive Ordnance Disposal (EOD), and other dismounted missions that require a computing function. Black Diamond doesn't really build computers; we build weapon systems, and our design staff consists of prior missile system engineers. We spent

Figure 1 | The IEE 10.4-inch Thin Client Military Display uses an ARM processor and has dual-mode backlighting for night vision and sunlight readability.



more money on human factors than any other design attribute of our system. Empirical end-user feedback was given directly to [the] designer. Unlike a traditional system where the designer writes a specification, then gets with [the] end user, we shortened that process by embedding our designer with Special Forces operators. They lived with the operator to get raw feedback, learning rapidly how the system needs to work in all conditions – rain, sleet, and mud – and with other equipment."

MTS is super scalable, and users can adapt the system based on mission needs, Lange continues. "If an operator does need to call in airstrikes, he can scale it down to just have navigation and command and control functionality. The system has different elements such as a rugged monitor, a GPS module, and a tactical expansion hub. The tactical mission controller – worn on upper-rear vest panel or integrated with an assault/carry pack – contains the tactical computing core, system power manager, and peripheral controller, and can be integrated with a helmet-mounted display. A variety of Department of Defense (DoD) Special Operations Command (SOCOM) elements in the Air Force, Army, Navy, and Marines use MTS. Most have been Joint Terminal Attack Controllers (JTACs), EOD personnel, or operators controlling UAVs and Unmanned Ground Vehicles (UGVs). MTS is the Air Force Special Operations Command Battlefield Airman Program of Record."

Getting rid of the heat

Dissipating the heat from today's modern processors continues to be a challenge for military system designers.

This task becomes more difficult as the military wants products in smaller and smaller packages, creating less room to move heat off the card or board.

"Getting the heat out of the latest embedded processors has always been a challenge for engineers," says Rob Scidmore, President and CEO of Extreme Engineering Solutions (X-ES) in Madison, WI. "It is especially true for Intel processors and is proving to be a challenge with the latest Intel Core i7 processors. For the latest Intel Core i7 processors, we have [integrated] a new thermal technology that improves the heat transfer from the processor to the heat frame, and to the sidewalls of the chassis; this enables us to continue to support conduction-cooled applications up to and even beyond +85 °C rail within a 0.8-inch pitch slot while still supporting an XMC/PMC module on the single board computer."

The credit-card sized Falcon rugged computer from Versalogic in Eugene, OR, uses a low-power Atom E6x0T processor, but still has thermal management built in to dissipate heat, says Gary Schultz, Director of Marketing at Versalogic. "After thermal modeling, much testing is done to ensure that the heat is going where it needs to go, at a fast enough rate, to keep the board functioning. Very specialized Thermal Interface Material (TIM), machined heat slugs, or heat plates (to maintain the flatness to match up exactly with the top of the processor and support chip) and spacers make sure it sits at exactly the right height (without crushing the CPU die); these are all combined to make what appears to be a very simple thermal solution."

Figure 2 | The SprayCool Multi-Platform Enclosure (MPE) chassis from Parker Aerospace is a standard two-phase SprayCool chassis. Pictured is an 11-slot 6U product.



"We have been pushing the limits with our water-cooled systems for the GPGPU and high-power CPUs," Crystal Group's Shaw says. "Crystal has a water block assembly that cools five C2075 NVIDIA GPGPUs. Each GPGPU can dissipate around 200 W; however, we have increased the density from each GPGPU taking up two slots to requiring only a single slot."

Liquid cooling is continuing to grow in popularity among military system designers. "The industry has been on the verge of embracing liquid cooling for a number of years at the box level (Figure 2)," says Michael Humphrey, Key Account Manager for Parker Aerospace. "Many have been reluctant to embrace a liquid approach and have tried to do as much as they could with air before moving to a liquid-cooling architecture. Companies will typically push the use of air as far as possible before switching over. Operating in harsh environments where shock and vibration as well as sand and dust are prevalent definitely adds to the challenge where fans are the critical component."

"Once a customer has exhausted all the possibilities with air, many of them are entering new ground," says Dan Kinney, Business Development Manager for Parker Aerospace. "There are two important characteristics that liquid cooling can enhance: heat density watts per centimeter squared and total density. Liquid cooling really helps customers deal with higher heat densities (that is, W/cm²) as well as total heat load (for example, taking a box from 600 W and now making it over 1 kW).

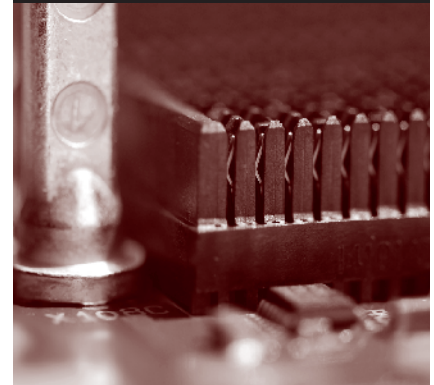
Two-phase cooling

Parker Aerospace has developed a thermal approach called two-phase cooling that "takes advantage of the

transition of a liquid to a vapor – latent heat of vaporization," Humphrey says. "The energy – heat – consumed by this transition is carried away by the vapor to the heat exchanger where the heat is dissipated and the vapor returns to a liquid. Parker's SprayCool chassis and two-phase cooling technology are being used by Sierra Nevada for the Army's Helicopter Autonomous Landing System (HALS)."

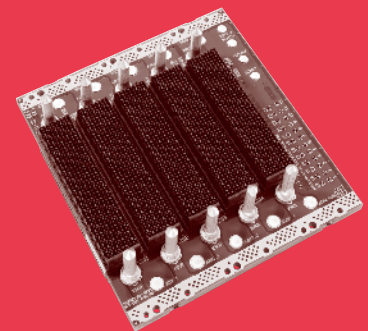
"Two phase is an efficient way to pull heat off electronics," Kinney says. "In very simple terms: When liquid becomes a vapor like boiling water on a stove, it can create good consistent temperatures. This method is ideal for radar applications for a couple reasons. When it comes to the thermal management system itself, the capacity of heat removal of a two-phase system translates into lower flow rates and smaller reservoir volumes, thus yielding a lower-weight solution when compared to traditional single-phase systems. Secondly, the electronics packages benefit from lower and more uniform temperatures, thus improving reliability – higher Mean Time Between Failure (MTBF) – and allowing the user to maximize performance. We've reached the waypoint in the system where primes are starting to look beyond the embedded box when it comes to designing a cooling architecture. It is the whole system, not just the compute engine, that needs to be cooled. It's no longer about what is in the sealed system; the antenna and the sensor suite need to be cooled as well. Airframe designers understand this and see a proper thermal management system throughout the aircraft as a way to reduce weight, thereby reducing fuel costs." (For a list of rugged computing companies, see pages 32 and 33.) **MES**

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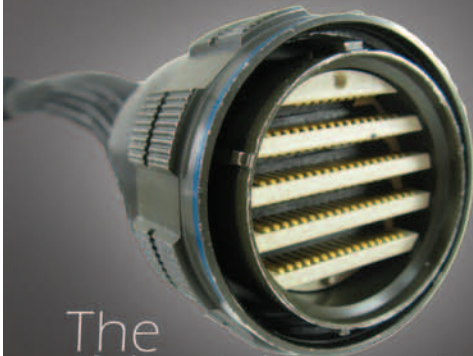


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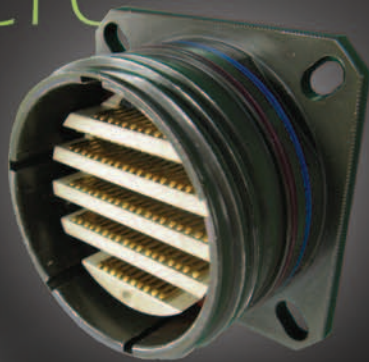
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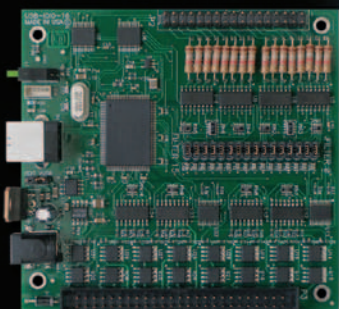
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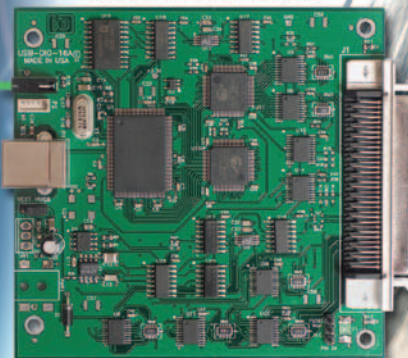


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AFT cools high-power COTS modules for military applications

By Jacob Sealander

Open-standard Air Flow Through (AFT) cooling technology is a welcome addition to the options available to designers of rugged COTS systems for defense and aerospace applications. Northrop Grumman's AFT technology, incorporated in the ANSI/VITA 48.5-2010 standard, provides a cost-effective way to cool high-performance VPX boards used in C4ISR applications.



U.S. Army photo by Sgt. 1st Class Brent Hunt, CAB PAO, 4th Inf. Div., MND-B

Successfully addressing the thermal management requirements of high-power, high-density COTS systems calls for a full range of cooling approaches, ranging from air and conduction cooling to spray and liquid flow through cooling technologies, as well as the requisite experience and expertise to implement them.

The power density of many VPX systems today precludes use of standard conduction-cooled cards. As cards reach up to 170 W densities, they are exceeding the single-slot capability that a conduction-cooled card can handle, especially when several of these high-powered cards are used in adjacent slots in a system (depending on components and environmental constraints). Northrop Grumman's Air Flow Through (AFT) cooling technology for VPX cards, defined in the ANSI/VITA 48.5-2010 standard, provides an additional weapon for defense and aerospace integrators to use in their fight against excessive heat in high-power-density cards and systems. AFT hits the "sweet spot" for today's high-performance modules, enabling reliable cooling of 120 to 200 W cards within the boundaries of +55 °C air. Consideration of alternative approaches such as conduction cooling, air cooling, spray cooling, and LFT serves to highlight the benefits of AFT.

Goal: Cooling close to the component **Conduction cooling**

Standard conduction-cooled cards have difficulty handling the temperature rise across a 170 W card. Adding to the challenge is the additional thermal resistance of transferring the heat to the enclosure, then rejecting to the surrounding air plus the adjacent cards' power dissipation. Regardless of which medium is used to reject heat, the solution becomes impractical for a typical +55 °C ambient air environment. This means that the familiar cooling methods – such as external forced convection (air blown over the outside of the chassis' surfaces to draw heat from the system) and baseplate cooled (heat conducted to the mounting surface and rejected into the mounting plate) – are insufficient.

A typical conduction-cooled card has too large of a thermal resistance to cool today's highest-performance modules. In some cases, heat pipes or copper inserts have been utilized to handle power densities too high for a typical aluminum conduction heat sink, to move heat to the card edge. The thermal transport capability of heat pipes can provide a significant benefit to solving the aforementioned issues. Unfortunately, when taking

“ Standard conduction-cooled cards have difficulty handling the temperature rise across a 170 W card. Adding to the challenge is the additional thermal resistance of transferring the heat to the enclosure, then rejecting to the surrounding air plus the adjacent cards’ power dissipation. ”

into consideration the total power of the system, the temperature range, and attitude dependencies of the heat pipes, the solution can become a significant cost driver and still does not effectively handle large power densities in the enclosure.

Air cooling

A better solution requires a shorter thermal path from the heat-generating component to the cooling medium. This means the cooling medium must be brought as close to the component as possible. The simplest, most reliable, and most economical approach is to simply blow air across the cards. This brings the cooling medium (air) right to the component, removing a huge amount of conduction resistance. But ambient air can be contaminated with dust, humidity, salt fog, and so on, which pose concerns such as electrical short circuits for the electronics, for example. So a sealed enclosure is needed to keep the ambient air from coming into contact with the cards. This eliminates the feasibility of ambient air-cooled cards and chassis for many rugged environments.

Theoretically, it would be possible to use air-cooled cards if they were in a sealed chassis that had internal fans to pull heat out of the cards, internal high-density fins to pull heat out of the internal air and push it into the chassis’ exterior, and external high-density fins to push heat into the external ambient air. Unfortunately, this approach would double the fan count, double the fan power, and, unfortunately, still might not provide a low enough thermal resistance. (Air-to-air heat exchangers are very inefficient.)

Spray cooling and Liquid Flow Through (LFT)

Other options for bringing a cooling medium close to the component are spray cooling or Liquid Flow Through (LFT) heat frames. Spray cooling could remove heat from the cards by spraying the cooling medium directly on the card, but it involves nontrivial modifications to the cards, corrosion/erosion concerns for the coolant on the cards, and complexity associated with the spray nozzles, pumps, accumulators, valves, coolant, liquid-to-air heat exchanger, and so on. This solution requires higher-frequency maintenance with some real reliability concerns, and makes it more difficult to meet weight requirements in SWaP-constrained environments.

With LFT heat frames, liquid is passed through the metal frame that mounts to the circuit card. The liquid removes the heat in the high-power components and alleviates erosion concerns – the fluid never contacts the components – but it’s costly to manufacture and includes a fair amount of complexity in valves, pumps, bladders, and so on. And like spray cooling, there are weight concerns because of the required chassis, coolant, hoses, valves, and a liquid-to-air heat exchanger. LFT has some very attractive qualities because the cooling medium is right over the component but not in contact, but the impact of weight and complexity limits its use.

AFT cooling

This leads us to the next approach, which replaces LFT’s cooling fluid with utilization of air. This delivers the same benefit of having the cooling medium very close to the component without direct contact. This also provides a very significant reduction of weight and complexity from the designs that utilize liquid. And air is cheap. A proven AFT method – which combines the simplicity of forced-air cooling and the extreme reduction of thermal resistance to the cooling medium offered by LFT – is Northrop Grumman’s AFT cooling technology, an open-standard defined in ANSI/VITA 48.5-2010. With AFT, air passes through the heat frame, preventing the ambient air

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Cooling technology	Application ruggedization level	Power "sweet spot"	Subsystem complexity	Subsystem cost	System cost/Impact
Air cooling	Benign or moderate	< 200 W/slot	Low	Low	Low
Forced air conduction cooling	High	< 80 W/slot	Low	Low	Low
Forced liquid conduction cooling	High	80-200 W/slot	Medium	Medium	High
Air Flow Through (AFT) cooling	High	80-200 W/slot	Medium	Medium	Low
Liquid Flow Through (LFT) cooling	High	> 200 W/slot	High	High	High

Table 1 | A side-by-side comparison of the cooling methods discussed.

from contacting the electronics but dramatically decreasing the thermal path to the cooling air.

Given the benefits of AFT in simplicity of design, weight efficiency, and low thermal resistance, Curtiss-Wright is utilizing this approach as a preferred solution for its highest-power-density systems. These AFT modules achieve reliable operation over an inlet ambient air temperature of -40 °C to +55 °C. The modules are enclosed in a thermal frame with openings for inlet and outlet air. AFT heat sinks provide maximum cooling over a large surface area for the system modules. On both the inlet and the exhaust sides of the card, a gasket mounted inside the chassis seals the card's internal air passage to the chassis' side-walls. These seals prevent air from being blown into the chassis and protect the internal electronics from the harsh external environment. A comparison of the aforementioned cooling methods is presented in Table 1.

Thermal analysis

As an example of the cooling benefits of AFT, we conducted a detailed thermal analysis of a variety of cases (results available upon request). The results of a typical VPX SBC thermal analysis indicated that with input air of +55 °C, the system can be adequately cooled with margin. One of AFT's benefits is that cooling air is brought in very close proximity to the high-power components; this is true not only for components on the base card, but also for the components on the XMC cards. Providing a short-circuit path to the cooling ambient air from the high-power components on the XMC enables the highest performance possible for even the XMC cards. Each high-power component interfaces to the AFT heat frame through a conductive, flexible gap pad.

Isolation of thermal paths

Another extremely valuable benefit of AFT is the isolation of the thermal path of each card in the system. With AFT, cards don't share cooling air or the thermal interface into which they conduct heat. Each AFT card has its own inlet of +55 °C air and its own exhaust. There is no other cooling path other than the cooling air. From a thermal standpoint, this enables each card to be viewed in isolation. By ensuring balanced airflow through all of the cards in the system, each card receives the amount of cooling air required to keep components at their appropriate temperature. To highlight the capability of the approach, a thermal analysis

was performed assuming a combination of a high-power base card and daughtercards. The results are shown here:

Thermal results:

SBC with two XMCs thermal results

This generic card was assumed to have the following heat loads:

SBC: 90 W XMC: 40 W

Total power = 170 W in a single slot

Thermal analysis summary

The thermal analysis is consistent with the performance and findings of the previously developed systems that utilize AFT for their cooling solution. The analysis overall shows a large amount of margin if it is assumed that case temperatures can be +100 °C or higher. As Curtiss-Wright performs these analyses very frequently, it is understood that the real application might have worse power density issues than described here, as the high-power components in many cases are "flip-chip" designs with the die mounted on the top of the BGA substrate. With the die generating all of the heat, the high power being dissipated is through a smaller area than allocated in this analysis.

Several techniques can be employed to combat the high-power-density challenges of these high-performance components – including higher-performance/thinner gap pads, use of copper heat spreaders, and use of adjustable-height copper heat spreaders to minimize gap pad thickness. Given this understanding and the results of the aforementioned analysis, AFT is a great solution for cooling the "sweet spot" 120 to 200 W high-power and high-performance SBCs and DSP modules. **MES**



Jacob Sealander is Chief Architect, Embedded Systems, at Curtiss-Wright Controls Defense Solutions. He has worked at Curtiss-Wright since 1996 in various design, engineering, and management positions including Engineering Manager of Embedded Systems, Mechanical Engineering Manager, and Manager of Product Line Engineering.

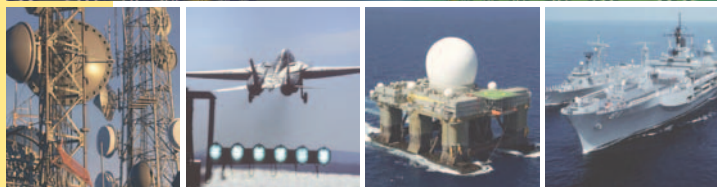
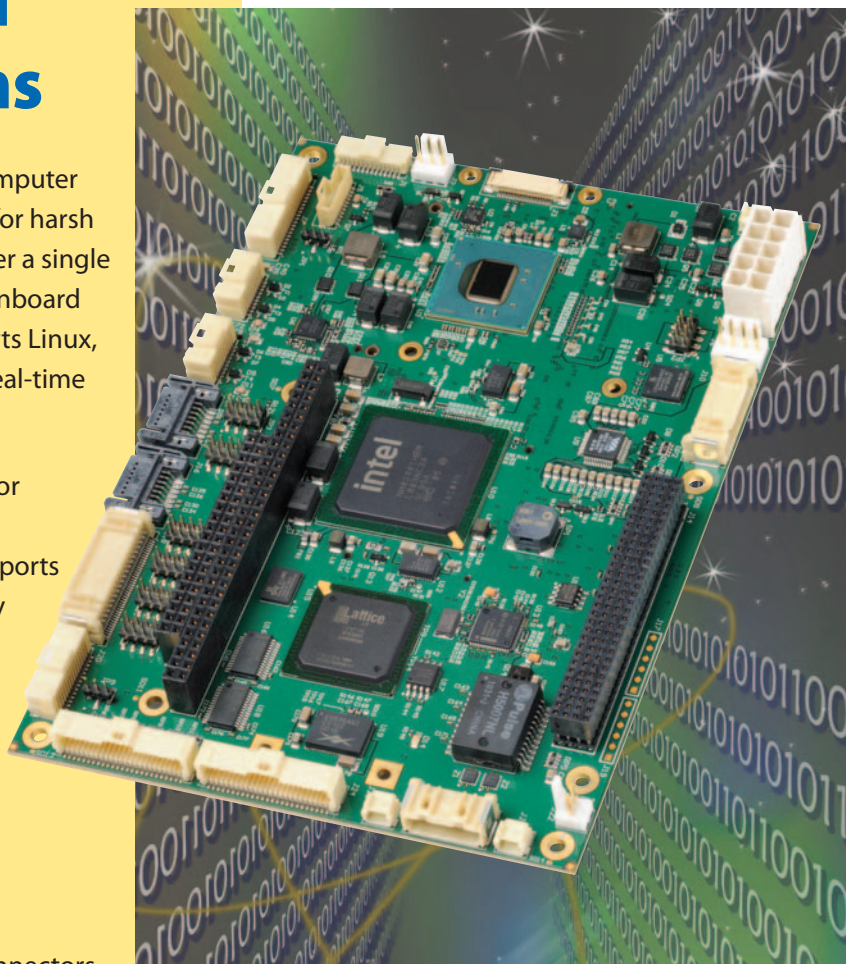
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Case study: Rethinking rugged subsystem computing design to accommodate military budget cuts

By Michael Smith

More now than ever, rugged computers must meet a myriad of DoD demands to provide more power and flexibility – all on a tight budget. These requirements have pushed designers of rugged military computers to rethink the traditional rugged subsystem design. The following case study examines how engineers recently designed a rugged computing subsystem to check every box on the military's growing list of requirements.



U.S. Marine Corps photo by Pfc. Ariel Solomon

Recent news of DoD budget cuts has greatly impacted the military electronics industry as designers of rugged computing systems must deliver solutions that can not only survive the battlefield, but the DoD's pocketbook. Leaders of the U.S. Department of Defense (DoD) propose spending approximately 10 percent less from current-year budgets, which were already further reduced the previous year. As a result, the U.S. government is placing greater emphasis on standard products (Commercial Off-the-Shelf) and tightening budgets for custom Non-Recurring Engineering (NRE).

Consequently, rugged COTS preintegrated computing subsystems are starting to replace what have been traditionally custom MIL-SPEC systems. However, many military programs are requiring higher-performance processing and memory architectures such as those offered by Intel's Core i7 processor. In addition, military customers are seeking greater support for high-bandwidth data buses (for example, PCI Express, Ethernet, and so on) and modular I/O expansion, plus scalable integration of subsystem functionality – eliminating the stand-alone "bolt-on" system integration paradigm that has added

unnecessary weight, complexity, heat, volume, and power draw to vehicle platforms. C4ISR/EW initiatives are particularly interested in interoperable networked-based solutions where mission computer, IP routers, and switches – along with other application functions – can be elegantly integrated and optimized for Size, Weight, and Power (SWaP).

The following case study reveals how Parvus engineers overcame the design challenges involved in developing a rugged computing subsystem for unmanned and manned aircraft, ground vehicles, and maritime platforms to meet the DoD's requirements for a flexible, cost-effective computing solution.

More power, more heat, more solutions

In light of the aforesaid paradigm, engineers recently set out to design a rugged computing subsystem, combining the in-demand Intel Core i7's powerful graphics and multicore processing capabilities with ultra-reliable mechanical robustness for extreme environmental conditions per MIL-STD-810G (thermal, shock, vibration, exposure to dust, water, and humidity) and EMI conditions per MIL-STD-461F. However,

as the unit's Core i7-2655LE-based PCIe104 Single Board Computer (SBC) can generate as much as 45 watts of power in its embedded 2.2 GHz dual-core variant, managing the thermal dissipation without increasing the size of the enclosure presented the largest challenge when designing this system.

In rugged designs, thermal dissipation is heavily dictated by the surface area of a chassis; therefore, the use of that surface area becomes very important when considering thermal management. When designing this system, there were several Integrated Circuits (ICs) in the system that were reaching over 100 °C. After some analysis and imaging with a thermal camera, engineers made a connection from these hot spots to the chassis wall using an aluminum heat sink at strategic locations of the chassis that were 2 to 3 degrees cooler (Figure 1). With this change, engineers saw the temperature come down on the ICs by over 10 °C, greatly reducing the risk of overheating the components. Although the external chassis only had a 2 to 3 degree temperature change, engineers were able to channel this temperature difference from the external surface of the chassis to dramatically lower the temperature of the ICs on the electronics.

Another IC in the system had a thermal protection mechanism that would turn the device off when it reached 100 °C. This meant that in a 71 °C ambient environment – the upper

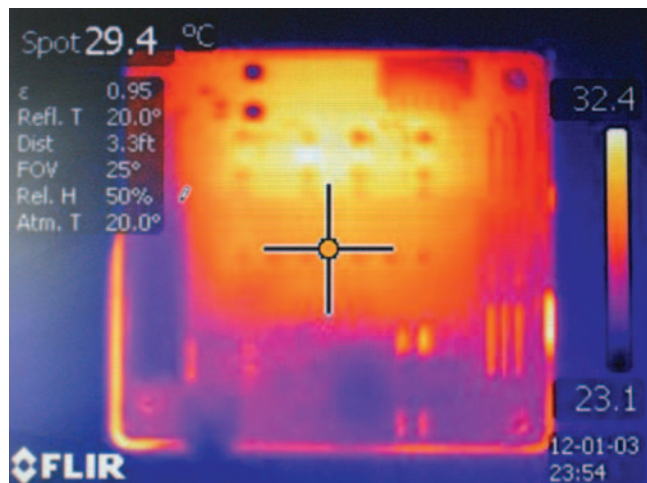


Figure 1 | A thermal image of the DuraCOR 80-40 rugged computing subsystem's PCIe104 single board computer was used to help determine thermal management solutions.

operating temperature of the system – engineers needed to keep this IC's heat sink below 100 °C for the device to continue full operation. Engineers improved the conduction path from the IC's heat sink to the system chassis using additional aluminum heat sinks. This produced similar results and as with the other components, lowered the temperature by approximately 10 °C for the IC, with minimal chassis temperature changes.

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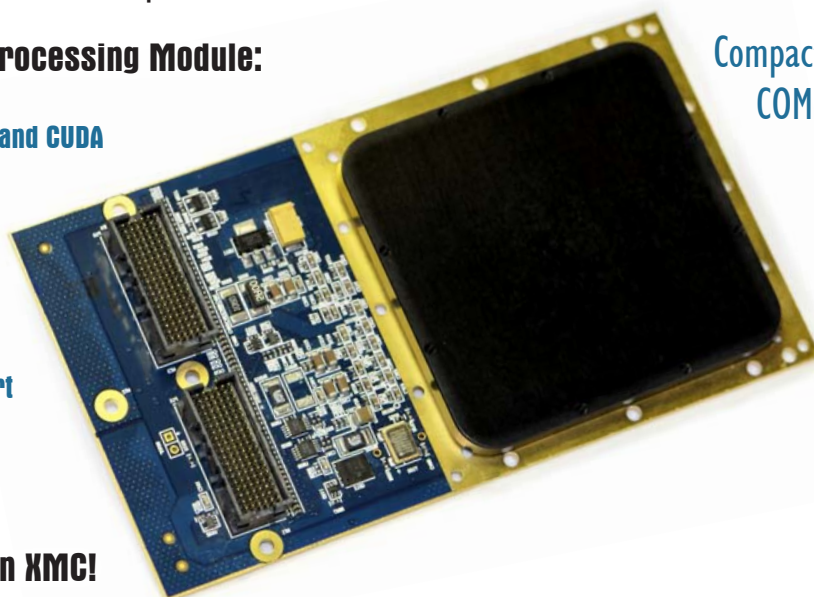
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Although both of the examples illustrated here were solved with simple aluminum heat sinks, other materials were used in the system to solve more complex thermal management issues. For example, combination copper and aluminum heat sinks, where copper is press fit into aluminum parts, effectively doubled the subsystem's transfer rates. (Aluminum has a thermal conductivity of approximately 170 W/mK, and copper has a thermal conductivity of approximately 390 W/mK.) In other areas of the design, pyrolytic graphite, with a thermal conductivity as high as 1,700 W/mK, was used to efficiently distribute the heat across the surface area of the chassis.

Even with all these specialized internal heat sinks, engineers needed to rework the external surfaces of the chassis (Figure 2). To improve the chassis, Parvus engineers designed nontraditional aluminum grooves on the exterior of the chassis, which not only minimized weight, but significantly increased the amount of surface area while reducing the vulnerability of more traditional fins. In comparison, most other chassis are designed with large fins that are mechanically weak and prone to bending and breaking. By increasing the surface area in this way, the chassis allowed for a thicker rib that not only provided increased surface area for heat dissipation, but also improved structural integrity.

The thermal design solutions implemented in this i7-based system have proven very effective. In past rugged subsystem designs, the internal air temperatures reached or exceeded 15 °C to 25 °C above the ambient external temperature. However, with these latest thermal management solutions in place, engineers have cut those numbers almost in half with a rise in internal air temperature of only 10 °C to 15 °C above the external ambient temperatures.

Modularity a must for cost savings

To make rugged systems viable for today's military requirements, system architectures must be scalable and flexible to change with the military's varying demands. To create a modular rugged computing subsystem, engineers needed to design a system that could support a stackable PCI Express bus architecture for I/O card expansion and a modular mechanical design that could grow based on I/O requirements. Offering a computing subsystem that allows this flexibility extends the life and usability of a system – a must for budget-conscious DoD programs.

One of the significant engineering challenges in building a modular card stack was the large number of signals – about 160 – that needed to be interconnected for external use in less than 1" of space, and designed in a way that is still easy to manufacture. To accomplish this task, board-to-board interconnections were used to eliminate bulky cable-runs as 160 wires would be nearly impossible to fit in such a small space (approximately 5"L x 2"W x 1"H). Another large challenge was the interconnection between chassis modules. With other modular systems, the sections are secured with a single bolt running the length of the system at each corner. This causes some problems



Figure 2 | The passively cooled chassis was optimized for heat dissipation and modular I/O expansion.

with structural integrity of the system, as well as difficulties in sealing the unit against ingress protection.

To maintain structural integrity, as well as ingress protection, engineers included strengthening ribs on the enclosure. The ingress protection was provided with a proprietary o-ring groove. A rib was included on each interconnecting module, which upon mating, was inserted into the o-ring groove. This increases the pressure on the gasket enough to allow only four bolts to be used at each interconnection point, rather than having bolts every few inches as is common in other designs.

From the electrical side, the intermodule communication and power interfaces use board-to-board connections to improve structural integrity in heavy vibration and shock environments, improve reliability by eliminating cable failures, and to allow ease of manufacturing in such tight spaces. Dual 2.5" form factor Serial ATA (SATA) flash disks slide in and out on mounting trays behind a sealed, hinged door on the rear panel (Figure 3). Engineers also created the electrical interconnects with PCIe-like connectors and connectors with tight pitch and forgiving alignment tolerances. Selecting these specific parts allowed for normal machining of mechanical parts and standard PCB tolerances to control costs.

With this building-block design, high-wattage and low-wattage cards could be more easily integrated in the DuraCOR 80-40's card stack. Typically with many rugged computing systems, each PC104 I/O card should not exceed 8 watts or risk overheating. This wattage limitation created problems as many military applications require high-wattage cards. By creating a flexible card stack, higher-wattage cards can now be attached to heat sinks to allow operation in hot environments or high-altitude situations where there is less air to dissipate the heat. The flexibility of this card stack design allows the military to adapt the rugged computing system to meet changing requirements.



Figure 3 | Sealed access panel on rear provides access to rugged and removable nonvolatile storage.

Rugged computing meets future challenges

Rugged electronic design for the military is faced with more challenges today than ever before. Tasked with creating

computing systems that not only have to endure the world's harshest environments, today's military electronics manufacturers must also deliver products that will endure military requirements for years to come. By employing a variety of techniques to improve thermal performance to accommodate increased processing power and improve structural integrity for a modular subsystem, engineers are proving that their designs are equipped to improve battlefield success while keeping budgets in check. **MES**



Michael Smith is Lead Engineer at Parvus Corporation, where he is responsible for overseeing the design of the company's rugged subsystems and contributes to the electrical, software, and mechanical engineering. Prior to Parvus, Michael worked in the communications and manufacturing industries. He graduated from the University of Utah with a Bachelors Degree in Computer Engineering and a minor in Computer Science. He can be contacted at msmith@parvus.com.

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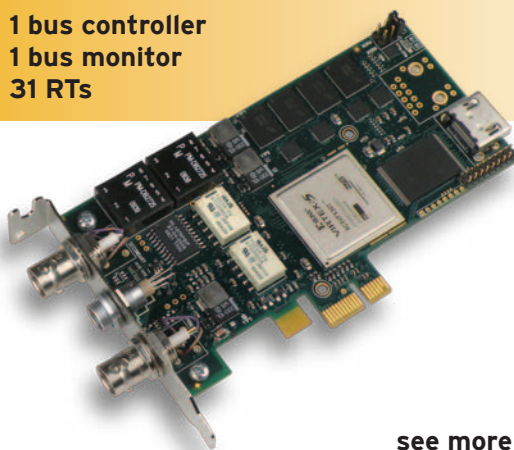
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Rugged handheld computers suit up with Android on the battlefield

By Mark Wilson

The Android Operating System (OS) has become the preferred OS for the military's dismounted situational awareness needs. Accordingly, Android has been enlisted as the backbone of ruggedized handheld computers utilized in Army Mobilization Network Integration Evaluation (NIE) activities and utilized in SA testing and evaluation using the Android OS and the Army's Software Engineering Directorate (SED) mobile application. Here's why.



