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ANNUAL RESOURCE GUIDE

Military EMBEDDED SYSTEMS

The COTS Technology Authority

VOLUME 3 NUMBER 3
MAY/JUNE 2007

INCLUDING:

MIL/COTS DIGEST SUPPLEMENT

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RESOURCE GUIDE

COVER
The amphibious assault ship **USS Bataan** is a U.S. Navy WASP Class vessel, supporting a U.S. Marines Expeditionary Strike Group (ESG) with a complement of AV8B Harrier II "jump jets," Light Amphibious Vehicles (LAVs), HMMWVs, CH-47 Chinook helicopters, and other rotary winged attack aircraft.

Of course, none of these machines are brand new; most have been in the military's inventory for decades. On the modern battlefield, the challenge is to recapitalize and modernize legacy equipment while maintaining the life cycle of older electronic systems. Our special section on **Managing the technology lifecycle** (page 34) examines *several strategies for keeping old equipment alive.* (Photo courtesy: U.S. Navy, Mass Communication Specialist 2nd Class Justin Webster)

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Technology trends and ruggedized MicroTCA

By Joe Pavlat

Debates about what *COTS* does or does not mean abound, but it is clear that open standards play an important role in the thinking of military electronic systems architects. VMEbus began this trend, and military applications are now probably the largest VME product consumers. VME's longstanding use is certainly a testament to the strength of the underlying technology, but it is also evidence of the inertia in the military market and its long adoption and procurement cycles.

That is changing though. One important reason is that silicon suppliers outside of a few specialists are not very interested in the military market as it is dwarfed economically by the commercial communications and consumer electronics markets. You currently cannot buy a military-qualified Pentium processor, and you likely never will. As a result, equipment designers must, at a minimum, use the silicon developed for the less environmentally demanding commercial markets. This is not necessarily a bad thing because the high volumes represented by *desktop* silicon offer the best possible bang for the buck, although obsolescence issues often blunt the advantages.

Perhaps the most important technology shift occurring is the move from parallel data buses to switched serial interconnects. Virtually every desktop PC sold today has PCI Express, which replaces the older PCI bus. It is faster, uses fewer interconnecting traces and connector pins, and can be made much more reliable. In a parallel bus such as VME or CompactPCI, any board can bring the entire system down. The board-to-board isolation provided by switched serial interconnects makes very robust and fault-tolerant architectures that continue to operate in the event of a possible failure, and this is of interest to military designers.

The concept of availability instead of simple Mean Time Between Failure (MTBF) has long been an integral part of core telecommunication equipment, and it is being embraced by military designers. *System management,* where all of the hardware and software resources of a system can be locally and externally monitored and controlled, is also a core telecommunication concept generating military equipment designers' interest.

Standards for systems based on switched serial interconnects are becoming mainstream. The PICMG 2.16 specification – which provides for a switched Ethernet fabric on the backplane – was the first, followed by VITA 41 and now VITA 46, among others. The most comprehensive and sophisticated standard now is AdvancedTCA, which appears to be the most widely adopted open computer standard ever developed for nonconsumer applications. While designed for central office telecommunication applications, AdvancedTCA is already being used by military designers, as Lockheed Martin's recently announced Wideband Data System (WDS) demonstrated. WDS uses a mix of commercially available AdvancedTCA gear and LM custom boards. The system is capable of routing more than 10 million 2 KB packets every second.

Out of AdvancedTCA came a requirement for a new, managed, fabric-based and hot-swappable mezzanine specification, which led to the development of the Advanced Mezzanine Card (AdvancedMC). Before too long, it became quite evident that AdvancedMCs were powerful enough to function as system boards when plugged directly into a backplane, and that concept led to the development of MicroTCA.

MicroTCA, originally developed for the telecommunication market, is garnering intense military designer interest. In an effort to respond to this and to expand MicroTCA's applicability for other markets, PICMG recently formed a new technical subcommittee to develop a ruggedized version for extreme environmental and mobile military applications. The group's goals are ambitious and include:

- ➔ Commercial and military applications
- ➔ Military airborne, shipboard, and ground mobile equipment
- ➔ Telco industry customer premise equipment
- ➔ Forced air and conduction-cooled rugged form factors
- ➔ Higher level of shock and vibration per IEC60721-3-3 Class 3M4 or 3M7 and possibly ANSI/VITA 47
- ➔ Machine industry – rotating machine mounted, no fans, vibration
- ➔ Transport industry – railway, truck, ship, aircraft mounted
- ➔ Telco industry – remote access such as roadside or pole mounted, no fans
- ➔ Traffic control – roadside, no fans
- ➔ Security – remote access, no fans

Known as *rugged MicroTCA,* this is primarily a thermal and mechanical design effort, and MicroTCA's basic system architecture will be retained. A basic premise is to reuse existing AdvancedMC modules, but with the addition of conduction cooling for many target markets. The conduction-cooled mechanics will increase the solution's robustness, improving shock, vibration, and extended-temperature performance. A range of liquid cooling solutions will also be developed for extreme environments.

