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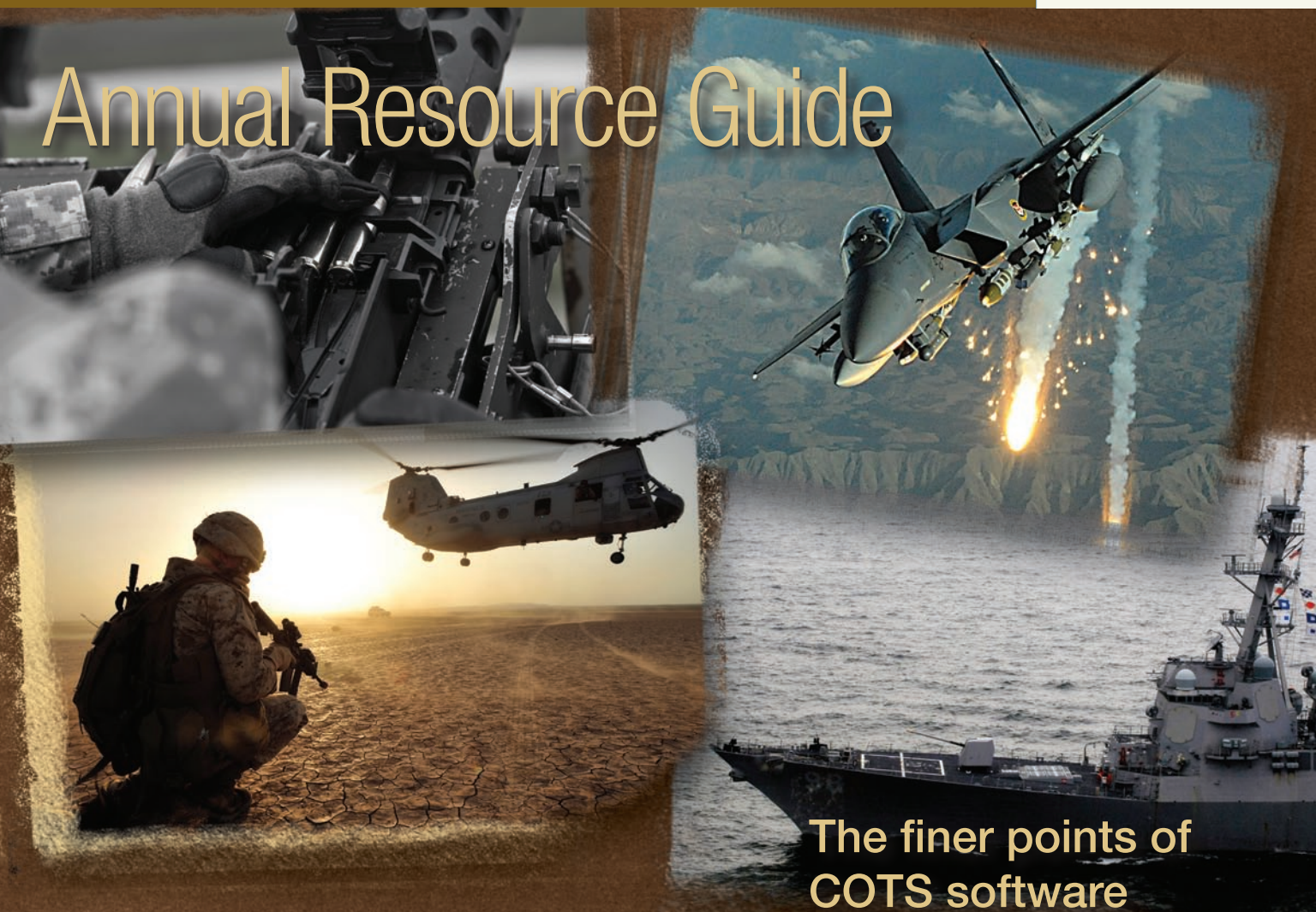

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September 2009 Volume 5 Number 6

COLUMNS

DEPARTMENTS

ON THE COVER:

The cool firepower montage by our illustrious art director David Diomede reminds us that modern military might is only possible because of our warfighters' commitment to liberty. Of course, all that heavy-ware relies on COTS technology – the focus of our Annual Resource Guide. There's so much in this issue that you've just got to thumb through it for yourself.

Clockwise from upper left: B&W Gun – Private First Class Ben McLaughlin, G Co., 141st BSB, 41st IBCT, adjusts rounds into the feedtray; an F-15E Strike Eagle deploys flares during a mission over Afghanistan (U.S. Air Force photo/Staff Sgt. Aaron Allmon); the guided-missile destroyer USS Forrest Sherman (DDG 98) is underway with the Danish Navy corvette HDMS Peter Terdemskiold (F 356) during exercise Baltic Operations (BALTOPS) 2009 (U.S. Navy photo by Mass Communication Special 2nd Class Michael T. Rumbach/Released); kneeling soldier – The Marines from Marine Helicopter Squadron Medium 262 use the helicopter to transport personnel participating in Balikatan 2009 around the various provinces of the Republic of the Philippines (U.S. Marine photo by Lance Cpl. Antwain J. Graham).

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Page	Advertiser/Ad title
13	**ACCES I/O Products, Inc.** – USB Embedded I/O
21	**ACT/Technico** – 3U CPCI Solutions
3	**Annapolis Micro Systems, Inc.** – WILDSTAR 5
41	**Concurrent Technologies, Inc.** – x86 Processor Boards
45	**CONEC Corporation** – CONEC Embedded Series
99	**Connect Tech, Inc. (CTI)** – Mass Storage and FPGA Computing Solutions
112	**Curtiss-Wright Controls Embedded Computing** – Defy size, weight and power
27	**Data Device Corp. (DDC)** – Total-ACE
12	**Elma Electronic** – Dish us the unusual
7	**Excalibur Systems, Inc.** – Dense?
111	**GE Fanuc Intelligent Platforms, Inc.** – Which of these platforms use GE Fanuc
TAB 3	**General Dynamics** – We specialize in embedded
46	**Jacyl Technology Inc.** – Python X
60	**LCR Electronics** – Engineered for your application
23	**LiPPERT Embedded Computers** – CoreExpress
2	**LynuxWorks, Inc.** – We won't leave you high and dry.
40	**Nallatech** – High performance FPGA solutions
32	**North Atlantic Industries** – Multifunction I/O Boards
5	**Pentek, Inc.** – We've hatched the next generation of software
TAB 4	**Performance Technologies** – The final piece is your application
29	**Phoenix International** – Data Storage
26	**Schroff a Brand of Pentair Electronic Packaging** – When imitations aren't good enough
37	**Sealevel Systems, Inc.** – High-speed synchronous communication
17	**Swissbit** – Experience the Evolution
38	**Technobox, Inc.** – BYOB
30	**TEWS Technologies LLC** – COTS I/O Solutions
TAB 1	**Themis Computer** – Introducing New 1RU and Blade Servers
25	**Tri-M Systems Inc.** – 100Mhz PC/104 Module
109	**Tri-M Systems Inc.** – PC/104 Can-Tainer
37	**Twin Oaks Computing, Inc.** – CoreDX
19	**Vector Electronics & Technology, Inc.** – VME/cPCI Ruggedized Chassis
18	**VPT Inc.** – Efficent, reliable power
10	**White Electronic Designs** – Dream Big ...
TAB 2	**WinSystems, Inc.** – A 1GHz Fanless Rugged SBC of EPIC Proportions

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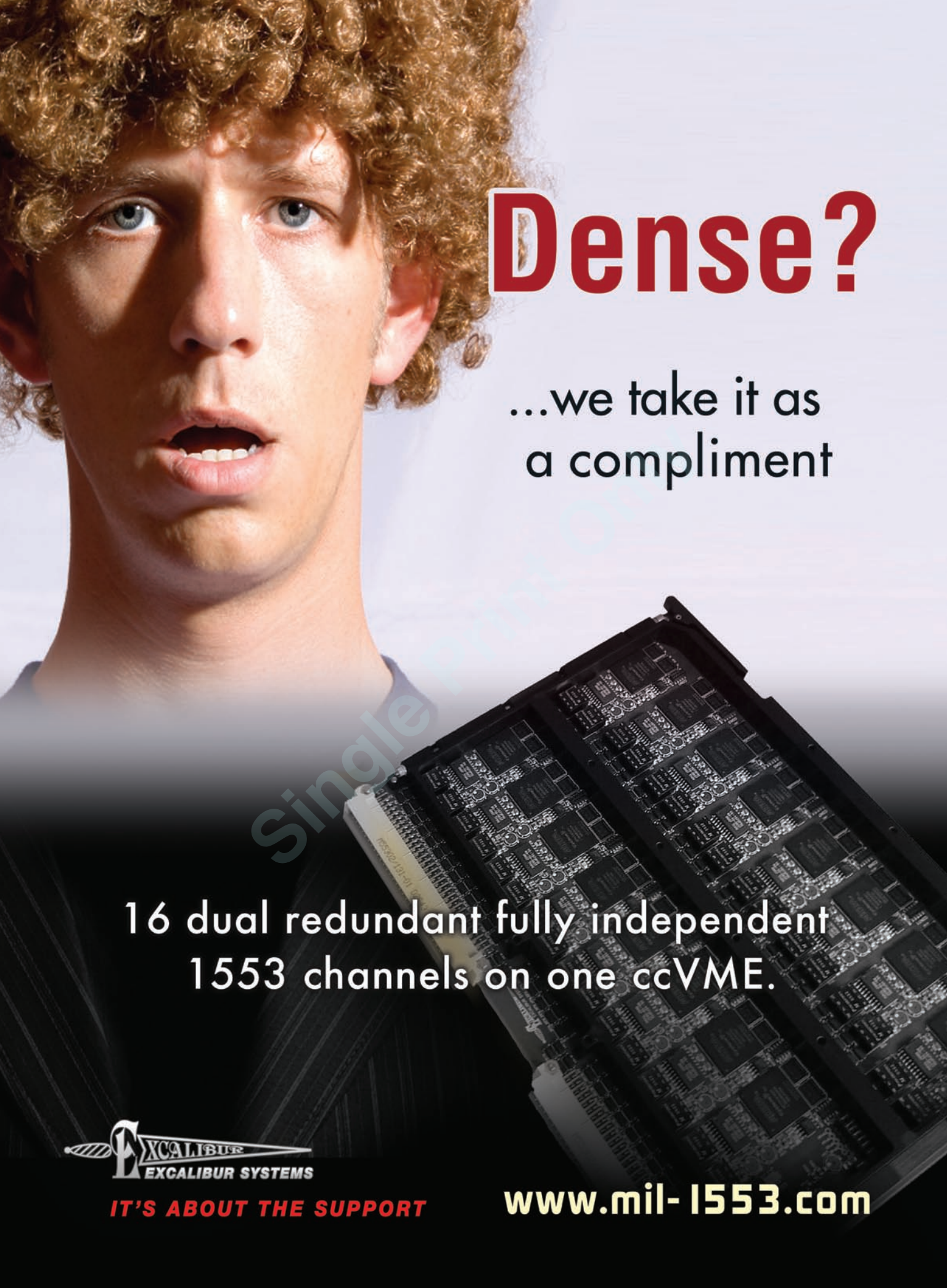
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COTS vendors step up to new multicore processors

By Duncan Young

Although multicore devices have been available for some time now, their use has not yet become widespread in real-time embedded applications. Multicore devices such as Intel's Core2 Duo and Core2 Quad are widely used in desktop and server applications. However, the number of cores available or in use is made transparent to the users by the operating system. In contrast, an embedded system must execute predictably within deadlines that at times require the full use of all available resources. This is most easily proven by just using a single dedicated processor with its own I/O and memory resources. Yet the potential for significantly greater performance in a smaller package and with less power consumption is sufficiently attractive to drive the design of new multicore devices.

Freescale Semiconductor QorIQ

The real-time military embedded market is dominated by Freescale Semiconductor's Power Architecture processor family. It includes a diverse application base ranging from ground-based combat vehicles, C2 and C4I, to avionics and flight control. For its next generation of devices, Freescale chose its e500 Power Architecture core, with up to eight cores arranged symmetrically on a single device. There is a range of devices in this new family named QorIQ (pronounced "Core-I-Q"), aimed at a broad spectrum of applications. At the high end, the P4080 is designed to dissipate no more than 30 W with eight cores operating at 1.5 GHz. This makes it ideal for high-performance yet space-, weight-, and power-constrained embedded applications, offering interesting architectural possibilities for efficient core utilization. The eight-core P4080 block diagram is illustrated in Figure 1.

Each core has 32 kB L1 instruction and data caches plus its own 128 kB L2 cache. The architecture supports independent execution of each core, with separate user and supervisor modes. In addition, a hypervisor running as a microkernel on each core plus a secure memory partitioning model provide many of the functions needed to support either Symmetric Multiprocessing (SMP) or Asymmetric Multiprocessing (AMP). This use of secure memory partitions naturally makes QorIQ suitable for trusted platform applications such as Multiple Independent Layer Security (MILS). An on-chip fabric connects the cores with L3 caches, external memory, network support including 2x 10 GbE (XAUI) ports, PCI Express (PCIe), and Serial RapidIO, now commonly used as a low-latency fabric in multicomputing sensor processing systems.

Migrating to multiple cores

New projects and the migration of existing Power Architecture applications can benefit from the flexibility of eight processing cores. Conventionally, real-time systems will dedicate functions and tasks to individual cores because this will provide more easily verifiable operation, particularly where timing deadlines are crucial. This model allows the migration and physical contraction of many existing applications from multiple SBCs to a single SBC – subject to review of a system's I/O requirements – while maintaining a high degree of software compatibility.

New applications might feature the AMP model partitioned differently, perhaps using one core for I/O, one for networking, and others for individual functions. Where a surplus of cores exists, one might also be allocated to online prognostics, self-test, and diagnostics. Using all eight cores in a dynamically scheduled SMP environment will require specialized software tools like those developed for multicomputing DSP systems that instrument and verify a system's performance. Similarly, the extension of today's multicomputer DSP tools to graphically visualize architecture, assess performance, and allocate tasks will merge the distinction between multicore and multicompute development environments and configurations.

Embedded product plans

Plans to support various versions of QorIQ with environmental options for military applications have already been announced by board-level COTS vendors such as GE Fanuc Intelligent Platforms. In addition to top-end, high-performance products based on the eight-core P4080 device using the 6U VPX (VITA 46) format, SBCs have also been announced in 3U VPX and 3U CompactPCI formats using the dual-core P2020. This is anticipated to offer comparable performance to existing products based on Freescale's 8641D but with lower power consumption.

There will still be much debate on the future shape of applications for multicore Power Architecture. But it is clear that the QorIQ family of devices re-establishes the MIPs/Watt position. Additionally, software compatibility is maintained for legacy migration, and major board-level COTS vendors are firmly committed to future product development. Whether AMP, SMP, or a mix of processing configurations will predominate remains firmly in the hands of future users and systems integrators.

To learn more, e-mail Duncan at young.duncan1@btinternet.com.

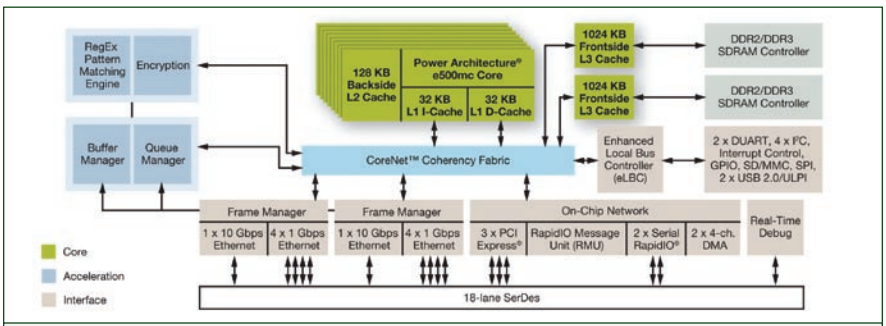

Figure 1 | The eight-core P4080 block diagram

Mil Tech Insider

Transporting and recording high volumes of sensor data

By John Wemekamp

There are classes of sensors such as air- or ground-based surveillance radars or towed-array or dipping sonars that generate very high volumes of digitized data. This data must often be streamed over long distances to the location of the signal processing equipment. Common solutions today use gigabit signaling of various types. However, as these sensors become faster and more sensitive and thus generate more data, many applications are migrating to 10 Gigabit Ethernet (10 GbE). During development and the continuous evolution of these sensor types, there is a need to accurately record and play back this data in real time.

Data transmission

There are many options available for the transmission of sensor data to signal processing equipment. Open architecture systems designers have generally adopted standards such as 1 GbE or Serial Front Panel Data Port (SFPDP), often used in multiples to achieve the data rates required. For long-distance transmission, standards-based options are available to support single-mode or multi-mode fiber, extending their range to many kilometers if required. 10 GbE becomes an attractive option for long-distance transmission as only a single fiber would be required. A typical mobile, ground-based radar system might deploy one or a number of radar antennas linked to a control shelter located a considerable distance away. This is to provide protection for both equipment and personnel if the radar is attacked by anti-radiation missiles. These would target and destroy the vulnerable emitters but not the shelter. Fixed installations of similar radar systems controlling an entire airspace might also be located many more kilometers from a heavily protected control room.

Many naval applications require physical separation from the severe external environment of, for example, a masthead sensor and the location of the associated signal processing in below-deck equipment rooms. Towed-array and dipping sonars are additional examples of sensors located in severe environments, in this case attached via an umbilical cable to the vessel or helicopter containing the more protected signal processing and display equipment.

Recording for playback

There are many reasons for recording streaming sensor data, including development and validation of signal processing equipment, off-line analysis and threat evaluation, equipment evolution, system testing, training, and live exercise evaluation. Even though the recorded data will have some embedded sensor timing, such as azimuth or elevation for a radar system, fidelity of playback can only be ensured by restoring the accurate timing of the data sampling within the data streams. The best way to achieve this is to time stamp every incoming sample as it is received, which would require a clock source with, typically, sub-100 ns resolution. This allows playback at the original sampling rate and provides the facility to start and stop at selected times within the recorded data.

Disk storage

Newer, high-performance sensor types can typically stream data at up to 800 Mbps. High-speed links from the sensor will commonly use a very lightweight protocol because at these data rates, errors in transmission can only be flagged, not retransmitted. Hence, UDP is used to stream datagrams over 1 and 10 GbE point-to-point links. For recording of any reasonable time duration, terabytes of data storage are required. Just one hour of recording might require up to 4 TB, which would be provided by Fibre Channel rotating disks in either Switched Bunch Of Disks (SBOD) or Redundant Array of Independent Disks (RAID) in benign environments. Because of timing constraints, data is striped onto the arrays without the use of a file system. This also has the advantage that it can be streamed in replay mode to many different computer types as it has no operating system-specific file attributes. Typical of this type of recorder is the SDR1X family (Figure 1), which is offered by Curtiss-Wright Controls Embedded Computing (CWCEC). SDRIX is a rack-mounted system giving more than two hours of 10 GbE recording with options for SFPDP and 1 GbE links to the sensor.

Figure 1 | Curtiss-Wright's SDR1X recorder is a rack-mounted system giving more than two hours of 10 GbE recording with options for SFPDP and 1 GbE links to the sensor.

The latest generations of sensors produce a tremendous volume of raw data, so much so that it would be impossible to record and archive it all. But sometimes the validation of new algorithms, the detection of new hostile capabilities, or the evaluation of a live exercise requires the replay or analysis of many hours of captured raw data. This is only possible with special-to-type recorders able to record and, just as critically, replay this data in true real time.

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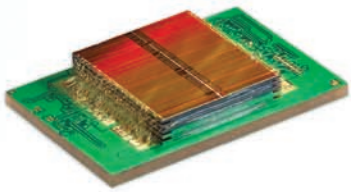

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Legacy Software Migration

Architectural visualization key to code reuse

By Gwyn Fisher

What can developers of military and avionics software systems do to take advantage of software reuse while ensuring that software is as bug-free and secure as possible?

In all industries, software is becoming increasingly ubiquitous. Take Boeing jets as an example. At 6.5 million lines of code, Boeing's 787 aircraft flight control system has three times more code than the 777[1].

Given this growth trend, it is both unrealistic and impractical to rewrite an entire system from scratch for each new project.

The reuse of code has become a universal software development best practice. It speeds time to market by increasing development efficiencies while minimizing the costs associated with brand-new development. The practice of code reuse also enables development organizations to leverage the lessons learned from an existing code base.

However, with code reuse, a balance between risk and reward must be achieved. When legacy software is ported to a new operating system or combined with new code, formerly latent bugs can become active critical defects or high-risk security vulnerabilities. In mission-critical military and avionics systems, software defects can lead to injury, costly malfunctions, and even loss of life.

In fact, improper legacy code reuse was the root cause of the Ariane 5 (unmanned) spacecraft's self-destruction in 1996. The code operated safely in the aircraft's previous version, but the execution context changed, transforming what was a latent bug in the Ariane 4 into a critical bug that caused its successor to explode 37 seconds after launch.

The power of architectural analysis

In industries with large and extremely complex code bases, such as military and avionics, one key element in successful reuse of legacy code is the ability to visualize and analyze the software system architecture. Leading Source Code Analysis (SCA) tools provide software system architects, development managers, and individual software developers with a graphical view of the design of their software directly from existing source code. This graphical view provides a comprehensive understanding of the application's structure and design, allowing the team to assess interfaces, relationships, and logic

flow to determine where and how to reuse existing code. Clearly understanding the systems' components and their interrelationships and dependencies is critical to improving the quality and security of software. Additionally, the ability to document system architecture is required to achieve compliance with the DO-178B standard within the avionics space.

When reusing legacy code, a comprehensive view of the system's architecture can help development teams in the following ways.

Isolate reusable components

When reusing components from a legacy software application for a new application, it is necessary to minimize the dependencies of those components on other parts of the software system. To do so, designers must ensure that the component contains only entities related to the component's functionality. A complete view of the system's architecture at all levels enables developers to isolate reusable components and reorganize them for the most efficient reuse of code.

Assess and improve quality of the software system design

The physical design of a software system might bear little resemblance to its high-level logical design. With a detailed view of the system's architecture, it's possible to:

- Navigate the system hierarchy and explore its structure
- Review a component's dependencies on other components
- View relationships between different components in the system

Through this view, inconsistencies between current implementation and design intent can be uncovered, including inappropriate relationships and dependencies and errors duplicated in different levels of the software hierarchy. This level of understanding allows development teams to assess the quality of the physical software system and implement the desired logical design on the system.

Portability to a new platform

Recycled code is frequently used in systems designed for platforms other than those for which the native code was originally developed. Ensuring that the in-house or third-party code will perform as designed on a new platform is challenging. However, a thorough architectural view of the system can help by revealing the application's dependencies on the external environment. With an accurate understanding of the code and its design, the development team can quickly determine the scope of the porting effort and the actions required.

The architecture of reuse

For military and avionics software development teams, comprehensive visibility and analysis of their software system architecture is critical in ensuring high-quality, secure results when reusing legacy software. Using the architecture capabilities of source code analysis tools, the risks associated with code reuse are greatly diminished, productivity gains are made through more comprehensive design planning, and the efforts required to achieve DO-178B compliance are streamlined.

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[1] Boeing Faces "Pretty Tight" 787 Delivery Schedule, by Michael Mecham, Aviation Week, Sept. 9, 2007, www.aviationweek.com/aw/generic/story_generic.jsp?channel=awst&id=news/aw091007p2.xml&headline=Boeing%20Faces%20%27%27Pretty%20Tight%27%27%20787%20Delivery%20Schedule

Gwyn Fisher *is the chief technology officer at Klocwork and has more than 20 years of global technology experience. He brings a valuable combination of vision, experience, and direct insight into the software developer's perspective. At Klocwork, Gwyn returns to his original passion, compiler theory, to move static source code analysis to the next level. He can be contacted at gwyn.fisher@klocwork.com.*

Daily Briefing: News Snippets

By Sharon Schnakenburg, Assistant Managing Editor

www.mil-embedded.com/dailybriefing

Q1 to Q2 GPU sales light the way

There is a light at the end of the economic tunnel according to a Q2 2009 report by Jon Peddie Research (JPR) on the latest graphics chips – and therefore, PC – shipments. The impetus for JPR's stance is primarily a comparison of Q1 to Q2 growth ratios since 2003, indicating that the two-quarter comparison for 2009 fared *much* better than its predecessors (see Table 1). In addition, Q2 2009's total GPU shipments rose to 98.3 million units, up from 94.42 million for Q2 2008.

2003	2004	2005	2006	2007	2008	2009
-5.42%	-5.18%	1.63%	-4.22%	3.13%	-0.49%	31.29%

Table 1 | Q1 to Q2 growth rates for 2003-2009

Meanwhile, market share among the three major contenders rose – mostly – between Q1 and Q2 2009 (see Table 2).

Vendor	This quarter	Market share	Last quarter	Market share
AMD	18.13	18.4%	12.81	17.1%
Intel	50.30	51.2%	37.20	49.7%
NVIDIA	28.74	29.2%	23.26	31.1%

Table 2 | Comparison of AMD, Intel, and NVIDIA graphics chip unit shipments and market share for Q2 2009 vs. Q1 2009

Meanwhile, JPR's prospectus for the near future is positive yet conservative. "Things probably aren't going to get back to the normal seasonality [until] Q3 or Q4 this year, and we won't hit the levels of 2008 until 2010. … We are still predicting an upturn in the PC market in Q3 and Q4 and in particular for the graphics market (which serves not just PCs but aerospace …)." Possible market stimulators on the horizon, JPR reports, include ATI and NVIDIA's introduction of their high-performance 40 nm wares.

[Editor's note: For more on graphics chips, see Mark Snyder of Quantum3D's article entitled "Warfighters harnessing today's mobile graphics technology: The impossible dream – or nearly reality?" in this edition.]

Imaging system enlightens U.S. Navy

While it might resemble an '80s video game in some crude way, it's anything but. It's a matter of survival for the U.S. Navy … and the impetus behind a new $93 million hardware production and engineering support and services contract between the former and Lockheed Martin. What is it? The AN/BVY-1 Integrated Submarine Imaging System (ISIS), which is used for surveillance. ISIS integrates still images and digital video gathered from devices situated on the outside of a submarine to yield real-time imagery to the submarine's control room. From there, submarine operators can move a photonic mast via a joystick control, viewing digital video displayed on a computer screen simultaneously with other combat team members aboard the vessel on their various displays. ISIS additionally provides image analysis and enhancement tools; recall, storage, and recording choices for related data and imagery; and transmission of enhanced images to other military forces via infrared cameras. Lockheed Martin provided its first ISIS system to the U.S. Navy in 2006.

GE and Fanuc split up, splinter market

While military and aerospace venues are often rife with mergers and acquisitions, much less commonplace are dissolutions of ventures like the one GE and Fanuc recently announced. Accordingly, the GE Fanuc Automation Corporation, established in 1986 by the two companies, is expected to be dissolved by the end of 2009. Going to their separate corners, GE – presently called "GE Fanuc Intelligent Platforms" but soon to be just "GE Intelligent Platforms" – is expected to retain embedded systems, services, automation and enterprise software, and control systems businesses; meanwhile, Fanuc focuses on the worldwide CNC business.

NASA's LEO technology moves forward – though its missions might not

It's been 40 years since the first moonwalk (Figure 1), and NASA is again planning a manned mission to the moon – by 2020; the U.S. agency is also hoping to conduct a manned jaunt to Mars' red soil – eventually. However, fiscal reports made to Pres. Barack Obama at the end of August by his appointed Human Space Flight Plans Committee might – or might not – put the kibosh on future NASA missions' fates or timelines. Nevertheless, technology developers such as Colorado-based Advantage Electronic Product Development and its "science partner" MSI – slated to develop the software, electronics, and enclosure for a radiation-detecting dosimetry instrument – are still moving forward with their existing contract. The dosimeter's prototype is anticipated for test-readiness in the first quarter of 2010 and is designed to aid in safeguarding astronauts from cosmic radiation, which can cause cancer and central nervous system damage. The in-development dosimeter is expected to first protect astronauts on the International Space Station, then ultimately help safeguard astronauts venturing beyond Low Earth Orbit (LEO), where particularly intense cosmic radiation levels are suspected.

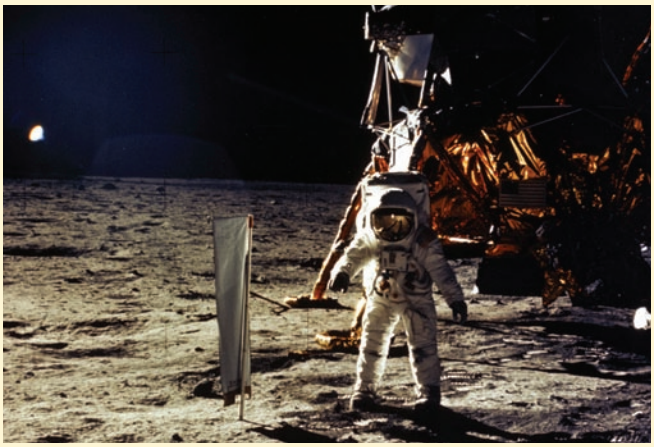


Figure 1 | July 20, 1969 – Apollo 11 astronaut Edwin Aldrin Jr. deploys scientific experiments while being photographed by astronaut Neil Armstrong during the first moonwalk. Photo courtesy of NASA

Korean Army gets a clean sweep with new prototype

In conjunction with the 2006-born Korean Helicopter Program, the first Korean Utility Helicopter (KUH) prototype (Figure 2) was recently rolled out on schedule. With Lee Myung-bak, President of the Republic of Korea present, developers from Eurocopter and Korean Aerospace Industries (KAI) revealed their KUH prototype – an 8 metric ton class military transport helicopter. The new aircraft is earmarked to replace all the South Korean Army's existing utility helicopters, and its maiden voyage will occur in early 2010. Thereafter, 245 KUHs will be produced for the Republic of Korea Army (ROKA) and are slated for deployment in 2012. In addition, per a 2007 Memorandum of Understanding (MOU), the two companies formed a joint venture in which they will "commercialize the KUH in the export market" and estimate a worldwide future demand for about 300 additional helicopters.

Figure 2 | The first Korean Utility Helicopter (KUH) prototype, photo courtesy of Eurocopter

USMC: Software is in, hardware is out

As technology such as SDR and virtualization, among many others, focuses less on hardware and relies more on software for flexibility and scalability, the U.S. Marine Corps' decision-making locales – or Combat Operations Centers (COCs) – are following suit. The evidence: A recent $21 million contract modification rendered to prime General Dynamics. The modification stipulates that the COCs' Model G system will be fitted with "Internet-like capabilities" to facilitate a higher level of tactical battlespace network connectivity, information sharing, and situational awareness. The new system enables email, electronic chat, and VoIP, and General Dynamics will additionally migrate COCs' present tactical and command and control hardware-based data systems into software-driven services based on a service-oriented infrastructure specific to the Marines Corps. COC Model G represents the Marines Corps' compliance with the DoD's Net-Enabled Command Capability (NECC), providing Internet-type capabilities across the worldwide battlespace. However, early last month, USSTRATCOM issued an order to ban accessing of social networking sites such as MySpace, Facebook, and Twitter via the Marine Corps Enterprise Network (MCEN) unclassified network (NIPRNET).

Figure 3 | C-17 Globemaster III – U.S. Air Force photo by Senior Airman Laura Turner

C-17 takes off in Middle East

From its central Persian Gulf locale, the small nation of Qatar is reputed to be a strong ally to U.S. forces in the Middle East. Now, the rapport between the two countries appears to be further solidified by the recent delivery of a Boeing-crafted C-17 Globemaster III airlifter (Figure 3) to Qatar's military. The C-17 was ordered via an agreement between The Boeing Company and Qatar in mid-2008 and represents the first C-17 sale to a Middle Eastern nation. It was delivered last month to the Qatar Emiri Air Force at a Boeing ceremony held in Long Beach, California. A second C-17, also purchased in the aforementioned agreement, is slated for delivery to Qatar later this year. Of the 205 C-17s in service, 16 are owned by non-U.S. nations. Soon joining them: The United Arab Emirates, which announced in February a purchase of four C-17s.

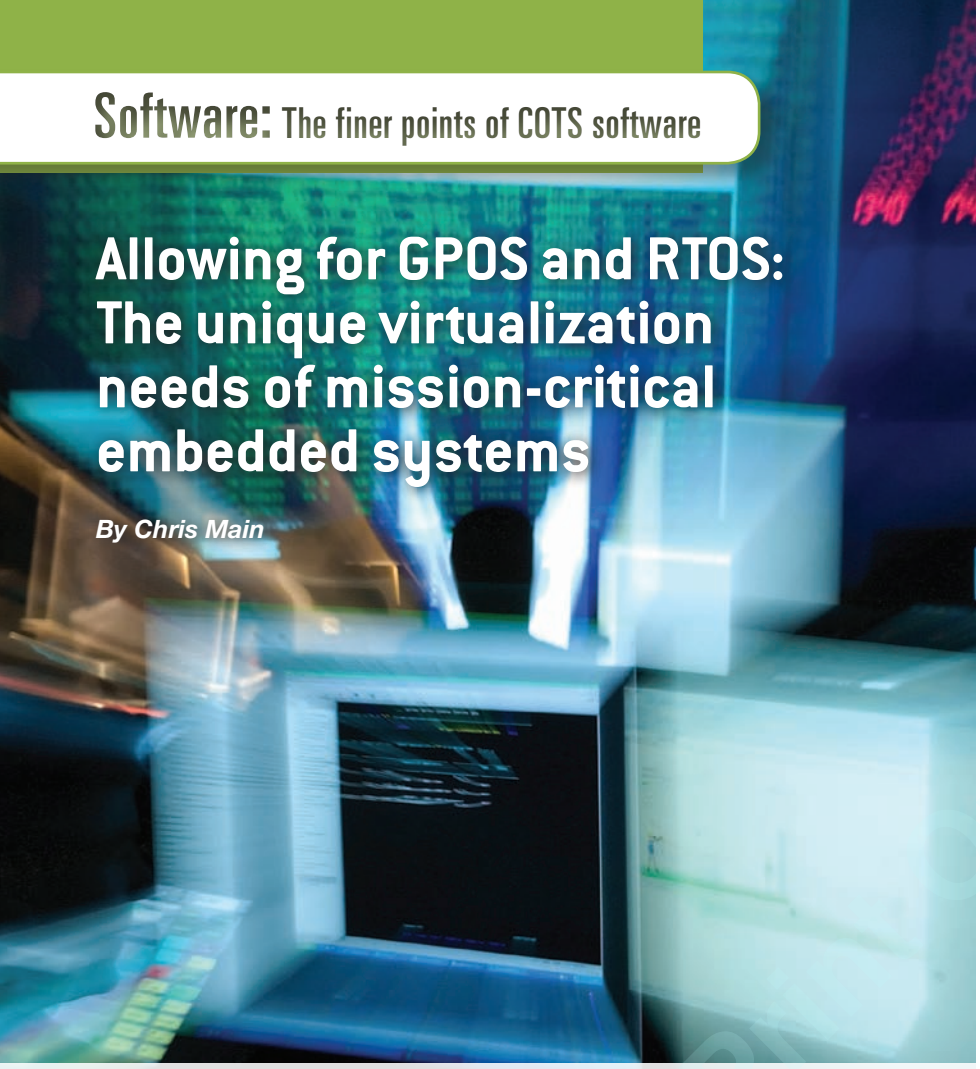
JWAC: 'Virtually' secure at all levels

Trust and security are important at any level, which is why the Joint Warfare Analysis Center (JWAC) recently implemented Trusted Computer Solutions, Inc.'s SecureOffice Trusted Thin Client product. Since the JWAC institution aims to solve U.S. warfighter challenges via its engineering and science know-how, security is not an option but an absolute must (Figure 4). Thus, the product's bestowed Authority to Operate (ATO) at the Top Secret/SCI and Below Interoperability (TSABI) ranking ensures that defense, intelligence, and civilian agencies can all access internal and external networks, each at their appropriate classification level. JWAC's virtual configuration of SecureOffice Trusted Thin Client provides security through multiple network connections that can be accessed via a distribution console, which serves double duty by maintaining back-end network separation while serving as a trusted router.

Figure 4 | Security is important, particularly at JWAC where defense, intelligence, and civilian agencies all need to access internal and external networks, each at their appropriate classification levels.

Allowing for GPOS and RTOS: The unique virtualization needs of mission-critical embedded systems

By Chris Main



U.S. Air Force photo by Jason Minto

The prevalence of multicore processors on the computing scene is now a fact of life, and OEMs are experimenting with ways to partition their applications on different processor cores. In the embedded computing world, this can mean hosting multiple, heterogeneous operating systems on the same processor chip at the same time. Thus, virtualization is key. While some Virtual Machine Managers (VMMs) blend only General Purpose Operating Systems (GPOSs), mission-critical virtualization schemes containing both Real-Time Operating Systems (RTOSs) and GPOSs present their own unique challenges. Chris reveals the finer points of virtualization and determinism, presents an example, then explains how legacy applications fit into the scenario.

Considering the ever-increasing pervasiveness of multicore processors in the embedded realm, virtualization is the key to enabling multiple operating systems to coexist on a multicore processor chip. However, each virtualized embedded system is different, particularly when an embedded system involves mission-critical or highly secure applications running on separate guest OSs on the same platform. Often, a Real-Time Operating System (RTOS) and a General Purpose Operating System (GPOS) will be combined. Different OSs are required because real-time or machine-directed tasks have different needs for OS functionality than general purpose or human-directed tasks.

But how virtualization is implemented makes all the difference when building such mission-critical embedded systems. The responsiveness of the system must be preserved, and that means preserving the original system's ability to respond to stimulus in a time-predictable and repeatable or deterministic manner. But therein lies the challenge: Not all Virtual Machine Manager (VMM) implementations are created equal. The VMMs used in server applications, for example, put maximum resource utilization as their highest priority, while hypervisors built for the needs of telecommunication applications typically focus on data throughput.

However, neither focuses on responsiveness to external events, as is needed in virtualization schemes for real-time defense applications. For most mission-critical military embedded systems, a special kind of virtualization – embedded virtualization – is required in order to respond with determinism to a range of external events. This ideal virtualization approach for military embedded systems additionally allows OEMs to save investment cost and preserve intellectual property by making it easy to host their legacy, real-time applications alongside new system elements with minimal, if any, changes to their existing code. Hosting legacy applications is much tougher than simply executing the code on a VMM or hypervisor, however. Our discussion explores the relationship between virtualization and determinism, includes an example, and explains how to fold in legacy applications.

Deterministic response to events

The key to building a deterministic VMM is to first deal with the issue of how processor interrupts are delivered to each of the guest operating environments. Enabling the shortest response times ensures determinism and requires differentiating between I/O resources that can be virtualized and those that should not. For example, disk accesses are typically not time-critical elements in an embedded system, so they can be virtualized. In this way, a single disk can be shared between multiple operating environments. In contrast, interrupts from hardware devices, such as encoders that provide inputs for closed-loop motion control, need to be handled according to a precise schedule in order for the application to work predictably. So the interrupt inputs to these processes must be, in effect, "hardwired" to the processor that runs the real-time control programs.

An embedded virtualization platform must enable isolation between multiple operating systems, with a minimum of virtualization overhead. Accordingly, operating system software and applications hosted by this platform are allowed direct access to critical I/O devices in order to maintain deterministic response to device events. General-purpose virtualization approaches that virtualize the entire machine environment might maximize the utilization of the CPU at the expense of responsiveness to external events. They attempt to maximize the utility of the platform and typically do this by allocating work to CPUs as they become available. In this way they can use a high proportion of the available CPU

cycles (over 90 percent claimed in some cases), which allows them to reduce the hardware cost of running a given number of server applications.

In contrast, an embedded VMM implementation must maximize the predictability of the response of applications to hardware events and CPU utilization is not as important. The overriding factor is performance of a given interface to the CPU, and the VMM ensures this by isolating hardware between virtual environments.

Example: GPOS/RTOS virtualization

Consider the following example wherein isolation of hardware between virtual environments is a factor in a system using multiple computing substations. The application's purpose is to retrieve small unmanned vessels and place them aboard Navy ships. The problem is how to guide a robot that is affixed to a ship so that it can attach a line or fixture to an unmanned floating vehicle while both are tossing at sea. The robotic crane uses a vision system to see exactly where the vehicle's attachment point is and computes the algorithms to predict where it will be in the future as it is moved by the action of the sea. The robot crane is guided by the motion control system to the place where a hook or latch is predicted to be, and contact is made as the two come together.