The technology used for Situational Awareness (SA) creates a digital battlefield to show what is happening around the warfighter. Using this technology, soldiers can acquire information about what is going on around them and share that information with the rest of their platoon. In today's environment of irregular warfare, more and more situational awareness technology is being used by the individual and smaller groups of soldiers rather than large military units. This shift in usage has successfully driven networked capabilities down to the small unit and soldier level. It has also provided a need for information to be integrated through rugged handheld computing devices in order to accommodate the plethora of situational awareness information provided to troops on the ground.

In theater, a warfighter might encounter a wide variety of digital data, communications, and tactical radio technology.

Communication between different branches of the military or between a military branch and a government, nonmilitary agency, for instance, might employ the use of text messaging, video, and/or mapping technology, such as Blue Force Tracking technology, to communicate with each other and determine the locations of both friend and foe. Additionally, fast response times during conflict require quick and accurate communication. In this volatile environment, using the same handheld computer devices among all players in theater helps ensure continuity and optimization; additionally, using a uniform operating system such as the Android OS further allows all users to share a common SA capability within the harsh environment they are called upon to endure.

A common mobile application

The Army's Software Engineering Directorate (SED) authors a common

mobile application in support of the Nett Warrior and Joint Battle Command Platform programs. This application will be deployed to soldiers in theater and run on a dismounted system that must include an ultra-rugged computing device, software, and in some cases, Suite B security. The application should also support various communications solutions in order to receive and send friendly force position location and provide communication capability to and from soldiers and marines.

After an extensive trade study of several software operating systems by SED, the Android OS was selected over Apple iOS and Microsoft Windows Mobile. The study concluded that Android OS provided an open standard with the highest potential for developing mobile computer applications for use by soldiers in theater. Additionally, it was determined that the Android OS would be

the common operating system of choice for future soldier devices, including rugged, mobile tablets, computers, and cell phones.

Military embraces the commercial market

The off-the-shelf cell phone model has been largely embraced by the U.S. military for a number of reasons. The military is able to benefit from the commercial cell phone's use of standard interfaces such as the Universal Serial Bus (USB), standard treatment of devices that include battery management, and rapid growth in technology advancements. Additionally, as the commercial market drives advancement of phone and OS features, the military can rapidly take advantage of new features to match increasing capability sets. Recent capability sets that have been adopted by the military include an anti-spoofing GPS signal, Radio-Frequency Identification (RFID) tag readers, and chemical bio-detection applications. The military can also benefit from the large number of applications being developed to run



Figure 1 | Military customers have many of the same “wants” as commercial customers: faster processors, lightweight, long battery life, and low cost; however, the most important capability is mission-critical reliability. Pictured: The Army's Network Integration Evaluation (NIE) 12.1, U.S. Army photo by Claire Schwerin, PEO C3T

on the Android OS, either natively or modified for military use.

The need for a rugged handheld computer

Military customers have many of the same “wants” as commercial customers:

faster processor, lightweight, long battery life, and low cost; however, the most important capability that is needed is mission-critical reliability (Figure 1). Initially, computers were introduced to the battlefield and treated as “nice to have” systems. Today, in the networked



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era, computers are the entry point to the network for soldiers and leaders – and they must be relied upon to work, regardless of the environment. Computers are now “need to have” and mission critical.

Rugged computing devices need to meet IP67 and MIL-STD-810G specifications for use in extreme environments. These computing systems also need to be able to withstand extreme temperatures, moisture, impact, vibration, dust, and sand so they can be used in any outdoor extreme environment during mission-critical events, including the battlefield. For example, devices should be able to operate in temperatures ranging from -4 °F to +140 °F, survive water immersion, and driving rain. Additional validation testing in accordance with MIL-STD-810G specifications include altitude storage testing for one hour at 15,000 feet, solar radiation testing, 10-day humidity exposure, and exposure for 12 hours of blowing dust. Devices must also be able to survive drop shock testing onto each face, edge, and corner from a height of 4 feet, in addition to extreme vibration testing.

As a result of the military’s decision to leverage commercial industry technologies and move to a rugged handheld computer running the Android OS for dismounted SA, soldiers will have the ability to access secure information when tethered to a secure military tactical radio. Expanded communications should be enabled through various input/output connections, such as a USB host, USB client, Ethernet, and RS-232 devices, which are used by the majority of common tactical radios deployed in theater today. Additionally, once tethered to a secure tactical radio, a ruggedized handheld unit should display Position Location Information (PLI). It should also send or receive classified data such as pictures, spot reports, or chat messages from other military personnel and platforms such as wheeled or tracked vehicles, unmanned aerial vehicles, and other air platforms. Another significant advantage of such a ruggedized, Android-based handheld is its phone-agnostic characteristic. It is well known

Figure 2 | DRS Technologies’ Scorpion H2 is an example of an Android-based, ruggedized handheld and has participated in SED/Android testing and the Army’s NIE activities.

that the commercial industry is moving rapidly along with technical advances, so not being limited to a particular smartphone model allows the military user to take advantage of industry advances and rapidly get the latest technology into their hands.

Mapping and video capabilities also need to be enabled on rugged handheld devices. This is provided by the Blue Force tracking applications, unmanned aerial vehicle feeds, and tactical ground reporting, which give soldiers a 360-degree view of an area – similar to a Google street view – prior to their arrival at that location. For handheld devices to be able to handle this type of usage, they need dual-core processing power.

The Scorpion H2, manufactured by DRS Technologies, is a ruggedized, Android-based, handheld technology that is being used to test and evaluate SA using the Android OS and the SED mobile application (Figure 2). Specifically, the Scorpion handheld has participated in Army Mobilization Network Integration Evaluation (NIE) activities. The NIE activities are part of a new evolutionary approach to establish an integrated military network baseline to validate emerging capability sets for handheld devices used by soldiers in theater. NIE aids the Army in aligning network programs and development efforts under a series of coordinated soldier-driven exercises where soldiers test technical capabilities together in a mission-focused setting. The soldiers’ familiarity with COTS smartphone and Android OS technology has helped to greatly reduce the warfighter’s training and learning curve when mastering the Scorpion device.



Android satisfies the dismounted SA paradigm

It’s easy to see how moving to an Android OS for SA in dismounted operations allows the warfighter to leverage ruggedized technology adapted from the commercial industry for continual technological improvement on the battlefield. This also provides a means to easily implement the latest Android-based products and upgrades into the user’s system in a practical and user-friendly manner. Moreover, because of the popularity of the Android OS, it is apparent that enhancements and development of new applications will continue to expand, further benefiting Android OS users – whether civilian or military – for years to come. **MES**



Mark Wilson is Director of Engineering for DRS Technologies and has a background in mechanical engineering with

a focus on vibration analysis and materials. With 30 years of experience working with defense contractors, he has been recognized internationally with awards for casting designs with magnesium and for U.S design patents for ruggedized electronics packaging. He can be contacted at mwilson@drs-ts.com.

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Net-centric security and CWE

By Chris Tapp

The Common Weakness and Enumeration (CWE) lists the common-mode failures that have lead to security breaches in numerous software systems. It can be used to help improve the robustness of critical networks and infrastructure to help thwart cyber attacks.



U.S. Marine Corps photo by Pfc. Mark W. Stroud

Net-centric warfare uses a system of networks to share information within a combat theatre. This advanced communications network enhances situational awareness with the aim of improving mission effectiveness.

The network that underpins such a system has the potential to expose a significant attack surface to the enemy, raising significant security concerns. After looking at what measures need to be adopted to ensure secure systems, the following examines the Common Weakness and Enumeration (CWE) and demonstrates how it can be used to enhance security in battle communications.

Security concerns

Internal networks are often targeted as a means of gaining access to confidential information. In 2008 classified and unclassified systems within a U.S. Military Central Command network were found to have been compromised. Investigations showed that a military laptop was infected by a portable USB drive. This infection then spread through

network connections to secure areas and is believed to have been used to transfer significant amounts of data to a third party. Infected machines are still being found four years after the initial attack.

External attacks are also attempted. For example, network vulnerabilities within one or more contractors working on the Joint Strike Fighter were exploited to gain access to sensitive project data. The attack appears to have started in 2007, but was not detected until 2009. The attack comprised installation of sophisticated spyware within the development environment. The spyware was used to transfer terabytes of data to a third party. The exact nature of the compromise is unknown as the data was heavily encrypted before being sent.

It is not always easy to understand why a system has been attacked, and it is possible that some attacks are accidental. The systems used to control the Predator and Reaper drone fleet were recently found to have been infected with a virus containing a key-logger payload. The key-logger recorded the

actions of drone pilots while on active service but did not affect system functionality. It appears that no data was lost, though this might simply be because of the lack of exploitable external network connection. The network infection is proving hard to eradicate and has been found to have spread to classified and unclassified systems. It is thought that the virus was unintentionally introduced by a portable USB drive used to transfer map and other data into the control system.

Loss of sensitive information is not the only possible outcome of an attack. A virus detected within a military air traffic control system has the potential to allow a third party to render radar data untrustworthy, leading to confusion or asset loss.

Security considerations

Many of these security concerns arise because of device interconnection within a system-of-systems. It is hard for an attacker to exploit systems that are operated in isolation. However, if they are networked, even if intermittently, the



network allows many other systems to be attacked. If they are all based on the same technology, then common security vulnerabilities can be exploited to allow rapid dissemination of malware.

CWE examined

The vulnerabilities exploited are generally related to code implementation or requirement errors. For example, a buffer overrun event triggered by invalid network data might be used to trick a system into running arbitrary code injected by an attacker. According to research by the National Institute of Security Technology (NIST), 64 percent of software vulnerabilities stem from programming errors.

CWE is a strategic software assurance initiative run by the MITRE Corporation under a U.S. federal grant, cosponsored by the National Cyber Security Division of the U.S. Department of Homeland Security. It lists the programming errors that have led to security failures within systems with the aim of improving the software assurance and review processes used to ensure connected devices are

secure. Enumeration of the vulnerabilities in this way allows coding standards to be defined to target them so that they can be eliminated during development.

The CWE database

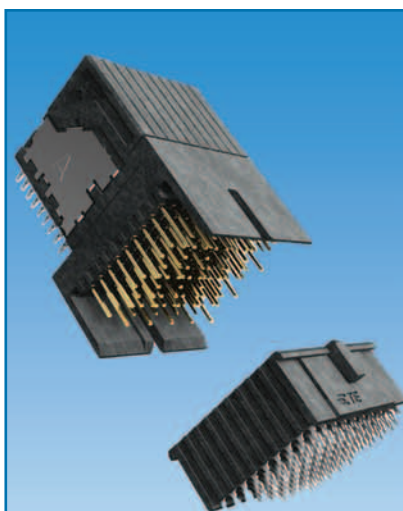
The CWE database contains information on security weaknesses that have been proven to lead to exploitable vulnerabilities. These weaknesses could be at the infrastructure level (for example, a poorly configured network and/or security appliance), policy and procedure level (for example, sharing usernames and/or passwords), or coding level (for example, failing to validate data). The CWE database holds information on actual exploits, not theoretical, and so only captures those coding weaknesses that have been exploited in the field.

Benefits of CWE compatibility

CWE should be used within the development environment to ensure that known vulnerabilities are not introduced into the software. Many of the issues that have been identified are amenable to automatic detection by static and/or dynamic checking tools. To obtain maximum benefit, such tools should be used as early as possible in the development process, as trying to add security in at the last minute is very unlikely to succeed. The adoption of other tool-enforced security standards, such as the CERT-C Secure Coding Standard, complements this objective and enhances the security characteristics even further.

Ensuring system security

Many security vulnerabilities can be traced to coding errors or architectural flaws and are generally hard and/or expensive to fix once a system has been deployed. Unfortunately, many developers are only interested in the development and testing of core application functionality. Security is rarely tested with the same rigor.



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The security of a system needs to be considered one of the most important attributes of a system. Security requirements need to be included up front in the system design and implemented during normal development if the final system is to be secure. CWE can be used to help in the identification of appropriate high-level security requirements.

Figure 1 illustrates the attributes associated with system quality. By focusing on these measures at all phases of the software development life cycle, developers can help eliminate known weaknesses.



Figure 1 | System quality is determined by many attributes, including those relating to security.

To prevent the introduction of security vulnerabilities, a development team needs to have a common understanding of the security goals and approaches to be taken during development. This should include an assessment of the security risks and the establishment of the secure coding practices that are to be used. Once again, CWE can help during coding as it highlights the constructs that have led to security compromises in other systems, reminding developers where they need to take extra care during implementation.

The risk assessment determines the quantitative and qualitative security risk for the various system components in relation to a concrete situation and recognized threat. This information is used to reduce security vulnerabilities in the areas that will have a high impact if their security is breached. The assessment results in the development of a set of

security control and mitigation strategies that will form the core of the system security requirements.

These security requirements become part of the same development process used for all other requirements. Detailed at the outset, the security requirements are then traced through the design, coding, and testing stages to ensure fulfillment of the initial requirements. These linkages form documentation that demonstrates how the final system meets the security objectives laid down at the beginning.

CWE: Not a coding standard

CWE is a “do not get caught by” list and is not an actual coding standard. However, coding standards can be used in complement to ensure that the CWE issues are not present in a project. Compliance with these standards helps ensure that project security goals are achieved, especially as many security issues result directly from the coding errors that they target. Additionally, compliance with a recognized standard helps to demonstrate that contractual security obligations have been met.

Compliance with the chosen coding standard (or standards) should be a formal process (ideally tool-assisted, but manual is also possible), as it is virtually impossible for a programming team to follow all the rules and guidelines throughout the entire code base.

Adherence to the standards is a useful metric to apply when determining code quality.

Static and dynamic testing should be considered essential practices. Static analysis tools confirming CWE compatibility systematically enforce the standard across all code. Dynamic analysis assures that the code does not contain runtime errors, including those that could be exploited to compromise security.

Traceability matters

If a claim is to be made that a system complies with a security standard like CWE, then evidence must be provided to support that claim. Traceability [which makes it possible to show which test result(s) prove that a particular security requirement has been met] from requirements to the design, verification plan, and resulting test artifacts can be used to support such a claim.

Figure 2 illustrates how traceability can be linked back to requirements, and the related test cases. Such graphical representation makes it easy for developers to immediately spot unnecessary functionality (code with no requirement), unimplemented requirements, and failed or missing test cases.

Moving forward

Adoption of a security standard that targets the CWE vulnerabilities allows security quality attributes to be specified

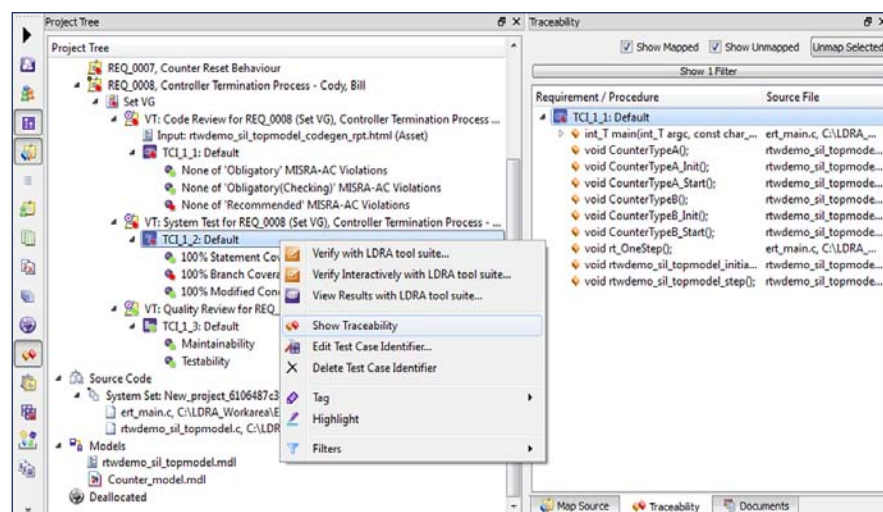


Figure 2 | LDRA TBmanager enables users to view traceability to source code for individual requirements and test cases.

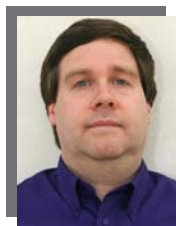
“ CWE is a ‘do not get caught by’ list and is not an actual coding standard. However, coding standards can be used in complement to ensure that the CWE issues are not present in a project. ”

for a project. Incorporation of security attributes into the system requirements means that they can then be measured and verified before a system is integrated into a network, significantly reducing the potential for in-the-field exploitation of latent security vulnerabilities by the enemy.

The use of a qualified and well-integrated Application Life-cycle Management (ALM) tool to automate testing, collation of process artifacts, and requirements traceability dramatically reduces the resources needed to produce the documentation required by certification bodies. It minimizes the workload for developers and allows managers to efficiently track progress.

It is clear that system developers need to rethink their assumptions if net-centric warfare systems are to be secured against information leaks and remote manipulation. Leveraging the knowledge contained within CWE and choosing to develop and test software with the aid of CWE-aware tools represent significant steps forward. Companies that incorporate CWE and embark on a process of continual improvement help ensure that only dependable, trustworthy, extensible, and secure systems are delivered to those who put their lives on the line to protect our countries.

The CWE list and further information on CWE are available on the MITRE website at <http://cwe.mitre.org>. **MES**



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Mitigating security risks early in the development life cycle

By Jane Goh

By limiting the number of primitives within code, developers can make the process of exploiting software much more difficult for hackers, thereby increasing the cost of exploitation and reducing its likelihood.



Software has increasingly become crucial to a military's field defense and combat support capabilities. Embedded software in military and aerospace systems has to be both reliable and secure because security vulnerabilities can be just as dangerous as the functional defects the industry has developed so many controls to prevent.

Many of the same techniques used to address functional or quality defects can also reduce security vulnerabilities. When it comes to software development, security defects should be treated like software defects and managed as part of the development process. Indeed, the distinction between security and quality can sometimes be a subtle one; the defect that manifests itself as a system failure today could be exploited by an attacker tomorrow.

Defects are essentially potential exploitation primitives¹ that can be creatively strung together by hackers into an attack. Developers can make the process of exploiting software much more difficult for the attacker by eliminating as many primitives as possible. The following example illustrates how multiple primitives can be chained together to achieve remote code execution.

Example of a multi-primitive attack

Let's assume that a security vulnerability exists in the code that resides on a remote server. While identifying the root cause is

sufficient for remediating the flaw, the successful exploitation of that vulnerability is dependent on multiple pre-existing conditions. For the context of this example, we assume an attacker attempts to achieve Remote Code Execution (RCE), thereby running code of the attacker's choosing on the remote machine. Although triggering the security vulnerability is required to achieve RCE, it actually requires many small steps that we refer to as *exploitation primitives*. By chaining these primitives together, the attacker can create an exploit that works reliably and maintains stability after the exploit has run its course.

In our example, the attacker is using, but is not limited to, four unique primitives. The first primitive used is the *soft leak*², which leverages legitimate program functionality to manipulate memory in the targeted application without any stability or security repercussions. These primitives happen to be the most common because they rely on intended, valid program functionality. For example, a server, by design, will accept requests from a client. That client sends information that is held until session termination occurs. An exploit writer can make certain assumptions about the memory layout of a particular application based on its functionality by figuring out how these requests and sessions work.

The next primitive used is the *hard leak*². The hard leak, or resource leak, is quite familiar to most C/C++ programmers. The leak occurs when the programmer forgets to free memory

that was acquired dynamically during runtime. While most programmers think of this as a quality problem that will result in massive memory consumption at worst, many exploitation artists see this as an opportunity to ensure exploit stability. An attacker can assure that certain portions of memory are never subsequently used throughout the lifetime of a process by acquiring memory permanently.

The third primitive used is the *integer overflow*. If a mathematical operation attempts to store a number that is larger than an integer can hold, then the excess is lost. The loss of the excess data is sometimes referred to as an *integer wrap*. For example, an unsigned 32-bit integer can hold a maximum positive value. By adding 1 to that maximum positive value, the integer will start counting again at zero (`UINT_MAX + 1 == 0`). A real-world example is the odometer of a car rolling over after 1 million miles and restarting its mileage count from zero. An attacker can allocate less memory than was intended by using this overflowed integer in an allocation routine.

Finally, the last primitive used is a *buffer overflow*. This is the most common kind of defect understood to have security implications in C/C++ programs. A buffer overflow is caused when the program writes past the end of a buffer, resulting in corruption of adjacent memory contents. In some instances, this may result in overwriting the contents of the stack or heap in ways that allow an attacker to subvert the normal operation of the system and, ultimately, take over the flow of control from the program.

Primitive use in RCE

Now that the primitive types have been covered, let’s discuss how the attacker in our example utilized them to achieve remote code execution. First, by using existing program functionality,

the attacker sends valid requests that result in allocating many chunks of memory based on the size of his input. This might seem harmless, but is vital to achieving heap determinism: the manipulation of the memory layout of an application into a known desirable state, which is obligatory when exploiting heap-based buffer overflows. Next, the exploit author knew that some memory, once allocated, should never be freed again. By leveraging hard leaks within the application, the goal of having memory that survives throughout the life of the process can be achieved, resulting in greater post-exploitation stability.

The integer overflow that caused an underallocated heap buffer to be overflowed was triggered. This causes a mismatch between the actual size of the allocated buffer and the expected number of data elements it holds. The attacker can then leverage a buffer overflow to overwrite the contents of adjacent memory. For example, imagine the inability to determine the last line of a piece of ruled paper. If you sequentially keep writing sentences, you would eventually write onto your desk and potentially that nice new shirt. By overwriting adjacent memory, the attacker can overwrite important information with data that he controls.

The ability to chain primitives together, regardless of severity, results in greater control of exploitation and post-exploitation functionality (Figure 1). If our attacker did not have the ability to create hard leaks within the application, he would have had to figure out a different way to ensure that his memory was not freed when his session timed out, or he would have at least come to the realization that an eventual program crash was inevitable. And if the integer overflow did not exist, there would not have been an opportunity at all for our attacker to exploit.

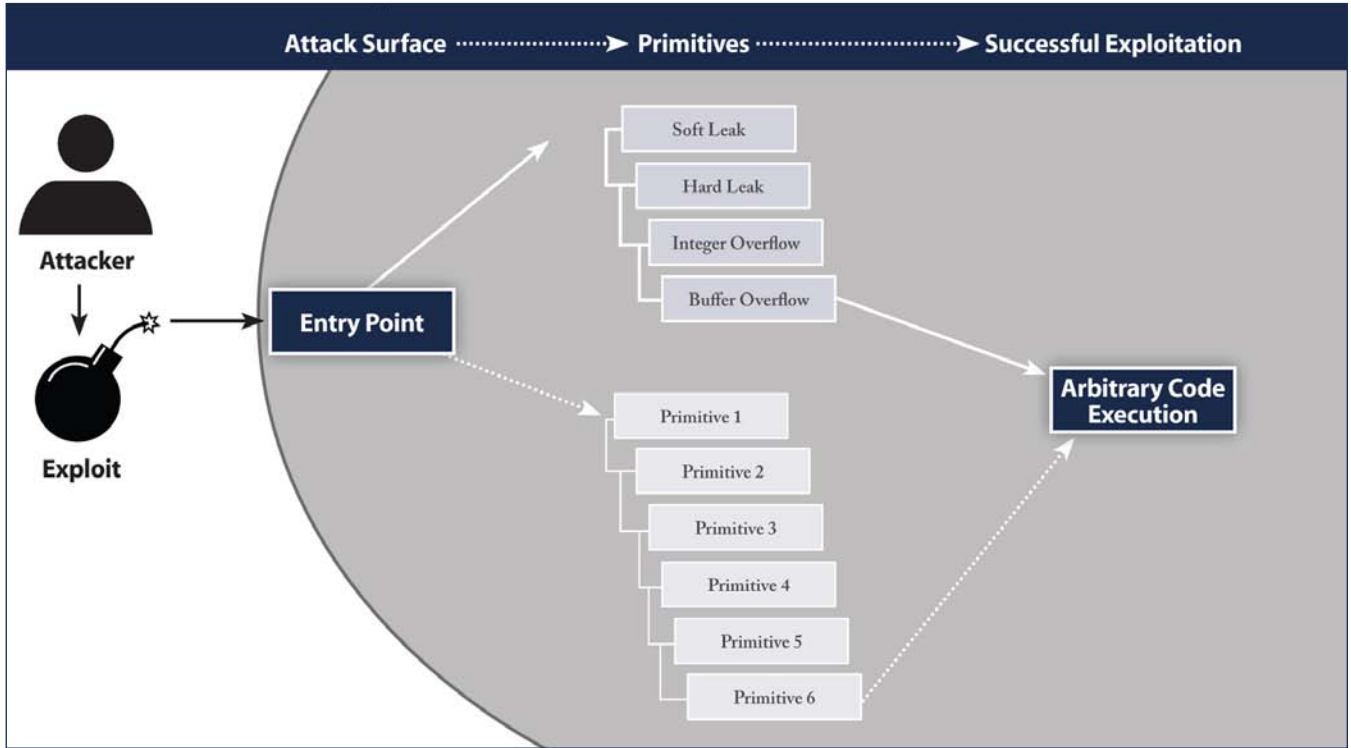


Figure 1 | An attacker chains primitives together to perform arbitrary code execution. By limiting the number of primitives within code, developers can make the process of exploiting software much more difficult, thereby increasing the cost and decreasing the likelihood of exploitation.

The link between exploitation primitives and security vulnerabilities can be direct or indirect. Certain kinds of primitives, such as buffer overflows, can lead to many different kinds of vulnerabilities, depending on the skill, creativity, and determination of the attacker. What is clear, however, is that having more primitives available makes it easier for an attacker to leverage more severe vulnerabilities and develop damaging exploits. Therefore, finding and eliminating large numbers of exploitation primitives early in the development process can greatly help in reducing security vulnerability exposure and maintenance costs over the entire time the application is in service.

A practical approach to secure code development

Developing reliable and secure software is a tough challenge that confronts IT teams when initiatives to integrate security testing early into the development life cycle have not been adopted widely. It is not that developers don't want to develop secure products, but they are focused on delivering new features and functionality and often are under intense pressure to meet release deadlines. Besides the lack of financial incentives to invest in strengthening security, developers are not traditionally trained to be security experts. Computer science programs have focused on producing programmers with a foundation to become good application developers but not necessarily security experts. As a result, developers today are by and large unaware of the myriad ways they can introduce security

problems into their code, and don't have the wherewithal to fix them when they are found.

Development testing solutions need to be designed from the perspective of the developer. This means addressing the major issues that have made developers shy away from traditional security assessment tools: lack of usability and high false positive rates. Development managers seeking to integrate security testing into their process should look for automated development testing tools that are able to deliver the following:

- Clearly explained defects with little noise: Developers simply don't have time to waste trying to sift through noisy results, or reproducing phantom defects that aren't really there. They need defects that are easy to understand with as few false positives as possible.
- Detection of defects early and often, as code is written: It takes significant effort to determine the exact cause of defects, and fixing defects can involve extensive architectural changes. Finding critical defects as early as possible enables development teams to anticipate workload and impact to release schedules, thereby reducing cost to the overall project.
- Actionable and correct advice on how to fix security defects: Defect remediation advice provided as part of security assessments usually isn't customized for the relevant framework, language, or libraries being used in the software package. It's hard for developers to translate generic advice into a fix that works and this often leads to a wrong or incomplete fix being applied – leading to churn and rework.

Defects are an inevitable fact of software development. While it might not be possible to completely prevent vulnerabilities from being introduced during code development, the technology and processes exist now to assist developers in finding and fixing these defects as quickly and efficiently as possible. **MES**



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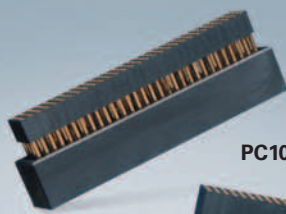
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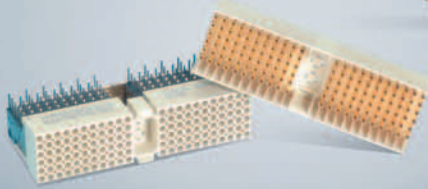
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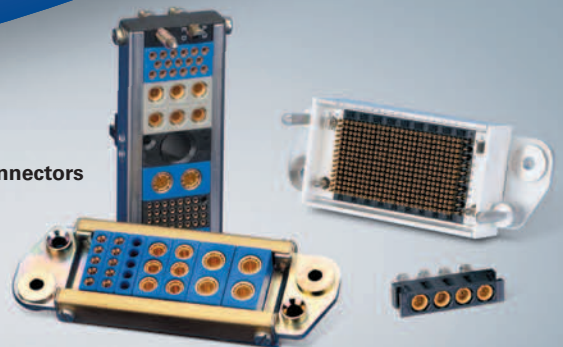
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Adding real-time Java to a MILS operating system

By Dr. Kelvin Nilsen

A Multiple Independent Levels of Security (MILS) operating system supports secure deployment of multiple applications with each application representing data belonging to a different security realm. Writing software for deployment with a MILS operating system requires attention to details that are not necessary on mainstream operating systems. Integrating a Java Virtual Machine (VM) within a MILS operating system simplifies the development of MILS application software.



U.S. Air Force photo by Senior Airman Kasey Zickmund

Usually, a Multiple Independent Levels of Security (MILS) operating system is a special configuration of a more general real-time operating system that is designed to simplify the development of software systems supporting multiple independent levels of security. Such systems are especially common in military scenarios where, for example, the same computer system may need to isolate top-secret data belonging to one national government from classified data belonging to a coalition of governments such as NATO (Figure 1).

Conceptually, a MILS operating system maintains logical partitions to isolate the memory, CPU time, and other resources accessible to a particular application and to limit the interaction between applications running in different logical partitions. Configuration of the MILS operating system for a particular set of

applications allows developers to establish the rules that govern interaction between partitions. A rule might state, for example, that partition A is only allowed to pass messages to partitions C and D.

The ideal of MILS partitioning is to reduce the costs of the security audit that is required to prove that the system is sufficiently secure. The operating system's implementation of partitioning is certified to be secure by the operating system vendor and the costs of this certification are shared between all licensees. Given that the operating system can guarantee the absence of communication between applications running in different partitions, much less effort is required to understand and document the security-sensitive behaviors of each application. Adding a Java Virtual Machine (VM) to a MILS

operating system greatly simplifies the porting and development of application software to MILS environments.

Case study: Pragmatics of deploying software within MILS environments

To facilitate the security audits that assure the absence of communication between independent partitions, the companies that develop MILS operating systems generally restrict the set of services provided by the operating system to applications running within MILS partitions. Each MILS environment presents different challenges with regard to effective execution of a Java virtual machine. Let's look at some of the problems encountered when a real-time virtual machine product was ported to a particular Commercial Off-the-Shelf (COTS) MILS operating system at the request of a customer in the military and aerospace industry.

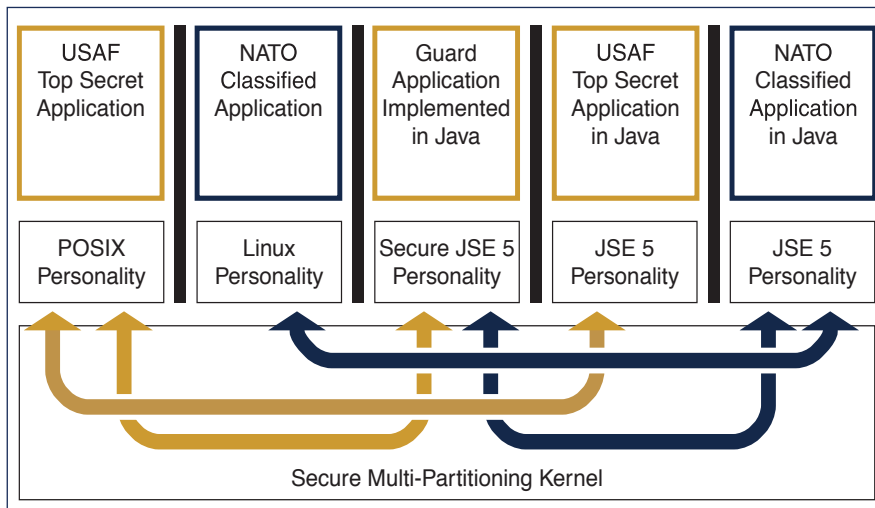


Figure 1 | Secure MILS operating system configured to restrict information flow between partitions

Among the limitations encountered in this MILS operating system, some of the constraints that were enforced by this MILS operating system in order to assure system security included the following:

1. It was not possible to write to a program's text segment.
2. The system provided no command-line facility for setting environment variables.
3. The system did not support dynamic linking of native libraries.
4. Though not a general limitation of this COTS MILS operating system, the platform targeted by our customer lacked a file system.

Given these restrictions, which are typical of deeply embedded MILS deployments, it is clear that considerable porting and integration effort would be required before most off-the-shelf applications would run in this environment. The portability of Java offers the potential of significantly reducing the costs of doing this porting and integration work.

The relevance of Java to MILS applications

Java is especially relevant to the development of secure software because the language is more strongly typed than C and C++. Since early development of

the Java language focused on Internet applications, security has been paramount in its design. Java, for example, forbids coercions between pointer and non-pointer data types, and it forbids pointer arithmetic. Furthermore, every access to a Java array performs an array bounds check. An exception is thrown instead of allowing software applications to reach beyond the end of an array's valid data. Likewise, the Java runtime environment checks for stack overflow and throws an exception instead of allowing a thread to trample on memory beyond the end of the thread's allocated stack. In general, these security features that are built into the Java language completely eliminate the large majority of vulnerabilities typically exploited in the implementations of Trojan horse

and virus software that commonly infect C and C++ applications.