It is likely that ruggedized MicroTCA's target market requirements will be beyond the scope of a single specification. It is also very possible that the committee will develop a series of distinct but interrelated specifications. The committee understands this and is defining various markets' specific requirements before the engineering begins.

If you or your company want to contribute to this effort, please contact me at jpavlat@opensystems-publishing.com.

3U emerges from the shadows

By Duncan Young

The 3U form factor, though appealing in size and inherent ruggedness, was never the runaway market success that many people had anticipated. 3U enjoys considerable success in Europe, having been a standard for industrial automation for a long time using many different types of parallel backplane buses. These include VME, CompactPCI, and their variations from many manufacturers of closed architecture industrial automation boxes. However, a new breed of 3U boards designed for military applications – and announced by vendors such as Curtiss-Wright and GE Fanuc – looks set to make a real impact. They offer all the features of *full-size* 6U boards without the disadvantages that inhibited 3U opportunities in the past.

For severe environments, the 3U module size of 100 x 160 mm offers many advantages. It has a natural frequency in the range of hundreds of Hertz, making it much more immune to the destructive effects of low-frequency vibrations found in large mechanical structures such as helicopters, aircraft, ships, and ground vehicles. This translates into more real-estate availability and proportionately more functionality as less space is required for stiffening bars or frames. A 3U conduction-cooled module is mechanically constrained on three sides by its mountings in a box. One short side is constrained by a mating backplane connector and the two long sides by wedgelocks that provide both thermal and mechanical interfaces. A further stiffening bar at the top of the module is all that is normally required to meet a program's overall mechanical requirements.

The 3U size offers a number of thermal advantages as well. With the wedgelocks on the long sides, the thermal interfaces can be made as large as a 6U card, providing the prospect of almost 100 W per module power dissipation. In addition, the thermal paths from the components will be shorter. And a high-power PMC/XMC module, if fitted, has much better thermal characteristics as both of its long edges are close to the wedgelocks on the base module. Fitting the backplane mating connector onto the short edge of a 3U module has always been 3U's Achilles' heel, limiting the number of pins available for extensive I/O functions. This is particularly true in the case of full VMEbus implementation, which leaves almost no spare pins for I/O.

3U CompactPCI

The 3U CompactPCI form factor has come closest to resolving these issues. Using two 5-row, 2 mm connectors (J1 and J2), a total of 220 signal and power pins is available, compared to only 96 on a 3U VMEbus card. J1 is used for power and the complete set of signals for a 32-bit PCI bus. J2 can be used to extend the address and data width of PCI to 64 bits, or can be utilized as user I/O. Many 3U CompactPCI suppliers choose the 32-bit backplane option with J2 pins allocated to basecard and PMC/XMC I/O.

3U CompactPCI products have found a sustainable niche in the deployable military embedded computing market. As expected, this market niche is primarily predicated on physical size available in the deployed platform. Successful programs include helicopters, small spaces on combat aircraft such as the tail, pylons, and wings, plus missiles, Unmanned Aerial Vehicles (UAVs), and armored ground vehicles. Applications for 3U embedded computing are many and varied, from missile warning receivers, to communications equipment, to extensive mission systems in UAVs.

Compared to their sibling 6U SBCs, processing performance is not constrained at all by the smaller 3U module size. It is perfectly feasible to offer the latest dual-core PowerPC or Intel Core Duo processor devices with at least 1 GB of 64-bit DDR2 SDRAM and 1 GB of flash memory, as real estate and thermal performance are easily accommodated. I/O functionality for 3U is generally less but can be expanded by using PMC/XMC mezzanines mounted on an SBC itself or on carrier cards accessed via the backplane PCI bus.

