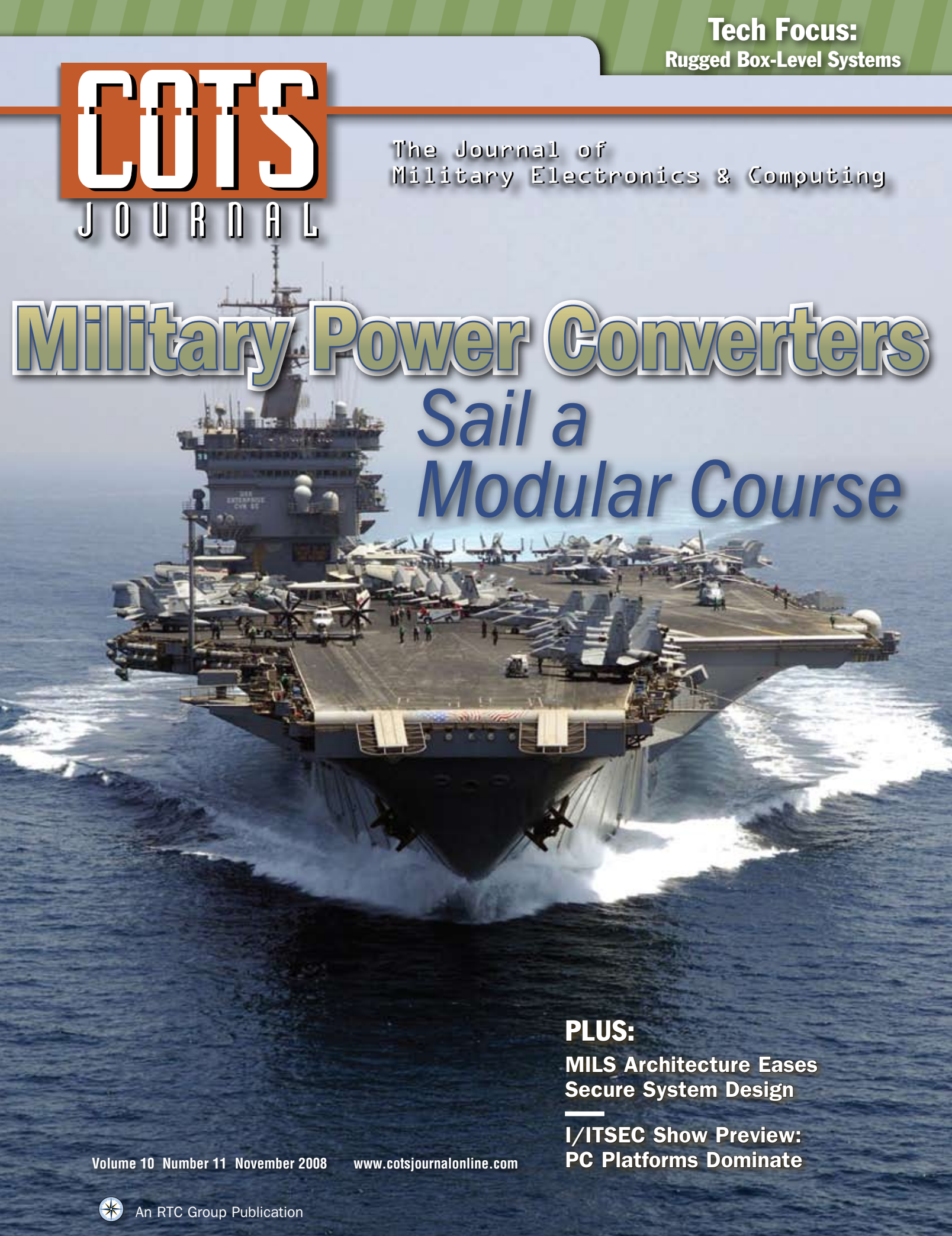
Tech Focus:
Rugged Box-Level Systems

COTS JOURNAL

The Journal of
Military Electronics & Computing

Military Power Converters Sail a Modular Course



PLUS:

MILS Architecture Eases Secure System Design

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Volume 10 Number 11 November 2008 www.cotsjournalonline.com

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Features

November 2008 Volume 10 Number 11

Special Feature

Military Power Supplies and Converters

Tech Recon

Implementing MILS and IA

System Development

Simulation & Test and I/ITSEC Products Preview

Technology Focus

Rugged Box-Level Systems

COTS (kots), *n.* **1.** Commercial off-the-shelf. Terminology popularized in 1994 within U.S. DoD by SECDEF Wm. Perry's "Perry Memo" that changed military industry purchasing and design guidelines, making Mil-Specs acceptable only by waiver. COTS is generally defined for technology, goods and services as: a) using commercial business practices and specifications, b) not developed under government funding, c) offered for sale to the general market, d) still must meet the program ORD. **2.** Commercial business practices include the accepted practice of customer-paid minor modification to standard COTS products to meet the customer's unique requirements.

——**Ant.** When applied to the procurement of electronics for the U.S. Military, COTS is a procurement philosophy and does not imply commercial, office environment or any other durability grade. *E.g., rad-hard components designed and offered for sale to the general market are COTS if they were developed by the company and not under government funding.*

Departments

Coming in December...
...See Page 68

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Originally designed for 20 years, nuclear-powered aircraft carrier USS Enterprise (CVN 65), upon retirement, will have served over 52 years, longer than any other Navy steel-hulled warship. Shown here is the Enterprise underway while conducting maritime operations in the region last year. Enterprise and embarked Carrier Air Wing (CVW) 1 were underway on a scheduled six-month deployment.

U.S Navy photo by MCSS Brandon Morris

COTS JOURNAL
The Journal of Military Electronics & Computing

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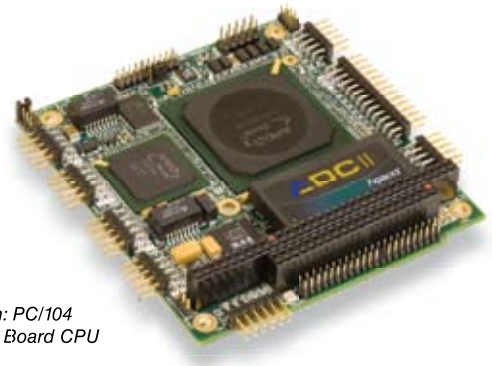

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PC/104-*Plus*	CME137686LX	333	512 MB	4	2	1	18	1	4 GB	1	—	5.2	–40 to +85
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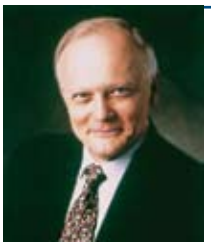

The Good, the Bad … … and then there's November

Here we are another November. When you read this column the election will be over and at least we will know whom to beat over the head to get us out of all the confusion we're in. I haven't felt this lack of leadership feeling since the late '70s. The next President better have a lot of Gen. George Patton in his leadership style—the time for politics is over. It's like we've hunkered down and only focused on the best defensive posture. The new President needs to get a strong decisive team in place that can prioritize and execute for the good of the nation, not an election.

Almost as exciting as politics over the last few years has been the feeble effort of various conference organizers to come up with a viable conference focusing on the needs of the military electronics market. It just confounds the heck out of me whenever I try to analyze why we don't have at least one conference to serve the unique needs of this market. Our market area—a small subset of the embedded electronics market—has very specific technical and operational requirements that need to be explored and developed. The uphill battle to all this is the fact that within the scope of the total electronics technology universe, the military market is barely a pimple on an elephant.

The reality is that the needs of space exploration and the military no longer drive either core or leading-edge electronics development. Therefore it is essential that the community of companies—primes, subcontractors and board suppliers—work together for the benefit of their individual companies and the marketplace. Going way back to the late '70s, trade associations were the forum for the development of open(ish) systems for the general embedded electronics market. Each of these trade associations would then either develop their own conferences or would align themselves with a general electronics conference. These two approaches provided an arena to educate the engineers that needed to develop products around these specific technologies, and a source for suppliers to assess the needs of their marketplace. Many trade associations still exist today and new ones continue to sprout up. However, their effectiveness has been greatly marginalized because of the lack of either a major technology or market focal point.

The VMEbus Standards Organization (VSO) is the key element to making VITA the exception to that rule. I'm sure that I'll get lots of emails because of this next comment: If it wasn't for the military embedded market I doubt VITA would still be in existence today. The military is the only market area where VME is still in a growth cycle. To its credit, the VSO has been clever enough to focus on any technology area—not just VME. Most recently, the VSO is considering a working group to update MIL-HDBK-217, which is a generic military reliability subject, just as many of the VSO's cooling and packaging efforts are.

Back to my issue regarding a core conference for embedded military products. For decades the big military conferences have had very little interest in catering to the electronic suppliers and development engineers. These conferences felt they were like a country club and they liked things just the way they were: a tight knit group that could lobby all the military brass for the next big contract. There have also been efforts by VITA—with their now defunct MEECC conference—and by a couple publishing houses to develop that one conference that both military electronics suppliers and users could rally around. In some cases the inability of these conferences to achieve the recognition of the "must go to" conference is a lack of endurance or focus by the organizers. And in other cases it's a lack of providing something attendees value and are willing to go to.

Once again I have high hopes for another conference to fill our needs. MILCOM has been around for a long time. It's an AFCEA event, but in its earlier years it was almost exclusively a hardened military communications conference—all about antennas, radios and so on. But in the last two years the number of electronic suppliers exhibiting at MILCOM has been doubling each year. I wouldn't say that the conference sessions have gone overboard with tackling issues that are significant to our marketplace. But they are getting better every year. This year I went down the list of exhibitors and found about sixty that I had to put on Jeff Child's and my hit list to stop in and discuss the market and products. MILCOM has a critical mass of attendees and suppliers, it's in a growth mode and technically can easily embrace the embedded electronics market without diversifying its core focus.

Meanwhile, I/ITSEC—another conference that has had respectable support from our market—is doing exceptionally well, but it has a very narrow and focused end product market. *COTS Journal* will once again have a large editorial presence at I/ITSEC this year. But MILCOM may just be the show that military embedded designers and suppliers can hook their wagon to. We'll know more after the 2008 conference, but the real ticket will be punched before the 2009 MILCOM. If it once again shows a significant increase in embedded suppliers, I think we will finally have the one big embedded electronics conference we can rally around. ■■

Pete Yeatman, Publisher
COTS Journal

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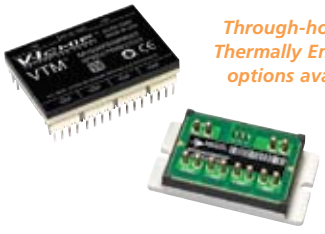

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The Inside Track

NASA Taps Harris' Software for Constellation Launch Control Program

NASA Kennedy Space Center has selected Harris' OS/COMET telemetry, tracking and command (TT&C) software for the Constellation Launch Control System. OS/COMET is an off-the-shelf software tool that provides superior TT&C capabilities for military, intelligence and commercial satellite constellations. The OS/COMET product will deliver critical command and telemetry processing services to meet the needs of the Launch Control System architecture.

The KSC Launch Control System architecture leverages leading-edge industry standards, existing technologies and commercially available products to provide significant core functionality in the command and control of constellation launch vehicles and ground support systems. Based on open software architecture concepts, the Launch Control System will deploy OS/COMET to provide a service within the Service Oriented Architecture (SOA) pattern. Using OS/COMET as a SOA service capitalizes on its ease of configuration and efficient API interface to the LCS architecture. The Constellation Program is NASA's initiative to return humans to the Moon. It includes a constellation of new space vehicles: a new crew exploration vehicle, Orion, to carry crew and cargo; two new launch vehicles—the Ares I rocket (Figure 1) to carry Orion to low earth orbit and the Ares V heavy lift rocket to launch the Earth departure stage; a lunar lander; and lunar surface exploration vehicles and habitat modules.

Figure 1

Part of NASA's Constellation Program, the Ares I rocket will carry the Orion crew vehicle to low earth orbit.

Harris
Melbourne, FL.
(321) 727-9100.
[www.harris.com].

Aitech to Provide Payload Processor for Next-Gen Orbcomm Satellites

Argon ST has selected Aitech Defense Systems to provide the payload processor systems for ORBCOMM's next-generation low earth orbit (LEO) communications satellites. Designed for larger and faster data transfers, backward compatibility and endurance in harsh environments, the OG2 Space Segment Satellites will incorporate Aitech's proven space technology that combines low power and compact size with exceptional computing performance. Aitech will develop, qualify and produce each system at the processor card level as well as integrate each system into the payload.

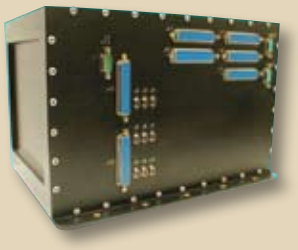

Figure 2

OG2 Satellite payloads are designed to increase subscriber capacity by up to 12 times more than the current satellites, while keeping the satellites within their compact footprint.

Argon ST designed the OG2 payloads to increase subscriber capacity by up to 12 times more than the current satellites, while keeping the satellites within their compact footprint, so the

RTI Middleware Selected to Enable Military Open-Architecture Solutions

Advanced Fusion Technologies, a product-oriented engineering design and services company, announced today that it will seamlessly integrate with middleware from Real-Time Innovations (RTI), the Real-Time Middleware Experts, to develop the industry's first product suite designed to modernize legacy U.S. military applications by enabling them to use a modern open-system architecture. Key to this strategy is the adoption of commercial off-the-shelf-solutions based on standards such as those defined by the U.S. Navy Open Architecture.

Advanced Fusion Technologies is developing a solution that will ease the challenge of modernizing legacy fleets by using a small appliance called the Open Systems Interface Converter (OSIC) to translate legacy communication protocols into a universal, industry-standard format. The OSIC will fully integrate with RTI Data Distribution Service, which provides high-performance messaging middleware based on the Object Management Group (OMG) Data Distribution Service for Real-Time Systems (DDS) standard. In addition to the DDS application programming interface, RTI middleware also implements Real-Time Publish-Subscribe (RTPS) wire-transfer protocol for sending and receiving equipment data, events and commands among the nodes. Advanced Fusion Technologies is currently developing a prototype OSIC as part of a project with the Office of Naval Research.

Real-Time Innovations
Sunnyvale, CA.
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[www.rti.com].

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payloads to support this design need to provide optimum performance. The $12.5M contract calls for the launch of the first LEO satellite as early as 2010. The initial contract includes an option to provide additional satellites and other ground support equipment during the life of the program. Aitech will also provide parts program management and component engineering services to overall payload for all other subsystems.

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

Northrop Grumman Wins Contract to Upgrade Carrier Steering System

The U.S. Naval Sea Systems Command has awarded a contract to Northrop Grumman's Sperry Marine business unit to upgrade the steering control systems for the aircraft carrier USS Carl Vinson (CVN 70)

Figure 3

Sperry Marine will replace the steering units and helm control console on the USS Carl Vinson's bridge and install new electronics and software.

(Figure 3). The cost-plus-fixed-fee contract has a total value of $2.1 million. The work will be carried out at Northrop Grumman Shipbuilding's Newport News shipyard during the ship's first scheduled maintenance period following its refueling and complex overhaul. Sperry Marine will replace the steering units and helm control console on the bridge and install new electronics and software. The contract also provides for engineering support and documentation. Sperry Marine previously completed the same upgrades for eight other Nimitz-class aircraft carriers.

Commissioned in 1982, the USS Carl Vinson was the third Nimitz-class nuclear-powered aircraft carrier. The ship is currently undergoing a 40-month complex refueling overhaul, in which the nuclear fuel is being replenished and the ship's services and infrastructure are being upgraded to prepare for the next 25 years of the projected 50-year service life.

Northrop Grumman Sperry Marine
Charlottesville, VA.
(434) 974-2656.
[www.sperrymarine.northropgrumman.com].

SRC Computers Ships First Airborne Signal Processor for Tracer Program

SRC Computers has shipped the first onboard signal data processor (SDP) for Lockheed Martin's Tactical Reconnaissance and Counter-Concealment Enabled Radar (TRACER) program. TRACER addresses the Army's critical need to have long-range, wide-area detection of targets, facilities and enemy equipment. Using dual-band low frequency synthetic aperture radar, TRACER can immediately downlink images and processed results from Predator-class UAVs to ground units in all-weather, day or night conditions. As conceived, the TRACER radar will be able to provide imagery of targets under camouflage, concealment and deception conditions, and supports detailed, wide-area topography mapping in complex environments such as jungles and rough terrain.

SRC's unique IMPLICIT+EXPLICIT Architecture provides TRACER with compute-intensive reconfigurable processing in a compact form factor. The IMPLICIT+EXPLICIT Architecture allows users to execute existing code, or easily develop and compile new codes, to take advantage of the power of the reconfigurable MAP processors in the system. The SDP designed for TRACER is comprised of a multi-MAP system that weighs 80 pounds and consumes less than 600W of power while being functionally equivalent to about 100 Power PCs for this application. Flight-testing for the TRACER program is scheduled to begin this month.

SRC Computers
Colorado Springs, CO.
(719) 262-0213.
[www.srccomputers.com].

Saab UAV Flies with Green Hills Software's RTOS

Green Hills Software has announced that Saab is using Green Hills Software's INTEGRITY operating system in the Saab Skeldar unmanned aerial vehicle (UAV). Saab also selected Green Hills Software's MULTI debugger and the Green Hills Probe for use in the development of the UAV's redundant flight control unit, which was based on the Freescale MPC5554 microcontroller. Saab's Skeldar (Figure 4) is a fully autonomous, lightweight, unmanned helicopter. It can hover and perform vertical take-off and landing (VTOL) with a minimum of field preparation or additional equipment. The system is designed to

Figure 4

Saab's Skeldar UAV is a fully autonomous, lightweight, unmanned helicopter. It can hover and perform vertical take-off and landing (VTOL) and is designed to support military as well as civil operations and to operate during day and night.

support military as well as civil operations, national and international missions, and to operate during day and night. Potential applications include target acquisition and designation, surveillance, reconnaissance,and electronic warfare. Weighing 150 kg, Skeldar has a maximum speed of 100 km/h, 4-hour operating endurance and a range of up to 100 km.

The INTEGRITY RTOS provides absolute reliability for embedded applications, allowing multiple applications to safely and securely operate on the same embedded computer. Memory partitioning prevents one application from accessing, stealing, or corrupting another application's memory or data. Time partitioning prevents a low criticality application from stealing CPU time away from high criticality applications on the same computer.

Green Hills Software
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[www.ghs.com].

COTS Websites

www.leadfreedod.com

DoD ELF-IPT Site Is Focal Point for Defense Lead-Free Knowledge

The Department of Defense ELF-IPT (Executive Lead Free – Integrated Process Team) is a group composed of representatives from industry and government who cooperate to advise the DoD on critical issues surrounding lead-free electronics. European legislation—the famous RoHS initiative—has outlawed lead in any electronics placed for sale on the European market. Even though the DoD is exempt from this legislation, DoD suppliers are not, and must eliminate lead from their electronic products. This poses a threat to DoD interests because many of these suppliers supply components and subassemblies to the DoD. Reliability of these lead-free electronic parts used in military systems could present a significant issue. In response, the DoD commissioned this ELF-IPT to advise on a joint DoD response in order to minimize any disruption of the supply or reliability of electronics, particularly COTS components and subassemblies.