A strength of Java that is especially relevant to the challenge of implementing new software capabilities within a MILS environment is that, compared to more traditional languages, Java significantly reduces the effort required to implement, port, and integrate independently developed software components into working applications. Representative projects find developers are typically twice as productive during the development of new functionality and up to 10 times more productive reusing software components when working in Java rather than C or C++. This is because the Java language supports higher-level abstractions, is more portable, and encourages tighter encapsulation than C and C++. The value of these benefits is highlighted in experience reports as summarized in Figure 2.

Built-in tracing garbage collection, which automatically reclaims the memory of dynamically allocated objects that are no longer relevant to the application, is one Java feature that makes it especially easy to integrate independently developed COTS Java components into a MILS application. Whenever an object is allocated by one component and used by other components, a C or C++ engineer is required to design and implement a protocol for detecting the end of the object's useful lifetime and reclaiming its memory at that time. With Java, dead

Software Development Productivity Benefits of Java
Intel fault tolerant telecommunications demonstration: Java software integration completed in 3 days vs. 3 solid months with C.
Calix management plane for C7 Broadband Loop Carrier: Java implementation finished in half the time of prior C implementation, with more features and fewer bugs.
Lockheed Martin Aegis Weapons System Modernization: Verified 3,500 requirements with one-ninth the effort of previous best practice experience based on mixed language CMS-2 and Ada implementation. After completing Java modernization, support for "Standard Missile 6" was added in only 3 months vs. full year with prior technology foundation.

Figure 2 | Relevance of Java to development of special-purpose, secure dedicated systems

objects are detected and reclaimed automatically, and reclaimed memory is automatically defragmented as a valuable side effect of most automatic garbage-collection techniques. Besides reducing the intellectual effort required to develop and integrate software components, this feature eliminates the need to debug many common memory management programming errors related to dangling pointers, memory leaks, and memory fragmentation.

Thus, being able to implement MILS applications in the Java language is highly desirable. The language is more secure than traditional legacy languages like C and C++, it reduces the effort required to implement custom-tailored functionality, and it delivers tremendous cost savings during reuse and integration of independently developed software components.

Porting a Java VM to a COTS MILS environment

To deploy Java software within a MILS partition, it is first necessary to install a Java virtual machine runtime environment within the MILS partition. The Java virtual machine provides the standard Java libraries, a Java class loader, the Java byte-code interpreter and/or a Just-In-Time (JIT) compiler, and an implementation of a tracing garbage collector. With the Java virtual machine in place, all the traditional benefits of programming in Java are readily available.

Given that a MILS environment typically offers far fewer services than the comparable non-MILS configuration of the same operating system, virtual machine products that have been configured to run on traditional or real-time operating systems will probably not run within a MILS partition. Recently, a customer requested that we provide virtual machine support for a particular COTS MILS operating system environment.

Because of the MILS-imposed limitations of this MILS environment, there were a few Java features that could not be supported. But for the most part, the MILS configuration of the virtual machine technology described supports all of standard-edition Java. The following five sections constitute a case study of the Java configuration's rationale and available workarounds.

#1 – High Assurance Network Stack (HANS)

Consistent with its objectives to support improved security, the customer-selected MILS operating system was distributed with an option to use a high-assurance network stack. This network stack ran in an isolated MILS partition, allowing it to run at very high priority without compromising the fair share of CPU time that is budgeted for other MILS partitions. Having the network stack in its own small partition allowed the stack to be isolated from

errors in individual applications. An application in a different partition could crash and restart without compromising the integrity of the HANS. Further, the CPU time and memory resources consumed by the HANS were limited by the constraints of the partition it ran in. This provided certain protections against denial of service attacks on the network stack implementation.

Given that the amount of memory and CPU time dedicated to HANS implementation was restricted by the MILS operating system, only the HANS partition itself is compromised by another computer's network communication requests to interact with this computer at higher rates than it is prepared to handle. While the HANS might drop packets in this scenario, applications running in other MILS partitions would not be compromised by the denial of service attack.

The virtual machine integration with this MILS environment supported the use of HANS, which accommodated a small number of differences between the HANS and the standard network stack APIs. In particular, the HANS did not enumerate the network devices configured for a particular MILS virtual board configuration. Instead, a command-line option allowed system integrators to supply the list of configured network devices. Domain name service functions `gethostname()` and also `hostGetByName()` were also not supported by HANS. The Atego Perc Ultra virtual machine technology's MILS integration provided the customer with an opportunity to implement these services using proprietary table-based lookups for these services if necessary.

#2 – No debugging of compiled code

Since the MILS environment forbade writing to the text segment, it was not possible to set breakpoints in Java code that was statically compiled and linked into the runtime image.

However, several approaches could be used by Java developers who need debugging capabilities. First, because Java is such a portable programming



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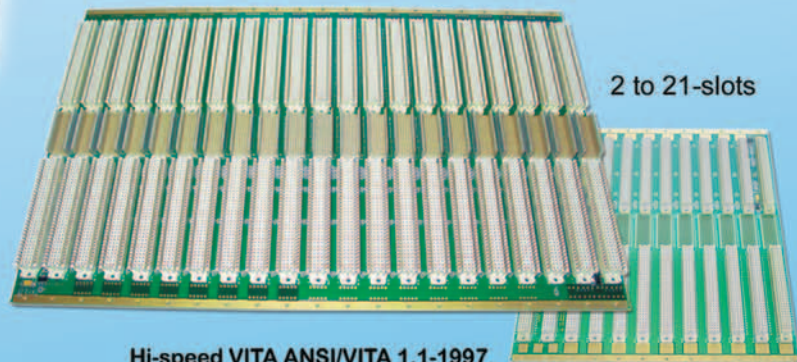


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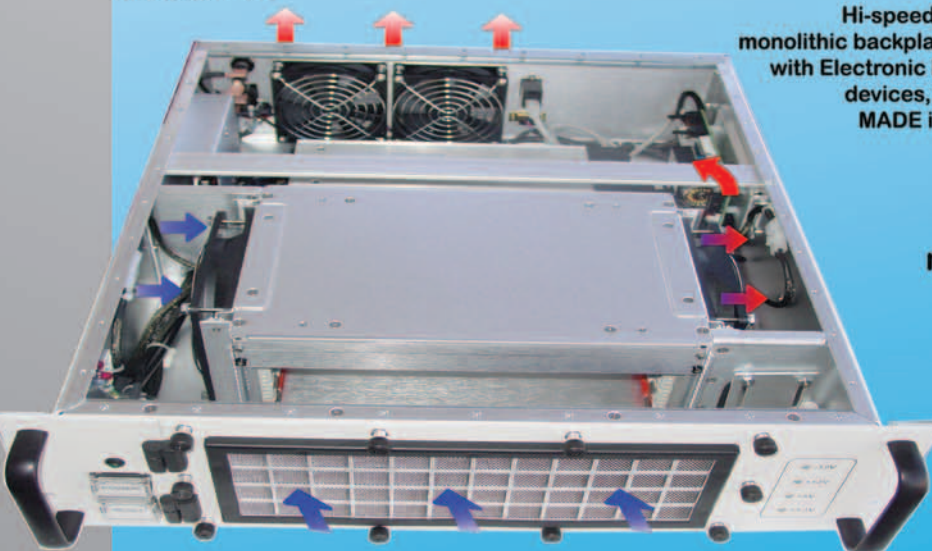
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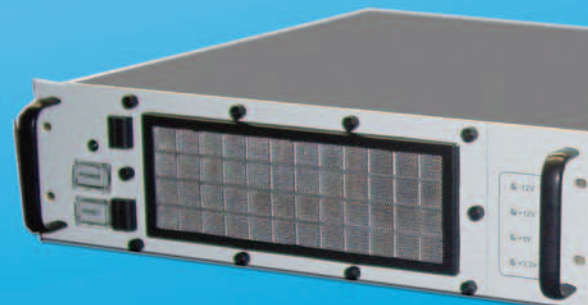
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language, it is usually possible to fully debug an application on a more full-featured platform, and then deploy the debugged application on the MILS platform. Second, if debugging is absolutely essential within the MILS environment, it is still possible to debug Java applications that are running as interpreted byte code.

#3 – No dynamic loading of native libraries

Many Java applications comprise a combination of Java and native code, often written in C or C++. When native components are part of a Java application, it is most common to load the native code dynamically under the direction of the Java `System.loadLibrary` service. This service was not available in the MILS integration of the real-time virtual machine. Instead, system integrators have the option to statically link native libraries.

#4 – Specialized virtual file system

To support MILS platforms that lack file system support, we implemented a virtual file system as part of the MILS port. This virtual file system allowed Java applications to create, write, and read file data stored in memory. Availability of the virtual file system made it much easier to test the virtual machine implementation and to port off-the-shelf Java code onto MILS platforms that are otherwise missing file support.

#5 – No environment variables

Environment variables are often used to hold key configuration data as a convenience to users. Configuration options specified by environment variables need not be repeated on command lines each time an application is started. Since the MILS environment did not provide users with an ability to set environment variables, this convenience was not generally available. Instead, MILS Java applications generally receive configuration data as command-line arguments.

Java reduces costs, adds reliability to MILS software systems

Enabling Java development within a MILS operating system partition makes perfect sense. Virtual machine technologies such as the Atego Perc Ultra

described make it possible to run standard-edition Java on MILS, providing cost savings and reliability benefits to projects that exploit Multiple Independent Levels of Security. **MES**



Dr. Kelvin Nilsen, Chief Technology Officer Java, Atego Systems, oversees development of Perc virtual machine technologies. He participates in the Java Community Process as a member of the JSR 282 and JSR 302 expert groups. He holds a B.S. in Physics from Brigham Young University, and M.S. and Ph.D. degrees in Computer Science from the University of Arizona. He can be contacted at kelvin.nilsen@atego.com.

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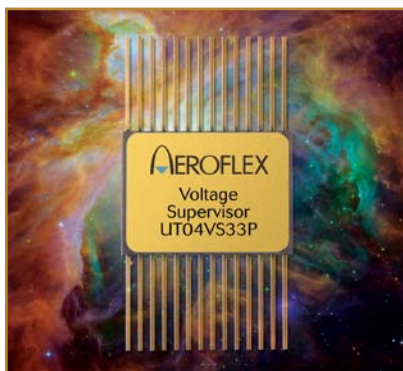
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Voltage Supervisor monitors power supplies in hi-rel space apps

Engineers at Aeroflex Colorado Springs developed a new device designed to manage power supplies in components such as DSPs, FPGAs, ASICs, and microprocessors. The Voltage Supervisor family, which has four products, enables users to reduce circuit quantity and complexity for the monitoring and sequencing power supplies in systems that use these components in High Reliability (HiRel) environments such as space. The Voltage Supervisor has a single-chip solution for power supply monitoring and sequencing of the UT699 LEON 3FT Microprocessor.

Aeroflex's UT04VS33P and UT04VS50P four-channel Voltage Supervisors can monitor and sequence as many as four different voltage supplies, thereby improving system reliability and accuracy. They can monitor a single supply or be combined with other four-channel or single-channel devices to monitor multiple numbers of supplies, enabling design flexibility in power supply monitoring solutions. Each Voltage Supervisor has 3.3 V and 5 V supplies over the full military temperature range of -55 °C to +125 °C, 300 kilorads (Si), and are Single Event Latch-up (SEL) immune to >110 MeV-cm²/mg.

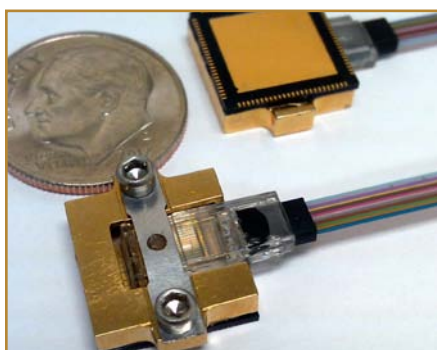
Aeroflex Colorado Springs | www.aeroflex.com | www.mil-embedded.com/p369098

Carbon-fiber chassis meets mil ruggedization and weight issues

The RE0412 Rugged Embedded computer from Crystal Group in Hiawatha, IA is protected by a carbon-fiber chassis (patent pending). It weighs only 3.8 lbs and measures 3.13" high by 10.76" wide with a depth of 8.13". The chassis uses Faraday cage construction techniques that utilize proprietary carbon-fiber material, which mitigates electromagnetic interference radiated susceptibility, conducted susceptibility, radiated emissions, and conducted emissions. The RE0412 uses an air-cooled design to limit weight and has conformal coating options for humidity protection.

The device came out of the Unmanned Aerial Vehicle (UAV) and soldier deployed markets where lightweight and low power were emphasized in the design requirements, says Jim Shaw, Executive Vice President of Engineering at Crystal Group. The new computer has as many as two 2.5" solid-state drives, a PCIe x16 expansion slot, and as much as 16 GB DDR3 RAM. The RE0412 computer has an Intel mini-ITX board, i3 (desktop) CPU, and DC power inputs from 18 to 36 VDC. The temperature range for the RE0412 is -40 °C to +55 °C with full CPU load, without throttling. The RE0412 unit passed MIL-STD-810 shock and vibration testing using UH-60 profile and shock testing for flight vehicle equipment. The unit has also passed MIL-STD-461 CE102 and RE102 testing.

Crystal Group | www.crystalrugged.com | www.mil-embedded.com/p369068



Optical, rad-hard, SFF transceiver for space

High-speed parallel optical communication for space applications is enabled by the latest radiation-hardened component from Ultra Communications in Vista, CA: the X80-Q Fury transceiver. The surface-mount device produces 12.5 Gbps per channel per receiver and has an extended temperature range of -40 °C to +100 °C. The Fury consists of a transceiver Integrated Circuit (IC), a Gallium arsenide (GaAs) Vertical Cavity Surface Emitting Laser (VCSEL) array, a GaAs PIN photodetector array, and a glass lens array. Applications for the device include 1 to 10 Gigabit Ethernet, 1x to 10x Fibre Channel, Serial RapidIO, PCI Express, and VITA 17.2, which focuses on 10 Gigabit Serial Front Panel Data Port (SFPDP).

A key feature is the device's Built-In-Test (BIT) functionality for continuous monitoring of operating conditions: internal IC status and external parameters such as signal quality and fiber-optic link loss. Its BIT functions include Transmitter Signal Strength Indicator (TSSI), Transmitter Modulation Strength Indicator (TMSI) for measuring Tx input amplitude, Receiver Signal Strength Indicator (RSSI) for measuring average Rx photocurrent, Receiver Modulation Strength Indicator (RMSI) for measuring Rx input and amplitude, critical transceiver operating conditions, and temperature sensor and VCSEL voltage. A digital SPI interface controls the bias settings and readout of BIT sensors.

Ultra Communications | www.ultracomm-inc.com | www.mil-embedded.com/p369099



GPS and INS in one embedded device

Engineers at VectorNav in Texas have developed a navigation device for avionics in manned aircraft and for Unmanned Aerial Vehicle (UAV) payloads that combines a GPS module with MEMS inertial and pressure sensor technology. The patent-pending VN-200 device enables embedded navigation in components with a small footprint. The VN-200 consolidates INS in a small package and is ideal for small applications such as UAV payloads where it can help stabilize camera platforms and keep it pointing in the right direction, says John Brashear, President of VectorNav. It is tiny enough to be placed in the camera itself, he adds.

The device has an onboard extended Kalman filter running at 200 Hz, coupled position, velocity, and attitude estimates, and dynamic accuracy better than .25 degrees in pitch/roll and .75 degrees in heading. The VN-200 also is compatible with external GPS pressure or magnetic measurements and comes with a temperature range of -40 °C to +85 °C. The surface-mount package – 30-pin LGA – is 22 x 24 x 3 millimeters and weighs 3 grams. The rugged package is 36 x 34 x 9.5 millimeters and weighs 14 grams. The VN-200 development tool set has a sensor explorer GUI that enables users to display sensor output as a 3D object, graph inertial data, configure sensor settings, and perform data logging.

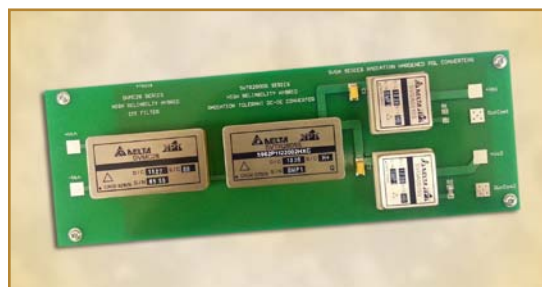
VectorNav | www.vectornav.com | www.mil-embedded.com/p369119

SVGA point of load DC-DC converters for space

The SVGA Series 10A and 15A POL devices from VPT in Everett, WA are non-isolated, regulated buck DC-DC converters that reduce voltage by a step-down process at the point of use in a distributed power system. There is a big push toward power distributed architectures for space applications, much like the way it is done in the commercial world, says Leonard Leslie, Manager of Space Programs at VPT. "Point of load converters enable this transition. Power distributed architectures provide one isolation boundary converter taking from the power bus of the vehicle to a distributed bus so you can move low-voltage conversion closer to the loads. This is especially important because the big demands of DSP and FPGA components require tight regulation at a high current level to keep the conversion as close as possible to the load."

The Defense Logistics Agency also issued Standard Microcircuit Drawings (SMDs) for the company's SVGA Series point of load DC-DC converters for space radiation environments. The converters are tiny and save space and weight, Leslie says. Features include: 100 krads (Si) radiation hardening, MIL-PRF-38534 Class K, 10 A and 15 A modules, 85 MeV-cm²/mg SEE, and as much as 94 percent efficiency. The modules are available off-the-shelf. The VPT products are ITAR-controlled products that require an export license.

VPT | www.vpt-inc.com | www.mil-embedded.com/p369120



Rugged computer for manned and unmanned aircraft

The new rugged computer – ONYX – is designed for constrained space applications such as Unmanned Aerial Vehicles (UAVs), ground vehicles, and manned aircraft. The device engineers at Ecrin Systems in Crolles, France based it on a modular mezzanine concept with a processor choice ranging from Intel Celeron low-power chips to multi-Core i7 2nd and 3rd generation components.

ONYX also has embedded video graphic capabilities via an optional module that targets high-end video digital, analog and broadcast SMPTE outputs and inputs, overlay, EAS-NI encryption, and H.264 AVC compression – all through a 500-pin connector with PCIe x16 lanes at 10 Gbps signaling. It also makes use of an AMD Radeon E6760 GPGPU with its 480 Stream Processors matrix that runs as fast as 576 GFLOPS.

Ecrin Systems | www.ecrin.com | www.mil-embedded.com/p368514

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Advanced Conversion Technology, Inc.	Power Conversion	117
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AIM-USA	COTS Collection: Boards, Carriers, Mezzanines, ICs	84
Aitech Defense Systems	COTS Collection: Boards, Carriers, Mezzanines, ICs	66
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Accelerated Memory Production, Inc.	Mass Storage	104-105
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Creative Electronic Systems – CES	Rugged Computer Systems	117
Crystal Group, Inc.	Rugged Computer Systems	118
Datakey Electronics	Mass Storage	109
Elma Bustronic	Packaging/Mechanical Chassis	113
Elma Electronic	COTS Collection: Boards, Carriers, Mezzanines, ICs	99
Elma Electronic	Packaging/Mechanical Chassis	112
Estereel Technologies	Software/Middleware	124
Extreme Engineering Solutions, Inc. (X-ES)	COTS Collection: Boards, Carriers, Mezzanines, ICs	88-89
Extreme Engineering Solutions, Inc. (X-ES)	Packaging/Mechanical Chassis	113
GE Intelligent Platforms, Inc.	Rugged Computer Systems	118
Great River Technology, Inc.	COTS Collection: Boards, Carriers, Mezzanines, ICs	90
Hartmann Electronic	Packaging/Mechanical Chassis	112
Hypertronics	Packaging/Mechanical Chassis	115
Innovative Integration	COTS Collection: Boards, Carriers, Mezzanines, ICs	77, 92, 99-100
Innovative Integration	Mass Storage	104
Kontron	COTS Collection: Boards, Carriers, Mezzanines, ICs	65, 67, 101
Kontron	Rugged Computer Systems	119-120
LCR Electronics	COTS Collection: Boards, Carriers, Mezzanines, ICs	64
Magma	COTS Collection: Boards, Carriers, Mezzanines, ICs	81, 86
Memoright Corporation	Mass Storage	106
Meritec	Rugged Computer Systems	122
Microsemi	Mass Storage	107
Microsemi	Sensors and RF	124
Micross Components	Obsolescence/DMSMS	110
Micross Components	Power Conversion	116
MPL AG	Rugged Computer Systems	120
Nallatech	COTS Collection: Boards, Carriers, Mezzanines, ICs	78
North Atlantic Industries	COTS Collection: Boards, Carriers, Mezzanines, ICs	67
Parvus Corporation	COTS Collection: Boards, Carriers, Mezzanines, ICs	101
Parvus Corporation	Rugged Computer Systems	121
Phoenix International	Mass Storage	107, 109
Pinnacle Data Systems, Inc.	COTS Collection: Boards, Carriers, Mezzanines, ICs	64, 68, 87, 102-103
Pinnacle Data Systems, Inc.	Packaging/Mechanical Chassis	111
Rochester Electronics	COTS Collection: Boards, Carriers, Mezzanines, ICs	81
Rochester Electronics	Obsolescence/DMSMS	110
RTD Embedded Technologies, Inc.	COTS Collection: Boards, Carriers, Mezzanines, ICs	87
RTD Embedded Technologies, Inc.	Packaging/Mechanical Chassis	115
SANBlaze Technology, Inc.	COTS Collection: Boards, Carriers, Mezzanines, ICs	65
Sealevel Systems, Inc.	COTS Collection: Boards, Carriers, Mezzanines, ICs	89
TE Connectivity	Packaging/Mechanical Chassis	116
TeleCommunication Systems, Inc. (TCS)	Mass Storage	108
Trenton Systems	Rugged Computer Systems	121
U2T Photonics	Communications Tech	63
Vector Electronics & Technology, Inc.	Packaging/Mechanical Chassis	114
WinMate Communications Inc.	Rugged Computer Systems	122
WinSystems, Inc.	COTS Collection: Boards, Carriers, Mezzanines, ICs	72, 84-85
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FEATURES

- › The high bandwidth photoreceiver XPRV2021 matches the high bandwidth modulator MZM02130 with low V_{pi} of 3V to support wideband analog links up to 32 GHz. Both products are available in extremely compact packages.

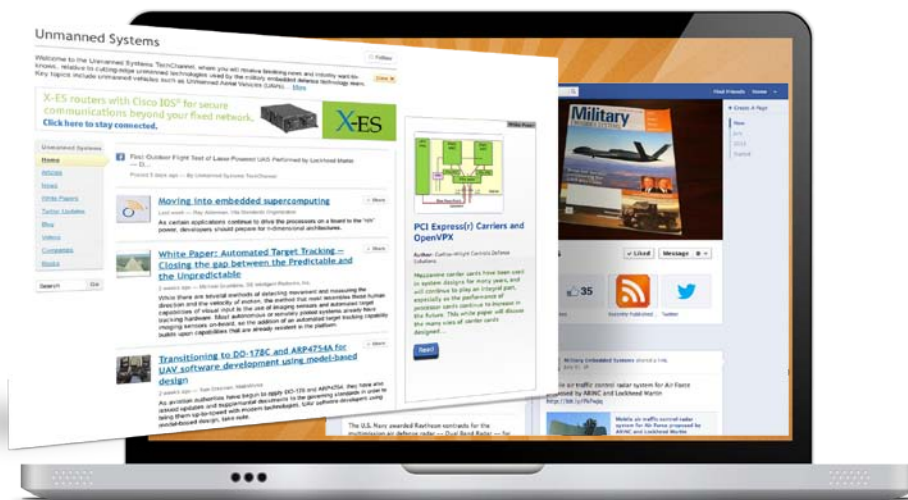
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www.lcr-inc.com

6U 6 Slot AC Chassis

LCR Electronics announces a new family of high performance small form factor (SFF) rugged ATCA chassis designed specifically to meet the compute intensive requirements of mobile command and control applications. LCR's SFF chassis range in size from 6U 6 slots to 4U 3 slots, and are available in both AC or DC powered versions. LCR's rugged ATCA SFF chassis allows for the use of readily available COTS ATCA blade products in military mission critical applications.

Join the growing number of customers and programs that have LCR's integrated ATCA chassis deployed in the field for mission critical computing. To learn more about LCR and our ATCA products, go to www.lcr-inc.com and contact us at military-sales@lcr-inc.com.



FEATURES

- > All LCR SFF ATCA chassis have the following product features
- > Full mesh backplane connectivity
- > Single or dual shelf management and control
- > Redundant cooling available from 200W to 400W per slot
- > AC or DC configuration for maximum flexibility
 - AC features dual 1500W power supplies
 - DC features redundant 48VDC PEMs
- > Designed and built to comply with the applicable shock and vibration requirements of MIL-STD-810 and MIL-S-901
- > Complies with MIL-STD-461 EMI requirements

LCR Electronics, Inc. | 800-527-4362

Contact: military-sales@lcr-inc.com

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www.pinnacle.com

ATCA-N1 (Dual Intel® Xeon® E5 ATCA®)

The ATCA-N1 blade is a high performance computing platform that is designed to provide maximum computing, memory and storage flexibility in a single ATCA chassis slot. The ATCA-N1 features dual Intel six-core or eight-core processors utilizing the Intel Xeon® E5-26XX Series family of CPUs (Sandy Bridge), and supports DDR3 memory. The ATCA-N1 delivers intensive virtual OS computing power in a highly available and flexible multiprocessing system needed in today's challenging markets.

Other features include support for up to four SATADIMM™ solid state drives, one mSATA solid state drive, 400W per ATCA slot chassis implementations and a Zone 3 interface for connection to a Rear Transition Module.



FEATURES

- > Intel-based AdvancedTCA blade server utilizing Intel's 32nm processor technology
- > Dual purpose memory sockets enable the use of up to 4 x SATADIMM solid state drives
- > mSATA solid state drive provides flexible expansion storage/boot option
- > Trusted Platform Module (TPM) capability
- > Redundant BIOS implementation
- > Optional Zone 3 RTM interface
- > 10Gb on both Ethernet Base and Fabric Interfaces
- > Pigeon Point® IPMC management with Hardware Platform Interface (HPI)
- > Customization welcomed and extended availability assured

Pinnacle Data Systems, Inc., An Avnet Company
614-748-1150

Contact: info.sales@pinnacle.com



www.sanblaze.com

Rugged Compute Platform (SB-RCP)**Rugged Highly available, Scalable Compute Platform**

The Rugged Compute Platform for Tactical Ops (RCP-Tactical Ops) is a field deployable ruggedized AdvancedTCA® (ATCA) Platform.

The integrated application ready platform incorporates superior computing density, inherent redundancy, class leading power efficiency, modularity and convenient serviceability thus addressing both the COTS and SWaP-C requirements of Modular Open Systems Approach (MOSA) for new DoD acquisition programs.

**FEATURES**

- › PICMG 3.1, Rev 2.0 (ATCA Ethernet)
- › Intel® Xeon processors (6 core)
- › SPARC® processors
- › SANBlaze Storage blades
- › Dual 10Gb Fabric backplane
- › Dual 1Gb base backplane
- › AC/DC power supply (200W per slot)
- › Redundant fan trays (push-pull cooling)
- › Field changeable fans and power
- › Field serviceable disks

Key Applications

- › C4ISR
- › Mobile tactical operations centers (TOCs)
- › Mobile network operations centers (NOCs)

SANBlaze Technology, Inc. | 978.679.1400

Contact: info@sanblaze.com

COTS Collection: Boards, Carriers, Mezzanines, ICs: AMC

www.mil-embedded.com/p368898



www.kontron.com

AM4022

The AM4022 is a highly integrated Advanced Mezzanine Card (AMC) CPU board for ATCA and MicroTCA applications. The design is based on the 3rd Generation Intel® Core™ i7 processor platform combined with the mobile Intel® QM77 Express Chipset. The board supports the Intel® Core™ i7-3612QE (2.1 GHz Quad Core) and the Intel Core™ i7-3555LE (2.5 GHz Dual Core) processors in 22 nm technology in a BGA package. Compared to its predecessors, the integrated Intel® HD Graphics 4000 of the Kontron AM4022 provides an immense performance boost that is supported by DirectX® 11, OpenGL 3.1, OpenCL 1.1 and Intel® QuickSync Video for high performance video transcoding. The AM4022 features up to 8 GB of soldered DDR3 1600 MHz ECC-protected memory for increased data integrity and system stability. Additionally, up to 64 GB of SLC NAND Flash can be integrated.

**FEATURES**

- › AMC Processor Module, Single-module, Mid-size (Full-size on request)
- › 4-core 2.1 GHz Intel® Core™ i7-3612QE processor
- › 2-core 2.5 GHz Intel® Core™ i7-3555LE processor
- › Up to 8 GB SDRAM memory (soldered) running at 1600 MHz with ECC
- › Graphics interface
- › Up to 64 GB SATA NAND Flash memory module
- › Comprehensive I/O capabilities
- › Superb monitoring features
- › PICMG AMC.0/1/2/3 compliance

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www.rugged.com/sbcs-and-general-purpose-processors

C925 RTCA-compliant 3U CompactPCI PowerPC-based SBC

Aitech Defense Systems now offers the RTCA-compliant C925, a rugged 3U CompactPCI PowerPC-based SBC with exceptionally low power. The board helps significantly reduce the engineering resources typically diverted to RTCA design requirements, saving on overall system development costs.

Developed specifically for avionics, the C925 is fully certifiable to both DO-178 (software) and DO-254 (hardware), making it ideal for safety and mission critical applications, such as flight and mission control computers into FAA-controlled airspace. In addition to reduced design costs, the C925 saves on DO-254 certification costs by minimizing the use of on-board FPGAs.

As the latest evolution in Aitech's C9xx family of rugged computing boards, the SBC is a drop-in upgrade for the popular C900 and C901 SBCs.

Featuring increased processing power without additional heat generation, the C925 incorporates a highly integrated PowerQUICC III 8548E processor that can be hardware configured to 1.2 GHz with a CPU core complex bus (CCB) speed of 400 MHz for maximum processing power. The processor also features an on-chip 32 K instruction and a 32 KB data L1 cache as well as a 512 KB L2 cache that supports a powerful e500 core.

The C925's large on-board memory consists of up to 1 GB fast DDR2 SDRAM at 400 MHz with ECC protection for exceptional data integrity, 128 MB of user Flash and 64 MB of both boot Flash and user-protected boot Flash for a total of 256 MB of Flash. 512 kB NVRAM with a fast EEPROM shadow memory and auto-storage capability is also provided for application-specific data, allowing easier data recovery in the event of a power outage.

Although in a compact 3U form factor, the SBC includes a wide range of integrated I/O providing two ports each of Gb Ethernet (10/100/1000 BaseT), USB 2.0, CANbus 2.0B and high-speed RS-232/-422/-485 as well as eight single-ended TTL or four RS-422/-485 differential discrete I/O lines. Each line is independently configured as input with interrupt at any event change level or as output.

An industry standard PMC/XMC slot, which supports up to eight lanes of PCI Express or four lanes of RapidIO, enables expanded functionality via added mezzanine modules.



FEATURES

- > Rugged 3U CompactPCI SBC
- > Ideal for DO-178/DO-254 Applications
- > PowerQUICC-III MPC8548E @ 800MHz (optional 666 MHz, 1.2 GHz)
- > 400 MHz Core Complex Bus (CCB) Speed
- > One Standard PMC/XMC Slot
- > XMC J5 Optional Configurations:
 - 1, 2, 4, 8 Lanes PCI-E
 - 1, 2, 4 Lanes PCI-E and 4 Lanes SRIO
 - 4 Lanes SRIO
- > PICMG 2.0, Rev. 3.0 Compliant
- > System Controller or Peripheral (Auto)
- > 1GB of DDR2 SDRAM at 400 MHz with ECC
- > 64 MB Boot Flash Memory
- > 128 MB User Flash Memory
- > 64 MB User Protected Flash Memory
- > 512 KB Autostore NVSRAM with Power Saving Support
- > Two 10/100/1000 Mbps Ethernet Ports
- > Two USB 2.0 Ports, Two CANbus 2.0B Ports
- > Two Async RS-232/-422/-485 Ports
- > Eight Single Ended TTL or Four RS-422/-485 Differential Discrete I/O Lines
- > Four High Performance DMA Engines
- > Four Timers (Internal to the CPU)
- > Three Watchdog Timers, Elapsed Time Recorder
- > Real Time Clock
- > Three On-board Temperature Sensors
- > VxWorks 6.x RTOS Support
- > Conduction and Air Cooled Versions

Aitech | 888-Aitech-8 (888-248-3248)

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www.kontron.com

CP3003-SA/CP6004-SA

The CP3003-SA and the CP6004-SA are highly integrated, high performance CompactPCI CPU boards based on the 3rd Generation Intel® Core™ processor technology. The new Intel® HD4000 graphics with integrated DirectX® 11, OpenGL 3.1 and OpenCL 1.1 support provides up to four times better graphics performance compared to previous platform designs.