Backplane bus relinquished

3U CompactPCI is now well-established in the military marketplace and is justifiably successful, having performance, I/O capability, longevity, and small size in its favor. Appearing alongside the established 3U CompactPCI product lines is a new breed of 3U products based on the VITA 46 (VPX) standard, eschewing the traditional parallel backplane bus altogether. Instead of VME or PCI, these new products make use of the VPX connector's high-speed signaling capability by offering four- or eight-lane PCI Express interfaces for connection to really high-performance external I/O devices such as graphics or directly to sensors. Figure 1 illustrates GE Fanuc's SBC330 single board computer based on the VPX form factor and offering a 1.5 GHz dual-core 8641D PowerPC and up to 4 GB DDR2 SDRAM in a single 3U module size.

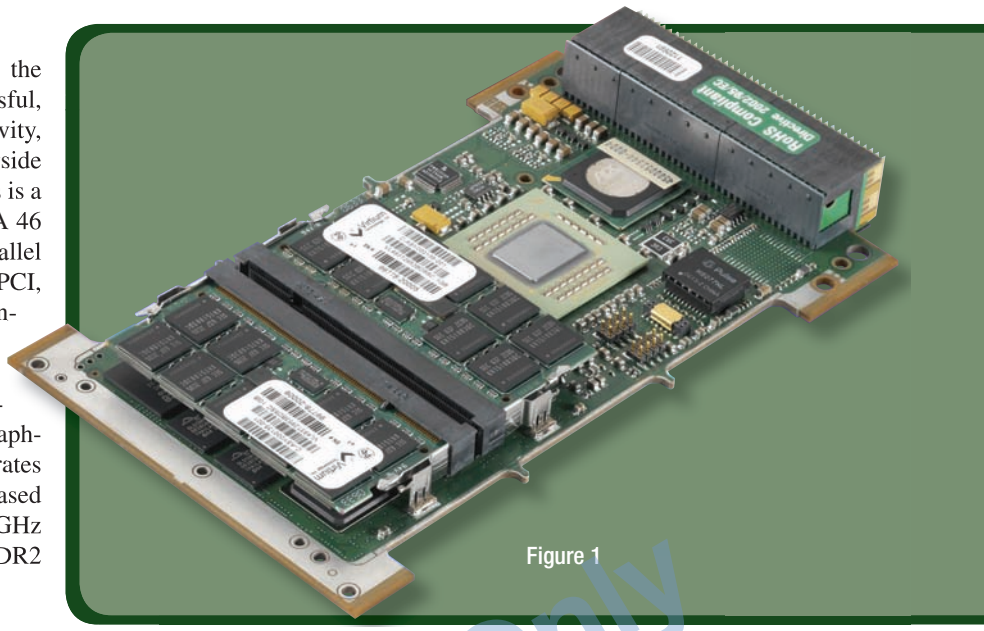
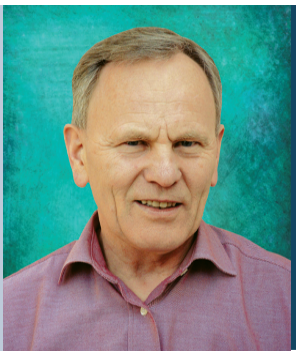


Figure 1

Although 3U VMEbus was never the success it was hoped to be, the VME standard has so much momentum and such an extensive ecosystem of vendors and products that it will continue to evolve and grow. Interestingly, the new generation of products it is spawning no longer requires the original parallel backplane bus to be successful. However, it does rely totally on the infrastructure and support created for VME over the years. It is difficult to be sure whether 3U VPX is the natural successor to 3U VME or 3U CompactPCI. It was certainly developed by the VMEbus community. However, rather than producing another fragmentation of the blood line that many had feared, 3U VPX could become the common future standard for military small form factor computing.

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

European update:
SatNav summit in Munich



By Hermann Strass

Prestigious venue

The fifth annual Munich Satellite Navigation Summit of global government, commercial, and technical experts was held March 6-8, 2007 in the Residenz in Munich, Germany. This was the residence of the former Bavarian kings in the center of Munich. It is also one of the most prestigious venues in Germany, showing due respect to the high-ranking delegates who came to the summit from all around the world. The summit was followed by a one-day field trip on March 9 to the Berchtesgaden area. The summit delegates were permitted to visit the special Galileo Test and Development (GATE) installation in a mountain valley in the Bavarian Alps.