The members of this IPT include the U.S. Army, U.S. Navy, U.S. Air Force, NASA, Missile Defense Agency and Defense Microelectronics Activity (DMEA). Industry members include BAE Systems, Boeing, Raytheon, Honeywell, ITT, Lockheed Martin, Rockwell Collins and Northrop Grumman. The ELF-IPT website features a wealth of resources including a FAQ, Discussion Board, links to key lead-free information resources, documentation on tin-whisker studies and links to relevant lead-free training courses.

Department of Defense ELF-IPT (Executive Lead Free – Integrated Process Team) [www.leadfreedod.com].

Special Feature

Military Power Supplies and Converters

Power Conversion Rinvents Itself for the FPGA Age

The hurdles of multi-voltage electronics and distributed system architectures continue to make life complicated for military power system designers in a jam. Military DC/DC converter vendors are easing the burden with more efficient products and new partitioning strategies

Jeff Child,
Editor-in-Chief

The military market isn't exactly keen to ride the bleeding edge when it comes to embracing new power supply and power conversion concepts. But it's had no choice than to evolve in order to keep pace with the challenges of modern digital electronics. The newest crop of high-performance FPGAs and processors demands a lot from a power supply. They typical require low voltages, high currents, tight regulation, fast transient response and even supply voltage sequencing. Meanwhile, the typical high-performance embedded computer requires several different voltages, 5V and below. For example, each FPGA or DSP will require one voltage for the I/O circuitry and another to power the processor core.

Applications in military and aerospace call for unique and highly reliable converters with multiple independent outputs. Martek Power, for example, added two high-power, multichannel models to the 28V Input DC/DC converter family earlier this year. The new models, CB150D (Figure 1) and CB225T, are available at 2, 3.3, 5, 5.2, 12, 15, 24 and 28 VDC outputs, expanding the choice of output power of the CB series DC/DC power converter to a range of 5 to 225W.

Figure 1

Martek Power's CB150D and CB225T are available at 2, 3.3, 5, 5.2, 12, 15, 24 and 28 VDC outputs, expanding the choice of output power of the CB series DC/DC power converter to a range of 5 to 225W. Both DC/DC converters feature a wide input range of 16 to 40 VDC and a power density of 45 W/in^3.

Measuring 2.28 x 2.90 x .0.50 inch (57.9 x 73.7 x 12.7 mm) in size, the CB150D is a 150W device with two independent 75W output channels. The CB225T, measuring 2.28 x 4.35 x 0.50 inch (57.9 x 110.5 x 12.7 mm) in size, is a triple output module with three independent 75W output channels. Both DC/DC converters feature a wide input range of 16 to 40 VDC and a power density of 45W/in3. These together with full specified performance over an operating temperature range of 55° to +100°C from no load to full load make the two new models unique in the mission-critical market segment.

System Partitioning Rethink

In the past, engineers would typically place a DC/DC power converter at each output—a solution that is very expensive, very heavy and often inefficient. The challenge therefore is to improve efficiency while supplying various low-voltage requirements on a single board. Today, engineers are turning to a single high-power DC/DC converter, with several point-of-load converters to power individual devices on the board. Separating DC/DC converter functionality, especially at the point of load, provides important benefits to military application such as flexibility, size and weight reduction.

For decades, the bricks of distributed power architecture converters delivered the classic functions of the DC/DC con-

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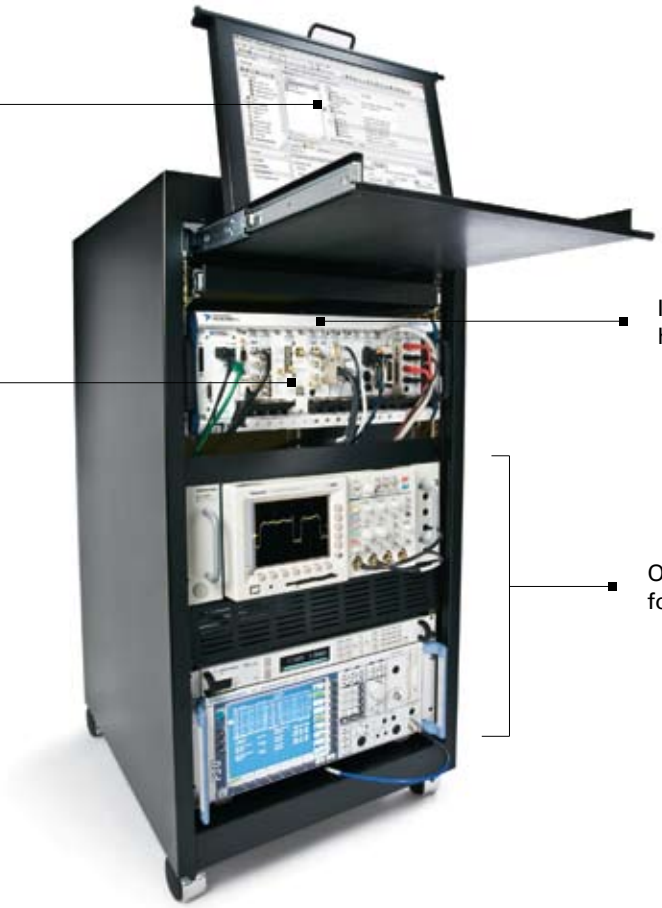

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verter—isolation, voltage transformation and regulation—to the point of load. As the number of voltages required at the board level began to proliferate, however, DPA increasingly consumed valuable real estate and unnecessarily replicated full converter functionality.

Putting a different twist on distributed power, Vicor came up with a DC/DC converter architecture with decoupled functionality called Factorized Power Architecture (FPA). FPA breaks power conversion into flexible and scalable power building blocks called V•I Chips. The Voltage Transformation Module (VTM) is a current multiplier that provides transformation and isolation. The Pre-Regulator Module (PRM) provides a regulated, non-isolated output voltage—a "factorized bus"—that is settable within the range of 26 VDC to 50 VDC from an unregulated input source.

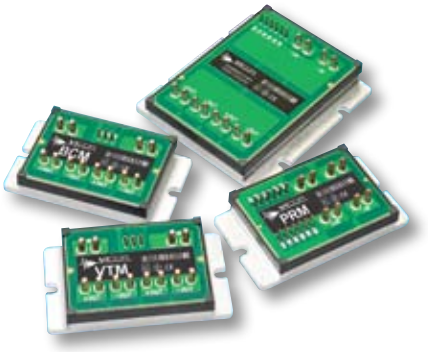

Figure 2

Vicor's VI BRICK BCMs provide a highly efficient solution for Intermediate Bus Architecture or point-of-load (POL) designs that require multiple output voltages. The efficiency and compact size of these modules yields power density up to 390 W/in³.

Isolated and Regulated

The combination of the PRM and VTM creates an isolated, regulated DC/DC converter. PRMs can also be used stand-alone as non-isolated voltage regulators when the input and output returns are not common. A military PRM-VTM chip set can provide up to 100A or 115W at a system density of 172 A/in³ or 198 W/in³, and because the PRM can be located, or factorized, remotely from the point of load, these power densities can effectively be doubled.

Vicor's latest offering in that architecture family is the VI BRICK (Figure 2). VI BRICK BCMs provide a highly efficient solution for Intermediate Bus Architecture or point-of-load (POL) designs that require multiple output voltages. They are available with nominal input voltages including 48 VDC (11 models) and high voltage up to 380 VDC (three models), and a wide array of output voltages from 1.5 to 48 VDC. The efficiency and compact size of these modules yields power density up to 390 W/in³. VI BRICK models are available in a base tempera-

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ture grade of -40° to +100°C operating, and -40° to +125°C storage, with a slotted-flange baseplate and through-hole pin style.

Digital Approach Reduces Parts Count

Although power supplies are still primarily analog components, the addition of digital circuitry and interfaces offers significant benefits for military system designers—especially given the wide variation of power supply characteristics demanded across the military market. Lambda offers a range of digitally controlled modules to its innovative NV-Power (Figure 3) family of configurable AC-DC power supplies, enabling increased power output of up to 1450W peak rating for 10 seconds. The new modules enable Lambda to satisfy the increasing demand for low-profile configurable power solutions from 350W to above 1,000W.

Figure 3

Lambda's NV-Power family of configurable AC-DC power supplies enables low-profile configurable power solutions from 350W to above 1,000W. The devices boast digital control that allows customization based on a military application's requirements.

The new digitally controlled modules incorporate many innovative design features including a new integrated magnetics transformer that allows for small size and increased efficiency. The digital control allows customizations based on the application's requirements. NV-Power employs an 8-bit microcontroller to handle housekeeping routines, replacing the array of comparators, op amps and other discrete components used in less integrated designs. This brings a 50% parts count reduction, which in turn allows 40% more board space for power components. All units operate with an input range of 90 - 264 VAC.

Brown-Out Protection

Forward deployed military systems must wrestle with uncertain and unreliable power conditions. Serving that need, Calex has announced its Hold Up and Hold Up Light product

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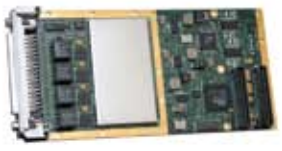

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offerings. The Hold Up modules (Figure 4) are designed for use with Calex DC/DC Converters to protect against brown-out and temporary power loss conditions, and provide a clean, uninterrupted source of power for downstream circuitry. The Hold Up model, part number HU-28, provides a complete turnkey solution for easy design integration. The Hold Up Light model, part number HUL-28, requires the use of an external capacitor bank in addition to the HUL module.

The HU-28 and HUL-28 have an input range of 15.5 VDC to 36 VDC. Both the HU-28 and HUL-28 offer user-programmable hold-up trip voltage. Both modules have two modes of operation: "stand-by" and "tripped." During stand-by, the module charges the hold-up capacitors to 45V and maintains that voltage. When tripped, the module stops charging the hold-up capacitors and connects them to the Vout pins. The operating temperature range for both models is -40° to 100°C.

Figure 4

Calex's Hold Up modules are designed for use with Calex DC/DC Converters to protect against brown-out and temporary power loss conditions, and provide a clean, uninterrupted source of power for downstream circuitry. The HU-28 and HUL-28 have an input range of 15.5 VDC to 36 VDC.

Unique Requirements for Space

Power conversion technology for space-based applications has its own unique challenges. What's needed is guaranteed radiation tolerance through long-term exposure to low dose radiation. At one time, a total dose of 100 krad or more was acceptable, but over time the industry learned that continual low dose radiation is much more of a concern and typical of that encountered during the application. With that in mind, VPT rolled out a new product line in April that meets today's updated reliability requirements for space, including the new radiation requirements, small size and light weight mandates, stringent requirements of 100% reliable operation through a wide range of space flight conditions.

This new family comprised of more than 50 DC/DC converter modules specifically designed and manufactured for space applications, is

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grouped into four product families. These new space DC/DC converters deliver up to 120 watts of output power and operate reliably through harsh radiation environments. VPT packages its "S" space series of DC/DC converters in miniature, hermetic, metal cases for reliable power delivery through the extreme temperature, shock, vibration and radiation environments of space travel. Specific features of the new SVSA, SVHF, SVTR and SVFL product families include 6 to 120W of output power in standard single and dual output voltages.

The devices are characterized and guaranteed to 30 krads (Si) per VPT's RHA plan specified per MIL-PRF-38534, Appendix G, Level P with 2x margin. MIL-PRF-38534 Class H element evaluated components standard is supported. The devices are guaranteed to contain no pure tin and feature a fault tolerant design with radiation-immune magnetic isolation technology. Case temperature operation is rated at -55° to +125°C with full performance over entire temperature range. ■■

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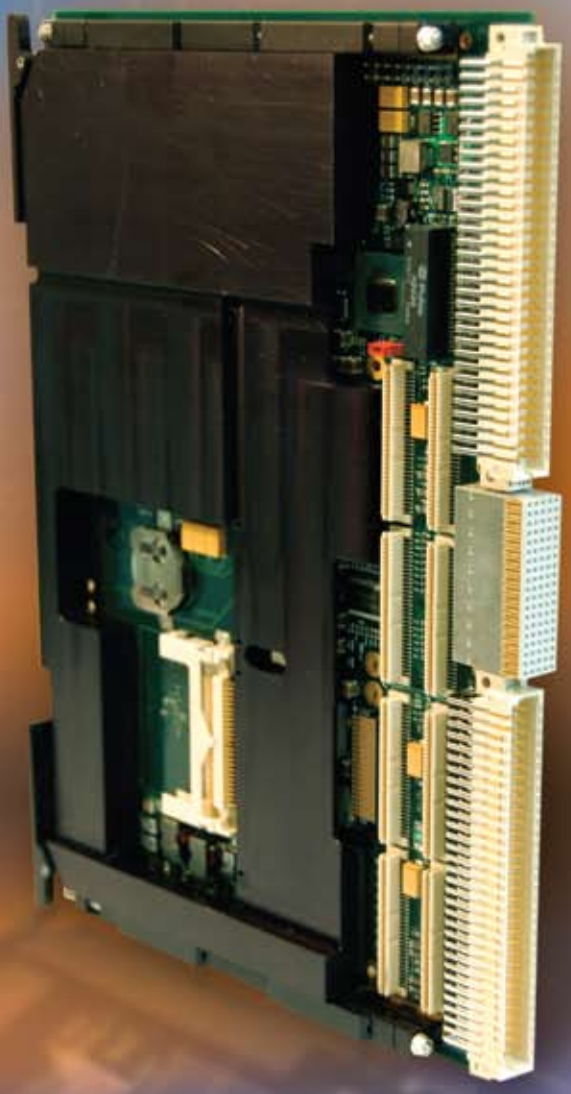

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Special Feature

Military Power Supplies and Converters

High Power Batteries Get Tactical

Driven by demands of other markets, advances in high power battery cell technology are moving right in line with the requirements of portable military system developers.

Jeffrey VanZwol, Marketing Manager
Micro Power Electronics

The military may soon reap the battery technology benefits driven by trends happening in the power tool industry. The power tool industry's demand for high power batteries with lighter weight, smaller and better cycle life than Ni-Cad batteries, has enticed cell manufacturers to develop high drain Li-ion cells. The RoHS restrictions on Ni-Cad have greatly improved the market success of high power cells. These cells are a derivative of Li-ion products, and are derived from the desire for high current combined with high capacity, resulting in cells that deliver high power for shorter periods of time.

There is a new variety of Li-ion cells available that supports high discharge currents required for many applications, and subsequently, supports high charge currents for fast charging. These cells are finding their way into custom battery packs that are specifically designed to mate with portable devices—such as chemical detectors. It is anticipated that the existing suppliers of rechargeable military BB batteries will introduce BB batteries based on these high power cells. An example military system that relies heavily on battery power is the Land Warrior system (Figure 1). Land Warrior consists of a helmet-mounted display, a small computer for situational awareness and navigation, and a headset with radio connectivity.

Figure 1

Depending heavily on battery power is the Land Warrior system. The system consists of a helmet-mounted display, a small computer for situational awareness and navigation, and a headset with radio connectivity.

High-Drain Cell

One vendor, E-One Moli Energy, offers a high drain cell based on a manganese

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Figure 2
High power cells are typically available in 26650 and 18650 (18 mm diameter, 65 mm length) sizes.

spinel cathode material. Their cylindrical 26700—26 mm in diameter, 70 mm in length—cell supports 80A pulses for over 10 seconds. Moli has very recently introduced a spinel chemistry cell in the traditional 18650 size. The drawback of a high rate cell is lower capacity than traditional cobalt oxide cells found in conventional notebook computers. The 26700s and 18650s have capacities of only about 2.9 Ah and 1.4 Ah, respectively. This cell was originally targeted toward power tool applications.

Meanwhile, A123 Systems offers a cell that supports very high drain rates. This cell was originally developed specifically for the power tool market. The A123 cell exploits nanoscale particles to achieve a performance very similar to the Moli cells. The fundamental cathode chemistry is also different from the Moli technology, so the voltage is somewhat lower. The A123 cell has an operating voltage of 3.2 instead of 3.6 because Lithium Iron Phosphate ($LiFePO_4$) material is used.

Kokam offers a high drain polymer option. This Lithium polymer battery is able to draw up to a 20C rate discharge continuously, with a peak discharge rate of 40C. These high drain cells have similar characteristics. The cell impedance is low, and the discharge/charge rates can be high. This enables fast charge, or allows fewer cells per battery pack. Unfortunately, the energy density of these high drain cells is lower than traditional Li-ion cells. From an economic perspective, the high drain cells are new to market, so the volumes and prices have not achieved the levels of traditional Li-ion cells. For any specific cell configuration, such as an 18650, it is anticipated that the high drain cells will always command a premium over traditional Li-ion cells (Figure 2).

Leveraging Other Markets

The availability of high drain cells has provided manufacturers of portable devices with greater variety when addressing high drain or fast charge requirements. High power cell suppliers are now looking for new applications beyond power tools and electric vehicles, so military equipment manufacturers should seriously consider these cells when designing their next portable device.

Integration of high drain cells with portable military devices has special consideration. Military OEMs must determine the maximum current or drain rate that the pack will experience, the maximum inrush charge current, and nominal operating drains under various operating modes of the device. For example, when the device is first powered on, the battery system may experience a high pulse current for a short time. During normal operation it may experience an entirely different current demand level if a special feature of the product is used, such as the transmission function.

OEMs may overlook the ambient, or operating temperature, range of the battery system within the host device. Engineers may look at a battery system as merely a "sum of parts," not understanding the interplay of cell heating on the circuitry within the pack. The temperature of high drain cells can jump to 70°C during a high rate charge or discharge. Placement of the battery pack is crucial, as excessive heat from the batteries may affect the host device electronics, or vice versa. The higher the discharge rate, the more heat generated by the batteries.

Charging Methodology Issues

The frequency and methodology of battery charging can greatly influence available capacity and cycle life, especially if the charging electronics and power supply are embedded within the host device. Many cell manufacturers place more restrictions on the charging of their cells than on the discharging of them. Because high drain cells have very low impedance

Figure 3

Multiple, parallel contact pairs can be used to deliver and accept high current.

levels, they can be charged very quickly if needed. Again, the higher the charge rate, the more heat generated by the batteries.

It is critical to understand how fast the device needs the cell recharged. Traditional cobalt oxide Li-ion cells appreciate a 3-hour charge cycle using a 0.5C rate constant-current constant-voltage (CC-CV) charge regimen. However, high drain cells can be recharged within 15 minutes. So, if the user of the device requires a fast charge cycle, a larger power supply would be required to support a fast charge scenario. The inclusion of a larger power supply within the portable device affects many aspects of the host device electronics.

Thermal management is greatly affected by larger power supplies and high-charge-current electronics. Not only is the heat generated from the power supply detrimental to the electronics of the host device, but this heat can put the batteries out of allowable charging temperature range or deteriorate the cells as they sit next to the charge electronics. So it is critical that engineers understand the thermal interaction of the high drain cells, the power supply, the charge electronics and host device electronics.

Contacts to Support High Currents

A final consideration is that the external contacts between host device and battery will need to be upgraded to support high currents delivered by high drain cells. Several options are available to support high-current discharges and charges. Engineers can utilize off-the-shelf contacts (such as pogo pins), however, most off-the-shelf contacts are limited to a 2 amp delivery. Off-the-shelf high-current contacts are available, but are more expensive than the lower-current alternatives.

Another approach is to use multiple low-current contacts in parallel to deliver positive and negative voltage to the battery (Figure 3). The use of several positive and negative contacts improves the redundancy of the overall connection between the device and battery in the event that one individual contact may fail.