As stated, this application utilizes multiple computing subsystems. One of the processors is dedicated to processing tasks relating to the vision system, while operating tasks associated with driving the motion subsystem are dedicated to another CPU. This scheme allows the processing of the vision system to monopolize the cycles of one processor without affecting the other functions of the system, and vice versa. A third processor, with no time-critical processing needs, supports the Human-Machine Interface (HMI). Before the advent of multicore CPUs and VMM software, these three processing subsystems (see Figure 1) would be implemented as three separate computing units, with their own processor cards, memories, power-conditioning circuitry, and so on.

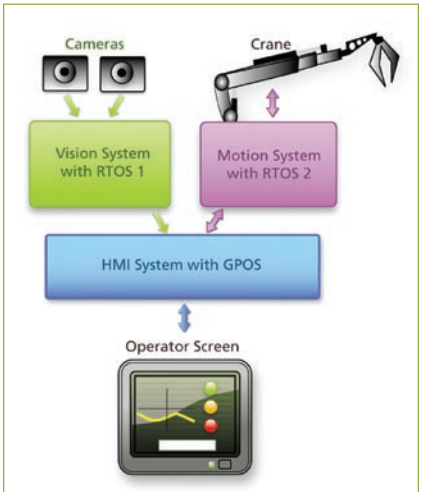


Figure 1 | Embedded system built as a set of independent subsystems

Now, the three separate subsystems can be hosted on different cores of the same processor chip, enabling system cost savings without sacrificing performance and determinism of the separate functions. As Figure 2 shows, one of the keys to maintaining the responsiveness of the system is to dedicate processor cores and associated I/O to separate operating environments.

To preserve determinism, embedded VMM developers must plan virtualization carefully so that interrupt overhead is predictable, measurable, and minimal. Also, each CPU core must have its own task scheduler and virtual machine, rather than using a single master scheduler designed to share multiple cores. An added benefit of this approach is elimination of the overhead associated with a master scheduler, which many virtualization schemes use to implement Symmetrical Multiprocessing (SMP) to manage execution of multiple GPOSs on multiple processor cores. The SMP scheduler has a relatively high overhead compared to the embedded multiprocessing approach, which does not impose scheduling policies at a system level.

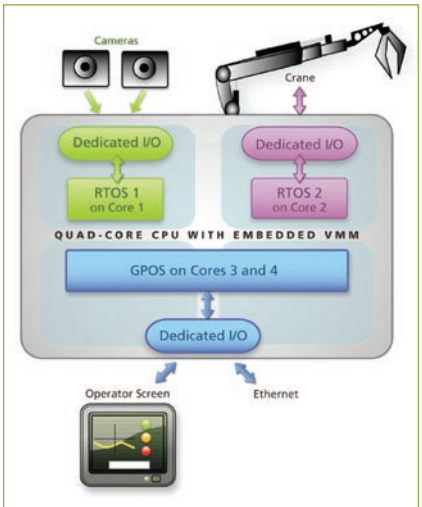


Figure 2 | Multicore processors and Virtual Machine Manager software enable multiple processing subsystems to be implemented on the same platform, saving system costs without sacrificing determinism.

Folding in real-time, legacy processes

As mentioned earlier, one of the most valuable uses for multi-OS embedded systems is incorporating legacy real-time processes into new or upgraded products. Military OEMs typically have a large intellectual property investment that they don't want to risk or discard when moving to a new platform. Typically, these OEMs will start out by just running their legacy RTOS alongside Windows on a VMM. But as time goes on, they might find the need for expanded real-time functionality and running multiple RTOSs alongside Windows.

When considering legacy application integration into a virtualization scheme utilizing RTOS and GPOS, besides the determinism issue, another issue is managing efficient communication between the environments. To move legacy applications from a multiplatform environment such as that shown in Figure 1 to a single platform, multicore, multi-OS environment (see again Figure 2), it pays to virtualize standard resources (disk services for booting, serial terminal services for logging, and Windows virtual communications services such as virtual Ethernet and virtual serial interconnects) that are not time-critical, while refraining from virtualizing I/O that is critical to delivering determinism (for example, a motion-control interface and vision subsystem). To allow for maximum performance with minimal lost data (typical requirement is none), handling the interrupt deterministically is critical.

An additional aspect of making legacy software work easily in an embedded virtual environment is that of providing support for software loading. Instead of requiring each guest operating system to be modified using a special Board Support Package (BSP) to make the software operate properly in the VMM, the embedded VMM platform should allow each guest operating system to boot as it normally would on a PC, without change. This eliminates the need for software modifications and can considerably decrease the cost and simplify the implementation of embedded systems.

Leveraging multicore chips via embedded virtualization

Embedded virtualization gives OEMs the opportunity to take full advantage of the new multicore processor chips in platforms where RTOS and GPOS both reside, to decrease system costs and preserve legacy code without sacrificing determinism. This new technology could not have come at a better time for the military embedded systems marketplace, as all OEMs are looking for ways to increase their efficiency.

Chris Main, *CTO, has led the development of TenAsys' virtualization technologies. He earned a graduate degree in Physics from York University (UK) and postgraduate degree from Bath University (Education). Chris has worked in real-time systems starting with minicomputers, then worked in the iRMX group at Intel. He was on the original development team for INtime and is a cofounder of TenAsys. He can be contacted at Chris.Main@tenasys.com.*

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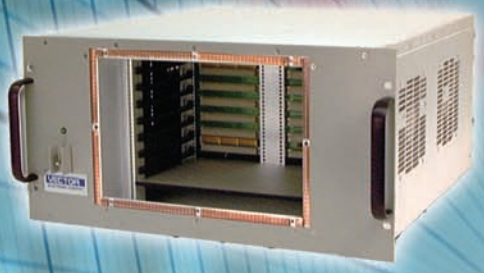

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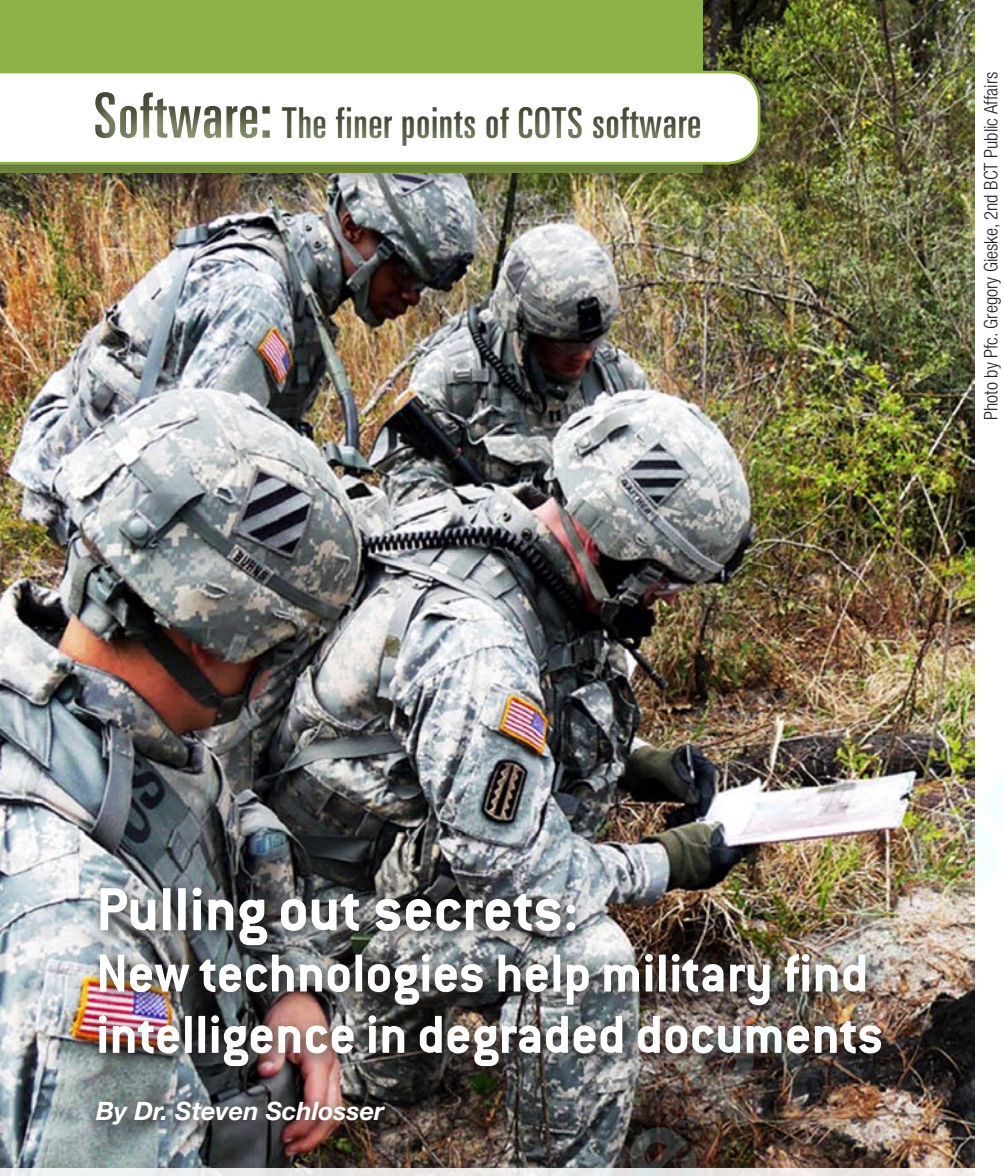

Photo by Pfc. Gregory Gieske, 2nd BCT Public Affairs

Pulling out secrets: New technologies help military find intelligence in degraded documents

By Dr. Steven Schlosser

Recent research has produced practical multilingual text processing systems that are assisting today's warfighters when they need to read captured paper documents that are in poor condition, hard to read, and written in a foreign language – immediately.

Modern warfighting emphasizes the development of intelligence to obtain strategic and tactical advantage. Recent technological advances have broadened and accelerated this trend enormously and, today, it is finally practical to make use of captured paper documents for intelligence purposes while still on the battlefield.

Today's soldiers need to determine the gist of paper documents that are in poor condition, hard to read, and written in a foreign language – immediately. Because soldier-linguists are in very short supply, it is a challenge to quickly assess a document's intelligence relevance and obtain actionable information from it to support the warfighter.

An emerging solution to the challenge of battlefield document exploitation employs field-based systems that integrate advanced forms of document image capture, multilingual Optical Character Recognition (OCR), multilingual machine translation, and multilingual word or phrase spotting. Of particular interest are the recent developments in multilingual OCR and multilingual word spotting that make field-based exploitation systems practical.

The current military operations in Iraq and Afghanistan underscore the need for OCR systems that effectively transcribe Middle Eastern and Asian languages. While OCR software for Latin languages has long existed, systems that can recognize languages such as Arabic, Persian, Pashto, and Urdu as well as Chinese, Japanese, and Korean are just emerging. Recently developed multilingual OCR systems address these military-significant languages and have a number of unusual capabilities that directly fulfill the needs of battlefield systems. Prominent among these are: accurate recognition of degraded documents and identification of words and phrases signifying people, places, or things.

Multilingual text transcription and word spotting

Accurate transcription of Middle Eastern and Asian text is difficult. Degraded document images must be enhanced before accurate recognition is possible. Figure 1 displays an example of the extent to which images can be enhanced and readable information recovered. Since degraded document images are the norm in battlefield situations, the integration of sophisticated

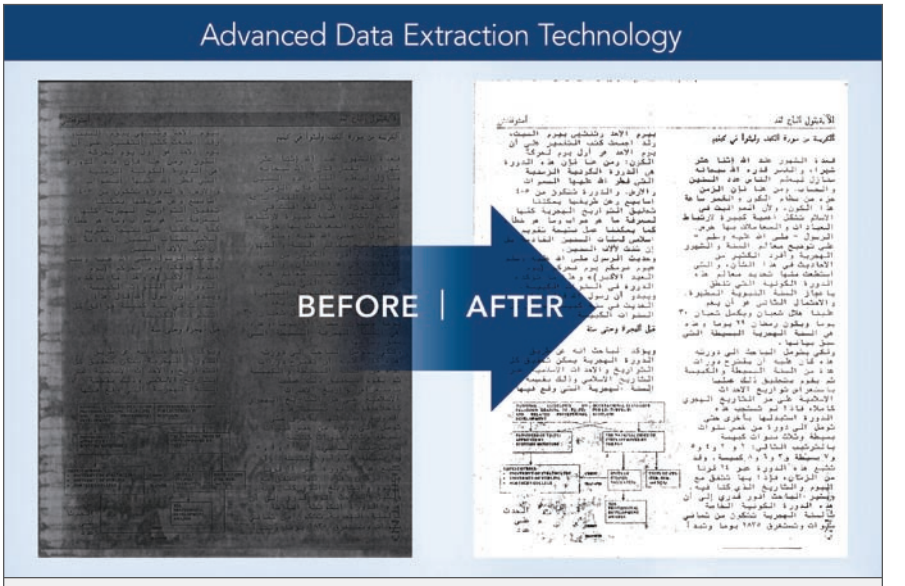

Figure 1 | Before – After: NovoDynamics software extracts information from degraded documents, to help military analysts pull valuable information from more sources.

enhancement capabilities with a recognition system makes military document exploitation much more successful.

Another key to accurate recognition of degraded documents lies in the recognition process itself. One superior method uses the concept of "over-segmentation," which overcomes many of the limitations of traditional character segmentation when working with low-resolution imagery or connected scripts (for example, Arabic). The goal of over-segmentation is to split, or segment, an image of text into primitives: pieces containing an individual character or a portion of a character. Then the task of correctly assembling the primitives into recognized characters can be performed and language-specific constraints incorporated to achieve maximum accuracy regardless of whether the source document is degraded, cursive, or even handwritten.

High word-spotting accuracy is obtained through the use of query-time OCR. A typical general-purpose OCR lexicon is designed to cover the most frequently used words in the target language to maximize recognition performance without making any assumptions about document content. While this strategy provides the best generic recognition, it is not ideal for word spotting, or equivalently, search queries, because queries against a document (or a corpus) are almost always concerned with less frequent words representing entities such as people, places, or things. Since these types of words occur only in specialized contexts, they are not usually included in a general-purpose lexicon. Consequently, they are more likely to be incorrectly recognized by a generic OCR engine, particularly in the case of low-quality document imagery where word-spotting accuracies are significantly decreased.

Query-time OCR is implemented by constructing a supplemental lexicon from the keywords of each query and providing it to the OCR when word spotting is performed. Though not obvious, query-time OCR turns out to be a very practical approach to word spotting that results in accuracy improvements of up to 15 percent compared to conventional methods.

Practical tools for document exploitation

The ascent of dissimilar enemies calls for new tools for the warfighter that address the need to obtain relevant intelligence information from degraded foreign language documents while on the battlefield. Modern document exploitation systems aim to provide that support by integrating software components that enable image capture, transcription, translation, and search (word spotting). VERUS, a product of NovoDynamics Inc., incorporates the OCR advances described for multilingual recognition of degraded Middle Eastern and Asian language documents. The aforementioned query-time OCR module has been proven in a laboratory setting and can be integrated with VERUS when needed. The result: highly accurate, rapid readings of degraded documents, to help the military find actionable intelligence.

Dr. Steven Schlosser *is senior scientist at NovoDynamics, Inc., an In-Q-Tel portfolio company headquartered in Ann Arbor, MI with offices in Vienna, VA. He holds a Ph.D. in Mathematics from SUNY at Buffalo and a B.S. in Physics from Rensselaer Polytechnic Institute. He can be contacted at steve@novodynamics.com.*

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Defense symbology standardization enhances public-private collaboration for warfighter safety

By Steve Panzer

Photo by U.S. Marine Corps, Cpl. Robert S. Morgan

Deploying symbology standardization through an easy-to-integrate geospatial module providing DoD's 2525B symbology maximizes effective communication and enhances public-private collaboration by enabling the private sector to work cohesively with defense agencies in support of the warfighter.

As we continue to witness the shift from face-to-face battle tactics to asymmetrical, network-centric warfare, effective communication is critical to the warfighter. In theater, the Department of Defense relies heavily on maps and other visual displays – computer generated or handwritten – to communicate information about fleet routing, enemy positioning, terrain details, and other important location-specific information. The lack of standard mapping symbols can cause confusion regarding intended routes or mission directives when mapping symbols are misinterpreted or unclear. In order to maximize effective communication across the Defense enterprise, a symbology standard needed to be created, streamlining mapping processes across the board. As the government is turning to the private sector to leverage expertise and best practice technologies, this 2525B standardization also needed to be made available to both public and private sectors – enabling the private sector to work cohesively with defense agencies in support of warfighters – maximizing effective communication and safety in the battlefield.

The 2525B standard

Prior to creating a standardized symbology library, different defense agencies were using a variety of symbols meant to represent the same objects – sparking confusion, inefficiencies, and significant command and control challenges. In response to the growing need for mapping standardization, 2525B Common Warfighting Symbology was created by the DoD. This standard provides established rules and requirements for the development and display of unit and mapping symbols for all branches of the military.

The icon-based symbols contained within the 2525B standard are used to symbolize objects typically or specifically found in the warfighter's operational environment – providing the viewer with an "at-a-glance" as well as a detailed view of the battlespace. A coding scheme for symbol automation and information transfer, each symbol is used to determine affiliation of the object as well as status and battle dimension. Status of a symbol refers to whether a warfighting object exists at the location identified or will in the future reside at the given location, and battle dimension defines the primary mission area for the operational object within the battlespace. The use of a common set of symbols is similar to everyone speaking the same language – it reduces confusion, and ensures accuracy among all parties involved, including the public and private sectors. Since the topic is often mission-critical – and life-critical – decisions and determinations, accuracy, and clarity are top priorities.

Accordingly, symbols can be used for red-force blue-force tracking, which provides the warfighter with critical enemy advancement information or the location of allied troops. The symbols can also be used for the creation of tactical graphics, indicating anchor points that define boundaries and reflect the area's size and shape. Further, important vehicle and object distinctions can be made,

Figure 1 | The ObjectFX MIL-STD-2525B service allows for using symbology with any geospatial viewer.

such as distinguishing combat, utility, medical, and cargo vehicles. The adoption of a symbology standard has been so widespread across the Defense enterprise that other agencies, like the Department of Homeland Security, are now moving forward on their own similar symbology standards.

Deploying the standard

While the library of symbols is comprehensive, ultimately maximizing efficiency of communication through maps and other visual displays, a means of deploying the 2525B standard across the department and throughout the private sector was still needed. As all maps created within the department require use of 2525B symbols, all proposals submitted by private sector vendors working toward a partnership with the defense department must also utilize the same set of symbols. Technology such as ObjectFX's DoD symbology module, a scalable, flexible, Web-based tool based on DoD 2525B, can be implemented on any PC and is geospatial-platform agnostic, meaning it works with ESRI and Google technologies or ObjectFX's SpatialFX (Figure 1). It provides vendors and defense agencies with a comprehensive library of defense symbols at their fingertips. This solution, which can also be implemented as a service, allows systems integrators and government program offices to integrate the 2525B standard symbols more easily into their products, improving consistency and clarity. The consistent use of the same symbols ensures maps and charts – computerized or handwritten – can be read and understood as a cohesive whole, even when coming from different sources. The end result: A broader pool of experts can share crucial information more easily and provide the resources needed to enhance public-private collaboration in support of the warfighter.

Steve Panzer *is Vice President, Government Division for ObjectFX, where he works closely with government agencies to guide ObjectFX in developing capabilities that assist government in geospatial technologies requirements. He can be contacted at Steve.Panzer@ObjectFX.com.*

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Ensuring data security in logic non-volatile memory applications: Floating-gate versus oxide rupture

By Todd Humes

U.S. Air Force photo by Tech. Sgt. Shane A. Cuomo

Military and other high-security applications demand data storage that cannot be compromised by methods such as reverse engineering. A comparison of methods for reverse engineering oxide rupture memories traditionally used for one-time programmable applications versus floating-gate technologies will be examined. Oxide rupture technologies will be shown to be more susceptible to attack by classic reverse engineering techniques than floating-gate technologies.

The requirement for embedded Non-Volatile Memory (NVM) in secure applications continues to grow, primarily in key storage applications for encryption and content protection. Commercial applications, such as High-Definition Multimedia Interface (HDMI)/High-bandwidth Digital Content Protection (HDCP) for authenticating and encrypting digital audio and video streams, continue to emerge. For HDMI licensees, steep financial consequences result from having the encryption key compromised. More secure applications, such as secure encryption of personal, financial, or military data, require a much more robust solution to avoid compromise. Common reverse engineering schemes for determining embedded memory contents and a comparison of two types of NVM in logic processes – oxide rupture versus floating-gate – are presented, illustrating that oxide rupture technologies are more susceptible to reverse engineering attacks and resulting security breaches than floating-gate technology.

Comparison of floating-gate and oxide rupture technologies

The differences between the data storage encoding methods of floating-gate and oxide rupture technologies present unique opportunities for reverse engineering. For floating-gate devices, oxides surround all sides of the gate and electrically isolate the charge-storing poly-silicon gate. The presence, or absence, of electrons stored on the poly-silicon gate encodes the data stored within the memory's bit cell. In the logic NVM approach, the current through the CMOS transistor's drain differentiates the data states, with high current or no current representing the data. Writing to floating-gates uses common techniques such as Fowler-Nordheim tunneling (electron tunneling through a barrier by the application of a high electric field) or hot carrier injection, where electrons gain sufficient kinetic energy to overcome a barrier.

In contrast, for oxide rupture technologies, a physical change to the CMOS transistor's gate oxide encodes the data. This physical change results from intentional damage to the gate oxide. The gate oxide damage creates a conduction path from the poly-silicon gate to the silicon substrate. Programming occurs when a silicon filament forms due to self-heating within the gate oxide, connecting the gate to the silicon surface. For an unprogrammed gate, only normal device leakage current exists within the CMOS transistor. As such, a difference in resistance between gates encodes the data state.

A reverse engineering primer

Although many reverse engineering techniques exist, engineers use three primary methods: device cross-sections, top-down planar inspection using optical microscopy or Scanning Electron Microscope (SEM), and voltage contrast (also using a SEM). In order to appreciate their applicability for use on embedded NVM, an understanding of the fundamentals of each approach is necessary, as follows:

- ***Device cross-sectioning*** uses physical deprocessing to cut the devices vertically for examination. Cross-sections typically reveal larger features such as poly-silicon gates, Shallow Trench Isolation (STI), spacers, contacts and vias, and oxides above and below the poly-silicon using Transmission Electron Microscopy (TEM). They are generally useful for determining larger defects related to processing rather than smaller defects such as pinholes in gate oxides used in oxide rupture technologies.
- ***Top-down planar inspection*** reveals features using techniques such as optical microscopy or Scanning Electron Microcopy (SEM). To be effective, deprocessing removes one or more of the layers that obstruct the feature being examined. Deprocessing involves many different methods including Focused Ion Beam (FIB) milling, chemical etching, backside or frontside

grinding (polishing), plasma etching, and other means. Required physical changes in the devices limit the effectiveness of this method.

- ***Voltage contrast*** utilizes a scanning electron beam to place charge on various circuit nodes. Depending on the circuit topology and other devices connected to the node, the charge either remains or gradually decays from the node. Using digital imaging, nodes appear brighter or darker depending on their charge. Voltage contrast also requires physical deprocessing down to the layer of interest, similar to top-down planar inspection. By using this passive voltage contrast technique properly, operators read an NVM's contents.

Deprocessing and inspection

Device cross-sectioning and top-down planar inspection rely on the fact that a physical change occurs and therefore represent useful techniques only for oxide rupture memories since floating-gate memories do not create any observable physical damage.

First, consider the first two methods for oxide rupture memories. For large arrays, an engineer would need to cross-section and image every single anti-fuse transistor in order to determine the contents of NVM. The rupture site for each device occurs randomly over the transistor's area; thus, reading the contents would require copious amounts of time and luck in large arrays in order to find the memory's contents. Cross-sectioning alone will not suffice as a technique for determining oxide rupture memory contents. Additionally, since there is no physical change in floating-gate memories, this technique will not work.

Next, microscopy techniques for oxide rupture memories may reveal the device's contents. In order to start, the devices must be de-processed down to the poly-silicon layer. Once the device has been de-processed down to the poly-silicon layer either through plasma or wet-etching techniques or grinding or a combination of various techniques, the physical difference between devices with intact gate oxide compared against ones with ruptured gate oxide can be enhanced by doing a silicon wet etch.

Recall that during programming, programmed oxide rupture bit cells create a silicon filament between the gate and silicon surface. Silicon selective etching removes the poly-silicon gate as well as the filament through the silicon dioxide. The silicon etch will continue down through the silicon filament in the gate oxide and etch the silicon substrate surface, while the gate oxide will protect the silicon substrate surface wherever it is intact. Top-down inspection will show a divot in the gate area of programmed oxide rupture bit cells. Top-down inspection easily reveals the contents of the memory array. Figure 1 shows the results of top-down inspection of a device with ruptured gate oxide.

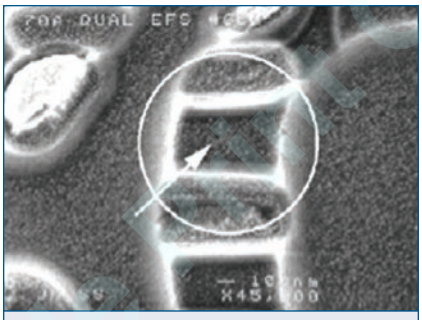

Figure 1 | Silicon deprocessing highlights ruptured gate oxide.

Finally, for both floating-gate and oxide rupture memories, voltage contrast techniques may reveal NVM contents. For this technique to be effective, the devices must be deprocessed down to the poly-silicon gate as shown in Figure 2 below. Floating-gate memories must be deprocessed down to poly-silicon gate. In anti-fuse memories, one poly-silicon gate can have many fuses on it. To electrically isolate the fuses from each other, the poly-silicon gates must be etched or polished back to at-or-below STI level. This deprocessing isolates the gates of the devices from other circuit elements so optimizing the voltage contrast eases.

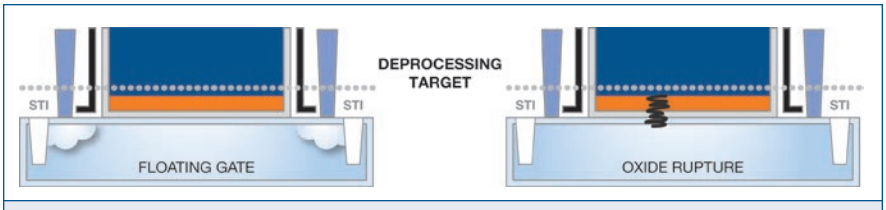

Figure 2 | Deprocessing is required for effective voltage contrast measurements.

To guarantee the results, the deprocessing cannot disturb memory contents. Floating-gate memories present unique challenges in this step, as the most effective techniques use plasma etching to remove the majority of the material. However, plasma etching often charges circuit nodes and could change the floating-gates charge and thus the NVM contents. Anytime the floating-gate is exposed, it is susceptible to having its contents disturbed or erased. To expose the floating-gate bit cells, only wet etch techniques guarantee minimum charge disturb. In contrast, oxide rupture technologies do not suffer from this limitation.

Next, once the samples have been successfully deprocessed, passive voltage contrast, either from a scanning electron microscope or focused ion beam, scans the memory arrays, bombarding the gates with charge. This process presents problems for floating-gate memories. Recall that in floating-gate memories, charge stored on the gate represents the digital state of the data: A floating-gate may be negatively charged (electron rich) or completely discharged (hole rich). In scanning the floating-gates with an electron beam, the negatively charged gates will repel the beam while positively charged gates will attract the electrons in the beam and, unfortunately, collect those electrons on the isolated gate. Those electrons will then rapidly become negatively charged. Thus, the beam disturbs the contents of the floating-gate memory. Effectively, no contrast optimization may be done prior to reading the memory, as the deprocessor has one shot at reading the entire memory array.

The same limitation does not apply for oxide rupture memories. In these memories, a ruptured oxide gate represents one data state while an unruptured gate represents the other data state. By deprocessing, the gates all become isolated, and thus ruptured gates look like leaky, resistive paths while unruptured gates electrically float. While scanning an electron beam over these memories, the deprocessor can raster scan the beam as long as necessary to optimize the contrast between ruptured and unruptured gates. Ruptured gates will draw the charge away while unruptured gates retain the charge. In this way, voltage contrast represents a very effective technique for determining an oxide rupture memory's contents.

The best choice for secure applications

Security applications demand the highest level of robustness and protection from physical attacks and deprocessing, especially in military applications. Three reverse engineering techniques have been examined: device cross-sectioning, top-down planar inspection, and voltage contrast for oxide rupture and floating-gate memories. Of these methods, floating-gates represent the most robust storage against these types of attacks.

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Warfighters harnessing today's mobile graphics technology: The impossible dream – or nearly reality?

By Mark Snyder

The exploding ubiquity of personal computing devices such as the iPhone or Sony PSPs gives a glimpse into the computing power consumers can now hold in their hands. These devices provide mapping, communication, video processing, and network data retrieval and allow connection and collaboration in ways never before imagined. So why has the military COTS community been so slow to harness these mobile technologies for the warfighter?

U.S. Army photo

No technology evolution in the past 10 years has shaped the way we interact with computers and information more than mobile multimedia platforms. Consider the average well-equipped consumer in the United States. In their car is a navigation map showing route guidance, their surroundings, local gas stations, and, if they are lucky, live traffic information. In their hand is an even more remarkable device, their mobile multimedia phone such as an iPhone or Sony PSP. In addition to offering the same mapping capabilities, this device might play 3D games with more graphical complexity than the average military map system, communicate both text and voice, play videos, and access the Internet.

This mobile graphics revolution has resulted from various factors, and consumers (and to some degree, businesses) have benefitted enormously. However, warfighters, especially in the U.S. military, have not seen this radical transformation for their computing equipment and capabilities. In many ways, the warfighter's computing architecture and methods are several years behind the times. The warfighter is still apt to be carrying the equivalent of a shrunken desktop computer just for mapping or to access videos or operate an unmanned platform. Vital to this equation are the hardware and software technologies behind the mobile multimedia revolution – and consideration of why our warfighters are not benefitting as they should and how the military COTS industry can improve.

Mobile graphics – The hardware

The key to the performance of mobile multimedia devices is matching the processor type to the task. Just as important is to provide a well-defined software environment and a strategy that leverages it. These processor types include:

- ***General purpose processors, optimized for sequential program execution.*** In the mobile processing world, these are typically low-power ARM RISC processing devices. These devices might be employed in scalable configurations.
- ***Dedicated graphics processors, optimized to provide rendering and media processing for standards-based media formats.*** These include 3D graphics or video data conforming to standards such as MPEG4 or the Khronos Group's (www.khronos.org) OpenGL ES for embedded systems. Mobile graphics accelerators can be employed as general purpose pixel processors, through the use of pixel and vertex shaders and languages such as OpenCL. Graphics processors are useful for such tasks as UI display, digital mapping, and data fusion. Some common mobile graphics accelerators used in mobile technology include Imagination Technologies' (www.imgtec.com) PowerVR MBX and SGX series, NVIDIA's Tegra and mobile GoForce/GeForce GPUs, AMD's Imageon, and many others.
- ***Pixel-programmable processors such as FPGAs, massively multicore processing chips, and DSP processors.*** These are optimized to process large amounts of data in parallel and are ideal for special-purpose tracking and image-processing algorithms, communications, and rapid data I/O required for systems processing visual media.

> The warfighter is still apt to be carrying the equivalent of a shrunken desktop computer just for mapping or to access videos or operate an unmanned platform.

In mobile devices, these components are combined into System-on-Chip (SoC) or System-on-Module (SoM) architectures that further reduce power and footprint. Hardware design often includes IP blocks for assembly within these systems. Several SoC architectures are available that provide very good mobile processor and graphics combinations that can be used to build mobile devices, and these technologies can also be used in military computing systems such as handheld UAV controllers, handheld mobile battlefield communication and shared situation computers, and onboard avionics or vetronics display systems. Some examples of common SoC architectures that offer new capabilities in interesting packages are Freescale's 5121 combining a PowerPC with a PowerVR GPU, and NVIDIA's ION platform combining Intel Atom with a low-power GeForce GPU.

Mobile software development

When Apple released its iPhone SDK to the software development public in 2008, nothing less than a new software subindustry was born. Micro companies formed to build games and applications for the device. Even technology with potential relevance to the warfighter, such as mobile geospatial applications and handheld simulators, has been developed and deployed to consumer and automotive marketplaces. In exchange for more universal acceptance of its devices (and a piece of the action), Apple unleashed the capabilities of its mobile media platform, offering a well-supported application framework, developer resources, and support. Their model deserves careful scrutiny by the military software development marketplace (Figure 1).

Figure 1 | Laminar Research's X-Plane iPod Edition (pictured) highlights mobile graphics technology with potential warfighter relevance.

Mapping capabilities are another area where mobile software development techniques offer advantages for potential military use. Mobile platforms stress vector-based graphics, and are therefore able to achieve high compression ratios and utilize data sources such as street-level data from TeleAtlas. Also, mobile navigation platforms have adopted certain standards for symbols and data interchange between applications, enabling geotagging and related forms of entertainment (Figure 2).

Figure 2 | Vector-based graphics, such as those utilized in Quantum3D's Mobile IFE with 1 Meter Imagery on NVIDIA ION, could prove useful in warfighter venues.

The military software development landscape

However, the military software industry has been slow to adopt the same kind of methods as the mobile multimedia industry. Software development for military platforms is primarily oriented toward desktop computing platforms or their embedded variants. As an example, at a recent industry meeting, the government distributed the software requirements for a handheld UAV control platform needed to support its chosen mapping toolkit. Their requirement called for processor and graphics performance benchmarks that could only be met with the equivalent of a dual-core desktop processor. These requirements were derived from a digital mapping engine chosen by the government for the effort.

Many military software programs suffer from this kind of software-driven lack of flexibility. In a world where hardware changes constantly, the software, oddly enough, has become much more resistant to change. This is understandable in some ways, since software development costs are such a large percentage in major weapons systems. Unfortunately, however, software techniques that might be used to leverage mobile multimedia technology for the warfighter are not commonly employed in the development of military systems. But this condition need not remain unchanged.

Closing the gap – Addressing the development challenge

To close this gap, the military, its contractors, and the COTS embedded community that serves it can begin to do business differently in several areas:

- ***Software development methods can be changed.*** Software toolkits can be offered that leverage mobile technology. Why not a mobile multimedia military SDK toolkit, similar to the iPhone SDK, designed from the ground up to take advantage of mobile graphics technology? Such a toolkit could put a set of reusable software in developers' hands to enable the rapid prototyping and development of applications designed to run on a new class of mobile multimedia-aware devices.
- ***Field devices should be based on mobile multimedia technology.*** Why not SoC-based avionics displays in military vehicles? The technology is certainly capable of doing the job. But, too often, a risk-averse military development community ignores such technology as it specs out its hardware solutions. Similarly, why not use more mobile-multimedia platforms for ruggedized handheld display systems and wearable computers? Too often, these systems are just shrunken desktops, which as a rule do a poor job of matching processor watts to pixel throughput performance for digital-media-based applications (resulting in both poor performance and overlarge power requirements).
- ***Develop the technology for mobile multimedia the same way the military uses its Science and Technology (S&T) development mechanisms for other new technologies.*** Look at the way, for instance, the military has adopted novel development methods for unmanned technology, using SBIRs, small companies, DARPA grand challenge, and wartime deployment of new technologies to accelerate the development of UAVs. Such a strategy could also be employed to bring mobile capabilities to warfighters.
- ***The military community should change the way it thinks about processors.*** Too often, processors are specified out, based on raw processor performance, but overall system performance is not considered. A 10 W SoC running a PowerPC or ARM core and a mobile GPU core might be an excellent choice to deploy on an embedded display system. But unless the spec allows bidding such a solution, it will not be considered; additionally, what might have been a 5 W solution will end up consuming 30 W to supply the same display.

In the end, military adoption of new technology such as low-power graphics is about changing the way military COTS vendors do business. But the changes are not radical. Having the power of mobile pixel processing onboard will enable the soldier of the future to sense more, interpret more, and share more information than ever before. The ability to process information on the fly, reason from it, and collaborate while using it will be key to fighting the new battles we are sure to face in the future. Consequently, the military COTS industry must harness low-power graphics technology to get there. But technology development does not need to occur: The proof that these warfighter-ready technologies can be done is already in our hands – and in our vehicles.

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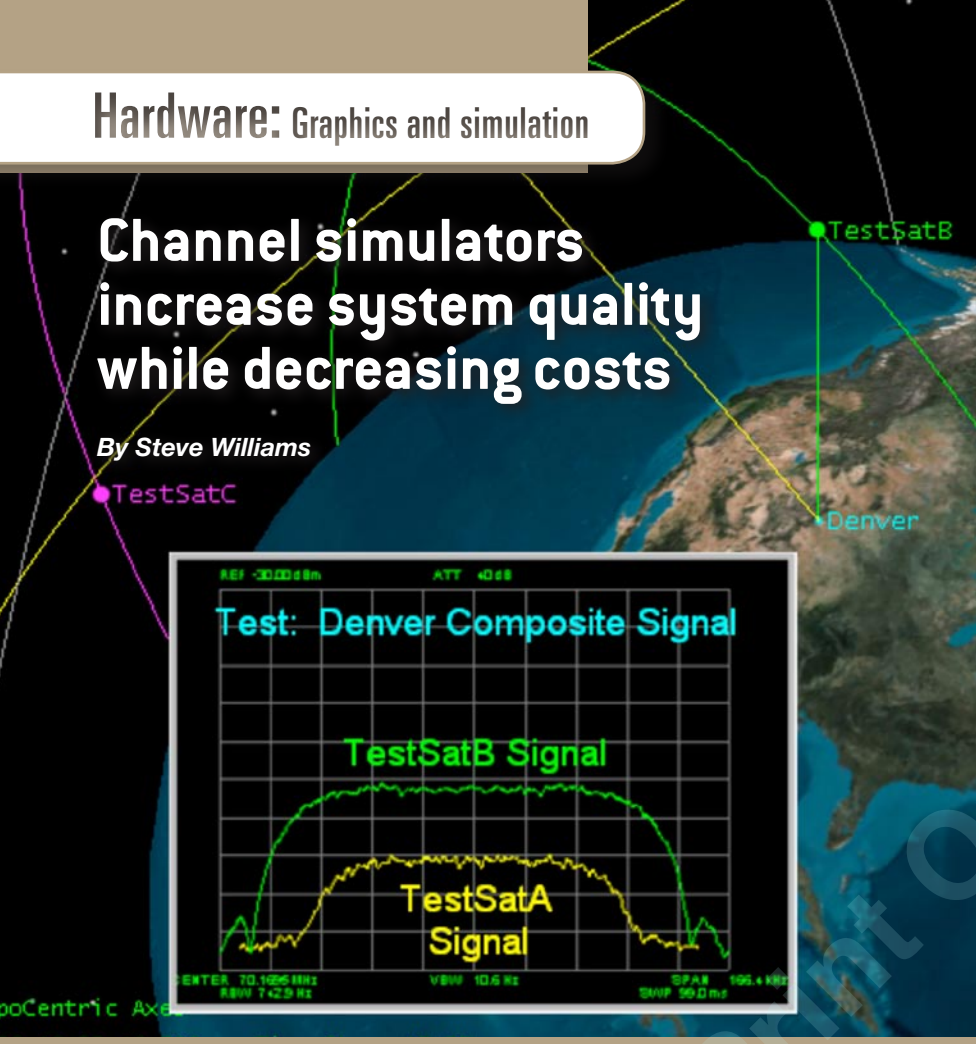
Channel simulators increase system quality while decreasing costs

By Steve Williams



Channel simulators create realistic signals using precision, physics-based Radio Frequency (RF) propagation models. They enable true, real-world hardware-in-the-loop tests for R&D, QA, and production verification, reducing R&D and test schedule and cost for RF Communication Systems (COMMS) and components used with satellites, Unmanned Aerial Vehicles (UAVs), weapons, targets, test ranges, ground systems, and aircraft.

Radio Frequency (RF) Communication Systems (COMMS) for satellites, Unmanned Aerial Vehicles (UAVs), weapons, targets, test ranges, ground systems, and aircraft – especially those that protect lives or relate to expensive, unique, or secure assets – must perform flawlessly in increasingly crowded, interference-laden, low-power and high-noise RF signal environments.

As these COMMS systems and components are designed and tested, performance assurance is initially achieved through well-known circuit, software/firmware, and system simulation along with rigorous link budget analysis. As development proceeds, increased assurance comes from the use of Test and Measurement (T&M) instrumentation for stimulus and analysis.