Conference

The summit was opened by Erwin Huber, Minister of Economic Affairs, Infrastructure, Transport, and Technology of the Free State of Bavaria, Germany, and Pedro Pedreira, Executive Director of the European GNSS Supervisory Authority. The summit's opening event was a reception in the All Saints Court Church, inside the Residenz, a solid block of buildings arranged around seven inner courts. Professor Dr. Guenter W. Hein and a team of others from the University of the German Armed Forces, Munich, Germany, organized the summit, conference, and field trip. The conference opened with statements from the major global providers of satellite navigation systems: GPS (United States), Galileo (Europe), and GLONASS (Russia). Addtionally, there were statements from the heads of delegations representing satellite navigation activities in Japan, India, Australia, and China. The United States and India had signed an agreement concerning GPS a few days before the conference. Australia is building a Galileo ground station near Brisbane, capital of Queensland, Australia. Thomas Reiter, German astronaut, reported about his recent several-month stay in the International Space Station (ISS). For more information on ISS, see *VMEbus Systems* magazine, February 2006, page 16. Reiter is now a veteran astronaut, having traveled on American and Russian shuttles to work on the ISS. He has been up in space several times for a total of 350 days, including several space walks.

Figure 1

The main topic at the conference was international cooperation on the Global Navigation Satellite System (GNSS) to make the three major satellite navigation systems as compatible as possible. Galileo, still in the experimental stage, will start with reduced precision to be more compatible with current GPS. There is a major upgrade effort underway to improve GPS precision. GLONASS is on an improvement plan to match current GPS precision in the not-so-distant future.

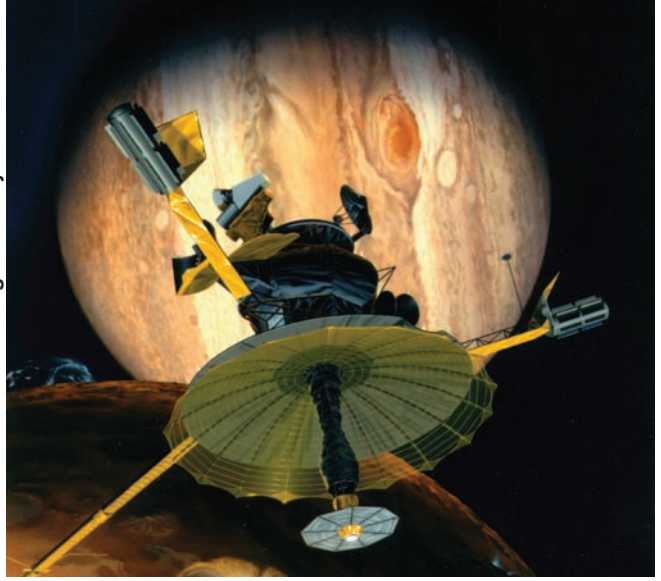


Image courtesy of NASA

The GATE area in the mountain valley near Berchtesgaden in the area bordering Salzburg, Austria, has been chosen to test simulated satellite signals because of very high mountains on three sides of the mountain resort. About 160 companies and institutes worldwide are participating. Repeaters on top of the mountains relay the signals into the valley. Special international testing will be performed there September 2-9, 2007. The First International Summer School on Global Satellite Navigation Systems will be organized by the University of the German Armed Forces in cooperation with Stanford University, Palo Alto, California, United States, and Ecole Nationale Superieure de l'Aeronautique et de l'Espace, Toulouse, France.

For more information, e-mail Hermann at hstrass@opensystems-publishing.com.

The summit's top-ranking speakers included:

- Ralph Braibanti, Director of Space and Advanced Technology, U.S. State Department
- Marc C. Crews, Colonel, Navstar GPS Chief Engineer, U.S. Air Force
- Professor Dr. Guenter W. Hein, Institute of Geodesy and Navigation, University of the German Armed Forces
- Pedro Pedreira, Executive Director of the European GNSS Supervisory Authority
- Sergey G. Revnivykh, Deputy Head of Mission Control Center (GLONASS)
- Professor Dr. Chris Rizos, Professor and Head, School of Surveying and Spatial Information Systems, Sydney, Australia
- Arun Singh, Space Applications Centre, India
- Koji Terada, Project Manager of QZSS, Japan Aerospace Exploration Agency

Most other speakers and panelists were technical experts from Europe and many countries around the world. Figure 1, courtesy of Technology Consulting, Germany, shows Ralph Braibanti and Erwin Huber at the press conference in the One Pillar Hall at the Residenz, Munich.

Status of Galileo

The European satellite navigation system is now in its initial phase of deployment, and one satellite is orbiting. It is used to test the system and its precision. Previously, a Zeppelin had been used to simulate navigation signals from space. Many Galileo teams have been testing all kinds of difficult environments. A few months ago, I participated exclusively during testing at the railway marshalling yard north of Munich. Reflections from all the metal in the rails, the Faraday cage effect from the electrical overhead wires, and reflections from many large freight trains moving nearby were easily filtered out.