The final option is the development of custom contacts, such as a spring-loaded or bent-wire contact, where the gauge of the metal contact is designed to carry the maximum current. The custom contacts can be designed with multiple contact points if heat-related contact issues need to be addressed. In summary, designing a portable military device to operate on high drain cells requires a new set of design guidelines for the electrical and thermal management challenges presented by this new technology. ▮▮

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Tech Recon

Implementing MILS and IA

Divide and Conquer Approach Wins for MILS

Rational approaches to building a secure defense subsystem don't scale in today's ever more space-constrained systems. Using MILS to rigorously isolate multiple software components, it's possible to guarantee the required resources for each component.

Robert E. Hoffman, Vice President and General Manager
Wind River Aerospace and Defense

In the face of modern threats, national defense requires more lethality and survivability in new environments. Defense planners must also meet purchase and operational cost targets. For the defense system builder, this translates to increasing requirements for more device functionality, mobility, connectivity, security and safety, with lower purchase and operational costs and controlled development time, cost and risk.

Demand for more connectivity to support integrated battle spaces is especially intense where devices connect to the United States Global Information Grid (GIG) or similar schemes elsewhere. This connectivity, coupled with the need to share information among coalition partners with varying degrees of trust, makes security requirements difficult to meet.

Microprocessor-based defense subsystems are traditionally built using multiple embedded boards, each running a single application or component that together delivers the functionality required by the subsystem. The traditional approach to delivering more functionality is to increase the number of subsystems and boards.

This traditional approach no longer scales. In addition to the requirements given above, space, weight and power (SWaP) are ever more constrained in modern defense systems. From unmanned combat air systems to highly mobile SATCOM systems (Figure 1) and modern attack aircraft, there is continued pressure to reduce subsystem form factors to accommodate more arms and armor.

Figure 1

Space, weight and power constraints are becoming an ever greater factor in modern defense systems like this Stryker ICV-based SATCOM on-the-move system. There's continued pressure to reduce subsystem form factors to accommodate more arms and armor.

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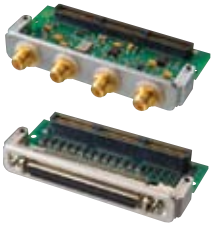

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multicore processors in particular are emerging as compelling technology. To take advantage of more powerful microprocessors, the major commercial real-time operating system (RTOS) companies are developing approaches to enable multiple applications to share a single microprocessor, thereby reducing the number of embedded boards in a subsystem and potentially the number of subsystems.

Running multiple applications on a single microprocessor introduces major new challenges. First, every application must be guaranteed processor time, memory, bandwidth and any other resources it requires. No application can be allowed to starve others of their required resources.

Second, applications formerly made secure by "air-gap security" must remain secure, limiting and minimizing damage from malicious attacks, and must communicate exactly as intended and in no other way. While malicious covert channels are possible on traditional systems, hosting several applications on a single microprocessor introduces new potential exposures.

Safety and security evaluation present a third challenge. Defense systems are Authorized to Operate (ATO) by Designated Approving Authorities in the United States and similar authorities elsewhere. Historically, "large" systems—with hundreds of thousands to millions of lines of code—have been difficult to certify. As illustrated in Figure 2, this is because such systems have typically been designed with large, relatively monolithic kernels that manage resource allocation, mandatory and discretionary access control, security auditing and event recording and more, with drivers all running in "privileged" or "supervisor" mode. Further, the systems include relatively large and monolithic middleware, such as network stacks, file systems and large applications. With security-critical code not well isolated in the large code bases, security evaluations have been complex and expensive—as high as $50-$100 million.

Safety Certification

In addition to security evaluations, a growing challenge for unmanned aircraft, especially in Europe with its narrow military air corridors, is a trend to require safety certification that formerly was required primarily for commercial aircraft. Controlling operational cost is a fourth challenge. The simple approach with applications on a single processor is to operate in "system high" mode. But this requires all personnel with access to the system to be classified at the highest level, often Top Secret, which is expensive and increasingly impractical.

Finally, the increasing functionality required of these complex systems increases the amount of software, which in turn increases the time, cost and risk of developing and integrating these systems. These costs must be controlled throughout a system life cycle that may span several decades.

Summarizing the challenges, running multiple applications on a single multiprocessor—whether single-core or multicore—is compelling for increasing

functionality while controlling SWaP, but doing so creates new threats of interference in applications, security, evaluating and certifying safe and secure system operation, potentially increased operating personnel cost and more challenging development.

A RTOS architecture and system infrastructure has emerged to meet these challenges called Multiple Independent Levels of Security (MILS). MILS uses a strategy of "divide and conquer" to carefully and rigorously isolate multiple software components running on a single microprocessor to guarantee the required resources to each component, enabling separate development, safety and security evaluation for each independent component and providing for composition of components into a single system that delivers the total functionality required.

Divide and Conquer

The MILS divide and conquer approach has three themes:

Separation: The software for the system is partitioned into components. Different applications, middleware and driver components can be readily separated. Individual applications, middleware and drivers may be further subdivided. The goal of separation is to isolate security-critical code in small components so that all security-critical code can be scrutinized intensely. Code of lesser or no security-criticality can be evaluated at lower levels or not at all.

Composition: The complete software for a system is built by composing the evaluated components to implement the overall functionality for the system—that is, by executing them together on the system in a way that ensures each component has the resources it requires, that the components communicate exactly as specified, and that no component can affect any other component other than as specified by system security policies—no covert channels for example.

Layered assurance: Instead of placing all responsibility for security in the kernel, the responsibility is distributed among the Separation Kernel and all user components, with each component responsible for its own security policy.

While there are several approaches to the MILS RTOS architecture, most broadly follow the three-layer scheme illustrated in Figure 3. The layers include trusted hardware, Separation Kernel and user components—applications, middleware and drivers.

Trusted hardware implies that there must be no intentional or unintentional exploits or covert channels present in the hardware that might defeat the security requirements. The hardware must also support trusted initialization to ensure the code running on the system is the same code certified by authorities. The details of trusted hardware are beyond the scope of this discussion; please consult commercial MILS RTOS vendors for more information.

The Separation Kernel (SK) meanwhile has four responsibilities: data and code isolation; periods processing; information flow control; and fault isolation. Data and code isolation means the

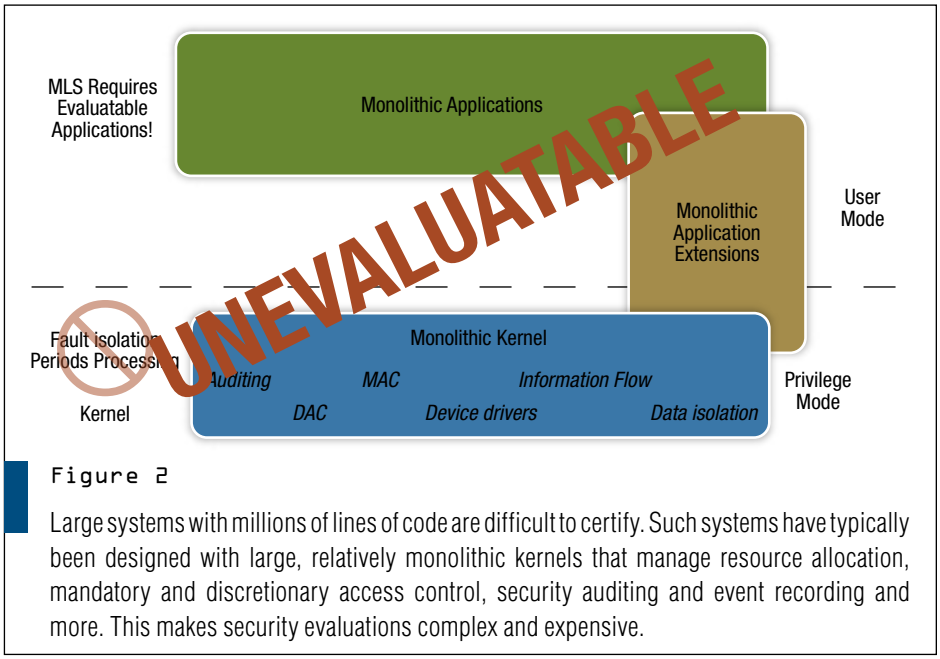

Figure 2

Large systems with millions of lines of code are difficult to certify. Such systems have typically been designed with large, relatively monolithic kernels that manage resource allocation, mandatory and discretionary access control, security auditing and event recording and more. This makes security evaluations complex and expensive.

prevention of unintended data and code commingling is accomplished through memory management for space partitioning. Meanwhile, periods processing entails assigning each component with a variable-length time slot in a fixed schedule, guaranteeing its time resources. Information flow control is a matter of ensuring that information originates only from authorized sources, is delivered only to the intended recipients and the source of information is authenticated to the recipient. And, finally, fault isolation means limiting fault damage by preventing a failure in one partition from cascading to others; failures are detected, contained and recovered locally.

SK Security Policy

By implementing the MILS Separation Kernel security policy, a MILS Separation Kernel isolates the other software components of the system in a much more profound and demonstrable way than in the past with secure systems. To achieve high security assurance, the Separation Kernel is typically the only code to operate in privileged mode. All other software components, including drivers and middleware, run in user mode in separate space partitions.

The user components of MILS meanwhile refers to applications, middleware or drivers, each executing in its own space partition per the defined schedule. A key advantage of MILS is the ability to run legacy code that may come from traditional RTOS environments, Linux or even Microsoft Windows. A MILS system permits legacy code to run by hosting their OSs in space partitions as "guest operating systems." Since the guest OSs and their hosted components are isolated in partitions, they may be evaluated, if necessary, to the appropriate level.

MILS systems are also designed to host applications requiring very high security assurance such as upgraders, downgraders, filters or other applications that must process data from multiple security domains. The expectation is that these applications are relatively small (roughly a few hundred lines), and because they can be isolated, they can be evaluated to very high security assurance. MILS vendors provide a "minimal runtime" to interface these high assurance applications to the Separation Kernel.

Demonstrating Security

In general it's not possible to achieve 100% assurance that a system is completely secure; however, using thorough evaluation methods, it's possible to achieve an acceptable level of risk. For MILS-based systems, we need assurance that the underlying MILS operating system is secure. The major commercial RTOS vendors use the international Common Criteria for Information Security Technology Evaluation methodology (ISO/IEC 15408) principally because it is preferred in the U.S.

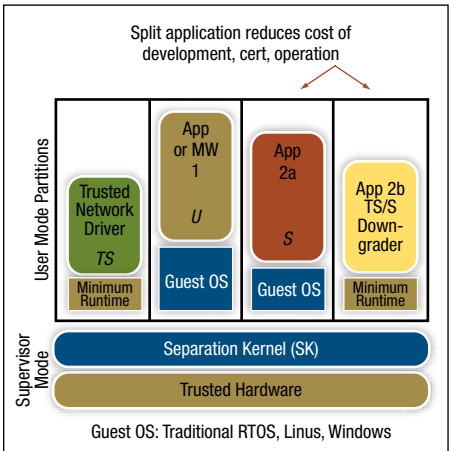

Figure 3

There are many ways to implement the MILS RTOS architecture. Most follow the three-layer scheme illustrated here with trusted hardware, Separation Kernel and user components.

for demonstrating adequate information assurance for such software.

At its highest assurance levels, evaluations using Common Criteria are mathematically based and expensive. Evaluation costs approximately $1,000 per effective line of code—Separation Kernels are typically in the 5,000-line range. In the United States, evaluation at the highest levels may require three or more years.

An entire operational system will not typically be certified using Common Criteria. In the U.S., a defense system is authorized to operate though DoD Information Assurance Certification and Accreditation Process (DIACAP). In addition, the intelligence community uses Director of Central Intelligence Directive 6/3 Protecting Sensitive Compartmented Information within Information Systems (DCID 6/3). Similar procedures are used elsewhere. In these processes, different types of evidence may be submitted for different subsystems. For example, DIACAP authorities accept Common Criteria certification, and MILS RTOS vendors expect that their Common Criteria certifications currently under way will be acceptable.

MILS Gets it Done

MILS' ultimate goal is the development and certification of a library of reusable certified components—RTOS, drivers, middleware and applications—for composition into systems that can be evaluated and certified at acceptable cost. MILS divides and conquers to help build today's Multi-Level Secure defense systems to process data at multiple security levels and from multiple coalition partners while increasing functionality and connectivity; reduce space, weight, power and purchase and operational cost; control development time, cost and risk; and slash the cost to demonstrate the safety and security of national defense systems. Implementing MILS can be challenging, but the user is rewarded with Multi-Level Secure systems that meet today's and tomorrow's threats at reasonable cost and acceptable risk. ■■

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Tech Recon

Implementing MILS and IA

Tools and Processes Round out the MILS Puzzle

Proper processes and tools must form part of the MILS puzzle. They're needed to ensure rigorous static and dynamic analysis and verification needed to match specified security requirements and properties.

John Greenland, VP Business Development
LDRA Technology

Security-related issues are at the forefront of decision making for military and aerospace systems development managers. Software developed for the defense market often requires systems to mitigate the risk of one component of the software affecting another. Often, these components operate at different security or trust levels, and the separation of these components must be assured. An architecture that assures these levels of separation is the Multiple Independent Levels of Security (MILS) architecture. MILS takes the software engineering best practice of componentization, originally intended to support software reuse, to an entirely new level.

These days the term Information Assurance (IA) is part of any discussion about today's network-centric programs like FCS (Figure 1), WIN-T and JTRS. The information and databases on the military's networks are national assets, and enemy access to them threatens our warfighters. Along with an architecture

Figure 1

An example military system that will need be tasked to handle massive amounts of secure information traffic, the Future Combat Systems program relies on a network capable of getting satellite information and video from UAVs in the air and on the ground and sending it directly to the troops that need the tactical information. Shown here a soldier reviews networked data during an FCS demonstration.

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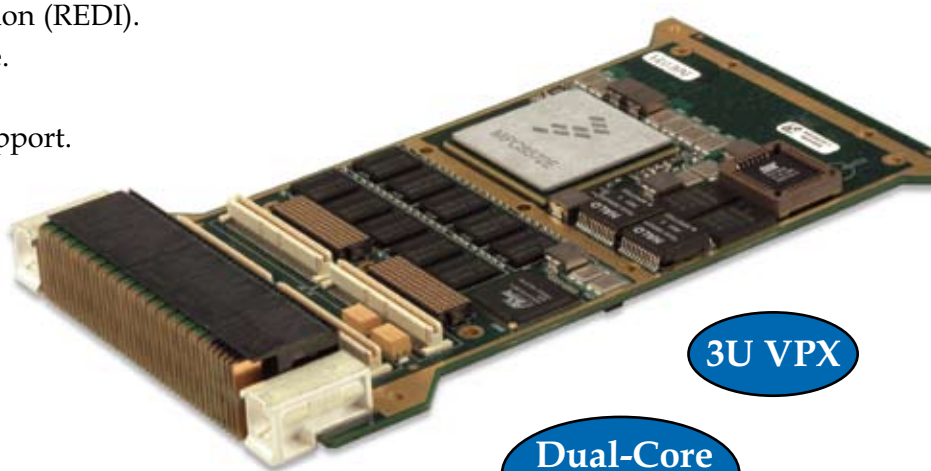

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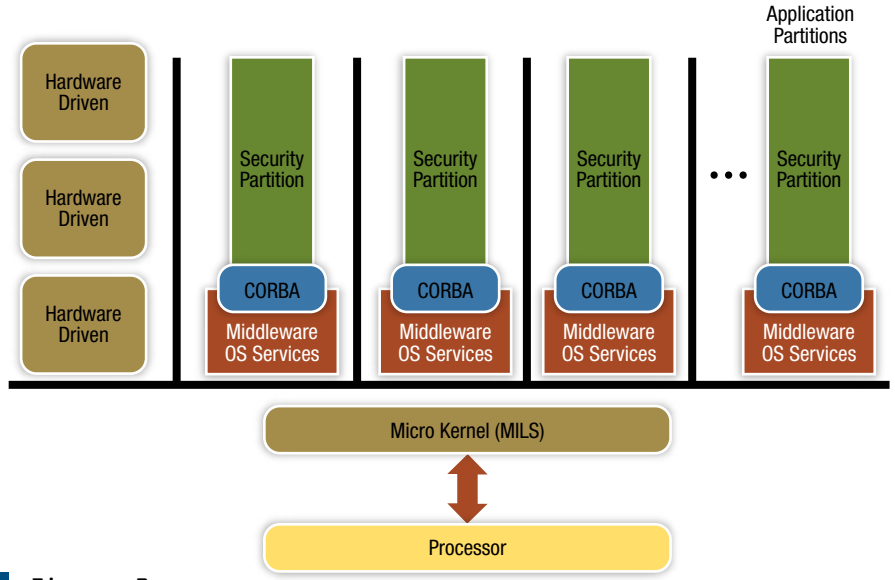

Figure 2

The Multiple Independent Levels of Security (MILS) architecture supports separation, but proper processes and tools must be used in the development of these systems to ensure rigorous static and dynamic analysis and verification under the Common Criteria certification process.

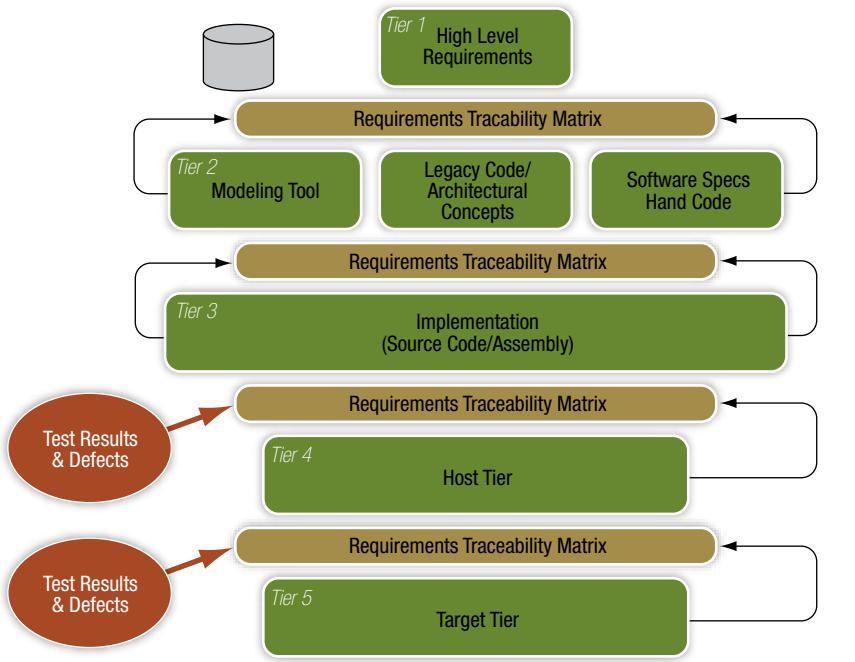

Figure 3

The Common Criteria standard mandates a requirements-based development and verification process determined by requirements coverage or traceability. Tool suites are available that blend a requirements coverage tool integrated with code review, data and control coupling, and code coverage tools.

like MILS (Figure 2) that supports separation, proper processes and tools must be used in the development of these systems to ensure rigorous static and dynamic analysis and verification in support of IEC/ISO Common Criteria for Information Technology Security Evaluation. Using the Common Criteria certification process, systems can be evaluated to a certain assurance level based on specified security requirements and properties.