The CP3003-SA is available with dual- and quad-core CPU performance scalable from the ULV 1.7 GHz Intel® Core™ i7-3517UE up to the 2.1 GHz i7-3612QE processor.

The CP6004-SA 6U CompactPCI processor board, available with third Generation Intel® Core™ Quad Core processors, meets the highest computing and graphics performance requirements at the lowest power budgets.

**FEATURES**

- › Scalable processor speed, 3rd Generation Intel® Core™ Processor
- › Up to 16GB DDR3 1600 MHz memory via two SO-DIMM sockets
- › Up to 16 GB DDR3 memory with ECC
- › Up to 32 GB SATA NAND Flash

CP3003-SA

- › Up to 3x GbE, WOL Support
- › Up to 3x independent graphics outputs
- › SATA 6Gb/s and USB3.0
- › Version for extended temp. E2 (-40°C up to +85°C)

CP6004-SA

- › 4HP, single slot processor board with passive cooling
- › 5x GigEthernet Interfaces via PCI Express
- › Latest I/O technology with SATA Gen 3, RAID, SSD
- › XMC/PMC + onboard HDD + SSD Flash configuration

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www.naii.com/3U-cPCI-12-Port-Gigabit-Ethernet-Switch/P262

NAI 75D4-H2 – 3U cPCI, 12-Port, Gigabit Ethernet Switch

Ultra low power and high performance, the 75D4-H2 is a 3U cPCI Layer 2+ Gigabit Ethernet Switch built upon NAI's multi-function, cPCI board technology. The 75D4 motherboard contains a high density I/O module slot that supports an H2 switch function. The 75D4 with H2 consumes approximately 9.5W of total power at 5V to operate at full 1000Base-T speeds. In addition, the 75D4 motherboard can integrate four channels of RS-232/-423/-422/-485 serial communications. This adds an additional 1.5W of 5V power. Serial data is available on the cPCI bus or can optionally be available over Ethernet via the use of one of the switch ports. Port segregating/partitioning options are available (i.e. separate 6/6 Ports for 2x independent networks). Also available in 6U VME.

**FEATURES**

- › 12-Port 10/100/1000Base-T Unmanaged Switch Standards:
 - IEEE 802.3ab (100BASE-T Gigabit Ethernet)
 - IEEE 802.3u (100BASE-TX Fast Ethernet)
 - IEEE 802.3 (10BASE-T Ethernet)
 - IEEE 802.3x (Flow control/full and half duplex)
- › Broadcom® 53312S
- › Non-blocking Gigabit Ethernet fully integrated switch fabric with 4Mb packet buffer memory
- › IPv4 and IPv6 traffic class support
- › Up to 12 Ports available for external Ethernet communication/connectivity
- › 4 integrated RS-232/-422/-423/-485 serial ports
- › Integrated MACs (IEEE 802.x compliant) with support for 9600-byte jumbo frames
- › Automatic learning and aging tags

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**Pinnacle
Data
Systems,
Inc.**

CP86-N2 (Intel® Core™ i7 cPCI® x86 CPU Blade)

PDSi's Intel-based CompactPCI® x86 Processor Blade (CP86-N2) provides a robust, high-performance general purpose compute platform for use in CompactPCI PICMG 2.16 systems. This latest addition to PDSi's ComputeNode™ family of carrier-grade CompactPCI solutions is built around Intel's 22nm technology "Ivy Bridge" Core i7 processor and Platform Controller Hub (PCH) QM77. This powerful, compact blade offers very high performance and dependability.

The ComputeNode CP86-N2 blade includes a standard XMC site for I/O expansion and features an onboard 2.5" SATA or SSD drive plus high resolution graphics. I/O capability covers a very broad range of interfaces including two 1000BaseT Ethernet ports that provide the PICMG 2.16-compliant fabric interfaces and two front panel 10Gbit Ethernet ports.

FEATURES

- › Intel-based CompactPCI blade server utilizing Intel's 22nm processor technology
- › Intel Core i7-3612QE, i7-3615QE
- › Up to 16GB, ECC, Unbuffered, DDR3, 1066 / 1333 MHz Memory
- › 1 x XMC mezzanine site
- › 1 x 2.5" SATA 3 HDD or Solid State Drive
- › 1 x Display Port, Intel HD Graphics 4000 (front panel)
- › 2 x 10Gbit/s Ethernet ports (front panel)
- › 2 x USB 2.0 (front panel)
- › 1 x Serial port (front panel)
- › Rear I/O interfaces (SATA, PCIe)
- › System slot operations (PCI bus control enabled)
- › Node slot operation (PCI bus control disabled)
- › Customization welcomed and extended availability assured

Pinnacle Data Systems, Inc., An Avnet Company
614-748-1150

Contact: info.sales@pinnacle.com



http://access.io

USB-AO Series Multifunction USB Analog Output

Small form factor USB-based data acquisition and control. The USB-AO Series is an innovative line of 12- and 16-bit USB analog output modules. Up to 16 channels of 16-bit resolution analog outputs along with two 16-bit analog inputs and 16 digital I/O lines. The USB-AO Series can be used in an assortment of USB-based embedded applications that require stable and accurate output signals. Ideal applications include light control, motion control, and process control.

The boards features both unipolar and bipolar output ranges. Additional specific ranges can be achieved as factory options. All analog output channels can be updated either individually or simultaneously. System calibration specific to user requirements can be performed via a provided, easy-to-use software utility.

A micro-fit USB header connector is provided in parallel with the high retention type B connector and can be used for stacking and embedded applications.



FEATURES

- › Up to 16 analog outputs with 12- or 16-bit resolution
- › Unipolar and bipolar output ranges
- › Real-time hardware calibration per channel
- › Update outputs individually or simultaneously
- › Two 16-bit analog inputs and 16 lines of digital I/O
- › OEM version (board only) features PC/104 module size and mounting compatibility
- › Alternate micro-fit embedded USB header connector
- › Type B USB connector features industrial strength and high-retention design
- › Extended operating temperature and DIN rail mounting provisions

ACCES I/O Products, Inc. | 858-550-9559

Contact: contactus@accessio.com

Follow us on Twitter @accessio



<http://aces.io>

Multifunction DAQ-PACK Series (Up to 128 Channels)

The DAQ-PACK Series is a highly integrated multifunction data acquisition and control system. The system offers an ideal solution for adding portable, easy-to-install high-speed analog and digital I/O capabilities to any PC or embedded system with a USB port. It performs signal conditioning such as RC filtering, current inputs, RTD measurement, bridge completion, thermocouple break detection, voltage dividers, small signal inputs, and sensor excitation voltage supply.

The small, compact, multifunction I/O DAQ-PACK Series units provide the user with everything needed to start acquiring, measuring, analyzing, and monitoring in a variety of applications. These data acquisition and control devices can be used in many current real-world applications such as precision measurement, analysis, monitoring, and control in countless embedded applications.



FEATURES

- › 32, 64, 96, or 128-channel single-ended or differential analog inputs
- › High-speed USB 2.0 multifunction DAQ
- › Sustained sampling speeds up to 500kHz
- › 12- or 16-bit resolution A/D converter
- › Flexible, software configured functionality
- › 18 input ranges, 9 unipolar and 9 bipolar, per 8-channel programmable
- › Wide range of flexible signal conditioning types
- › Autocalibration and oversampling for real-time accurate data
- › A/D starts via software, timer, or external trigger
- › Two 16-bit analog outputs and 16 high-current digital I/O lines
- › 16-bit programmable counter/timer

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Contact: contactus@acesio.com

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www.AlphiTech.com

Ultra-small footprint and lightweight 1553 Data Logger

The latest member of the ALPHI 1553 product line is a stand-alone, fully sealed, rugged, ultra-small and ultra-low-power Intel Atom™ based module. The system has an ultra-small footprint and is lightweight at only 6.4" x 3.5" x 2.9" and 3.5 lb., which includes an SBC and mass storage.

It supports up to four 500GB removable, sealed SSDs for up to 2TB total. It includes support for Network Attached Storage (NAS) Power by a dual redundant MIL-STD-1553 interface, programmable bus controller, remote terminal, or bus monitor modes, and supports MIL-STD1553A/B. It is controlled by a 1.6GHz Atom™ processor, 512KB of L2 Cache and up to 2GB of 533MHz DDR-2 SDRAM. The system I/O configuration is based on two non-switched x1 PCI Express lanes used on two Express Mini Cards slots.

The 1553 capabilities can be complimented by ARINC 429, FireWire, CANbus, GPS, GigE, A/D, D/A or any other functionality.

- Support for Windows® XP/XPE/7, Linux® and VxWorks®
- Available in extended temp -40°C to +85°C

This is a perfect solution for a wide array of 1553 communication applications such as: military mission computers, ground vehicles and many others.



FEATURES

- › Supports up to four removable, sealed SSD Drives
- › Each drive supports up to 500GB of storage for up to 2TB total
- › Each SSD may be accessed via SATA or USB port when removed
- › 1.6GHz Intel® Atom™ processor with 512KB of L2 Cache
- › 2GB of 533MHz DDR-2 SDRAM
- › Support for Network Attached Storage (NAS)
- › PCI Express Mini Extension
- › One Fast Ethernet port
- › Line-In/Mic-In, and Line Out
- › Eight buffered General Purpose I/O lines (Optional)
- › DVI-D Video Port video ports or Headless operation
- › Four USB 2.0 ports, one Serial port with RS-232/-422/-485 support
- › Extensive Built-In-Test (BIT) and Extended BIT for diagnostics
- › Full power management control for Sleep/Hibernate operation
- › RTC with external/internal or no battery operation
- › CPU temperature and voltage monitoring for safe operation
- › Reset and power On/Off switch with suspend support

Alphi Technology Corporation | 480-838-2428

Contact: sales@AlphiTech.com



www.annapmicro.com

Dual 4.0 GSps DAC

The Annapolis Micro Systems Dual Channel 4.0 GSps D/A I/O Card provides one or two 12-bit digital output streams at up to 4.0 GSps. The board has one or two MAX 19693 for 4.0 GSps, MAX 19692 for 2.3 GSps, or MAX 5859 for 1.5 GSps.

The Dual Channel DAC board has five SMA front connectors: two single-ended DAC outputs, a high-precision trigger input with Fs precision, and a universal single- or double-ended 50 ohm clock input. It has excellent gain flatness in the first 3 Nyquist Zones, ultra-low skew and jitter saw-based clock distributions, and main board PCLK sourcing capability.

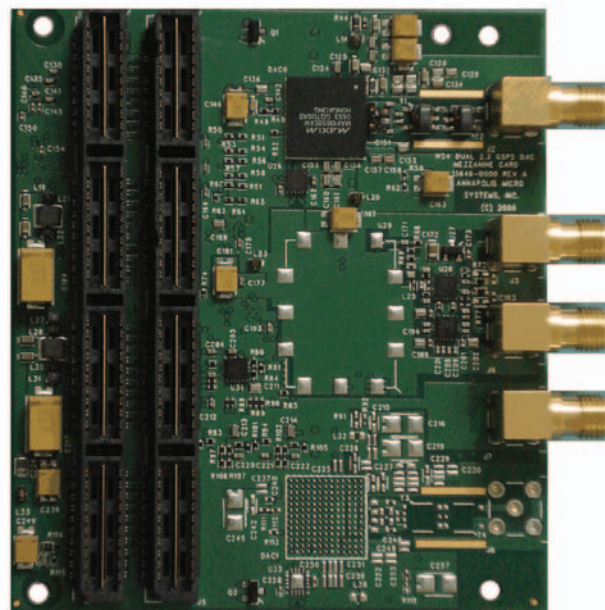
In concert with the WILDSTAR 4 or WILDSTAR 5 FPGA processing main boards, this mezzanine board supplies user-configurable real-time A to D conversion and digital output. Up to two A/D or D/A and up to two serial I/O cards can reside on each WILDSTAR 4 or WILDSTAR 5 VME/VXS or IBM Blade main board, or up to one A/D or D/A and up to one serial I/O card on each PCI-X or PCI Express main board.

Our boards run on many different operating systems. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models. VHDL source is provided for the interfaces to A/Ds, D/As, DRAM/SRAM, LAD bus, I/O bus, and PPC Flash. CoreFire™ users will have the usual CoreFire Board Support Package.

The combination of our COTS hardware and our CoreFire FPGA Application Development tool allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.

Annapolis Micro Systems, Inc. is a world leader in high-performance COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, Digital Signal Processing, FFTs, communications, software radio, encryption, image processing, prototyping, text processing, and other processing intensive applications.

Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed. We offer training and exceptional special application development support, as well as more conventional customer support.



FEATURES

- › One or two 12-bit Analog to Digital Converters: MAX 19693 for 4.0 GSps, MAX 19692 for 2.3 GSps, or MAX 5859 for 1.5 GSps
- › Five SMA front panel connectors: two single-ended DAC outputs, one high-precision trigger input with Fs precision
- › One universal single- or double-ended 50 ohm clock input
- › High-precision trigger input manufacturing options – 1.65 V LVPECL, 2.5 V LVPECL, 3.3 V LVPECL
- › I/O card plugs onto WILDSTAR 4 or 5 VME/VXS/PCI-X/PCI Express/IBM Blade main boards
- › JTAG, ChipScope, and Serial Port access
- › Full CoreFire Board Support Package for fast, easy application development
- › VHDL model, including source code for board-level interfaces
- › Proactive thermal management system
- › Industrial temperature range
- › Includes one-year hardware warranty, software updates, and customer support
- › **Designed and manufactured in the USA**

Annapolis Micro Systems, Inc. | 410-841-2514

Contact: wfinfo@annapmicro.com



www.annapmicro.com

Four Channel Clock Synchronization Board

The Four Channel Clock Distribution Board distributes a common clock and synchronized control signal triggers to multiple cards in the system. This 6U VME64x/VXS board provides four high-speed, ultra-low jitter, ultra-low skew differential bulkhead mounted clock outputs, two ultra-low skew differential vertical SMA on-board clock outputs, and four ultra-low skew and clock synchronized single-ended bulkhead mounted control signal triggers.

A jumper set at board installation time or via optional P2 Serial Port determines which one of the two installed clock sources is active. Manufacturing options for Clock Source 0 are Single Ended or Differential External Clock, a PLL ranging from 700 MHz to 3 GHz with an On-Board Reference Oscillator, or a PLL ranging from 700 MHz to 3 GHz with a 10 MHz External Reference. Manufacturing options for Clock Source 1 are a PLL ranging from 700 MHz to 3 GHz with an On-board Reference Oscillator, a PLL ranging from 700 MHz to 3 GHz with a 10 MHz External Reference or an On-Board Low Frequency Oscillator ranging up to 800 MHz.

The four control trigger outputs can originate from a high-precision external source via front panel SMA, from a manual pushbutton on the front panel, or from software via an optional Backplane P2 Connector Serial Port. These trigger outputs are synchronized to the distributed clock to provide precise output timing relationships.

Annapolis Micro Systems is a world leader in high-performance, COTS FPGA-based boards and processing for RADAR, SONAR, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications.

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FEATURES

- › Four Synchronized Differential Front Panel Clock Outputs up to 3 GHz with Typical Skew of 5 ps
- › Ultra-low Clock Jitter and Phase Noise – 275 Fs with 1,280 MHz PLL and external 10 MHz Reference
- › On-board PLLs Manufacturing Options provide Fixed Frequencies of 700 MHz to 3 GHz, Locked to Internal or External Reference
- › On-board Low Frequency Oscillator provides Fixed Frequencies up to approximately 800 MHz
- › Four Synchronized Trigger Outputs, always Synchronized with the Output Clock, with Typical Skew of 5 ps
- › Jumper Selectable Trigger Output Levels of 3.3 V PECL, 2.5 V PECL, or 1.65 V PECL
- › Source Trigger from Front Panel SMA, Pushbutton, or Optional P2 Serial Port
- › Cascade boards to provide up to 16 sets of outputs
- › Compatible with standard VME64x and VXS 6U backplanes
- › Universal clock input supports wide range of signal options, including signal generator sine wave
- › Differential clock input permits multiple standards including: LVDS, 3.3 V PECL, 2.5 V PECL, and 1.65 V PECL
- › Clock and Trigger Outputs Compatible with all Annapolis Micro Systems, Inc. WILDSTAR™ 2 PRO I/O Cards and WILDSTAR™ 4/5 Mezzanine Cards



Agilent Technologies

www.agilent.com/find/M9703A

M9703A AXIe 8 channels, 12-bit High-Speed Digitizer

The Agilent M9703A is the world's first 12-bit high-speed digitizer based on the AXIe standard, offering large size and power capability, allowing building a large number of synchronous acquisition channels at GHz speed with the best dynamic range in a limited footprint.

The M9703A is a revolutionary 8-channel digitizer, able to capture wideband signals with the highest dynamic range. The interleaving capability of this product allows capturing at 3.2 GS/s with the best measurement accuracy. The Agilent M9703A also provides very long acquisition capability by implementing up to 4 GBytes internal memory and real-time data processing with four Virtex-6 FPGAs.

This makes it ideally suited to multi-channel antenna calibration and test, such as Radar (array), Satellite (beam-forming) and Communications (MIMO).



FEATURES

- › 8 synchronous channels
- › 12-bit resolution with a DC to >1 GHz frequency range
- › Up to 3.2 GS/s sampling rate
- › Real-time data processing
- › Up to 4 GB (256 MSamples/ch) on-board memory
- › >650 MB/s sustained data transfer speed

Agilent Technologies Inc. | 800-829-4444

Contact: digitizers@agilent.com

Blog: <http://high-speed-digitizer.tm.agilent.com>

Twitter: https://twitter.com/High_speed_ADC



www.WinSystems.com

Fanless 1.66GHz Intel® Atom™ EPIC SBC

WinSystems' EPX-C380 is a full-featured EPIC-compatible SBC with a rich array of onboard peripherals such as video, Ethernet, USB, and serial, plus more I/O expansion options with PC/104 and MiniPCIe modules.

It also supports either the Intel® Atom™ single core N450 or dual core D510 processors. Since the EPX-C380's architecture is PC-compatible, it supports Windows® XP Embedded, WES7, and Linux software operating systems along with a vast software development tool set including device drivers and libraries.

The board is designed for rugged applications, including industrial automation, security, Mil/COTS, and transportation. It operates over a temperature range of -40°C to +70°C without a fan or the necessity to slow down the CPU clock frequency.

For more information go to
www.winsystems.com/EPX-C380MRG



FEATURES

- › Intel® Atom™ 1.66GHz single or dual core CPU
- › Advanced power management features
- › Supports CRT and flat panels simultaneously
- › Two Intel Gigabit Ethernet controllers
- › 802.11a/b/g wireless supported with MiniPCIe
- › Four serial COM ports, four USB 2.0 ports, and 48 bidirectional TTL digital I/O lines
- › Two SATA channels and CompactFlash supported
- › PC/104 and MiniPCIe module expansion
- › Starter kits to speed system development

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2.0 GSps 10-bit A/D

The Annapolis Single Channel 2.0 GSps A/D I/O Card provides one 2.0 GHz A/D input with a resolution of 10 bits. The board has one e2v AT84AS004 that is fed by an onboard analog input circuit, which converts the single-ended 50-ohm SMA input into differential signals for the ADC. There is a universal single-ended 50-ohm SMA clock input and a high-precision trigger input allowing multiple A/D I/O cards to be synchronized together. Synchronization of A/D I/O cards can be facilitated by the Annapolis 4 or 8 Channel Clock Distribution Boards.

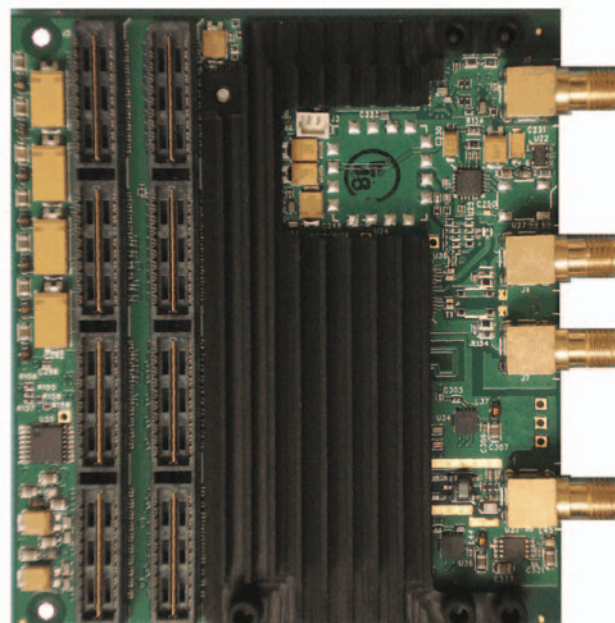
In concert with the WILDSTAR 4 or WILDSTAR 5 FPGA processing main boards, this mezzanine board supplies user-configurable real-time continuous sustained processing of the full data stream. Up to two A/D and up to two Serial I/O cards can reside on each WILDSTAR 4 or WILDSTAR 5 VME/VXS or IBM Blade main board, or up to one A/D and up to one Serial I/O card on each PCI-X or PCI Express main board.

Our boards run on many different operating systems. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models. VHDL source is provided for the interfaces to A/Ds, D/As, DRAM/SRAM, LAD bus, I/O bus, and PPC Flash. CoreFire™ users will have the usual CoreFire Board Support Package.

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Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed.



FEATURES

- › One e2v AT84AS004 (2.0 GHz, 10-bit) A/D
- › Four SMA front panel connectors: one 50-ohm analog input, one single-ended 50-ohm clock input, or differential 1.65 V LVPECL clock input
- › One high-precision trigger input with Fs precision; high-precision trigger input – 1.65 V LVPECL, 2.5 V LVPECL, 3.3 V LVPECL
- › Analog input bandwidth is 100 KHz-3.0 GHz
- › I/O card plugs onto WILDSTAR 4 or 5 VME/VXS/PCI-X/PCI Express/IBM Blade main boards
- › JTAG, ChipScope, and Serial Port access
- › Full CoreFire Board Support Package for fast, easy application development
- › VHDL model, including source code for board-level interfaces
- › Proactive thermal management system
- › Includes one-year hardware warranty, software updates, and customer support
- › We offer training and exceptional special application development support, as well as more conventional customer support
- › **Designed and manufactured in the USA**



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WILDSTAR 5 for IBM Blade

Perfect Blend of Processors and Xilinx Virtex-5 FPGAs. Eleventh Annapolis Generation.

Direct Seamless Connections – No data reduction between: external sensors and FPGAs, FPGAs and processors over IB or 10 Gb Ethernet backplane, FPGAs and standard output modules.

Ultimate Modularity – From zero to six Virtex-5 processing FPGA/memory modules, and two Virtex-5 I/O FPGAs. Accepts one or two standard Annapolis WILDSTAR 4/5 I/O mezzanines: Quad 130 MSps through Quad 500 MSps A/D, 1.5 GSps through 2.2 GSps A/D, Quad 600 MSps DAC, InfiniBand, 10 Gb Ethernet, SFPDP.

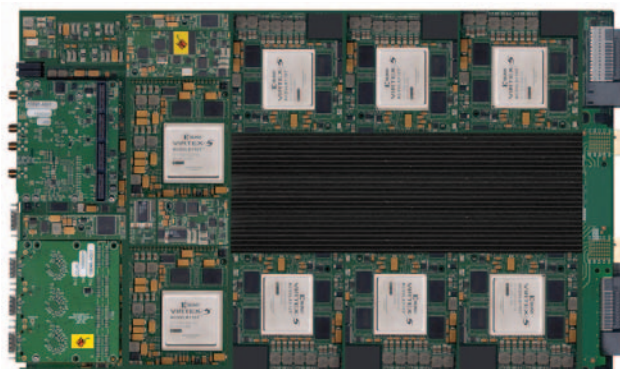
Fully Integrated into the IBM Blade Management System – Abundant power and cooling for maximum performance.

Annapolis Micro Systems, Inc. is a world leader in high-performance COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, Digital Signal Processing, FFTs, communications, software radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models.

Develop your application very quickly with our CoreFire™ FPGA Application Builder, which transforms the FPGA development process, making it possible for theoreticians to easily build and test their algorithms on the real hardware that will be used in the field. CoreFire, based on dataflow, automatically generates distributed control fabric between cores. Our extensive IP and board support libraries contain more than 1,000 cores, including floating point and the world's fastest FFT. A graphical user interface for design entry supports hardware-in-the-loop debugging, and provides proven, reusable, high-performance IP modules.

WILDSTAR 5 for IBM Blade, with its associated I/O cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.

Achieve world-class performance; WILDSTAR solutions outperform the competition.



FEATURES

- › From two to eight Virtex-5 FPGA processing elements – LX110T, LX220T, LX330T, FX100T, FX130T, or FX200T; six are pluggable with power module and memory
- › Up to 10.7 GB DDR2 DRAM per WILDSTAR 5 for IBM Blade Board
- › 144 x 144 crossbar; 3.2 Gb per line; two external PPC 440s – 1 per each I/O FPGA
- › Full CoreFire Board Support Package for fast, easy application development
- › VHDL model, including source code for hardware interfaces and ChipScope access
- › Available in both commercial and industrial temperature grades
- › Proactive thermal management system – board-level current measurement and FPGA temperature monitor, accessible through host API
- › Includes one-year hardware warranty, software updates, and customer support
- › Blade management controller; USB, RS-485, Ethernet, KVM, 16 RIO, Switch to 1 GbE over backplane
- › Save time and effort; reduce risk with COTS boards and software
- › We offer training and exceptional special application development support, as well as more conventional support
- › Famous for the high quality of our products and our unparalleled dedication to ensuring that the customer's applications succeed

Annapolis Micro Systems, Inc. | 410-841-2514

Contact: winfo@annapmicro.com



www.annapmicro.com

WILDSTAR A5 for PCI Express

Supports up to Three 56G FDR InfiniBand, Three 40Gb Ethernet, or Twelve 10Gb Ethernet Connections.

WILDSTAR A5 for PCI Express uses Altera's newest Stratix V FPGAs for state-of-the-art performance. This is the first of a series of Altera Based FPGA Processing Boards from Annapolis.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. It accepts one or two I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 GbEthernet, InfiniBand), and Tri XFP (OS 192, 10G Fibre Channel, 10Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

Develop your application very quickly with our CoreFire™ FPGA Application Builder, which transforms the FPGA development process, making it possible for theoreticians to easily build and test their algorithms on the real hardware that will be used in the field. CoreFire, based on dataflow, automatically generates distributed control fabric between cores.

Our extensive IP and board support libraries contain more than 1,000 cores, including floating point and the world's fastest FFT. CoreFire uses a graphical user interface for design entry, supports hardware-in-the-loop debugging, and provides proven, reusable, high-performance IP modules. WILDSTAR A5 for PCI Express, with its associated I/O Cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.



FEATURES

- › Supports up to Three 56G FDR InfiniBand, Three 40Gb Ethernet, or Twelve 10Gb Ethernet Connections
- › Up to Three Altera Stratix V FPGA Processing Elements – GSD4, GSD5, GSD6, GSD8, GXA3, GXA4, GXA5, GXA7, GXA9, GXAB
- › Up to 4 GBytes DDR3 DRAM in 2 Memory Banks and Up to 192 MBytes QDRII + SRAM in 12 Memory Banks per WILDSTAR A5 for PCI Express Board
- › Programmable FLASH for each FPGA to Store FPGA Images
- › 16X PCI Express Bus Gen 1, Gen 2, or Gen 3 to Host PC through On Board PCIe Switch
- › Supports PCI Express Standard External Power Connector
- › Multi Channel High Speed DMA
- › Full CoreFire Board Support Package for fast, easy application development
- › VHDL model, including source code for hardware interfaces and ChipScope Access
- › Available in both commercial and industrial temperature grades
- › Proactive Thermal Management System – Board Level current measurement and FPGA temperature monitor, accessible through Host API
- › Includes one year hardware warranty, software updates, and customer support
- › Training available

Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed. We offer training and exceptional special application development support, as well as more conventional support.

Save time and effort and reduce risk with COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition.

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WILDSTAR 6 PCIe

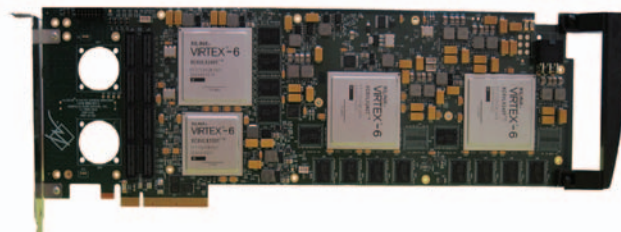
Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing-intensive applications. Our fifteenth-generation WILDSTAR 6 for PCI Express uses Xilinx's newest Virtex-6 FPGAs for state-of-the-art performance. It accepts one or two I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OS 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows, Linux, Solaris, IRIX, ALTIX, and VxWorks. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models.

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Save time and effort and reduce risk with COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition.



FEATURES

- › Up to three Xilinx Virtex-6 FPGA I/O processing elements – LX240T, LX365T, LX550T, SX315T, or SX475T
- › Up to 8 GBytes DDR2 DRAM or DDR3 DRAM in 14 memory banks per WILDSTAR 6 for PCI Express board or up to 480 MBytes DDRII+/QDRII DRAM in 15 memory banks
- › Programmable FLASH for each FPGA to store FPGA images
- › 8X PCI Express Bus Gen 1 or Gen 2
- › Supports PCI Express standard external power connector
- › High-speed DMA Multi-Channel PCI controller
- › Full CoreFire Board Support Package for fast, easy application development
- › VHDL model, including source code for hardware interfaces and ChipScope access
- › Available in both commercial and industrial temperature grades
- › Proactive Thermal Management System – Board Level current measurement and FPGA temperature monitor, accessible through Host API
- › Includes one year hardware warranty, software updates, and customer support. Training available.

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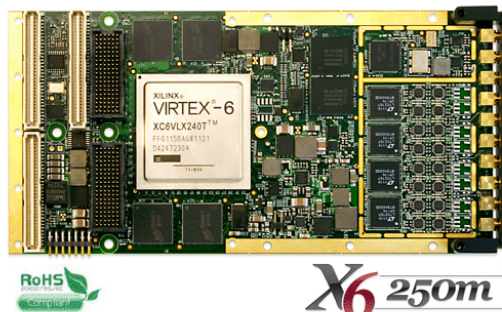
Contact: wfinfo@annapmicro.com

**X6-250M**

X6-250M integrates digitizing with signal processing on a PMC/XMC I/O module. The module has a powerful Xilinx Virtex-6 FPGA signal processing core, and high performance PCI Express/PCI host interface. Applications include software-defined radio, RADAR receivers, and multi-channel data recorders.

The X6-250M has eight simultaneously sampling A/D channels that sample at rates up to 250 MSps (14-bit). The A/D has matched input delays and response. The A/D is supported by a programmable sample clock PLL and triggering that support multi-card synchronization for large scale systems.

A Xilinx Virtex-6 SX315T (LX240T and SX475T options) with 4 banks of 1 GB DRAM provides a very high performance DSP core with over 2000 MACs (SX315T). The close integration of the analog I/O, memory and host interface with the FPGA enables real-time signal processing at extremely high rates. Download Data Sheets & Pricing Now!

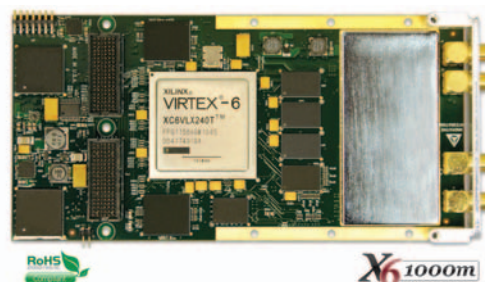
**FEATURES**

- › Eight 250 MSps, 14-bit A/D channels
- › $\pm 1V$, AC-Coupled, 50 ohm, SSMC inputs
- › Xilinx Virtex-6 SX315T/SX475T or LX240T
- › 4 Banks of 1GB DRAM (4 GB total)
- › Ultra-low jitter programmable clock
- › Gen2 x8 PCI Express option providing 2 GBps sustained transfer rates
- › PCI 32-bit, 66 MHz with P4 to Host card PMC/XMC Module (75x150 mm); 18-22 W typical Conduction Cooling per VITA 20
- › Ruggedization Levels for Wide Temperature Operation
- › Adapters for VPX, CompactPCI, desktop PCI and cabled PCI Express systems

Innovative Integration | 805-578-4260**Contact:** sales@innovative-dsp.com**X6-1000M**

The X6-1000M integrates high-speed digitizing and signal generation with signal processing on a PMC/XMC I/O module for demanding DSP applications. The tight coupling of the digitizing to the Virtex-6 FPGA core realizes architectures for SDR, RADAR, and LIDAR front end sensor digitizing and processing. The PCI Express system interface sustains transfer rates over 2 GBps for data recording and integration as part of a high performance real-time system.

The X6-1000M features two, 12-bit 1 GSps A/Ds and two 1 GSps 16-bit DACs. Analog input bandwidth of over 2 GHz supports wide-band applications and undersampling. The DACs have features for interpolation and coarse mixing for upconversion. The sample clock is from either a low-jitter PLL or external input. Multiple cards can be synchronized for sampling and down-conversion.