Full and final verification is normally achieved through numerous system insertions, and test and debug cycles with all other interacting system hardware and software components are included – over a full span of nominal and worst-case signal scenarios. Often, these scenarios include those expensive or dangerous to create, time consuming to replicate, or theoretical and cannot – or should not – be produced in the real world. However, in marked contrast to these expensive and tedious tests conducted without them, tests that employ channel simulators sharply reduce risks associated with under-design and over-design – and save time, reduce cost, and increase test coverage and quality. Channel simulators enable this same level of rigorous testing and are essential to comprehensive COMMS system and component test, yet are much more economical.

Our discussion describes channel simulator use in testing wireless COMMS systems. We explore how channel simulators provide physics-obedient, phase-continuous carrier and signal Doppler shift, range delay, and range attenuation to test signals, resulting in signal environments that precisely duplicate what will be encountered in actual system deployment.

Wireless COMMS testing and channel simulators

For stimulus and analysis, robust wireless COMMS R&D and test activities utilize spectrum analyzers, signal generators, oscilloscopes, data generators, Bit Error Rate (BER) testers, and other instruments specific to the mission and to the hardware, firmware, and/or software under test.

Especially in wireless COMMS systems where receivers and transmitters will be in motion and at distance with respect to one another, test instrumentation must generate test signals that include time-varying Doppler shift, delay, and attenuation, along with noise and interference impairments.

When testing receivers, demodulators, and decoding algorithms, for example, it must be verified that these remain locked, maintaining acceptable BER performance, even as the received signal frequency shifts, and as the received data rate changes due to the time-varying relative motion of the transmitter and receiver. As well, Digital Signal Processing (DSP) algorithms must be proven able to extract the desired signal from noise and interference as its amplitude varies over time.

Channel simulators create the signals, nominal and worst-case, that faithfully model nature and enable such testing. They perform their functions in a fully phase-continuous manner with smooth interpolation and high output resolution. This ensures that no data errors are introduced by the instrument as a result of waveform discontinuities, inappropriate phase shifts, flat spots, or other anomalies.

Channel simulators perform inherently difficult tasks but buffer users from this complexity. Simple, yet flexible and powerful scenario creation and visualization are core attributes, as are the technical capabilities explained in the next sections.

Channel simulator – Doppler shift

RF signals between moving transmitters and receivers are affected by a number of

RF propagation effects. The first of these is Doppler shift.

Equation 1 describes Doppler shift based on an actually transmitted frequency and the relative velocity between the transmitter and the receiver:

$$F_s = F_\alpha * V/c \qquad (1)$$

where F_s = Doppler shift in Hz; F_a = actually transmitted frequency in Hz; V = relative velocity between transmitter and receiver in km/s; and c = speed of light (~299,792.458 km/s).

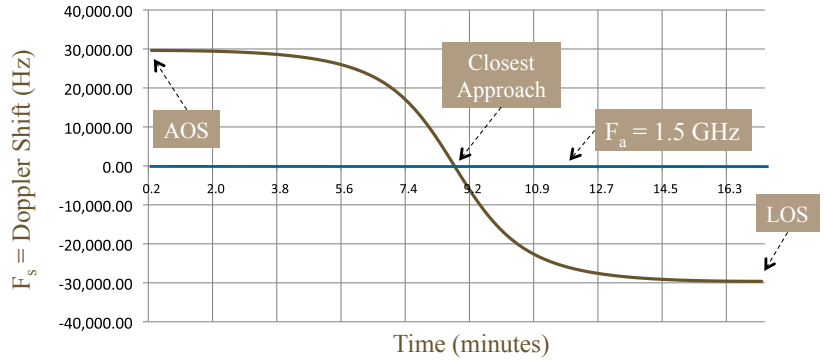


Figure 1 | Example Doppler shift curve

Equation 1 is plotted in Figure 1 for a typical LEO satellite in an 800 km circular orbit, with a 1.5 GHz RF COMMS link. Acquisition Of Signal (AOS) and Loss Of Signal (LOS) points are shown.

Observed with a spectrum analyzer, a channel simulator-generated signal for this scenario smoothly moves from right to left (higher to lower frequency) as time progresses, exactly like a signal from an on-orbit LEO. This is referred to as "carrier Doppler shift."

As well, the channel simulator applies appropriate Doppler shift across its bandwidth. This means that the higher-frequency edge of a 30 MHz-wide QPSK signal, for example, will receive a higher Doppler shift than the components of the QPSK signal that are lower in frequency. This is a subtle yet important aspect of carrier Doppler shift.

In addition to carrier Doppler shift, "signal Doppler shift" is based on the data modulation rate. The data rate varies similarly to Figure 1, but with a data rate vertical scale.

Well-designed channel simulators implement fully phase-continuous carrier and signal Doppler shift. If either is missing, because a channel simulator is not utilized, or an incompletely implemented one is, the instrument might introduce bit errors.

Channel simulator – Range delay

All COMMS systems incur some form of propagation delay between transmitter and receiver, whether they are wired systems, optical systems, or wireless radio systems.

In each, the propagation velocity is related to the dielectric constant of the

medium through which the signal passes. Propagation velocity is expressed as a percentage of the speed of light. In vacuums (dielectric constant = 1) and in air (dielectric constant = 1.00054), propagation velocity can be considered to be 100 percent of the speed of light for most practical purposes.

Therefore, in wireless COMMS systems, the propagation delay between a transmitter and receiver can be calculated by dividing the straight line distance between the transmitter and the receiver by the speed of light, as shown in Equation 2:

$$D = R / c \qquad (2)$$

where D = delay in seconds (s); R = range in km; and c = speed of light (299,792.458 km/s).

For the LEO satellite discussed earlier, the range delay profile of Figure 2 applies.

When observed with an oscilloscope triggered with a suitable time synchronization signal, a reference point in a channel simulator-generated output signal smoothly moves from right to left (larger to smaller delay), then from left to right as time progresses, exactly like a signal from an on-orbit LEO.

Channel simulators implement smooth and phase-continuous range delay that precisely matches what would be encountered on a real-world RF link such as with the described LEO satellite. Tests without channel simulators capable of such fidelity, high delay resolution, and range might unnaturally exercise the systems or components being tested.

Channel simulator – Range attenuation

COMMS system performance also depends on the power level of the received signal. Often, transmitters are low-power systems at great distances from receiver systems. Verification with dynamic signal power levels and validating signal reception under worst-case conditions are key COMMS system tests.

The power level of a received signal is affected by free-space path loss, which can be calculated from Equation 3:

$$L = 32.4 + 20 \log F + 20 \log R \qquad (3)$$

where L = free-space path loss in dB; F = frequency in MHz; and R = range in km.

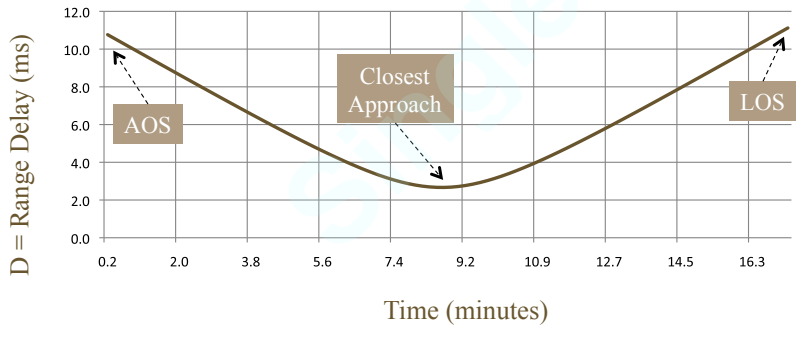


Figure 2 | Example delay curve for a LEO satellite

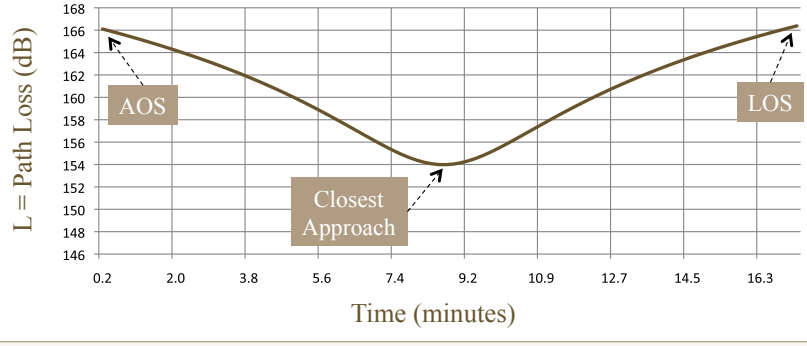


Figure 3 | Example path loss curve for a LEO satellite

> "With its dynamic, physics-compliant application of Doppler shift, delay, and attenuation – in combination and singly – the channel simulator is a vital tool for generating realistic test signals..."

For the LEO satellite discussed, the path loss profile in Figure 3 can be expected.

When observed with a spectrum analyzer, the amplitude of a channel simulator-generated satellite signal moves smoothly, moves lower (higher to lower power), then back up as time progresses, exactly representing the scenario requested.

Channel simulators increase system assurance

With its dynamic, physics-compliant application of Doppler shift, delay, and attenuation – in combination and singly – the channel simulator is a vital tool for generating realistic test signals that exercise tested hardware, firmware, and software in realistic as well as worst-case fashion. As a result, channel simulator-enhanced testing significantly increases system quality while decreasing costs.

Steve Williams *is a business area manager at RT Logic, responsible for R&D and business development activities for RT Logic's channel simulator, range test, and signal geolocation systems. His 28-year digital and RF instrumentation career has also included R&D, management, and business positions at Hewlett-Packard, Agilent Technologies, and precisionWave Corporation, which he cofounded. Steve has a BSEE from the University of Illinois and is an Extra Class amateur radio licensee (KØSRW). He can be reached at swilliams@www.rtlogic.com.*

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U.S. Air Force photo by Senior Airman Levi Riendeau

Project 'Total Recall' case study: Designing a large rugged/ redundant storage server

By Ken Owens

The task: to design and build a massively redundant, ruggedized storage and computing subsystem, without the end application being disclosed. Meanwhile, challenges of backplane design, thermal dissipation, and ruggedization arose.

Recently, Conduant Corporation in Longmont, CO was subcontracted to design and build a massively redundant, ruggedized storage and computing subsystem. Although the end application was not disclosed, Conduant's requirements included redundant servers each with redundant access to storage with a capacity of up to 2 TB. Challenges of backplane design, thermal dissipation, and ruggedization under weight constraints all needed to be conquered by the engineering team to satisfy the project requirements.

The challenge

The basic system called for a large storage farm of up to 2 TB connected to a server host along with eight processor boards for data manipulation and processing. For redundancy there had to be four independent servers and each server had to include a primary and secondary path to the storage farm. The active server and processing boards were required to have network access to each other and externally using a GbE LAN. A final major requirement was that power to all components must be individually controllable for power conservation. This included each individual storage device. The entire configuration had to be contained in a ruggedized chassis measuring 17" x 12" x 11", cooled only by conduction, and able to survive high vibration and shock levels. Thus, the primary challenges were designing the backplane, thermal dissipation, and meeting these specific ruggedization stipulations. A look at the overall design is necessary before delving into these challenges.

The design

The design task included selection and qualification of the major COTS components, development of the custom backplane, and the mechanical design of the chassis. Software integration support and all testing to qualify and demonstrate the required functionality were also performed.

The major components selected for the system include the single board computer, which has a dual-core 64-bit CPU running at 2 GHz, solid-state SATA disks, and a 10-port GbE switch. There are also DC/DC power supplies and an EMI power filtering module. Although the system dissipates more than 400 W, no fans or other convective cooling devices could be used; conduction cooling to a customer supplied cold plate was specified. The proposed ambient operating environment ranged from -5 °C to +50 °C with the customer supplied cold plate at up to 50 °C.

Conduant designed a custom backplane to accommodate the 12 SBCs, 16 SSDs, 6 DC/DC power supplies, and the 2 GbE switch boards. The components were a mix of conduction-cooled 3U CompactPCI and VPX. The backplane also had to include the SATA connectors to allow the SSDs to connect directly to the backplane. The SSD storage device was mounted on a carrier to fit a standard 3U conduction-cooled chassis slot. This allows easy removal/replacement of the SSDs for service or expansion. Four of the CPUs are designated as servers with one active as the other three stand in reserve. The remaining eight CPUs are utilized as processing centers and communicate with the active server CPU for storage access over the internal Ethernet LAN. With the design in mind, the engineering team was ready to face the three primary challenges. See Figure 1 for an overview of the high-level architecture.

Challenge #1: The backplane

The complexity of the backplane design quickly became a major obstacle to overcome. Multiple data paths were necessary to allow for instantaneous switching between the available servers, the client CPUs, and all the SSDs in response to unit failures anywhere in the system. The backplane is designed with dual PCI Express connections from each of the four servers along with redundant SATA controllers for the solid-state disks. There is power switching controlled through redundant FPGA devices using an I2C interface that also includes voltage and thermal monitoring throughout the system. With all these components, the backplane became very densely populated on both sides with surface-mount devices.

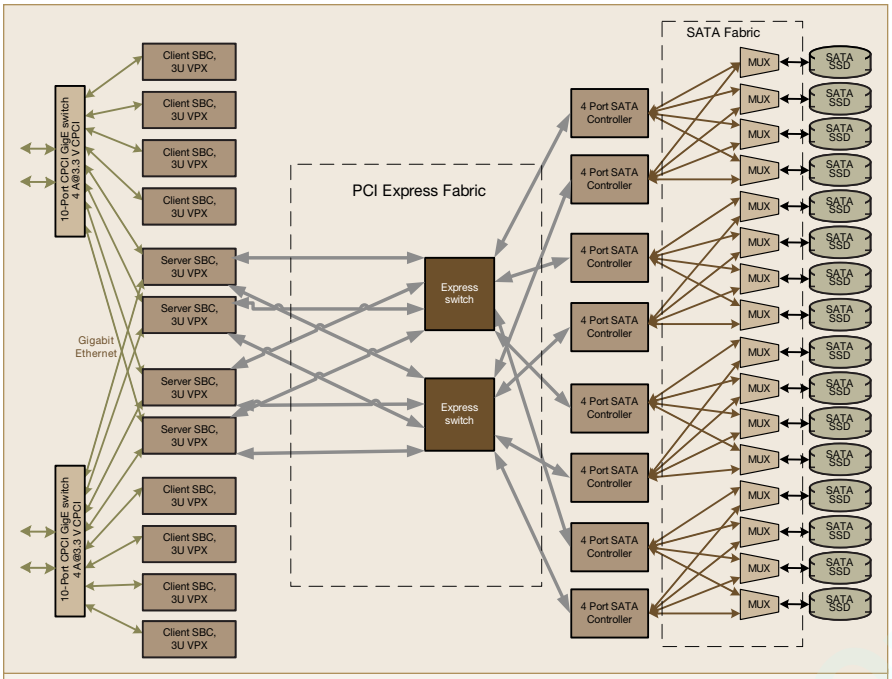

Figure 1 | An overview of the system's high-level architecture. The components comprise a mix of conduction-cooled 3U CompactPCI and VPX.

Moving much of this circuitry to additional VPX or CompactPCI boards was considered but rejected due to space constraints. The main chassis could not be increased in size enough to allow this change. Adding additional routing layers caused the PCB via size to increase and resulted in a loss of real estate for components on the top and bottom surfaces. By balancing these trade-offs and by carefully following best-practice PCB design rules to avoid signal interference and cross-talk issues, the design team was successful in producing a backplane to meet all the requirements with 18 layers. Nearly every component in the system has a redundant counterpart and can be switched on or off for power conservation. Perfecting this redundancy and switching capability proved to be the most challenging aspect of the system design.

Challenge #2: Thermal dissipation

Due to the thermal problems facing the engineering team, chassis design and backplane configuration required careful planning, modeling, and creativity. The conventional approach would call for the backplane to be positioned near the cold plate with the CPU cards and SSD loaded from the top and hence a considerable distance from the cooling heat sink. This approach required that the chassis walls be thick enough to carry the thermal load down the sides of the chassis to the cold plate. A heavier chassis meant exceeding the weight limits specified by the customer, and there was considerable worry that critical components would overheat.

The mechanical team responded with an upside-down approach. The backplane was moved to the top of the chassis and the cards and drives were loaded from the bottom, positioning them adjacent to the cooling plate. This change – along with careful placement of the heat-generating components relative to other components and metal heat sinks added to increase the heat transfer from some components – assured that the thermal requirements were met. Since the cards are arranged in two rows with a middle wall, this arrangement also allowed this internal wall to directly connect to the cold plate for additional cooling capacity to the external cold plate.

Challenge #3: Ruggedization

An additional design requirement centered on shock and vibration tolerance. The entire subsystem is required to withstand a 20 *g* shock force. Wedge locks are included on all cards, and the SSDs are inherently shock and vibration resistant. The typical right-side-up orientation would have resulted in the walls carrying the full weight of the components above, and would, therefore, require thicker walls for support.

However, the upside-down approach again provided an advantage by keeping the mass as low as possible in the system. By taking this approach, the walls above the backplane and the space required for cable routing, and so on, are not part of the main chassis structure, and the design team was able to decrease wall thicknesses in these areas for weight savings.

Upside-down thinking saves the day

Designing a complex subsystem as described is always a challenge. Most often, the larger project specifications are not disclosed, and the subcontractor works within the scope of their contribution and the limited specifications provided. With this project, the challenges included the design of a complex multilayered backplane and a bit of upside-down thinking (see Figure 2, which depicts the finished package). The engineers continually confronted unique requirements and unusual design constraints involving backplane design, thermal dissipation, and ruggedization. But at the end of the day, they delivered a successful project.

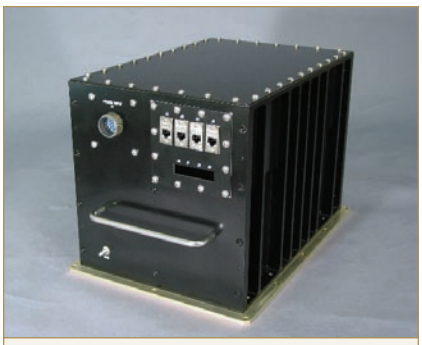

Figure 2 | The finished system – a massively redundant, ruggedized storage and computing subsystem.

Kenneth R. Owens *is cofounder and CEO of Conduant Corp. Prior to forming Conduant, Ken spent 20 years developing hardware and software architectures at data storage companies including StorageTek and Maxtor. Ken holds two U.S. patents that apply to the design of disk storage systems. He studied Mechanical Engineering at the University of Colorado. Ken can be reached at ken@conduant.com.*

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Software warranties — A new era?

By Dr. Robert Dewar

When anyone buys a television, a car, or even a ballpoint pen, the purchaser expects it to work properly. This assumption is backed by the legal machinery of warranties and consumer protection legislation. So software carries the same protection, right? Wrong! Historically, commercial software products have been sold with absolutely no claims that they are fit for purpose or free of vulnerabilities. But that might be changing, thanks to several factors.

For a high-ticket item like a television, an explicit warranty covers repair and replacement for a limited period. So, if a new TV is turned on and the picture has no reds, the consumer has legal recourses. And even when there is no written warranty, there are typically consumer protection laws in place that give the purchaser some rights.

However, by tradition, software is sold without any real guarantees. If there is any guarantee at all, it is generally limited to assuring that the media is uncorrupted and that the program can successfully be read. Not only that, many disclaimers say, in effect, that users can't expect the software to work reliably.

And typical software most certainly does live down to users' low expectations. The word "virus" suggests some kind of biological agent that users can fight against, but can't fully expect to insulate themselves from. Thus, the idea that it is an unacceptable technical flaw for an operating system to be vulnerable to such attacks is a foreign concept to both manufacturers and users of such systems.

Software reliability: Is it possible?

So why do we accept this state of affairs? One viewpoint is that software is so complex that it is impossible to guarantee reliability; thus, it is "normal" and "reasonable" for big systems to be full of bugs (see Figure 1). In a legal case in which I testified as an expert witness years ago (580 F.Supp.474. Selden vs. Honeywell), Honeywell was being sued on the grounds that it had allegedly committed fraud by distributing an operating system so full of bugs that it could not be called an operating system. In this particular case, the software in question was in beta test and was explicitly not covered by a warranty. But the allegation of fraud was legally novel in a software context.

I testified on Honeywell's behalf, along the lines of: "Judge, we know that there were lots of bugs, but that's normal. It's 'industry standard practice.'" The judge was not convinced and eventually ruled against Honeywell, but the case did not rise high in the court hierarchy so it had limited industry effect. "Industry standard practice" is indeed a defense, but judges are free to decide that a practice is unacceptable, and perhaps we need more judges like the one in the Honeywell case who just refused to understand our "reasonable" position.

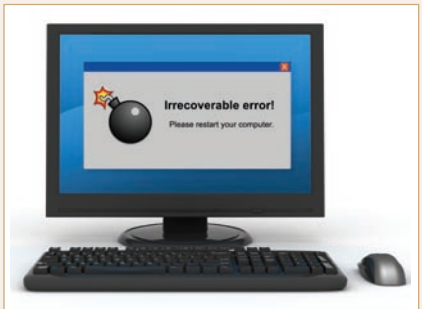

Figure 1 | One viewpoint is that software is so complex that it is impossible to guarantee reliability; thus, it is "normal" and "reasonable" for big systems to be full of bugs.

The idea that all big software always has serious bugs is a common one, often, for example, expressed by faculty members in computer science as well as other industry experts. I recently attended a talk by a leading law professor in the field of product liability, who argued that the industry needs a different legal standard for software when it comes to product safety and warranties, since clearly software can't be held to the same standards as other goods in the marketplace. After all, everyone knows it is technically impossible to produce reliable software.

But is this really true? Are we really incapable of producing software that works reliably? The answer is very clearly no. We do, in fact, know how to write software that is remarkably reliable. Take the case of modern aircraft, controlled by sophisticated, large-scale software (see Figure 2). If there is a serious bug in such software, planes could crash and people could die. Yet, thanks in part to the requirements imposed by the commercial avionics certification standard DO-178B, there has never been a death on a commercial airliner that could be attributed to a software error.

I am not saying that software certified against DO-178B is perfect. In fact, there have been some close calls due to errors (for example, the incident with a

Figure 2 | Thanks in part to the requirements imposed by the commercial avionics certification standard DO-178B, there has never been a death on a commercial airliner that could be attributed to a software error.

Malaysian Airlines jet in 2005 due to a bug in an upgrade of the air data inertial reference unit software). Still, nothing fatal, and software is definitely doing better than hardware when it comes to making planes reliable. Furthermore, it is clear that such software is covered by warranties. If a plane crashes, Boeing or Airbus is not going to get away with saying, "We're very sorry, but we are not liable. We have determined the crash was due to buggy software, and if you consult page xxx of the contract, you will see that we disclaim all software bugs."

Its successful record on the commercial side is one of the reasons that DO-178B is being applied to military systems. As an example, critical systems on the USAF's C-130 AMP aircraft have been certified to Level A, the most demanding level of DO-178B. And clearly other kinds of military systems, for example weapons control, must function correctly or the consequences could be catastrophic.

Software reliability: Is it practical?

Apparently, the technology for producing reliable software exists. Therefore,

the question is: Why don't we use it more extensively?

The answers heard from many software vendors reflect the inertia of a long-established industry. What sells a typical commercial software product are new features, low price, and better performance, while reliability has lower priority. So vendors offer a variety of reasons for treating software differently from (and thus not needing the same warranty protection as) durable goods: The added expense would mean fewer and less frequent products/releases and thus less choice for users. Warranting reliability could also compromise intellectual property, and correctness depends on the environment in which the software is used and third-party components that the vendor cannot control.

As Yogi Berra might put it, some of these arguments are *déjà vu* all over again. Years ago, the automobile industry fought against the requirements for seat belts, then air bags for similar reasons – including manufacturing expense and fear of liability if the equipment malfunctioned – until these safety features were legally mandated. Then somehow the industry solved these issues.

Vendors are correct that it is more expensive to warrant software reliability, but only if one tries to achieve reliability *à posteriori* by fixing bugs until an acceptable tolerance level is achieved. If instead one designs the product by considering reliability (and safety and security) up front, then uses appropriate development tools and programming languages, the proposition is considerably more cost effective. When judged over its full life cycle, software can cost less to develop (and maintain and extend) because of, and not despite, its reliability.

And as for the argument that software is essentially different from durable goods and thus should not be subject to similar warranty protection, it is ironic that software vendors are making the opposite point when they apply for software patents.

The claims that reliability need not come at the expense of development cost and that warranty protection for software is practical and appropriate are not just theoretical. Praxis High Integrity Systems, a UK company specializing in safety-critical and high-security software, demonstrated in the NSA-sponsored Tokeneer project that reliable and ultra-secure systems can be developed in a cost-effective manner. And Praxis stands behind its software by offering a warranty to fix any bugs for free. Admittedly, this is far from "industry standard practice." Rod Chapman of Praxis told me that at one meeting, people actually laughed when he suggested that this be done more widely.

Their laughter, however, might be short lived. Invisible market forces rarely succeed in bringing consumer-oriented protection to an industry, hence initiatives such as the European Commission's proposal to extend product warranty coverage to encompass software.

Time for a change

Many years ago, I was frustrated that the judge did not understand "industry standard practice." Now looking back, I think he had the right idea. Yes, of course if we insist on software working, it will mean that new features don't get implemented quite so quickly, but think about it: Wouldn't you prefer a product that always worked 100 percent reliably, even if it had a few less-fancy features? It's time to end the exemption that software makers seem to feel is reasonable. The question is not whether we can afford to update our attitudes and policies on software warranties, but rather: How can we afford not to?

Dr. Robert Dewar *is cofounder, president, and CEO of AdaCore; he has also had a distinguished career as a professor of Computer Science at the Courant Institute of New York University. He has been involved with the Ada programming language since its inception in the early 1980s. As codirector of both the Ada-Ed and GNAT projects, Robert led the NYU team that developed the first validated Ada compiler, and he is a principal architect of AdaCore's GNAT Ada technology. Robert has also served as an expert witness in several federal trials, and has testified in cases involving copyrights, patents, and software contracts. He can be reached at dewar@adacore.com.*

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Radar comes of age – but where does it go from here?

Q&A with Joseph Hajduk, CEO of dB Control

EDITOR'S NOTE

Radar has – in some form or another – been in development since the early 1900s. Its applications include technologies such as Synthetic Aperture Radar (SAR), Electronic Counter Measures (ECM), and Electronic Warfare (EW) threat simulation, and its pervasiveness in U.S. Army, Navy, and Air Force operations is undeniable. However, today's radar, EW, and satcom systems are requiring ever-more-sophisticated signal amplification technology in light of increasing threats. Our recent Q&A with Joseph Hajduk, CEO of dB Control, reveals exactly why. Edited excerpts follow.

MIL EMBEDDED: ***Can you familiarize readers (briefly) with your company, including its offerings and the military programs for which it's provided technology?***

HAJDUK: dB Control, Inc. designs and manufactures high-power microwave amplifiers, transmitters, high- and low-voltage power supplies, and modulators for military organizations, major defense contractors, and commercial manufacturers. These products are for ground-based, shipboard, and high-altitude military manned and unmanned aircraft in applications such as multimode, pulse-Doppler, and Synthetic Aperture Radar (SAR); Electronic Counter Measures (ECM); Electronic Warfare (EW) threat simulation; airborne data links; and more. Some of the programs we have provided power for include General Atomics Aeronautical Systems' Predator B and Northrop Grumman's Fire Scout and Global Hawk aircraft. Our company's 40,000-square-foot Fremont, Calif. facility also serves as the prime depot overhaul facility for the high-voltage power supplies used in the AN/ALQ-172 jammer for the B-52H, AC-130U, MC-130H, and other aircraft.

MIL EMBEDDED: ***Power is emphasized more and more in military applications. What do you think the expectations for power supplies will be 5 to 10 years from now, and how will that goal be achieved?***

HAJDUK: Power supplies will need to be lighter and more compact. To meet these critical requirements, Traveling Wave Tubes (TWTs) in a power-combined configuration for each frequency band are necessary. These TWTs should then be combined with solid-state amplifiers to produce smaller, lighter Microwave Power Modules (MPMs).

> "Over the next decade, TWT amplifiers will be the amplification device of choice for a broad range of defense systems ... No single solid-state amplifier can deliver this level of peak-to-average power and bandwidth."

As an example, TWTs used for transponder amplifiers in satellites requiring Ku-band and higher frequencies will need to be even more efficient and reliable. Fortunately, the TWT amplifier's ratio of RF output power to prime power input (real efficiency) is now greater than 60 percent and will soon reach 70 percent. Plus, since TWTs have operating lives greater than 20 years, they will continue to be the best choice for providing uninterrupted service in communication and radar applications.

Over the next decade, TWT amplifiers will be the amplification device of choice for a broad range of defense systems and some commercial and industrial applications with RF power outputs up to 2.5 kW CW and 25 kW pulse at frequencies up to 95 GHz. No single solid-state amplifier can deliver this level of peak-to-average power and bandwidth.

MIL EMBEDDED: ***How will SECDEF Gates' proposed defense-spending shifts affect the industry?***

HAJDUK: Gates' proposal forces major defense contractors to make a rapid shift away from programs that have sustained them for years and look to more diversified applications for their technology. Once they set the new direction, subcontractors and suppliers will follow their lead. But if the Tier One contractors are slow to respond, it could have industry-wide repercussions. For example, part of Gates' plan references unmanned spy drones for now and future use. Several drones use Lynx SAR/GMTI radar systems. As prime manufacturers ramp up production of these UAVs it will be beneficial for suppliers, such as dB Control, who support those platforms and systems.

MIL EMBEDDED: ***Has your company made any changes in the aftermath of the proposed shifts, or is it full speed ahead on military programs?***

HAJDUK: Definitely full speed ahead! In response to the U.S. Army, Navy, and Air Force's demand for reliable, high-power microwave amplifiers, radar transmitters, and power supplies, we recently signed five contracts worth a combined total of more than $10 million with major U.S. defense contractors. All five contracts have the potential for renewal over the next six to eight years. While we can't divulge the exact customers, product

specifications, or specific military installations, we can tell you that:

- The largest contract worth close to $3 million is from the U.S. Air Force for high-power, power-combined Traveling Wave Tube Amplifiers (TWTAs) for radar applications.
- A multiyear contract worth $2.9 million is from an international defense contractor for a follow-on product order of X-Band TWTAs.
- Several contracts from major U.S. and foreign defense contractors, worth a combined total of $2.7 million, will provide the military with TWTAs and MPMs for SAR systems for UAVs.
- An $800,000 contract from a well-known U.S. defense contractor is for the development of high-power TWTAs for use in Intelligence, Surveillance, and Reconnaissance (ISR) data collection applications.
- A major contractor for the U.S. Navy awarded dB Control a contract worth $800,000 to provide high-power TWTAs for airborne ECM.

MIL EMBEDDED: ***Clearly, many of your products are geared toward radar applications. What are the latest trends in radar technology, and how are they being utilized on the battlefield?***

HAJDUK: Today's radar, EW, and satcom systems require more sophisticated signal amplification technology. This is because threats have increased in volume and waveforms are becoming more exotic. In particular, to acheive low probability of detection, radars, ECM transmitters, and EW threat simulators require higher microwave power over a wider bandwidth.

MIL EMBEDDED: ***Which technology advancements should the next generation of radar apps comprise?***

HAJDUK: Radar transmitters will most certainly benefit from the rapid advances being made in solid-state technology, as well as from the continuous improvement in the performance of Vacuum Electron Devices (VEDs). As the size and weight of VEDs continues to decrease and the efficiency and reliability continues to increase, these devices will find numerous radar applications for years to come.

However, the challenge for designers is to continue to use both technologies – solid-state and vacuum electronics – in a complementary manner, rather than as competing technologies. For example, VEDs have the advantage of low dollar cost per watt, enabling them to cost effectively meet design challenges and system specifications. Likewise, the improved thermal performance of wideband gap semiconductor devices supports the development of a wider range of real-world applications.

MIL EMBEDDED: ***Is using modular designs to promote COTS really COTS, or is it more Custom Off-the-Shelf than Commercial Off-the-Shelf?***

HAJDUK: While we use Commercial Off-the-Shelf components and other standard modules in our modular designs, in most cases, these COTS components are integrated into custom configurations and

assemblies. So I'd say that the Commercial Off-the-Shelf components enable us to more economically produce Custom Off-the-Shelf modules for our contract manufacturing and depot repair services.

MIL EMBEDDED: ***How can vendors reduce customization or adjustment costs and efforts on new COTS-centric designs? Is it all worth it?***

HAJDUK: Most of our products are custom designed and are not COTS-centric. In our particular case, it's not worth it.

MIL EMBEDDED: ***With today's economic downturn, where should wise military embedded technology companies be focusing?***

HAJDUK: Military embedded technology companies should explore ways to adapt their products and services to commercial applications. For example, we're seeing that our products that were originally developed and tested for mission-critical military SAR applications are now being adapted for a variety of commercial applications, such as the SAR images taken under adverse weather conditions and through foliage. This is used to assess the best response to forest fires, for example.

MIL EMBEDDED: ***What are the biggest challenges for your customers and how are you remedying them?***

HAJDUK: Prime concerns for our customers include reducing the size, weight, power consumption, and operating and maintenance costs of radar systems – without compromising reliability. We will continue to design new transmitters to meet these challenging requirements.

MIL EMBEDDED: ***Which single technology will be most influential in the military embedded market in the next two years?***

HAJDUK: We believe one of the most influential technologies will be radar systems and the highly efficient, reliable products that power them. In addition to affecting overall performance, radar systems rely on high-power transmitters to amplify the waveform to the desired output power level without distortion. Perhaps that's why high-power transmitters are now recognized as one of the most critical elements in radar systems.

Joseph Hajduk *is CEO of dB Control. His strategy and vision enabled dB Control to grow from the start-up he co-founded in 1990 to the successful $22 million company it is today. After graduating with a BS in Engineering from Cogswell College, Joe joined Teledyne and later Aydin and Varian (now CPI), where his designs doubled AN/ALQ-172 Countermeasures Radar Warning System amplifier output. This Pave Mint Program eventually became the largest military program in Varian's history and today is supported by dB Control's depot repair service. Joe is known for his ability to turn high-power amplification concepts into reliable military and satcom products. He can be reached at jhajduk@dbcontrol.com.*

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A world perspective: How the 'triple whammy' affects it all

Q&A with Peter Cavill, General Manager Military & Aerospace, GE Fanuc Intelligent Platforms

EDITOR'S NOTE

Having recently announced the dissolution of joint venture of GE and Fanuc, the soon-to-be-renamed GE Intelligent Platforms is not unlike the defense industry itself – rife with change and evolution. Thus, in our exclusive interview, Peter Cavill, General Manager Military & Aerospace at GE tells us about the "triple whammy" of worldwide changes and challenges that, he says, make predicting the future of defense spending a job for the brave or the foolish: a change in U.S. political leadership, a worldwide recession, and turmoil in Iraq and Afghanistan. Edited excerpts follow.

MIL EMBEDDED: ***Do you think we'll see more mergers and acquisitions in the current climate?***

CAVILL: I don't foresee any major acquisitions occurring in the near future in the mil/aero embedded computing sector, mainly because with a few notable exceptions – for example, Mercury – there aren't many large independent players left. I guess you might see Emerson or Kontron – both of which are (as is typical when the telecom and industrial markets are down) looking to expand in mil/aero – looking at acquiring some of the smaller niche companies in order to boost their own military credentials.

However, a number of companies out there are looking seriously undervalued and might make a very cost-effective acquisition. There are also a few companies that are really struggling and would probably be open to an approach. On the other hand, purse strings are tight – and beyond that, I'm really not sure that there's room for much more consolidation in the defense industry. Or, at least, nothing particularly earth-shattering.

MIL EMBEDDED: ***What about GE Fanuc – sights set on any potential acquisitions at the moment?***

CAVILL: From our point of view, we're very comfortable where we are. GE Fanuc Intelligent Platforms has, as you know, grown to be one of the market's most significant players through a series of acquisitions. A number of conscious decisions have been made to acquire capabilities that allow us to become more of a one-stop-shop, more able to add value for our customers by being able to integrate more parts of the solution. Those acquisitions have enabled us to enrich our basic "products" business – a business that's still very important to us – with more of a "solutions" capability.

> "While other countries around the world aren't – at least on the surface – impacted by the political dislocation in the United States ... there is an impact ... . When U.S. defense sneezes, the rest of the world catches a cold."

MIL EMBEDDED: ***What did you make of Intel's acquisition of Wind River Systems?***

CAVILL: Intel's acquisition of Wind River Systems was an interesting one. It seemed to us to be further compelling evidence of Intel's commitment to the embedded space. There was speculation around the announcement that the acquisition was all about Intel's plans for Linux, Android, and the cell phone market, but it's interesting to speculate whether there might be more.

Even Intel would probably not disagree that, historically, their position on embedded computing was an equivocal one. But in recent years, we've been reassured by what Intel has done within its business. The most important thing in the military embedded business is the longevity of many programs and the implications thereof for long-term support of components. That's very different from the commercial marketplace, where product longevity is less prized than product leadership, and product life cycles are typically shorter. Intel has made important changes to reflect the different priorities of the embedded market. And what we're now seeing is that customers in the embedded space have a real choice, with both Intel and Freescale bringing very attractive products to market that all deliver different strengths. Our strategy is to continue to reflect that choice in the platforms we deliver for customers.

MIL EMBEDDED: ***Boeing has entered the UAV market. What does that tell you?***

CAVILL: When a major name enters a market, that has to tell you something about the attractiveness of that market. It's widely agreed that the market for UAVs is a multibillion dollar one, whereas only three or four years ago it was measured in the low hundreds of millions. It's hardly surprising that a company like Boeing, with its extensive experience and expertise, would have been evaluating the opportunity very closely.

Certainly, Boeing's interest matches our own experience in terms of what a vibrant market the unmanned vehicle market is. As with so many markets, it's difficult to determine whether it's the application that's driving the technology, or the technology that's making the application possible. Look at 3U VPX, for example. It offers outstanding processing performance and an architecture that lends itself readily to communications-centric environments. Plus it's small, lightweight, and easily managed from a heat/power perspective. We can do things with 3U VPX that we could only dream of with 3U VME and 3U CompactPCI. Along with advances in D/A and A/D conversion and in video, it's enabling unmanned vehicles to be far more autonomous than before, more capable of self-determination as a mission develops.

MIL EMBEDDED: ***What's your reading of how defense budgets are going to pan out?***

CAVILL: It's still not clear to us how the whole budget scenario will shake out. There are just too many variables to enable anything better than a guesstimate. First, you have the change in political leadership in the United States – a new president with new ideas, new approaches, new priorities. That in itself, under normal circumstances, would make the future difficult to predict. But we find ourselves in abnormal circumstances. The worldwide recession has changed everything. Even if we had political continuity, priorities in terms of spending would almost certainly have changed. But now, we have what you might call a double whammy. Add to that the uncertainty about how the change of situation in Iraq will alter things or how things will play out in Afghanistan and you're probably looking at a triple whammy. It's a brave – or foolish – pundit who will claim to predict what the future of defense spending will be.

And while other countries around the world aren't – at least on the surface – impacted by the political dislocation in the United States (with the transition from Republican to Democrat, from Bush to Obama), there is an impact just because the United States is by far the biggest defense spender. When U.S. defense sneezes, the rest of the world catches a cold. And, of course, other countries are no less impacted by the changing priorities brought on by a recession and by the uncertain outcome of places like Afghanistan, which involves many of the world's forces. From our point of view, we're happy with how the business is looking. We could wish for more growth, but the things we forecasted to happen are happening. In fact, if we look around, the defense business is probably doing better than many others. Of course, there are some programs, most notably FCS, that are being curtailed or foreshortened or consolidated. We expect some, possibly most, of the funding earmarked for these programs to be diverted elsewhere – most likely into increasing ISR capabilities overall and, in particular, in upgrading existing ground vehicles like Abrams, Stryker, and Bradley.

MIL EMBEDDED: ***How is the market in Europe? We hear a great deal about BAE and Eurofighter, for example.***

CAVILL: Markets outside the U.S. are mixed – but the news is mostly positive. What we're seeing in Europe is that investment is continuing in existing programs, but future programs are somewhat subject to moving to the right. We haven't, for example, seen the kind of major cancellations like FCS – a cancellation that, fortunately, hasn't affected the parts of FCS that we're designed in to, such as NLOS with its projected 900+ systems. On the other hand, we're seeing some delays, some program restructuring. The Eurofighter Typhoon, for example – Europe's biggest program, with 620 aircraft planned for Europe alone – is currently approaching Tranche 3, but the decision has been to divide that tranche into two, with the second half being delayed. Having said that, with Tranche 3A, 586 aircraft have been ordered and current production will continue for many years. Tranche 3B may well still happen, too.