The Common Criteria standard provides detailed guidelines for the production of software to provide a level of assurance from the lowest levels of security (unclassified) to the highest (top secret). When multiple levels coexist on a system at the same time, proper separation is required. The Common Criteria standard covers the complete software lifecycle: planning, development and integral processes to ensure correctness, control and confidence in the software. The integral processes include requirements traceability, software design, coding and software verification. To achieve the security objectives requirements traceability and testing tools are essential.

Software tool vendors have extensive experience in various aspects of this specialized area, though few comprehensively meet all requirements. To fully meet Common Criteria software development and verification requirements, it's necessary to include traceability, static source code analysis, dynamic coverage, data flow, and control flow analysis and testing facilities. As the implementation of Common Criteria standards becomes more widespread, a tool vendor's experience and reputation in security- and safety-critical expertise will be invaluable.

Software Development Process

As part of the software development process, the Common Criteria standard specifies that software must meet certain software development process requirements. These include adherence to a set of programming standards, software verification activities, and traceability from high- to low-level design requirements and then down to the resulting source code and object code.

Using the latest source code analysis technology, current software tools provide code analysis features to enable programming standards compliance and detailed source code documentation. These tools can also offer components for restricting complexity, measuring the degree of coupling between software components, and minimizing the nesting levels for control structures. As part of meeting the accuracy and consistency objectives of the standard, methods such as data flow analysis can be employed to identify uninitialized and unused variables or constants.

Structural Coverage Analysis

To provide evidence that security requirements are satisfied by a particular system, documentation of the correlation between stated requirements and the operation of code running on the host or target system is essential. Structural coverage analysis is used to establish a correlation between the requirements that were tested and the code structures exercised by the test.

Consequently, structural coverage analysis provides an adequacy measure of requirements-based testing. The intent of structural coverage is to provide evidence that the code structure was verified to the degree required for the applicable software level, and to provide a means to demonstrate the absence of unintended functions.

Structural coverage analysis involves the synthesis of requirements coverage (traceability) analysis and code coverage, or the actual quantification of this analysis at runtime measuring both source code and object-code execution. It is important to focus on tools that provide an independent analysis of structural coverage from the high-level software requirements through the design (low-level requirement) to the source code and into the object code.

Current tools can graphically indicate control coupling via the control flow graph, which visually represents the dependence of a given software component on the components that call it or are called from it. From the control flow graph, certain tools target specific instances of control coupling by selecting an individual software component (procedural node) and providing an option to navigate a graphical representation of both the immediate control coupling and the extended or hierarchical control coupling.

This information may also be mapped back directly to the source code by drilling down to the specific predicates within the source code, which must be satisfied in order to affect the call. This can be achieved directly from a control flow graph containing source code annotations that allow efficient navigation between flow graph elements and the related source or object code segments. Analyzing control coupling with an efficient set of tools allows developers and Q/A departments to concentrate only on

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Expansion Bus	PC/104 ISA Bus	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	PCI-104 PCI Bus	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓
	PCI Bus Masters	4	4	4	4	4		4	4	4	4	4	4		4
	APIC (add'l PCI interrupts)	9	9	9	9	9	9	9	9	9	9	9	9		
CPU and BIOS	CPU Max Clock Rate (MHz)	1400	1400	1400	1400	1400	650	400	650	400	650	400	650	500	500
	L2 Cache (KB)	2048	2048	2048	2048	2048	256	256	256	256	256	256	256	128	128
	Intel SpeedStep Technology	✓	✓	✓	✓	✓									
	ACPI Power Mgmt	2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0
	Max Onboard DRAM (MB)	512	1024	1024	1024	1024	512	512	512	512	512	512	512	512	512
	RTD Enhanced Flash BIOS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Nonvolatile Configuration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	RTD Quick Boot	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	USB Boot	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Peripherals	Watchdog Timer & RTC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	ATA/IDE Disk Chip (MB)	4096	4096	4096	4096	4096	4096	4096	4096	4096	4096	4096	4096	4096	4096
	Audio		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		
	Analog Video	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA
	Digital Video	LVDS	LVDS	LVDS	LVDS	LVDS				TTL	TTL	LVDS	LVDS	LVDS	
	AT Keyboard/Utility Port	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	PS/2 Mouse	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	USB Mouse/Keyboard	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
I/O	**RS-232/422/485 Ports**	4	4	2	4	2	2	2	2	2	2	2	2	2	2
	USB Ports	4	2	4	2	4	2	2	2	2	2	2	2	2	2
	10/100Base-T Ethernet	1	1	1	1	1	1	1	1	1	1	1	1	2	1
	ECP Parallel Port		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	aDIO (Advanced Digital I/O)	14	18	18	36	36	18	18	18	18	18	18	18	18	18
	multiPort (aDIO, ECP, FDC)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SW	ROM-DOS Installed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DOS, Windows, Linux	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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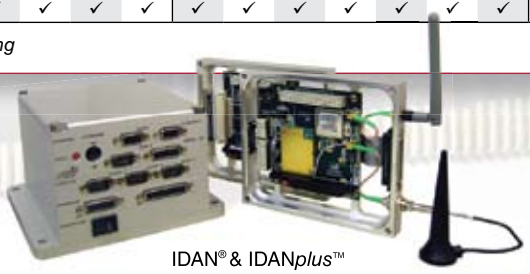

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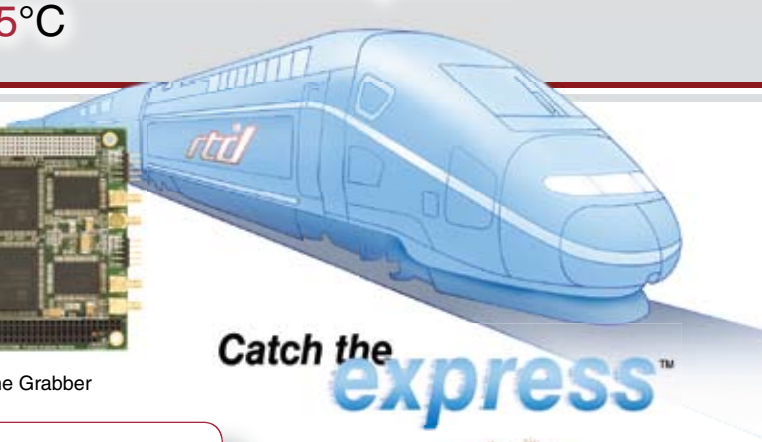

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Bus	Active Bus	PCI	PCI	ISA	ISA	PCI	PCI	PCI	PCIe	ISA	ISA	ISA	PCI	PCI	PCIe	PCI
	Passthrough Bus	ISA				ISA	ISA		PCI				ISA		PCI	ISA
	DMA or PCI Bus Master	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓
	McBSP Serial Ports	✓	✓			✓	✓	✓	✓							
Analog Input	Single-Ended Inputs	16	16	16	16	16	16	16	16							
	Differential Inputs	8	8	8	8	8	8	8	8							
	Max Throughput (KHz)	1250	1250	500	100	1250	500	500	500							
	Resolution (bits)	12	12	12	16	12	16	16	16							
	Input Ranges/Gains	3/7	3/7	3/4	1/4	3/6	3/3	3/3	3/3							
	Autonomous Calibration	✓	✓													
	Data Marker Inputs	3	3	3		3										
Conversions	Channel-Gain Table	1K	1K	1K	1K	1K	1K	1K	1K							
	Scan/Burst/Multi-Burst	✓	✓	✓	✓	✓	✓	✓	✓							
	A/D FIFO Buffer	8K	8K	8K	8K	8K	8K	8K	8K							
	Sample Counter	✓	✓	✓	✓	✓	✓	✓	✓							
	SyncBus	✓	✓			✓	✓	✓	✓							
Digital I/O	Total Digital I/O	16	16	16	16	16	16	16	16	48	18/9	64	48	48	48	48
	Bit Programmable I/O	8	8	8	8	8	8	8	8	24	6/0		48	48	48	✓‡
	Advanced Interrupts	2	2	2	2	2	2	2	2	2			2	2	2	✓‡
	Input FIFO Buffer	8K	8K	8K	8K	8K	8K	8K	8K							
	Versatile Memory Buffer												4M	4M	4M	8MB
	Opto-Isolated Inputs											48				
	Opto-Isolated Outputs											16				
	User Timer/Counters	3	3	2	2	3	3	3	3	3	3		10	10	10	6
	External Trigger	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓‡
	Incr. Encoders/PWMs										3/9		4/8	4/8	4/8	✓‡
Analog Out	Analog Outputs	2	2	2	2	2	2	2	2							
	Max Throughput (KHz)	200	200	200	100	200	100	100	100							
	Resolution (bits)	12	12	12	16	12	16	16	16							
	Output Ranges	4	4	3	1	4	5	5	5							
	D/A FIFO Buffer	8K	8K			8K	8K	8K	8K							

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the code that affects current verification efforts.

In addition to these static analysis facilities, ensuring that a tool suite has the capability of displaying control flow as a result of dynamic program execution demonstrates the degree to which the identified control coupling has been exercised at run time.

Data Coupling

In addition to control coupling, data coupling analysis is another important component in the certification of security-critical systems. Data coupling functionality is available in many tools by accessing data flow graphs that correspond to the control flow graphs described in the previous section.

More specifically, however, many tools now employ data object analysis that provides all instances of the data items accessed by a software component, including local variables declared within the scope of the component and global variables accessed by the component, but declared elsewhere. Significantly, analysis tools should track and report these data items across procedure and file boundaries, even in cases where they are aliased as parameters to procedure calls.

In the dynamic domain, the dynamic data flow coverage facility provided by these analysis tools indicates which data components have been accessed at run time. In so doing, it uses the execution trace associated with a specific test data set and thereby provides the data coupling for that particular test case.

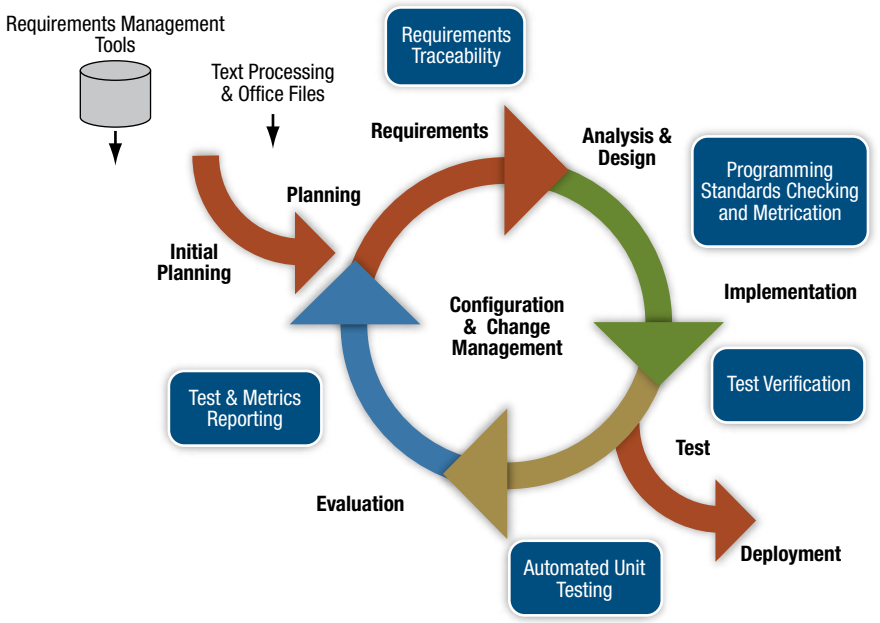

Figure 4

Software process and automated tools supporting that process are critical in providing the proper analysis and verification artifacts for certification authorities.

Requirements Coverage, Traceability

The correctness of requirements-based development and verification process mandated by the Common Criteria standard is determined by requirements coverage or traceability. This analysis assures that software requirements are properly associated with the requisite test

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cases and can be traced from their highest level through the design to the final implementation and deployment of the software on the hardware target system (Figure 3).

Some tool suites available offer a requirements coverage tool that is integrated with code review, data and control coupling, and code coverage tools. The integration of these tools offers the best possible support for Common Criteria certification.

Structural Code Coverage

The Common Criteria standard imposes strict structural coverage analysis objectives on the software. If code coverage is not monitored, there is the possibility that errors will still be present in the code that has not been executed by any of the test data. Through automatic source code instrumentation, currently available analysis tools report on the areas of code not executed at run time and therefore facilitate quick identification of missing or inadequate test data. When an error has been identified by the test data, these tool suites show exactly which code areas were executed through textual and graphical reports. These features save time in fixing the error and re-testing.

Through the coverage analysis tool suite's measurement of these coverage metrics, testing strategies can be implemented and enhanced to meet the required degree of coverage appropriate to the security assurance level of the software. This greatly increases confidence in the tested code.

As organizations target security-related development and certifications in the MILS and Common Criteria areas, software process and automated tools supporting that process are critical in providing the proper analysis and verification artifacts for certification authorities. Tools automation in the static analysis, dynamic analysis, test and requirements traceability areas significantly reduces resource requirements and reduces cost and schedule risks when implementing software processes targeting security-related certifications (Figure 4). Specific analyses in the areas of structural coverage, control coupling, data coupling and requirements traceability provides the required information to generate the appropriate artifacts when engaging with certification organizations. Without leveraging these tools and processes, security-related development and verification activities are a much more onerous proposition. ■■

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MILS assures virtual isolation between apps running on the same systems in distinct security domains. Java offers the best language choice for implanting secure, certifiable MILS implementations.

Dr. Kelvin Nilsen, CTO
Aonix

Designers of secure defense systems must balance conflicting objectives to provide convenient, reliable and timely access of information to those authorized to access the information while preventing access by unauthorized users. Open-market competition among multiple suppliers to mainstream consumers has yielded inexpensive, easy to use, off-the-shelf software that satisfies most of the objectives of convenience, reliability and timeliness. Unfortunately, most off-the-shelf software fails to satisfy the government's demanding requirements for information security.

Typically, security considerations win out, leading to proprietary hardware and software with complete physical isolation of secure networks and no connection between secure networks and public networks. Those responsible for developing and managing secure computing environments, where much of the IT processing must be carried out by custom-tailored applications and severely restricted configurations of off-the-shelf software applications, are highly motivated to reduce the costs of implementing and maintaining the software that runs within these environments.

Figure 1

Until recently, the only option for enabling authorized users access to both secure and non-secure information was multiple physically isolated computers on their desk, each computer representing a different security enclave.

Java for Secure Computing

Java is the perfect technology for implementing secure computing capabilities, easing the integration and customization of off-the-shelf functionality, while enabling quicker turnarounds on requests for the development of new software features, and significantly reducing both software development and maintenance costs. Traditionally, authorized users who need access to both secure and non-secure information have multiple physically isolated computers on their desk, each computer representing a different security enclave. Figure 1 illustrates the traditional physical isolation approach to multiple levels of security: data with different levels of security are kept on different systems.

The challenges of the traditional physical isolation approach to security are severalfold. First, there is the challenge of physical real estate. People who need access to multiple security realms must find space on their desktops for multiple computers, along with electricity and cooling facilities for that much more hardware. This is especially challenging when the computation is required in the field, including airborne, shipboard, or even camouflaged tent deployments. Second,

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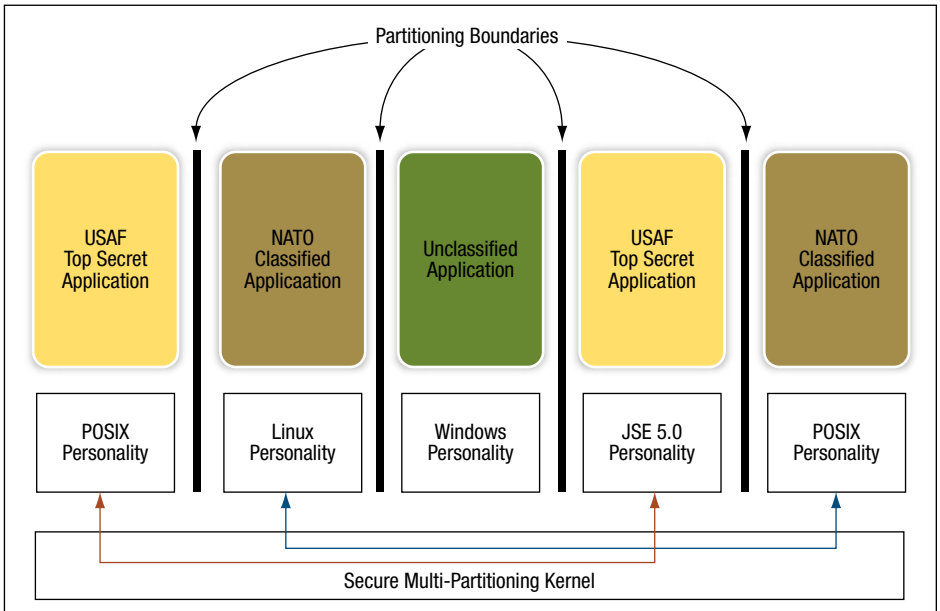

Figure 2

This diagram illustrates how a partitioned kernel allows multiple security levels on the same hardware. Each application can communicate only with other applications running within the same security level. That means there's no risk that misbehavior of the application will leak secure information beyond the boundaries of its security realm.

the audit requirements associated with certification of security impose severe restrictions on the software running within the more secure enclaves.

Such systems may use non-standard proprietary operating systems. Some even use non-standard proprietary processor architectures. Besides being physically disconnected from the public Internet, they may also forbid information transfer via USB flash or floppy disks. Any software installed on the system must be vetted by appropriate IT administrators. All of this makes it difficult for users of the secure computer system to get their work done.

MILS in the Networked World

As computers and software become more powerful, and the relevance of the public Internet to secure processing applications increases, the trend is to enable carefully guarded interactions between secure networks and the public Internet. Related to this is a trend to allow a single computer to be connected to more than one security enclave. The typical approach is characterized as MILS, which stands for Multiple Independent Levels of Security. With MILS, a trusted secure operating system assures virtual isolation between software applications running on the same computer in distinct security domains.