**FEATURES**

- › Two 1 GSps, 12-bit A/D channels & Two 1 GSps, 16-bit DAC channels
- › $\pm 1V$, AC or DC-Coupled, 50 ohm, SMA inputs and outputs
- › Xilinx Virtex-6 SX315T/SX475T or LX240T
- › 4 Banks of 1GB DRAM (4 GB total)
- › Ultra-low jitter programmable clock
- › Arbitrary Waveform Generation Memory
- › Controller for DACs; Gen2 x8 PCI Express providing 2 GBps sustained transfer rates
- › PCI 32-bit, 66 MHz with P4 to Host card
- › PMC/XMC Module (75x150 mm)
- › 20-25W typical & Conduction Cooling per VITA 20
- › Ruggedization Levels for Wide Temperature Operation
- › Adapters for VPX, CompactPCI, desktop PCI and cabled PCI Express system

Innovative Integration | 805-578-4260**Contact:** sales@innovative-dsp.com



PCIe-287N™ Network Processing Card

The PCIe-287N network accelerator card delivers the processing and I/O performance required to develop and deploy solutions in a range of application areas including network processing, cyber security and algorithm acceleration. Four SFP+ ports supporting a range of protocols including 10GbE LAN/WAN are directly coupled to two Kintex-7 FPGAs, supported by multiple banks of QDR-II SRAM and DDR3 SDRAM. A Gen2 PCI Express interface provides high-bandwidth connectivity and seamless integration with the host environment.

A comprehensive software and firmware suite is delivered with the product, including optimized memory controller cores, reference designs, card driver and APIs. The PCIe-287N is compatible with a range of server and blade center platforms from leading OEMs.



FEATURES

- › Two Xilinx Kintex-7 K325T user FPGAs
- › PCI Express 2.0 form factor
- › Four SFP+ ports supporting a range of 1G and 10G protocols including 10GbE (LAN and WAN)
- › 8-lane PCI Express 2.0 host interface:
 - Up to 2.5 GB/s WRITE (system-to-card)
 - Up to 2.5 GB/s READ
- › Six independent banks of 9MB QDR-II SRAM
- › Two independent banks of 1GB DDR3 SDRAM
- › Linux 64-bit Operating System support

Nallatech | 805-383-8997

Contact: info@nallatech.com



PCIe-385N™ Network Processing Card

The PCIe-385N low profile network processing card provides a powerful PCI Express Gen 3 computing platform for FPGA development and deployment across a range of application areas including network monitoring, filtering, analytics, data retention and algorithm acceleration.

The PCIe-385N features two SFP+ connectors supporting 1GbE, 10GbE, SONET/SDH and OTN via the PCI backplate. These network interfaces are directly coupled to an Altera Stratix V FPGA with high bandwidth DDR3 SDRAM memory. The PCIe-385N is the same form factor as most standard network cards, providing compatibility with almost all high density server and blade center platforms.



FEATURES

- › FPGA types:
 - Altera Stratix V A4 or A7
 - Altera Stratix V A3, A5, D3, D4: footprint compatible
- › Low profile PCIe Gen 3 form factor
- › Two independent banks of DDR3 SDRAM, up to 16GB
- › Two SFP+ ports support for 1GbE, 10GbE, SONET/SDH and OTN:
 - SONET/SDH
 - 10G – OC192/STM64
 - 2.5Gb – OC48/STM16
 - 622M – OC12/STM4
 - 155M – OC3/STM1
 - OTN
 - 10Gb – OTU2/2e/1e/2f/1
 - 2.5Gb – OTU1

Nallatech | 805-383-8997

Contact: info@nallatech.com



Xilinx Defense-Grade Spartan-6 FPGAs

Defense-Grade FPGAs: Security, Longer Mission Profile and Reliability

Xilinx® Spartan®-6Q defense-grade FPGAs represent a technology leap forward in three directions: security, power reduction, and integration. Handheld developers can meet current design challenges by building lighter, smaller mobile devices that more easily comply with the latest security mandates. And with battery life that can be extended far longer even as more functionality is built into the target systems, Spartan-6Q defense-grade FPGAs are the ideal choice for secure, low power, low cost small form factor designs.

Off-the-Shelf Ruggedized Devices with 65% Reduction of Power and Cost

Compared to the previous grade-equivalent Xilinx devices, Spartan-6Q FPGAs leverage new technology nodes, Advanced Power Management and integration innovations to significantly reduce size, weight, power, and cost (SWaP-C). In particular, overall power consumption has been lowered by almost two-thirds while lowering costs.

Pin compatibility with commercial-grade products and comprehensive Xilinx Targeted Design Platforms – which combine the necessary hardware, design tools, IP and reference designs – further drives down development costs. Designers can start immediately, using affordable commercial-grade solutions and introduce the defense-grade Spartan-6Q devices when project requirements call for more security or extended temperature. Bare die options are also available, to accommodate the development of custom form factors.

Industry-Leading Cryptography and Anti-Tamper Solutions

In 2006, Xilinx introduced the first single-chip cryptography (SCC) solution for FPGAs. The Spartan-6Q family delivers third-generation SCC technology for advanced information assurance. Choosing Xilinx devices gives designers the benefits of more than 20 years of industry and agency partnerships, a proven in-production information assurance approach, and a commitment to industry-leading mask set control for mission-critical security designs including Type 1 cryptography.

Third-generation anti-tamper features and Security Monitor (SECMON) IP also help Spartan-6Q FPGA designers comply with regulations such as the U.S. Department of Defense (DoD) mandated 5000 Series AT requirements. By delivering cost-effective and power-conserving information assurance and anti-tamper features, Spartan-6Q FPGAs contribute to leading-edge designs for secure handheld and portable devices.



FEATURES

- › Advanced process technology and 6-input LUT architecture enable implementation of complex, high-performance functionality with smaller devices in the least expensive speed grade
- › Abundant logic resources with increased logic capacity 3.8K to 150K logic cells for higher performance
- › Simplified configuration supporting low-cost 3rd party standards
- › Easy-to-use and high-performance system IP
- › Totally green, RoHS-compliant Pb-free packaging
- › Reduced total power consumption
- › Efficient utilization of 45nm low-power copper process technology
- › 250 MHz DSP48A1 slice for up to 50% lower power consumption
- › Low-voltage device options available for addressing the strictest power budgets
- › Advanced power management for lower static and dynamic power
- › Flexible power-saving hibernate and suspend modes
- › Integrated memory controller supports low power memory standards
- › Mobile DDR and 1.3/1.5V DDR3

Xilinx | 408-559-7778

Contact: more_info@xilinx.com

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Xilinx® Virtex®-6Q Defense-Grade FPGAs

Xilinx Virtex-6Q Defense-Grade FPGAs

Xilinx® Virtex®-6Q Defense-Grade FPGAs introduce advancements in performance, security, and reliability to help defense electronics designers build in more functionality while accelerating design cycles.

Faster “Time to Mission-Readiness” with Off-the-Shelf Devices

Off-the-shelf Virtex-6Q devices are pin compatible with commercial-grade products; project teams can start designing today and migrate to ruggedized solutions when requirements call for extended temperature range operation or ruggedized installations. Further accelerating the development cycle, Xilinx offers comprehensive Targeted Design Platforms that include all the necessary hardware, design tools, IP and reference designs for application-specific designs. For ultimate design flexibility, teams can also take advantage of bare die options for custom form factors.

Maximizing Security and SWaP-C

Virtex-6Q devices offer breakthrough performance while reducing SWaP-C through integration and technology nodes to meet the needs of the most-demanding defense applications. Third-generation anti-tamper features help designers comply with regulations such as the U.S. Department of Defense (DoD) mandated 5000 Series Anti-Tamper requirements. Xilinx pioneering efforts in security resulting in antitamper innovations include Security Monitor (SECMON) IP, uniquely giving designers the latest security advancements while simultaneously supporting DO-254 enablement, making the features accessible for a broad range of applications.

Reliably Operating in Harsh Environments

Xilinx defense-grade devices offer ruggedized packaging protection against “tin-whiskering” and caustic solvent cleaning systems. Virtex-6Q FPGAs are also fully tested for extended temperature ranges, giving designers a choice of solutions qualified for operation in either I-temperature or M-temperature ranges.



FEATURES

- › High performance and integration
- › Security (anti-tamper features) and superior SWaP-C
- › Fully tested temperature range including military
- › Off-the-shelf availability
- › Pin-compatible commercial-grade portfolio
- › Reliability with ruggedized packaging
- › 3rd generation Anti-tamper (DoD 5000 Series)
- › Smaller size and lower weight with performance per logic cell count and external component integration
- › 50% lower power over Virtex-5Q FPGAs (equivalent temperature range)
- › Lower cost over previous generations
- › Heritage of 20+ continuous years in A&D: Customers, agencies and standards
- › True, full range tested (vs. “characterized”) I and M temperatures
- › Ruggedized packaging
- › 16 year long term product support
- › Mask set control

Xilinx | 408-559-7778

Contact: more_info@xilinx.com

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www.magma.com

7 Slot PCIe Expansion Chassis (ExpressBox 7 RAS)

Smart, Manageable, Multi-Host PCIe Expansion

Expand one PCIe slot to seven PCIe slots with an ExpressBox 7 RAS expansion chassis. Magma's software utility enables you to partition expansion slots among multiple servers and monitor critical components through a Web browser or SNMP agent.

- Add (7) hot-pluggable slots through a single host slot
- Partition slots among multiple servers
- Remote monitoring with SNMP and Web Interface
- Supports any combination of x1, x4, x8 and x16 PCIe cards

Magma is a Service Disabled Veteran Owned Small Business (SDVOSB) located in San Diego, CA.



FEATURES

- › Low profile host card allows for easy installation in any computer
- › Visible LEDs indicate correct installation
- › Hot-pluggable PCIe slots support full length and full height cards
- › 4U rack-mount enclosure with superior EMI control, vibration, shock and moisture resistance
- › Power supply, hot-swappable fans, and chassis temperature constantly monitored for failure status
- › Rack slide kit for rack installation (Optional)
- › Designed to meet MIL-STD-461E
- › CE Certified and FCC Class A verified
- › RoHS Compliant

Magma | 800-285-8990

Contact: sales@magma.com

Facebook: www.facebook.com/MagmaPCIExpress

COTS Collection: Boards, Carriers, Mezzanines, ICs: Microprocessors & Microcontrollers

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FASSt™ and Extension-of-Life® (ExOL)

Rochester Electronics maintains the world's largest Factory Authorized Safety Stock™, offering active and mature semiconductor solutions ready for immediate shipment. Coupled with the most comprehensive support for aftermarket semiconductors in the world, all products are completely authorized and licensed by the original manufacturer, eliminating any chance of supply-chain issues or disruption due to counterfeit semiconductors. Through Extension-of-Life® programs, Rochester Electronics can sustain the supply of your critical semiconductor devices for the life of your system. Authorized by 60+ semiconductor manufacturers, Rochester Electronics is a complementary source for finished goods, die and the re-creation of unavailable devices.



FEATURES

- › Every device is 100% inspected both inbound and outbound
- › Only Rochester Electronics provides complete device replication services, performance guarantee, and sustained, long-term source-of-supply programs
- › Re-create devices even when original tooling no longer exists, the design archive is missing, or there is only one working device left
- › All products are 100% guaranteed and factory traceable
- › With the most expansive manufacturing capability in the semiconductor industry, Rochester utilizes a die bank of more than 10 billion units
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Xilinx Zynq-7000 EPP – An All Programmable SoC

Breakthrough in "All Programmable" SoC-level Integration

The Xilinx® Zynq™-7000 Extensible Processing Platform (EPP) redefines the possibilities for embedded systems, giving system and software architects and developers a flexible platform to launch their new solutions and traditional ASIC and ASSP users an alternative that aligns with today's programmable imperative. The new class of product elegantly combines an industry-standard ARM processor-based system with Xilinx 28nm programmable logic in a single device. The processor boots first, prior to configuration of the programmable logic. This, along with a streamlined workflow, saves time and effort and lets software developers and hardware designers start development simultaneously.

The Zynq-7000 EPP makes market- and application-specific platforms easier to use, modify, and extend thanks to the programmable logic. These new devices build on Xilinx-pioneered development methodologies to maximize the value of the breakthrough levels of integration, power efficiency, and high performance. Integrating the industry-standard dual ARM® Cortex™-A9 MPCore™ also gives designers access to the ARM IP and software ecosystem. Design teams can get started today using Xilinx ISE® Design Suite, industry-standard operating systems, and best-in-class productivity tools from the industry's leading solution providers.

Breakthrough Single-Chip Platforms

The architecture of the Zynq-7000 EPP offers unrivaled features and performance while driving down cost and power requirements. The ARM dual-core Cortex™-A9 processor is enhanced with the NEON engine, a single and double-precision vector floating-point unit and a large set of peripherals including memory controllers, CAN, USB, Gigabit Ethernet, SD-SDIO, UARTs, analog-to-digital converters and more. Its high performance multi standard I/Os and multi-gigabit transceivers offer a wide range of connectivity options allowing designers to use Zynq-7000 EPP devices in most applications. The programmable logic portion of Zynq-7000 EPP devices leverages the Xilinx 7 series programmable logic. This allows designers currently developing on the Xilinx 7 series to seamlessly port their FPGA designs to Zynq-7000 EPP devices. Z-7010 and Z-7020 are based on the Artix™-7 FPGA fabric, and Z-7030 and Z-7045 are based on the Kintex™-7 FPGA fabric.



FEATURES

- › All Programmable platform: processor, logic, DSP, I/Os and AMS
- › 800MHz ARM® dual-core Cortex™-A9 MPCore™, >10X SW acceleration with Programmable Logic
- › Integrated platform yields up to 40% BOM cost savings
- › Processor low power modes, 28nm HPL, and integration yield up to 50% power reduction
- › Flexible and scalable platform, comprehensive ecosystem of tools, OS and IP
- › Market-specific Targeted Design Platforms that allow system developers to start design efforts with an integrated targeted system solution
- › Xilinx and 3rd party IP including connectivity, DSP, embedded and video processing options
- › C-to-gate and ESL tools improve system partitioning by taking compute intensive software code and mapping it directly into optimized and powerful hardware accelerators

Xilinx | 408-559-7778

Contact: more_info@xilinx.com

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**Cool FrontRunner-AF**

The LiPPERT by ADLINK™ Cool FrontRunner-AF is a PC/104-Plus single board computer (SBC) featuring an AMD Fusion accelerated processing unit (APU), 1.0/1.65 GHz, and outstanding graphics capabilities. The APU supports single or dual-independent, high-resolution displays and exceptional multi-media capability with hardware decode support for H.264, VC-1, MPEG2, WMV, DivX, and Adobe Flash.

DirectX® 11 support guarantees awesome graphics performance, stunning 3D visual effects, and dynamic interactivity. Advanced discrete-level GPU with OpenGL 4.0 and OpenCL™ 1.1 support in an integrated device provides ability to build the designs of tomorrow, today. Unprecedented graphics performance/watt through advanced graphics and hardware acceleration deliver over 3X performance per watt of previous generation.

**FEATURES**

- › AMD Fusion APU, single and dual core
- › Up to 4 Gbytes DDR3 RAM
- › Graphics: Radeon HD6250
- › LVDS: 1920 x 1200 pixel
- › Gigabit LAN, 8 x USB 2.0
- › SATA port
- › High Definition Audio
- › Power consumption: max. 18 W

ADLINK Technology | 408-360-0200**Contact:** info@adlinktech.com**Cool RoadRunner-945GSE**

The LiPPERT by ADLINK™ Cool RoadRunner-945GSE is a PC/104-Plus Single Board Computer (SBC) featuring the Intel® Atom™ N270 processor, and delivering high computing performance while consuming little power. Its Atom processor was created with today's most advanced semiconductor technology and is especially suitable for low-power embedded devices.

The Cool RoadRunner-945GSE is available in the standard temperature range of 0° C to +60° C. Optionally, it can be ordered for the extended range of -40° C to +85° C. There are standard cooling solutions available for both temperature ranges. A suitable heat spreader is already included.

**FEATURES**

- › Intel® Atom™ N270 Processor
- › Up to 2 Gbytes soldered DDR2-RAM
- › SXGA: 2048 x 1536 pixel, CRT and LVDS
- › Gigabit Ethernet
- › 8 x USB 2.0, 2 x RS-232/RS-422/RS-485
- › 2 GB Solid State Disk
- › HD audio
- › 2 x SATA

ADLINK Technology | 408-360-0200**Contact:** info@adlinktech.com



www.aim-online.com

AP104-1553-x

MIL-STD-1553 Test & Simulation Module for PC/104-Plus with 1, 2 or 4 Dual Redundant Streams plus up to 8 bidirectional Discrete I/O signals.

The AP104-1553-x is a member of AIM's new family of advanced PC/104-Plus bus modules targeted to embedded MIL-STD-1553A/B applications.

The AP104-1553-x Full Function version concurrently acts as the Bus Controller, Multi RT (31) & Chronological Monitor. Single Function & Simulator Versions are also available.



FEATURES

- › Complex Triggering, Data Capture/Filtering, 100% Bus Recording
- › Full Error Injection/Detection (AS4112)
- › Physical Bus Replay
- › Extended temperature range variants available
- › Driver Software included: Windows XP/Vista/7, Linux
- › Optional Databus Test & Analysis Software plus RT Production Test Plan SW

AIM-USA | Toll free 877-520-1553

Contact: salesusa@aim-online.com

For more information: www.aim-online.com/products/hardware/mil-std-1553/ap104-1553-x.aspx



www.WinSystems.com

Fanless 1.66 GHz Atom™ PC/104 SBC with stackable PCI Express

WinSystems' PXM-C388-S single board computer uses Intel's Atom N455 single core 1.66GHz processor and ICH8M I/O controller. Its onboard I/O supports CRT/LVDS video simultaneously, Gigabit Ethernet port, 8 USB 2.0 ports, 2 serial RS-232/422/485 COM channels, 2 serial RS-232 COM channels, 24 digital I/O lines with event sense, HD audio, and a watchdog timer. Its PC/104 and SUMIT A/B connectors provide additional I/O expansion.

Designed for upgrading PC/104-based designs with Intel's Atom processor family, the PXM-C388-S blends high-speed serial bus expansion with legacy PC/104 I/O module migration to strike a balance of high-integration computing power for existing cost-effective applications. It supports Linux, Windows, and other x86-compatible real-time operating systems with fanless, -40°C to +85°C temperature operation.



FEATURES

- › 1.66GHz Atom™ N455 powered PC/104 SBC
- › Advanced power management features
- › Simultaneous LVDS and CRT video supported
- › Gigabit Ethernet, four serial ports, and eight USB ports
- › 24 digital I/O lines with event sense
- › Up to 2GB DDR3 SODIMM system memory and CompactFlash supported
- › PC/104 and SUMIT™ connectors for I/O module expansion
- › Fanless, -40°C to +85°C temperature operation
- › Runs Linux, Windows®, and other x86-compatible operating systems
- › Long-term PC/104 product availability
- › Designed for rugged, embedded and Mil/COTS applications

WinSystems, Inc. | 817-274-7553

Contact: Info@WinSystems.com

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www.WinSystems.com

Multifunction PC/104 A/D, D/A, and DIO Module

The PCM-MIO is a versatile, PC/104-based analog input, analog output, and digital I/O board. The board's precision converters and voltage references require no calibration.

It will support up to 16 single-ended input channels or 8 differential input channels with a 16-bit A/D. The software-programmable input ranges are $\pm 5V$, $\pm 10V$, 0-5V, and 0-10V. There are eight, 12-bit Digital-to-Analog (D/A) converters with individual software programmable voltage ranges of $\pm 5V$, $\pm 10V$, 0-5V, and 0-10V. A total of 48 bidirectional TTL-compatible digital I/O lines can be software configured as input, output, or output with readback.

The PCM-MIO operates over the industrial temperature range of $-40^{\circ}C$ to $+85^{\circ}C$. Free software drivers are available for C, Windows®, and Linux.

WinSystems also offers one configuration with A/D only and another with only D/A to reduce system cost.



FEATURES

- › Two, 16-bit 100K samples/sec Analog-to-Digital (A/D) converters
- › Two quad, 12-bit Digital-to-Analog (D/A) converters
- › 48 bidirectional TTL-compatible digital I/O lines
- › Free software drivers in C, Windows®, and Linux
- › $-40^{\circ}C$ to $+85^{\circ}C$ operational temperature
- › Lower cost A/D- or D/A-only configurations available
- › 30-day product evaluation program
- › Long term availability

WinSystems, Inc. | 817-274-7553

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COTS Collection: Boards, Carriers, Mezzanines, ICs: PC/104

www.mil-embedded.com/p364763



www.WinSystems.com

-40° to $+85^{\circ}C$ PC/104 SBC with Dual Ethernet

The PCM-VDX-2 is a highly integrated PC/104-compatible Single Board Computer (SBC) designed for space-limited and low-power applications.

The full-featured SBC includes a 1GHz Vortex86DX with 512KB of DRAM. I/O support includes two 10/100 Ethernet ports, four USB 2.0 ports and four COM channels. Its low power dissipation permits fanless operation over a temperature range from $-40^{\circ}C$ to $+85^{\circ}C$. This board is well suited for rugged applications requiring excellent processor performance in an embedded PC design.

The PCM-VDX-2 has x86 PC software compatibility, which assures a wide range of tools to aid in your application's program development and checkout. It supports both Windows® XP Embedded and Linux operating systems and other real-time operating systems. WinSystems provides free technical phone support to assist customers with system integration of our SBCs and I/O modules with their designs.



FEATURES

- › Fanless 1GHz Vortex86DX processor
- › Small size: 90mm x 96mm
- › Two 10/100 Mbps Ethernet controllers
- › Four USB 2.0 ports with overcurrent protection
- › Four serial RS-232/422/485 channels with FIFOs
- › 16 digital I/O lines with event sense supported
- › AC'97 audio, PATA, LPT, mouse and keyboard controllers
- › MiniPCI and PC/104 expansion connectors
- › $-40^{\circ}C$ to $+85^{\circ}C$ operating temperature
- › Long-term PC/104 product availability

WinSystems, Inc. | 817-274-7553

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www.AlphiTech.com

PCle-Mini-AD8200

The PCle-Mini-AD8200 with 1X Lane PCI Express Mini card and a simultaneously sampled A/D, offers a mix of up to 8 single-ended or 4 differential analog input channels. All channels feature programmable gain 1 or 2 and can be programmed to handle analog input with a single-ended or differential configuration.

The 16-bit A/D converters can provide a global acquisition and conversion time of $\leq 5\mu\text{sec}$ per sample per channel. The board offers a programmable digital filter with $\pm 5\text{ V}$ range and the -3 dB frequency is typically 15 kHz. In the $\pm 10\text{ V}$ range the -3 dB frequency is typically 23 kHz.

Alphi Technology offers a variety of PCI Express Mini cards: PCle-Mini-DA16, PCle-Mini-1553, PCle-Mini-ARINC429, PCle-Mini-CAN, PCle-Mini-DIO and more.



FEATURES

- > 8 channels 16-bit A/D converter simultaneously sampled
- > Fast throughput rate: 200 KSps for all 8 channels
- > 8 channels SE or 4 pseudo differentials
- > Single-ended or 4 differential channels
- > True bipolar analog input ranges: $\pm 10\text{ V}$, $\pm 5\text{ V}$ – selection applies to all channels
- > Analog input clamp protection
- > $1\text{ M}\Omega$ analog input impedance
- > Programmable 2nd order anti-alias analog filter
- > Over-sampling capability with digital filter
- > PCI Express compliant

Alphi Technology Corporation | 480-838-2428

Contact: sales@AlphiTech.com



www.magma.com

7 Slot PCIe Expansion Backplane (EB7NE-X8G2)

Magma expansion solutions provide a high-performance and low-latency way to take PCI Express signals outside the computer or server. Expand one PCIe slot to single or multiple slots on a separate backplane.

- Add (7) PCIe slots through a single host slot
- Use any combination of x1, x4, x8 or x16 PCIe cards
- Hot-swappable slots
- Board-sets or chassis options

Magma is a Service Disabled Veteran Owned Small Business (SDVOSB) located in San Diego, CA.



FEATURES

- > ATX style backplane with (7) x8 PCIe slots
- > Low profile PCIe host card
- > Automatic power-up control by computer
- > Hot pluggable PCIe slots means individual PCIe slots can be turned off without powering down
- > Supports peer-to-peer transfers between slots to provide full bandwidth
- > LEDs indicate correct installation
- > CE certified and FCC Class A verified
- > RoHS compliant

Magma | 800-285-8990

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www.rtd.com | AS9100 and ISO9001 Certified

Intel® Core™ 2 Duo CPU Family

RTD is proud to offer advanced single board computers with Intel Core 2 Duo 1.20 GHz and 1.86 GHz Processors on 45nm. These high-performance, energy-efficient SBCs offer a dual-channel DDR2 memory interface that ensures adequate memory bandwidth to keep up with both processor cores. An Intel Gen 5.0 integrated graphics engine provides extensive rendering capabilities. These modules support RTD's Advanced Digital and Analog I/O, which allows them to be used as single-board solutions for some data acquisition and controller applications. CMX models include high-definition audio with Cirrus Logic CS4207 Codec. The CMV configuration includes four x4 PCI Express links, and four USB 3.0 ports making it ideal for high-speed FPGA and DSP applications. This product line is available in Dual Core and Single Core configurations with PCIe/104 and PCI/104-Express stackable bus structures, or as a COM Express module. Rugged, modular, stackable enclosures are available.



FEATURES

- › COM Express, PCIe/104 and PCI/104-Express configurations
- › -40 to +85°C Operating Temperature @ 1.20 GHz
- › -40 to +70°C Operating Temperature @ 1.86 GHz
- › 2 GB surface-mount, dual-channel DDR2-667 SDRAM
- › Flat heat spreader and active heat sink options
- › Available in rugged, modular, stackable enclosures
- › SATA Disk Chip socket supports up to 32GB Flash Disk
- › One x16, Four x4 and Eight x1 PCI Express links
- › High-speed peripheral connections including USB 3.0 and GigE
- › Windows 7 ready with 16GB or 32GB Flash Disk
- › Supports Intel Virtualization Technology
- › Enhanced Intel Dynamic Acceleration Technology
- › 1066 MHz, source-synchronous Front Side Bus (FSB)
- › Intel Gen 5.0 Integrated Graphics Engine

RTD Embedded Technologies | 814-234-8087

Contact: sales@rtd.com

COTS Collection: Boards, Carriers, Mezzanines, ICs: PMC

www.mil-embedded.com/p363394



An Avnet Company

www.pinnacle.com

**Pinnacle
Data
Systems,
Inc.**

XMC-E24D/PMC-E24D Dual Display Graphics Module

PDSi offers these high-performance dual-display graphics modules in both XMC and PMC form factors. Using the ATI Radeon™ E2400 graphics controller from AMD, these modules enable VME, CompactPCI, and AdvancedTCA systems to take full advantage of AMD's embedded advanced graphics technology. They provide simultaneous independent support of either one digital DVI and one VGA analog display or two VGA displays at 32-bit color and up to 2048 x 1536 resolution.

This module provides the high performance, low power, flexibility, and long life-cycle availability required by many real-world embedded applications in industries such as military/aerospace, industrial control and instrumentation, telecom/datacom, and medical imaging.



FEATURES

- › Based on ATI Radeon E2400 graphics processor
- › Superior 2D and 3D graphics acceleration
- › On-chip GDDR3 video memory
- › Dual independent high-performance display interfaces
- › DVI-I and analog VGA (full size connectors)
- › Dual integrated triple 10-bit DACs for dual RGB output
- › Supports analog displays up to QXGA (2048 x 1536)
- › 32-bit color depth
- › Low-power 65nm design
- › Customization and third-party integration welcomed; extended availability assured

Pinnacle Data Systems, Inc., An Avnet Company
614-748-1150

Contact: info.sales@pinnacle.com



xes-inc.com

**XPedite5205: Rugged 4-port Router Running Cisco IOS**

The XPedite5205 Embedded Services Router (ESR) PMC/XMC is the highest performance, smallest available, rugged 4-port router hosting Cisco IOS® IP Routing software. It provides highly secure data, voice, and video communications to stationary and mobile network nodes across both wired and wireless links. When combined with UHF, VHF, Wi-Fi, and other radio platforms, the combination creates Mobile Ad hoc Networks (MANETs), without requiring a connection to central infrastructure. It uses the same Cisco IOS software that IT professionals in the military, energy, public safety, and other industries are already trained on, enabling organizations to expand their networks to include rugged embedded systems without any additional training.

FEATURES

- › Runs Cisco IOS software
- › Four integrated 10/100/1000 Ethernet ports
- › Cisco Unified Communications Manager Express (CME) support
- › Cisco Mobile Ready Net, which allows for mobile ad hoc networking and radio-aware routing
- › On-board hardware acceleration
- › Hardware encryption
- › Integrated threat control using Cisco IOS Firewall, Cisco IOS Zone-based Firewall, Cisco IOS Intrusion Prevention System (IPS), and Cisco IOS Content Filtering
- › Identity management using authentication, authorization, and accounting (AAA) and public key infrastructure
- › PMC/XMC form factor
- › Conduction- or air-cooled

Extreme Engineering Solutions, Inc. (X-ES) | 608-833-1155

Contact: sales@xes-inc.com
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Aeroflex Microelectronic Solutions**Digital, Analog, Power, RFMW, and Motion Solutions for HiRel Applications****Serving worldwide customers with HiRel standard products:**

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| • A-to-D Converters | • Voltage Regulators/Supervisors |

Aeroflex custom ASICs –**90 and 130nmHBD, 0.25 and 0.6 μ m technologies and FPGA to ASIC Conversions****Electronic Manufacturing Services:**

- Circuit Card Assembly
- Radiation Testing
- Custom Hybrid, Module and MCM Services

**Aeroflex | 719-594-8035****Contact:** info-AMS@aeroflex.com

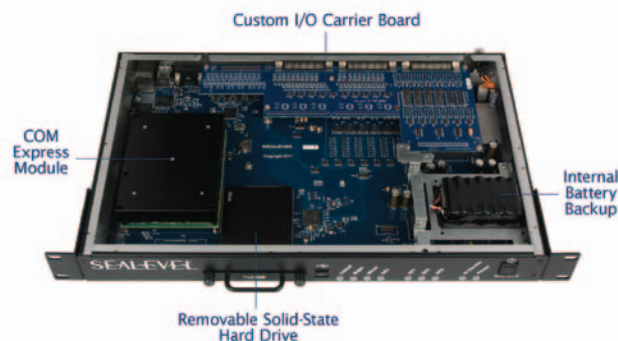


www.sealevel.com/custom

COM Express Custom Carrier Boards

COM Express, a widely supported implementation of Computer on Module (COM) design, minimizes the difficulty of custom computer board design by combining the processing, memory, video, Ethernet and USB functionality in a small, highly integrated module. The COM Express module brings the processor bus and high-speed I/O out to a connector that installs on purpose-built carrier boards and provides application-specific I/O and external connectors.

Sealevel carrier boards are customized to meet all required system functionality in addition to the core features supplied by COM Express modules. Sealevel can include common I/O features such as serial, analog and digital I/O, all of which can be designed to the exact electrical and mechanical requirements for your specific application.



FEATURES

- › Fast time to market
- › Scalability for easy upgrade
- › Application specific I/O
- › Flexible mechanical configuration
- › Vibration resistance
- › Extended operating temperature
- › Long-term availability
- › Superior life cycle management

Sealevel Systems, Inc. | 864-843-4343

Contact: sales@sealevel.com

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xes-inc.com

XPedite7450: Intel Core i7 Rugged COM Express Module

The XPedite7450 is a rugged COM Express module that complies with the PICMG COM Express Basic form factor (95mm x 125mm) and supports an enhanced Type 6 pinout. It supports the 2nd/3rd generation Intel Core i7 processors and Intel QM67 chipset. The small footprint and standards-based form factor make the XPedite7450 perfect for portable and rugged environments, while providing an upgrade path for the future.

The XPedite7450 provides ruggedization and reliability features not found on commercial COM Express modules. These include class III PCB fabrication and assembly, soldered DDR3 ECC SDRAM, additional mounting holes for rugged and conduction-cooled environments, tin whisker mitigation, designed and tested for extended solder joint reliability, and BIT support.



FEATURES

- › Dual- and quad-core Intel® Core™ i7-2655LE, -2610UE, -3555LE, -3517UE, and -3612QE processors
- › Up to 16 GB of soldered DDR3-1333 ECC SDRAM in two channels
- › 32 MB NOR boot flash and up to 16 GB of NAND flash
- › Two x8 PCI Express ports, one x4 PCIe Express port, and two x1 PCI Express ports
- › Two 10/100/1000BASE-T Gigabit Ethernet ports
- › Four USB 2.0 ports
- › Six SATA 3.0 Gb/s ports
- › Two digital display interfaces (DP/DVI/HDMI)
- › Intel High Definition Audio port
- › Wind River VxWorks and Linux Board Support Packages (BSPs), as well as Microsoft Windows drivers

Extreme Engineering Solutions, Inc. (X-ES) | 608-833-1155

Contact: sales@xes-inc.com

twitter.com/xes_inc • facebook.com/XES.INC



www.greatrivertech.com/arinc-818-made-easy-tools.html

Master the ARINC 818 Avionics Digital Video Bus

Military and commercial aerospace programs use ARINC 818, including the Boeing 787 and the Airbus A400M and A350XWB. Many fighter upgrades are underway. ARINC 818 is the commercial standard and de facto military standard to transport mission-critical avionics video.