Concerning BAE and GE Fanuc, we both have a substantial presence in Europe, but the majority of our business comes from North America, which makes both of us susceptible to changes in the U.S. market. However, they've been somewhat impacted by delays in the UK Army's Future Rapid Effects System (FRES) program, with a restructuring that has seen the utility vehicle de-emphasized with focus switched to the scout vehicle. Much like in North America, there's also significant activity going on with UAVs. BAE's HERTI and Taranis are two prime examples. We've also seen delays in the Airbus A400M turboprop transporter aircraft program. It's now running around four years late, but the issues there are technical rather than financial. That's another program we're designed in to – but via an American supplier! Yet another program in which we're present is the Puma tank: The good news is that the German government has just signed an order for 405 vehicles.

MIL EMBEDDED: ***Clearly, a lot of shifts for Europe. What about other world regions?***

CAVILL: Outside of Europe, India is seeing a lot of activity as it becomes more self-sufficient and creates its own defense equipment infrastructure. Budgets are actually rising there. The big program there is the Tejas fighter aircraft, for which we're supplying the mission computer.

Besides that, an interesting phenomenon we're seeing in Asia Pacific is that programs are far less conservative than in North America, with much more willingness to embrace new technologies. The opportunities there are relatively smaller than in the rest of the world – but they're very exciting.

Peter Cavill *is General Manager Military & Aerospace at GE Fanuc Intelligent Platforms. He graduated in Electrical Engineering, then earned a Masters degree in Microelectronics and Semiconductor Technology. He has worked at GEC Semiconductors, Fairchild, Inmos, and Anamartic. He joined Radstone Technology in 1995 and was Managing Director of its embedded computing business until its acquisition by GE Fanuc in 2006. He can be contacted at peter.cavill@gefanuc.com.*

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In the cage with '800-lb gorillas': How to compete – or compute

Q&A with Thomas Sparrvik, Vice Chairman of Kontron AG and CEO of Kontron America and Asia-Pacific

EDITOR'S NOTE

In an arena dominated by industry heavyweights Curtiss-Wright Controls Embedded Computing and GE Fanuc Intelligent Platforms, Kontron is still coming out slugging, according to Thomas Sparrvik, vice chairman of Kontron AG and CEO of Kontron America and Asia-Pacific. But how? Our recent Q&A reveals the key strategies: worldwide R&D; an affinity for VPX, SWaP, and the Atom; and an 800-strong engineering staff. Enough to beat the 800-lb gorillas? Sparrvik asserts an equivocal "yes." Edited excerpts follow.

MIL EMBEDDED: ***It's been more than 18 months since Kontron made the Thales Computers "lucky buy." What's been happening?***

SPARRVIK: It has certainly been an exciting 18 months since the acquisition in March 2008. The team at Thales Computers has been fully integrated into Kontron and we are moving forward as one company, under one name. Both Thales Computers and Kontron customers are benefiting from an expanded portfolio of rugged and commercial products. The acquisition enabled Kontron to extend its PowerPC-based and relevant operating system support to provide everything demanded by the VME, CompactPCI, and mezzanine card markets.

MIL EMBEDDED: ***Where do you expect Kontron to be ranked in the industry against heavyweights Curtiss-Wright Controls Embedded Computing (CWCEC) and GE Fanuc Intelligent Platforms (GE Fanuc)?***

SPARRVIK: Kontron is well-positioned to grow further in this market. Even before the acquisition, Kontron's experience with VME and harsh environments started back in the 1980s. However, we saw a critical opportunity with the acquisition to further expand our offering with an even more aggressive and advanced VME lineup. We believe solutions from Kontron are very competitive compared to Curtiss-Wright and GE Fanuc. We've got an 800-person engineering organization, worldwide R&D capabilities, and a strategic partner network that spans the entire globe.

MIL EMBEDDED: ***What new products can we expect to see from Kontron in the future?***

SPARRVIK: Specifically for A&D, we will continue to develop our rugged COTS offerings. There was the launch of our VPX product line this year, which included the VX3230 and VX3020 PowerPC- and Intel-based VPX product offerings. Both VPX and VME are critical architectures for A&D, and while we see VPX as the future of rugged COTS, we know VME remains very viable and is not going away anytime soon. And we continue to incorporate advancements in processor technology such as the Intel Atom, now used in our low-power, small form factor lines.

MIL EMBEDDED: ***Kontron is a super-tight partner with Intel on the commercial side. How will this translate on the military side?***

SPARRVIK: Our strategy is to develop successful commercial products and directly duplicate that success in our rugged COTS product offerings. Our 6U CompactPCI product line is a great example. The CP6001 is an Intel Core 2 Duo rugged processor blade available in three versions, each suitable for a specific environment. We offer a standard air-cooled version; another that is ruggedized for high shock and vibration, air-cooled environments up to and including VITA 47's EAC3/EAC6; as well as a fully conduction-cooled version that meets VITA 47's ECC4 requirements. With a product like the CP6001, both commercial and A&D customers benefit from our partnership with Intel. This partnership also allows us to release our products at the same time Intel releases a new chipset, ensuring our customers have access to the most leading-edge technologies.

MIL EMBEDDED: ***Most of the strong A&D COTS players have two key technology areas we haven't noticed within Kontron's lineup: data acquisition modules and FPGA/reconfigurable computers. What about Kontron?***

SPARRVIK: In June Kontron launched the VM6250, a high performance 6U VME PowerPC-based single board computer. As evidenced by the VM6250, designed to be easily extensible with an FPGA (via an FMC), Kontron is in full support of the VITA 57 FMC standard. Kontron's lineup also includes data acquisition PMCs such as our FPDP and HotLink PMC. As I mentioned earlier, our engineering groups around the globe are continually developing products to address the needs of our customers in every market segment, including A&D. Since this is a key focus for Kontron, you can expect to see continuing updates and additional products that meet evolving military program requirements.

MIL EMBEDDED: ***Where do you expect to see technology move in the 2010-2012 timeframe?***

SPARRVIK: We see the growing technology trend for smaller, faster, and more power-efficient computing platforms. This is true for both commercial and military markets. And technologies being integrated into applications within these

spaces are expected to meet the most stringent requirements – especially as budgets continue to be cut. Companies are looking for the most efficient way to balance their technology and economic goals.

For the A&D market, it's all about SWaP [Size, Weight, and Power], and that will continue to push new designs toward smaller form factors such as 3U VPX, 3U CompactPCI, and MicroTCA. Costs will be more important as well. To that end, we are often asked which of these smaller blade form factors are going to "win." From our perspective, there is a place for all of them – each brings its own advantages – so there is no clear "winner."

Our customers are looking for proven, reliable, cost effective, and scalable technology. And while it's important to offer the latest-and-greatest, we support the form factors that are widely deployed and continue to be a viable option for many programs and applications. Kontron is an active member of the PICMG committee for Rugged MicroTCA and we stand firmly behind the conviction that this technology will have a big impact on future defense programs. VME, VPX, and CompactPCI as well will continue to be strong and evolve over time to meet the changing demands of military applications.

MIL EMBEDDED: ***Tell us about your software offerings (especially beyond RTOS BSPs).***

SPARRVIK: Kontron's core business is embedded hardware, but through in-house expertise, we are able to offer customers the option of a full solution, which includes both hardware and software. Unlike many of our competitors, we develop software in-house for BIOS, drivers, BSPs, and so forth. Having both software and hardware expertise in-house allows us to more efficiently customize our offerings to meet customer program needs. In addition, Kontron actively pursues experienced software and middleware partners such as Wind River, Microsoft, QNX, ENEA, and others. These partnerships let us further expand our portfolio of tailored products and services so that we meet exact program specifications.

MIL EMBEDDED: ***How do you see President Obama's and SECDEF Gates' new DoD budget affecting the market? Affecting your company?***

SPARRVIK: Looking at Gate's plan, it appears that some vehicle and aircraft programs have decreased budgets, but UAV programs are receiving an increase in funding. Because of this, many companies may actually see programs grow – which is fine with us and benefits our diverse product line. With DoD budget cuts, the focus for many military system manufacturers now becomes sustainability.

Kontron is seeing many upgrade programs that include electronic maintenance that cannot be delayed. Defense companies are looking for suppliers who will help maintain technologies currently deployed as well as offer a diversified path into the future. Kontron is not tied to any one form factor, so we have the flexibility and technical strength to be a true resource to our customers in everything from software and OS support to highly integrated low-power and prevalidated platforms. We remain committed to exceed the requirements demanded by defense suppliers – whether it's for new programs or those that have been around for years.

MIL EMBEDDED: ***Can you tell us about some of the on-the-books DoD programs into which Kontron supplies boards?***

SPARRVIK: Kontron's products can be found in many DoD programs. To name just a few applications, one of the most current is the P-8 Poseidon, a military aircraft for the U.S. Navy. Another aircraft program includes the Airborne Early Warning & Control (AEW&C) or "Wedgetail" as it's commonly known. Kontron products are widely used throughout many naval programs and have been integrated into several aircraft carriers and destroyers. It is interesting to note that these programs are using a wide variety of form factors.

Thomas Sparrvik *is Vice Chairman of Kontron AG, a member of Kontron's managing board of directors, and CEO of Kontron America and Asia-Pacific, where he is responsible for worldwide sales and marketing. Previously, he was CEO at Laserstans AB, Sweden and a subcontract manufacturer and CEO at Betech Components AB, Sweden. He holds an MBA from the Warwick Business School, University of Warwick, Coventry, England; an MSC in Electrical Engineering from Lund University, Sweden; and a BA in Electrical Engineering and Telecommunications from Pauli College, Malmoe, Sweden. For more information, e-mail info@us.kontron.com.*

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Designed to Survive

Now Available with a Core i7 Processor

- 19" Rackmount, 1U size
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  Intel Core 2 Duo
  Intel Core 2 Quad
  Intel Core i7
- Configurable up to 24GB RAM
- All drives are hot swappable
- Designed for minimal weight
- Multiple internal PCIe and PCI slots
- Can be configured for an AC or DC power source
- Wide functional temperature range
- Specialized testing to MIL-STD 810
- Can be custom configured for unique applications
- Also available in a non-ruggedized version

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www.pinnacle.com

AMC-E24D Dual Display Graphics + Storage Module

This mid-size AMC offers both high-performance dual display graphics and SATA onboard storage in a single module. Featuring the ATI Radeon™ E2400 graphics controller, the AMC-E24D module supports two independent high-resolution display devices (one digital HDMI and one analog VGA) and features 128 MB of on-chip GDDR3 video memory for fast, high-quality 2D and 3D graphics rendering.

In addition, the module adds enterprise-grade SATA storage to xTCA systems. It carries a 2.5" hard drive (HDD) or solid state drive (SSD) with up to 320 GB capacity for convenient local boot-up and storage. The Port Selector feature converts SAS commands to SATA, allowing the use of SATA drives with compute modules that only support SAS interfaces. This robust module is an excellent I/O expander for AdvancedTCA carriers such as PDSi's ATCA-F1 blade.

FEATURES

- ATI Radeon E2400 graphics processor for superior 2D and 3D graphics acceleration
- 128 MB on-chip GDDR3 video memory
- Dual independent high-performance display interfaces - HDMI/DVI-D and analog VGA
- Dual integrated triple 10-bit DACs for dual RGB output
- Supports analog displays up to QXGA (2048 x 1536)
- HDMI Connection for 480p, 720p, and 1080i Output
- 2.5", 9.5 mm SATA drives – Enhanced Availability HDDs up to 320 GB or Intel SSDs up to 160 GB
- SAS-to-SATA converter allows SATA drives to interface with SAS commands

For more information, contact: rob.ellis@pinnacle.com

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6600 Port Road • Groveport, OH 43125
Tel: 614-748-1150 • Fax: 614-748-1209
www.pinnacle.com

ATCA-F1 Quad-core AMD Opteron™ Processor Blade

This industry-proven ATCA-F1 server blade features two AMD Opteron quad-core processors for the absolute maximum performance available in a general-purpose AdvancedTCA® server blade. Supporting a full 32 GB of 800 MHz memory and the benchmark-setting AMD embedded "Shanghai" quad-core 2.4 GHz CPUs, this blade provides the extra level of computing horsepower and built-in virtualization support demanded by the next generation of COTS-integrated architectures. With its robust design, the ATCA-F1 blade has been thoroughly tested and successfully deployed in military and critical systems.

The ATCA-F1 blade features a mid-size AMC site and a standard Zone 3 interface for connection to PDSi's ATCA-RT01 RTM, which adds SAS storage, video, Ethernet, and USB resources. The ATCA-F1 and ATCA-RT01 RTM combination has been certified with the VMWare® ESX Server virtualization platform.

FEATURES

- 2 x AMD Socket F (1207 pin) CPU sockets
- Embedded "Shanghai" 23QS 2.4 GHz quad-core AMD Opteron CPUs
- Zone 3 RTM interface (to ATCA-RT01 RTM)
- 4 DIMM sockets, up to 32 GB DDR2 800 MHz Memory
- Ethernet Base and Fabric Interfaces
- 2 x Gb Ethernet links (Front panel)
- 2 x USB 2.0 (Front panel)
- 1 x AMC.1 slot (Mid-size)
- Certified with VMWare® ESX Server 3.5
- Pigeon Point IPMC management
- Customization welcomed, extended availability assured

For more information, contact: rob.ellis@pinnacle.com

RSC# 39364 @ www.mil-embedded.com/rsc

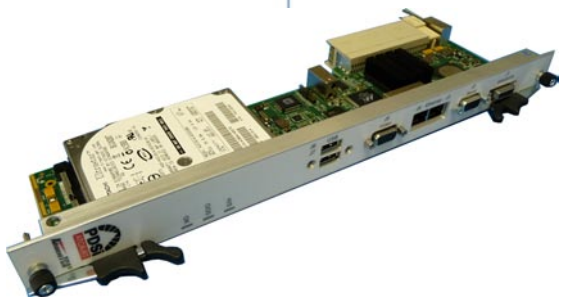
PDSi – Pinnacle Data Systems, Inc.

6600 Port Road • Groveport, OH 43125
Tel: 614-748-1150 • Fax: 614-748-1209
www.pinnacle.com

ATCA-RT01 Video+Storage Rear Transition Module

The ATCA-RT01 from PDSi provides high-reliability SAS storage, VGA video output, as well as additional Ethernet and USB I/O for AdvancedTCA x86 processor blades from PDSi (ATCA-F1) or Sun Microsystems (Netra™ CP3220). With its industry-standard Zone 3 interface, this RTM also operates with Sun's UltraSPARC® T2-based CP3260 blade. For systems requiring a mix of these compute blades, the ATCA-RT01 can provide a convenient single RTM solution.

The robust ATCA-RT01 RTM has been thoroughly tested and successfully deployed in critical systems including military applications. The 2.5" SAS HDD provides local storage with front-panel connection to secondary or redundant storage arrays. Additional ports include VGA video output and USB I/O for convenient local monitoring. In combination with PDSi's ATCA-F1 blade, the ATCA-RT01 RTM has also been certified with the VMWare® ESX Server virtualization platform.



FEATURES

- Compatible with x86 and Sun SPARC front blades, including PDSi dual AMD Opteron™ ATCA-F1, Sun Netra™ CP3220 (single AMD Opteron), and Sun Netra CP3260 (UltraSPARC® T2)
- High-resolution VGA video output
- Onboard SAS storage
- 2 x 10/100/1000BASE-T Ethernet ports
- 1 x serial port
- 2 x USB ports
- Certified with VMWare® ESX Server 3.5
- Pigeon Point IPMC management
- Customization welcomed, extended availability assured

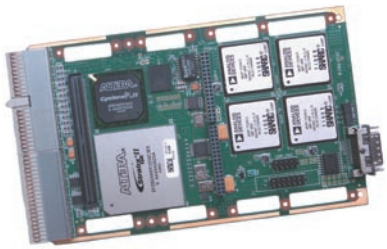
For more information, contact: rob.ellis@pinnacle.com **RSC# 39363 @ www.mil-embedded.com/rsc**

BittWare

9 Hills Avenue • Concord, NH 03301
603-226-0404
www.BittWare.com

GT-3U-cPCI

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



FEATURES

- Altera® Stratix® II GX FPGA for I/O, routing, and processing
- One cluster of four ADSP-TS201S TigerSHARC® DSPs
- BittWare's ATLANTiS™ FrameWork with 1 GB/s of simultaneous external input and output, eight link ports @ up to 1 GB/s each routed from the on-board DSPs
- Up to 1 GB of on-board DDR2 SDRAM or 64 MB of QDR SDRAM
- BittWare's FINe™ Host/Control Bridge
- 64 MB of flash memory for booting DSPs and FPGA
- 3U CompactPCI form factor

For more information, contact: info@bittware.com **RSC# 32632 @ www.mil-embedded.com/rsc**

Aitech Defense Systems
19756 Prairie Street • Chatsworth, CA 91311
888-248-3248
www.rugged.com/s950.htm

S950-02 1 GHz 3U cPCI SBC

Aitech Defense Systems launched the new S950-02, an enhanced, 1 GHz version of its space-flown S950 3U CompactPCI (cPCI) radiation-tolerant, single board computer (SBC) providing increased processing power and data throughput.

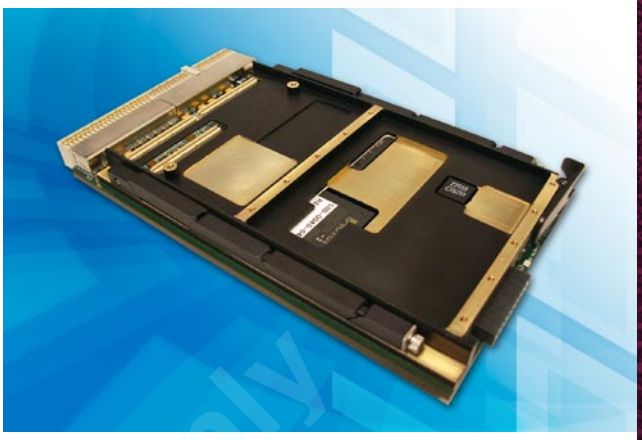
Using the high-performance PowerPC 750GX running at 1 GHz, coupled with silicon on insulator (SOI) PowerPC® technology, the new conduction-cooled S950-02 combines a significantly low overall board power consumption of less than 10 W with configurable processor speeds and better radiation tolerance to provide an effective unshielded total ionization dose (TID) greater than 15 krad (Si).

Designed for numerous space applications including low earth orbit (LEO), Mars terrestrial and geostationary earth orbit (GEO), the highly reliable SBC provides a low single event upset (SEU) rate of less than one upset per 900 days of operation in LEO with considerations for the worst case solar flare and the South Atlantic Anomaly (SAA).

This makes the board ideal for use in a variety of harsh, mission-critical systems including redundant mission computers, flight guidance and navigation computers, command and data handling computers as well as in solid state recorders, video controllers and manipulation controllers.

To protect on-board memory resources from radiation effects, the S950-02 incorporates 128 MB of triple-redundant SDRAM with three bits per cell. On the rad-tolerant FPGA, a voting mechanism performed only on the read cycle allows for data correction before sending to the CPU or PowerPC bus. 1 MB of dual-redundant boot Flash stores the on-board boot firmware and ensures full data integrity in the event of corruption during the boot-up sequence.

Complementary memory resources consist of 64 MB of ECC-protected user flash with optional Flash FileSystem Driver (FFD) software to implement a file system. The high-integrity internal L1 and L2 cache, 32 kB and 1 MB respectively, both feature parity checks on tags and data arrays, with an ECC check on data arrays in the L2 cache.



FEATURES

- Designed for LEO, Mars Terrestrial with an Option for GEO Environments
- Single-Slot Conduction-Cooled 3U CompactPCI (cPCI) Single Board Computer (SBC)
- High-Performance PowerPC® 750FX Processor
- Low Power Consumption
- 128 MB of SDRAM Arranged in a Triple Voting Architecture (3 Bits per Cell)
- Internal L1 Cache (32 kB) with Parity Check for both Tags and Data
- Internal L2 Cache (512 kB) with Parity Check on Tags and ECC Check on Data
- 1 MB Dual-Redundant Boot
- 64 MB ECC-Protected User Flash Memory
- Two Serial Ports Supporting RS-422 Interface
- Off-Board Ethernet Interface (10/100 Mbps) for Ground Development
- Level-2 Components per NASA GSFC-INST-001 Specification are Available

For more information, contact: sales@rugged.com

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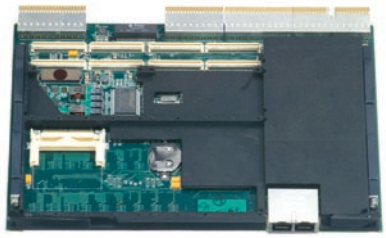
Dynatem, Inc.
23263 Madero, Suite C • Mission Viejo, CA 92691
949-855-3235
www.dynatem.com

CRD Conduction-cooled Core2 Duo based CompactPCI SBC

The CRD is a 6U single-slot CompactPCI compatible platform based on the Intel® low-power Core™2 Duo processor. The CRD takes advantage of the L7400 Core™2 Duo's low power consumption as a rugged SBC. Versions supporting the T7400 2.16 GHz Core2 Duo are also available.

The CRD is a conduction-cooled module with wedge locks and a full-board heat sink for high shock/vibration environments and temperature extremes. Extended temperature and versions with conformal coating are available.

Shock and vibration immunity were major goals in the CRD design. All major components including processor, chipset and memory are BGA based. The only socketed devices onboard are the optional CompactFlash and optional battery, both of which are securely fastened when required.



FEATURES

- Intel Pentium Core™2 Duo processor @ 1.5 GHz or 2.16 GHz
- E7520 chipset for PCIe support, high memory bandwidth and ECC support
- Onboard SVGA controller
- Two Gb Ethernet ports routed to the backplane in compliance with PICMG 2.16; as a special option, two more Gb Ethernet ports available from the front
- Supports two PMC sites, one of which optionally supports XMC modules
- Available with conformal coating
- All boards thermally tested prior to shipment
- Support for Windows, VxWorks, Linux, QNX Solaris, and LynxOS

For more information, contact: sales@dynatem.com **RSC# 41290 @ www.mil-embedded.com/rsc**

CompactPCI Military Embedded Systems Resource Guide

PDSi – Pinnacle Data Systems, Inc.
6600 Port Road • Groveport, OH 43125
Tel: 614-748-1150 • Fax: 614-748-1209
www.pinnacle.com

CP86-N1 Intel® Core™ 2 Duo Processor Blade and RTM

PDSi's new Intel-based CompactPCI x86 Processor Blade (CP86-N1) provides a robust, high-performance cPCI compute platform that is also compatible with PICMG 2.16 (cPSB) systems. Built around Intel's 45nm technology Core 2 Duo processor and server-grade chipset (5100 MCH/ICH9R) supporting ECC memory, this compact blade offers the highest performance and dependability in its class.

The CP86-N1 blade includes a standard PMC/XMC site for I/O expansion and is offered in two alternate models, one featuring an onboard SATA drive plus high-resolution graphics, the other providing a second PMC expansion site. On-blade options include a USB Flash drive. Rear I/O capability includes additional SATA storage and high-speed ports that can be accessed through one of PDSi's companion rear transition modules CP86-RT01 and -RT02. Two 1000Base-T Ethernet ports provide the PICMG 2.16-compliant fabric interfaces.

FEATURES

- Server-grade CompactPCI 2.16 compute blade
- Intel T9400 Core 2 Duo 2.53 GHz with 5100 MCH/ICH9R
- Up to 8 GB Registered ECC DDR2 667 memory
- 1 PMC/XMC mezzanine site standard
- 2 alternate models, offering second PMC site, or ATI Radeon™ E2400 graphics and 2.5" SATA HDD/SSD
- 2 x 1 Gb Ethernet links (front panel)
- 2 x USB 2.0 (front panel)
- Rear I/O interfaces to PDSi CP86-RT01 and -RT02 RTMs
- Optional USB Flash drive
- Customization welcomed, extended availability assured

For more information, contact: rob.ellis@pinnacle.com **RSC# 40980 @ www.mil-embedded.com/rsc**

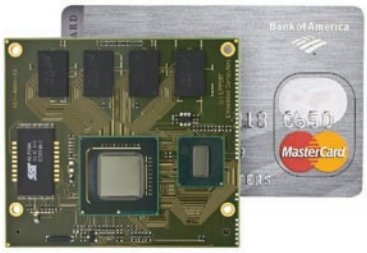
LiPPERT Embedded Computers Inc.

5555 Glenridge Connector, Suite 200 • Atlanta, GA 30342
404-459-2870
www.lippertembedded.com

CoreExpress®-ECO

The CoreExpress-ECO is an advanced Computer on Module (COM) implementation in a tiny 58 mm x 65 mm format. CoreExpress modules are legacy-free. Other interfaces can easily be implemented on the carrier board. The Intel Atom processor with its low TDP requires only minimum cooling. The module comes with up to 2 GB of soldered SDDR2 RAM, graphics, LVDS and SDVO display ports, and HD Audio. Two PCI Express lanes are available for I/O. There are 8 USB 2.0 ports, IDE, SDIO/MMC interface, SMBus, and LPC bus available. All signals are accessible on a 220-pin connector.

CoreExpress-ECO features LiPPERT Enhanced Management Technology. It handles power sequencing and other housekeeping tasks, and provides a secure write- and clear-protected Flash area for miscellaneous user information. An evaluation kit is available. Ask us about licensing options!



FEATURES

- Intel Atom Z5xx processor
- 512 MB, 1 GB, 2 GB SDDR2 soldered RAM
- 2x PCI Express x1 lanes
- SDIO/MMC
- SMBus, GMBus/DDC, LPC bus
- 2x graphics ports (LVDS and SDVO)
- HD Audio
- 8x USB 2.0
- IDE
- 5 V only supply, 5 W
- Optionally extended temperature range -40 °C to +85 °C

For more information, contact: ussales@lippertembedded.com **RSC# 37871 @ www.mil-embedded.com/rsc**

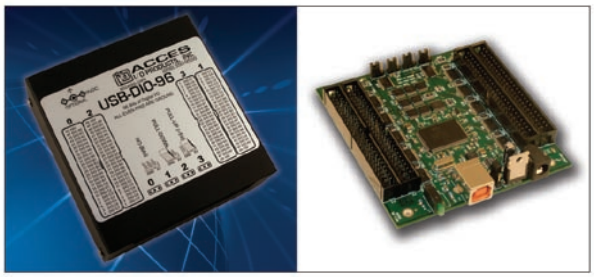
ACCES I/O Products, Inc.

10623 Roselle Street • San Diego, CA 92121
858-550-9559
www.accesio.com

96 USB Digital I/O Series

Model USB-DIO-96 was designed for compact control and monitoring applications and features 96 or 48 industrial-strength TTL digital I/O. This USB device is an ideal solution for adding portable, easy-to-install digital I/O to any PC or embedded system with a USB port. The unit is a true USB 2.0 device, offering the highest speed available with USB, and is hot-pluggable, which allows quick connect/disconnect whenever you need additional I/O on your USB port. The USB-DIO-96 is useful for monitoring dry contacts or generating outputs for controlling external devices such as LEDs and other indicators or system equipment. Applications include home, portable, laptop, education, laboratory, industrial automation, and embedded OEM.

A Micro-USB header connector is provided in parallel with the high-retention Type B connector for stacking and embedded applications.



FEATURES

- 96 or 48 lines of digital I/O
- Twelve or six 8-bit ports independently selectable for inputs or outputs
- All I/O lines buffered with 32mA source, 64mA sink current
- I/O buffers can be enabled or tri-stated under program control
- Jumper-selectable I/O pulled up to 5V for contact monitoring, down to ground, or floating
- Resettable fused +5VDC outputs per standard 50-pin connector
- USB/104 form factor for OEM embedded applications features PC/104 module size and mounting compatibility
- Type B USB connector features high-retention design
- Small (4" x 4" x 1.4"), rugged industrial enclosure available

For more information, contact: contactus@accesio.com **RSC# 42373 @ www.mil-embedded.com/rsc**

WinSystems, Inc.
715 Stadium Drive • Arlington, TX 76011
817-274-7553
www.winsystems.com

PCM-MIO Multifunction A/D

The PCM-MIO is a versatile, PC/104-based analog input, analog output, and digital I/O board designed to meet customer demands for high accuracy and high channel count analog and digital I/O. The board is based on Linear Technologies' precision converters and voltage references, which require no external calibration.

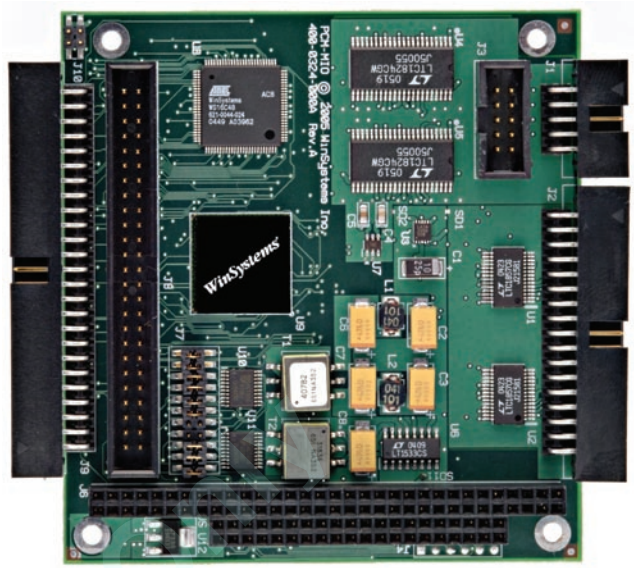
The board will support up to 16 single-ended input channels, 8 differential input channels, or various combinations of both. The software programmable input ranges are ±5V, ±10V, 0-5V, and 0-10V. The input channels are voltage protected to ±25V and can work directly with industry-standard signal conditioning modules.

There are eight 12-bit Digital-to-Analog (D/A) converters with individual software programmable voltage ranges of ±5V, ±10V, 0-5V, and 0-10V. The output channels can be updated and cleared individually or simultaneously. They also work with industry-standard signal conditioning modules.

A total of 48 onboard bi-directional TTL-compatible digital I/O lines can be software configured as Input, Output, or Output with Readback. Twenty-four can generate interrupts if the board senses a change of state. Each output can sink 12mA and will interface directly with opto-isolated modules.

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

WinSystems can depopulate this board to meet special OEM applications. For example, all the A/D channels or perhaps all the D/A channels could be removed. Please contact an applications engineer with your requirements.



FEATURES

- Analog and digital I/O on a PC/104 module
- 16-bit Analog-to-Digital (A/D) converter
- Conversion speed: 100K samples per second
- Two quad 12-bit Digital-to-Analog (D/A) converters
- Each individual channel is independently software programmable
- Low-noise onboard DC/DC converter
- No adjustment potentiometers or calibration needed
- 48 bi-directional TTL-compatible digital I/O lines with 24 capable of event sense interrupt generation
- Free software drivers in C, Windows®, and Linux
- +5V-only operation
- -40°C to +85°C temperature operation
- Special OEM configurations available for 16-bit D/A and other analog and digital I/O combinations

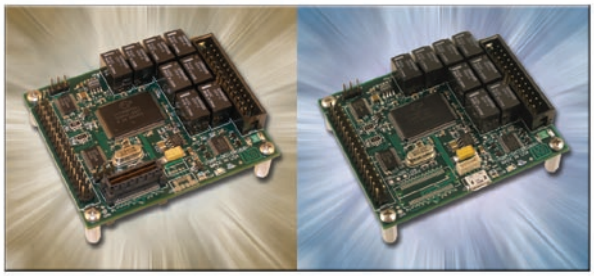
ACCES I/O Products, Inc.

10623 Roselle Street • San Diego, CA 92121
858-550-9559
www.accesio.com

Pico-I/O™ Series

ACCES I/O Products, Inc. is excited to announce the first of a new line of small form factor products – Pico-I/O™ Model PICO-DIO16RO8. Designed for expansion on Pico-ITXe single board computers, this unit features 16 industrial-strength TTL/LVTTL digital I/O and 8 Form C electromechanical relay outputs. This mix of programmable inputs and outputs combined with the dedicated relays allows system designers greater flexibility while containing overall costs.

This product is also available as a USB 2.0 device (Model USBP-DIO16RO8) and features a high-retention USB Micro-B connector and an additional Micro-USB input header. This tiny OEM board is an ideal OEM USB solution for adding embedded, easy-to-install buffered TTL/LVTTL digital I/O and relay output capabilities to any computer with a USB port.



FEATURES

- TWO MODELS AVAILABLE
- Pico-I/O™ USB device featuring SUMIT™ stacking connector and up to 4 I/O expansion boards in SUMIT™ stack or wired high-speed USB 2.0 device; USB 1.1 compatible with alternate embedded USB connector and all required power drawn from USB port; no external power adapter required
- BOTH MODELS FEATURE:
- 16-channel TTL/LVTTL digital I/O
- All 16 I/O lines buffered with 32mA sink/source current capabilities
- 8 Form C electromechanical relays switch 1A
- Custom high-speed function driver
- Pico-I/O™ module size (60mm x 72mm) and mounting capability

For more information, contact: contactus@accesio.com

RSC# 42372 @ www.mil-embedded.com/rsc

Military Embedded Systems Resource Guide Data acquisition

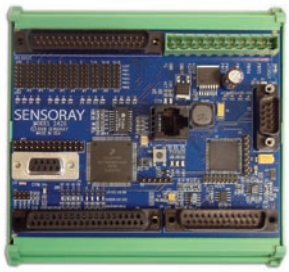
SENSORAY

7313 S.W. Tech Center Drive • Tigard, OR 97223
503-684-8005
www.SENSORAY.com/2426

Model 2426 | Modular Industrial I/O via Ethernet

Model 2426 is a versatile and compact multifunction I/O board that concurrently serves up to four Ethernet clients.

It features eight optically isolated digital inputs, 16 digital outputs, six 12-bit analog inputs, one 12-bit analog output, an RS-422/485 serial port and a high speed 32-bit encoder interface that accepts both quadrature and single-phase clocks. All I/O is accessible via Telnet and HTTP. It is powered from a single 24VDC supply.



FEATURES

- Concurrently serves up to four Ethernet clients
- Eight optically isolated digital inputs
- 16 digital outputs
- Six 12-bit analog inputs
- 12-bit analog output
- RS-422/485 serial port
- High speed 32-bit encoder interface that accepts both quadrature and single-phase clocks

For more information, contact: info@sensoray.com

RSC# 36513 @ www.mil-embedded.com/rsc

Annapolis Micro Systems, Inc.
190 Admiral Cochrane Drive, Suite 130 • Annapolis, MD 21401
410-841-2514
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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.

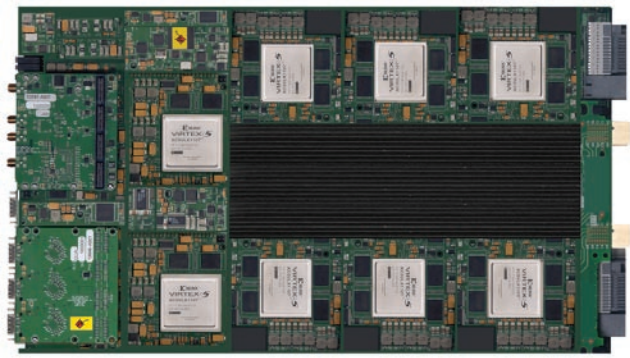
Fully Integrated into the IBM Blade Management System – Abundant power and cooling for maximum performance.

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 data flow, 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 Gb Ethernet 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 customers' applications succeed

For more information, contact: wfinfo@annapmicro.com **RSC# 35882 @ www.mil-embedded.com/rsc**

WinSystems, Inc.
715 Stadium Drive • Arlington, TX 76011
817-274-7553
www.winsystems.com

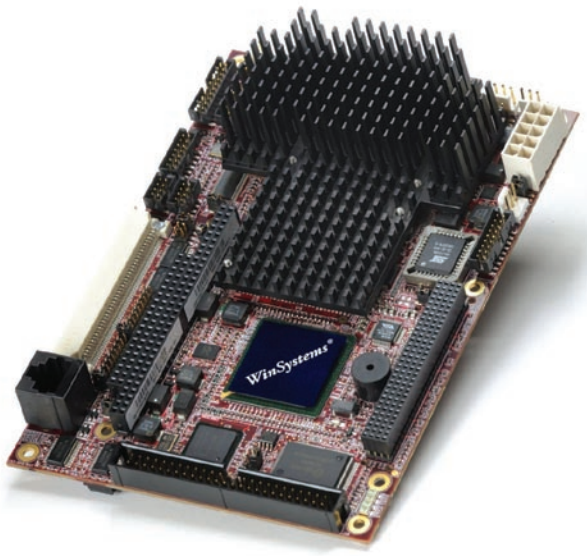
EPX-855-G Fanless 1GHz SBC

The EPX-855-G-1G-0 is a highly integrated, low-cost Single Board Computer designed for rugged, performance-driven applications. It operates over a temperature range of -40°C to +70°C without a fan and is designed for applications including industrial automation, security, medical/diagnostic equipment, MIL/COTS, test and measurement, and transportation. WinSystems uses chipsets from Intel's long life embedded road map to ensure longevity of the core technology.

The EPX-855-G includes support for both wired and wireless Ethernet (with remote boot capability), simultaneous support of both SVGA and LVDS flat panel video, four USB 2.0 ports, four serial COM ports, AC'97 audio, PS/2 keyboard, LPT, and 24 lines of digital I/O. It supports up to 1GB of industry-standard PC2700 SDRAM, up to 8GB of CompactFlash, plus support for hard and floppy disk drives. PC/104 and PC/104-*Plus* expansion is supported for additional special I/O requirements.

It also supports advanced features such as custom splash screen, APM 1.2 and ACPI 1.0b power management modes, PXE boot, and multi-language support. The BIOS supports legacy operation of a USB keyboard and mouse, as well as booting from a USB floppy disk, USB keys, and other USB-connected mass storage devices.

The board supports Windows® XP embedded, Linux, and other x86-compatible RTOSs. The EPX-855-G requires only +5V and typically draws 2.1A with 1GB of DDR SDRAM installed. A 1.8GHz Pentium® M version is available. These features are also available in our EBC-855 EBX-compliant board.



FEATURES

- Intel® 1GHz CPU (fanless); higher-performance 1.8GHz Pentium® M version is available
- Intel® Extreme Graphics 2 technology supports CRT and LVDS flat panels simultaneously
- Custom splash screen on startup
- Two Intel Ethernet controllers: one Gigabit and one 10/100 Mbps
- 802.11a/b/g wireless supported
- Four serial COM ports, four USB 2.0 ports, and 24 bi-directional TTL digital I/O lines
- Bi-directional LPT port, AT keyboard, and FDC controller
- PC/104 and PC/104-*Plus* expansion
- 4.5" x 6.5" (115mm x 165mm) EPIC-compliant SBC
- Also available in 5.75" x 8.0" EBX-compliant SBC
- Long-term product availability
- Quick Start Kits for software development

For more information, contact: Info@WinSystems.com **RSC# 41297 @ www.mil-embedded.com/rsc**

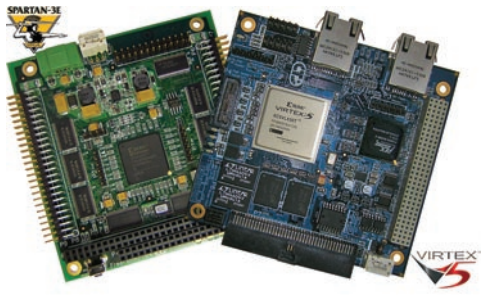
Connect Tech Inc.
42 Arrow Road • Guelph, ON N1K 1S6 Canada
519-836-1291 • 800-426-8979
www.connecttech.com

FPGA Computing Modules

Connect Tech's FPGA embedded computing modules offer a robust, compact platform for rapid prototyping; instantly test your FPGA code for faster time-to-market. Based on the Xilinx Virtex-5 and Spartan-3E FPGAs, FreeForm provides a versatile platform for design flexibility. FreeForm is perfect for real-time applications where speed and accuracy are critical.

FreeForm/PCI-104
Virtex-5 FPGA (LX30T, LX50T, FX30T), up to 5 million gates, 8MB Flash, 128MB DDR2-400 memory, 64 single-ended or 32 LVDS I/O, 2x10/100 Ethernet, 2xRS-485 serial interface, PowerPC 440 option

FreeForm/104
Spartan-3E FPGA, 500,000 gates, 4MB Flash, standard/custom cores, counter/timers, digital I/O, Opto-22 compatibility, LEDs, rotary switch, reset button



FEATURES

- Off-the-shelf Virtex-5 (LX30T, LX50T, or FX30T) FPGA computing modules ready for field deployment
- QNX embedded software support and host system support for QNX, Linux, and Windows
- FPGA reference designs and BSPs for PowerPC and MicroBlaze embedded processors
- Industrial temperature range models available (-40°C to +85°C)
- Lifetime warranty, free technical support, RoHS compliant

For more information, contact: sales@connecttech.com **RSC# 42573 @ www.mil-embedded.com/rsc**

Xilinx, Inc.
2100 Logic Drive • San Jose, CA 95124
408-559-7778
www.xilinx.com

Defense-Grade Virtex-5Q FPGA Family

Xilinx® Virtex®-5Q FPGAs are the highest performance, largest capacity off-the-shelf programmable defense-grade devices designed to address the elevated performance and security demands of modern defense electronics systems. The Virtex-5Q FPGA family delivers a scalable mix of 30 percent higher performance, 65 percent more capacity, and 35 percent lower dynamic power than previous generations, with integrated embedded processing, high-speed connectivity, and DSP features.