Certain software resides within a "red" (classified) partition. Other software resides within a "black" (unclassified) partition. The computer itself is connected to both secure and insecure networks. The trusted operating system ensures that black software only communicates with the black network, and red software interacts only with the red network. To ensure that secure information never flows to insecure realms, the secure operating system typically places severe restrictions on the behavior of application software running in the more secure domains. For example, secure software may be prohibited from certain file subsystem, GUI, or network access. Figure 2 shows how a partitioned kernel allows multiple security levels on the same hardware

Using a partitioned kernel to support multiple independent levels of security on a shared hardware platform greatly reduces the costs of security certification. The secure operating system itself must

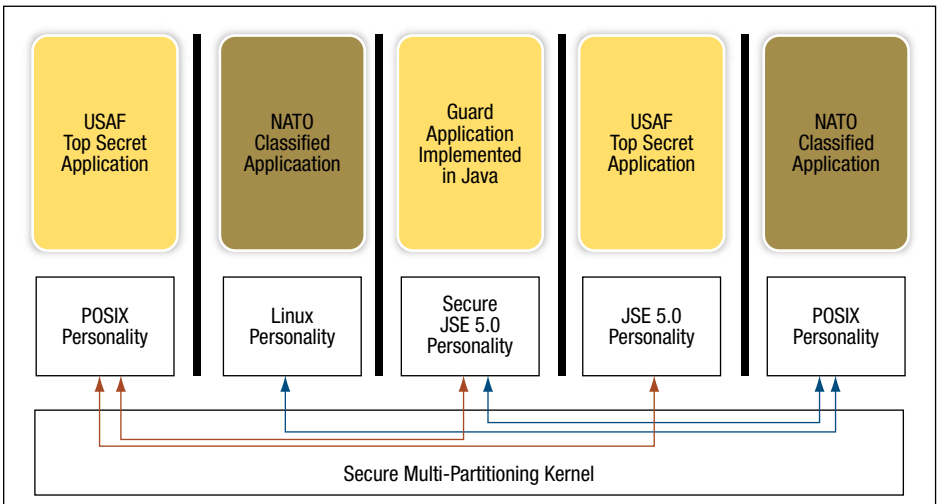

Figure 3

Sometimes application-specific guard software must implement the security policy that is appropriate for each particular circumstance. This guard implemented in Java allows limited communication between security enclaves.

be certified secure, as must be the kernel's configuration choices that determine which partitions are allowed to communicate with other partitions. However, given that the kernel is certified secure, there is no need to certify the application code running within each partition. Since each application can communicate only with other applications running within the same security level, there is no risk that misbehavior of the application will leak secure information beyond the boundaries of its security realm.

Security/Functionality Trade-Offs

The greater challenge to software developers, rather than certifying the application software that runs within the secure partitions, is delivering the necessary functionality to run within each partition. In general, off-the-shelf software will not run within the most secure partitions because the operating system services offered within the most secure operating system partitions are significantly more restrictive than mainstream operating systems. Thus, much of the software that runs in the secure partition must be custom developed.

Java, a hugely popular and portable software platform, supports the ability to deploy software within a secure partition, which greatly simplifies development of software running in secure partitions. When developing new functionality from scratch, typical developers find they are about twice as productive using Java than using C or C++.

Of greater significance, when reusing and integrating existing software components as part of a new development effort, Java developers typically find they are five to ten times more productive than C and C++ developers for several reasons. Java offers superior object orientation, which improves separation of concerns between independently developed components. The language also provides better portability, which makes it easier to reuse software originally developed and tested on a different operating system. And finally, Java offers improved generality, which enables reuse of the software even in situations that do not exactly match the original development requirements.

Porting and Reusing Components

This flexibility of Java enables easy porting and reuse of existing software components and entire applications. Because of these known benefits of Java, it is the most popular language in use today and is the most common language for undergraduate education in computer

science and software engineering. Use of Java means it is easier to recruit competent developers and find open-source and commercially licensed reusable off-the-shelf software components.

Though a secure partitioned kernel does a good job of emulating the traditional approach of physical isolation to assure independent security enclaves, it does not solve the problem of deciding when communication can be allowed between distinct security enclaves. There are many situations where limited communication between different security levels is highly desirable. Such instances include situations where unclassified information—such as weather satellite images—might need to flow into a secure environment, for example, planning a targeted bombing mission.

Meanwhile secure information—gathered by a top-secret U.S. Air Force reconnaissance fly-over—might need to flow to a less secure (NATO classified) domain. The operating system cannot determine which information is allowed to flow because the security policies are highly application dependent. Thus, application-specific guard software must implement the security policy that is appropriate for each particular circumstance. Figure 3 shows how a guard implemented in Java allows limited communication between security enclaves.

Java More Secure than C/C++

Though this guard software can be written in any language, Java is a particularly good choice because Java represents a much more secure programming environment than C or C++. Unlike C and C++, Java has a byte-code verifier that prohibits unsafe type coercions and address arithmetic, a run-time environment that checks for null pointers and out-of-bounds array subscripts, an automatic garbage collection system that guarantees the absence of dangling pointers, and compiler enforcement that applications handle declared exceptions. Java completely eliminates many of the most common mechanisms exploited in popular virus and Trojan Horse applications. Implementing guard software in Java is thus easier than implementing the guard software in C or C++. For similar reasons, it is less costly to certify the security of a guard written in Java.

When auditing the security of guard software implemented in Java, it is important to recognize that as far as the security model is concerned, the Java virtual machine must be treated as a part of the guard application. Flaws in the JIT translator, garbage collector, or standard libraries could, for example, allow inappropriate information to leak from a more secure domain to a less secure domain. To deploy guard software implemented in Java, the underlying Java virtual machine must be subjected to the same levels of scrutiny as the application software itself. Note that Figure 3 labels the guard's Java personality as secure to emphasize this fact.

Pruning out Generality

To make certification of a Java virtual machine economically viable, it is desirable to prune out generality that is not required by the guard application. For example, a typical guard application may not require dynamic class loading, JIT compilation, reflection, or file system access. Removing this unnecessary capability from the Java virtual machine before subjecting the software to a security audit greatly reduces the costs of certification. Careful selection of a Java virtual machine will enable these customizations without sacrificing efficiency. For example, some mission-critical Java virtual machines can be configured to pre-link and pre-compile the entire application.

In summary, secure partitioned kernels provide critical infrastructure to enable multiple levels of security to run on shared hardware. Integrating a Java virtual machine within a secure partitioned kernel makes the most of this environment by simplifying software development, easing integration of off-the-shelf software capabilities and reducing the costs of security certification. ■■

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System Development

Simulation & Test and I/ITSEC Products Preview

Simulation and Training Systems Take a PC Twist

Applications running on high-end PCs and servers now dominate the military/aero simulation and training realm. Products to be showcased at this year's I/ITSEC show exemplify that trend.

Jeff Child,
Editor-in-Chief

Long gone now are the days when it took a large multi-board chassis' worth of electronics to drive a military simulation program. By leveraging advanced commercial graphics silicon targeted for PCs and game boxes, military graphics subsystem integrators are able to blend a wealth of graphical and video features into the popular PMC mezzanine form factor. In the past couple years, the move has come full circle to where PCs and servers themselves have become the preferred platform for simulation and training software.

Part of that trend also includes gaming software technologies ramping up their impact on military simulation system development. Today the PC gaming and game box market provides a satisfactory view of what can be done in terms of simulator realism. And now many components and technologies that comprise those advanced consumer games are becoming available for defense industry military simulation software vendors to build upon. A number of solutions showcased at next month's Interservice/Industry Training, Simulation and Education Conference (I/ITSEC) exemplify these trends.

Image Generation Solution

Among the products Quantum3D will have on display at the I/ITSEC show is its Independence IDX 4000 ER Image Generator (IG). The 4000 ER (Figure 1) is suited for a wide range of mission-critical military and civilian applications that require synthetic environment simulation, training, or mission rehearsal. The system is designed for fixed- and rotary-wing aviation simulation and training; weapons systems and gunnery training; hardware-in-the-loop sensor simulation; military ground vehicle training; and ship's bridge simulation and training.

The system can be scaled from 1, 2, 4, or 8 IGRs per channel working in parallel and provides for customization of each visual environment's need. The 4000 ER uses up to five times less vertical rack space than competitive image generators. The system's consolidated Independence Centralized Storage Architecture (CSA2) provides centralized, convenient and removable RAID subsystems.

A version of the Independence was selected by Northrop Grumman as the upgraded image generator in its Pilot Evaluation Simulator (PES) for the B-2 stealth bomber (Figure 2). Northrop Grumman is leveraging Quantum3D's Independence 3500 solution, an upgrade from its previous installation of the Independence 2500 in early-2005.

Figure 1

Independence IDX 4000 ER Image Generator (IG) is designed for fixed- and rotary-wing aviation simulation and training, and numerous other military simulation roles. The system's consolidated architecture provides centralized, convenient and removable RAID subsystems.

The upgrade means that the PES will benefit from a higher performance simulator with a greater polygon count. These improvements include volumetric clouds and other enhanced weather plug-ins provided by Quantum3D's Mantis software, such as shader-based rendering for enhanced lighting effects and anisotropic filtering for more realistic surface effects. The net result will be industry-leading performance and features with image quality sustained at a 60 Hz frame rate. The Independence 3500 IG features NVIDIA QuadroFX Graphics Subsystems configured in a unique system-level, parallel-rendering architecture.

Radar Simulation System

Blue Ridge Simulation (BRS) meanwhile plans to have its High Performance Radar Simulation System (Figure 3) on display at I/ITSEC. The company's Digital Radar Landmass Simulator (DRLMS) accurately simulates real-world terrain and cultural feature returns, as well as weather patterns and targets. Configurable parameters allow realistic simulations for a wide range of radar types, including sophisticated fire control radar simulation systems, search radars, navigation radars, high-resolution Synthetic Aperture Radar (SAR) and Inverse Synthetic Aperture (ISAR) applications. All systems can be customized for each application and support a variety of video interfaces for use with either actual or simulated aircraft displays.

The BRS DRLMS model provides realistic radar modeling, including effects such as range attenuation, 4/3 Earth radius horizon, shadowing, grazing angle attenuation, pulse width effects, antenna pattern effects, radar characteristics—such as STC, AGC, noise and so on—and far shore brightening. The system supports a variety of video interfaces including ARINC 708 (453), RS-170/NTSC/RS-343/PAL, VGA/SVGA, multiple display channels and custom formats.

For its part, NGRAIN, a vendor of 3D performance support solutions, plans to unveil at I/ITSEC its new Virtual Damage Assessment application, currently being used by the Joint Strike Fighter program. The application is designed to help technicians accurately capture, record and track damage assessment information. Back in February, Lockheed Martin selected NGRAIN to provide a customized version of their commercial off-the-shelf 3D visualization and annotation software as part of the F-35 Lightning II (Figure 4) Autonomic Logistics Information Systems ("ALIS") program. ALIS, the information infrastructure for the F-35, also known as the Joint Strike Fighter, provides core functionality for maintenance, supply and training operations to aircraft technicians worldwide.

Figure 2

A B-2 Spirit bomber comes in for a landing at Nellis Air Force Base in Nevada.

NGRAIN's software is used by aircraft maintainers to record damage and repair details on an aircraft faster and more accurately by marking up a virtual 3D model of the aircraft. The 3D model provides maintainers with easy access to highly accurate damage and repair status and history of the aircraft. This means maintainers are able to assess which damages are in need of immediate repair more efficiently and accurately, and they will also be able to interactively reference the aircraft damage and repair information at other operating locations.

Meanwhile at I/ITSEC, Presagis, a provider of modeling, simulation and embedded display graphics software, will showcase Aeria, the company's vision for an M&S workflow. Aeria brings together a singular portfolio of software into an open, scalable and reusable environment. Virtually any GIS data, sensor material, or existing synthetic environment database can be imported into the Aeria workflow. Using Presagis Creator, developers can add highly realistic and accurate 3D OpenFlight models to simulations, including buildings, building interiors and vehicles. GIS data and 3D models can then be organized, processed, rendered and exported using Terra Vista. These can be exported as correlated terrain databases for a wide number of formats including OTF, CTDB, JCATS, OpenFlight or TerraPage. Terra Vista may also be used to produce a Common Database (CDB). Once a CDB is created it can be used at runtime by simulation or visualization clients.

Common Database Advantage

Drawing directly from the CDB in real time, Aeria lets developers build simulation scenarios using STAGE Scenario and AI.implant. Photorealistic graphical interfaces can be added to the simulation using VAPS XT. All Aeria applications are interoperable out-of-the-box either through DIS or HLA. Users can also integrate third-party products with a larger variety of networks (even rare proprietary specific protocols) using Presagis SIM OneNet. The Aeria workflow has the capability to interoperate with third-party or proprietary network protocols to monitor, collect and re-inject information.

Concurrent Computer, meanwhile, will showcase at I/ITSEC its latest advancements in COTS PC-IG (image generation) and simulation host systems. The company's ImaGen visual servers offer outstanding fidelity with state-of-the-art graphics technology along with iHawk host systems both offering high performance—ideal for taking full advantage of today's multicore technology. New ImaGen visual servers will be on display featuring compact systems and running the latest version of Concurrent's RedHawk Linux.

Figure 3

Blue Ridge Simulation's Digital Radar Landmass Simulator (DRLMS) accurately simulates real-world terrain and cultural feature returns, as well as weather patterns and targets. Configurable parameters allow realistic simulations for a wide range of radar types.

Figure 4

NGRAIN's Virtual Damage Assessment software application, currently being used by the Joint Strike Fighter program, is designed to help technicians accurately capture, record and track damage assessment information. NGRAIN's software is used by aircraft maintainers to record damage and repair details on an aircraft faster and more accurately by marking up a virtual 3D model of the aircraft.

RedHawk Linux 5.2's new features include enhanced 2.6.26 Linux kernel version, full compatibility with Red Hat Enterprise Linux 5.2, the latest NVIDIA graphics drivers optimized for real-time performance, and support for the latest Intel and AMD processors and chipsets. The system provides Precision Time Protocol (PTP) support as defined in the IEEE 1588 standard, providing very precise synchronization of multiple systems on a network, for example, a distributed training environment. The unit has the ability to synchronize multiple platforms via Concurrent's Real-Time Clock & Interrupt Module fiber cable. The system offers improved memory shielding support for Non-Uniform Memory Architecture (NUMA) platforms. ▮▮

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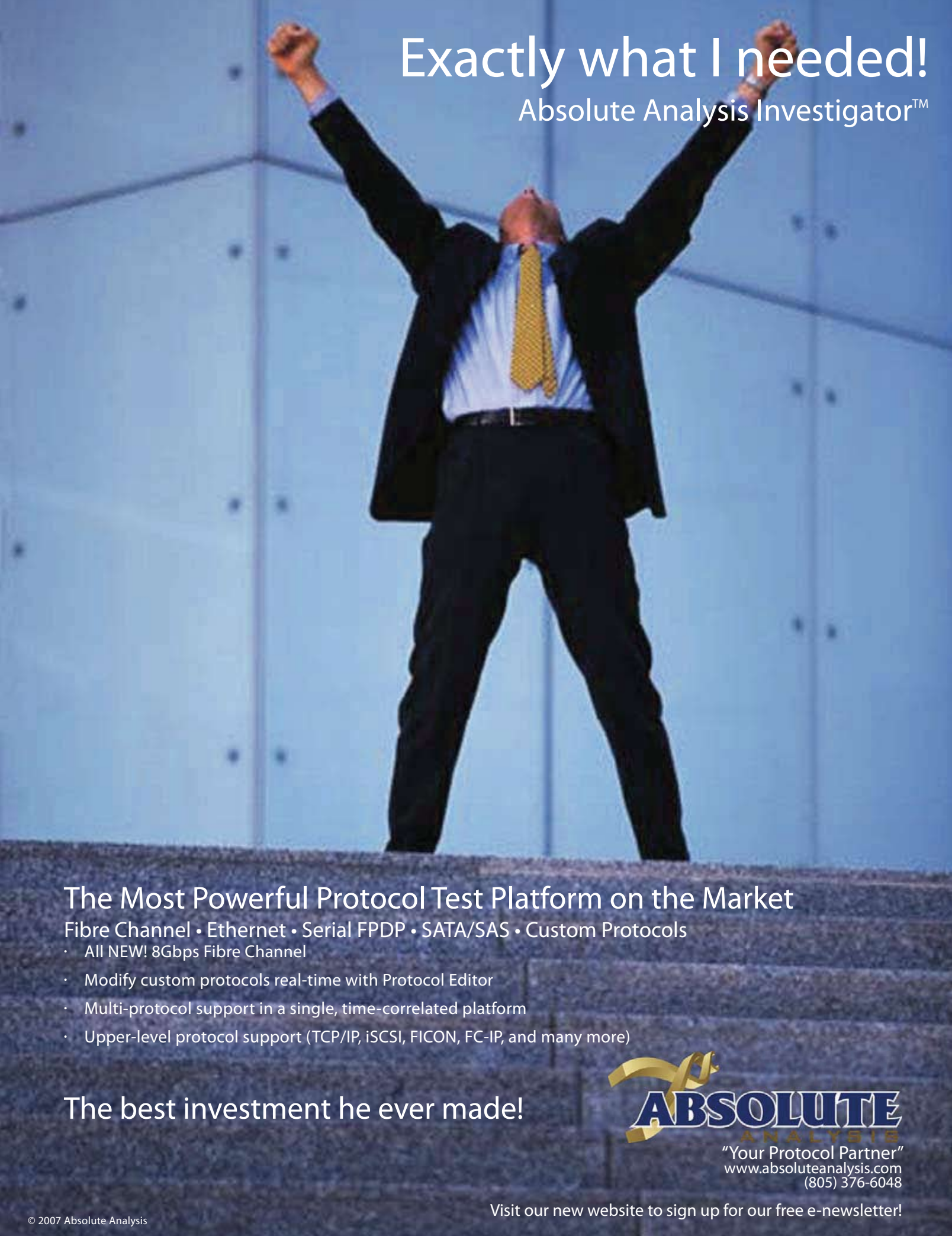

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Technology Focus

Rugged Box-Level Systems

Rugged Box-Level Systems
Expand Their Sphere of Influence

As demand grows for more complete solutions, the embedded computing industry is ramping up its stake in stand-alone rugged box-level system products.

Jeff Child,
Editor-in-Chief

Within the last two years the concept of "Stand-Alone Rugged Boxes" has become a fixture in this market. The trend has now broadened out to include a larger contingent of smaller form factor board vendors. The term stand-alone rugged boxes applies to complete system boxes—which often support standard form factor boards inside them. These systems provide a complete, tested and enclosed computing solution that eliminates complex integration chores for military customers. This idea has been gathering momentum in the past couple years whereby traditional embedded board vendors are adding stand-alone rugged box-level systems to their military market offerings

As the product roundup in this section shows, at present, there are more than a dozen vendors that have some sort of stand-alone rugged box-level system in their offerings—many even have whole product lines in that category. As a product category, stand-alone rugged boxes are somewhat difficult to define because they're available in a variety of shapes, sizes and capabilities. They typically comprise a set of modular embedded boards housed in a rugged enclosure that has its own power supply and interface ports to link to a variety of user terminals.

Often the boards in the box are standards-based cards such as PC/104, PMC and 3U CompactPCI. But the enclosures by and large aren't in any industry standard footprint, although that may change as standards like MicroTCA and some box-level VITA standards gain acceptance in the military realm. Recently a number of vendors from the PC/104 community have joined the stand-alone rugged box trend. This stacked multi-board PC/104 architecture provides for a shock- and vibration-resistant off-the-shelf computing solution by eliminating backplanes and metal card cages, making PC/104 ideal for military vehicles such as tanks or even Humvees.

Earlier this month—on Election Day in fact—this topic of complete integrated systems was discussed at a luncheon panel session (Figure 1) at RTC Group's Real-Time Embedded Computing Conference (RTECC) in Reston, VA. The panel discussed how stand-alone rugged box solutions have emerged as a second center of gravity alongside SBCs. Board-level systems, according to the panel, remain tremendously important—and active—especially in the areas of tech upgrades and tech refresh where board-level products shine. But some new military programs are opting for complete box-level systems—and some older programs are shifting from a slot-card scheme to a box-level implementation. The panel also discussed the technology forces that have brought this trend toward integrated system solutions into the forefront—such as FPGAs and the emergence of multi-function boards. Also analyzed by the panel was the issue of how mergers and acquisitions in the embedded computing industry pushed forward this trend toward integrated solutions. ▮▮

Figure 1

A luncheon panel at RTC Group's RTECC show in Reston, VA discusses the trend toward complete integrated system solutions. From left to right: John Sayer, Xembedded; Rodger Hosking, Pentek; Robert Reilly, Mercury Computer Systems; Jim Ison, One Stop Systems; Leslee Schneider, Quantum3D; and moderator Jeff Child, *COTS Journal* Editor-in-Chief.