Deliver video payloads from infrared sensors, optical cameras, radar, flight recorders, map/chart systems to cockpit displays. Do it reliably in real time.

Discover the versatility of ARINC 818. Use our powerful tools to understand, evaluate, and design your ARINC 818 solution.

Start with five free tools from Great River Technology, the leader in ARINC 818 implementation.



FEATURES

- › **Learn (Tool #1):** View a 30-minute narrated overview of the ARINC 818 protocol and applications from one of the authors of the ARINC 818 specification.
- › **Understand (Tool #2):** A 33-page Implementer's Guide introduces the protocol to engineers so they can structure and sequence data for an ARINC 818 system.
- › **Plan (Tool #3):** Use an ICD template to view all the parameters of an ARINC 818 system and to ensure interoperability of its components.
- › **Compare (Tool #4):** View all ARINC 818 parameters in complete interface control documents (ICDs) for XGA and SXGA resolutions.
- › **Design (Tool #5):** Compute values for your ICD parameters, including video line and frame timing, with this timing calculator.
- › **Prototype:** Implement your design with our Frame Grabbers, Converters, Switches, IP Cores, FPGA Dev and Eval Kits, Analyzers, and Generators. Consult our Engineers for design assistance.

Great River Technology, Inc. | 505-881-6262

Contact: grt@greatrivertech.com
www.greatrivertech.com



www.wolf.ca/products/xmc-e6760-vo

XMC-E6760-VO

XMC-E6760-VO video graphics GPU module supports up to six independent DisplayPort video outputs, or your choice of: four DisplayPort, two DVI, or one LVDS.

XMC-E6760-VO is conduction-cooled with an Extended Temperature operating range between -40°C and +85°C. It is designed to RIAC and MIL-810, and manufactured to exceed IPC Class 3.

WOLF offers its customers dynamic control of power from 20W to 43W based on the customer's system ability to conductively cool the board.



FEATURES

- › AMD™ Radeon™ E6760 GPU 600MHz
- › Up to 6 Independent DisplayPort Outputs
- › 576 GLOPS GPGPU Parallel Processing
- › 800MHz 128-bit 1GB GDDR5 Memory
- › Form Factor: XMC Short Card (VITA 42.3), Conduction-Cooled
- › Up to 8 Lanes PCIe 2.1
- › 40nm Process Technology
- › Shader Processing Units: 480
- › DirectX® 11; OpenGL® 4.1
- › Shader Model 5.0
- › OpenCL™ 1.2, AMD™ Stream Computing, DirectCompute 11
- › AMD™ Eyefinity™ Display

Wolf Industrial Systems, Inc. | 905-852-1163

Contact: sales@wolf.ca



Agilent Technologies

www.agilent.com/find/U1083A

U1083A VME/VXS 10- to 14-bit High-Speed Modules

Based on a scalable, modular architecture, the Agilent Acqiris VME/VXS board family platform U1083A features two Xilinx Virtex-4 FPGAs, one targeted at digital signal processing, and one for data flow control. An optional firmware development kit (FDK) is available to help development of application firmware on the FPGAs. The embedded FLASH memory allows the platform to be easily reconfigured to perform user-defined applications. The board is fully VME64x compliant and supports the 2eSST protocol, providing a substantial aggregate data bandwidth of more than 3.5 Gbps.

- U1083A-001:** 14-bit dual-channel, 10 to 500 MHz bandwidth, 1.2 GS/s high-speed generator
- U1083A-002:** 10-bit dual-channel, up to 3 GHz bandwidth, 2 GS/s, high-speed digitizer
- U1083A-003:** 10-bit ADC, 14-bit DAC, 1.2 GS/s high-speed data converter
- U1083A-005:** 12-bit quad-channel, 2 GHz, 500 MS/s high-speed digitizer
- U1083A-007:** 14-bit eight-channel, 300 MHz, 125 MS/s high-resolution digitizer

This architecture makes the U1083A platform ideal for wideband, high-dynamic-range demanding applications such as electronic warfare (EW), ESM/ECM applications, radar digital receiver/transmitter, telecommunications, and semiconductor testing, where high sample rate, high data-processing capabilities, and high throughput are mandatory.



FEATURES

- > 6U single slot VME/VXS (VITA 41)
- > 2 Xilinx Virtex-4 FPGAs, SX55 and FX100
- > Firmware development kit containing FPGA interface cores, software, and reference design
- > Two on-board DDR2 SDRAM banks (512 MB total) and local 128 MB FLASH memory able to store multiple FPGA bitstreams
- > VXS VITA 41.0 compliant, 8 x 3.125 Gbps serial I/O links on P0 connector
- > Two front panel SFP slots for up to 3.125 Gbps fiber or copper transceivers
- > Auxiliary I/O mezzanine with multipurpose 12-bit, 65 MS/s ADC, 12-bit, 130 MS/s DAC, and 14 digital I/O ports on front panel

Agilent Technologies Inc. | 800-829-4444

Contact: digitizers@agilent.com

Blog: <http://high-speed-digitizer.tm.agilent.com>

Twitter: https://twitter.com/High_speed_ADC



www.gocct.com

VX 91x/01x – VME/VXS Processor Board

The VX 91x/01x is a high performance VME/VXS processor board supporting the **3rd generation Intel® Core™ processor** and Mobile Intel® QM77 Express Chipset and with up to 16 Gbytes of DDR3-1600 ECC DRAM.

With an extensive range of I/O interfaces, in addition to 2 PMC/XMC sites, the board is suitable for a wide variety of applications, particularly within the defense, aerospace, and scientific market sectors. For harsher environments, the board is available in extended temperature and ruggedized variants.

To ensure ease of integration, support is available for a variety of operating systems including Windows®, Linux®, and VxWorks®.



FEATURES

- > 2- or 4-core 3rd generation Intel® Core™ processor
- > Up to 16 Gbytes DDR3-1600 DRAM with ECC
- > SATA interfaces and optional on-board drive
- > CompactFlash® site
- > 2 x PMC/XMC module interfaces
- > Triple independent graphics displays
- > Serial, Ethernet and USB interfaces
- > Optional VXS P0 connector supporting dual PCI Express® links (VITA 41.4) dataplane and dual 1000 Base-X ports (VITA 41.6) control plane
- > Optional BIT
- > Extended temperature and ruggedized variants available

Concurrent Technologies | 781-933-5900

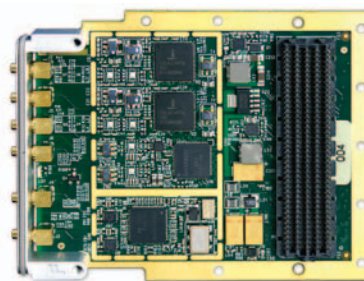
Contact: info@gocct.com

**FMC-500M**

The FMC-500M is a high speed digitizing and signal generation FMC I/O module featuring two 500 MSps A/D channels and two 500 MSps D/A channels supported by sample clock and triggering features.

The FMC-500M features two 14-bit 500 MSps or 16-bit 250 MSps A/Ds, either AC or DC-coupled, plus two 500 MSps update rate DACs. The DAC can be used as a single 1 GHz output channel. Analog I/O is either AC or DC coupled. Receiver IF frequencies of up to 250 MHz are supported. The sample clock is from either a low-jitter PLL or external input. Multiple cards can be synchronized for sampling.

The FMC-500M power consumption is 6W for typical operation. The module may be conduction cooled using the VITA 20 standard and a heat spreading plate.

**FEATURES**

- > Two A/D Inputs & 500 MSps, 14-bit & 250 MSps, 16-bit option
- > AC or DC coupled; two D/A outputs
- > 500 MSps, 16-bit D/A & 1 GSps single channel mode
- > Sample clocks and timing and controls
 - External clock/reference input; programmable PLL; 10 MHz, 0.5 ppm reference; integrated with FMC triggers
- > High Pin Count no SERDES required
- > Compatible with 1.2 to 3.3V VADJ
- > Power monitor and controls
- > 6W typical (AC-coupled inputs)
- > Conduction Cooling per VITA 20 subset

Innovative Integration | 805-578-4260

Contact: sales@innovative-dsp.com



www.gocct.com

TR 90x/x1x – 3U VPX processor board

The TR 90x/x1x is a high performance 3U VPX (VITA 46.0) processor board supporting the **3rd generation Intel® Core™ processors** and the Mobile Intel® QM77 Express Chipset. Additionally the board offers up to 16 Gbytes of DRAM and a wide range of I/O interfaces, further expandable by the addition of XMC modules.

The TR 90x/x1x can also be supplied as part of a pre-configured Development System that includes a VPX switch and Fabric Interconnect Networking Software (FIN-S). This software allows applications on multiple processor boards to communicate efficiently with each other over the PCI Express® interconnect fabric.

To further ease integration, support is offered for leading Operating Systems including Windows®, Linux® and VxWorks®.

**FEATURES**

- > 2- or 4-core 3rd generation Intel® Core™ processor
- > Up to 16 Gbytes DDR3-1600 SDRAM with ECC
- > 2 x SATA interfaces
- > Serial, USB, Ethernet interfaces
- > Graphics and optional audio interface
- > Configurable PCI Express® (PCIe) data plane fabric interface
- > Optional BIT and security package
- > Ruggedized conduction-cooled VPX-REDI versions available

Concurrent Technologies | 781-933-5900

Contact: info@gocct.com



www.annapmicro.com

WILD OpenVPX Four Slot Mesh Chassis

Annapolis enters the OpenVPX market with WILDSTAR 6 Xilinx Virtex-6 and WILDSTAR A5 Altera Stratix 5 FPGA Processing Boards, an 8 TB per slot WILD Storage Solution, a WILD Switch, a Four Slot and a Twelve Slot Chassis.

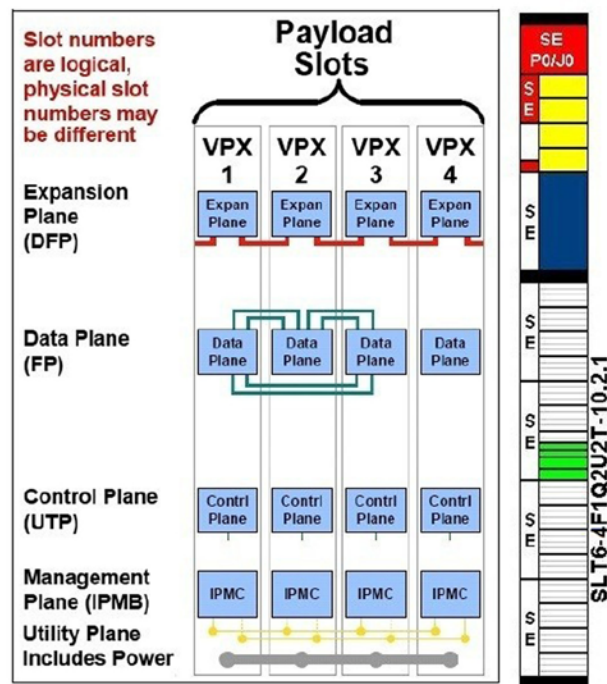
The Four Slot Mesh Chassis has a particularly powerful Backplane Configuration, as shown in the diagram.

The chassis could, for example, be filled with two of the 8 TB WILD Storage Cards, one WILDSTAR A5 Stratix V FPGA Processing Board, and a Single Board Computer.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Annapolis provides I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10Gb Ethernet, InfiniBand), and Tri XFP (OS 192, 10G Fibre Channel, 10Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

Develop your application very quickly with our CoreFire™ FPGA Application Builder, which transforms the FPGA development process, making it possible for theoreticians to easily build and test their algorithms on the real hardware that will be used in the field. CoreFire, based on dataflow, automatically generates distributed control fabric between cores.

Our extensive IP and board support libraries contain more than 1,000 cores, including floating point and the world's fastest FFT. CoreFire uses a graphical user interface for design entry, supports hardware-in-the-loop debugging, and provides proven, reusable, high-performance IP modules. WILDSTAR A5 for OpenVPX, with its associated I/O Cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.



FEATURES

- 4U High 19" Rack Mount Chassis with Front Mounted Horizontal OpenVPX Card Cage with Four Slots
- 4 Slot OpenVPX High Speed Mesh Backplane with Rear Transition Module Support
- 10+GBps on Data Plane for 10GBase-KR Ethernet, 40GBase-KR4 Ethernet, 10GBase-KX4 XAUI or SDR, DDR and QDR 4x InfiniBand
- 8x PCIe Gen 1, 2 or 3 on Expansion Plane
- 1000Base-X on Control Plane
- Large Power Supply
- Chassis Management, including Voltage, Temperature and Fan Monitoring and Control and a Front of Chassis Display Panel
- High Performance Convection Cooling with Replaceable and Cleanable Fan Tray and Filter
- Front Panel Power Switch, System Rest Switch and Maskable Reset Switch, all with Safety Covers
- Electromagnetic Shielding
- Includes one year hardware warranty

Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed. We offer training and exceptional special application development support, as well as more conventional support.

Save time and effort and reduce risk with COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition.



www.annapmicro.com

WILD OpenVPX Storage Board

Annapolis leads the OpenVPX market with the 8 Terabyte per slot WILD Storage Solution with 4GBps Write and 8GBps Read Bandwidth. The Storage Board has a Hot Swappable Canister containing up to 16 Pluggable 1.8" SSD SATA 3.x Drives, with 2, 4 or 8 Terabytes per Board.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Annapolis provides I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10Gb Ethernet, InfiniBand), and Tri XFP (OS 192, 10G Fibre Channel, 10Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

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FEATURES

- › 4 GBps Write and 8 GBps Read Bandwidth
- › Up to 40Gb Ethernet or QDR InfiniBand on each of Four Fat Pipes on P1 for a total of 20GBps on P1
- › PCI Express 8x Gen 1, Gen 2 or Gen 3 on P2 and P5 of the OpenVPX Backplane
- › 2, 4 or 8 Terabytes per OpenVPX Slot
- › Hot Swappable Canister
- › Up to 16 Pluggable 1.8" SSD SATA 3.x
- › API for Command and Control of the Storage Process
- › Includes one year hardware warranty

Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed. We offer training and exceptional special application development support, as well as more conventional support.

Save time and effort and reduce risk with COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition.

Annapolis Micro Systems, Inc. | 410-841-2514

Contact: wfinfo@annapmicro.com



www.annapmicro.com

WILD OpenVPX Switch Board

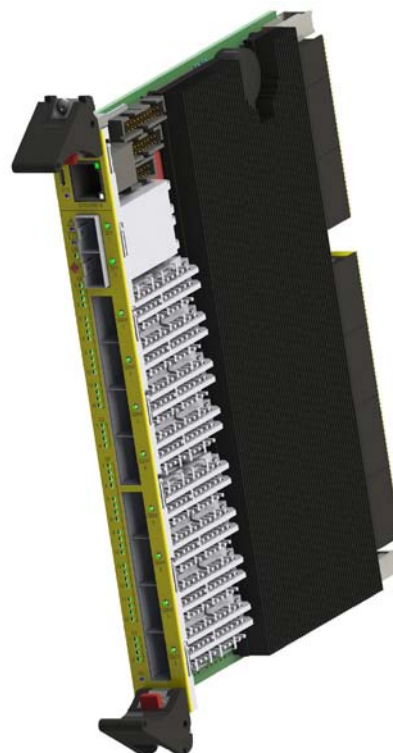
Annapolis leads the OpenVPX market with the WILD 6U OpenVPX (VITA 65.0 Compliant) Switch Board, with up to 4 Tbps non-blocking switching capacity with up to 8 switch partitions.

Supports OpenVPX Switch Profiles: SLT6-SWH-20U19F-12.4.1: 20 Control Plane and 19 Data Plane Backplane Ports; SLT6-SWH 16U20F-12.4.2: 16 Control Plane and 20 Data Plane Backplane Ports; SLT6-SWH-24F-12.4.3: = 24 Data Plane Backplane Ports.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Annapolis provides I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10Gb Ethernet, InfiniBand), and Tri XFP (OS 192, 10G Fibre Channel, 10Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

Develop your application very quickly with our CoreFire™ FPGA Application Builder, which transforms the FPGA development process, making it possible for theoreticians to easily build and test their algorithms on the real hardware that will be used in the field. CoreFire, based on dataflow, automatically generates distributed control fabric between cores.

Our extensive IP and board support libraries contain more than 1,000 cores, including floating point and the world's fastest FFT. CoreFire uses a graphical user interface for design entry, supports hardware-in-the-loop debugging, and provides proven, reusable, high-performance IP modules. WILDSTAR A5 for OpenVPX, with its associated I/O Cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.



FEATURES

- › 6U OpenVPX Board
- › Up to 4Tbps Non-Blocking Switching Capacity with up to 8 Switch Partitions
- › Multiprotocol Switch – SDR/DDR/QDR/FDR InfiniBand and 1/10/20/40 Gb Ethernet
- › Each Backplane and Front Panel Port can be Configured for either InfiniBand or Ethernet
- › Front Panel: Up to 8 QSFP+, Up to 2 SFP+, RJ45 Management Port, USB USART, LED Status
- › Supports OpenVPX Switch Profiles
- › InfiniBand and IP Routing
- › Ethernet Gateways
- › ChMc Management Plane Support
- › Includes one year hardware warranty

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WILD OpenVPX Twelve Plus 3 Slot Switched Chassis

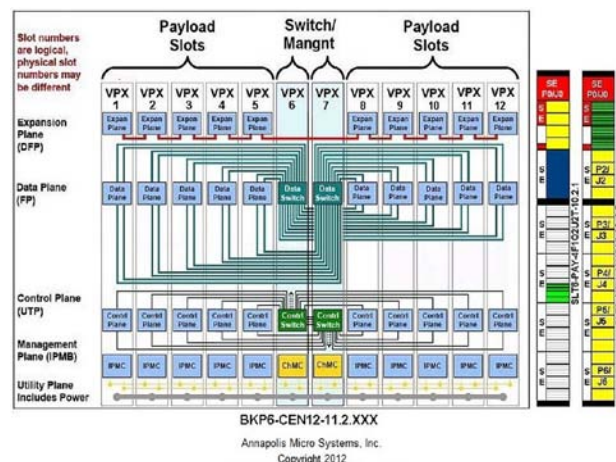
Annapolis enters the OpenVPX market with WILDSTAR 6 Xilinx Virtex-6 and WILDSTAR A5 Altera Stratix 5 FPGA Processing Boards, an 8 TB per slot WILD Storage Solution, a WILD Switch, a Four Slot and a Twelve Plus Three Slot Chassis.

With Ten Payload Slots and Two Switch Slots, and an option for Three VME/VPX Slots, the Twelve OpenVPX Plus 3 Chassis has a particularly powerful Backplane Configuration, as shown in the diagram.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Annapolis provides I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10Gb Ethernet, InfiniBand), and Tri XFP (OS 192, 10G Fibre Channel, 10Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

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FEATURES

- › 19" Rack Mount Chassis with Front Mounted OpenVPX Card Cage
- › Primary Twelve Slot 6U OpenVPX High Speed Switched Backplane with Rear Transition Module Support
- › 10+GBps on Data Plane for 10GBase-KR Ethernet, 40GBase-KR4 Ethernet, 10GBase-KX4 XAU1 or SDR, DDR and QDR 4x InfiniBand
- › 8x PCIe Gen 1, 2 or 3 on Expansion Plane
- › 1000Base-X on Control Plane
- › Secondary Three Slot VME/VPX Backplane for Power Only Payload Cards
- › Very Large Power Supply
- › Chassis Management, including Voltage, Temperature and Fan Monitoring and Control and a Front of Chassis Display Panel
- › High Performance Convection Cooling with Replaceable and Cleanable Fan Tray and Filter
- › Front Panel Power Switch, System Rest Switch and Maskable Reset Switch, all with Safety Covers
- › Electromagnetic Shielding
- › Includes one year hardware warranty

Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed. We offer training and exceptional special application development support, as well as more conventional support.

Save time and effort and reduce risk with COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition.

Annapolis Micro Systems, Inc. | 410-841-2514

Contact: winfo@annapmicro.com



www.annapmicro.com

WILDSTAR A5 for OpenVPX

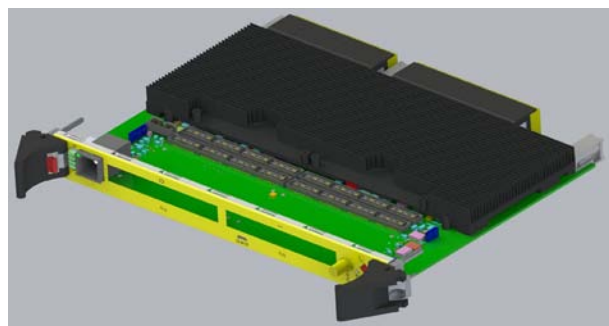
Supports up to Twenty-four 14G InfiniBand, Six 40Gb Ethernet, or Twenty-four 10G Ethernet Connections.

WILDSTAR A5 for OpenVPX uses Altera's newest Stratix V FPGAs for state-of-the-art performance. This is one of a series of Altera Based FPGA Processing Boards from Annapolis.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. It accepts up to four I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10Gb Ethernet, InfiniBand), and Tri XFP (OS 192, 10G Fibre Channel, 10Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

Develop your application very quickly with our CoreFire™ FPGA Application Builder, which transforms the FPGA development process, making it possible for theoreticians to easily build and test their algorithms on the real hardware that will be used in the field. CoreFire, based on dataflow, automatically generates distributed control fabric between cores.

Our extensive IP and board support libraries contain more than 1,000 cores, including floating point and the world's fastest FFT. CoreFire uses a graphical user interface for design entry, supports hardware-in-the-loop debugging, and provides proven, reusable, high-performance IP modules. WILDSTAR A5 for OpenVPX, with its associated I/O Cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.



FEATURES

- > Supports up to Twenty-four 14G InfiniBand, Six 40Gb Ethernet, or Twenty-four 10G Ethernet Connections
- > Up to Three Altera Stratix V FPGA Processing Elements – GSD4, GSD5, GSD6, GSD8, GXA3, GXA4, GXA5, GXA7, GXA9, GXAB
- > Up to 8 GBytes DDR3 DRAM in 4 Memory Banks and Up to 80 MBytes QDR II + SRAM in 5 Memory Banks per WILDSTAR A5 for OpenVPX Board
- > Programmable FLASH for each FPGA to Store FPGA Images
- > APM86290 PowerPC on Board Host
- > PCI Express Bus Gen 1, Gen 2, or Gen 3 to P2 Expansion Plane through On Board PCIe Switch
- > Full CoreFire Board Support Package for fast, easy application development
- > VHDL model, including source code for hardware interfaces and ChipScope Access
- > Available in both commercial and industrial temperature grades
- > Proactive Thermal Management System – Board Level current measurement and FPGA temperature monitor, accessible through Host API
- > Includes one year hardware warranty, software updates, and customer support
- > Training available

Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed. We offer training and exceptional special application development support, as well as more conventional support.

Save time and effort and reduce risk with COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition.



www.annapmicro.com

WILDSTAR 6 for OpenVPX

Annapolis Micro Systems is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Our 14th-generation WILDSTAR 6 for OpenVPX uses Xilinx's newest Virtex-6 FPGAs for state-of-the-art performance. It accepts one or two I/O mezzanine cards in one VPX slot or up to four in a double wide VPX slot, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OS 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows, Linux, Solaris, IRIX, ALTIX, and VxWorks. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models.

Develop your application very quickly with our CoreFire™ FPGA Application Builder, which transforms the FPGA development process, making it possible for theoreticians to easily build and test their algorithms on the real hardware that will be used in the field. CoreFire, based on dataflow, automatically generates distributed control fabric between cores.

Our extensive IP and board support libraries contain more than 1,000 cores, including floating point and the world's fastest FFT. CoreFire uses a graphical user interface for design entry, supports hardware-in-the-loop debugging, and provides proven, reusable, high-performance IP modules. WILDSTAR 6 for OpenVPX, with its associated I/O cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.

Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed. We offer training and exceptional special application development support, as well as more conventional support.



FEATURES

- › Up to three Virtex-6 FPGA processing elements – XC6LX240T, XC6LX365T, XC6LX550T, XC6SX315, or XC6SX475
- › Up to 7 GB DDR2 DRAM in 14 banks or up to 448 MB DDRII or QDRII SRAM
- › OpenVPX backplane
- › 80 x 80 crossbar connecting FPGAs and VPX backplane
- › 1 GHz 460EX PowerPC onboard host
- › 4X PCIe controller
- › Programmable Flash to store FPGA images and for PCI controller
- › Full CoreFire Board Support Package for fast, easy application development
- › VHDL model, including source code for hardware interfaces and ChipScope Access
- › Host software: Windows, Linux, VxWorks, etc.
- › Available in both commercial and industrial temperature grades
- › Proactive Thermal Management System – Board level current measurement and FPGA temperature monitor, accessible through host API
- › Save time and effort and reduce risk with COTS boards and software; achieve world-class performance – WILD solutions outperform the competition
- › Includes one-year hardware warranty, software updates, and customer support; training available

Annapolis Micro Systems, Inc. | 410-841-2514

Contact: wfinfo@annapmicro.com



www.elma.com

Elma 3U OpenVPX Storage Module

The 3VPX9289 is a 3U OpenVPX™ Storage Module providing front-removable, hot-pluggable CFast™ storage, enabling fast and easy system upgrades, reconfigurations and repairs. Designed for high-speed system boot and data access operations, the 3VPX9289 offers dual CFast drives – one front removable and one internal – for maximum operational flexibility.



FEATURES

- › Dual and single CFast configurations. Capacities currently up to 64GB for a total of 128GB of rugged dependable SSD storage
- › Serial ATA CFast drives – data rates up to 106MB/sec write and 108MB/sec read. Data rates are media and operating system dependent
- › Front-panel LED drive activity indicators
- › Available in extended temperature, shock and vibration version

Elma Electronic Inc. | 510-656-3400

sales@elma.com



VPX6-COP 3U OpenVPX Coprocessor with FPGA Core & FMC I/O

The VPX6-COP is a flexible FPGA coprocessor card that integrates a Virtex-6 FPGA computing core with an industry-standard FMC I/O module on a 3U OpenVPX card.

The FPGA computing core features the Xilinx Virtex-6 FPGA family, in densities up to LX550 and SX475. The SX475 provides over 2000 DSP MAC elements operating at up to 500 MHz. The FPGA core has two 9MB QDRII+ SRAM banks, two 256MB LPDDR2 DRAM banks, and a 128MB DDR3 bank. Each memory is directly connected to the FPGA and is fully independent.

For system communications, the VPX6-COP has a PCI Express and two SRIO/Aurora interfaces.

Data Sheets and pricing are available online.



FEATURES

- › FMC I/O site (VITA 57) with 8x 5 Gbps MGT lanes, 80 LVDS pairs (LA, HA, HB full support)
- › 2 banks of 256 MB DRAM (512MB total)
- › 2 banks of 9MB QDRII+ SRAM (18MB total)
- › 128MB DDR3 DRAM
- › VPXI system-timing features supporting global and local timing and triggering features
- › Gen2 x8 PCI Express providing 4 GBps burst and 2 GBps sustained transfer rates
- › Two Serial RapidIO or Aurora ports supporting x4 Gen2 (2 GBps)
- › < 15W typical excluding FMC
- › Ruggedization Levels up to L4
- › Forced air or conduction cooling
- › 40g shock, 9g sine vibration

Innovative Integration | 805-578-4260

Contact: sales@innovative-dsp.com



VPXI-ePC Air Cooled 4U 1/2 Rack OpenVPX Computer

The VPXI-ePC is a 4U VPX embedded computer system that provides a performance architecture for instrumentation, signal processing and embedded computing applications. Four expansion slots, plus an IO/HDD drive, are in a compact half rack, 4U enclosure. The VPX-COMEX CPU combines an Intel-architecture COM Express CPU module with timing and communications features. Real-time, data-intensive operation is built on multiple, high performance data planes employing both centralized and mesh topologies interconnections between the cards.

VPXI integrates timing features into the VPX architecture providing synchronized high performance clock and trigger features to each slot. Peripheral slots receive a dedicated clock and trigger input, as well as several shared coordination signals. These signals are used by VPX-COP, X6 (see FPGA cards within guide) and X3 I/O card families and support simultaneous and coordinated sampling. An optional high precision GPS can be used with the VPX-COMEX as a timing reference.

The backbone of the system in the VPXI-ePC comprises the PCIe and SRIO planes in the VPXI system. Each plane can sustain data rates over 500 MB/s concurrently on PCIe and SRIO planes. The SRIO data plane also has a x4 optical link on the front panel supporting 12 Gbps connection.

The VPXI may host one VPX-COMEX CPU card to create a Windows/Linux/VxWorks compatible PC. The VPXI-ePC can run the same applications as desktop systems. Performance OSs such as Linux Xenomai and VxWorks are available for real-time applications.

Download Datasheets & Pricing Now!



FEATURES

- > VPX for Instrumentation
- > 4U OpenVPX embedded computer system
- > Integrated timing and triggering
- > Advanced multiple plane connectivity
- > Rugged with wide-temperature options
- > Embedded PC
- > Runs Windows, Linux or VxWorks
- > COM Express module with Intel i5/i7 CPU with up to 8 GB memory
- > Gb Ethernet, 4x USB, DisplayPort video
- > 256GB SSD + up to 3 removable drives
- > Half (1/2) rack, 4U system
- > Six slots total: CPU slot + 4 OpenVPX Peripheral Slots + Storage/I/O Slot
- > Compatible with many OpenVPX cards
- > Up to 3 HDD/SSD storage slots
- > Supports Innovative X3/X5/X6 and VPX-COP
- > Integrated timing and triggering features
- > Synchronized, multi-card sampling
- > Internal or external clock/references
- > Generate low phase noise sample clocks from 0.125 to 1 GHz
- > 10 MHz, 0.5 ppm stable clock reference
- > Optional GPS-disciplined reference
- > Advanced architecture supports multiple data planes
- > PCI Express and SRIO planes
- > Mesh interconnects all I/O cards
- > Front panel x4 optical link for SRIO I/O
- > Rear Terminal Modules for I/O and CPU slots
- > Forced air cooling with upper and lower fans
- > Integrated 500W power supply
- > Expands to additional VPXI chassis using cable PCI Express option

Innovative Integration | 805-578-4260

Contact: sales@innovative-dsp.com



www.kontron.com

VX3042 & VX3044 – 3U OpenVPX Single-board Computers

Kontron recently announced its 3rd generation of 3U OpenVPX™ single-board computers (SBCs) with the latest interface technology based on the 3rd generation Intel® Core™ i7 processors. They are the first 3U OpenVPX™ SBCs with native support for 10 Gigabit Ethernet and PCI Express 3.0 to meet and exceed even the highest bandwidth demands of network centric military, aerospace and transportation applications. The Kontron 3U OpenVPX™ SBCs VX3042 and VX3044 are specifically designed to provide the ideal combination of leading-edge performance, power efficiency and bandwidth to long life-cycle applications. The new Kontron 3U OpenVPX™ SBCs VX3042 and VX3044 are backed up by Kontron's Long Term Supply (LTS) program with a 15-year life cycle to fulfill the demands of current and upcoming military and transportation programs. The new Kontron VX3042 and VX3044 are available now and support Windows Embedded Standard 7, Linux and VxWorks.

**FEATURES**

- › VX3042 – 3U Intel® Dual-Core™ 3rd Generation Intel® Core™ i7
- › VX3044 – 3rd gen Core™ i7 quad-core 3U VPX Single Board Computer
- › Dual 10 Gigabit Ethernet
- › PCI Express Gen 3.0, with Kontron VXFabric™
- › Up to 3 simultaneous graphics heads
- › Turnkey Evaluation/Development Platforms

Kontron | 888-294-4558

Contact: info@us.kontron.com

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www.parvus.com

DuraNET 40-10

Rugged, high-performance 10 Gigabit/1 Gigabit Multilayer Ethernet router, switch and security appliance optimized for tactical edge IP LAN and WAN networking deployments in military/aerospace/civil applications. Integrating up to 20 ports of fully managed routing, switching, and security services in a single hardened subsystem, this robust networking solution is primed for Size, Weight, and Power (SWaP)-sensitive situational awareness tech refreshes onboard aircraft, ground vehicles and maritime platforms. For maximum reliability and 2-level maintenance (2LM) field serviceability, the unit features a high-performance 3U VPX blade architecture, including a 3U VPX-REDI secure router/switch card and MIL-STD-704/1275 compliant power supply line replaceable modules (LRMs), as well as a spare 3U VPX payload slot to support customized system configurations (i.e. integrated Single Board Computer).