These defense-grade variants of Xilinx high performance commercial devices combine reduced system power, cost, and form factor with the highest level of integration, extreme operating temperatures, and ruggedized packaging. With Type-1 and Type-2 single-chip cryptographic technology, tamper-proofing, and partial reconfiguration capabilities, Virtex-5Q FPGAs are ideally suited for mission-critical applications.

FEATURES

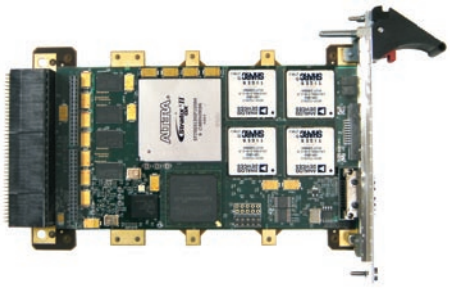
- Up to 330,000 logic cells and 500 MHz block RAM
- 6.5 Gbps serial transceivers and PCI Express® endpoints
- Multiple embedded PowerPC® 440 processors
- 500 MHz DSP slices with 25x18 multipliers for acceleration
- Single- and double-precision floating point
- Industrial-temp (-40 to +100°C) and Military-temp (-55 to +125°C)
- Pin-to-pin compatibility with Xilinx commercial devices
- Fully supported FPGA design methodology and Isolation Verification Tool
- Off-the-shelf part/package and custom bare die options with extended life cycle

For more information, contact: lisa.hartman@xilinx.com **RSC# 42566 @ www.mil-embedded.com/rsc**

BittWare
9 Hills Avenue • Concord, NH 03301
603-226-0404
www.BittWare.com

GT-3U-VPX

BittWare's GT-3U-VPX (GT3X) is a ruggedizable 3U VPX board designed for demanding multiprocessor-based applications. The board's hybrid processing architecture takes advantage of both FPGA and DSP technology to provide a complete solution for applications requiring flexibility and adaptability along with high-end signal processing. The GT3X features a large Altera Stratix II GX FPGA and one cluster of four ADSP-TS201S TigerSHARC processors from Analog Devices. The board's front panel interface supplies four channels of high-speed SerDes transceivers, 10/100 Ethernet, and RS-232; and its extensive back panel interface supports PCI Express, sRIO, GigE, and 10 GigE. The GT3X can achieve simultaneous on-board and off-board data transfers at rates exceeding 2 GB/s via BittWare's ATLANTiS FrameWork implemented in the Stratix II GX FPGA. The board also provides a large amount of on-board memory, including 2 GB of DDR2 SDRAM and 64 MB of flash memory for booting the FPGA and DSPs.



FEATURES

- Altera® Stratix® II GX FPGA supported by ATLANTiS™ FrameWork for I/O, outing, and processing
- BittWare's FINe™ Host/Control Bridge provides control plane processing and interface – GigE and RS-422 to rear panel – 10/100 Ethernet and RS-232 to front panel
- One cluster of four ADSP-TS201S TigerSHARC® DSPs
- 15 SerDes lanes (supports sRIO, PCI Express, and 10GigE-KX4) to Stratix II GX via P1
- 32 LVDS (16 Tx, 16 Rx) pairs to Stratix II GX via P2
- GigE and two RS-422 to FINe
- Up to 1 GB of on-board DDR2 SDRAM

For more information, contact: info@bittware.com **RSC# 42636 @ www.mil-embedded.com/rsc**

Military Embedded Systems Resource Guide FPGA/Reconfigurable computing

BittWare
9 Hills Avenue • Concord, NH 03301
603-226-0404
www.BittWare.com

GT-6U-VME

BittWare's GT-6U-VME (GTV6) is a rugged 6U VME/VXS (VITA 41) board designed for demanding multiprocessor-based applications. The hybrid processing architecture takes advantage of both FPGA and DSP technology to provide a complete solution for applications requiring flexibility and adaptability along with high-end signal processing. The board features two high-density Altera Stratix II GX FPGAs, two clusters of two ADSP-TS201S TigerSHARC processors from Analog Devices, a front panel interface supplying four channels of high-speed SerDes transceivers, and an extensive back panel interface including VXS. Simultaneous on- and off-board data transfers can be achieved at a rate of 5 GB/s via two BittWare ATLANTiS FrameWorks implemented in the Altera Stratix II GX FPGAs. The board also provides a large amount of on-board memory with up to 3 GB of DDR2 SDRAM, as well as 128 MB of flash memory for booting both the FPGAs and DSPs.

FEATURES

- Two Altera® Stratix® II GX FPGAs for I/O, routing, and processing
- Two clusters of two ADSP-TS201S TigerSHARC® DSPs
- Dual ATLANTiS™ FrameWork
- Up to 3 GB on-board DDR2 SDRAM
- BittWare's FINe™ Host/Control Bridge
- One PrPMC site with PMC+ extension for BittWare's PMC+ I/O modules and XMC connector with 8 SerDes ports (4 to each FPGA)
- Tundra Tsi148™ PCI-VME bridge with 2eSST support
- 128 MB of flash memory for booting DSPs and FPGA
- 6U VME form factor supporting VITA 41/VXS (VMEbus Switched Serial)

For more information, contact: info@bittware.com **RSC# 36356 @ www.mil-embedded.com/rsc**

Annapolis Micro Systems, Inc.
190 Admiral Cochrane Drive, Suite 130 • Annapolis, MD 21401
410-841-2514
www.annapmicro.com

Wildstar 5 for XMC

The perfect blend of processors and FPGAs. Adds the Processing Power of an FPGA to your Embedded System.

- Input High Speed Data via Front Panel Connectors
- One Virtex™-5 FPGA Processing Element
- XC5VLX110T, LX155T, SX95T, FX70T, or FX100T
- Up to 2 GB DDR2 DRAM per Board, in Four Ports
- Or Up to 64 MB DDR2 or QDR2 SRAM per Board, in Four Ports
- Two Front Panel InfiniBand Style Connectors
- Eight SFPDP Channels
- Two 10GE XAUI Ports – Four Fibers per Port
- One InfiniBand Port (none on FX70)
- Supports both Primary and Secondary XMC Connectors
- On-Board Flash for FPGA Program Storage
- Full CoreFire™ Board Support Package for Fast, Easy Application Development
- VHDL Model including Source Code for Hardware Interfaces, with ChipScope Access
- Optional Heatsink
- Also available in Industrial Temperature Grades

Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customers' applications succeed. We offer training classes and exceptional special application development support.

FEATURES

- Reduce Risk With Our 12th Generation of COTS (Commercial Off the Shelf) FPGA Based Processing Boards
- Save Time and Effort – Develop Your Application Very Quickly and Easily with CoreFire™
- CoreFire™ Provides Thousands of Proven, Reusable, High Performance IP
- Modules, Including Some of the World's Fastest FFTs and Filters
- Standardize and Control Your Team's Development
- Achieve World Class Performance
- WILD™ Solutions Outperform the Competition

For more information, contact: wfinfo@annapmicro.com **RSC# 42568 @ www.mil-embedded.com/rsc**

Jacyl Technology
3909 Fourier Drive, Suite B • Fort Wayne, IN 46818
800-590-6067
www.jacyl.com

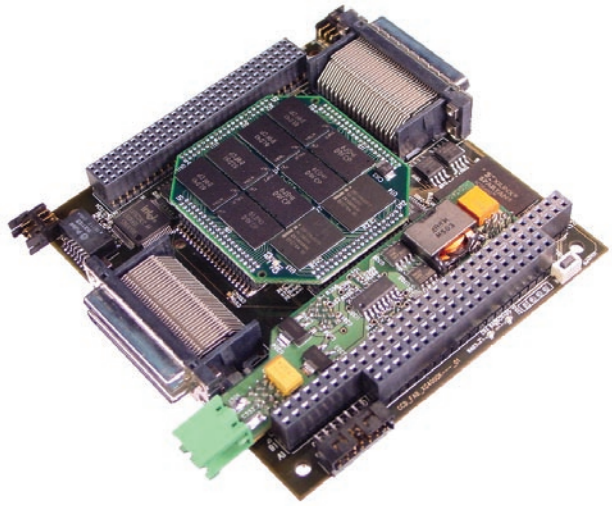
XG-5000K

The XG-5000K, the 5 million gate PC/104-*Plus* FPGA board
Centered around a 5 million gate Spartan-3 FPGA, the XG-5000K is the ultimate PC/104-*Plus* FPGA board that is ready to meet the most demanding of system designs. The board features a 5 million gate Spartan-3 FPGA, 256 MB of onboard Micron SRAM, 32 MB of onboard Intel flash, 264 user-programmable I/O, Type 1 CompactFlash connector, a secondary 500K Gate Spartan-3 FPGA, 10/100BASE-T Ethernet interface, two RS-232 interfaces, PC/104 connector, PC/104-*Plus* connector, 0-25 MHz programmable DDS master clock source, 8 MB of secondary DataFlash, and a 25 MHz initial master clock.

The XG-5000K has the advanced feature of allowing the user to remotely reconfigure the entire board through the onboard JTAG connector, PC/104 connector, PC/104-*Plus* connector, 10/100BASE-T Ethernet interface, or any external interface connected to the XG-5000K. The XG-5000K has been developed with Xilinx's advanced design revisioning technology. This allows the XG-5000K to retain onboard as many as 16 partial or up to 4 complete design revisions for the 5 million gate Spartan-3 FPGA. Any one of these design revisions can be remotely programmed into the 5 million gate Spartan-3 FPGA, or the XG-5000K can be programmed to reconfigure itself based upon external or internal events.

The XG-5000K also incorporates a secondary 500,000 gate Spartan-3 FPGA. This second FPGA is initially configured to control remote reprogramming and control of the design revisioning features of the XG-5000K. But the secondary Spartan-3 FPGA can be reconfigured by the user to meet the requirements of a particular system design.

The XG-5000K can be powered from the PC/104 bus or can be powered from a single 5 VDC external source allowing the board to be utilized as a stacked module in PC/104 applications or as a stand-alone product design platform. This allows the board to be ideal in embedded PC/104 applications or to be utilized in development platforms, design prototypes, or production products.



FEATURES

- 5 million gate Xilinx Spartan-3 FPGA on a PC/104-*Plus* platform
- Onboard 256 MB of Micron SRAM and 32 MB of Intel flash
- Four 66-pin VHDC connector banks providing a total of 264 user programmable I/O
- CompactFlash Type 1 connector
- A secondary 400K gate Spartan-3 FPGA for remote reconfiguration and design revisioning of the XG-5000K or custom user configuration
- 10/100BASE-T Ethernet interface and two RS-232 interfaces
- Can be used in a PC/104 stack or as a stand-alone product design platform
- 0-25 MHz user-programmable DDS FPGA master clock source, along with a fixed 25 MHz FPGA master clock source
- Incorporates Xilinx's design revisioning technology and can retain onboard as many as 16 partial or up to 4 complete design BIT files
- Can be reconfigured through the configuration PROMs, JTAG, 10/100BASE-T Ethernet, PC/104, PC/104-*Plus* connectors, or the user I/O
- Available in industrial temperature range
- Can be powered from the PC/104 connector or an external 5 VDC source

Advanced Micro Peripherals Inc.
234 5th Ave., Suite 424 • New York, NY 10001
212-951-7205
www.amp-usa.com

Advanced Micro Peripherals
THE EMBEDDED VIDEO EXPERTS

MPEG4CPCI

The MPEG4CPCI is a 3U CompactPCI 4-channel MPEG4 Codec. It provides high performance capturing and compression of up to four concurrent analog NTSC or PAL video and audio inputs to MPEG4 for storage or further processing at full resolution and full frame rates. The MPEG4CPCI can also decompress and play back MPEG4 recordings from storage. Additionally, incoming video can be viewed on the host screen. This multiple simultaneous functionality is enabled by the MPEG4CPCI's 32-bit PCI architecture.

High performance MPEG4 video data compression and reduced bus utilization allow multiple MPEG4CPCI cards to be deployed within a CompactPCI system for multi-channel video recording and streaming applications.

The MPEG4CPCI has a suite of Windows, Linux, and QNX drivers.

FEATURES

- Four asynchronous live NTSC/PAL inputs
- 4 x D1 size MPEG4 encode at full frame rate
- MPEG4 decode/playback
- Text overlay – time and date stamp
- Video preview to system VGA, NTSC/PAL
- Multiple MPEG4CPCI cards per system
- Motion detection on all channels

For more information, contact: sales@amp-usa.com **RSC# 33487 @ www.mil-embedded.com/rsc**

PDSi – Pinnacle Data Systems, Inc.

6600 Port Road, Suite 100 • Groveport, OH 43125
Tel: 614-748-1150 • Fax: 614-748-1209
www.pinnacle.com

PMC-E24D & XMC-E24D Dual Display Graphics Modules

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 add advanced 3D accelerated graphics to VME, CompactPCI, and AdvancedTCA systems. Full-size front connectors give 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. OS support includes Windows and Linux.

These modules provide 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.

Contact PDSi for more details or special requirements.

FEATURES

- PMC and XMC versions
- Modern 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, new low power 65nm design
- Windows and Linux support – call for others
- Customization welcomed, extended availability assured

For more information, contact: rob.ellis@pinnacle.com **RSC# 39360 @ www.mil-embedded.com/rsc**

ALPHI Technology Corp.

1898 E. Southern Ave. • Tempe, AZ 85282
480-838-2428
www.alphitech.com

MPCI-1553-DDC

The ALPHI MPCI-1553-DDC provides a dual redundant 1553 controller, on a very small Mini PCI Type III Module: 44.6mm x 59.8mm. It features the BU-65864 communication device as its 1553 bus controller, or remote terminal, or monitor terminal. A single controller has two redundant channels and built-in transceivers. The controller has internal transceivers for both channel A and B. The Mini PCI board has onboard transformers for both channels. The board format is a Mini PCI board layout. This is a perfect solution for a wide array of 1553 communication applications such as:
• Industrial and Military – Test equipment supporting Evaluation, Simulation, Monitoring, and Analysis • Operational equipment such as Avionics, Space, Satellite Systems, Aircraft onboard systems, UAVs, etc.

ALPHI Technology also provides a large choice of other MIL-STD-1553 solutions for all major Form Factors.

FEATURES

- Controller of dual redundant (A/B channel) 1553 communications
- 32-Bit/33MHz PCI Interface
- DDC Chip BU-65864
- Programmable Bus Controller, Remote Terminal, or Monitor Terminal
- Multiprotocol Support MIL-STD01553A/B Notice 2 and STANAG 3838
- +3.3V Operation and Logic
- Long or short stub support
- Low power consumption
- On-chip transceivers
- Selectable 10, 12, 16, or 20 MHz Systems Clocks

For more information, contact: sales@alphitech.com **RSC# 41481 @ www.mil-embedded.com/rsc**

Performance Technologies
205 Indigo Creek Drive • Rochester, NY 14626
585-256-0200
www.pt.com

IPnexus® Application-Ready Systems for MicroTCA®

Performance Technologies' award-winning Application-Ready Systems for MicroTCA® have revolutionized how system architects think of MicroTCA. The company's sleek, 1U highly integrated design with built-in infrastructure provides a powerful and cost-effective building foundation that combines mature, integrated Carrier Grade Linux® with a wide range of supporting AdvancedMC™ (AMC) options to meet virtually any communications equipment design criteria.

IPnexus® Application-Ready Systems can significantly reduce development expenses and shorten development schedules, resulting in cost savings and faster time-to-market. These second- and third-generation systems are pre-integrated and pre-tested, so they are ready to run your embedded application out of the box.

Application-Ready Systems offer significant design flexibility and can be configured with high-performance single/dual-core compute modules and storage/video/audio modules, as well as serial or T1/E1 communications I/O cards. The platforms accommodate all major AMC form factors such as single/double-width cards, mid- or full-size height. All elements run Performance Technologies' NexusWare®, a CGL 4.0-registered and POSIX-compliant Linux distribution and development environment. NexusWare includes a full suite of software tools that can encompass communication protocols, HA middleware, and SAF-compliant APIs that fully integrate the platform solutions.

All Performance Technologies' Application-Ready Systems for MicroTCA feature advanced cooling, with both push and pull fans to cool up to 40 W per mid-size, single-slot module. The front I/O panel features LEDs (in-service, out-of-service, and user-defined), a reset switch, and a platform management console port. Interconnects to the AMC modules include 1 GbE, x1 PCI Express®, SATA/SAS storage, IPMI management, and Telco Clock distribution. The rear panel has dual 10/100/1000 Mb Ethernet uplink ports, a 10/100 Mb Ethernet out-of-band platform management port, power input, and a power switch.

FEATURES

- Remote systems management with NexusWare® Portal, RMCP, and SNMP interfaces
- Designed for telecom as well as aerospace and defense applications
- Supports a wide range of processing capabilities
- Integrated NexusWare® Linux® Operating System
- Integrated Ethernet switch with dual 1 GbE uplinks
- Integrated PCI Express® switch
- Integrated MicroTCA® carrier and shelf managers
- Front-to-back, push/pull cooling
- AC or DC power options
- Cooling supports up to 40 W per mid-size, single AdvancedMC™ (AMC) module
- Telco Clock support
- Fully compliant with MicroTCA.0, AMC.0, AMC.1, AMC.2, and AMC.3

For more information, contact: info-request@pt.com **RSC# 41103 @ www.mil-embedded.com/rsc**

LiPPERT Embedded Computers Inc.

5555 Glenridge Connector, Suite 200 • Atlanta, GA 30342
404-459-2870
www.lippertembedded.com

Thunderbird-E3100

The Thunderbird-E3100 is a high-reliability, server-class Mini-ITX board for mission critical applications. Its E3100 server-class chipset handles up to 8 GB of registered DDR2 ECC RAM. Together with the Intel Core 2 Duo processor, it delivers maximum throughput yet needs little power, just about 29 W. The board features an integrated Volari graphics controller. Its graphics engine works with 16 MB video RAM and efficiently handles 2D operations. It supports graphics modes up to 16M true color and resolutions up to 1600 x 1200 pixels. There are 2 Gigabit LAN, 6 USB 2.0 host, and 6 SATA ports. Two serial interfaces are available. There are two PCI Express x4 slots available. A PCI Express Mini Card can be used.

The Thunderbird-E3100 comes with LiPPERT Enhanced Management Technology functions. Together with the board's ASF Out Of Band operation features, it allows remote control and supervision.

FEATURES

- Intel Core 2 Duo processor, 1.89 GHz
- Intel E3100 server-class chipset
- 8 GB DDR2-400 ECC RAM max
- Graphics up to 1600 x 1200 pixels
- VGA CRT
- 2x Gigabit LAN
- 6x USB 2.0
- 2x RS-232/422/485
- 6x SATA
- 2x PCI Express x4 slots
- PCI Express Mini Card

For more information, contact: ussales@lippertembedded.com **RSC# 41278 @ www.mil-embedded.com/rsc**

PDSi – Pinnacle Data Systems, Inc.

6600 Port Road, Suite 100 • Groveport, OH 43125
Tel: 614-748-1150 • Fax: 614-748-1209
www.pinnacle.com

XMC-GBX4 Quad Gigabit Ethernet Adaptor

This new 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

For more information, contact: rob.ellis@pinnacle.com **RSC# 39452 @ www.mil-embedded.com/rsc**

Advanced Digital Logic, Inc.

4411 Morena Blvd., Suite 101 • San Diego, CA 92117-4345
858-490-0597
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ADLS15PC Z510/530 Atom CPU 1.1GHz-1.60GHz - NOW SHIPPING!

The ADLS15PC PC/104-Plus CPU is based on the Intel® Atom™ and the Intel US15W (Poulsbo™) chipset. The Intel Atom is a single core processor built on a 45nm process that boasts an impressive 2.64 watts TDP (CPU alone). The Intel Atom delivers the benefits of genuine Intel architecture to small form factor and thermally constrained markets. The Intel US15W System Controller Hub (SCH) incorporates all functions of legacy GMCH and ICH architectures into a single die.

Application Areas
Automotive, Communications/Networking, Industrial, Medical, Military/Aerospace, Security, Transportation, Wireless/Mobile (low power)

NOW SHIPPING! Please contact our Sales Department for more information at sales@adl-usa.com or 858-490-0597. (Pictured: ADLS15PC with low profile passive heatsink)

FEATURES

- 1.1GHz (Z510) and 1.6GHz (Z530)
- Up to 2GB DDR2 DRAM and up to 4GB Onboard SSD
- 8x USB2.0 Ports, 2x RS-232/422/485 COM
- LPT, 7.1 High Definition Audio
- 10/100/1000 Base-T Ethernet and GPIO Interface
- CRT/LVDS, PATA and SM-Bus Interfaces
- Extended Temperature Available
- Various Active and Passive Cooling Options Available
- Serving the PC/104 Industry for over 15 years!

For more information, contact: sales@adl-usa.com **RSC# 41831 @ www.mil-embedded.com/rsc**

PC/104 Military Embedded Systems Resource Guide

LiPPERT Embedded Computers Inc.

5555 Glenridge Connector, Suite 200 • Atlanta, GA 30342
404-459-2870
www.lippertembedded.com

Cool LiteRunner-LX800

The Cool LiteRunner-LX800 is an affordable PC/104 board with an AMD Geode LX800 processor. It features 256 MB soldered DDR RAM, AC'97 sound, and four USB 2.0 host ports. It has an integrated graphics controller and supports VGA monitors, digital TFT, or LVDS panels. Serial and printer interfaces, floppy disk and PS/2 ports, and a Mini PCI slot are integrated onboard, as are 2 Ethernet controllers. Two of the three serial ports can be configured for RS-232 or RS-485. The third is RS-485 only.

Eight I/O signals are freely usable and are accessible on a flat cable connector. An ATA-66 compliant EIDE interface is provided, as well as a CompactFlash® adapter.

Troubleshooting is easy with supervision LEDs for power, watchdog, Ethernet, and application-defined life signalization on the module. The board is plug-in compatible with the Cool LiteRunner-2.

FEATURES

- AMD Geode LX800 @ 0.9 W, 500 MHz
- 256 MB soldered DDR-400 RAM
- Graphics up to 1920 x 1440 pixels
- CRT, TFT, LVDS, with backlight
- 2x LAN
- 4x USB 2.0
- 2x RS-232/422/485, 1x RS-485/IrDA
- IDE Ultra ATA100
- CompactFlash® socket
- Low power consumption
- Optionally extended temperature range -40 °C to +85 °C

For more information, contact: ussales@lippertembedded.com **RSC# 41281 @ www.mil-embedded.com/rsc**

VersaLogic Corp.
3888 Stewart Road • Eugene, OR 97402
1-800-824-3163 • 541-485-4875
www.VersaLogic.com/oce

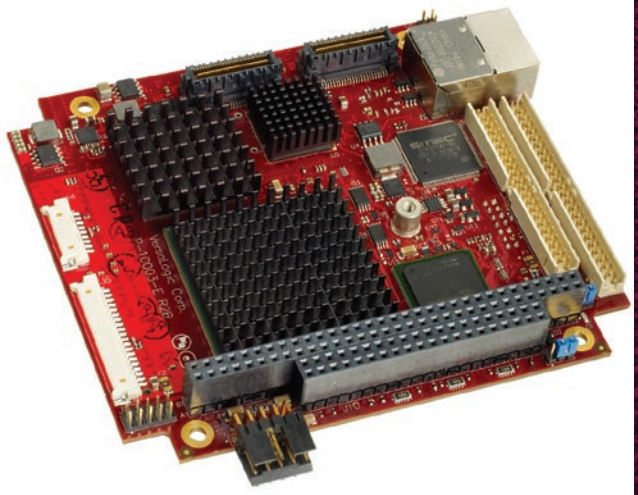
Ocelot (EPMs-21) Single Board Computer

The Ocelot is a rugged, compact SUMIT-104 (SUMIT-ISM) SBC that leverages the high processing performance, low power consumption, and extended temperature range of the next generation Z5xx series Intel® Atom™ processor. This versatile SBC is designed for robust embedded industrial, medical, and military/aerospace applications requiring higher processing power (1.33 to 1.6 GHz), low power draw, a small footprint, and fanless operation.

The synthesis of the Intel Atom processor, companion chipset, and SUMIT™ connector (Stackable Unified Module Interconnect Technology) provide most of the Ocelot's features and on-board I/O: three x1 PCIe lanes, LPC, SPI, USB, and HD audio. The highly integrated processor facilitates fast on-board transfers, high-speed memory access, and integrated high-performance video with support for LVDS flat panel screens and analog displays (optional). Ocelot also features a SO-DIMM socket for up to 2 GB of DDR2 and additional I/O including ISA, IDE, GbE, four COM ports, and an SPX interface.

Available in both standard (0° to +60°C) and extended (-40° to +85°C) temperature versions, the Ocelot is certified to MIL-STD-202G specifications. This SBC supports reliable field operation with TVS devices and fanless operation.

The Ocelot is compatible with most popular operating systems and features a Phoenix Technologies field reprogrammable embedded BIOS; ACPI 2.0 provides advanced power management features.



FEATURES

- **SUMIT-104 (SUMIT-ISM):** Supports SUMIT and ISA expansion on a compact, highly rugged format
- **Intel Atom Processor:** Up to 1.6 GHz performance with extremely low power draw
- **Fanless Operation:** No moving parts required for CPU cooling
- **Extended Temperature Version:** -40° to +85°C operation for harsh environments
- **System RAM:** Up to 2 GB socketed RAM for system flexibility
- **High Performance Video:** LVDS flat panel outputs for 18/24-bit displays and optional analog support
- **Network Support:** Gigabit Ethernet with boot ROM support
- **USB I/O:** Three USB 2.0 ports support keyboard, mouse, and other devices; four additional USB channels available via the SUMIT-A connector
- **Device I/O:** Four COM ports, IDE interface, and HD audio
- **Disk on Module:** Supports removable, bootable storage via IDE
- **SPX™ Module Interface:** Supports expansion with versatile SPX add-on I/O modules
- **RoHS compliant:** Full compliance with EU Directive 2002/95/EC for devices used in Europe

For more information, contact: Sales@VersaLogic.com **RSC# 42572 @ www.mil-embedded.com/rsc**

WinSystems, Inc.
715 Stadium Drive • Arlington, TX 76011
817-274-7553
www.winsystems.com

WinSystems®
An Employee-Owned Company

PPM-LX800 Extended Temperature PC/104-*Plus* SBC

The PPM-LX800-G is a highly integrated, PC/104-*Plus* Single Board Computer (SBC) designed for space-limited and low-power applications. It is a full-featured SBC that utilizes an AMD LX800 x86-compatible CPU.

Onboard I/O functions include analog CRT and digital flat panel video controller, Intel 82551ER 10/100 Ethernet, two USB 2.0 ports with overcurrent protection on each channel, and four COM channels. The PPM-LX800-G provides standard PC controllers for IDE hard disks, CompactFlash device, PS/2 mouse and keyboard controller, AC'97 audio, LPT, and PC/104-*Plus* expansion connectors all on a single 90mm x 96mm module.

There are 16 bits of TTL-compatible digital I/O with each line individually programmable for input, output, or output with read-back operation. The major feature of the onboard digital I/O controller is its ability to monitor the 16 lines for either rising or falling digital edge transitions, latch them, and then interrupt the host processor notifying it that a change-of-input status has occurred.

The PPM-LX800-G has x86 PC software compatibility that assures a wide range of tools to aid in your application program development and checkout. It supports both Windows® XPe and Linux operating systems and other RTOSs. WinSystems provides free technical phone support to assist customers with system integration of our SBCs and I/O modules.

The SBC's low power dissipation permits fanless operation over a temperature range from -40°C to +85°C. The PPM-LX800-G is well suited for rugged applications requiring excellent processor performance in an embedded PC design.

FEATURES

- AMD LX800 CPU; x86-compatible
- Small size: 90mm x 96mm
- Video with CRT resolutions to 1920 x 1440 and panel resolutions to 1600 x 1200
- Custom splash screen on startup
- 10/100 Mbps Ethernet controller
- Two USB 2.0 ports with overcurrent protection
- Four COM channels with FIFO
- 16 digital I/O lines with event sense supported
- AC'97 audio, LPT, mouse, and keyboard controllers
- -40°C to +85°C operating temperature
- Long-term PC/104-*Plus* product availability

For more information, contact: Info@WinSystems.com **RSC# 41296 @ www.mil-embedded.com/rsc**

LiPPERT Embedded Computers Inc.
5555 Glenridge Connector, Suite 200 • Atlanta, GA 30342
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www.lippertembedded.com

Cool RoadRunner-Atom

The Cool RoadRunner-Atom delivers high computing performance while consuming little power. It comes complete as a stand-alone embedded PC. It features a maximum of 2 GB soldered DDR2 RAM. There is a graphics controller and VGA and LVDS ports. HD Audio is supported, too. Two SATA ports are onboard, while a 2 GB IDE solid state disk allows construction of systems without moving parts. A Gigabit Ethernet port, 8 USB 2.0 host ports, and flexible serial interfaces provide versatile connectivity to networks and external peripherals. SMBus signals are available, too. The CRR-Atom operates from a single 5 V supply.

The integrated LiPPERT Enhanced Management Technology provides housekeeping functions like power sequencing and utility functions including secure Flash areas and various types of operating state counters. Supported operating systems are Windows, Windows Embedded, Linux, and QNX.

FEATURES

- Intel Atom N270, 1.6 GHz
- 512 MB/1 GB/2 GB soldered DDR2 RAM
- Graphics up to 2048 x 1536 pixels
- CRT and LVDS, with backlight
- Gigabit LAN
- 8x USB 2.0
- 2x serial, RS-232/422/485
- 2 GB solid state disk
- 2x SATA
- Low power consumption
- Optionally extended temperature range -40 °C to +85 °C

For more information, contact: ussales@lippertembedded.com **RSC# 41279 @ www.mil-embedded.com/rsc**

Military Embedded Systems Resource Guide PC/104-*Plus*

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404-459-2870
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Cool SpaceRunner-LX800

The Cool SpaceRunner-LX800 is a fully self-contained, rugged single board computer with an AMD Geode LX800 processor. It comes with 256 MB soldered RAM and a 2 GB solid state disk. The integrated graphics controller connects to either VGA or LVDS displays. There is a LAN interface, 4 USB 2.0 host ports, and 2 serial interfaces. An IDE interface and a flexible parallel printer port complete the interfaces. Power consumption is a mere 5 W and allows fanless operation.

The Cool SpaceRunner-LX800 uses LiPPERT Enhanced Management Technology. It handles the board's housekeeping tasks such as power sequencing and watchdog, and provides utility functions including a secure write- and clear-protected Flash area that can be used for security keys. LEMT also enables remote condition monitoring. The board is specified for an extended ambient temperature range of -40 °C to +85 °C.

FEATURES

- AMD Geode LX800 @ 1.0 W, 500 MHz
- 256 MB soldered DDR-333 RAM
- Graphics up to 1920 x 1440 pixels
- CRT, LVDS, with backlight
- 100/10BASE-T Ethernet
- 4x USB 2.0
- 2x RS-232/422/485
- IDE Ultra ATA100
- 2 GB solid state disk
- Low power consumption
- Extended temperature range -40 °C to +85 °C

For more information, contact: ussales@lippertembedded.com **RSC# 37901 @ www.mil-embedded.com/rsc**

Tri-M Engineering

100-1407 Kebet Way • Port Coquitlam, BC V3C 6L3 Canada
604-945-9565
www.tri-m.com

VSX104+

The VSX104+ is a 300MHz PC/104-*Plus* CPU module with dual 10/100 LAN. Its 300MHz DM&P Vortex86SX System-on-Chip (SoC) is a fully static 32-bit x86 processor designed to work with embedded operating systems including Windows® CE, Linux, DOS, and most popular 32-bit RTOSs. Standard features of the VSX104+ include soldered 128MB DDR2 RAM, four COM ports, two USB 2.0, and two 10/100 LAN ports. An 8-bit GPIO port and redundancy port are also standard features. In addition to 2MB onboard SPI flash, the VSX104+ includes a Type I CompactFlash™ and microSD socket. System expansion is supported by the PC/104-*Plus* interface. The VSX104+ has an operating temperature of -40°C to +85°C. Single +5VDC power is supplied through the PC/104 bus or 2-position screw terminal, and total power consumption is a mere 2.5W.

FEATURES

- 300MHz Vortex86SX SoC
- 128MB soldered DDR2 RAM
- Integrated dual 10/100 LAN, 4x RS-232, 2x USB 2.0, 1x LPT, keyboard, mouse
- 2MB onboard SPI flash
- PC/104-*Plus* compliant
- Fanless operation
- 2.5W power consumption
- Type 1 CompactFlash™ and microSD sockets
- Extended temperature operation
- RoHS compliant

For more information, contact: info@tri-m.com **RSC# 41282 @ www.mil-embedded.com/rsc**

LiPPERT Embedded Computers Inc.

5555 Glenridge Connector, Suite 200 • Atlanta, GA 30342
404-459-2870
www.lippertembedded.com

Cool XpressRunner-GS45

The Cool XpressRunner-GS45 is the fastest PCI/104-Express processor module available today. Its Intel Core 2 Duo processor runs at up to 2.26 GHz. The board is equipped with 1 GB soldered DDR3-1066 RAM. Its Mobile GS45 chipset features an integrated GMA4500 graphics processor. Displays are connected using either VGA or dual channel LVDS interfaces. HD Audio with analog as well as digital inputs and outputs are available, too. There is a Gigabit LAN port, 8 USB 2.0 host ports, 2 serial interfaces, and 2 SATA ports.

The board comes with LiPPERT Enhanced Management Technology. It handles the board's housekeeping tasks like power sequencing and watchdog, and provides utility functions including a secure write- and clear-protected Flash area that can be used for security keys. The 1.2 GHz model is optionally available for the extended temperature range of -40 °C to +85 °C.

FEATURES

- Intel Core 2 Duo processor
- 1 GB soldered DDR3-1066 RAM
- SXGA: 2048 x 1536 pixels
- Dual channel LVDS and CRT
- Gigabit Ethernet
- 8x USB 2.0
- 2x RS-232, RS-485
- HD Audio
- 2x SATA
- Passive cooling possible
- Optionally extended temperature range @ 1.2 GHz

For more information, contact: ussales@lippertembedded.com **RSC# 41280 @ www.mil-embedded.com/rsc**

Annapolis Micro Systems, Inc.
190 Admiral Cochrane Drive, Suite 130 • Annapolis, MD 21401
410-841-2514
www.annapmicro.com

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.

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.

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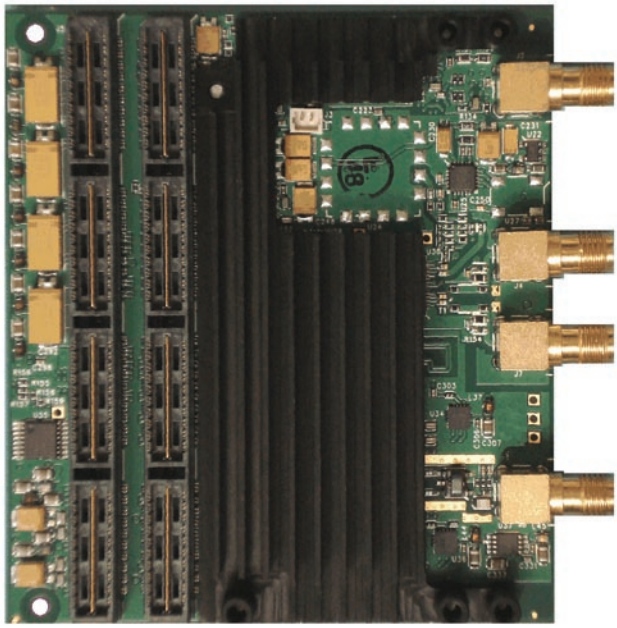

FEATURES

- 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

For more information, contact: wfinfo@annapmicro.com **RSC# 36021 @ www.mil-embedded.com/rsc**

Annapolis Micro Systems, Inc.
190 Admiral Cochrane Drive, Suite 130 • Annapolis, MD 21401
410-841-2514
www.annapmicro.com

Quad 600 MSps 16-bit DAC

The Annapolis Quad 600 MSps 16-bit DAC I/O Card provides up to four 16-bit output streams at up to 600 MSps each. The board has four Max 5891 16-bit DACs. Use the high-precision trigger to synchronize the four onboard DAC channels or to synchronize DACs between multiple boards (<1 Fs period).

The Quad 600 MSps board has six SMA front panel connectors: four single-ended DAC outputs, a high-precision trigger input with Fs precision, and a universal single-ended 50-ohm clock input. It has excellent SFDR and IMD performance, 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 Analog to Digital 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.

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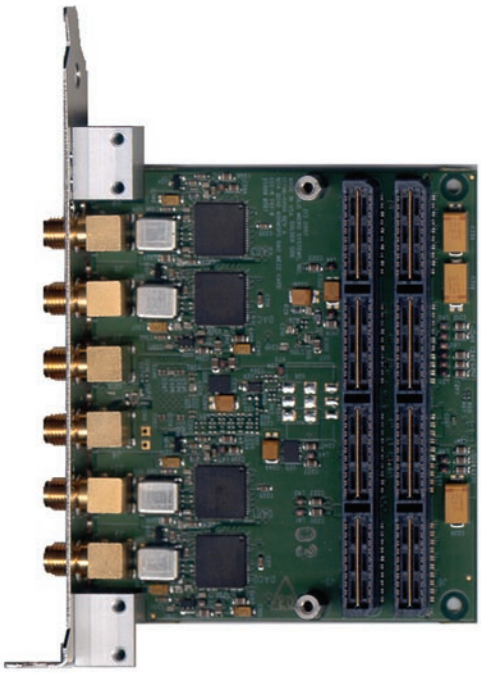

FEATURES

- Four 16-bit Analog to Digital Converters: Max 5891
- Six SMA front panel connectors: four single-ended DAC outputs, one high-precision trigger input with Fs precision, and one universal single-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 hardware interfaces and ChipScope access
- Industrial temperature range
- Proactive thermal management system
- Save time and effort; 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

For more information, contact: wfinfo@annapmicro.com **RSC# 38791 @ www.mil-embedded.com/rsc**

Annapolis Micro Systems, Inc.
190 Admiral Cochrane Drive, Suite 130 • Annapolis, MD 21401
410-841-2514
www.annapmicro.com

WS4 1.5/2.3/4.0 GSps 12-bit DAC

The Annapolis Dual Channel 1.5/2.3/4.0 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 panel 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 three 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 Analog to Digital 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.

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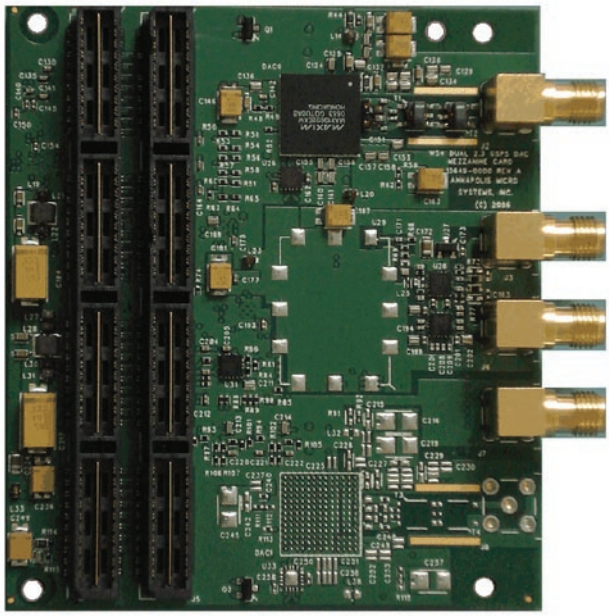

FEATURES

- 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, and 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
- Proactive thermal management system; available in industrial temperature range
- Full CoreFire Board Support Package for fast, easy application development and technology refresh
- VHDL model, including source code for hardware interfaces
- Includes one-year hardware warranty, software updates, and customer support; reduce risk with COTS
- We offer training and exceptional special application development support, as well as more conventional customer support
- Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that customers' applications succeed

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Annapolis Micro Systems, Inc.
190 Admiral Cochrane Drive, Suite 130 • Annapolis, MD 21401
410-841-2514
www.annapmicro.com

WS4 Quad 250/400/500 MSps A/D

The Annapolis Quad Channel 250/400/500 MSps A/D I/O Card provides four A/D inputs with converter speeds of up to 250, 400, or 500 MHz and resolutions of 13, 14, or 12 bits, respectively. The board has four A/D converters from TI (ADS5444, ADS5474, or ADS5463) fed by onboard analog input circuits that convert the single-ended, 50-ohm SMA input into differential signals for the ADC.