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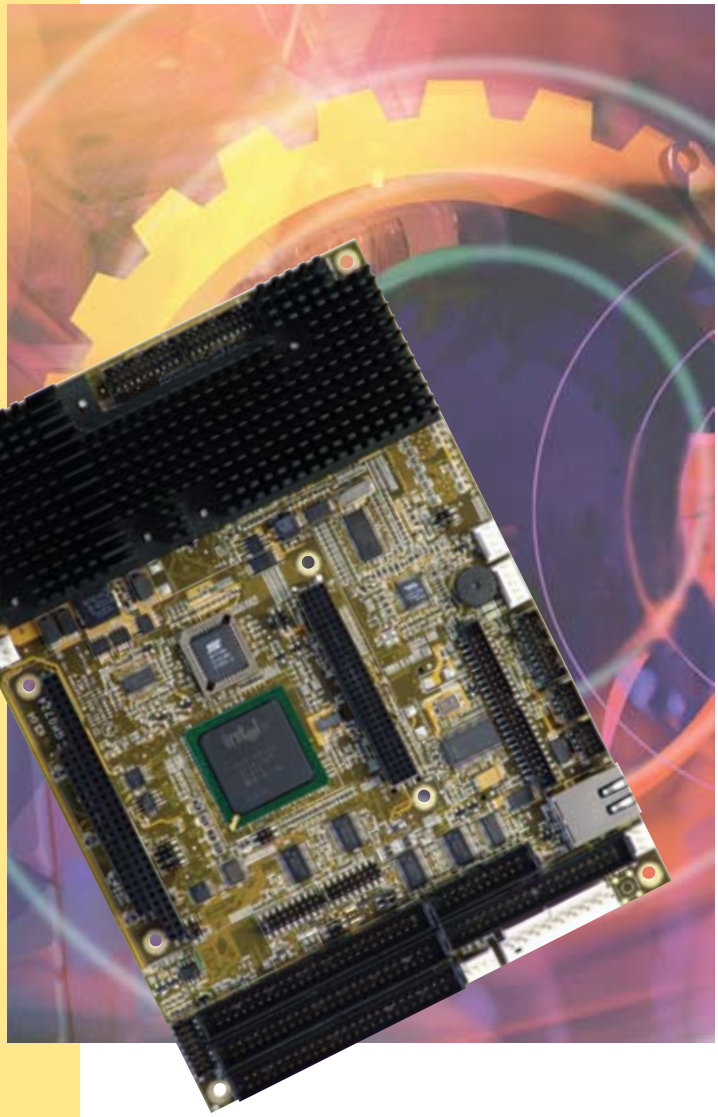

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Technology Focus:

Rugged Box-Level Systems Roundup

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

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

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

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

Box-Level System Embeds Core2 Duo, PCI Express

The multicore processor trend has sunk its teeth deep into the military embedded computer realm. Adlink technology has made available a rugged system based on the Intel Core2 Duo processor and GME965 chipset. The Ampro by ADLINK RuffSystem 840 integrates dual-core processor, RAM, graphics, networking, and PCI Express expansion in an Extreme Rugged enclosure that operates from -40° to +75°C. Designed for extreme rugged environments, the RuffSystem 840 showcases the Intel Core2 Duo L7500 1.66 GHz 45nm processor with support for 4 Mbytes of on-chip L2 cache, 800 MHz FSB (front side bus), and two SODIMM sockets for up to 4 Gbytes of DDR2 RAM. The board's built-in graphics display subsystem utilizes Intel's GMA950 with 224 Mbytes of 64-bit video RAM, and can drive CRTs, flat panels, and wide screen digital TVs at resolutions of up to 2048x1536 including 1920x1080 at 85Hz (HDTV) on CRTs. An onboard video encoder adds TV-out capabilities such as HDTV (420p, 720p, and 1080i), Component, and S-Video.

The RuffSystem 840 also packs a broad complement of I/O, including two gigabit Ethernet ports, eight USB 2.0 channels, DVI, VGA, Multiple LVDS, HD audio, 4 serial ports, two supporting RS-232/422/485, parallel interface, and two SATA II and one UDMA EIDE interfaces. The system also provides flexible expansion via Compact Flash socket, PCI Express Mini Card and Mini-PCI slot.

Adlink Technology
Irvine, CA.
(970) 377-0385.
[www.adlinktech.com].

System Embeds Stacked PCI-104 Modules

Many military applications depend on reliable data acquisition, along with resistance to extreme temperature fluctuations, shock and vibration. To meet this demand for a highly modular, compact and rugged solution, Advantech has added a new compact embedded computer to its ARK-4000 product series. The ARK-4180 is a PCI-104-based solution with high vibration/shock resistance and wide temperature capability. The ARK-4180 with Intel Celeron M 1.0 GHz processor can operate in temperatures ranging from -40° to 75°C, providing high processing performance in a compact, rugged enclosure.

The ARK-4180 is developed from PCI-104 stackable modules that are designed and qualified for demanding applications. The PCI-104 form factor allows modules to stack vertically to provide a naturally rugged architecture. Each system is housed in a specially cast and milled solid aluminum block with thermal fins that help dissipate heat. Another feature is the specially designed fanless thermal solution with embedded heat pipes, which allow wide temperature operation without active cooling. The ARK-4180 supports six USB 2.0 and two RS-232 connectors, 10/100Base-T Ethernet LAN and VGA for versatile connectivity. It supports one PCI-104 connector for expansion, and by adding another enclosure layer, up to two more PCI-104 modules can be stacked.

Advantech
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Pre-Qualified Rugged System Is 3U cPCI-based

One level of added-value that can be added to stand-alone rugged box systems is the benefit of pre-testing and pre-configuration. Along just those lines, Curtiss Wright earlier this year rolled out the first member of a new family of Packaged COTS (PCOTS) fully integrated rugged subsystems. The new PowerPC-based Multi-Platform Mission Computer-9350p (MPMC-9350p) and Intel-based MPMC-9350i PCOTS subsystems are flexibly configured five-slot 3U CompactPCI (cPCI) subsystems housed in a sealed, light weight, compact chassis fully preconfigured with power supply and a wide range of I/O.

The rugged MPMC-9350 family is designed to meet the harsh environments of many military and aerospace computing applications. To ensure the highest levels of performance, the MPMC-9350 has been designed to meet or surpass DO-160E Environmental Conditions for Airborne Equipment. The main processing power of the MPMC-9350p is provided by up to three Freescale 7448 PowerPC-based DCP-124 and DCP-124P SBCs. The DCP-124P peripheral-only processor is a variant of Curtiss-Wright's standard DCP-124 SBC and supports PMC I/O, dual Ethernet channels, and a USB 2.0, RS-232 and dual RS-422 ports. The MPMC-9350p and MPMC-9350i can be ordered with a modified front panel connector set, modified backplane wiring or a modified card set to fit a unique application's exact needs. Most configurations of the MPMC-9350p and MPMC-9350i are priced between $40,000 and $60,000.

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[www.cwcembedded.com].

Family of Rugged 3U and 6U Chassis Are Customizable

Every military system design has its own little unique part that needs some level of custom work. Feeding that need, GE Fanuc offers a family of rugged systems and enclosures. The system chassis are all supplied with a backplane, power supply, I/O wiring and necessary connectors. They are available with VME or CompactPCI backplanes for 3U or 6U COTS boards. These ruggedized COTS chassis are designed to support GE Fanuc systems that will be deployed in harsh environments like submarine and naval applications, sonar and radar systems, land based and avionic and aerospace systems in combat ground vehicles and UAVs. Because all of these systems chassis use standard backplane technology like CompactPCI and VME, customers can choose just the right embedded COTS boards for their customized designs and quickly field their applications.

These rugged systems chassis are ready for system customization and include the 3 slot 3U conduction-cooled RCBC03, 3 slot 3U conduction-cooled RCBC03 with fastening footpads, 3 slot 6U conduction-cooled RCCC03, 7 slot 6U conduction-cooled RCFC07, 8 slot conduction-cooled 6U RCFC08, 12 slot ATR conduction-cooled 6U RCFC12, and the 17 slot convection-cooled 6U RCFA17 chassis.

GE Fanuc Embedded Systems
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(800) 368-2738.
[www.gefanucembedded.com].

Rugged Box-Level System Targets Avionics

Stand-alone rugged box systems have entrenched themselves as a major product category in the military embedded marketplace. Kontron's latest offering along those lines is the Kontron MEC-PPC-AV1, a completely rugged Modular Embedded Computer (MEC) specifically targeted toward avionics applications. The Kontron MEC-PPC-AV1 is a low-cost 3U CompactPCI rugged subsystem designed to exceed requirements through its compact dimensions, low-power dissipation and real-time software with a very large I/O offering.

The Kontron MEC-PPC-AV1 is targeted toward the avionics market because of its ATR footprint dimensions, 28 VDC power supply, lightweight structure in aluminum, conduction-cooled dissipation, MIL-STD-1553 links, MIL-C-38999 connectors and a very low power consumption of less than 17W.

The Kontron MEC-PPC-AV1 hosts a Kontron 3U CompactPCI Single-Slot PowerEngineC7 Embedded Computer, a low-power dissipation and high-performance processor board already embedded in major avionics programs. The PPC-AV1 offers a large range of I/Os such as Ethernet, general-purpose I/Os, serial lines and MIL-STD-1553 links thanks to the Kontron CPMC-1553-R PCI Mezzanine. The Kontron CPMC-1553-R is a redundant MIL-STD-1553B interface with two channels. The PMC module has a 32-bit, 33 MHz PCI interface and a parallel 8-bit TTL I/O port.

Kontron America
Poway, CA.
(858) 677-0877.
[www.us.kontron.com].

Ultra-Compact Rugged Computer Delivers 172 GFLOPS

The processing muscle of FPGAs has moved the game when it comes to packing massive amounts of computer density into a small space. Mercury Computer Systems exemplifies that trend with its PowerBlock 50 real-time computing system. Measuring approximately 4- x 5- x 6-inches and weighing less than 7 pounds, the PowerBlock 50 has six slots for control, processing, or storage modules, interconnected by a high-bandwidth PCI Express switch fabric.

Module options include a Freescale PowerQUICC III processor, a Xilinx Virtex-4 FX-60 Series FPGA, a Virtex-4 FX-100 Series FPGA, a P.A. Semi PA6T-1682M vector processor, a SATA drive with 250 Gbytes of hard drive storage and a SATA SSD with 128 Gbytes of solid-state drive storage. A maximum performance configuration of the PowerBlock 50 is achieved with six Vector-2000 modules, delivering a total of 172 GFLOPS from the 1.8 GHz dual-core processors. External I/O and networking is provided through the use of integrated daughtercards attached to the processing modules. The initial daughtercard configuration includes Gigabit Ethernet and RS-232 interfaces. The PowerBlock 50 chassis is designed throughout to isolate its internal electronics from all external environmental and physical conditions, allowing deployments in harsh environments. Availability of a conduction-cooled chassis is planned for early 2009.

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

Fanless System Targets Rugged, Space-Critical Apps

A fanless, rugged system that supports two PCI expansion cards in one compact chassis targets space-critical, mission-critical applications requiring fanless operation, extreme reliability, low power operation and versatile I/O configuration, such as access control and security in transportation vehicles. The NISE 3100-P2 from Nexcom is based on Intel's Pentium M/Celeron M processor with 400 MHz FSB. The system supports either a Pentium M from 1.6 to 1.8 GHz with up to 2 Mbytes of L2 cache or a Celeron M from 1.3 to 1.5 GHz with up to 1 Mbyte of L2 cache, as well as LV and ULV versions of both CPUs. DDR 200/266 memory up to 1 Gbyte, one CompactFlash socket and a 2.5-in. hard disk drive bay are also included.

Housed in a compact 195 mm x 268 mm x 107 mm heavy-duty aluminum chassis, this system provides a wide variety of connection options with I/O ports located at both the front and rear of the unit. These include two 10/100 Ethernet LAN ports, six USB 2.0 ports (two front, four rear), VGA, TV-out interface and direct LVDS output via a DB44 connector. For added flexibility, the NISE 3100 also boasts three RS-232 ports, one RS-232/422/485 port and two 32-bit/33 MHz PCI expansion slots. DC to DC power is designed for onboard support of 12 VDC to 30 VDC, maximum 120 watts. Pricing starts at $450.

Nexcom UK,
Newport Pagnell, UK.
+44 (0) 1908 218914.
[www. nexcomuk.co.uk].

Expandable Rugged Box Boasts Wide Temp Range

A high-performance mobile server is the latest member of Octagon Systems' Core Systems line of rugged systems with expandable I/O and fanless operation. The RMB-S is a "no compromise" design that optimizes the electrical, thermal and mechanical components for maximum reliability.

The basic unit includes the processing power, mobile power supply, memory, connector card and I/O for most applications. Standard I/O includes dual Ethernet, quad USB 2.0, dual serial, CRT & LCD video and digital I/O. The RMB-S is fully functional out of the box, and additional I/O, such as GPS, analog, radio or Wi-Fi, can be readily added via PC/104 and PC/104-Plus modules. An option panel can be easily removed and punched for custom annunciators, connectors and controls. Heat from the system is channeled directly to the case to help prevent internal hot spots. The RMB-S mobile server operates in ambient temperatures from -40° to 70°C, depending upon the processor speed, user options and mass storage devices. A MIL-810F version offers a case with military-grade connectors and gasket sealing to provide dust-resistant, waterproof protection in outdoor environments.

Octagon Systems
Westminster, CO.
(303) 430-1500.
[www.octagonsystems.com].

Processor Platform Targets Ground Vehicle Apps

Systems that must function as onboard military vehicles or aircraft must meet strict requirements for shock, vibration, humidity and extreme temperatures. A rugged processor platform series from Parvus meets MIL-STD-810F requirements for shock/vibration, temperature, humidity and impact compliance. The DuraCor 810 integrates a fanless, low-power x86-compatible processor with a vehicle-class power supply in a shock/vibration-isolated card cage with a hardened finish. Memory includes 128 Mbytes of soldered-on SDRAM and a 512 Mbyte flash disk. PC/104, 100 Mbit/s Ethernet, USB, serial, video, audio and IDE interfaces are provided. Locking MIL-grade circular connectors include hardened RJ-45 Ethernet and USB. Power is supplied from a 50W, 8-40 VDC input DC/DC converter with input protection and automotive transient voltage suppressor. Operating temperature range is -40° to +70°C.

Options include AMD Geode or Intel Celeron or Pentium III processors, integrated cards such as MIL-STD-1553, GPS, FireWire and PCMCIA, an isolated 100W DC/DC power supply and alternate IDE or CompactFlash mass storage. The unit ships with Linux and is hardware-compatible with Windows XPe, Windows CE, QNX and VxWorks. Pricing for the DuraCor 810 starts at $3,499.

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

Third-Gen Thermite Embeds Core 2 Duo, 4 Gbyte/s DRAM

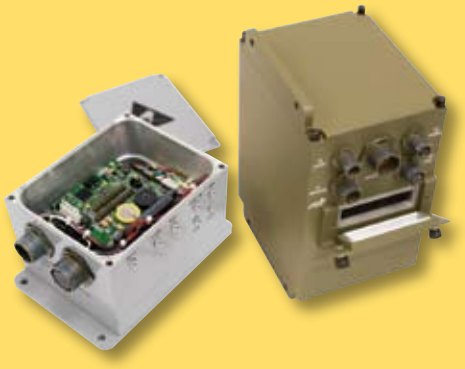
The trend toward stand-alone rugged box-level systems has moved to the forefront of military system design. An early convert to that trend, Quantum 3D has announced its third-generation Thermite Tactical Visual Computer (TVC-3.0) Model 1000, in both deployable units and development kits, is now available for purchase. The 3.0 version is designed to complement the Thermite TVC-2.0 family by providing a range of higher performance models that are optimized for deployed, extended-environment, vehicle-mount and man-wearable advanced visual computing applications. Example applications include embedded training and mission rehearsal, 3D-enabled C4ISR, sensor processing and C2 that require desktop-level visual computing performance in a small form factor, conduction-cooled, mil-spec rugged system.

To support these performance-intensive requirements, Thermite TVC-3.0 systems, including the Model 1000, are available with CPU/memory modules equipped with the latest Intel mobile processors including Core 2 Duo processors with up to 4 Gbytes of high-performance system memory, graphics modules with either NVIDIA or AMD advanced mobile 2D/3D GPUs with up to 256 Mbytes of memory and FPGA-based processing subsystems including Quantum3D's Eidetix advanced, video capture and display subsystems. International, single-unit pricing for Thermite TVC-3.0 Model 1000 systems starts at under $15,000, and it is available for delivery with standard lead times in low volumes.

Quantum3D
San Jose, CA.
(408) 361-9999.
[www.quantum3d.com].

PC/104-Based Rugged Boxes Are Ready for Rough Duty

Stand-alone, ruggedized systems have become a go-to for military and industrial customers who need solid, turnkey solutions. RTD Embedded Technologies makes box-level PC/104-based systems qualified for demanding applications like military vehicles. RTD's rugged HighRel line of systems is built using frames milled from solid aluminum blocks to exacting specifications ensuring that the solution is rugged and reliable. Frames for thermally sensitive components have internally milled heat sinks and embedded heat pipes to move heat to the outside walls of the enclosure, allowing operation from -40° to +85°C without the use of active cooling. Optional shock-mount bases withstand specific shock and vibration specifications.



RTD's IDAN box-level product consists of any RTD PC/104, PC/104-Plus, or PCI-104 boards mounted in its own frame and wired to the standard PC connectors on that frame, thus eliminating the need for module-to-module wiring inside the case. This solution maintains PC/104's modularity and lets system designers configure a system as rapidly as one would configure a stack of boards. The product line is also available in a watertight version, HiDANplus, with environmental sealing and EMI suppression O-rings coupled with MIL I/O connectors. HiDANplus does inter-module communications via a custom wiring harness that is enhanced by an internal 100 pin stackable signal raceway.

RTD Embedded Technologies
State College, PA.
(814) 234-8087.
[www.rtd.com].

Enclosed Celeron M SBC Boasts Fanless Operation

As a general rule, fan-cooled computing systems are frowned upon by all but the most benign military applications. Serving the need for low-power, fanless operation, WIN Enterprises offers an enclosed computer designed for the embedded OEMs designing applications for harsh environments. The PL-06058 is powered by an 34W Intel Celeron M ULV or Pentium M processor with low power requirements. The fanless unit provides silent operation where ambient noise is unwanted. Internal heat pipes conduct heat to the aggressive heat-sink design of the rugged aluminum enclosure.

The PL-06058 is an enclosed version of WIN's popular IP-06058 single board computer (SBC). The PL-06058 is suited for scientific, military and aerospace applications. The compact unit supports a CompactFlash socket, Mini-PCI slot and up to 1 Gbyte of DDR RAM. Also featured are: one 10/100 Ethernet port, four serial ports, one parallel port, an IDE interface, three USB 2.0 ports and a FDD interface packaged into an industrial grade enclosure of 12.3 (width) x 5.5 (depth) x 2.6 (height) inches. Pricing for the PL-06058 ranges from $533 to $552.