**FEATURES**

- › Up to 20-Port L2/L3 Network Router/Fully Managed Ethernet Switch/Security/Appliance
- › High Bandwidth Broadcom IP Packet Processor & Quad-Core Freescale Management Processor
- › Conduction-Cooled 3U VPX Blade Architecture
- › ARINC 404A ATR Chassis/Flange Mount
- › MIL-STD-810G, MIL-STD-461F, MIL-STD-1275/704
- › Support for Optional 1 Gig/10 Gig Ethernet Fiber Optic Interfaces
- › SWaP Optimized Open Architecture 3U VPX Cards (VITA 46/48/65)
- › -40 to +71 °C Fanless Extended Temp Operation with No Moving Parts
- › Extended Temperature, Ultra-Rugged Conduction-Cooled VPX
- › Data Zeroization Support to Erase Sensitive Information

Parvus Corporation | 800-483-3152

Contact: sales@parvus.com

LinkedIn: Parvus Corporation • Facebook: Facebook.com/parvusCorp

CONCURRENT TECHNOLOGIES

www.gocct.com

VP 91x/x1x – VME processor board

The VP 91x/x1x is a high performance VME processor board supporting the **3rd generation Intel® Core™ processors** and Mobile Intel® QM77 Express Chipset, and with up to 16 Gbytes of DRAM.

The board offers a wide variety of I/O interfaces that can be further extended through the addition of XMC or PMC modules. With optional support for a variety of security features, the board is particularly suitable for applications within the defense and aerospace markets. For harsh environments, extended temperature and ruggedized variants are available.

Support is available for many of today's leading operating systems including Windows®, Linux® and VxWorks®.



FEATURES

- › 2- or 4-core 3rd generation Intel® Core™ processor
- › Up to 16 Gbytes DDR3-1600 DRAM with ECC
- › SATA interfaces and optional on-board mass storage drive
- › Onboard CompactFlash® site
- › 2 x PMC/XMC module interfaces
- › 3 x Ethernet interfaces with optional support for VITA 31.1 interface
- › Graphics, keyboard and mouse
- › Optional BIT
- › Optional security package
- › Extended temperature and ruggedized variants available

Concurrent Technologies | 781-933-5900

Contact: info@gocct.com



PMC-SD18 and XMC-SD18 SATA HDD/SSD Storage Modules

These new SATA Storage Modules are offered in both PMC and XMC formats. Both provide high capacity SATA storage using compact 1.8 inch hard disk (HDD) or solid state drives (SSD) – up to 250GB of storage is available with either drive type. Whether configured with an economical rotating HDD or with a highly shock-resistant SSD, these low profile modules fit comfortably into VITA 42.3-compatible VME, CompactPCI®, AdvancedTCA®, and PCI Express processor boards without risk of mechanical interference.

The onboard 4-port SATA controller provides 3 additional external drive interfaces. OS support includes Windows, Linux, Solaris x86, and Solaris SPARC. Critical military and aerospace applications will appreciate the high operating shock resistance (1000+ G) and high MTBF (over 1 million hours) when configuring these modules with the latest SSD technology.



FEATURES

- › High-capacity 1.8 inch SATA storage PMC and XMC
- › Low-cost rotating HDDs for normal uses
- › Rugged SSDs available for high shock and vibration
- › Up to 250GB SSD storage capacity
- › Featuring Intel advanced SSD technology (80GB and up)
- › 3 additional SATA channels
- › Windows, Linux and Solaris support
- › Customization welcomed, extended availability assured

Pinnacle Data Systems, Inc., An Avnet Company
614-748-1150

Contact: info.sales@pinnacle.com



**Pinnacle
Data
Systems,
Inc.**

An Avnet Company

www.pinnacle.com

XMC-GBX Quad Gigabit Ethernet Adaptor

This quad gigabit Ethernet XMC is a high-performance, low-latency network adaptor providing four high-speed Ethernet interfaces for use with VITA 42.3-compatible VME, PCI Express, CompactPCI®, and AdvancedTCA® processor boards. It is available in three configurations offering a mix of front and rear port access.

Wide internal data paths eliminate performance bottlenecks. The parallel and pipelined logic architecture is optimized for Gigabit Ethernet and efficiently handles packets with minimum latency. Using widely accepted Intel 82571EB Ethernet controllers, this adaptor offers up to four 10BASE-T/100BASE-Tx/1000BASE-T copper ports with front-mounted RJ-45 connectors and full status indicators. Alternatively, up to four SERDES ports are accessible through the Pn4 connector for use via an appropriate copper or fiber-based rear transition module.



FEATURES

- › Quad Gigabit Ethernet interfaces – Copper or SERDES
- › Up to 4 10BASE-T/100BASE-Tx/1000BASE-T ports with RJ-45 front connectors with status indicators
- › Up to 4 rear-accessible SERDES ports via Pn4
- › Low-latency data handling
- › Efficient packet prioritization
- › Enables use of jumbo frames
- › Maximum system performance and throughput
- › Windows, Linux and Solaris x86 support
- › VITA XMC-compliant interfaces for high bandwidth
- › Customization welcomed, extended availability assured

Pinnacle Data Systems, Inc., An Avnet Company
614-748-1150

Contact: info.sales@pinnacle.com

The screenshot shows the OpenSystems Media TechChannels website. The main navigation bar includes links for Home, Integrations, E-cast & Virtual Event Schedule, White Papers, TechChannels, Video Library, and Product Guides. The 'TechChannels' section is active, displaying a list of articles under the 'Safety and Security' category. Articles include 'White Paper: No Room for Error: Creating Highly Reliable, High-Availability FPGA Designs', 'Silicon uniqueness as a security feature', 'The growth of IP communications drives advances in embedded military data security', 'New Safety and Security Articles', 'Safety and Security updates on Twitter', and 'Video: Boeing, Lockheed Martin, Raytheon, and Rockwell Collins demonstrate multiple independent levels of security (MILSI) at MILCOM 2008'. The website also features a sidebar with 'Start Options' and a 'Register Now' button.

Safety and Security TechChannel

Up-to-the minute,
in-depth, focused info

OpenSystems Media is continuing
innovation with TechChannels:

Microsites that explore topics in more detail. Combine contributed articles from industry experts with the best in staff-written material, and mix in instant information from:

- Latest news and videos
- Blogs
- White Papers
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tech.opensystemsmedia.com



Andale – High-speed data acq. with up to 48 TB Hard Disk

Andale is a powerful data logging system that directly controls an NTFS disk subsystem to support gap-free storage or playback of analog or digital signals acquired using the Innovative X-series XMC modules. The included logging software moves data in real-time between the analog or digital I/O peripherals on any Innovative XMC module to/from dedicated SATA drives with minimal intervention from application software or Windows.

Dedicated PCI Express SATA3 RAID controllers interface to conventional hard/SSD drives supporting data flow rates up to 2600 MB/s, sustained. File sizes are limited only by the amount of disk storage available. Two terabytes of storage are available in the standard configuration; an optional 48 TB configuration is available and even larger storage is supported via external JBOD enclosures.



FEATURES

- › Runs Windows7/i7 CPU in ATX enclosure with integrated cooling
- › Up to 48 TB Hard Disk Array
- › Expandable storage via external JBOD
- › 2600 MB/s sustained performance from analog or digital I/O module to standard NTFS disk files
- › Supports all Innovative X3, X5 & X6 I/O module features including triggering and timing features.
- › Wideband (500 MHz) logging/playback
- › Autonomous or Network-controlled operation via named pipe

Innovative Integration | 805-578-4260

Contact: sales@innovative-dsp.com

Mass Storage: Ruggedized SO-DIMM

www.mil-embedded.com/p369100



DDR3 Ruggedized SO-DIMM

The new DDR3 Rg SO-DIMM™ 4GB standard offers a cost effective way to satisfy the need for high durability standards in applications such as transportation, medical, military and aviation. In most respects the DDR3 Rg SO-DIMM™ 4GB and standard JEDEC SO-DIMM modules are identical. The DDR3 Rg SO-DIMM™ 4GB extends the module height by 4mm and allows for a pair of mounting holes for a more secure latching with low-level contact resistance. These modules have been successfully tested to 12G, per MIL STD 202 and are currently being designed for deployment in military vehicles. The new Rg SO-DIMM™ modules are rated at -40° to +85° or -20° to +70° C temperature operation, providing critical durability in the harsh environments they are designed to operate in. The DDR3 Rg SO-DIMM™ memory standard provides an easy and efficient way for makers of single board computers to enhance the ruggedness and reliability of their products.



FEATURES

- › JEDEC standard 1.5V $\pm 0.075V$
- › SSTL 1.5 interface
- › VDDQ = 1.5V $\pm 0.075V$
- › Module rank = 2
- › Non-ECC/64 bit wide
- › Supports 667 MHz clock (1333 MT/s)
- › Programmable CAS Latency 6, 7, 8, 9
- › Burst Length: 4, 8
- › Bidirectional differential data strobe
- › Thermal Sensor with Integrated SPD
- › FBGA DDR3 SDRAM
- › Screw mounted for Ruggedized applications
- › Module Height: 34.0mm, (1.34 in.)
- › Made in USA

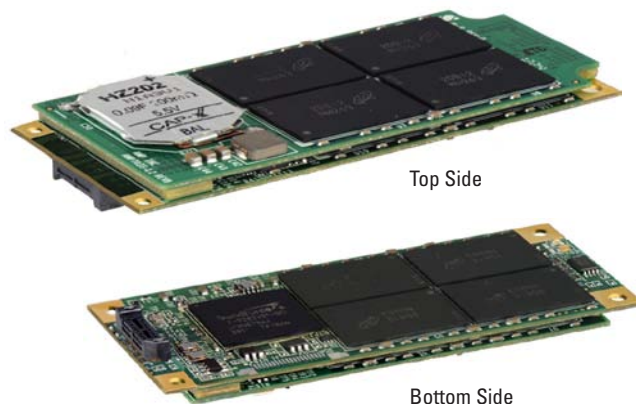
Accelerated Memory Production, Inc.
714-460-9800 • 800-778-7928

Contact: sales@ampinc.biz



SATA 3 Rg SSD™, Ruggedized with Advanced Encryption

The amp inc SATA 3 Rg SSD™, ruggedized with AES crypto engine of 256 bits, is the key to encrypt the entire SSD. This is a flash based solid state disk drive with SATA 3.0 compliant interface. It provides fast read and write speeds; high reliability and its data protection make it an ideal storage solution for the server and mobile environment. It is built with Multi Level Cell (MLC) NAND flash, which is cost effective while providing great performance. Due to its non-mechanical nature, it has higher shock resistance and lower access time than traditional rotating hard disks. Built-in ECC and EDC ensure error-free transactions for the most demanding applications.



FEATURES

- > Density 256GB & 480GB
- > User defined form factor
- > Host Interface 2.0 & 3.0 Compliant
- > Pin and socket connector
- > Weight 18.20g
- > Data Encryption (external) 256 bit
- > Military Erase
- > Power Requirements 3.3V ± 10%
- > Made in USA

Accelerated Memory Production, Inc.
714-460-9800 • 800-778-7928

Contact: sales@ampinc.biz

Mass Storage: Solid State Disk (SSD)

www.mil-embedded.com/p369096



Apacer's Compact high-speed mSATA industrial SSD for Ultrabooks

SSDs, with their advantages of high performance, compactness and low power consumption, are the perfect adaption of the storage to the emergence of tablet PCs and Ultrabooks. Indeed, SSDs have become the standard storage solution for ultra-thin notebooks.

Apacer, the leading manufacturer of industrial SSDs, has produced a new mSATA S1-M modular SSD that features a SATA 3.0 high-speed transmission interface and complies with the JEDEC MO-300 standard. The mSATA S1-M modular SSD is only one-third the size of a credit card. Its dimensions are 50.8 x 29.8mm and the product thickness is only that of a single PCB panel. In terms of product performance, the mSATA S1-M uses high-speed ONFi 2.2 DDR NAND Flash memory and the cache memory of plug-in DDRII, realizing estimated maximum sequential read/write speeds of 500/500 MB/sec and IOPs up to 60K. (Customer samples will be available in Q3.)



FEATURES

- > mSATA Connector
- > Mini PCIe form factor (50.8 x 29.8mm)
- > Compliant with JEDEC MO-300 standard
- > High IOPs (4K Random Write): Est. 60K
- > Built-in AES 128-bit encryption
- > Intel® Rapid Start and Intel® Smart Response support

Apacer Memory America, Inc. | 1-408-518-8699

Contact: ssdsales@apacerus.com



www.memoright.com

QuadLife Series SSD

QuadLife Series SSDs deliver constant sequential performance and constant random access performance and allow MLC-based SSDs to deliver longer lifespans for enterprise storage systems.

QuadLife Series SSDs are tuned for the enterprise storage area that demands extremely stable random access performance and lower cost storage solutions with MLC NAND. Normally MLC only takes up to 3,000 to 5,000 cycles of erasures. With Memoright's proprietary flash writing scheme, called Endurance Write, QuadLife is able to boost the MLC NAND endurance up to 20,000 cycles.



FEATURES

- › **Form Factor:** 2.5" & 1.8"
- › **High Capacity**
 - 2.5": 265/530 GB
 - 1.8": 220 GB
- › **Sequential Read/Write**
 - 2.5": Up to 220/190 MB/s
 - 1.8": Up to 200/180 MB/s
- › **Long Lifespan, P/E cycle:** 20,000
- › **Wide Temperature:** 0°C ~ +70°C
- › **MLC NAND Type**
- › **Support SATA**
- › **Humidity:** 5% ~ 95%
- › **InDrive UPS:** A specific energy storage element guarantees no data loss during any unexpected power spikes, dips or failures.
- › **Security Erase:** Memoright provides users both commercial and military Security Erase modes that can be triggered either by the hardware button or a sequence of commands.

Memoright Corporation

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Taiwan

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Memoright USA

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Memoright Corporation
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Contact: sales@memoright.com



www.microsemi.com

Rapid Erase TRRUST-Stor™ Data Storage

Whether in a compact BGA package or in a 2.5" SATA drive, Microsemi's ruggedized solid state data storage devices provide highest security and reliability for applications where data is critical. It's the new generation of secure data storage designed from the ground up for high-end industrial, aerospace, defense and intelligence applications requiring ultimate data protection.

These products can be ruggedized and processed for optimum information assurance. Our new Rapid Erase TRRUST-Stor drive offers unparalleled security and performance features including hardware-based encryption and loss prevention.

*When failure is not an option,
Microsemi solid state storage is the answer.*



FEATURES

- › 64/128GB Densities
- › TRRUST-Purge™ Protection renders data non-recoverable in milliseconds
- › Full drive erase in less than 4 seconds
- › Certified hardware-implemented AES-256 Encryption
- › Hardware-based authentication
- › Optional ruggedized SATA connector

Microsemi Corporation | 602-437-1520

www.microsemi.com

Mass Storage: Solid State Disk (SSD)

www.mil-embedded.com/p369043



www.phenxint.com

VP1-250X VPX Solid State Data Storage Module

The VP1-250X Serial Attached SCSI (SAS)/Serial ATA (SATA) based VPX blade delivers high capacity, high performance data storage for military, aerospace and industrial applications requiring rugged, secure and durable mass data storage.

The VP1-250X is a 3U VPX storage module and is available in air cooled and conduction cooled configurations. It integrates MLC, eMLC and SLC NAND SSDs and can be direct connected as a SAS/SATA Drive or via the PCIe interface. When used with supporting media, the VP1-250X supports the purge input to destroy media or the Zeroize that will erase the media.

The Phoenix VP1-250X's outstanding performance and versatility are enabled by Phoenix International's state-of-the-art technology, which provides high transfer and I/O rates, endurance and data integrity.



FEATURES

- › Conduction, REDI Conduction or Air Cooled
- › Supports SATA, SAS and PCI Express interfaces
- › Up to 80,000 Feet Operational Altitude
- › Operational Temperature from -40° to +85° C
- › Can be Configured to work from Fat Pipe A or B from the VPX bus
- › Integrated SLC, eMLC or MLC NAND SSDs
- › Meets Military and IRIG 106-07 Declassification Standards
- › Optional AES 256 Encryption
- › Advanced NAND Flash Management for Enhanced Reliability and Durability
- › Made in USA

Phoenix International | 714-283-4800

Contact: info@phenxint.com



www.ToughSSD.com

Proteus Plus SSD

TCS Space & Component Technology specializes in the best performing, highest quality ruggedized solid state drives for the most demanding environments. With a 100% focus on the military, aerospace and industrial markets, TCS can customize the performance and functionality of the drive to meet each customer application. All TCS SSDs are built in the USA at AS9100 or QML certified facilities to ensure high reliability.

Proteus Plus SSDs deliver mass storage in industry-standard form factors. They are available in a rugged milled Aluminum alloy case with standard 2.5" drive dimensions, allowing direct replacement of rotating disk drives. The speed and ruggedness of TCS' Proteus Plus Solid State Drives are also available in bare board form factors for embedded use. Available in capacities from 32GB to 256GB, these drives provide another option for delivering extreme ruggedness and reliability to applications where an industry-standard drive form factor is too large.

Proteus Plus SSDs support the SATA, revision 2.6, interface standard at up to 3.0Gb/s. With a high speed controller and 64MB of on-board cache, the Proteus Plus SSD delivers sustained reads up to 250MB/s and sustained writes up to 205MB/s. A robust interface is ensured by integrated hardware support for on-the-fly, per sector error detection and correction. The resulting Bit Error Rate is less than one in 10^{14} .

Applications

- Military and Defense – Ground, Sea and Air
- Ruggedized computers and notebooks, including small form factors like Netbooks
- Homeland Security/Surveillance/Mapping/Reconnaissance/Remote Sensing
- Aerospace avionics, cockpit instrumentation both commercial and defense
- Data recorders for extreme environments
- Portable and handheld devices
- Unmanned vehicles including UAVs, robotics and mine detection
- Radar/Guidance Systems and Telemetry/Tracking
- Extreme operating environments including oil & gas exploration and drilling
- Anywhere your SSD absolutely, positively has to work!



FEATURES

- Support for SATA version 2.6 at 1.5 and 3.0 Gb/s
- 64MB cache enables high IO/s for small block random operations
- Available with and without secure erase capabilities, triggered in hardware or software
- Available in a 2.5" hard drive form factor, or as a bare PCB in 2.5" or industry-standard JEDEC MO-297 and MO-300 form factors to meet a wide variety of applications
- Completely SATA compatible, no device driver development required

Specifications			
	2.5" SSD and 2.5" Bare PCB	MO-297A SlimSATA	MO-300B mSATA
Performance			
Raw Capacity	32, 64, 128, 256 GB	16, 32, 64 GB	16, 32, 64 GB
Sustained Read	Up to 250 MB/s	Up to 136 MB/s	Up to 136 MB/s
Sustained Write	Up to 205 MB/s	Up to 132 MB/s	Up to 132 MB/s
Random Read (4K blocks)	> 7500 IOPS	> 7500 IOPS	> 7500 IOPS
Random Write (4K blocks)	> 1700 IOPS	> 1700 IOPS	> 1700 IOPS
Erase Methods			
Fast Erase, DoD NISPOM 5220.22-M, DoD NISPOM 5220.22-M Sup 1, NSA/CSS 9-12, NSA 130-1, Army AR 380-19, Navy NAVSO P-5239-26, Air Force AFSSI-5020, RCC-TG IIRIG 106-7			
Power			
Input Voltage	+5Vdo ± 10%	+5.0Vdo ± 10%	+3.3Vdo ± 10%
Read Max	1.30 W	1.60 W	1.60 W
Write Max	2.00 W	1.50 W	1.50 W
Idle Power		0.4 W	0.4 W
Reliability			
Bit Error Rate	< 1 non-recoverable error in 10 ¹⁴ bits read		
Data Retention	> 10 years		
Endurance	> 100,000 writes		
Wear-leveling	Proprietary static and dynamic algorithms		
Environment			
Operating Temperature	-40°C to +85°C		
Storage Temperature	-50°C to +95°C		
Altitude	80,000 feet		
Humidity	5% to 95% relative humidity, non-condensing		
Shock	1.500G at 0.5ms		
Vibration	16.3Grms minimum		

TeleCommunication Systems, Inc. | 310-214-5500

Contact: tcssales@telecomsys.com



RPC12 Ruggedized Data Storage Array

The RPC12 is a high performance Fibre Channel/SAS/iSCSI host interface, 6Gb SAS/SATA-II RAID subsystem utilizing Hard Disk and Solid State Disk devices that deliver a level of operational environmental capability not previously available in COTS Data Storage Systems.

The Storage Area Network (SAN)-ready RPC12 features a 12-drive Array housed in a rugged 3U (5.25") panel height enclosure, providing 8Gb FC, 6Gb SAS or 10GigE iSCSI host interfaces to high performance 6Gb SAS and/or SATA SSDs and HDDs. It is designed to be compliant with military and industrial specifications such as MIL-STD-810F, MIL-STD-901D, MIL-STD-461F and NEBS Level 3.

The unique design of the RPC12's rugged, cableless, passive midplane-based, high density 3U chassis provides an increased environmental operational envelope (-20 to +70 degrees C, 45,000 ft. altitude with SSDs), redundant, hot-swap components and massive storage capacity, while assuring the highest level of data availability.



FEATURES

- › Single Active or Dual Active, Failover/Failback Controller
- › 8GB Fibre Channel, 6GB SAS or 10GigE iSCSI host ports
- › Sustained Data Rates in Excess of 700MB/sec per port
- › Battery-free Cache Backup
- › Enclosed and Electronically Isolated Hot-swap Drive Canisters
- › 40 to 440Hz, 90/240VAC Input Operation
- › Linux, Windows and UNIX Support (VMware and Cluster Certified)
- › Redundant, Hot-swap Components/FRUs
- › Management GUI and Failover Software
- › Very Cool Operation – Less than 12 Degrees F Max. Temp. Rise
- › Made in the USA

Phoenix International | 714-283-4800

Contact: info@phenxint.com

Mass Storage: USB Flash

www.mil-embedded.com/p365610



UFX RUGGEDrive™ Memory Token/Flash Drive

The **UFX RUGGEDrive™ Memory Token** is not your typical USB flash drive. It's **more rugged** and **more secure** than consumer flash drives, making it an ideal choice for harsh-environment embedded applications.

While it does function like a USB flash drive, the RUGGEDrive™ memory token utilizes solid over-molded construction – making it impervious to liquids and virtually crush-proof. RUGGEDrive™ receptacles are rated for 50,000 insertion cycles (compared to only 1,500 for USB) and are available with IP67 and MIL-STD-810F ratings. Standard cables connect RUGGEDrive™ receptacles to header or USB connectors on PC/104 and other single board computers. The UFX PC Adapter allows RUGGEDrive™ tokens to plug into standard PC USB ports. For increased security, each UFX token has a unique serial number, which can be utilized for data encryption.



FEATURES

- › USB 2.0 High-Speed (electrical) Interface
- › Capacities: 4GB, 8GB, 16GB, 32GB
- › Solid Over-Molded Construction
- › PCB-Mount and Panel-Mount Receptacle Options
- › Receptacles Rated for 50,000 Insertions (compared to only 1,500 for USB Type A)
- › Reduced Emission, MIL-STD-810F, IP67-Rated Receptacles
- › Fixed USB Vendor ID & Product ID
- › Unique Serial Number for Each UFX Memory Token
- › Receptacles Connect to Header and Type A USB Connectors
- › Ideal for Use in Harsh Environments with PC/104 and Other Single Board Computers
- › Adapter Allows UFX Tokens to be Used in Standard PC USB Ports

Datakey Electronics | 800-328-8828

Contact: info@datakey.com



A Wide Range of Remedies for Your Obsolescence Headaches

Microcross Components is a worldwide leader in solutions for obsolete components. We offer a complete turnkey package, replacing an unavailable part with a matching part using current technology. Closely collaborating with our customer, we design, assemble, test and deliver the final equivalent product. From 2-pin discretes to multichip modules, we have a history of success in engineering application solutions.

Your options range from sourcing the original die, storing it and packaging it as you need it, to a full ASIC design and manufacture. Other alternatives involve package modifications, electrical upscreening, and qualification testing. Microcross can change, form and finish leads. We also have a comprehensive set of counterfeit component identification methods including our own Contest-1K Device Comparison Tester.



FEATURES

- › In-house talent and facilities for design, product engineering, manufacturing, test and qualifications
- › Die sourcing and long term die storage
- › Ceramic and metal can assembly
- › Plastic package form, fit, and function replacement
- › Footprint adaptors
- › ASIC design
- › Upscreening
- › Test and qualification capabilities
- › COTS/iPEMS
- › SMD, M Level and QD Level
- › MIL-PRF-38534 Class H, MIL-PRF-38535 Class Q and Class V (assembly)
- › AS9100:2009-C and ISO9001:2008

Microcross Components | 1.855.4COMPONENTS

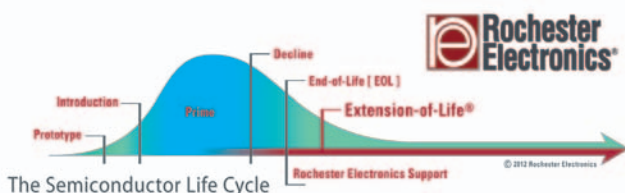
Contact: sales.americas@microcross.com



www.rocelec.com/

Extension-of-Life® (ExOL) Manufacturing

Semiconductor end-of-life announcements don't have to abruptly change your engineering project development schedules. Through Extension-of-Life® programs, Rochester Electronics can sustain the supply of your critical semiconductor devices for the life of your system. Authorized by 60+ semiconductor manufacturers, Rochester Electronics is a complementary source for finished goods, die and the re-creation of unavailable devices.



FEATURES

- › Only Rochester Electronics provides complete device replication services, performance guarantee, and sustained, long-term source of supply programs
- › Special Product Agreements (SPAs) are long-term supply programs tailored to reduce customers' end-of-life investments
- › Partner with original semiconductor manufacturers and Rochester Electronics to proactively create a viable continuing supply program to alleviate problems associated with obsolescence
- › Protect against semiconductor counterfeiting
- › Re-create devices even when original tooling no longer exists, the design archive is missing, or there is only one working device left
- › All products are 100% guaranteed and factory traceable

Rochester Electronics | 978-462-9332

Contact: sales@rocelec.com

Facebook: www.facebook.com/RochesterElectronicsLLC



www.aem-usa.com

AEM's Tin Whisker Mitigation Process

- Mitigation of tin whiskers through tin/lead conversion is critical for prevention of system failures due to short circuit.
- Tin/Lead conversion processing of RoHS components ensures resultant termination finish is a homogeneous mixture of Sn/Pb.
- The process ensures all areas of each component termination are converted to Sn/Pb including any egress or wraparound areas.
- The process includes monitoring of component quality going into and out of the Sn/Pb conversion process (QA1/QA2/DPA – to verify solderability, leach resistance, and terminal strength).



AEM's Tin Whisker Mitigation Process
Assures Surface-Mount Component Reliability

FEATURES

- › Most surface mount components including both passive and active can be processed using AEM's approach.
- › The conversion process is included within the scope of AEM's AS9100 and ISO 9001:2008 QMS certifications.
- › The process can be followed by 100% electrical or customer SCD requirements.
- › Both XRF and SEM/EDS are utilized to verify minimum 5% lead finish content.
- › AEM fully warrants all converted components.

AEM, Inc. | 858-481-0210

Contact: hrccsales@aem-usa.com

Packaging/Mechanical Chassis: 19" Rack

www.mil-embedded.com/p365412



ComputeNode™ CompactPCI Chassis Products

PDSi's ComputeNode line offers a range of NEBS Level 3-compliant CompactPCI chassis in sizes from 1U to 4U. These carrier-grade chassis include a horizontal design, superior air cooling, CompactPCI and cPSB (PICMG 2.16) backplanes, redundant hot-swappable fans, hot-swappable front-accessible AC or DC power supplies, and rear single or dual power feeds. All 2U and larger ComputeNode platforms include PDSi's unique Alert!Node™ (or Enhanced Alert!Node) alarm card, an intelligent chassis management controller for comprehensive fan and power monitoring. The Alert!Node card does not occupy a CompactPCI slot, front or rear.

OEMs and Independent Software Vendors (ISVs) can also take advantage of PDSi's design, integration, and support services, including custom board and system design, validation and certification, production assembly and test, as well as extended service programs.



FEATURES

- › Proven NEBS Level 3-compliant design
- › Designed for high availability applications
- › Redundant hot-swap fans
- › Redundant AC or DC power supplies
- › Power filters and dual feed power
- › Easily serviced
- › Broad range of chassis choices 1, 2, 3, and 4U sizes
- › CompactPCI and PICMG 2.16 (cPSB) backplanes
- › Alert!Node intelligent chassis manager
- › Customization and integration services available

Pinnacle Data Systems, Inc., An Avnet Company
614-748-1150

Contact: info.sales@pinnacle.com



SWaP Rugged Enclosure for OpenVPX

The modular design of this Mini ATR platform allows for various configurations. The chassis can easily be scaled up or down while using the same sidewalls. DC and AC power variations as well as custom front I/O configurations are available. Elma also offers a wide selection of backplanes in various architectures and has different milled card cage sizes off-the-shelf.



FEATURES

- › Small form factor Mini ATR-style chassis, natural convection-cooled is low weight, ideal for weight critical applications
- › 3-slot backplane meets VITA 65 Backplane Profile BKP3-CEN03-15.2.9-n, accepts 3U OpenVPX boards on a 1" pitch, according to VITA 48.2 (REDI)
- › Other backplanes can be accommodated: 3U cPCI, COM Express, custom
- › Two sizes available; other sizes custom
- › Advanced airflow design distributes air across external fins in sidewalls
- › Optional plug-in power supply & 2.5" storage with drive tray
- › Custom I/O options including MIL-STD wiring and connector

Elma Electronic Inc. | 510-656-3400

sales@elma.com



ATR System

Hartmann Rugged MIL $\frac{3}{4}$ ATR – the system platform conforms to the ARINC 404 standard, and provides an intelligent, practical packaging solution for different Backplanes, cPCI, PCI, VME64x, VME/VME64, VPX and custom.

- Operating temperature range of -40°C to +85°C
- Rugged aluminium dip-braided constructions is designed and optimized for cooling via thermal studies
- Low weight, ideal for applications where the weight is critical
- System is designed with enhanced EMI/EMC as per MIL-STD-461E features. Rugged yet stylish chassis conforms to mechanical standards IEEE 1101.20
- All standard cPCI, VME64x and more than 10 different OpenVPX Backplanes are available from stock



FEATURES

- › 9 slot VPX – Backplane, 8 VPX Slot + 1 Edge Board Slot + 1 Power Slot VITA 62
- › 100 x 160mm front side Edge Board with Mil 38999 Connectors
- › $\frac{3}{4}$ ATR Chassis, Conduction Cooled, with additional fans
- › Up to 6x DC fans, 40 x 40 x 38mm, rear sides, Airflow front to rear
- › Convection and Conduction cooled
- › H=193,5 W = 190,5 D = 320,5mm 8,5 kg
- › Power Supply 1x 300W or 400W VPX VITA 62, wide range input 18 - 36VDC
- › Slot pitch possible 0.8", 0.85" and 1"
- › Order number: RHE0000100

Hartmann Electronic | 937.324.4422

Contact: info@hartmann-electronic.com



xes-inc.com

XPand6000 Series: Small Form Factor (SFF) ATR Chassis

In a package less than 72 cubic inches and weighing less than 3.5 pounds fully populated, these convection- and conduction-cooled Small Form Factor (SFF) ATR enclosures support open-standard, COTS components: a COM Express processor module, a PMC/XMC I/O module, and a 1.8" SSD storage module. The COTS components are easily integrated into the XPand6000 Series enabling rapid development and rapid deployment into airborne or ground vehicles. The XPand6000 Series supports the highest performance Freescale QorIQ and Intel Core i7 processors. The PMC/XMC form factor is utilized for the plug-in I/O card because of the wide ecosystem of PMC/XMC I/O modules available from a number of vendors.

To address the needs of a wide range of small form factor system applications, the XPand6000 Series chassis is available in vertical and horizontal orientations.

**FEATURES**

- › A horizontally oriented, conduction-cooled version, 7.70" D x 4.88" W x 1.90" H, < 3.5 lbs. fully loaded
- › A horizontally oriented, natural convection-cooled version, 7.70" D x 4.88" W x 2.10" H, < 3.75 lbs. fully loaded
- › A vertically oriented, natural convection-cooled version, 7.10" D x 2.36" W x 4.88" H, < 4.0 lbs. fully loaded
- › Integrated MIL-STD-704 28 V DC power supply
- › Integrated MIL-STD-461E/F EMI filtering and optional internal hold-up
- › Environmentally sealed D38999 connector support with configurable I/O connections

Extreme Engineering Solutions, Inc. (X-ES) | 608-833-1155

Contact: sales@xes-inc.com
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Packaging/Mechanical Chassis: Backplane

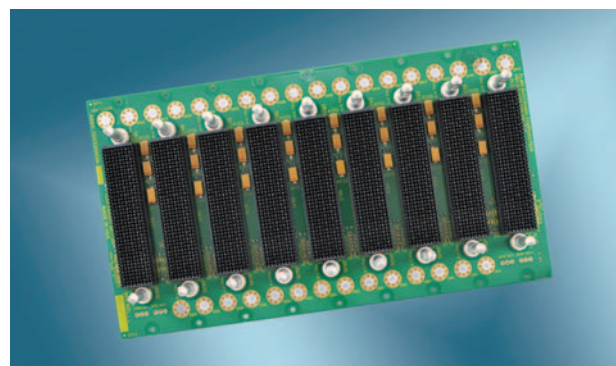
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www.elmabustronic.com

3U OpenVPX™ 9-slot Backplanes

Elma Bustronic offers two versions of the BKP3-CEN09-15.2.17-n Backplane: one with an expansion control plane and one without. Designed to VITA 65 design principles, the 9-slot OpenVPX backplane features a centralized routing topology. The switch slot is connected to slots 1, 5, 6, 7, 8, and 9. Slots 1-3 are also connected on the data plane.