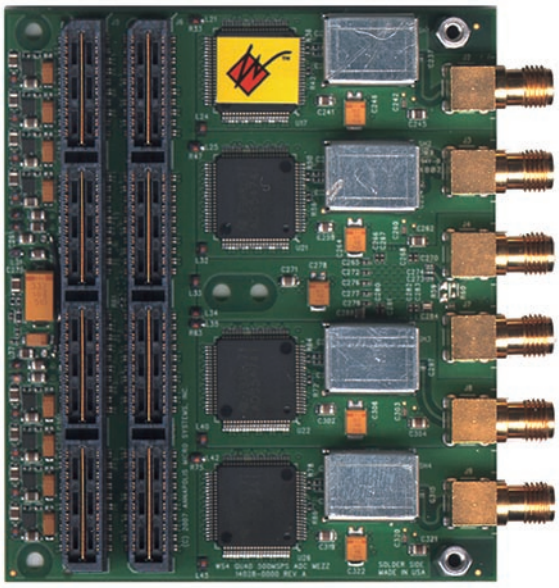
There is an onboard ultra-low jitter and skew clock distribution circuit to allow all four channels on a single A/D I/O board to be synchronized together. There is also an external clock input and a trigger input allowing multiple A/D I/O cards to be synchronized together. Synchronization of A/D I/O 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 I/O cards can reside on each WILDSTAR 4 or WILDSTAR 5 VME/VXS or IBM Blade main board or reside on one A/D I/O card on each PCI-X or PCI Express main board.

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.

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.



FEATURES

- Four TI A/D converters of one of these speed and bit size types: ADS5444 250 MSps 13-bits, ADS5474 400 MSps 14-bits, ADS5463 500 MSps 12-bits
- Analog input bandwidths of up to: 500 MHz for the 250 MSps A/D board; 1,400 MHz for the 400 MSps A/D board; 2,000 MHz for the 500 MSps A/D
- Six SMA front panel connectors: four 50-ohm analog inputs, one single-ended 50-ohm clock input, one trigger input
- Onboard ultra-low jitter and skew clock distribution circuit to allow synchronization of all four channels on a single I/O card
- 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
- Proactive thermal management system; available in both commercial and industrial temperature ranges
- Full CoreFire Board Support Package for fast, easy application development and technology refresh
- VHDL model, including source code for hardware interfaces
- Includes one-year hardware warranty, software updates, and customer support; reduce risk with COTS
- We offer training and exceptional special application development support, as well as more conventional customer support
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WILDSTAR 5 for PCI Express

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.

Twelfth generation WILDSTAR 5 for PCI Express uses Xilinx Virtex-5 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 3 Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (10 G Fibre Channel, 10 Gb Ethernet, OC-192). 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 data flow, 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 5 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.

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

FEATURES

- Up to three Xilinx Virtex-5 FPGA I/O processing elements – LX110T, LX220T, LX330T, or FXT
- Up to 7 GB DDR2 DRAM in 12 memory banks per WILDSTAR 5 for PCI Express board or up to 2 GB DDR2 DRAM in two memory banks and up to 40 MB DDRII, QDRII SRAM, or up to 1.4 GB RLDRAM
- Programmable Flash for each FPGA to store FPGA image
- 8x PCI Express bus; high-speed DMA multichannel PCI controller
- Supports PCI Express Standard External Power Connector
- Available in commercial or industrial temperature ranges
- Full CoreFire Board Support Package for fast, easy application development
- VHDL model, including source code for hardware interfaces and ChipScope access
- We offer training and exceptional special application development support, as well as more conventional support
- Includes one-year hardware warranty, software updates, and customer support
- Proactive thermal management system – board-level current measurement and FPGA temperature monitor, accessible through Host API
- Save time and effort; reduce risk with COTS boards and software
- Achieve world-class performance; WILD solutions outperform the competition

For more information, contact: wfinfo@annapmicro.com **RSC# 36017 @ www.mil-embedded.com/rsc**

PDSi – Pinnacle Data Systems, Inc.

6600 Port Road, Suite 100 • Groveport, OH 43125
Tel: 614-748-1150 • Fax: 614-748-1209
www.pinnacle.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 drive (HDD) or solid state drives (SSDs); up to 160GB 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 additional 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 160GB storage capacity
- Featuring Intel advanced SSD technology (80GB and up)
- 3 additional SATA channels
- Windows, Linux, and Solaris support
- Customization welcomed, extended availability assured
- RoHS compliant

For more information, contact: rob.ellis@pinnacle.com **RSC# 41871 @ www.mil-embedded.com/rsc**

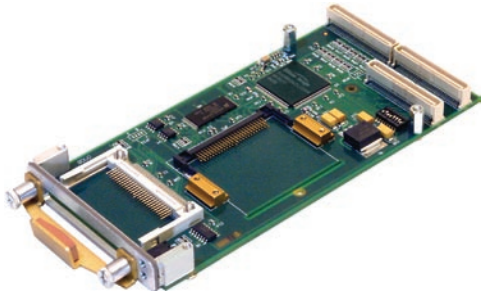
PMC Military Embedded Systems Resource Guide

Technobox

140 Mount Holly Bypass, Unit 1 • Lumberton, NJ 08048-1114
609-267-8988
www.technobox.com

5264

Built around a Silicon Image PCI-680, the 5264 Front Panel CF Adapter provides an interface for two Type I or Type II CF devices. One device, connected to the Primary IDE channel, is available out the front panel. A second device, connected to the Secondary IDE channel, is mounted on the body of the adapter. Additionally, the Secondary IDE channel of the adapter can interface other IDE/ATA devices, via its rear I/O connector. The CF sites operate in true IDE mode and can be set to operate as either a master or a slave device via DIP switches. Two LEDs on the front panel provide activity status for the primary and secondary IDE channels.



FEATURES

- Supports 2 CF devices (Type I or II)
- Silicon Image PCI-680 controller
- Ultra133 on primary and secondary channels
- Front panel CF device on primary channel; onboard CF site on secondary; both with positive retention
- Supports DMA transfer to CF devices
- RoHS compliant

For more information, contact: info@technobox.com **RSC# 37062 @ www.mil-embedded.com/rsc**

Technobox
140 Mount Holly Bypass, Unit 1 • Lumberton, NJ 08048-1114
609-267-8988
www.technobox.com

5575

The 2.5-inch SATA disk adapter provides an industry standard SATA connector for mounting a 2.5-inch SATA hard drive in the space occupied by a PMC.

This product uses the Silicon Image SiI3512 IC that supports SATA operation of a single hard drive. The Silicon Image SiI3512 controller connects the PCI bus to the one SATA link. The PCI bus can operate at 33 MHz or 66 MHz. Both 5 V and 3.3 V PCI bus signaling are supported.

The Silicon Image SiI3512 controller is programmed with a BIOS image stored in a 512K x8 EEPROM. A green status LED on the PCB conveys the activity of the hard drive.

This product is normally supplied without a hard drive, permitting purchase of drives for installation by the user.

FEATURES

- Accepts 2.5-inch SATA HD or solid-state media
- Silicon Image SiI3512 controller
- Standard mounting
- RoHS compliant
- Lead-free

For more information, contact: info@technobox.com **RSC# 36166 @ www.mil-embedded.com/rsc**

Military Embedded Systems Resource Guide PMC

Technobox
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609-267-8988
www.technobox.com

Triple Isolated RS-232/485/422 PMC

The Technobox 5751 3-port Isolated Async Communications Adapter is a cost-effective solution for providing additional asynchronous serial ports.

Each port may be configured independently as RS-232, RS-422, or RS-485. All three ports are accessed via 9-pin Micro D-Subminiature connectors on the PMC front panel.

Options to terminate the differential RS-422/RS-485 signals with 150 ohm parallel termination are provided by the design. Independent isolation is provided for each port using a separate isolated DC-to-DC converter and opto-isolators for conveying I/O signals.

FEATURES

- Three async serial ports (16550 UARTS)
- Supports RS-232, RS-422, or RS-485
- Front panel I/O only
- Independent isolation for each port
- Selectable interrupt configuration for each port
- RoHS compliant

For more information, contact: info@technobox.com **RSC# 40983 @ www.mil-embedded.com/rsc**

American Portwell Technology, Inc.
44200 Christy Street • Fremont, CA 94538
510-403-3399
www.portwell.com

PQ7-M102XL

Portwell's ultra compact PQ7-M102XL is a Qseven module board (70mm x 70mm), based on the Intel Atom processor Z510PT/Z520PT and the Intel SCH US15WPT. Both the PQ7-M102XL and its companion PQ7-C100XL 3.5" ESB developer carrier board support an industrial temperature range of -40ºC to 85ºC. The PQ7-M102XL module board features 512MB memory; dual independent display by LVDS/SDVO; one GbE; eight USB ports; and expansion of two SATA, one SDVO, one PCI-E x1, LPC and high definition audio interface. Portwell's PQ7-M102XL module board with companion PQ7-C100XL developer carrier board is the ideal solution for low power, wide temperature and fanless devices in applications such as medical, outdoor embedded systems, industrial control, gaming machines, and COTS military.

FEATURES

- Intel Atom processor Z510PT/Z520PT and the Intel System Controller Hub US15WPT, featuring industrial temperature range
- Supports two SATA ports from the Qseven golden finger
- Onboard 512MB DDR2 memory
- Dual independent display by SDVO and LVDS
- Expansion: One SDVO, one PCI-E x1, two SATA, LPC and high definition audio interface
- Ultra compact footprint at 70mm x 70mm (2.75" x 2.75")

For more information, contact: info@portwell.com **RSC# 42419 @ www.mil-embedded.com/rsc**

Curtiss-Wright Controls Embedded Computing
741-G Miller Drive, SE • Leesburg, VA 20175
613-254-5112
www.cwcembedded.com

VPX3-127 Freescale MPC8640D Single Board Computer

The VPX3-127 combines the performance and the advanced I/O capabilities of the Freescale Power Architecture MPC8640D processor with an extensive I/O complement to provide a highly capable processing platform for a wide range of embedded military/aerospace applications. Designed for space constrained applications, the VPX3-127 represents the latest step in the evolution of rugged high-performance, highly integrated small form factor SBCs.

The VPX3-127's integral high-speed backplane and PMC/XMC connectivity allows for multi-GB/sec data flows from board-to-board through the backplane interface and from the backplane to PMC/XMC site supporting the acquisition, processing, and distribution of sensor data such as video, radar, and sonar data. A rich I/O complement includes 2 Gigabit Ethernet ports, 4 serial channels, up to 8 bits of discrete digital I/O, USB 2.0 ports, and a PMC/XMC site with 64 bits of I/O to the backplane.

FEATURES

- Powerful general-purpose Single Board Computer with Freescale MPC8640D processor
- Dual Freescale Power Architecture cores up to 1.0GHz
- Up to 2 GB DDR2 SDRAM controlled by dual 64-bit controllers
- I/O including Ethernet, serial, USB 2.0, PCI Express, TTL, and differential discretes
- 3U VPX format with two 4-lane PCI Express fabric ports or one 4-lane PCI Express port and one 4-lane Serial RIO port
- VxWorks 6.x BSP, Linux GPP LE, Green Hills INTEGRITY, and LynxOS
- Continuum Software Architecture (CSA) firmware
- Designed for military harsh-environment applications, both air- and conduction-cooled

For more information, contact: sales@cwcembedded.com **RSC# 41195 @ www.mil-embedded.com/rsc**

Curtiss-Wright Controls Embedded Computing

741-G Miller Dr. SE • Leesburg, VA 20175
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www.cwcembedded.com

VPX6-185 Freescale MPC8640/8641 Single Board Computer

The VPX6-185 combines the performance and the advanced I/O capabilities of the Freescale Power Architecture MPC8640/8641D processor with an extensive I/O complement to provide a highly capable processing platform for a wide range of embedded military/aerospace applications.

The VPX6-185's integral high-speed backplane and PMC/XMC connectivity allow for multi-GB/sec data flows from board-to-board through the backplane interface, from backplane to PMC/XMC site, and between PMX/XMC sites supporting the acquisition, processing, and distribution of sensor data such as video, radar, and sonar data. A rich I/O complement including four Gigabit Ethernet ports and options for multi-function RS-232/422/485 serial ports, MIL-STD-1553, SCSI, Serial ATA, and TTL and differential discretes provides connectivity integration with other system elements without using up PMC/XMC sites.

FEATURES

- Powerful general-purpose Single Board Computer with Freescale MPC8640/8641D processor
- Single or dual e600 cores at up to 1.33GHz
- Up to 2 GB DDR2 SDRAM controlled by dual 64-bit controllers
- I/O including Ethernet, SCSI, serial, USB 2.0, 1553, Serial ATA, TTL, and differential discretes
- VPX/VPX-REDI formats with four 4-lane fabric ports, port selectability between either Serial RIO or PCI Express
- VxWorks 6.x, MILS, Linux 3.0 GPP LE, and INTEGRITY support
- Continuum Software Architecture firmware
- Air- and conduction-cooled models for military harsh-environment applications

For more information, contact: sales@cwcembedded.com **RSC# 42580 @ www.mil-embedded.com/rsc**

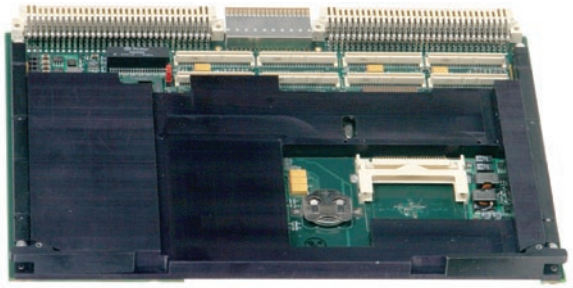
Dynatem, Inc

23263 Madero Suite C • Mission Viejo, CA 92691
949-855-3235
www.dynatem.com

VMEbus conduction-cooled Pentium Core™2 Duo SBC

The RPD is a rugged conduction-cooled VMEbus (and VME64) compatible platform based on the low power Intel® Core™2 Duo Mobile Processor L7400. The E7520 Memory Controller Hub (MCH) and 6300ESB I/O Controller Hub (ICH) chipset support PCI-X and PCIe expansion, USB 2.0, ATA/100, and Serial ATA (SATA).

Two VITA 31.1-compliant, 10/100/1000BaseTX ports are routed to the backplane. Two SATA ports, VGA video, two Gb Ethernet ports, four RS-232 ports, one RS-422 port, an IDE interface, PS/2 mouse and keyboard, and two more USB 2.0 ports are additionally routed to the backplane. Conformal coating and extended temperature options are included. RPD supports up to two PMC sites. (One is also x8 XMC.) RPD is compatible with 5V only backplanes but can optionally use 3.3V to support higher power PMC or XMC mezzanines.



FEATURES

- Intel® Core™2 Duo Mobile Processor L7400 @ 1.5 GHz
- 2 GB or 4 GB ECC DDR-2 BGA memory
- VITA 31 compatible dual Gb Ethernet routed to P0
- Two PMC sites (one site is also XMC)
- Single-slot VMEbus operation with an on-board CompactFlash disk for bootable mass storage
- Conduction cooled per IEEE 1101.2
- Extended temperature operation available
- Full compliance with MIL-STD-810F
- SM712 graphics controller for VGA
- Support for Linux, Windows, VxWorks, QNX, LynxOS, Solaris
- RTM available

For more information, contact: sales@dynatem.com **RSC# 42448 @ www.mil-embedded.com/rsc**

Aitech Defense Systems
19756 Prairie Street • Chatsworth, CA 91311
888-248-3248
www.rugged.com/c160.htm

C160 6U VME SBC

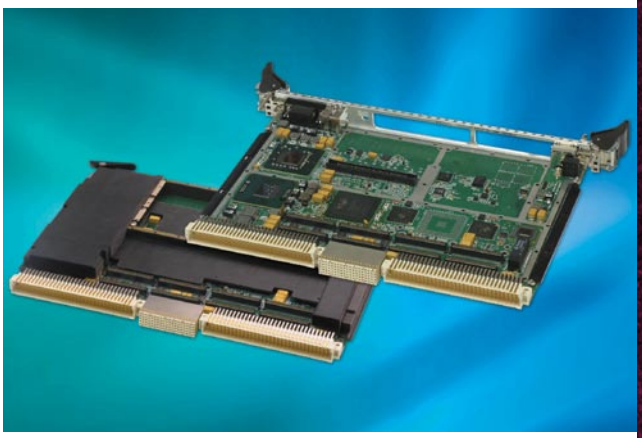
Aitech Defense Systems' new 6U VME single board computer (SBC) uses Intel's latest T7500 low-power, high-performance Merom Core 2 Duo dual core processors. The new C160 is designed for rugged, mission critical mobile applications requiring exceptionally low power and high processing throughput.

The updated single-slot C160 now offers clock frequencies up to 2.2 GHz for the high-performance version and 1.67 GHz for the low-power version, which draws only 25 W. The new board also uses Intel's Virtualization Technology (VT), enabling the board to run different applications simultaneously using multiple virtual partitions.

The fully featured C160 incorporates a custom metal thermal management frame supporting an array of integral stiffeners for increased resistance against high shock and vibration. This makes the board ideal for rugged and harsh military environments such as radar and sonar communications processors, autonomous vehicle IED and RPG protection subsystems, mission management computers and heads-up display controllers.

The newest addition to Aitech's extensive family of high-performance SBCs, the C160 offers 2eSST and 2eVME functionality as well as VME and PCI legacy support via a Tundra Tsi148 bridge. The bridge's decoupled architecture can handle simultaneous transactions and the large FIFOs (first in first out) to prevent PCI/X to VME deadlock conditions for better, more reliable data throughput.

The board offers large memory arrays providing extensive volatile and non-volatile memory resources. These include up to 2 GB fast DDR2 SDRAM operating at 667 MHz and up to 8 GB of onboard Flash disk (NAND Flash) with IDE controller eliminating the need for externally attached mass-storage media. Additional on-board, non-volatile mass storage for convenient, local program and data file storage is provided by a solid state disk (SSD) with up to 16 GB of memory as well as auto-wear leveling to ensure long media life.



FEATURES

- Rugged 6U VME Single-Slot SBC
- Intel® L7500 Core™2 Duo (Merom) processor @ 2.2/1.67 GHz
- On-Chip 32 kB Data/32 kB Instruction on L1 Cache
- On-Chip 4 MB L2 Cache
- Up to 2 GB DDR2 SDRAM
- 8 GB IDE Flash Disk
- Up to 16 GB USB SSD (Solid State Disk)
- VME 2eSST with Legacy VME Support
- On-Board Graphics Controller
- Two Gigabit Ethernet Ports
- Two RS-232/422/485 Serial Ports
- Eight Discrete I/O Lines
- Two SATA II Interfaces
- Two USB 2.0 Interfaces
- High Definition Audio
- Two Temperature Sensors
- Real Time Clock with Capacitor and Battery Backup
- Avionics Windowed Watchdog Timer
- Two PMC Slots
- Two Temperature Sensors
- Conduction and Air Cooled Versions
- Vibration and Shock Resistance
- OS Support:
  - Windows™
  - Linux®
  - Wind River VxWorks®
  - Green Hills INTEGRITY®

For more information, contact: sales@rugged.com **RSC# 41956 @ www.mil-embedded.com/rsc**

Annapolis Micro Systems, Inc.
190 Admiral Cochrane Drive, Suite 130 • Annapolis, MD 21401
410-841-2514
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.

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

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 1280 MHz PLL and external 10 MHz Reference
- On-Board PLL's 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

For more information, contact: wfinfo@annapmicro.com **RSC# 33661 @ www.mil-embedded.com/rsc**

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190 Admiral Cochrane Drive, Suite 130 • Annapolis, MD 21401
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SFPDP UNI6 I/O

Annapolis Micro Systems Inc.'s FPGA-based WILDSTAR family provides 24 SFPDP channels per VME slot.

The Annapolis SFPDP cards (UNI3 or UNI6) come with an easy to use Serial FPDP interface supporting up to 12 lanes of 2.5 Gb full duplex data. Three frame types are supported: Normal Data Fiber Frame, Sync Without Data Fiber Frame, and Sync with Data Fiber Frame in Point-to-Point Mode.

The card has three individually configurable, industry-standard 4X connectors, providing four lanes per connector, with dedicated signal conditioners to ensure clean communication. It supports up to 7.5 GB full duplex per I/O card and a wide variety of readily available copper and fiber cables.

Up to two serial I/O cards and two LVDS I/O cards can reside on each WILDSTAR 4 or WILDSTAR 5 VME/VXS main board, with half that number for the PCI-X or PCIe. The SFPDP card (UNI6) supports RocketIO protocol at up to 75 Gb full duplex per I/O card, three ports of 10 G full duplex InfiniBand per I/O card, or 10 G full duplex Ethernet per I/O card.

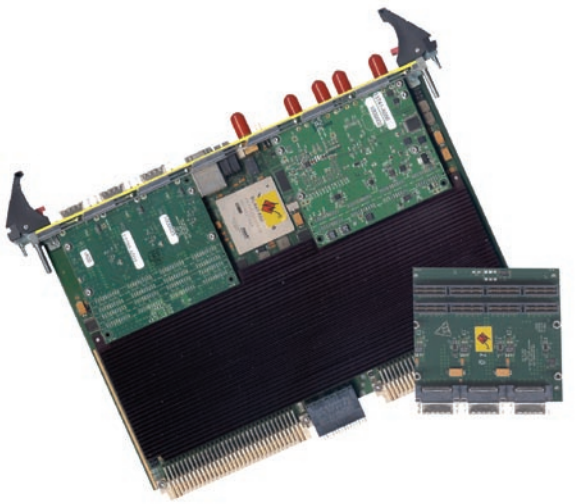
No other FPGA board vendor can match the volume of data we can send straight into the heart of the processing elements and then straight back out again.

An FPGA-based high-performance processing engine thrives on data streaming in and out at high rates of speed. The FPGAs should be part of a balanced and unified system architecture, providing maximum performance, with memory, processing power, and I/O speeds designed and integrated for performance, scalability, and growth.

Annapolis Micro Systems, Inc.'s WILDSTAR 4 (Xilinx Virtex-4 based) and WILDSTAR 5 (Xilinx Virtex-5 based) families of FPGA-based processing boards also support an extensive set of extremely high-quality A/D and D/A boards.

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.



FEATURES

- Three individually configurable 4X connectors – four lanes per connector
- Up to four 2.5 Gb full duplex Serial FPDP ports per connector
- Up to 25 Gb full duplex RocketIO per connector
- Up to 10 Gb full duplex InfiniBand per connector
- Up to 10 Gb full duplex Ethernet per connector
- Optional onboard oscillators for other line rates like Fibre Channel
- I/O card plugs onto WILDSTAR 4 or 5 VME/VXS/IBM Blade Chassis/PCI-X/PCI Express main board
- JTAG, ChipScope, and Serial Port access
- Proactive thermal management system. Available in both commercial and industrial temperature grades
- 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
- Full CoreFire Board Support Package for fast, easy application development
- VHDL model, including source code for hardware interfaces

For more information, contact: wfinfo@annapmicro.com **RSC# 35968 @ www.mil-embedded.com/rsc**

Emerson Network Power
2900 S. Diablo Way, Suite 190 • Tempe, AZ 85282
800-759-1107 or 602-438-5720
EmersonNetworkPower.com/EmbeddedComputing

MVME4100 VMEbus Single-board Computer

MVME4100 incorporates the fastest Freescale MPC8548E system-on-chip processor, industry-leading storage options, extensive I/O, high-speed 2eSST protocol and flexible expansion options that include an on-board PMC site and up to four optional XMC sites via expansion cards.

The MVME4100 SBC provides a high-performance, cost-effective continuation for currently deployed VME infrastructure. The Freescale e500 core coupled with the current operating systems allows for double precision floating point operations. In addition, the processor-enabled supplementary encryption engine can be leveraged to address new opportunities meeting the ever-growing demand for network privacy and data security. The memory and storage options of the MVME4100 raise the bar in the embedded computing market. 2GB of DDR2 RAM is provided in SODIMM format. Innovative MRAM is included for truly non-volatile memory.

FEATURES

- 1.3GHz system-on-chip Freescale MPC8548E with e500 processor core and double precision floating point operations
- 2eSST VMEbus protocol with 320MB/s transfer rate across the VMEbus
- Dual 33/66/100MHz PMC sites for expansion via industry standard modules with support for processor PMCs
- 8x PCI/PCI-X expansion connector for PMC/XMC expansion using Emerson XMCspan carrier
- 2GB of DDR2 ECC memory, 128MB NOR flash and 4GB NAND flash
- 512KB of MRAM non-volatile memory
- Four Gigabit Ethernet ports; five serial ports
- USB 2.0 controller for integrating cost-effective peripherals

For more information, contact: EmbeddedComputingSales@Emerson.com **RSC# 39671 @ www.mil-embedded.com/rsc**

Military Embedded Systems Resource Guide VMEbus

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2900 S. Diablo Way, Suite 190 • Tempe, AZ 85282
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EmersonNetworkPower.com/EmbeddedComputing

MVME7100 Multi-core VMEbus Single-board Computer

The MVME7100, with the system-on-chip MPC864xD processor, offers a growth path for VMEbus customers with applications on the previous generation of VME products. With power/thermal, reliability, and life-cycle advantages not typically found in alternative architectures, the MVME7100 helps OEMs of industrial, medical, and defense/aerospace VMEbus platforms add performance and features for competitive advantage while protecting their investment in VMEbus and related technologies.

The 2eSST protocol offers an available VMEbus bandwidth of up to 320MB/s, an increase of up to 8x over VME64, while maintaining backward compatibility with VME64 and VME32. The combination of Texas Instruments VMEbus transceivers and the Tundra Tsi148 VMEbus bridge's legacy protocol support allows customers to integrate the MVME7100 series into their existing infrastructure, thereby preserving their investment.

FEATURES

- Up to 1.3GHz system-on-chip Freescale MPC864xD with dual PowerPC® e600 processor cores
- 2eSST VMEbus protocol with 320MB/s transfer rate across the VMEbus
- Dual 33/66/100MHz PMC-X sites for expansion via industry standard modules with support for processor PMCs
- 8x PCI Express expansion connector for PMC-X and XMC expansion using Emerson XMCspan
- Four Gigabit Ethernet ports
- Up to 2GB of DDR2 ECC memory, 128MB NOR flash, 4 or 8GB NAND flash and 512KB MRAM non-volatile memory
- USB 2.0 controller for integrating cost-effective peripherals

For more information, contact: EmbeddedComputingSales@Emerson.com **RSC# 36477 @ www.mil-embedded.com/rsc**

PDSi – Pinnacle Data Systems, Inc.
6600 Port Road • Groveport, OH 43125
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www.pinnacle.com

VM86-N1 and -N2 Intel® Core™ 2 Duo Processor Blades

These two new VME processor blades offer convenient, pin-compatible replacements for legacy 7750- and 7751-based systems while offering upgraded technology, higher performance, more memory and an extended product life cycle. Built around Intel's low-power Core 2 Duo SL9400 processor and server-class 5100 MCH chipset, these blades support up to 4 GB of ECC memory.

The VM86-N1 blade includes dual gigabit Ethernet ports and dual USB 2.0 ports for high-speed front communication links, and the VGA port gives access to high-resolution graphics capability. A PMC site provides I/O expansion capability, and there is an optional onboard Flash drive. The two-board VM86-N2 blade adds two more PMC sites on the upper board and offers onboard SATA storage options and dual Ultra 160 SCSI channels, as well as rear floppy and SCSI interfaces. Rear I/O interfaces are pin-compatible with existing 7750/7751-based RTMs.

FEATURES

- 2 low-power, high-performance VME compute blades for legacy 7750/7751 upgrades
- Intel SL9400 Core 2 Duo 1.86 GHz, Intel 5100 MCH
- Up to 4 GB Registered ECC DDR2 400 Memory
- Up to 3 PMC expansion sites (VM86-N2)
- VGA graphics up to 2048 x 1536 resolution
- 2 x 10/100/1000 Ethernet, 2 x USB 2.0, 2 x RS-232 serial
- Optional USB Flash drive up to 8 GB
- Dual Ultra 160 SCSI channels (VM86-N2)
- Optional 2.5" SATA HDD up to 320 GB (VM86-N2)
- Rear 7751-compatible floppy and SCSI interfaces
- Customization welcomed, extended availability assured

For more information, contact: rob.ellis@pinnacle.com **RSC# 41870 @ www.mil-embedded.com/rsc**

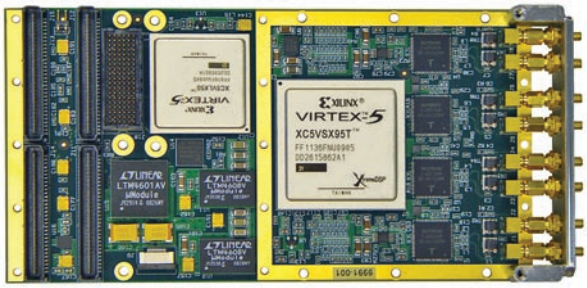
Nallatech, Inc.
759 Flynn Road • Camarillo, CA 93012
805-383-8997
www.nallatech.com

XMC-240 Analog Data Capture and FPGA Processing

Nallatech, a leading supplier of high-performance COTS FPGA processing solutions, offers the new XMC-240 FPGA processing and analog input PMC/XMC mezzanine. It is designed to meet the signal processing needs of modern signal intelligence, software defined radio and radar applications. The XMC-240 is the latest product to be introduced to the highly successful Nallatech REVX Series of rugged embedded processing solutions.

The XMC-240 is also available for both Linux and Wind River VxWorks. These include a Software Development Kit (SDK) with all necessary software drivers and libraries. They also include an FPGA Development Kit (FDK), with FPGA cores supplied to interface to FPGA peripherals including memories, data interfaces and analog interfaces.

www.nallatech.com



FEATURES

- The XMC-240 features four channels of analog input that can sample analog signals at up to 250 MSPS with 14 bit resolution
- These are coupled directly to a Xilinx Virtex-5 SX95T FPGA for the implementation of high-performance DSP applications to process the data captured from the A/D converters
- The XMC-240 has comprehensive clock management capabilities and offers either on-board clocking or external clock input
- Supported by comprehensive Development Kits for both Linux and Wind River Vx Works
- Supported by FPGA Development Kit with FPGA cores supplied

For more information, contact: contact@nallatech.com **RSC# 42637 @ www.mil-embedded.com/rsc**

Merix Corporation

1521 Poplar Lane • Forest Grove, OR 97116
503-359-9300
www.merix.com

Technologically advanced, rigid, multi-layer PCBs for A&D

Headquartered in the United States, Merix is a leading provider of technologically advanced, rigid, multi-layer Printed Circuit Boards (PCBs) used in the design and development of complex electronic applications. We provide a large, diverse, worldwide customer base with a seamless and cost-effective transition from quick-turn prototyping through pre-production to high-volume PCB manufacturing across the broadest array of technologies.

Our advanced technology includes HDI structures, Via-fill, Cu fill and Stacked micro-vias; high-performance materials expertise; and embedded passives: 2 mil, 1 mil and sub-1 mil embedded capacitance, along with buried resistor technology. Our PCBs are designed for the defense and aerospace, communications, computing, industrial, networking, peripherals, and test end markets. For more information, please visit us at www.merix.com.

FEATURES

- Seamless transition from quick-turn prototyping to production ramp to high-volume manufacturing
- Complete product life-cycle support
- Superior quality and reliability
- IPC-6012 Class II/III/MIL-P-55110/MIL-PRF-31032/ITAR compliant
- Advanced technology: HDI structures, Via-fill, Cu fill and Stacked micro-vias
- RF/microwave applications
- Thermal management solutions
- Factory floor online management, part traceability
- High-performance materials expertise
- Factory DFM support; robust DFM reviews

For more information, contact: info@merix.com

RSC# 42642 @ www.mil-embedded.com/rsc

Curtiss-Wright Controls Electronic Systems

2600 Paramount Place, Suite 200 • Fairborn, OH 45324
937-610-5457
www.cwcembedded.com

Vortex SDR Data Recorders for streaming data applications

Vortex SDR Data Recorders acquire, store and play back 1 Gigabit Ethernet (GbE), 10 GbE or Serial FPDP data in streaming sensor-to-DSP applications. The SDR data recorders support data frames of any size with up to 960MB/s sustained transfer rate. Each incoming data frame is time-stamped for later playback and to assist in detailed post-analysis of retrieved data. The Vortex SDR can play back data as it arrived for simulation or DSP algorithm development.

The Vortex SDR controller integrates the Vortex family recorder software, Fibre Channel interface, and RapidReplay data capture hardware, all in a powerful 3U rack mount computing platform. Both Switched Bunch of Disks (SBOD) and RAID storage options are supported. With a Vortex SAN Access Kit running on a customer-provided PC workstation, captured data can be retrieved quickly for post-analysis.

FEATURES

- 1 Gigabit Ethernet (GbE), 10 GbE or Serial FPDP interfaces
- Up to 800MB/s sustained data recording
- Easy-to-use web-based GUI
- Scalable Fibre Channel storage in SBOD or RAID configurations
- Vortex SAN Access kit for data retrieval from almost any workstation
- Accurate time stamping of incoming frames
- Ideal for use in radar simulation, DSP algorithm development or storage of raw or processing data

For more information, contact: data_recorders@curtisswright.com

RSC# 42581 @ www.mil-embedded.com/rsc

InnoDisk USA Corporation
43154 Christy Street • Fremont, CA 94538
Tel: 510-770-9421 • Fax: 510-770-9424
www.innodisk.com • Email: usasales@innodisk.com

INNODISK®
Beyond your imagination

InnoDisk SATADOM i-100

SATADOM i-100 Specifications:

****

Capacities:	2GB ~ 32GB
Interface:	Serial ATA II
Transfer Mode:	PIO 0~4, MwDMA 0~2, UltraDMA 0~5
Transfer Rate:	Read: 100MB/sec; Write: 70MB/sec
Operation Temp.:	Industrial 0~+70 °C; Wide Temp -40~+85 °C
Storage Temp.:	-55~+95 °C
Vibration:	20G (7~2000Hz)
Shock:	50G/10ms
DC Input Voltage:	+5V single power supply operation
Power Mode:	Auto stand-by mode
Dimension:	24.95x39.34x6.57mm (WxLxH)

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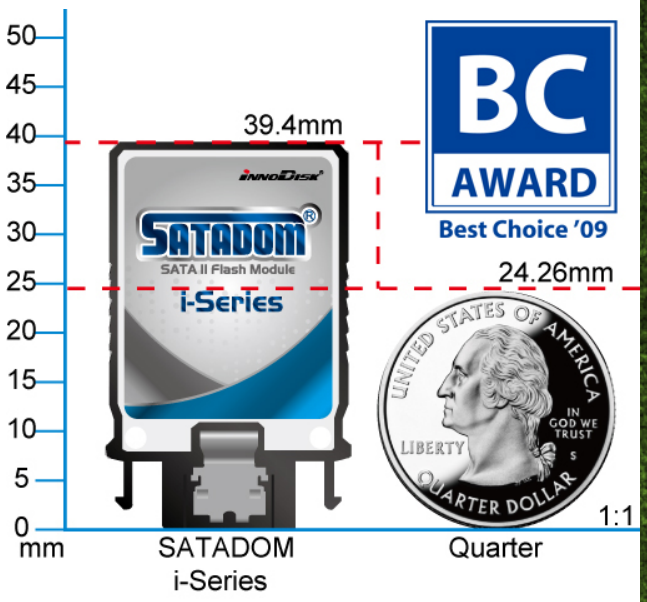

InnoDisk **SATADOM** design is developed in full consideration of the special needs for industrial fields: The tiny SSD products are among the most widely used in the Industrial PC, Thin Client, Set Top Box, Game Console, POS, Communication Devices, and Military Devices arenas. There are 5 key points to make a good and reliable flash memory module: Power Source, Volume, Capacity, Speed, and Connector binding reliability followed by industry standards and regulation. InnoDisk has the solution to keep all 5 key points in balance by 2 exclusive innovations, InnoDisk SATADOM Power Build-In Technology and Safe Mounting Technology. InnoDisk SATADOM supports a Pin 7 built-in power supply. With this function, a power cable is not required. Installation is as easy as using a USB drive.

InnoDisk is one of the leading manufacturers of industrial storage devices worldwide. The elite team holds many product patents and is well experienced in designing industrial grade storage devices for embedded systems. The ISO-9001 company provides comprehensive solutions for embedded systems and specialized applications. InnoDisk is among the most reliable and highest performing vendors globally.

Call 510-770-9421 or visit www.innodisk.com to learn about the latest news and updates on InnoDisk products.

FEATURES

- Smallest SATA disk module in the world
- 15% of size of general 2.5" SSD
- Data transfer rate is 100MB/s, twice as fast as traditional hard disks
- Built-in VCC at Pin 7 (InnoDisk Patented)
- Advanced and innovative mechanical design for anti-vibration (InnoDisk Patented)
- Zero mechanical interference
- Self-Mounting Technology
- A power cable is not required, installation is as easy as using a USB drive
- Industrial grade Single Level Cell (SLC) NAND Flash in ruggedized enclosure
- Auto ECC Function
- Mean Time Between Failure (MTBF) > 4,000,000 hours
- Static Wear Leveling algorithm to ensure consecutive writes of a specific sector are not written physically to the same page/block in the Flash
- Hard and Secure Erase algorithms for complete media declassification: Data will be completely erased within seconds with no trace back
- Data encryption AES-128 support
- Fast Erase specially designed for military applications
- Outstanding performance and excellent reliability
- Mission-critical functions for software and hardware
- Supports Self-Monitoring Analysis and Reporting Technology (SMART)
- Customized firmware available for special applications
- Connector with latch (and thus, such secured mechanical design will improve data transfer reliability while the device is operating)

For more information, contact: usasales@innodisk.com **RSC# 42523 @ www.mil-embedded.com/rsc**

SMART Modular Technologies

4415 East Cotton Center Blvd. • Phoenix, AZ 85040
602-735-0303
www.smartm.com

Rugged SSDs for Demanding Applications

SMART Modular Technologies' XceedUltraX Solid State Drives (SSDs) deliver high performance, high capacity storage solutions for aerospace, industrial automation, transportation, medical, and telecommunications applications.

SMART's XceedSecure 2.5" SSDs with EraSure® technology deliver high performance, high capacity storage solutions optimized for defense, aerospace, and other applications requiring durable, rugged, and secure storage. Designed to meet the needs of defense applications, EraSure technology complies with current military data elimination standards, providing multiple levels of secure erase techniques. SMART's Xcel family of 2.5" SSDs is optimized for high random read and random write performance in rugged applications. ATA-7 Security Erase is available for applications requiring a moderate level of data security. SMART's XceedSCSI family of 3.5" SSDs can be quickly integrated into existing SCSI-based systems.

FEATURES

- Capacities up to 128 GB
- Sustained throughput up to 125 MBps
- Random performance up to 6,000 IOPS
- True industrial-grade solutions
- Secure, ruggedized solutions for defense applications
- 2.5" and 3.5" form factors
- 3 Gbps SATA, PATA, and SCSI interfaces

For more information, contact: info@smartm.com

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Military Embedded Systems Resource Guide Solid State Disk (SSD)

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www.smartm.com

Xceed SSDs

XceedLite and Xceed Ultra SSDs

SMART Modular Technologies' XceedLite Solid State Drive (SSD) product offering is specifically targeted at the needs of OEM markets such as mobile and embedded computing, medical, automotive, and industrial applications. The small form factor, extremely low power consumption, and fast data throughput are major advantages of SMART XceedLite SSDs over traditional rotating hard drives.

SMART's XceedUltra solid state drives achieve sustained read speeds up to 135 MBps and write speeds up to 100 MBps. The XceedUltra level of SSD performance and reliability is primarily directed at high performance applications found in industrial, transportation, communications, and other embedded computing industries.