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

Economical PC/104 Enclosure Has Multiple Configuration Options

An often overlooked aspect of military system design is that not all applications require costly, battlefield-ready configurations. There's a wide range of more modest requirements. Responding to the need for a simple, low-cost enclosure for PC/104 modules, WinSystems today introduces the ENC-104. It is designed for embedded applications requiring mounting inside NEMA boxes, OEM machinery, wiring closets, equipment rooms, and other areas where it is necessary to protect a PC/104 embedded PC module stack. The ENC-104 allows a designer to package a variety of system configurations to quickly and easily take full advantage of the reliability, modularity and small size (90 mm x 96 mm) of PC/104 and PC/104-Plus modules.

The ENC-104 is small and lightweight yet designed for strength, durability, and functionality. Fabricated from 0.0625-inch rustproof 5052 aluminum, it weighs less than two pounds (without PC/104 modules installed). The enclosure's dimensions are 7.725- x 8.325- x 4.0-inches. The enclosure is made of 5 items: chassis base, chassis cover, two end plates and a square PC/104 module stack plate. The chassis cover can easily be removed to provide easy access during development or for maintenance and upgrades. The cover is slotted to allow convection cooling. The ENC-104 is shipped pre-assembled with the appropriate hardware. The unit is easy to mount and only requires four #8 screws. The ENC-104-10's list price is $99.

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

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Compatible XMC Modules from Innovative Integration

X5-400M - 400 MSPS 14-bit A/D (x2) • 500 MSPS 16-bit D/A (x2) • 1GB DDR2 DRAM
X5-210M - 210 MSPS 14-bit A/D (x4) • 512MB DDR2 DRAM
X5-GSPS - 1.5 GSPS 8-bit A/Ds (x2) • 512 MB Memory
X3-10M - 25 MSPS 16-bit A/D (simultaneously sampling x8)
X3-25M - 130 MSPS 16-bit A/D (x2) • 50 MSPS 16-bit D/A (x2)
X3-A4D4 - 4 MSPS 16-bit A/D (x4) • 50 MSPS 16-bit D/A (x4)
X3-DIO - 64-bit 66MHz LVDS
X3-SD - 216 KHz, 24-bit Analog Input (x16)
X3-SDF - 24-bit, Fast Sigma-Delta A/D >110 dB (x4)
X3-Servo - 250 KSPS A/Ds (x12) • 2MSPS DACs (x12)

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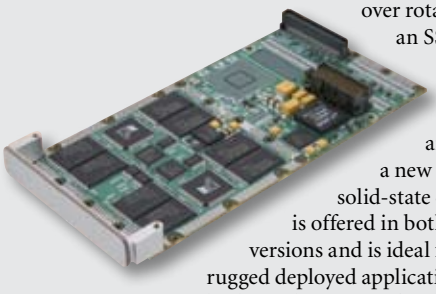
Video Processor Card Gains Image Fusion Capabilities

It's no easy trick to combine images from multiple sensors and cameras and assimilate and interpret that data. Providing the level of real-time processing needed, GE Fanuc Intelligent Platforms announced the IMP20 Video Processing Mezzanine Card. The IMP20 adds image fusion capabilities to the GE Fanuc ADEPT104 and AIM12 automatic video trackers. It allows the design of highly integrated, high-performance graphics capabilities in any environment where the input from multiple devices needs to be fused in order to provide a complete, easy-to-interpret image. When configured with the IMP20, the ADEPT104 and AIM12 automatic video trackers provide a powerful system for detection, tracking, stabilization and fusion that delivers better performance than existing software-based solutions and can be used in harsher environments than other hardware-based solutions.

The IMP20 offers intelligent, real-time, full-frame, multi-resolution image fusion, which aims to maximize scene detail and contrast in the fused output, producing superior fused image quality with maximized information content. The image fusion algorithm embedded into the IMP20 is a new approach to multi-scale fusion that benefits from much faster execution times and reduced memory overheads. The novel algorithm gives significantly improved results over the baseline weighted average algorithm while still performing in real time on live imagery.

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

Rugged XMC/PMC Card Sports 32 Gbyte SSD



The advantages of solid-state disk storage over rotating disks are many. Combining an SSD with rugged XMC sweetens the deal. Along just those lines, Curtiss-Wright Controls Embedded Computing has announced the XMC/PMC-550, a new high-performance, rugged solid-state drive card. The XMC/PMC-550 is offered in both XMC and PMC form factor versions and is ideal for use in legacy and latest rugged deployed applications. The XMC/PMC-550's standard Serial ATA interface enables it to be easily supported and integrated into VME VPX and CompactPCI systems.

The XMC/PMC-550 NAND flash solid-state drive provides up to 32 Gbytes of disk space in an XMC (VITA 42.3) or PMC (IEEE1386.1) form factor. It is available in configurations of 8, 16, or 32 Gbytes, and is visible to the system as two independent SATA drives. Using multi-tasking technology, the XMC/PMC-550 delivers data transfer rates of up to 30 Mbytes/s for simultaneous read to each drive. The XMC/PMC-550 also comes with RAID 0 support that stripes data across the two independent SATA drives for maximum performance. With RAID 0, the 550 can achieve read transfer rate of up to 50 Mbytes/s. Pricing for the XMC/PMC-550 starts at $2,495.

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

PXI Card Blends Boundary Scan and Dynamic Functional Test

System developers can now get more bang for their buck when it comes to test instrumentation gear. That's because multi-functions are now available on boards that used to require several. Goepel Electronic has launched a new series of JTAG Digital I/O PXI modules named PXI 5396-x. The PXI 5396-x modules offer 96 individually configurable single ended channels and support the structural JTAG/Boundary Scan test as well as dynamic I/O operation up to 100 MHz to execute functional tests.

PXI 5396-x are 1-slot 3U modules, which differ in onboard memory depth of 72 Mbytes (PXI 5396-X) and 144 Mbytes (PXI 5396-XM). All modules offer 96 single ended channels configurable as input, output and tri-state, which allow simultaneous driving, measuring and real-time comparison. While the signals are processed to test bus operations completely synchronous in the JTAG mode, the dynamic I/O mode enables functional testing with freely programmable clock frequencies from 500 Hz to maximum 100 MHz. That's why, first structural Boundary Scan tests and afterward functional tests can be executed with the same instrument.

Goepel Electronic, Jena, Germany. +49 03641 6896-739. [www.goepel.com].

FPGA AMC Module Features Optical Transceivers

System design used to mean the realm of the system box. Now complete military systems can reside on a single FPGA-based card. Along just such lines, BittWare has introduced its newest AdvancedMC module: the SF/GX-AMC (SF/GXAM). The SF/GXAM features four small form-factor pluggable-plus (SFP/SFP+) transceivers enabling support of virtually any serial communication standard, including Fibre Channel, Gigabit Ethernet, SONET, CPRI and OBSAI. The four SFP/SFP+ SerDes channels are connected directly to the onboard Altera Stratix II GX FPGA, which handles the higher level communications protocols.

Based on Altera's Stratix II GX FPGA, BittWare's SF/GX-AMC (SF/GXAM) is a full-size, single-wide AdvancedMC that can be attached to AdvancedTCA carriers or other cards equipped with AMC bays, and used in MicroTCA systems. The SF/GXAM provides a four-cage SFP/SFP+ connector on the front panel with each transceiver providing support for virtually any serial communication standard, including: Fibre Channel, Gigabit Ethernet, SONET, CPRI and OBSAI. The four SerDes channels are connected directly to the Stratix II GX FPGA. The SF/GXAM will begin shipping Q4 2008 priced under $4,000 in OEM quantities.

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

Family of 14 Data Acquisition Devices Leverages USB

Thanks to USB, military test engineers can craft instrumentation systems on the desktop instead of piecing together racks of boards and backplanes. Feeding such needs, Measurement Computing has announced 14 new high-performance, multifunction and special-purpose USB-based data acquisition products, targeting applications requiring high accuracy, measurement repeatability and high throughput. The list includes: high-channel-count and high-accuracy analog input and thermocouple measurement devices; several high-speed, simultaneous sampling, multifunction devices; and an eight-channel, simultaneous input quadrature encoder counter.

The new devices are supported by the Universal Library, programming libraries and drivers for most popular Windows-based programming languages. In addition to the Universal Library, all the new USB DAQ modules ship with an impressive array of software, including TracerDAQ, a full-featured, data logging, viewing and analysis application; Universal Library for LabVIEW, VIs and program examples for LabVIEW; InstaCal installation, calibration and test utility; and support for DASYLab, icon-based data acquisition, graphics, control and analysis software, and Measurement Studio MCC Edition, Visual Studio 2005/2003 components and controls optimized for test, measurement, analysis and presentation—powerful software solutions for programmers and nonprogrammers alike.

Measurement Computing, Norton, MA. (508) 946-5100. [www.mccdaq.com].

First Stand-Alone High-Resolution LXI Digitizers Roll

No longer the new kid on the block in the instrumentation world, LXI has emerged as an essential tool for LAN-based military instrumentation projects. Agilent Technologies has introduced the first stand-alone high-resolution digitizers with LXI connectivity for R&D and manufacturing engineers. These LXI digitizers are the choice of instruments when digital multimeters cannot sample fast enough, or oscilloscopes cannot provide high enough resolution for the waveform analysis requirements.

The Agilent L4532A 2-channel and L4534A 4-channel digitizers are new, high-performance, stand-alone LXI digitizers that offer simultaneous sampling at up to 20 MS/s, and with 16-bit resolution. The isolated input channels can measure up to ±250V and are designed to handle demanding applications requiring electromechanical device control for product test or characterization. The Agilent L4532A and L4534A are fully compliant with the LXI class C specification. They include USB 2.0 and Gigabit Ethernet (LAN) interfaces as standard features, enabling quick and simple connectivity to a PC or a network. In addition, they can be remotely operated from any browser by simply connecting to the built-in Web page. The Agilent L4532A 2 channel 20 MS/s digitizer is priced at $6,500, and the L4534A 4 channel 2 0MS/s digitizer is $8,500. Extended memory is an additional $1,500.

Agilent Technologies, Palo Alto, CA. (650) 752-5000. [www.agilent.com].

Multi-I/O 1553/ARINC429 Functions Climb Aboard PCI

The magic of semiconductors has enabled board designers to fit multiple avionics and military I/O functions on one board. Exemplifying that trend, Data Device Corporation (DDC) has introduced a new multi-I/O PCI Card. The BU-65590I card provides up to four dual redundant MIL-STD-1553 channels, sixteen ARINC 429 receive channels, four ARINC 429 transmit channels, six user programmable Digital Discrete I/Os, two RS-232 Serial I/O Channels, two RS-422/485 Serial I/O Channels, and an IRIG-B time synchronization input.

Each 1553 channel can emulate a Bus Controller, Remote Terminal, or a Bus Monitor. The card includes a combined RT/Monitor mode to monitor all 1553 communications on the bus including the 1553 channel's own RT address. The card has an intelligent hardware offload DMA architecture that dramatically reduces host CPU and PCI bus utilization while storing 1553 monitor data in a convenient and portable IRIG-106 Chapter 10 file format. Each ARINC 429 channel supports high/low speed operation, message scheduling, label filtering and full error detection. A standard version of the card is available with just ARINC 429 to interface with up to sixteen receive and four transmit ARINC 429 channels.

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

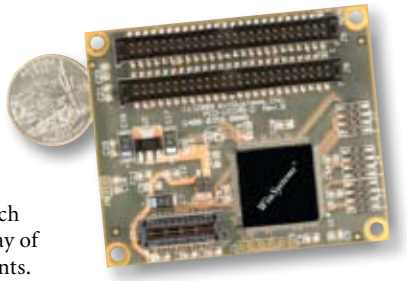
Rugged Workstation Boasts 5.7-inch VGA TFT LCD

The military's initiative toward net-centric operations has boosted the demand for all manner of display-based computer terminals. Along just such lines, the Industrial Automation Group of Advantech launches the IACP-4000D, a 4U 19-inch rackmount industrial workstation with a 5.7-inch VGA TFT LCD display that supports a Pentium 4/Celeron D processor. This design reduces the interconnections between the backplane and the CPU card, which enhances the platforms reliability.

Features include: shock-resistant disk drive bay designed to hold up to three 5.25-inch and one 3.5-inch disk drives, front accessible USB interface for easy data transferring, dual front-accessible filtered cooling fans providing optimal airflow, front LEDs indicating system health, lockable front door, and supports 300W single PS/2 and redundant ATX power supplies. The IACP-4000D is compact and has a reliable design catered for use in limited space environments, such as test and measurement stations.

Advantech, Irvine, CA. (949) 789-7178. [www.advantech.com].

Small 48-Point Digital I/O Module Uses SUMIT Standard



Earlier this year, the Small Form Factor Special Interest Group introduced the SUMIT (Stackable Unified Module Interconnect Technology) connector standard. SUMIT is an electromechanical connectorization specification that enables stacking of common serial and legacy chipset expansion buses on I/O modules for next-generation embedded systems products. Some of the first products supporting that standard have started to emerge. WinSystems, for its part, introduced the first Pico-I/O module designed for expansion on Pico-ITXe SBCs. The PCO-UIO48-G is a 48-point digital I/O interface with interruptible event sense.

An important feature of the card is that it can monitor 24 of the rising and falling digital edge transitions, latch them, and then signal the host processor that a change of input status has occurred. This is the most efficient way of sensing and signaling a CPU of real-time events without the burden of continuous polling of the digital I/O points. Pico-I/O modules are designed to offer low cost I/O expansion for Pico-ITXe single board computers from VIA and other manufacturers. The module requires only +3.3 volts; however, an optional onboard regulator is available to allow it to be powered from +5VDC. Operational temperature range is from -40° to +85°C. A Pico-I/O module is small and measures only 60 mm x 72 mm, which is half the area of a PC/104 module. The PCO-UIO48-G lists for $59. A depopulated version with 24 lines, called the PCO-UIO24-G, lists for $49.

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

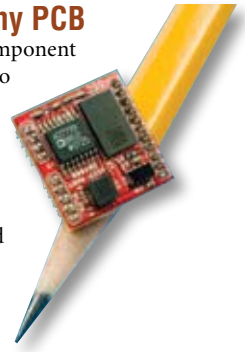
FPGA-Based I/O Module Family Rides PXI

There's always been conflict between the need for application-specific flexibility and standards-based I/O instrumentation. National Instruments tackles that head on with a new family of open, FPGA-based hardware for the PXI platform. With NI FlexRIO, engineers can add custom signal processing algorithms to their PXI-based field-programmable gate array (FPGA) hardware. Then, with interchangeable adapter modules, they can directly interface the FPGA to instrument-class I/O or create their own custom front-end hardware to meet their specific application requirements.

NI FlexRIO FPGA modules feature high-performance Xilinx Virtex-5 FPGAs. Using LabVIEW FPGA, engineers gain direct access to raw digital pins on the NI FlexRIO FPGA modules, with 66 differential lines at up to 1 Gbit/s per pair or 132 single-ended lines at up to 400 Mbits/s. In addition, NI FlexRIO FPGA modules offer deep onboard memory and the ability to use external clocks. All NI FlexRIO implementations require two distinct hardware pieces—a PXI FPGA module and an adapter module, which defines the specific I/O capabilities of the system. The first NI FlexRIO adapter module is the NI 6581 high-speed digital I/O adapter, which is ideal for algorithmic pattern generation and protocol-aware tests. Pricing for the modules ranges from $999 to $4,999 depending on configuration and type.

National Instruments, Austin, TX. (512) 683-0100. [www.ni.com].

Electronic Compass Resides on Tiny PCB



Electronic compass technology is a critical component in a variety of military systems. A new addition to their low-cost line of tilt-compensated OEM digital compasses for embedded applications that is ultra-small and highly accurate is being introduced by OceanServer Technology. The OS4000-T Nano Compass features 3-Axis magnetic sensors with 3-Axis accelerometers and provides nominal accuracy of 0.5 degrees, 0.1 degree resolution, ±180 degree roll, ±90 degree tilt and includes electronically gimbaled tilt compensation. Offered in a 0.6-inch square through-hole package, weighing only 1 gm, this ultra-small device is designed for mounting on a system board and talking via a TTL interface for a wide range of applications.

Available with a carrier board, serial and USB drivers, evaluation software and schematics to assist with applications/integration, the OS4000-T Nano Compass includes an ASCII interface, hard- and soft-iron calibration and user-configurable data formatting. Providing up to a 40 Hz data update rate, a 50 MIPS processor supporting IEEE floating point math, a 24-bit A/D converter and a programmable com rate from 4,800 to 115,000 baud are included. OS4000-T Nano Compasses are priced at $249 each or $89.74 (500s); with larger quantity discounts offered. Developer's kits are $399.

OceanServer Technology, Fall River, MA.
(508) 67-0550. [www.ocean-server.com].

AC-DC Isolated Power Brick Serves Up 1000W

High-power AC-DC conversion always comes down to a question of board space. With that in mind, TDK-Lambda has expanded its PFE series of AC-DC power bricks with the introduction of the new PFE1000F modules. These modules provide a convenient AC-DC pcb-mounted solution with an output power of up to 1008W. Up to now, using bricks in an AC to DC conversion application required two modules. One module was needed to handle the AC input rectification and power factor correction (PFC), and a second for the DC-DC isolation and low voltage conversion. The PFE series combine these two functions into a single brick.

All PFE1000F models accept a wide AC input from 85V to 265V at 47-63 Hz; have active power factor correction (PFC), an input to output isolation of 3 kVAC, and an input to baseplate rating of 2.5kVAC with application circuitry. In addition, over-voltage, over-current and over-temperature protections are included. The PFE1000F comes in a compact 3.94 x 0.53 x 6.3-inch package and can be conduction-cooled with a cold-plate or forced air-cooled with a heatsink. The PFE1000F series is available now with prices starting at $430 each in 100 piece quantities.

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

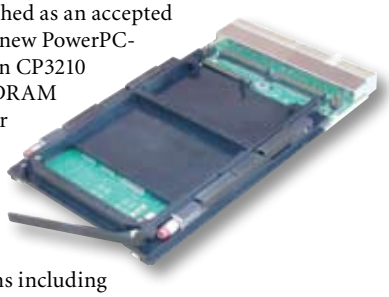
Single-Slot cPCI Is Ethernet-Capable Multi-Function Card

The multi-function board trend has hit the military world and brings great savings. North Atlantic Industries (NAI) has announced an upgrade to the functionality of its single-slot, 6-module, 6U cPCI multi-function card. This universal card eliminates the complexity and size constraints of using multiple, independent, single-function cards. The 78C2 cPCI card can accommodate up to 6 independent modules. ARINC 429/575 (6-channels), RS-232/422/485 (4-channnels), D/S Converter (3-channels) and Reference Generator functions have recently been added to its library of available modules. Other available function modules include A/D (10-channels), D/A (10-channels), S/D (4-channels), Discrete I/O (16-channels), TTL I/O (16-channels), Transceiver I/O (11-channels), LVDT/RVDT (4-channels), and RTD (6-channels).

The 78C2 incorporates an Ethernet interface that can be used to transfer data to and from the board, without using the backplane bus. This Ethernet port allows the board to be used as a stand-alone remote sensor interface, without using a separate computer board. Multiple 78C2 boards can be distributed in a system, and networked together using Ethernet for complete data acquisition capability. The 78C2 is available with operating temperature ranges of -40° to +85°C and 0 to +70°C. Conduction-cooled versions with wedgelocks are also available. Pricing for 100 pieces starts at $2350.