**FEATURES**

- › Compliant with VITA 65 Backplane Profile BKP3-CEN09-15.2.17-n
- › Available with or without expansion control planes
- › Accommodates 3U OpenVPX boards
- › High-speed MultiGig connectors
- › Provides built-in ESD ground protection in every slot

Elma Bustronic | 510-490-7388

sales@elmabustronic.com



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VECTORPAK™ SYSTEMS PACKAGING

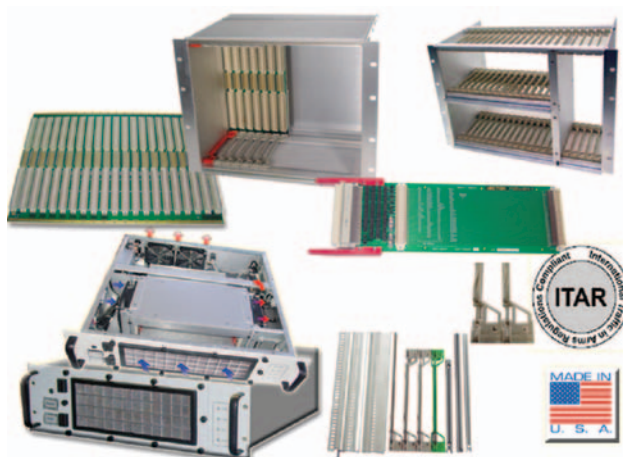
For over sixty years Vector has supplied packaging products including backplanes, chassis (VME, cPCI, PXI, etc.) and integration services to industry.

We insist on control of our supply chain and heavily invest in our own tooling, injection molds, dies and presses. We are the only **US manufacturer of complete DIN metric sub-rack systems.**

Our 3-D CAD capabilities, PCB design, metal fab, electro-mechanical and backplane assembly & test are all under one roof in our Los Angeles manufacturing facility.

Our commercial and rugged chassis have many power options. Vertical or horizontal card installation; shock and vibration tested to MIL-STD-461D and UL compliance.

Many of our products are available through our dynamic distributor network or contact us directly at Inquire@Vectorelect.com.



FEATURES

- > MADE IN THE USA
- > ITAR Registered
- > ISO 9001:2008/AS9100C Certified
- > Custom designs
- > 1101.10 Card Guides, rails & accessories
- > Chassis & sub-rack form factor 1U to 12U
- > COTS
- > Blank or Custom Front Panels
- > Custom Chassis design – 3D CAD

Vector Electronics & Technology, Inc. | 800-423-5659

Contact: inquire@vectorelect.com



www.rtd.com | AS9100 and ISO9001 Certified

IDAN, HiDAN, and HiDANplus

RTD Embedded Technologies, Inc. specializes in the design and manufacturing of rugged, turnkey PC/104 systems qualified for the most demanding applications. RTD's rugged HighRel systems include IDAN® (Intelligent Data Acquisition Node), HiDAN® and HiDANplus® (High Reliability Intelligent Data Acquisition Nodes). Each system is built using frames milled from solid aluminum blocks to exacting specifications ensuring that the solution is rugged and reliable. By following the proven PC/104 stackable standards, RTD's rugged box enclosures guarantee modularity and reconfigurability. Frames for thermally sensitive components have internally milled heat sinks and specialized thermal transport technology to move heat to the outside walls of the enclosure allowing operation from -40 to +85°C without the use of active cooling. Optional shock-mount bases withstand specific shock and vibration requirements. Visit www.rtd.com/systems to learn more.



FEATURES

- › -40 to +85°C Operation
- › Compatible with RTD's complete product line of PCI Express, PCI, and ISA modules
- › Modular Stack for easy upgrades and field serviceability
- › Shielding membranes for EMI suppression (HiDAN & HiDANplus)
- › Watertight (HiDAN & HiDANplus)
- › Shock-mount isolation options
- › Milled from solid T-6061 aluminum
- › Optional milled heat sink fins
- › Advanced thermal transport technology options
- › MIL-SPEC paint options
- › Standard PC interface connectors
- › MIL-SPEC cylindrical connectors
- › Deployed worldwide and proven in the field

RTD Embedded Technologies | 814-234-8087

Contact: sales@rtd.com

Packaging/Mechanical Chassis: Cables, Connectors

www.mil-embedded.com/p365061

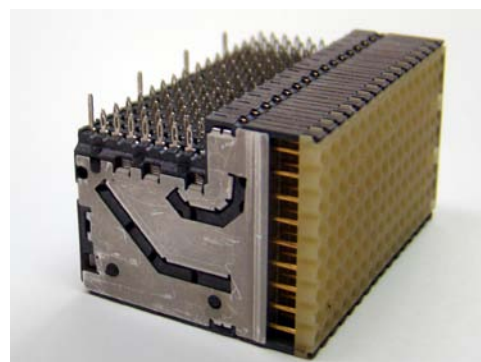


www.hypertronics.com

KVPX

Hypertronics KVPX, an embedded systems interconnect featuring the Hypertac technology, is designed as a drop-in replacement for use in high reliability VITA 46/48 backplane architectures and succeeds in meeting all the high-speed electrical requirements of VITA while vastly increasing the mechanical reliability and physical ruggedness of unmated connectors and modules.

KVPX is designed specifically to allow for top signal integrity under all dynamic environmental conditions, which makes it a perfect fit for those applications where failure is not an option.



FEATURES

- › Drop-in replacement for VITA 46/48 backplane architectures
- › Top signal integrity under all dynamic environmental
- › Immunity to shock, vibration and fretting
- › Verified for 6.25 Gbps data rate performance
- › Custom configurable allowing for "mix and match" in application scenarios
- › ESD protection that fully supports Level 2 Maintenance

Hypertronics | 978-568-0451

Contact: info@hypertronics.com



1-800-522-6752

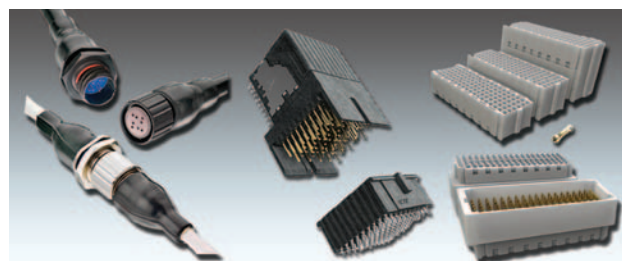
TheFutureUnleashed.com

Meet the Next Generation

Designed to perform in the most extreme environments, these compact, lightweight and high-speed interconnect solutions from TE Connectivity support increasing bandwidth requirements and withstand increasing shock and vibration conditions of emerging military, aerospace and marine applications.

CeeLok FAS-T Connector

- 10 Gb/s
- Small form factor – Shell size 8
- Field terminable
- 360° EMI protection



CeeLok FAS-T Connector

Fortis Zd Connector

Mezalok Connector

Fortis Zd Connector

- 12 Gb/s+
- 4-point contact redundancy
- Ruggedized for harsh environments

Mezalok Connector

- 5 GHz+
- 500 mating cycles
- ANSI/VITA 61 XMC 2.0
- 4-point contact redundancy

TE Connectivity | TheFutureUnleashed.com

Power Conversion: Batteries

www.mil-embedded.com/p369065



www.microcross.com

Microcross Components Offer Solid State Batteries in Die Form

Going where no battery has gone before, EnerChip™ by Cymbet is the world's first solid state rechargeable energy storage and management device. The die form of EnerChip™ is available through Microcross Components, bringing the benefits of embedded energy in the smallest footprint available to high-reliability and state-of-the-art customers in military, space, medical, telecommunications, and other demanding industries.

EnerChip™ rechargeable solid state energy storage devices in die form offer substantial space and weight savings as well as co-packaging opportunities with other ICs and passive devices.

EnerChip™ bare die enable new concepts in embedded energy storage applications such as wireless sensors and RFID tags, medical monitoring, wearable electronics and smartcard power solutions.



FEATURES

- > High cycle life (>5000)
- > No external charge circuit
- > No sockets/holders
- > Low self-discharge
- > Stable output voltage
- > Smaller area
- > No hazardous chemicals
- > Eco friendly
- > EnerChip™ bare die are certified non-cytotoxic

Receive free samples of EnerChip™ bare die rechargeable solid state batteries for your next project – call or email Microcross today!

Microcross Components | 1.855.4COMPONENTS

Contact: sales.america@microcross.com



Advanced Conversion Technology, Inc.

www.actpower.com

SR# 12553

The 12553 low voltage DC/DC converter was custom designed with proven topologies to convert +28 VDC, MIL-STD-704D input power into eight DC output voltages (+5V, +10V, ±15V, ±18V, +30V) to deliver the system power for a sophisticated avionics system. This compact unit can be mounted via the mounting holes or in a card rack. Utilizing Hi-Rel componentry and quality workmanship ensures a reliable design. The coated aluminum housing provides mechanical protection. The overall size is 6.3" x 4.4" x 1.75" (16 cm x 11.2 cm x 4.4 cm) with a weight of 1.9 lbs (0.9 kg). It meets tough environmental conditions such as a shock of 20 gs, an altitude of 70,000 ft with continuous operation, and an operating ambient temperature range of -54°C to +85°C (95°C max base plate temperature). Contact ACT to learn more on how we can customize this or other power supplies to your application.



FEATURES

- › Eight Outputs
- › Output Power of 150 W Continuous (Rated for 300 W max)
- › Meets MIL-STD-704D, MIL-STD-461, and MIL-STD-810
- › Conduction Cooled
- › Over Current Protection
- › Over/Under Voltage Protection
- › Power Down Warning Signal
- › Remote Turn-On/Turn-Off
- › Filament Output Only Command
- › Internal Monitoring Circuitry
- › Thermal Overload Protection
- › Input to Output Isolation
- › 1 Year Warranty
- › Made in the USA

Advanced Conversion Technology, Inc. • 717-939-2300
2001 Fulling Mill Rd., Middletown, PA 17057

Contact: sales-mes@actpower.com

LinkedIn: www.linkedin.com/company/
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Rugged Computer Systems: Mission Computer

www.mil-embedded.com/p369097



CREATIVE ELECTRONIC SYSTEMS

www.ces.ch

Safety-Critical Mission Computers

Mission computers for UAV systems provide high-level flight management, mission management and payload management functionalities. Processing power is provided by one or more CES processor boards, which communicate over VME/VPX and/or high-speed serial links. Custom processing or I/O functionality can be implemented in FPGAs. A large variety of avionic interfaces are available from CES, including MIL-1553, ARINC 429, RS-422/485 and many others. An integrated Gigabit Ethernet switch assures standard connectivity, both internally and externally, in addition to the VME or VPX backplane. Multiple high-speed serial links can be used for additional high-bandwidth connectivity. Video processing capabilities include analog and digital video input and output, still image and streaming video compression, as well as custom processing in the processor or FPGA. Flash-based mass storage is available for mission data storage or video recording. These systems are typically integrated into a sealed ATR military enclosure and qualified to withstand the most severe environmental conditions.



FEATURES

- › Safety-critical and certifiable solution
- › COTS building blocks
- › Powerful and rugged multiprocessing architecture
- › Custom processing in the FPGA
- › Wide range of avionic interfaces
- › Multiple Gigabit Ethernet interfaces
- › Video input, output and compression
- › Flash-based mass storage
- › Sealed ATR military enclosures
- › DAL A
- › DAL C certified

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Contact: ces@ces.ch



www.crystalrugged.com/products/embedded.aspx

RE0412 Carbon Fiber Embedded Computer

The RE0412 has been designed and developed to support airborne and ground mobile applications where significant processing power is required while still being lightweight and rugged.

The system is designed around a DC power solution with an Intel mini-ITX board form factor using an air-over-components cooling approach. The system can accept a single PCIe X4 card in a X16 slot and up to two hard drives and 16GB RAM. The RE0412 is exceptionally rugged, powerful, and lightweight.



FEATURES

- › Ultra-light carbon fiber chassis provides exceptional ruggedness
- › Unit weighs 4 lbs. with card, 3.6 lbs. without card
- › Extended temperature range -40C to +55C
- › Intel mini-ITX motherboard, LGA1155 socket, LAN, 2XUSB 3.0, 2XUSB 2.0, DVI-I, eSATA, HDMI, Audio, PCIe (X4 in X16 slot) provides exceptional performance in small package
- › Air cooled design limits weight
- › Two (2) 204 pin DDR-3 SDRAM sockets support 1066 MHz and 1333 MHz SO-DIMMs of 2GB to 8GB size i.e. up to 16GB capacity non-ECC memory
- › Intel H61 express chipset controller hub provides traffic management between memory, CPU, and I/O
- › Integrated graphics support within processor incorporates latest QB graphics technology
- › HDMI, DVI-I video options provide broad video support
- › Supports one (1) or two (2) 2.5" SATA hard drives (weight based on single drive)
- › One PCIe X4 electrical in a X16 slot via riser card supports LP expansion card
- › Power LED, power switch, and circular connector provide easy access and operation

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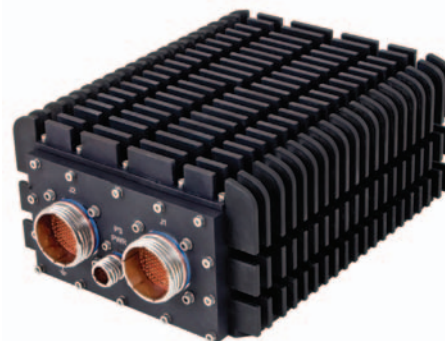


defense.ge-ip.com

CRS-C2I-3VB1

GE Intelligent Platforms' CRS-C2I-3VB1 rugged system is a packaged prevalidated data processing and control computer system with an Intel-based processor single board computer that provides a rugged and highly flexible computing platform suited for applications requiring rock-solid reliability such as civilian and military UAVs, manned commercial and military aircraft, helicopters, over- and underwater research vessels, ground vehicles, and locomotives.

GE's COTS-based CRS-C2I-3VB1 Application Ready computer system can be deployed in the field as soon as your application is ready, or use the CRS-C2I-3VB1 as a starting point for multiple application-specific configurations.



FEATURES

- › **Rugged baseplate cooled chassis:**
 - 2 slot plus SSD 3U VPX
 - MIL-DTL-38999 connectors
- › **Intel® 2nd Gen Core™ i7 @ 2.2 GHz**
- › **Linux operating system**
- › **I/O capabilities:**
 - Ethernet, Serial, USB, MIL-STD-1553, VGA
- › **Weight:** 12 lbs (5.4 kg)
- › **Dimensions (H x W x D, excludes connectors):**
3.96 x 7.15 x 9.2 inches
- › **Operating Temperature:** -40°C to +70°C (baseplate)
- › **Input Power (MIL-STD):** 28VDC (MIL-STD-704F)

GE Intelligent Platforms | 800-433-2682

www.ge-ip.com/contact



www.kontron.com

ApexVX – Multi-Mission Rugged Computer

Kontron's ApexVX is a pre-validated computer system specifically designed for the rapid deployment of a broad range of military and avionics applications that can be easily modified and adapted to your application requirements. ApexVX modular design ensures fast customization features that allow the system to adapt to the specific requirements of multiple missions, helping secure an ambitious deployment schedule. It is based on Kontron's leading edge 3U OpenVPX™ computing technology and smart software including VXFabric™, VXControl™, and PBIT system test solution. It integrates all components required for the early evaluation phase up to long term deployment. With Kontron's time and cost efficient two step approach of development and deployment, the prequalified Kontron ApexVX provides a proven basis for OEMs who need to develop reliable solutions within strictly limited time and cost budgets.



FEATURES

- › Prequalified Solution based on COTS Building Blocks
- › Flexible Design for Easy Customization
- › 5-slot 3U VPX Computer System
- › Environmentally Sealed Enclosure
- › PBIT System Test Innovative Learning Mode
- › Support for Kontron VXFabric™ and VXControl™ Smart Technology

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Rugged Computer Systems: Mission Computer

www.mil-embedded.com/p369038



www.kontron.com

COBALT – Reduced SWAP Rugged Embedded Computer

COBALT is a highly scalable embedded computer system that is available with a wide selection of processor, storage, power and interface options. The small footprint and low power make it the ideal solution for applications requiring both performance and reduced SWAP (Size, Weight & Power). The flexibility in processing power, data throughput, storage and interface options make it the clear choice for demanding military and commercial applications. Based on Kontron's years of design experience for military and avionics platforms, COBALT provides reliable operation and full compliance in a wide range of rugged environments:

- Military ground vehicles
- UAVs
- Military and commercial aircraft
- Shipboard and submarines



FEATURES

- › Small Form Factor (8.5" x 7.0" x 3.4")
- › -40°C to +70°C with extended temperature SSD option
- › Intel® Core™ i7, Core™2 Duo processor options
- › 10 W to 30 W, depends on processor selection
- › Dual Gigabit Ethernet ports for network connectivity
- › Delivered with Linux or Windows operating systems installed
- › Fanless, fully enclosed design for efficient thermal management

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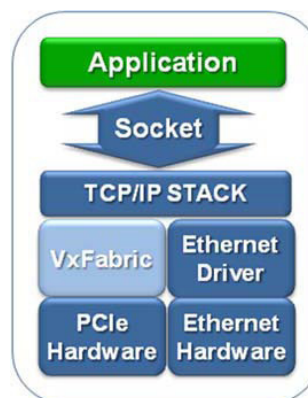
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VXFabric™ and VXControl™ – Smart Technology

VXFabric™ and VXControl™ – smart technology for a secure system deployment and maintenance.

VXFabric™ solution is a set of turnkey APIs for data flow applications to implement efficient inter-board communication at high data rates. For example, with a PCIe Switch, such as the Kontron VX3905, it is possible to interconnector up to 12 nodes with VxFabric via PCI Express. From the software perspective, this is equivalent to an Ethernet network infrastructure mapped over a switched PCIe express fabric. VxFabric implements the layers allowing the user to handle the communication with an IP socket interface. This helps to reduce the development effort and migration of several CPU boards (with multiple cores) interconnected through PCIe via the VPX backplane, using a PCIe switch.

VXControl™ is a solution for fine grained Out Of Band health management at the computer level. It relies on onboard controllers interfaced through the standard SMB (System Management Bus) of the VPX backplane.



FEATURES

- › VxFabric™ – PCI Express Switch Fabric For High Performance Embedded Computing
- › Data communication APIs
- › Protect application software investment with the socket API and VPX backplanes
- › Cost-efficient migration path to the next breakthrough in VPX: 10G and 40G Ethernet
- › **Featured Products:** VX3042 & VX3044 (3U Intel 3rd gen Core i7), VX6060 (6U 2x Intel quad-core i7), VX3035 (3U Intel 2nd gen Core i7), ApexVX (VPX system), VX3905 (3U PCIe & Ethernet Switch)

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Special designed Rugged Embedded PC up to 3rd Gen Core i7

The PIP Family is a powerful, highly integrated, robust and fanless rugged embedded PC, based on Intel's Mobile Technology, all out of the Embedded Roadmap for long-time availability. The systems represent a unique solution for today's demanding defense requirements and are available with basically unlimited options. They are designed to operate under extreme and normal conditions without the need of fans at full load and without derating or throttling. The MPL solutions are designed and produced in Switzerland and assembled according to your needs.

Outstanding is the extreme low power consumption. The systems have a complete set of standard PC features as well as industrial features like wide DC input power, reverse polarity protection. Additional GPS, WLAN, CAN, Sound, and UPS modules are available.



FEATURES

- › Wide CPU selection up to Core i7
- › Soldered CPU and chipset
- › Soldered ECCRAM
- › Lockable headers
- › Up to 5 x Gigabit Ethernet
- › Up to 7 USB (3.0 & 2.0)
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www.parvus.com

DuraCOR 80-40

Rugged COTS tactical mission computer subsystem based on the high performance Intel Core i7 Sandy Bridge and Ivy Bridge processors with a high-speed, stackable PCI Express bus (PCIe/104) architecture for I/O card expansion. Optimally designed for Size, Weight, and Power (SWaP)-sensitive military/aerospace vehicle and aircraft installations, the DuraCOR 80-40 combines powerful graphics and multi-core processing with ultra-reliable mechanical robustness for extreme environmental and EMI conditions per MIL-STD-810G (thermal, shock, vibration, exposure to dust, water, humidity) and MIL-STD-461F. The DuraCOR 80-40 is completely sealed (IP67), requires no active cooling, and features a hinged panel on the rear for removable SATA Solid State Disk (SSD) storage.

**FEATURES**

- › Intel 2nd/3rd Generation Core i7 (Sandy/Ivy Bridge) Processor
- › 2x GigE, 6x USB, 2x RS-232, 16x GPIO, DVI/VGA, Audio, PS2
- › Dual Removable SATA SSD Storage (Sealed, Hinged Panel on Rear)
- › Pre-Installed MIL-38999 Connectors and PCIe/104 Card Slots
- › Modular Interlocking Chassis Mateable w/ DuraMAR 5915 Router
- › Designed for MIL-810G Shock, Vibration, Thermal, Altitude, Humidity
- › -40 to +71 °C Fanless Extended Temp Operation with No Moving Parts
- › Filtered, Transient-Protected Power Supply for Aircraft and Vehicles

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Rugged Computer Systems: Mission Computer

www.mil-embedded.com/p369041



www.trentonsystems.com/military

TRC4008 4U Rugged Rackmount Computer

The TRC4008 is a shallow depth 4U rackmount computer designed for space constrained applications. With flexible configuration options that include single board computers with a PCI Express backplane or embedded motherboards that employ the latest generation, multi-core processors from Intel®, this rugged rackmount computer is intended for deployment in demanding environments.

The lightweight, rugged aluminum enclosure is only 20" deep and accommodates eight hot-swap 2.5" storage devices. The system fan control option controls and monitors tach pulses from up to four system fans. The controller also accepts fan speed commands and provides individual pass/fail fan status.

Power supply options include a single, fixed ATX/EPS 1500W supply or a mini-redundant ATX power supply up to 500W, and front tool-less access to the system filter allows easy cleaning and maintenance.

**FEATURES**

- › Shallow 20" depth, all-aluminum system enclosure
- › Rugged construction withstands shock & vibration
- › Single board computer & backplane or motherboard
- › Up to eight front-access, hot-swap storage drives
- › Optional system fan control for cooling efficiency
- › Mini-redundant power supply option is available

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HERCULES

Meritec's HERCULES Interconnection System, embedded in the mating rugged circular MIL-38999 shell, provides both a durable and high bandwidth interconnect scheme suitable for many Military and Aerospace ruggedized high bandwidth applications not previously accommodated by industry standards.

The HERCULES system will beat the price of your current solution, while beating the performance at the same time. The HERCULES is the first of the High BandWidth (HBW) Family to be released in MIL-38999 Series III sizes: 9, 11, 13, 15, 17 & 23. Meeting protocols such as USB 2.0 & 3.0, IB, SAS, SATA, Serial I/O, and PCIe, dependent on the shell size, you have many build options.



FEATURES

- > Keying: "N" (Standard) "A", "B", "C", "D"
- > Optional connectors available for both cable assemblies & pigtail assemblies
- > Cable types available: 4X High Bandwidth cable with LSZH or PVC jacket & FEP insulated 28 Awg Twin-ax w/Halar Expando
- > Available in 26, 28, 30 Awg cable
- > Supports data rates in excess of 10Gbps and differential pair signaling with low-skew pairs & shielding for maximum EMI/RFI protection
- > Meets or exceeds SAS, InfiniBand, USB 2.0 & 3.0, PCI Express Gen2, Serial I/O, Ethernet, CX4, 10G Ethernet and SATA specifications
- > Matched impedance design of 100 Ohms

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20.1" Military Console Display

20.1" Military Grade Rugged Display provides the anti-corrosion housing, fanless design and military grade power connector to various harsh environment applications, including logistics, heavy vehicle, and Military management.

20.1" Military Grade Rugged Display has certifications of not only MIL-STD-810F but also MIL-STD-461E. For the power input source, it supports two modes, wide power range DC input with isolation and AC build-in. 20.1" Military Grade Rugged Display has a light sensor to detect the light of the environment, which means the backlight of the display can be changed automatically.

20.1" Military Grade Rugged Display has an optical bonding technique to resist the fog, moisture, and reflection resulting from the outdoor environment. To fulfill the user-friendly UI demand, it comes with an 8-key OSD that has the functions of LED indicator adjustment, brightness up and down, displaying position up and down, menu, and power switch.

20.1" Military Grade Rugged Display enhances the front cover with ITO coating glass or a touch screen for less interference of electromagnetic, and it also supports 5-wired resistive touch for easy control.



FEATURES

- > Fanless system rugged design for harsh environment
- > Military Grade Power Connector Model JY27466
- > MIL-STD-810F/MIL-STD-461E Certifications
- > AC build-in or DC with isolation Power Input
- > Backlight control with light sensor
- > Optical bonding to resist fog/moisture/reflection



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Commercialized High-performance Computing: Keys to determining the right cost/performance mix

Presented by: DELL, AMD

September 12th, 2pm EDT

High Performance Computing (HPC) brings to mind massively parallel systems that spare no expense. But today there is a very large HPC application space where computational performance must be balanced against cost to make a sound business case for real-world use. Advancements in processor and system technologies are advancing "business-optimized HPC" applications in areas like manufacturing, aerospace, and automotive. In addition, university research centers are also making use of these same technologies so their research is more adaptable to business application. Join us as experts from AMD, Dell, and NCSA discuss processor and system optimizations for business-class HPC applications and how to apply these optimizations to your HPC application.

Don't Bet Your Distributed System Project on the Wrong Software Licensing Model

Presented by: RTI

September 27th, 11am EDT

Across industries as diverse as transportation, energy, defense and aerospace, industrial control, and medical electronics, next-generation distributed systems are approaching a level of scale and complexity never before seen. Moreover, distributed system developers across these industries are finding that standardizing on common infrastructures and platforms delivers significant technical and business advantages. Unfortunately, suppliers of key infrastructural software components have failed to evolve their licensing practices to keep pace with their customers' changing strategic objectives. Learn about the most important change you can make to the way you license and deploy critical software for distributed systems, thanks to a new way of leveraging the OMG Data Distribution Service (DDS) standard.

Monetizing Deep Packet Inspection (DPI)

Presented by: IP Fabrics, Inc.

September 27th, 2pm EDT

The transition from technology to business intelligence for enterprise, telecom, data center, and government applications can be challenging. This is a brave new IP-connected world. Communications service providers are faced with cost recovery issues involving VoIP and line termination issues and need business intelligence facilities that provide insight into network usage to identify billable and non-billable traffic. Government agencies are tasked with the prevention and detection of illegal activities and cyber crime, while the cloud computing paradigm requires data center operators to provide security, authentication, and detection of outside threats. Deep Packet Inspection has long been a technology that relies on parallel processing and multicore technology to reassemble, analyze, and provide metadata about packet flows and the applications therein. But how do you cross the chasm between DPI technology to business intelligence revenue and/or cost recovery capabilities?



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GaN 9.9-10.7 GHz 15 Watts

AML910P4215 is a high efficiency, high power density 15 Watt GaN power amplifier. PAE is 30% typical with package dimensions of 3.8" x 3.6" x 0.67". This amplifier is designed to operate over 9.9-10.7 GHz. Small signal gain is 46 dB min across the entire band.

Amplifier is operated from a +32 VDC supply. Amplifier features a fast TTL controlled muting function (200nS on/off speed). Unit is in a hermetically sealed aluminum housing with field removable SMA(f) connectors. Operating temperature range is -40°C to +85°C.



- AML910P4512 is one example of our High Power technology. Microsemi RFIS utilizes Gallium Arsenide and Gallium Nitride technology to offer solid state microwave power amplifiers operating in the frequency range from 1 to 40 GHz with output power from .5W to 300W.

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Esterel Technologies' SCADE® product family provides complete solutions for developers of critical systems and software applications. All SCADE solutions easily integrate, allowing for development optimization and increased communication among team members.

SCADE Suite and Display Code Generators have been qualified/certified at the highest level of safety across six market segments by more than ten safety authorities worldwide, including DO-178B up to Level A – Aerospace and Defense Applications by FAA, EASA, Transport Canada and ANAC; IEC 61508 up to SIL3 – Transportation and Industrial Applications by TÜV SÜD; EN 50128 up to SIL3/4 – Rail Transportation Applications by TÜV SÜD, EBA and Certifier.

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- Aligns the design process according to safety standard objectives
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- Speeds certification so that it is achieved two times faster



FEATURES

- SCADE Suite for control logic and algorithm development
- SCADE Display for display and HMI development
- SCADE System for system architecture design
- SCADE LifeCycle for application lifecycle management
- SCADE Solutions for ARINC 661-compliant systems for development of ARINC 661-compliant avionics displays and user applications

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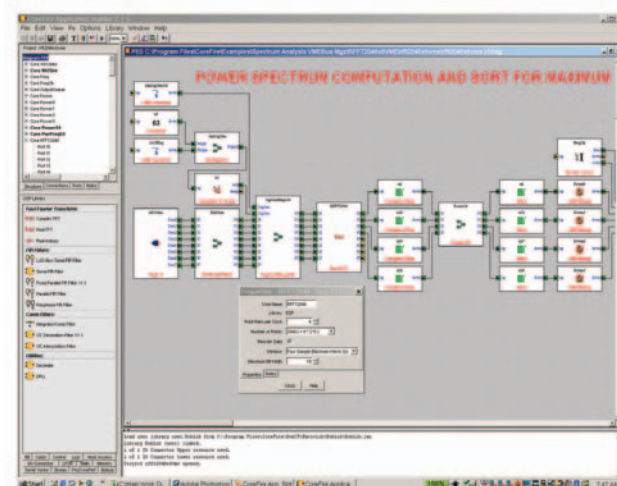
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Develop your application very quickly and easily with our CoreFire™ FPGA Application Builder, which transforms the FPGA development process, making it possible for theoreticians to easily and quickly build and test their algorithms on the real hardware that will be used in the field.

Use CoreFire's graphical interface to drag and drop library elements onto the design window. Modify your input and output types, numbers of bits, and other core variables by changing module parameters with pull-down menus. The modules automatically provide correct timing and clock control. Insert debug modules to report actual hardware values for hardware-in-the-loop debugging. Hit the Build button to check for errors and as-built core sizes and to build an encrypted EDIF file. Use the Xilinx ISE tool to place and route each FPGA design. Modify and use the jar file or the C program created by the CoreFire Build to load your new file into your WILDSTAR and I/O card hardware. Use the CoreFire Debugger to view and modify register and memory contents in the FPGA and to step through the dataflow of your design running in the real physical hardware.

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The combination of our COTS hardware and CoreFire enables our customers to make massive improvements in processing speed while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.



FEATURES

- › Dataflow-based – automatically generates intermodule control fabric
- › Drag-and-drop graphical interface
- › Work at high conceptual level – concentrate on solving algorithmic problems
- › Hardware-in-the-loop debugging
- › More than 1,000 modules incorporate years of application experience
- › Reduce risk with COTS boards and software
- › Save time to market
- › Save development dollars
- › Easily port completed applications to new technology chips and boards
- › Training and custom application development available
- › Achieve world-class performance; WILD solutions outperform the competition
- › Annual node locked or networked license; includes customer support and updates

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RUGGED COMPUTING SYSTEMS FOR OEM



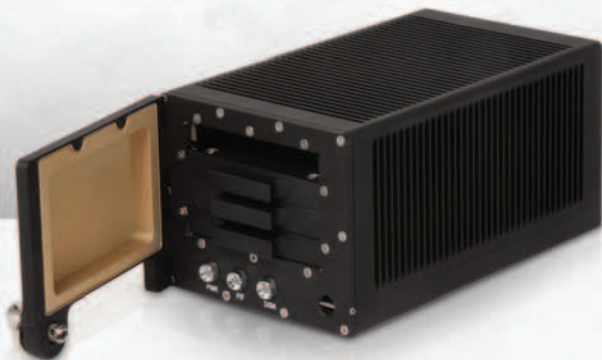
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Rugged, Six-Way Secure Virtual Machine Server Class System, Westmere® CPU w/96GB RAM, Dual Removable Drives for up to 2TB of storage. Ultra-Small overall footprint only 13"x7.5"x4"



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Rugged, Small, Lightweight, Quad Core Intel® i7 System w/16GB of RAM and Quad Removable SSD for up to 4TB of storage. Small 7"x5.5"x4" and 6.5lbs. (w/ Four Drives)
(Available in 2 drive configuration)



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You can't see them – but there are 300,000 people standing behind this display

What you can see is GE's Intelligent Vehicle Display, available with a 10" or 15" screen. By combining it with a powerful on board processor, memory and extensive I/O and networking capabilities, it can make a significant contribution to reducing in-vehicle size, weight and power.

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