FEATURES

- Capacities up to 64 GB
- Sustained throughput up to 135 MBps
- Extremely low power dissipation
- Commercial (0 °C to +70 °C) and industrial (-40 °C to +85 °C) temperature
- SMART features
- 1.8" and 2.5" form factors
- Ultrasonically welded enclosure
- SATA II and PATA interfaces

For more information, contact: info@smartm.com

RSC# 37666 @ www.mil-embedded.com/rsc

Trident Space & Defense

19951 Mariner Avenue #157 • Torrance, CA 90503
310-214-5500
www.tridentsd.com

Triton Series Solid State Drives featuring Fast and Secure Erase

Secure your data with Trident's Triton Series of Solid State Drives featuring Fast and Secure Erase. Trident's Triton Series drives are purpose built for high end industrial and rugged military applications. Triton Series drives incorporate proven non-volatile industrial grade SLC NAND Flash in a completely solid state design with no moving parts. Triton SSDs are offered in an industry-standard 2.5" form factor and are available with either an IDE/PATA or SATA interface. This makes them ideal as a direct drop-in replacement for conventional rotating hard disks that are prone to short production life and often fail in mobile computing and industrial environments where temperature fluctuations, shock, vibration, dust, moisture, and/or magnetic fields are present. For embedded computing, Trident offers its BGADrive, which is a small form factor SSD on a BGA module that can be mounted directly on a PCB. When it absolutely has to work, choose Trident for all your storage needs.

FEATURES

- Ruggedized Solid State Drive for military and high end industrial applications
- Industrial grade SLC NAND Flash with operating temperature range from -40°C to +85°C
- Available with Fast and Secure Erase functionality for complete media declassification
- Tested to MIL-STD-810F: Shock 1,500G; Vibration 16.3G RMS
- Precision machined aluminum alloy case that is anodized inside and out for improved corrosion resistance and durability
- Available with custom features and in custom form factors

For more information, contact: sales@tridentsd.com **RSC# 41666 @ www.mil-embedded.com/rsc**

Hybricon Corporation

12 Willow Road • Ayer, MA 01432
978-772-5422
www.hybricon.com

UV Small Form Factor – VPX Solutions

Hybricon introduces our 3U/6U VPX Small Form Factors for defense electronics/embedded MCOTS computing. The VPX architecture supports high-bandwidth data rates. This technology was designed to support today's most challenging computing applications, such as radar and image processing, as well as control applications.

Full mesh or daisy-chain fabric and other configurations can be made available, as well as .8" and 1" pitch VITA 46 Mesh Technology. Hybricon's 3U VPX Small Form Factor technology utilizes high-performance backplane laminate and design techniques to ensure maximum signal integrity. Our new Baseplate Conduction Cooled Enclosure offers a sealed card cage to protect against foreign matter, as well as a custom 3U backplane with I/O connectors and a 3U 200 watt conduction cooled power supply module.

FEATURES

- 3U VITA 46 0.8" pitch backplane with daisy-chain fabric topology
- High-performance signal integrity built into the design
- Supports VITA 46.3 SRIO or VITA 46.4 PCIe fabrics
- Modified ½ ATR; top load payload
- 3U, 6 slot dip brazed card cage
- Front I/O panel with integrated flex circuit
- 28VDC power input via filtered 38999 connector

For more information, contact: cburden@hybricon.com **RSC# 42441 @ www.mil-embedded.com/rsc**

SIE Computing Solutions

10 Mupac Drive • Brockton, MA 02301
508-588-6110
www.sie-cs.com

Model 716

SIE Computing Solutions' 716 Series Conduction Cooled ATR Enclosures offers a wide range of COTS solutions from a rugged precision-machined design. Engineered for strength, light weight, and maximum cooling in a conduction cooled environment, the 716 Series incorporates a unique frame and configurable conducting walls that allow the ATR to be tailored to meet a wide range of thermal requirements.

FEATURES

- Precision-machined construction
- Available in 3U or 6U card formats
- Rugged deployment
- Expansive range of ARINC sizes; easily configurable for custom sizes
- Modular power supply
- AC or DC filtered inputs
- High altitude fan offering
- System performance monitoring
- Multiple bus architectures
- Cold start heaters
- Avionics isolation tray and configurable I/O panel

For more information, contact: pr@sie-cs.com **RSC# 42442 @ www.mil-embedded.com/rsc**

Elma Electronic

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510-490-7388
www.elma.com

Backplanes

Elma Bustronic is the leader in industry-standard and custom backplanes for the Mil/Aero market. Our standard lines include a wide selection of backplanes in AdvancedTCA, CompactPCI/2.16, MicroTCA, VME/64x, VPX, VXI, and VXS. Elma Bustronic's custom design incorporates computer simulation and testing to ensure the backplane meets or exceeds the customer's specifications.

Elma Bustronic has extensive experience in a wide range of design elements for Mil/Aero applications such as conformal coating, simulation, characterization, special connectors and components, and much more.

Come to the leader in Mil/Aero backplanes; come to Elma Bustronic!

FEATURES

- Backplanes in AdvancedTCA, CompactPCI, MicroTCA, VME/64x, VPX, VXI, VXS, and more
- Widest range of VME, VME64x, and VXS backplanes in the industry
- Most experienced team in switched fabric architectures such as PICMG 2.16/3.0, VITA 41 and 46, and EXP 0
- Services include conformal coating, simulation, characterization, modeling, special components, and more
- Custom design experts – well over 2000 custom designs to date
- Ask about our new 6U and upcoming 3U VPX (VITA 46) backplanes

For more information, contact: sales@elma.com **RSC# 33118 @ www.mil-embedded.com/rsc**

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CONEC
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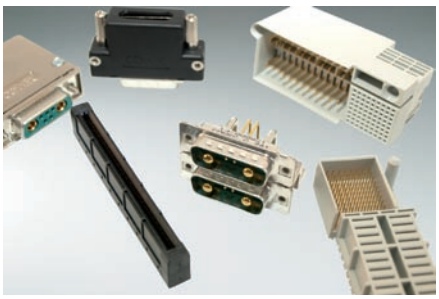
Complete MicroTCA Connector Program

CONEC, the specialist for high-quality power and signal connectors, offers a complete connector series for MicroTCA applications. Through suitable material selection and high-quality processing, CONEC connectors meet the strict requirements of the MTCA.0 specification and go above and beyond to provide high-performance reserves.

The program encompasses the AMC backplane connector, power output connectors for backplane and power modules in press-fit technology as well as a broad array of power module input connectors.

On the cable side, the program is completed by extra flat hoods suitable for use on dual-port interfaces and D-SUB socket connectors with unbridged and bridged signal contacts in combination with crimp or solder power contacts for 10 to 30 A.



FEATURES

- Power module input connector 7W2 – dual port – solder version without and with filter (Part No: 13-000011/24-000031/24-000041)
- Socket connector for MTCA power modules 7W2 – solder cup AWG10-12 – bridged signal contacts (Part No: 13-000161)
- Low-profile metal hood – side cable entry (Part No: 16-000010)
- Power module output connector – module version right angled – eye of the needle press-fit contacts (Part No: 47-100011)
- Power module output connector – backplane version straight – eye of the needle press-fit contacts (Part No: 47-100001)
- AMC high-speed backplane connector – eye of the needle press-fit contacts (Part No: 47-000001)

For more information, contact: info@conec.com

RSC# 39274 @ www.mil-embedded.com/rsc

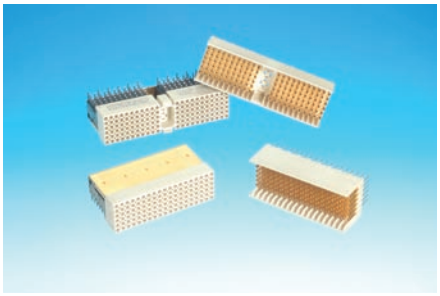
Hypertronics Corporation

16 Brent Drive • Hudson, MA 01749
978-568-0451
www.hypertronics.com

HYPERTAC
HYPERTRONICS

cPCI 2mm Connector

Hypertronics cPCI 2mm connectors are based on the legendary Hypertac Contact Technology, which provides protection from extreme shock and vibration. Tested to the highest level of military standards, the cPCI delivers the highest performance in a ruggedized CompactCPI format for mission-critical applications. The Hypertac contact features less than 8 milliohms of contact resistance and a current rating of 1.0A, has a high-temperature LCP insulator that meets NASA outgassing requirements, provides superior performance in high-speed signal applications, and the connectors are compatible with standard reflow soldering processes. The cPCI is interchangable with the board layout on COTS systems and is reverse-gender to commerical 2mm products.



FEATURES

- Immunity to Shock and Vibration
- Low Insertion/Extraction Forces
- 100,000 Mating Cycles
- Interchangeable with COTS Systems
- High-temp LCP Insulator
- Standard 2mm Footprint
- Keyed and Unkeyed Configurations

For more information, contact: info@hypertronics.com

RSC# 35133 @ www.mil-embedded.com/rsc

Hypertronics Corporation

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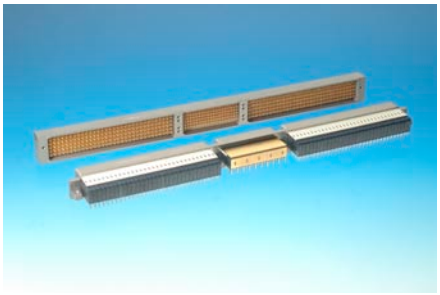
978-568-0451
www.hypertronics.com

VME64x

Hypertronics VME64x provides superior performance in high-speed signal applications. The Hypertronics engineers designed the VME64x, using Hypertac Technology, to be a complete solution that removes weakness of the electrical interface from the standard COTS VME architecture while reducing the associated costs. The VME64x is mechanically compliant with IEEE-1101.2-1992 supporting the premier embedded bus architecture. Aluminum frames provide ruggedness and conduction cooling while keying features allow for proper mating. The VME64x holds all the benefits of the Hypertac Contact Technology including shock and vibration protection, high mating life cycle, optimal signal integrity and low insertion/extraction forces. Hypertronics VME64x complies with ANSI/VITA 1.7 high-current standards.



FEATURES

- Ruggedized Interconnect with High Signal Integrity
- Shock and Vibration Immunity
- Standard and Custom Solutions
- Compatible with IEEE-1101.2-1992
- Complies with ANSI/VITA 1.7 High Current Standard for VME64x
- Aluminum Frames for Ruggedness and Conduction Cooling
- Keying Features for Proper Mating
- High Mating Life Cycle
- Hypertac Contact Technology

For more information, contact: info@hypertronics.com **RSC# 35134 @ www.mil-embedded.com/rsc**

Vector Electronics & Technology, Inc.

11115 Vanowen Street • North Hollywood, CA 91605
800-423-5659
www.vectorelect.com

VME/cPCI Ruggedized Chassis

Series 790 (horizontal cards) or Series 445 (vertical cards) Vectorpak™ Ruggedized chassis/system enclosures for standard or non-standard Eurocards.

They are designed and have been tested to meet or exceed MIL-STD-461D and -E for harsh environments and RFI/EMI frequency protection at high and low frequencies.

Removable rear panel section allows custom I/O connector panelization at minimum cost.

These series are available at a much lower cost than competitive units with the same features.

FEATURES

- For VME, cPCI, custom bus
- Low cost, lightweight
- MIL-STD-461D compliant and certified, field tested
- Withstands high humidity, shock and vibration
- EMI/RFI removable door panels
- Many power options

For more information, contact: inquire@vectorelect.com **RSC# 42421 @ www.mil-embedded.com/rsc**

Tri-M Engineering

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604-945-9565
www.tri-m.com

HE104+DX

The HE104+DX is a high efficiency 108W DC-DC converter that can supply +3.3V, +5V, +12V, and -12V DC outputs. The HE104+DX is designed for low noise embedded computer systems, has a wide input range of 6V to 40V DC, and is ideal for battery or unregulated input applications. The HE104+DX is specifically designed for vehicular applications and has heavy-duty transient suppressors (9,000W on both main and secondary inputs) that clamp the input voltage to safe levels, while maintaining normal power supply operation. The HE104+DX is a MOSFET-based design that provides outstanding line and load regulation with efficiencies up to 90 percent. Organic Semiconductor Capacitors provide filtering that reduces ripple noises below 20mV. The low noise design makes the HE104+DX ideal for use aboard aircraft or military applications or wherever EMI or RFI must be minimized.

FEATURES

- 108W DC-DC converter
- +3.3V, +5V, +12V, and -12V DC output
- 6V to 40V DC input range
- Extended temperature: -40°C to +85°C
- PC/104-*Plus* compliant
- High efficiency up to 90 percent
- High transient suppression
- Low output ripple
- Remote on/off standard
- Removable connector blocks

For more information, contact: info@tri-m.com **RSC# 16985 @ www.mil-embedded.com/rsc**

Kontron

14118 Stowe Drive • Poway, CA 92064
888-294-4558
www.kontron.com

CP308

The Kontron CP308 is equipped with the next generation of high-performance Intel® Core™2 Duo mobile processors.

Manufactured using the 45nm process and the mobile chipset GS45, the Kontron CP308 offers scalable CPU performance. The Kontron CP308 is ideal for applications that demand energy efficient dual-core performance like image processing, video processing, robotics and other real-time applications.

CPU performance ranges from the high-end 2.26 GHz version for computation intensive solutions, to the low-voltage 1.86 GHz version for energy sensitive applications, to the ultra-low power 1.2 GHz version, where power dissipation is critical.

FEATURES

- Dual-core 45nm CPU and mobile chipset in SFF package
- Up to 8 GB DDR3 memory, dual channel SODIMM
- One version for extended temperature range, E2: -40°C to +85°C
- Usage in peripheral slot, CPCI "Drone Mode"
- System Management functionality, based on IPMI 1.5
- SATA support, 2 dedicated external SATA connectors on base board
- Onboard additional Flash device, boot support
- Wake on LAN functionality
- iTPM (integrated Trusted Platform Module): creation, storage and management of keys for safer applications and systems

For more information, contact: info@us.kontron.com **RSC# 42578 @ www.mil-embedded.com/rsc**

Introducing New 1RU and Blade Servers for Mission Critical Applications.

1RU RES Servers

- One or two Intel® Xeon® quad-core CPUs
- Up to 96GB ECC SDRAM
- Up to 3 lockable and removable HDD
- Dual redundant, hot-swappable PSUs
- Dual redundant DC power option

1RU RES Server shown with optional front panel dust filters.

CoolShell™ CS-3U Blade Server

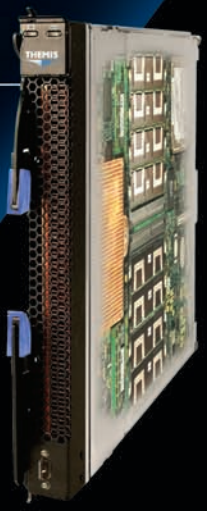
- 3RU, 17.75" deep subrack
- Two Intel Xeon quad-core sockets
- Up to 64GB ECC memory
- DVD, 2 x 2.5" HDD's
- 2.5" SATA HDD option
- Seven independent 1Gb/s Enet NIC's
- Copper or Fibre interface to NICs
- Twelve independent USB ports
- Up to three Graphics GPU's
- Two hot swap 850W, PSU's

CoolShell™ CS-4U Blade Server

- 4RU, 17.75" deep subrack
- Up to 12 quad-core AMD® Opteron™ sockets
- Up to 32 GB memory per socket
- 1Gb and 10Gb/sec redundant network fabrics
- I/O and Storage with high performance RAID
- Redundant System Managers
- KVM access to Processor Blades
- Three hot swap 850W PSU's
- 25G shock and 55°C

T2BC™ UltraSPARC™ T2 Server

- Eight core Sun UltraSPARC T2 CPU
- Installs in IBM® BladeCenter® chassis
- Operates with other IBM blades
- Integrated 1Gb and 10Gb/sec Enet
- Runs Solaris™ 10 apps unmodified
- Solaris 8/9 apps with Solaris 8/9 Containers



For Sun® Solaris, Linux®, and Microsoft® Windows® environments

When it comes to computing in harsh environments, nobody is more at home with its surroundings than Themis Computer®. For over a decade, Themis has delivered high performance, high availability computing for the most demanding military, aerospace and communications applications.

Themis' new family of 1RU, CS-2U and CS-3U Rugged Enterprise Servers™ (RES) includes the latest quad-core processors from AMD and Intel, offering ruggedized systems with the fastest, widest range of performance options and scalability.

Themis CoolShell systems combine cable management with industry leading SWAP optimization. These modularly maintainable systems have front only access for all FRU's, fans and cabling, achieving the lowest possible MTTR. Dual and quad Socket blades support the latest Intel and AMD quad-core processors and I/O blades support up to 300 watts of PCI-e I/O, including up to three high performance graphics processing units or the latest GPU based numerical coprocessing units.

The Themis T2BC blade is the industry's first blade server to run Solaris 10 applications natively on the Sun UltraSPARC T2 Chip Multi-Threading processor within IBM BladeCenters. The T2BC functions as an independent Sun T2 server running the Solaris operating system.

Themis servers provide far greater reliability, improved life cycle management and substantially lower TCO than other COTS systems solutions.

Themis rugged, mission-critical computers.
Designed to take it.

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THEMIS

Transformational.

Rugged computer systems

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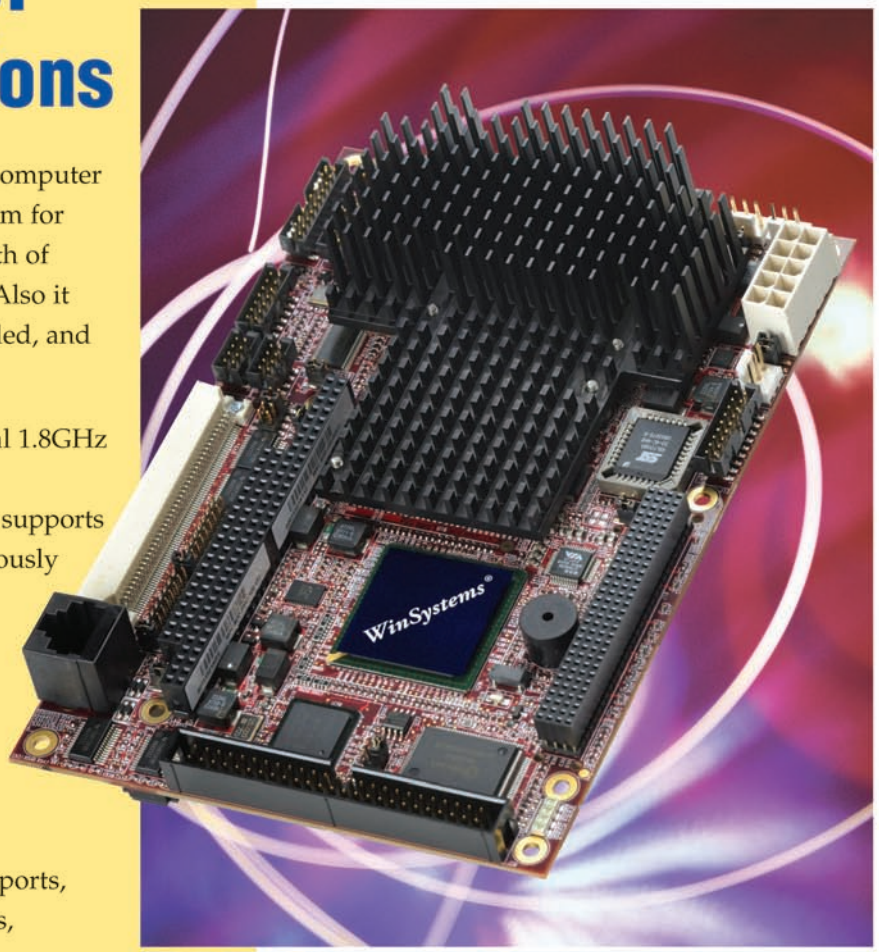
A 1GHz Fanless Rugged SBC of *EPIC* Proportions

The EPX-855 is a rugged single board computer that provides an open powerful platform for demanding applications. It has a wealth of onboard I/O plus expansion options. Also it supports Linux, Windows® XP embedded, and other x86 real-time operating systems.



- Intel® 1GHz CPU (fanless) or optional 1.8GHz Pentium® M
- Intel® Extreme Graphics 2 technology supports CRT and LVDS flat panels simultaneously with dual independent display and resolutions up to 2048 x 1536
- 802.11 a/b/g wireless support
- Custom splash screen on start up
- Two Ethernet ports; one Gigabit and one 10/100Mbps
- CompactFlash (CF) card supported
- Four serial COM ports, four USB 2.0 ports, 24 bi-directional TTL digital I/O lines, and two UDMA IDE ports
- Bi-directional LPT port, keyboard controller, FDC, and AC97 audio
- PC/104 and PC/104-*Plus* Bus expansion
- EPIC sized 4.5" x 6.5" and RoHS compliant
- +5V only operation
- -40°C to +70°C operational temperature range
- Responsive and knowledgeable technical support
- Long-term product availability
- Quick Start Kits offered for easy software development

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

Call 817-274-7553 or Visit www.winsystems.com/EPX-855
Ask about our 30-day product evaluation

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Phone 817-274-7553 • FAX 817-548-1358
E-mail: info@winsystems.com

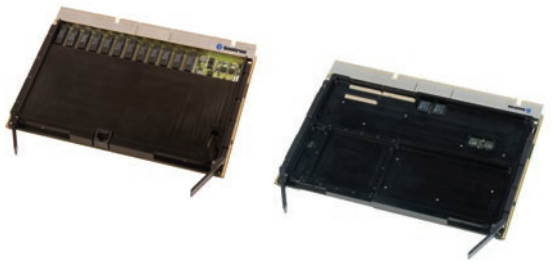
Kontron
14118 Stowe Drive • Poway, CA 92064
888-294-4558
www.kontron.com

CP6001/CP6923

In today's demanding world, designers need smart solutions. The Kontron CP6001 and CP6923 were designed with exactly that in mind. The CP6001 is a rugged Intel® Core™2 Duo CPU and is a perfect fit with the CP6923 PICMG 2.16 rugged Ethernet switch board. Both boards are available in three ruggedization levels: R1-Standard, R2-Rugged Air-Cooled and R3-Conduction-Cooled. (R3-Conduction-Cooled versions are shown here.)

With up to 8 GB of USB or 2 GB soldered flash, the CP6001 enables construction of a highly shock and vibration resistant system with non-rotating, non-volatile memory. The CP6923 supports all relevant standards on carrier grade L2 and L3 switching and routing.

Together, these 6U CompactPCI boards provide a cost-effective solution for rugged, high-performance systems.



FEATURES

- CP6001: Up to 8 GB of USB or 2 GB soldered flash
- CP6001: Based on the Intel® Mobile 945GM chipset with a front side bus of up to 667 MHz and ICH7-R Southbridge
- CP6001: Two independent video outputs to the rear I/O (2x DVI – 1x DVI and 1x HDMI)
- CP6923: 24x GbE ports
- CP6923: Leading edge technology based on BCM5650X chip
- CP6923: Copper, optical, rear I/O version – hot swap, IPMI – comprehensive firmware package

For more information, contact: info@us.kontron.com **RSC# 36014 @ www.mil-embedded.com/rsc**

Kontron
14118 Stowe Drive • Poway, CA 92064
888-294-4558
www.kontron.com

Nano Client HMI

The scalable Kontron product line of the new embedded HMI systems (Panel PCs, Micro Clients, Touch Panels) offers a wide range of processor capacities and display dimensions from 7.0" up to 19". The 100% industry-capable Panel PCs and displays meet the toughest industrial requirements for shock, vibration and temperature resistance. Kontron HMI embedded systems are designed for reliability and low cost of ownership. Systems are revision controlled.

The Nano Client (shown) has a stainless steel housing and all-around protection in IP66. It is ideal as a thin client, web client, user terminal or as a controller in rugged, low power environments where touch screen operation is needed.

Semi-custom and full-customized Panel PCs and displays for your control and visualization applications are also available.

FEATURES

- Closed cabinet (stainless steel, IP66 around)
- Fanless cooling
- Low power management w/Intel® Atom™ processor up to 1.6 GHz
- CompactFlash internal drive
- Compact space saving systems with max. 63 mm depth
- 1,024 x 768 resolution 15" TFT
- I/O: USB, LAN 10/100/1000, RS-232 (RS-422/RS-485) opt.
- 295 mm x 380 mm x 63 mm (11.6" x 15.0" x 2.5"); VESA 100 mounting
- Approx. 6 kg (13.2 lb)
- MTBF = > 40,000 hours (excluding the Backlight Tube)

For more information, contact: info@us.kontron.com **RSC# 42576 @ www.mil-embedded.com/rsc**

Kontron

14118 Stowe Drive • Poway, CA 92064
888-294-4558
www.kontron.com

KR-2201 PCI-760 2U Industrial Silent Server

Pretested, configurable, long-life embedded industrial PC systems to precisely meet your application needs. Select the CPU, memory, hard drives, graphic card, etc.

Kontron U.S. and German designed and engineered embedded industrial PC systems use Kontron boards that are optimized for reliability and low cost of ownership (revision controlled and assembled in the U.S.). Kontron offers a complete line of 1U to 4U low noise (under 35 dB) system options using either motherboards or PICMG 1.0 or 1.3 boards.

The Kontron KR-2201 PCI-760 (shown) supports up to quad core CPUs, up to 8 GB DDR2 and Vpro (AMT) with 2 PCIe and 3 PCI slots and 3 drive bays. It also offers 3x hot swap sensor controlled chassis fans.

Also see Kontron for custom systems.

FEATURES

- KR-2201 PCI-760 2U Industrial Silent Server specifications:
- Intel® Core™ Duo, Core™2 Duo, or Core™2 Quad (Q9400)
- 3x shock protected drive bays
- 3x PCI free full size, 1x PCIe x16, 1x PCIe x4
- 2x USB 2.0 to the front
- Rear interfaces: 1x VGA, 2x USB 2.0, 2x LAN 10/100/1000
- Controls on front: ATX Switch, Reset
- Rack mounted: 88 mm x 482 mm x 472 mm (2U x 19" x 18.58")
- Approx. 10 kg
- MTBF: 50,000 hours

For more information, contact: info@us.kontron.com **RSC# 42579 @ www.mil-embedded.com/rsc**

Themis

47200 Bayside Parkway • Fremont, CA 94538
510-252-0870
www.themis.com

Themis CoolShell CS-3U System

Themis' new modularly maintainable CoolShell blade server is designed for applications that need a compact, lightweight computing solution that must operate in demanding environments. CoolShell uses commercial off-the-shelf components to bring blade server efficiency and reduced total cost of ownership to environmentally challenging applications. Themis CoolShell systems combine cable management with industry leading SWaP optimization. These modularly maintainable systems have front only access for all FRUs, fans and cabling, achieving the lowest possible MTTR.

CoolShell CS-3U features include:
- One (1) Processor Blade
- One (1) I/O Blade
- Media Module
- Redundant, hot-swappable power supplies
- Environmentally robust: 55° C and 30G+ 30ms shock

FEATURES

- CoolShell CS-3U I/O Module
- CoolShell CS-3U Processor Blade
- Removable Media Module
- 3-RU, 17.5" deep subrack – Two quad-core Xeon sockets
- Up to 32GB memory per socket – DVD, 2 x 2.5" HDDs
- 256GB SSD option – Seven independent 1Gb/s Enet NICs
- Copper or Fibre interface to NICs
- Twelve independent USB ports
- Up to three Graphics or DSP GPUs
- Two hot swap 850W, PSUs
- FOR MORE INFO, CONTACT INFO@THEMIS.COM

For more information, contact: info@themis.com **RSC# 42456 @ www.mil-embedded.com/rsc**

Jacyl Technology
3909 Fourier Drive, Suite B • Fort Wayne, IN 46818
800-590-6067
www.jacyl.com

Mission Workstation

The Mission Workstation is a multi-computer ruggedized workstation for applications that demand the best. The Mission Workstation features 4 completely independent computer systems housed in a single 19" 6U rackmount enclosure. The Mission Workstation can be ordered with a standard set of options for each computer, or each individual computer within the mission workstation can be custom configured from our factory for CPU processing capability, video processing capability, I/O capabilities, and/or OS configurations to meet your system requirements. The Mission Workstation can also be factory configured as a single cluster computer, harnessing the full potential of up to 16, 3 GHz Intel processors and 32 GB of DDR2 RAM. This parallel processing capability is available to meet the most demanding applications.

The Mission Workstation has been specially designed to be a ruggedized multi-computer system with unique features such as custom air filters located on all air cooling inlets, specially designed internal dual ball bearing fan cooling system for each individual computer, steel reinforced internal structure, anodized aluminum enclosure, removable ruggedized hard-drive caddies, full access to all CPU, video, and I/O ports from the front of the unit, and reinforced internal cable routing.

The Mission Workstation is designed to be utilized in the most demanding applications. Every production Mission Workstation is tested to a 3G NAVMAT vibration profile with the unit fully powered and subjected to full temperature range Environmental Stress Screening (ESS) with the unit fully powered. Other production testing is performed on each Mission Workstation such as 100% loaded CPU duration testing, 100% video processor duration test, performance verification testing, and burn-in testing, all to ensure that the Mission Workstation is the most ruggedized and reliable multi-computer workstation available.

Jacyl Technology is the OEM of the Mission Workstation and provides an off-the-shelf or custom configuration of the Mission Workstation to meet the requirements of your system design.

FEATURES

- All CPU, video, and I/O connectors are located on the front of the unit for convenient access
- All air cooling intakes incorporate a ruggedized air/EMI filter system
- Every system is production tested to a fully powered 3G NAVMAT vibration test and Environmental Stress Screening (ESS) test
- Can be factory configured to be powered from a DC or AC input source
- All hard drives are removable and are enclosed within ruggedized caddies
- Each Mission Workstation is functionally tested from -10 °C to +60 °C
- Each computer can be independently configured with a Core 2 Dual or Core 2 Quad Intel processor and processor clock speeds up to 3 GHz
- Each individual computer has 2 PCI, 1 PCI x6, or 2 PCI x8; 2 Gb Ethernet; 4 SATA; up to 2 ESATA; up to 12 USB 2.0 ports; and up to 32 GB RAM
- Each of the 4 individual computers supports 32- or 64-bit and operating system configurations
- Can be factory configured as 4 individual computer systems or one cluster/parallel computer
- When factory configured as a cluster computer, the processing power would include 16, 3 GHz processors, 32 GB RAM, and 5.7 TB HDD space
- Each individual computer supports SATA II 300 (dependent upon CPU selection) and RAID 0, 1, 5, 10 controller implementations

For more information, contact: sales@jacyl.com **RSC# 37071 @ www.mil-embedded.com/rsc**

Parvus Corporation
3222 Washington Street • Salt Lake City, UT 84115
800-483-3152
www.parvus.com

DuraCOR 810-Duo

Dual-Core MIL Rugged Computing Platform

The DuraCOR® 810-Duo is a rugged multi-core mission processor subsystem designed for high-reliability applications requiring MIL-STD-810F environmental compliance with extreme temperatures, shock/vibration, and ingress. Based on a modular, open architecture COTS design with Intel's Core 2 Duo CPU, solid state disk, MIL-STD-704/1275 power supply and expandable rugged chassis, DuraCOR 810-Duo is an ideal computing solution for harsh mobile military and homeland security C4ISR deployments. To ensure high reliability, signal integrity, and extended environment operation, the high-performance vehicle-mount tactical computer comes equipped with sealed MIL-38999 connectors, integrated EMI/EMC filtering, watertight aluminum enclosure, aluminum railed card cage, and near cable-less internal interconnect scheme.

FEATURES

- CPU: 1.5GHz Intel Core 2 Duo, 2GB RAM
- Expansion: 6 Slots for PC/104+ Cards
- Network: Gigabit and Fast Ethernet Controllers
- I/O: 6x USB, 2x RS-232 Serial, LCD/VGA Video, Audio
- Operating Temp: -40°C to +71°C Ambient
- Mechanical: Sealed Chassis, MIL-C-38999 Connectors
- Designed to Meet MIL-STD-461E, 704E and 1275D
- Designed to Meet MIL-STD-810F (Crash Safety Shock, Functional Shock, Vibration, Temperature, Humidity, Dust and Water Ingress, Immersion)

For more information, contact: sales@parvus.com **RSC# 40229 @ www.mil-embedded.com/rsc**

Mission computer Military Embedded Systems Resource Guide

Parvus Corporation
3222 Washington Street • Salt Lake City, UT 84115
800-483-3152
www.parvus.com

DuraCOR 820

Small Form Factor Tactical Mission Computer

The DuraCOR® 820 is a rugged mission processor system designed for space/weight-constrained military/aerospace ground mobile and airborne deployments. Targeting manned and unmanned applications where reliable high-performance computing is required, the DuraCOR 820 delivers compliance to MIL-STD-810F environmental conditions (high altitude, thermal, shock, vibration, humidity), MIL-STD-461E EMI/EMC levels, and 28VDC avionics power supply standards (MIL-STD-704E). Less than 3" in height and 3 lbs in weight, the DuraCOR 820 features a conductively cooled 1.4GHz Intel Pentium M processor and a solid state disk pre-loaded with a Linux or Windows XPe operating system image. Rugged watertight ultraminiature Mil-spec performance connectors bring out power, 3x USB, 2x RS-232, DIO, Keyboard, Mouse, and dual Ethernet.

FEATURES

- Small Form Factor: <3 lbs., <3" in Height
- CPU: 1.4GHz Intel Pentium M, 1GB RAM
- SSD: CompactFlash
- Connectivity: 2x 10/100 Ethernet Interfaces
- I/O: 3x USB 2.0 port, DIO, 2x RS-232 Serial Ports, VGA Video, Keyboard, Mouse
- Operating Temperature: -40°C to +71°C Ambient
- Compliance: MIL-STD-810F, MIL-STD-704E
- Power Consumption: <24W
- Power Input: 9 to 32VDC

For more information, contact: sales@parvus.com **RSC# 36887 @ www.mil-embedded.com/rsc**

Parvus Corporation
3222 Washington Street • Salt Lake City, UT 84115
800-483-3152
www.parvus.com

DuraMAR 3230

Rugged Cisco 3230 IP Router with Integrated Gigabit Ethernet Switch

The DuraMAR® 3230 is a Cisco IOS-managed mobile network router with 16 Ethernet switch ports and an ultra-rugged chassis optimized for harsh military and civil vehicle/aircraft installations. The unit integrates Cisco Systems' 3200 mobile access router technology together with Parvus PC/104+ Gigabit Ethernet switch cards to expand LAN port count and consolidate switch and router functions into a single hardened subsystem designed to MIL-STD-810F and MIL-STD-461E environmental conditions. Sealed MIL-C-38999 connectors bring out an IOS-managed 10/100 WAN port, three IOS-managed 10/100 switch ports, and thirteen 10/100/1000 Gigabit Ethernet switch ports, as well as two serial ports and RS-232 console port.

FEATURES

- Cisco Inside: Integrated Cisco 3230 Mobile Router
- Ports: 17x Ethernet, 3x Serial Ports
- Management: Advanced Enterprise Cisco IOS CLI, SNMP, etc.
- Security: Zeroization, IPSec, SSH, etc.
- QoS: 802.1p, 802.1Q, etc.
- Mechanical: Sealed Chassis, MIL-38999 Connectors
- Environmental: MIL-STD-810F
- Power/EMI: MIL-704E, MIL-STD-1275B (limited), MIL-461E

For more information, contact: sales@parvus.com **RSC# 42569 @ www.mil-embedded.com/rsc**

Military Embedded Systems Resource Guide Networking

Parvus Corporation
3222 Washington Street • Salt Lake City, UT 84115
800-483-3152
www.parvus.com

DuraNET 1268

Rugged 10-Port Gigabit Ethernet Switch Subsystem

The DuraNET® 1268 is a rugged Layer 2+ Gigabit Ethernet switch subsystem equipped with ten 10/100/1000Mbps ports for connecting IPv4 and IPv6 computing devices in demanding military vehicle LAN apps. It features an onboard microprocessor for local/remote control and monitoring, as well as support for Quality of Service (QoS) traffic prioritization, Virtual Local Area Network (VLAN) trunking, and Rapid Spanning Tree Protocols (RSTP) redundancy. Small and lightweight in form factor, yet robust in mechanical design, the DuraNET 1268 switch serves as an ideal COTS solution to enhance situational awareness in unmanned aircraft, tactical ground vehicles and maritime assets.

FEATURES

- Ports: 10x Gigabit Ethernet (10/100/1000MBps)
- Management: Serial or Ethernet Console
- VLAN: up to 4,096 Virtual Local Area Networks
- Protocols: RSTP, STP, RMON, SNMP
- Mechanical: <5 lbs, Sealed Chassis, MIL-38999 Connectors
- Environmental: Designed to MIL-STD-810F
- Security: Data Zeroization Support
- Power: MIL-STD 704E & 1275 Compliant
- Operating Temp: -40°C to +71°C Fanless
- EMI: Designed to MIL-STD-461E

For more information, contact: sales@parvus.com **RSC# 40230 @ www.mil-embedded.com/rsc**

Kontron
14118 Stowe Drive • Poway, CA 92064
888-294-4558
www.kontron.com

VX3020/VX3230

VPX is a VITA 46 family of standards for extensive high-speed serial interconnects designed for systems operating within rugged environments. Kontron offers several VPX boards including the VX3020 and VX3230.

With the VX3020, Kontron is offering an Intel® multicore rugged computer board with a complete set of I/O features allowing rapid design of embedded PCs in the VPX form factor. Every step of the design has been driven by efficiency, safety and harsh environments compatibility.

The 1 GHz 8544 PowerPC processor on the Kontron VX3230 gives designers the coolest implementation of an E500 core with plenty of features. With a requirement as low as 10 Watts between -40°C and +85°C, applications targeting Vetronics and onboard UAVs that operate on a tight power budget will welcome its innovative design.

FEATURES

- VX3020: 1.5 GHz Dual-Core Core™2 Duo processor
- VX3020: High-performance 3U VPX rugged
- VX3020: Implements VITA 46.0, 46.4, 46.7, 46.9
- VX3020: PCIe (4x), SATA, Gigabit Ethernet on the VPX backplane
- VX3230: 3U VPX PowerPC SBC
- VX3230: Implements VITA 46.0, 46.4, 46.7, 46.9
- VX3230: PCIe (4x), SATA, Gigabit Ethernet on the VPX backplane
- VX3230: 1 GHz Freescale MPC8544 32-bit PowerPC processor

For more information, contact: info@us.kontron.com **RSC# 42577 @ www.mil-embedded.com/rsc**

Kontron
14118 Stowe Drive Poway, CA 92064
888-294-4558
www.kontron.com

PENTXM2/PENTXM4

The Kontron PENTXM2, a 6U VME board, uses the latest low-power Dual-Core Intel® Xeon processor and E7520 chipset and offers high-speed, server-class performance for advanced embedded applications. The PENTXM2 supports all of the up-to-date standard interfaces required for a modern communication server including high-speed serial storage and data I/O interfaces, SATA-150 and USB 2.0.

The Kontron PENTXM4, also a 6U VME board, features two of the low-power Dual-Core Intel® Xeon processors. For applications that require extra processing power, the single slot PENTXM4 SBC is ideal for thermally constrained environments and includes all the up-to-date I/O standard interfaces required in a server blade PC.

FEATURES

- PENTXM2: 1.67 GHz Dual-Core Intel® Xeon ULV processor SBC
- PENTXM2: Dual Ethernet 10/100/1000 configurable either on front or rear VITA 31
- PENTXM2: Commercial and Rugged Conduction-Cooled builds
- PENTXM4: Twin 1.67 GHz Dual-Core Intel® Xeon processor VME SBC
- PENTXM4: Up to 4 GB of DDR2-SDRAM and 4 GB soldered USB Flash disk option
- PENTXM4: Dual Ethernet 10/100/1000 configurable on front or rear VITA 31

For more information, contact: info@us.kontron.com **RSC# 39449 @ www.mil-embedded.com/rsc**

Mercury Computer Systems, Inc.
201 Riverneck Road • Chelmsford, MA 01824
978-967-1401
www.mc.com/3uVPXsystems

MERCURY COMPUTER SYSTEMS

Ensemble 3000 Series 3U OpenVPX™ Systems and Modules

Ensemble 3000 Series 3U VPX systems are designed to deliver high-density, high-performance real-time processing in a 3U form factor, suitable for use in applications with Space, Weight, and Power (SWaP) limitations.

Systems use three module types: System Controller Hub (SCH), Data Plane Switch (DPS), and Payload, which can be processing modules, I/O carriers, or both. Configurations are built with a variety of compute options including the Xilinx Virtex-5 LX-330T FPGA and multi-core PPC processors such as the Freescale 1GHz 8640D.