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

Rugged Conduction-Cooled 3U cPCI Board Sports PowerPC



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

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

Kontron America, Poway, CA. (858) 677-0877. [www.kontron.com].

Time and Frequency Synchronization Board Targets WiMAX

The military is looking for a broad range of technologies when it comes to wireless data communication, and WiMAX is on this list. With that in mind, Spectracom offers a time and frequency engine for digital broadcast and WiMAX applications, fully integrated GPS synchronization solution in a board ready for integration. The EB03 from Spectracom boasts a state-of-the-art, compact design that is suited for digital broadcast single frequency networks as well as emerging WiMAX infrastructure.

The EB03 can also use an external 1PPS or external 10 MHz as its reference in place of GPS. For instance, it switches automatically from one reference to another while minimizing phase jump. Depending on the customer's configuration, the connectors can be positioned on the top or bottom of the board in the factory before shipment for maximizing space. The EB03 features remote management via SNMP. From the convenience of a PC, hundreds of transmitters can be monitored and configured regardless of their geographic location. For best WiMAX performance, the EB03 can be configured with a low-cost oscillator resulting in competitive pricing, which is critical for successful WiMAX implementation worldwide. For the most precise performance, mandatory for digital broadcast, a high-performance OCXO oscillator is available.

Spectracom, Rochester, NY. (585) 321-5800. [www.spectracomcorp.com].

Slim 3U Chassis Enclosure for MicroTCA

MicroTCA is rapidly gaining acceptance in military applications. Elma Electronic has announced a new MicroTCA solution in a 3U MicroSlim design. The MicroSlim line is geared to maximize performance in a minimum of space. The 19-inch rackmount 3U MicroSlim chassis offers 12 AMC (AdvancedMC), 2 MCH (MicroTCA Carrier Hub), 1 JSM (J-TAG Switch Module), 2 PM (Power Modules) and 3 spare slots. There are also 4 HDD slots with SATA connectivity. Cooling is achieved with redundant Cooling Units in a push/pull airflow configuration. They feature 42 cubic feet per minute of airflow each with a hot-swap switch, fan fail indicator, and ergonomic handles. Thermal simulation and testing confirms the chassis offers excellent cooling performance.

The MicroSlim chassis accepts cards in the single module/mid size (75 mm high x 4 HP wide). The chassis configuration can be customized to allow double modules (150 mm) and compact (3 HP) or full size (6 HP) modules. The 3U enclosure is the 2nd in the line of Elma's MicroSlim chassis. Other features of the 3U MicroSlim include a separately removable filter tray with 45 PPI NEBS grade filter and dual ESD jacks in the front of the chassis. Pricing for the 3U MicroSlim is under $4,000 depending on volume and options.

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

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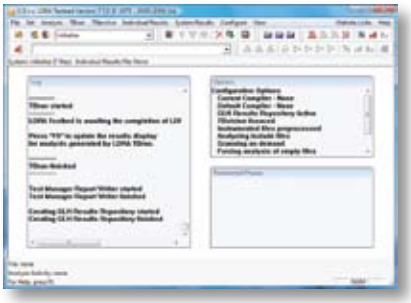
Full-sized, AdvancedMC SBC Features Core 2 Duo

The AMC form factor is shaping up to be a full fledge processor solution. Performance Technologies, for example, offers a full-sized AMC single board computer module featuring an Intel Core 2 Duo 2.16 GHz processor and is designed for MicroTCA and AdvancedTCA applications. The AMC122, when combined with Performance Technologies' MicroTCA platform, the MTC5070, and Carrier Grade Linux OS, NexusWare, offers a ready-to-use solution for next-generation MicroTCA-based applications, such as military comms servers, security, and data acquisition and processing applications.

Key features include the 2.16 GHz Intel Core 2 dual-core architecture processor and up to 8 Gbyte DRAM. An onboard MiniSD card site with program and operating system storage space enables the module to boot without an external connection. The architecture includes enhanced Intel SpeedStep technology for more efficient power management. The board also provides TCP/IP Offload (TOE), iSCSI and RDMA on Ethernet Channels

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

Test and Verification Suite Now Covers DO-178B



A software verification and test tool suite has extended its complement of programming standards and code coverage up to DO-178B Level A certification, an essential certification level for the avionics sector. LDRA tool suite v7.7 adds TBreq v2.2, LDRA's requirements traceability tool, and TBvision, a tool designed to increase visibility for industry standards compliance, security vulnerability and defect and fault detection. The integrations enable LDRA tool suite to verify all aspects of software development from requirements through run-time while easy-to-read graphical reports and other enhancements boost development team productivity.

TBreq, LDRA's collaborative, requirements-focused development and verification solution, enables project teams to automate the processes of requirements verification and traceability, solving some of the most difficult aspects of software development. TBvision enables developers to see how the source code performs against security vulnerabilities, fault-detection, and adherence to the required quality standards. Aimed at enhancing collaboration and communication between development teams, TBvision enables managers, team workers and individual developers to collectively monitor testing and quality metrics.

LDRA Software Technology, San Bruno, CA.
(650) 583-8880. [www.ldra.com].

Atom Processor and GPS Ride PC/104-Express

A host of power-sensitive military applications—ranging from small UAVs and UGVs to handheld devices—are hungry for lower power embedded computing. Based on the latest Intel Atom processor, a PC/104-Express board called the MSM200X/XL/XP from Digital-Logic provides all standard PC interfaces required for such demanding applications, including Ethernet LAN, an audio controller (HDA-AC97), four RS-232 interfaces, two SATA and one PATA interfaces. In addition, the PCI/104-Express bus (PCI + PCIe), PCIe Minicard and six USB interfaces are available as functional extensions.

All three options (X, XL and XP) are equipped with the SMA200 Atom Z510/Z530 processor (1.1 or 1.6 GHz) and offer up to 1 Gbyte RAM. The XL version is a low-cost variant without battery or sound codec, while the XP version features a 4 Gbyte SDD on board (optional for the two other variants). The versions MSM200X and MSM200XP are also available for the extended temperature range of -40° to +85°C. The boards have dimensions of 90 mm x 96 mm (W x L) and a weight of 105 or 115 grams respectively. The MSM200 is priced starting at 364.00 Euros (US PRICE TO COME) in quantities of 100 or more.

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

Nano-ITX Board Boasts All-in-One Media System Processor

Small form factor boards are key to a variety of size, weight and power (SWaP) constrained military applications. A compact, low-heat, power-efficient Nano-ITX board is suitable for compact industrial PCs and embedded automation devices. Measuring only 12 cm x 12 cm, the Via EPIA N700 board is the lowest profile Nano-ITX board yet. VGA, USB, COM and Gigabit network ports are provided on the board to help reduce system footprint size and eradicate cluttered cabling for improved air-flow and enhanced stability in always-on systems. The Via VX800 offers an integrated DirectX9 graphics core and excellent hardware accelerated video playback for MPEG-2, MPEG-4, WMV9, VC1 and DiVX video formats. An onboard VGA port is provided along with support for DVI and a multi-configuration 24-bit, dual channel LVDS transmitter, enabling display connection to embedded panels.

The Via EPIA N700 is available with either a power-efficient 1.5 GHz Via C7 or 500 MHz Via Eden processor, supports up to 2 Gbytes of DDR2 system memory and includes two onboard S-ATA connectors, USB 2.0, COM and Gbit LAN ports. Expansion includes a Mini-PCI slot with an IDE port, additional COM and USB ports and PS/2 support available through pin-headers.

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

Fanless Low Voltage Celeron M PC/104-Plus SBC Rolls

Fans are frowned upon for any harsh environment military application where a single point of failure can't be risked. A fanless PC/104-Plus embedded single board computer (SBC) boasts the processing power of Intel's ultra-low-voltage Celeron M CPU, but operates without a fan and uses only eight watts of power. The new Cheetah EPM-32v from VersaLogic is targeted at applications such as medical, avionics, navigation and tracking, system monitoring and security/homeland defense that require substantial processing power and low power draw, as well as extensive features in a rugged, compact design.

Standard onboard features of this RoHS-compliant SBC include two COM ports, two USB 2.0 ports, Ethernet, IDE, LPT, audio and PS/2 keyboard/mouse support. The board also features integrated high-performance video with support for both analog monitors and LVDS flat panels. The Extreme Graphics 2 video processor includes high-speed 3-D rendering, full-motion video and MPEG-2 decoding. The PC/104-Plus interface supports both ISA and PCI add-on modules. Standard pass-through connectors allow the board to be used above other PC/104 modules. It may also be used as a CPU module for larger systems, by plugging it into a proprietary base board that includes specific user I/O circuitry. The EPM-32v is available starting at $1,170 in OEM quantities.

VersaLogic, Eugene, OR. (541) 485-8575. [www.VersaLogic.com].

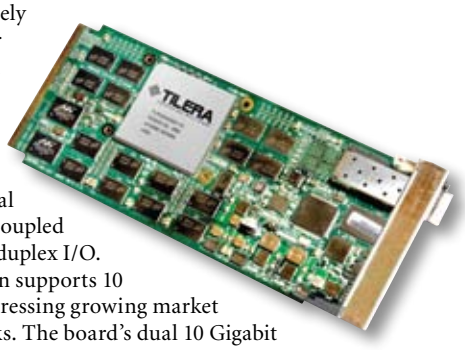
PCIe x8 Gen 2 Cable Adapter Delivers 40 Gbits/s

PCI Express wasn't the first switched fabric to enter the game, but it has certainly been the most accepted—and the military is riding that wave. With what may be the first x8 Gen 2 PCI Express host cable adapter, One Stop Systems enables high-speed expansion over a PCIe cable from a host system at 40 Gbits/s to a PCIe downstream device or expansion chassis. The PCIe x8 cable adapter provides greater bandwidth for applications demanding high-speed throughput such as video, imaging and audio devices, and requires no additional software or drivers to operate. The PCIe x8 Gen 2 cable host adapter is based on redriver technology. No switches are involved, thus there are no latency obstacles to throughput.

A target version is available to be used with the OSS 2-slot Gen 2 backplane (OSS-PCIe-BP-2000) and then cabled to the host version installed in the host system. A PCIe I/O board can be inserted in the second slot of the backplane. The card then operates on the PCIe bus as a component of the host system. A good example is a PCIe RAID board installed in the second slot and then connected to drives in a drive array such as in the OSS 3U 12-drive RAID array (OSS-PCIe -3U-RAID-12-x8). The PCIe x8 host cable adapter lists for $750.

One Stop Systems, Escondido, CA. (877) 438-2724. [www.onestopsystems.com].

PrAMC Sports 64-Core Tilera TILE64 Processor



Processor AMCs fit in nicely with the military's desire for compute density. Based on a new 64-core processor, the TILE64 from Tilera, an AdvancedMC (PrAMC) platform, offers 64 cores of general-purpose and signal processing compute power coupled with over 20 Gbits/s of full-duplex I/O. The T6M-100 from JumpGen supports 10 Gbit Ethernet interfaces addressing growing market requirements for IP networks. The board's dual 10 Gigabit Ethernet interfaces and 64 processor cores make it attractive for hosting high-bandwidth embedded communication applications.

The RoHS-compliant T6M-100 features the TILE64 processor with 64 cores running at 700 MHz, 2 Gbytes of ECC DDR2 memory running at 800 MHz, and up to 8 Gbytes of persistent memory. It incorporates dual 10 Gigabit Ethernet interfaces (AMC.2 Type 6 or AMC.2 Type 5 with 10 Gbit/s SFP+ on front panel) as well as dual Gbit Ethernet interfaces (AMC.2 Type E2). The front panel I/O includes an RS-232 Serial and an optional SFP+ for 10 Gbit/s fiber connection. The T6M-100 is available in both full and mid-size AMC configurations for AdvancedTCA (ATCA), MicroTCA and proprietary architecture systems. A complete set of tools and runtime software stack is provided by the Tilera Multicore Development Environment.

JumpGen Systems, Carlsbad, CA.
(760) 931-7800. [www.jumphen.com].

Quad-Core PICMG 1.0 SBC Supports TPM

For some military applications, it's not the ruggedness that's important but rather the right level of performance for the mission. With that in mind, Adlink offers a PICMG 1.0 full-size single board computer that is powered by the next-generation Intel Core2 Quad/Duo processor on 45nm process. Featuring a 1333 MHz front side bus and Intel Q35 Express chipset, the NuPRO-935A is specifically designed for high-performance computing applications. With processor speeds up to 3 GHz, the board is designed to be a high-performance industrial computing solution. High-bandwidth dual-channel DDR2 800 MHz memory up to 4 Gbytes is supported, meeting high-speed data transfer requirements.

By applying the Intel Graphics Media Accelerator 3100 (Intel GMA 3100), the NuPRO-935A is able to provide integrated VGA functionality and excellent graphics performance. For data protection, the NuPRO-935A supports a Trusted Platform Module (TPM) hardware security chip, which is used for disk encryption. TPM offers hardware-based facilities to effectively secure the data on your platform. The PICMG 1.0 SBC offers an ample range of I/O ports for data processing and storage. It provides up to five USB ports, two Serial ATA II storage ports, five USB 2.0 ports, two 10/100/1000 Mbit/s Ethernet ports, one RS-232 port, one RS-232/422/485 port and one parallel port.

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

COTS JOURNAL

- *Thermal Analysis for Boards and Enclosures.* As more and more military programs hunger for increasing compute-density, there's still the same trade-off of processors and other key components ramping up in wattage. And more power means more challenges dissipating heat. All that's making thermal analysis of boards and enclosures ever more critical. Articles in this section touch on all these present-day and future thermal analysis challenges, and tools and techniques available to surmount them.
- *VME in Tech Refresh Programs.* Often filling the role as the "cash cow" of the military embedded computer business, slot-card technology upgrade programs are continuing to do brisk business. That ability to insert new processing, memory and I/O functionality on legacy platforms is exactly why the military has favored modular slot-card form factors like VME in the first place. This section takes the pulse of these architectures and examines how they fit into the military's growing demand for more complete integrated solutions.
- *Options in Small Form Factor Boards.* Complete computing systems can now easily fit on the area of a coaster or a napkin. These small single board computers—in both standard and non-standard form factors—are finding a growing niche in applications characterized as extremely space- or weight-constrained or where traditionally only a fully custom solution would do the job. Small UAVs, robotics, mission-specific handheld systems, and even intelligent munitions are prime examples along those lines. Products in form factors such as mini-ITX, StackableUSB, COM Express and MicroETXexpress, along with a variety of small non-standard boards, are broadening the choices available to system designers.
- *Solid-State Disk Drives.* Free from the woes of moving parts, flash-based solid-state disks F-SSDs are able to operate under the harshest conditions, unlike magnetic hard disk drives. And because F-SSDs targeted for military and aerospace apps use the same fundamental flash components as the consumer realm, the price advantages can be leveraged across all markets. This Tech Focus section updates readers on F-SSD products and provides a product album of representative drives.

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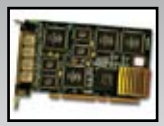

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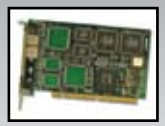

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Editorial

Jeff Child, Editor-in-Chief

Small Victories

Systems including small UAVs, robotics, mission-specific handheld systems, intelligent munitions and many others have one thing in common: a desire for small form factor embedded computers that draw scant amounts of power. The ongoing march of Moore's Law keeps working its magic such that, today, the definition of "system" has been redefined to where complete computing engines now easily fit within the area of a cocktail napkin. Boards in this category include such form factors as PC/104, EPIC, mini-ITX, StackableUSB, COM Express, Micro-ETXexpress along with a variety of small non-standard boards.

For a long time this segment of the embedded computing industry was pretty stagnant when it came to new architectures and standards. VITA and PICMG, in contrast, have been far more active in crafting new specs and form factors in recent years. Even while vendors of the PC/104 board community have enjoyed robust business and growth over the years, extensions, follow-ons or spin-off specifications from the PC/104 mothership were few are far between. Stirring the pot somewhat, a new consortium was formed last year—separate from the PC/104 Consortium—called the Small Form Factor Special Interest Group (SFF-SIG), by founding members Octagon, Samtec, Tri-M, VIA and WinSystems. A year later that group has shown some impressive progress. The SIG now includes 18 leading suppliers of embedded components, boards and system technologies.

At last month's Embedded Systems Conferences (ESC) in Boston, the SSF-SIG and its members followed through on promises made back in the spring, and rolled out products based on the SFF-SIG's SUMIT standard. Initially launched by the SFF-SIG in March, SUMIT collects PCI Express, USB, SPI, I2C and LPC Bus expansion into two, footprint-efficient, 52-pin, high-speed rugged Samtec Q2 connectors. The standard is among the very first designed especially to accommodate the new family of ultra-low-power processors such as VIA Nano and Intel Atom.

The products announced at ESC implementing the SUMIT interface include the VIA EPIA P710 Pico-ITXe Single Board Computer. This 72 mm x 100 mm SBC based on the SFF-SIG's soon to be published Pico-ITX form factor standard provides a SUMIT AB interface for I/O expansion. Before SUMIT was available, SBCs as small as the Pico-ITX format were unable to support I/O expansion cards within the outline of the SBC itself. VIA's design is based on a draft version of the Pico-ITXe Specification available to SFF-SIG members. The SFF-SIG expects to publish Version 1.0 of the Pico-ITXe Specification on their Web site before the end of 2008. Also rolled out at ESC was WinSystems' PCO-UIO48 Digital I/O Card. This 48-line digital I/O card is in the new Pico I/O form factor and uses the SUMIT A interface to an SBC. The Pico I/O form factor specification is available now to members of the SFF-SIG and will be published on the SFF-SIG Web site by the end of 2008. It defines a 60 mm x 72 mm I/O card using the SUMIT A or SUMIT AB interface.

On the standards side, SFF-SIG also announced its intention to adopt and enhance SiliconSystems' SiliconDrive II Blade Specification for small, rugged subsystems such as mass storage and other I/O technologies under the trade name MiniBlade. SFF-SIG is expanding its portfolio of next-generation industry standards that speed and simplify the development of small embedded systems

The design of a small embedded system requires many special technologies beyond small CPU and chipset combinations, small SBCs, small I/O expansion modules and/or small Computer-on-Module products. These designs must also be able to shrink and ruggedize mass storage, power supplies, cooling solutions and other key system component elements. The new MiniBlade Specification, created by various suppliers for embedded applications, takes the first step toward standardizing an ultra-small, mass storage solution for the small form factor embedded system market. A plug-in peripheral card that is retained with latches in its socket withstands embedded environments better than consumer-grade dongles and thumb drives. The SiliconDrive II Blade Specification was jointly developed by SiliconSystems and Samtec.

This new specification now forms the cornerstone of a new SFF-SIG Working Group to define the interfaces to allow a wide array of storage, communications, GPS and other I/O products to be compatible with the MiniBlade socket. The MiniBlade Specification, to be published within the next few months, will define the mechanical form factor and interface pin definitions for MiniBlade devices.

In the other small form factor camp—the PC/104 Consortium—activity has been robust. In the spring the PC/104 Consortium launched a set of new PCI/104-Express and PCIe/104 specifications. A number of vendors showcased products based on these standards at ESC Boston. All in all, it's been a busy and productive year for the small form factor board community. I, for one, am pleased to see this all important segment of the military embedded technology no longer holding its breath, and moving forward.

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