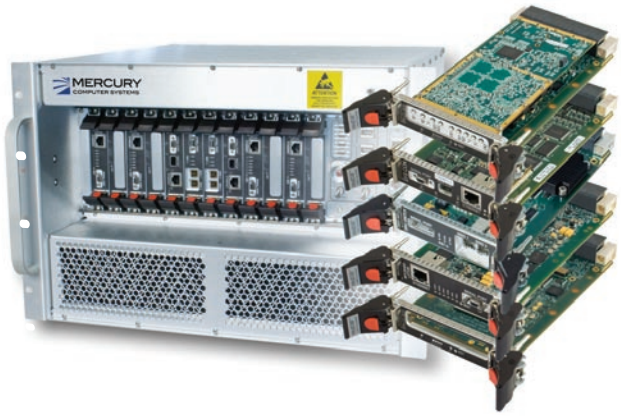
Using a multi-plane architecture, communications between all system components are partitioned into three types of independent planes: (1) a Gigabit Ethernet Control Plane, (2) an IPMI-based management plane, and (3) high-bandwidth data planes for direct support of multi-stage processing. This design model, created in accordance with OpenVPX design principles, maximizes system performance by allowing concurrent system management and control operations to proceed without affecting time-critical application operations using the data plane.

These systems also offer three styles of dataplane operations, all of which can be used concurrently. Each application can implement the data movement style that best fits its processing model, or use multiple styles at different stages within complex models, further maximizing system performance.

For multi-processor systems like the Ensemble 3000 Series, a powerful option is to partition the application across multiple processors of multiple types, so that each processing step is handled by the right type of processor.

Designed in compliance with VITA 46 and 48 standards (VPX-REDI), conduction-cooled versions of the Ensemble 3000 Series 3U VPX systems are fully capable of being deployed in harsh environments, including extreme ranges of temperature and humidity, high levels of shock and vibration, and poor air quality. Air-cooled options are also available for use in less demanding environments. The system supports Mercury's MultiCore Plus® software environment, incorporating open standards such as Linux® and the Eclipse IDE.

OpenVPX is a trademark of VITA.



FEATURES

- Built in accordance with OpenVPX design principles
- Multi-plane processing for open, optimized high performance
- Comprised of three module types: System Controller Hub (SCH), Data Plane Switch (DPS), and payload modules, which can include processing modules, I/O, carriers, or combinations of both
- Three types of independent planes: a Gigabit Ethernet control plane, IPMI-based management plane, and multiple high-bandwidth data planes for direct support of multi-stage processing
- Compliance with VITA 46 and 48 standards (VPX-REDI), conduction-cooled versions
- MultiCore Plus® software environment, which offers application portability among Mercury platforms and incorporates open standards such as Linux® and the Eclipse IDE
- Mercury MathPack software package with Scientific Algorithm Library (SAL), in single-core and multi-core (MC SAL) versions
- 10Gbps full-duplex Serial RapidIO (4 x 3.125Gbps, with 8/10 encoding) switch fabric data plane
- Backplane PCIe connection forms direct link between adjacent payload slots
- Control plane communications supported by a Broadcom Gigabit Ethernet switch with integrated MIPS processor core
- System Management plane based on IPMI standard

For more information, contact: info@mc.com

RSC# 42430 @ www.mil-embedded.com/rsc

Sealevel Systems, Inc.
2779 Greenville Highway • Liberty, SC 29657
864-843-4343
www.sealevel.com

ACC-188

The ACC-188 USB synchronous serial radio adapter and free software from the Defense Information Systems Agency (DISA) upgrades tactical radios with the capability to send and receive IP data such as GPS maps, images, coordinates, and IM-type communications.

The ACC-188 operates in conjunction with standard PDA-184 software developed by and available from DISA. The PDA-184 software provides a Graphical User Interface (GUI) that allows radio users to transmit and receive a variety of data types at much higher speeds than is possible with comparable, proprietary solutions.

A key advantage of the ACC-188 is that it enables interoperability among the various radio brands and models used by the defense community. The ACC-188 is compatible with any tactical radio that has a synchronous communication port using MIL-STD-188-184. This includes the most prevalent brands and models: Raytheon AN/PSC-5D and AN/ARC-231, Harris AN/PRC-117F and AN/PRC-150, Thales AN/PRC-148 and AN/PRC-150, Rockwell Collins AN/ARC-210, Motorola LST-5B and LST-5C.

The cable and integrated assembly consists of a printed circuit board that is tested and then encapsulated using an over-mold process, commonly called a "bump" in the cable. This process results in a rugged, shielded, battlefield ready product capable of withstanding harsh environments. One end of the cable includes a standard type-A USB connector, suitable for use with any USB enabled computer. The other end of the cable includes a connector specific to the brand or model of tactical radio.

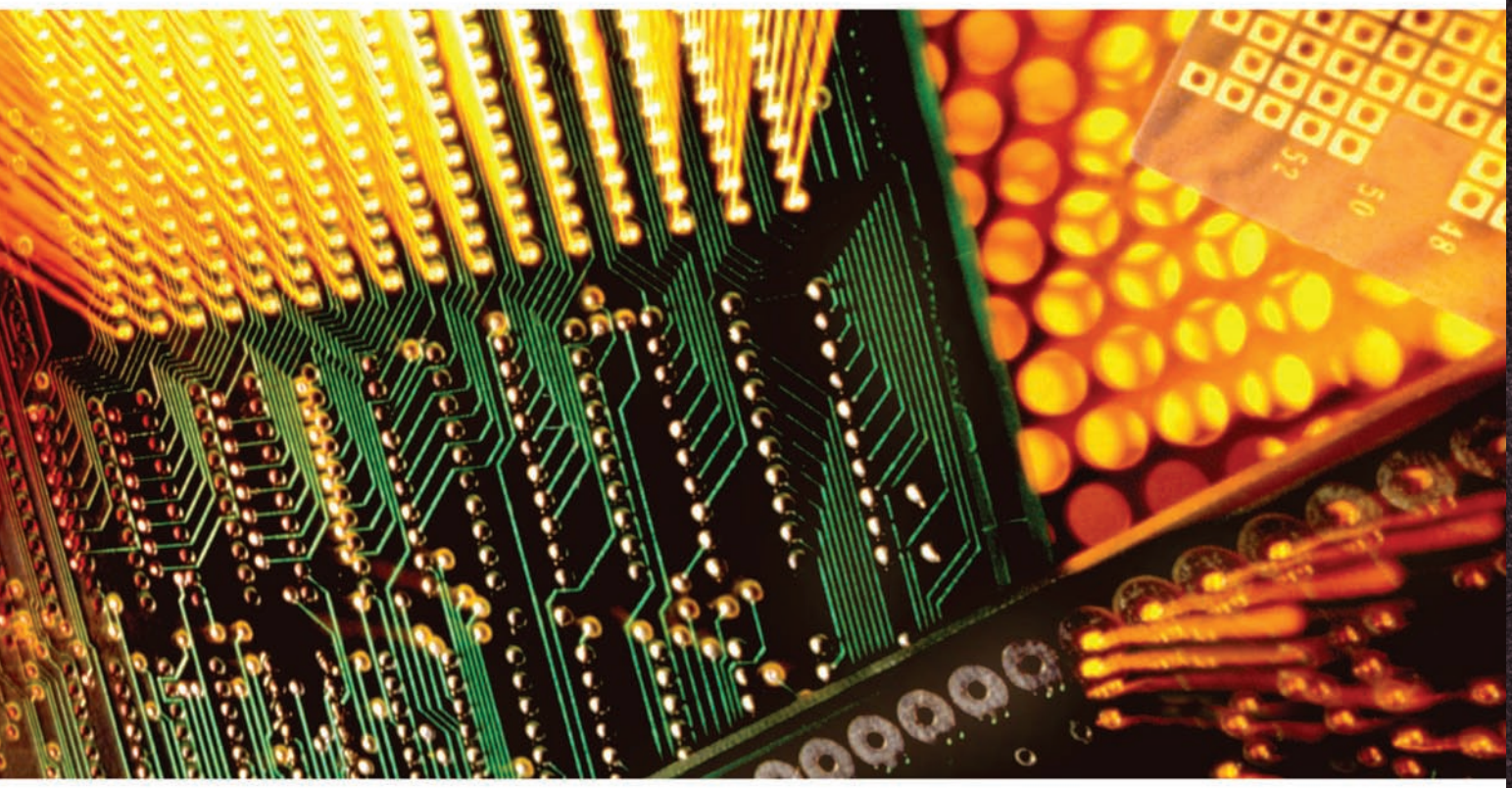
Sealevel Systems, founded in 1986, provides industrial computing solutions in addition to a variety of communications and I/O products including PCI Bus cards, Ethernet serial servers, USB serial adapters, PCMCIA cards, and PC/104 modules. The product line includes multi-port RS-232, RS-422/485, RS-232/422/485 multi-interface high-speed sync/async, and digital/relay I/O.

FEATURES

- Send text messages, email, files, images, GPS data, etc.
- HF, UHF, VHF, and SATCOM
- Non-proprietary MIL-STD-188-184 compliant
- Powerful FPGA programmable architecture
- Transmits data @ up to 76K via SATCOM
- Transmission speed automatically adjusts to optimize signal integrity
- Hot swappable
- Aluminum chassis with rubber over-mold
- Resistant to liquid, dust, and dirt
- Heavily shielded against electrical interference
- Easy-to-use GUI

For more information, contact: sales@sealevel.com **RSC# 36154 @ www.mil-embedded.com/rsc**

We specialize in embedded programmable crypto solutions. And that's a FAC²T.



Meet the Family of Advanced Core Cryptographic Technologies (FAC²T) from General Dynamics: leading edge, trusted solutions for all of your embedded high assurance needs.

Currently in leading high-assurance military and government applications across air, sea, land and space.

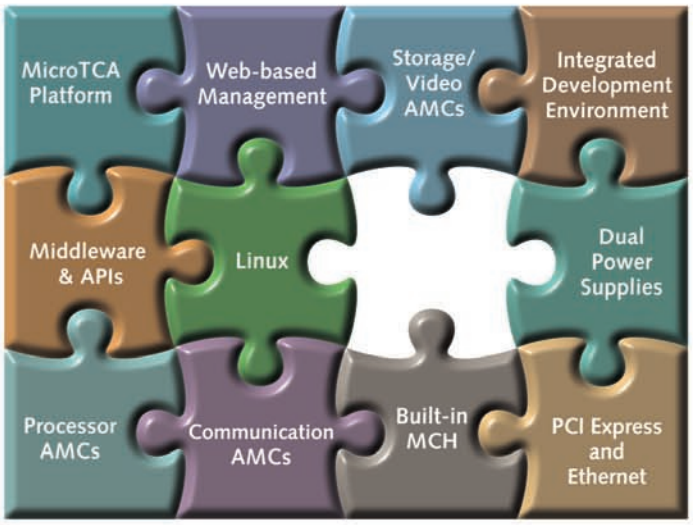
- Crypto modernization designed-in
- Proven technology across multiple platforms (air, sea, land, space)
- Over 40 years of experience with customized, dependable solutions for your high performance needs
- COTS-based solutions for low SWAP applications
- Multiple Independent Levels of Security (MILS) solutions for embedded security applications

When it comes to high performance solutions, get the FAC²Ts from General Dynamics. Visit www.gdc4s.com/FAC²T.

General Dynamics Secure Communications: We've got the FAC²Ts

GENERAL DYNAMICS
C4 Systems

The Final Piece is Your Application



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Performance Technologies furnishes Application-Ready Systems designed to accept your customization and go straight to market, saving you valuable time and resources. These pre-integrated systems allow you to focus on developing the most important piece of the product design puzzle – your application.

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FreeWave Technologies, Inc.
1880 South Flatiron Court, Suite F • Boulder, CO 80301
303-381-9200
www.freewave.com

MM2 Series

FreeWave leads the industry in providing military and ISM band radios that are designed to perform at the highest level of performance in rigorous conditions known only to military personnel. FreeWave radios are renowned for their high performance, reliability and security. The FreeWave MM2 Series delivers a heavyweight radio capability in a lightweight package. At just 14 grams and 1.4" x 2" (TTL version*), the MM2 is ideal for embedding into OEM products such as sensors, RTUs (Remote Terminal Units), PLCs (Programmable Logic Controllers), robots and unmanned vehicles (UAVs, UUVs and UGVs). The MM2 is available in standard and high speeds and in TTL and Ethernet versions for multiple frequencies.

FEATURES

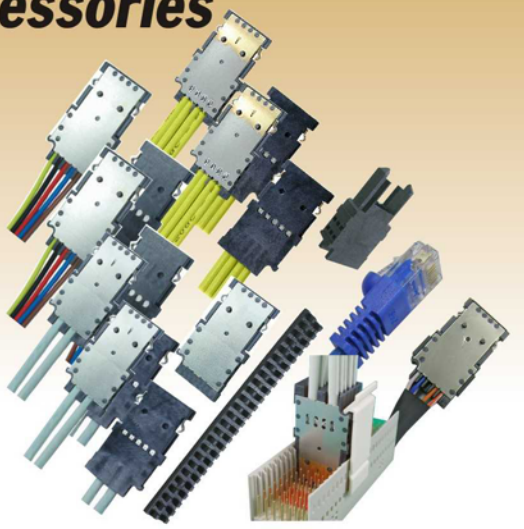
- Multiple Frequencies: 340-400 MHz, 900 MHz, 1.3 GHz, 2.4 GHz
- Powerful: Best-in-class range of up to 60 miles LOS
- Robust: Unmatched overload immunity and sensitivity
- Small & Lightweight: Only 14 grams at 1.4" x 2.0" (TTL version*)
- Durable: In any environment and temperature from -40°C to +85°C
- Tested: Every unit 100% tested through 6 quality steps
- Versatile: Single radio configurable as a master, slave, or slave/repeater
- Flexible: 3.3 or 5.0 VDC operating voltage
- Secure: 128/256 AES encryption

*Ethernet version with 2 serial ports available

For more information, contact: moreinfo@freewave.com

RSC# 42574 @ www.mil-embedded.com/rsc

HPM 2MM Hard Metric Cable Assemblies & Accessories



CompactPCI, VME64, & all standard 2mm headers applications

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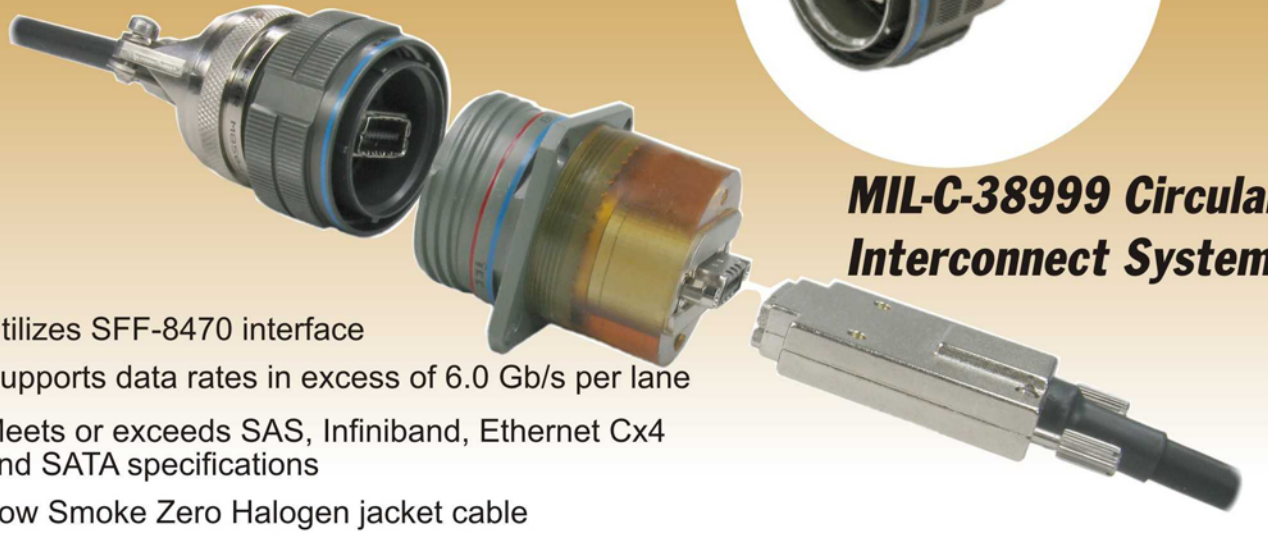
Rugged High Band Interface



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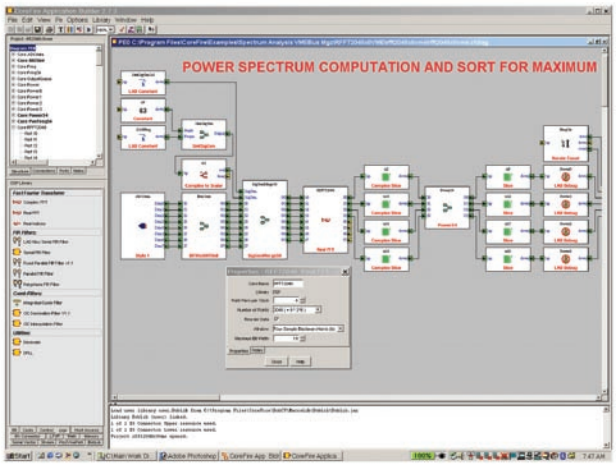
CoreFire

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 data flow of your design running in the real physical hardware.

Our extensive IP and board support libraries contain more than 1,000 proven, reusable, high-performance cores, including FIR and CIC filters, a channelizer, and the world's fastest FFT. We support conversion between data types: bit, signed and unsigned integers, single precision floating point, integer and floating point complex, and arrays. A few of the newly added array cores include array composition and decomposition; slice, parallelize, serialize, repack, split, merge, reorder, rotate, and concatenate transformations; matrix math, sliding windows, and convolutions.

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

- Data flow-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
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- Save time to market
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For more information, contact: wfinfo@annapmicro.com **RSC# 33544 @ www.mil-embedded.com/rsc**

Twin Oaks Computing, Inc

755 Maleta Ln., Ste 203 • Castle Rock, CO 80108
720-733-7906
www.twinoakscomputing.com

CoreDX Data Distribution Software

The Publish-Subscribe communication paradigm eases system design, development, integration, and test by supporting Open Architecture principles.

The CoreDX Data Distribution Software provides a high-throughput, standards compliant, Publish-Subscribe middleware component. Built with a focus on size and performance, the CoreDX middleware delivers a quality implementation of the OMG Data Distribution Service (DDS) standard in a small footprint library.

CoreDX offers proven interoperable data communications with the Real-Time Publish Subscribe (RTPS) wire protocol. Application integration is easy with support for C and C++.

Make CoreDX a part of your architecture and enjoy Quality of Service enabled Publish-Subscribe communications.

FEATURES

- High-performance Publish-Subscribe communications
- Small footprint – library is less than 500KBytes
- Multi-Vendor DDS Interoperability with RTPS wire protocol
- Type-safe, portable, code generation for error-free integration
- No operating system services or daemons required
- Robust Quality of Service policies tailor middleware behavior
- Dynamic Discovery for easy deployment
- Perfect for embedded, resource constrained applications
- Powerful data management – time and content filtering
- Synchronous and Asynchronous event notification
- Supports Linux, QNX, Solaris, VxWorks, Windows

For more information, contact: sales@twinoakscomputing.com **RSC# 42571 @ www.mil-embedded.com/rsc**

Esterel Technologies, Inc.

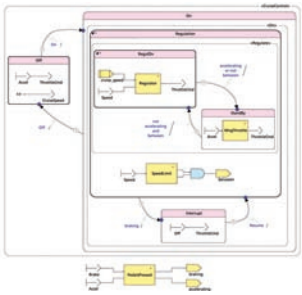
100 View Street, Suite 208 • Mountain View, CA 94041
860-417-2464
www.esterel-technologies.com

SCADE Suite

Esterel SCADE Suite's formal model-based development reduces time-to-deployment and certification for critical embedded control applications with graphical design, simulation, formal verification, and qualifiable code generation. SCADE Suite enables full life-cycle development with support for requirements traceability, configuration management, testing, and automatic documentation generation and deployment.

SCADE Suite improves specification quality and accuracy by providing formal, deterministic, and verifiable specifications.

SCADE Suite has been qualified/certified by FAA/EASA and TUV SUD under DO-178B up to Level A for Aerospace and Defense Appplications. For Industrial Applications, SCADE Suite has been certified to SIL 3 under IEC 61508.



FEATURES

- Expedites analysis, design, implementation, and verification of critical embedded systems
- Shortens time-to-certification with automatic code generation, documentation generation, qualification kits
- SCADE Unified Modeling Style – data flows and state machine behavior defined at any level in the design hierarchy; the support of array operators optimizes the design and code generation for complex data processing of control law components
- SCADE models modularity/ensures safe and manageable partitioning between several designers or teams

For more information, contact: sales@esterel-technologies.com **RSC# 36878 @ www.mil-embedded.com/rsc**

Esterel Technologies, Inc.

100 View Street, Suite 208 • Mountain View, CA 94041
860-417-2464
www.esterel-technologies.com

SCADE Display

Esterel SCADE Display is a model-based embedded graphics display development environment for critical applications. For aerospace applications, SCADE Display has been qualified up to level A under DO-178B.

With native support for the OpenGL SC standard, SCADE Display optimizes embedded graphics design and generation in critical embedded environments. SCADE Display enables display prototyping, design, simulation, verification and validation, and DO-178B qualified code generation.

SCADE Display can be tightly coupled with SCADE Suite, offering a comprehensive combined display and embedded logic development environment.

FEATURES

- SCADE Display offers safety-critical embedded display development qualified under DO-178B
- SCADE Display's intuitive development environment provides programmers and non-programmers with a tool suite supporting advanced prototyping and specification of embedded displays
- SCADE Display provides native support for OpenGL® SC and fully portable, targeted code generation for embedded display systems

For more information, contact: sales@esterel-technologies.com **RSC# 36929 @ www.mil-embedded.com/rsc**

SYSGO

Am Pfaffenstein 14 • 55270 Klein-Winternheim, Germany
www.sysgo.com

PikeOS

PikeOS is an innovative product providing an embedded systems platform where multiple virtual machines can run simultaneously in a secure environment. The Safe and Secure Virtualization technology allows multiple operating system APIs to run concurrently on one machine, such as an ARINC 653 application working together with full user mode Linux.

The PikeOS separation microkernel architecture allows it to be used in cost-sensitive, resource-constrained devices as well as large, complex systems. The simplicity and compactness of the PikeOS design result in real-time performance that competes head-to-head with conventional proprietary RTOS solutions. PikeOS is certifiable to the DO-178B standard and is also MILS compliant. PikeOS is hardware independent, allows legacy code easy reuse and has the largest set of supported APIs (called Personalities) in the market.

FEATURES

- Combines paravirtualization and hard real-time
- Eclipse-based development environment
- DO-178B, IEC 61508 and EN 50128 certifiable
- MILS compliant
- Personalities examples:
  - Linux – full user mode
  - POSIX, ARINC 653, Native
  - µITRON, OSEK, legacy RTOS
  - Ada, Java Real-Time
- Available for PowerPC, x86, ARM, MIPS and others
- Available on Linux and Windows hosts

For more information, contact: jacques.brygier@sysgo.com **RSC# 33227 @ www.mil-embedded.com/rsc**

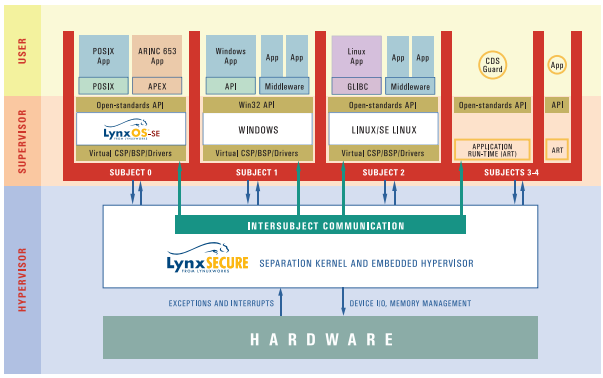
LynuxWorks, Inc.
855 Embedded Way • San Jose, CA 95138
800-255-5969
www.lynuxworks.com

LynxSecure Embedded Hypervisor and Separation Kernel

With the introduction of the new LynxSecure separation kernel and embedded hypervisor, LynuxWorks once again raises the bar when it comes to superior embedded software security and safety. LynxSecure has been built from the ground up as a real-time separation kernel able to run different operating systems and applications in their own secure partitions.

The LynxSecure separation kernel is a virtual machine monitor that is certifiable to (a) Common Criteria EAL 7 (Evaluated Assurance Level 7) security certification, a level of certification unattained by any known operating system to date; and (b) DO-178B Level A, the highest level of FAA certification for safety-critical avionics applications.

LynxSecure conforms to the Multiple Independent Levels of Security/Safety (MILS) architecture. The embedded hypervisor component of LynxSecure allows multiple "guest" operating systems to run in their own secure partitions. These can be run in either paravirtualized or fully virtualized modes, helping preserve legacy applications and operating systems in systems that now have a security requirement. Guest operating systems include the LynxOS family, Linux and Windows.



FEATURES

- Optimal security and safety – the only operating system designed to support CC EAL 7 and DO-178B Level A
- Real time – time-space partitioned RTOS for superior determinism and performance
- Virtualization technology – supports multiple heterogeneous operating system environments on the same physical hardware using Intel VT hardware
- Highly scalable – supports Symmetric MultiProcessing (SMP) and 64-bit addressing for high-end scalability
- Support for open standards – supports 100% binary compatibility for Linux or POSIX-based software applications to migrate to a highly robust, secure environment

For more information, contact: inside@lnxw.com **RSC# 30051 @ www.mil-embedded.com/rsc**

ITCN, Inc.
591 Congress Park Dr. • Dayton, OH 45459
800-439-4039
www.itcn-test.com

BCIT

Bus Characterization and Integrity Toolset

The BCIT is a portable network analyzer designed to test and monitor the network operation and cable function of MIL-STD-1553 databus networks. This all-in-one test instrument can troubleshoot cables, diagnose bus health, and monitor bus performance.

It includes a network bus monitor and a Time Domain Reflectometer (TDR). Both of these features are integrated in an easy-to-use, database driven Windows® software package. Users can save and recall bus topology, test data and reference data, and configure its display.

Bus characterization testing provides monitoring for protocol errors, loading, status exceptions, and terminal response for up to four fully loaded, dual redundant MIL-STD-1553 buses. It can also capture faults that impact bus protocol, such as faulty stubs or terminals.

The high performance TDR allows technicians to analyze MIL-STD-1553 twisted-pair cabling to locate opens, shorts, and faulty shields and couplers within 6 inches of the fault location for cables up to 1,000 feet long. The TDR also provides a "Trigger on Anomaly" mode that can locate intermittent faults easily by capturing data only when an anomaly occurs, such as when a cable is "jiggled" or bent.

The BCIT's historical database makes it easy for engineers and technicians to compare data over long periods of time. Recording and monitoring historical changes to the network and cabling can help predict when cables may need to be replaced, or if maintenance schedules should be updated.

"... a cross-cutting solution for virtually all platforms utilizing MIL-STD-1553 network architectures ... applications include all Air Force and Navy aircraft, Navy surface ships and submarines, Army helicopters and tanks, and many commercial uses."

– Air Force SBIR/STTR "Transition" Feature Story

FEATURES

- Test MIL-STD-1553 networks from end-to-end using a single tool
- Save time and money on system diagnosis and repair by locating problems within the system faster and more precisely
- Detect cable shorts, opens, and faulty shields to within 6 inches with TDR testing
- Monitor up to four fully loaded, dual redundant 1553 channels simultaneously (physical connection to eight bus stubs)
- Maintenance is made easier with the historical database
- Wear and tear on cables and buses can be detected over time using the historical reference database to track changes
- Maintenance schedules become predictive and can be adjusted to meet upcoming needs
- Protect classified environments with the removable hard disk and memory write protection
- Easy to use Windows Graphical Interface for analysis
- Use color-coded, intuitive, pre-configured displays for fault indications, or configure your own
- Portable, self-contained unit available in Semi-Rugged and Fully Rugged cases for your test environment

For more information, contact: sales@itcninc.com

RSC# 42029 @ www.mil-embedded.com/rsc

Siborg Systems Inc.

24 Combermere Crescent • Waterloo, Ontario N2L 5B1 Canada
Tel: 519-888-9906 • Toll-free: 877-823-7576 • Fax: 519-725-9522
www.siborg.com/smarttweezers

ST-SB, STIC-SB

Smart Tweezers: A new Generation of Digital Multimeters
Increasing PCB density and decreasing component size makes it more and more difficult to use a conventional multimeter for PCB debugging. Digital Multimeter Smart Tweezers was specifically developed for this purpose. A light weight of only 2 oz and easy one-hand operation make Smart Tweezers an unrivalled tool for electronic measurements. Smart Tweezers automatically selects measurement type and range. With 1% typical accuracy and the ability to measure DC/AC voltage, ESR, capacitances as small as 1 pF and test diodes, it fills the gap between conventional multimeters and expensive bench-type testers.

Smart Tweezers is a perfect tool to take with you on a fieldtrip. The latest model of Digital Multimeter Smart Tweezers is powered by rechargeable batteries with an inductive charger that virtually eliminates the necessity of battery replacement.

FEATURES

- Automatic recognition of LCR measurement mode
- Automatic best measurement range
- Reading of main and parasitic impedance components
- DC/AC voltage measurement up to ±8 Volts
- Continuity/open and diode test
- Typical accuracy of 1% for resistance and 3% for inductance and capacitance
- Measurement ranges from 0.05 Ohms to 10 MOhms, from 1 pF to 5 mF and from 1 µH to 1 H
- Measurement of dissipation and quality factors
- Very low built-in parasitics and less than 2 oz weight

For more information, contact: siborg@siborg.ca **RSC# 42451 @ www.mil-embedded.com/rsc**

Agilent Technologies Inc.

5301 Stevens Creek Blvd. • Santa Clara, CA 95051
www.agilent.com/find/vme

Agilent U1083A, 10- and 14-bit High-Speed VME/VXS 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. The embedded Flash memory allows the platform to be easily reconfigured to perform user-defined applications.

- U1083-001: 14-bit dual-channel, 10 to 500 MHz bandwidth, 1.2 GS/s high-speed generator
- U1083-002: 10-bit dual-channel, up to 3 GHz bandwidth, 2 GS/s high-speed digitizer
- U1083-003: 10-bit ADC, 14-bit DAC, 1.2 GS/s high-speed data converter

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

Agilent Technologies

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 onboard DDR2 SDRAM banks (512 MB total) and local 128 MB Flash memory able to store multiple FPGA bit streams
- VXS VITA 41.0 compliant, 8x 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

For more information, contact: digitizers@agilent.com **RSC# 42370 @ www.mil-embedded.com/rsc**

Highland Technology, Inc.
18 Otis Street • San Francisco, CA 94103
415-551-1700
www.HighlandTechnology.com

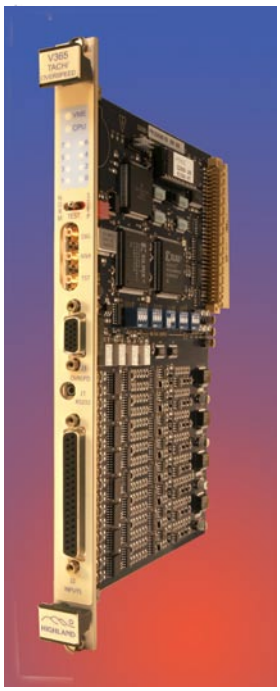
V365

The V365 is a single-width, 6U height VME module designed specifically to acquire low-frequency inputs from industrial-speed sensors. The module can measure frequency and period over a wide dynamic range, and is specifically designed to ensure reliable measurement in high-noise industrial environments.

Differential signal inputs are signal conditioned, filtered and presented to the inputs of a custom gate array chip that manages period and frequency measurement.

The input signal conditioners can be connected directly to common transducer types, including variable reluctance or hall-effect magnetic speed pickups, AC line voltage or alternator windings up to 150 volts RMS, optical pickups, reed-switch or signal-conditioned fuel flow meters, contact closures, or other special levels.

Four independent programmable overspeed blocks are provided. Each may be aimed at any selected tach channel, and each is programmable to trip on static or latched overspeed or underspeed conditions. Control provisions include relay polarity and startup override, and provision is made for self-test of the overspeed facilities.



FEATURES

- Eight tachometer channels, numbered 0 through 7; each channel has differential inputs, ground, and +12 volt source
- Input impedance is > 60K to ground on differential inputs; signal level inputs are configurable for standard
- TTL, open collector, AC generator, and variable reluctance sensor pickups
- Onboard signal conditioning includes VME-selectable gains, filtering/integration, and trigger levels to accept 100 millivolt to 150 volt RMS signals up to 100 kilohertz
- Inputs will tolerate 1000 volt transients for 50 us
- Four isolated SPDT overspeed output relays, Fujitsu type FTR-B3
- Contacts rated 1 A at 30VDC, 0.3 A at 120VAC, resistive loads
- 32 bits with 20 ns LSB resolution, approximately 85 seconds maximum period; transparent interlock logic allows skew-free reading of 32-bit period data
- Accuracy of ± 0.005% ± 1 LSB
- DB37 connector for signal inputs and current-limited +12 volt excitation outputs
- HD15 connector provides four SPDT relay contacts for overspeed/underspeed function
- 2.5 mm stereo phono connector for RS-232 serial port
- Three SMB signal monitor connectors monitor analog and digital signal levels of any selected channel and access test signal frequency

For more information, contact: info@highlandtechnology.com **RSC# 32240 @ www.mil-embedded.com/rsc**

Highland Technology, Inc.
18 Otis Street • San Francisco, CA 94103
415-551-1700
www.HighlandTechnology.com

V346

The V346 provides eight independent waveform outputs, created through a fast direct digital synthesis architecture for high agility. Each frequency, amplitude, phase, and DC offset can be adjusted independently with a single write. "Any-to-any" modulation and summing, synchronization, and noise generation allow complex coordinated waveform generation while keeping all parameters independently adjustable, allowing for real-time manipulation of harmonic distortion, noise, jitter and other hard-to-simulate signal chain realities.

A fast 14-bit DAC per channel provides high resolution to accurately simulate complex mechanical and structural systems, while the 32 MHz outputs make the V346 equally suited to radar and communications tasks. Shaft runout and vibration, DSB/SSB of arbitrary waveforms, sweeps, chirps, constellations, multichannel frequency tracking, and quantitative control of noise and jitter can all be easily simulated.

Hundreds or thousands of channels may be exactly synchronized across multiple modules via a dedicated intermodule link to simulate very high-channel-count processes, such as radar and sonar arrays, diesel/jet engines, stationary and aircraft AC power systems, and many others.

For cost-sensitive applications not requiring modulation features, the compatible V344 is available. The T344 and T346, compact stand-alone, non-VME, RS-232/Ethernet controlled versions, are also available for embedded applications.

FEATURES

- "Any-to-any" modulation: AM, FM, PM, PWM, and channel summing
- Channel/board sync provisions allow generation of polyphase or synchronized waveforms across unlimited channels
- Bandlimited Gaussian noise generation allows direct noise output, modulation, noise floor summing, and calibrated jitter
- PWM facility generates precision digital outputs for motion control or optical encoder simulation
- Includes Built-In Self-Test (BIST) and dedicated channel test connector
- 8 independent channels, 0 to 32 MHz with 0.015 Hz resolution, or 0-250 KHz with 166 uHz resolution; 16-bit programmable amplitude, DC offset, and phase; 14-bit DAC output resolution
- Two programmable ranges, ±5.12 volts and ±1.024 volts peak, 50-ohm output impedance
- Arb memory of 4096 points, 16-bit data per channel; hardware interpolation is available
- Gaussian noise, programmable amplitude 0-1 volts RMS, programmable 3 dB bandwidth 0 to 2 MHz
- Channels may be synchronized across multiple modules; frequencies can be locked to external 10 MHz reference

For more information, contact: info@highlandtechnology.com **RSC# 37060 @ www.mil-embedded.com/rsc**

Military EMBEDDED SYSTEMS

RESOURCE GUIDE PROFILE INDEX

Cell phones: The next great *software* driver

By Chris A. Ciufo, Editor

One of the advantages of my being so delayed in writing up press interviews is that notes can be spread out on a large table and literally looked at top-down. When I recently assembled six months' worth of information from dozens of companies, several trends materialized that weren't previously obvious. In particular, it's astounding how many hardware, semiconductor, and software companies are gearing their offerings towards the cell phone handset and portable *Mobile Internet Devices* (MIDs) market. With this segment in mind, new, refined technologies emerge such as: virtualization-ready lightweight OS hypervisors; Size, Weight, and Power (SWaP); and secure operating systems with information assurance. These technologies are all hugely important in personal communications, financial transactions, medical devices with record storage/retrieval, and defense systems. Here's a sample of some of these software announcements and how they are driving the next wave of the cell phone and overall embedded markets.

Intel and Wind River

The August 31, 2009 issue of *Fortune* magazine highlights the growing battle between smartphone giants Research in Motion (BlackBerry) and Apple (iPhone) with a market that, according to analyst firm IDC, was 1.19 billion handsets strong in 2008, of which 13 percent (155 million) were smartphones. IDC predicts that by 2013, 14 percent of the 1.4 billion handset market will be smartphones. Think of every smartphone as having *more* than the capabilities of your desktop computer plus a three-day battery life. The technology required to make this possible is awesome.

I believe Intel acquired Wind River Systems to gain a foothold in this market by figuring the operating system could help supplant ARM and Freescale SoCs by making painless the abstracted transition to Intel's x86-inspired Atom CPU. (See my "MIDs course correction: Intel buys Wind River" writeup in the *Military Embedded Systems* June edition at www.mil-embedded.com/articles/id/?4025.) This idea of using *software* to leverage IC sockets is gaining momentum. Mentor Graphics recently made several acquisitions geared to keep the company's EDA tools and Nucleus RTOS firmly focused on the cell phone and MIDs market.

Mentor's acquisitions galore

By acquiring Embedded Alley Solutions, Mentor Graphics combines "Embedded Alley's Android and Linux products and services with the Mentor Graphics Nucleus Real-Time Operating System (RTOS), tools and middleware," said the July 30, 2009 press release. Mentor Graphics can now provide device manufacturers with all the software they need to build their products, while the company's August 18, 2009 acquisition of LogicVision provides Built-In Self Test (BIST) capabilities for advanced SoC designs with logic, memory, and high-speed analog SERDES. Mentor Graphics' Hank Andray, the business unit director of their embedded systems division, sees Android as the User Interface (UI) springboard into a plethora of MIDs. Also, Mentor Graphics' *Vista* platform (no relation to Microsoft's product) is a power modeling tool clearly targeting low-power, handheld devices such as cell phones. It's not too hard to envision Nucleus or Android powering other display-oriented embedded devices besides cell phones.

One might think that a lightweight OS such as Nucleus would fare better than the perceived "heavy" VxWorks from Wind River. Not so, says Warren Kurisu, senior director of VxWorks product management at Wind River. The current 6.7 version is modular and scalable, making it ideal for smartphones and other MIDs. Its footprint can be reduced to a mere 50 KB, though it appears the company hasn't won many "feature phone" designs in awhile. Instead, the company is focusing more on bolting VxWorks to the new Wind River Hypervisor (June 2009) to enable multicore designs and multi-OS virtualization – the same vision shared by Mentor with Nucleus, Linux, and Android.

It's OK to be secure

Open Kernel Labs, a company known for its OKL4 embedded hypervisor used in more than 300 million cell phones, is also onboard with the concept of a partitioned OS that runs virtualized applications on top of a single- or multicore CPU. But recently, OK Labs announced that the precursor of their Secure HyperCell Technology has completed "formal verification" and "mathematical proof of correctness of OS/hypervisor kernel" by NITCA (Australia's Information and Communications Technology Research Centre of Excellence).

While OKL4 was always secure enough to prevent priority inversions or rogue applications from spilling between handset partitions, it's entirely conceivable that OK Labs *could achieve the government's rigid EAL 7 NIAP Common Criteria certification.* This is something achieved by no other operating system on the planet, much less one designed for use in cell phones and MIDs. The significance for handsets is bulletproof secure financial transactions and record retrieval, or just mission- and safety-critical computing in the palm of your hand rivaling desktop systems.

Software as drivers

The aforementioned announcements are but a handful aimed at cell phones and MIDs. Add in Samplify, Synopsis/Synplicity, Open Silicon, LynuxWorks, and others and the trend is clear: Those portable, handheld wonderblocks are driving the pace of innovation for the entire embedded community.

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MLRS Multiple Launch Rocket System AH-64 Helicopter T-6A Peloton
CV90 Armored Vehicle DDG-1000 Multi-Mission Destroyer Roland Air Defense System
HIMARS Artillery Rocket System B-2 Stealth Bomber F-35 Lightning II
LHD Class Amphibious Assault Ship Expeditionary Fighting Vehicle Gripen Fighter
Littoral Combat Ship A400M Transport NSSN Virginia Class Submarine
F-117 Stealth Fighter MEADS Air Defense System EMB-145 Challenger 2 Tank
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Taranis UCAV Avenger Air Defense System F-22 Raptor C-130 Transport
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