Modern battery technology distinguishes military handhelds – and presents significant design challenges

By Robin Sarah Tichy, PhD

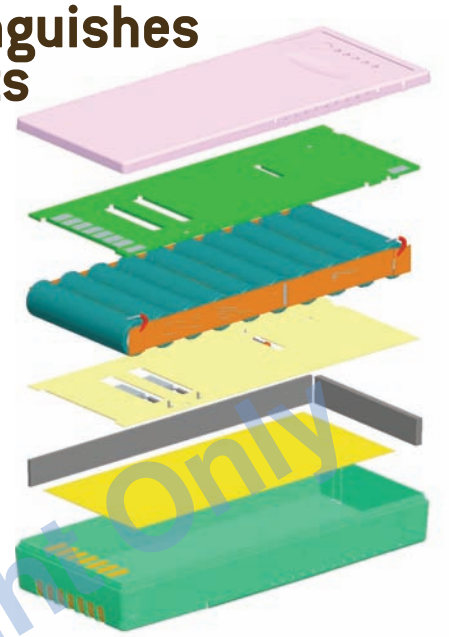


Figure 1

Numerous challenges await designers of reliable, portable power systems for use in rugged, mobile military applications such as Multiband Inter/Intra Team Radios (MBITR). Robin presents information on innovations in cell chemistries, power management electronics, enclosure designs, and safety strategies that address these challenges.

Electrical design engineers need to understand new power technologies on the horizon as they develop portable devices for military applications. The battery pack – embedded in the portable device – is fundamental to functionality, and a high-performance battery can differentiate a product in the handheld military market. Battery packs for ruggedized portable devices must operate in both extremely hot and cold environments. Many devices – such as handheld radios, telemetry monitors, weather stations, test equipment, missiles, rockets, and satellites – are used in harsh environments.

The building blocks of a battery pack

Figure 1 shows the main components of a typical battery pack, including:

- The cells providing the primary energy source
- The Battery Management Unit (BMU) providing system intelligence for advanced functions such as fuel gauge calculations on remaining cell capacity, protection circuitry, thermal sensors used to monitor internal pack temperature, LEDs that indicate pack or cell status, and a serial data bus that communicates to the host device
- A custom plastic enclosure typically produced in an injection mold
- External contacts providing a physical electrical interface with the host device
- Insulation used to absorb external shock, as well as retain or dissipate heat generated with the pack

All these elements can be customized when designing a battery pack for extreme environments such as those seen by an MBITR radio; however, the cells are critically affected by extreme temperatures, and this is a particular challenge.

Li-ion batteries offer many attractive advantages over other rechargeable chemistries, including a much higher energy density, lighter weight, longer cycle life, superior capacity retention, broader ambient-temperature endurance, and higher current tolerance. Over the past 10 years, the fundamental materials on which Li-ion is based have not changed much. New safety schemes have been developed and energy density increased by stuffing more and more material into the same size can. Li-ion is more environmentally friendly than the other chemistries, and modern designs are very safe. Li-ion has decreased in cost because of the economies of scale driven by consumer products such as laptop and cell phones. Often a Li-ion solution is at cost parity with a Ni-metal hydride solution because the higher operating voltage, 3.6 V versus 1.2 V, allows for a lower cell count. Thus, many applications that require multiple cells in a series will migrate to Li-ion batteries as have the MBITR radios, which require three Li-ion cells in series. All Li-ion batteries

The "whys" and "wherefores" of the Sony battery recall

By Jeffrey VanZwol

As of October 2006, Sony has recalled 9.6 million batteries worldwide, including 250,000 of its own VAIO batteries. The battery recall affected some, but not all, Sony customers who purchased batteries September 2004 through October 2006. Affected customers of Sony Energy Devices – the world's second-largest rechargeable battery cell manufacturer – included Dell, Apple, Gateway, Fujitsu, Toshiba, and Sony VAIO. The recall arose because microscopic metal particles in the 18650 battery cells (18 mm x 65 mm) came into contact with the cell's internal elements, leading to a short circuit within the cell.

In response to the global awareness of the Sony battery recall, several industry groups are expediently upgrading standards for Li-ion battery packs, including IEEE 1625, UL 1642 and 2054, and ANSI C18.2M, Part 1-2001 specifications.

Jeffrey VanZwol is marketing director at Micro Power Electronics, Inc. He can be reached at jvanzwol@micro-power.com.

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are not created equal. Therefore, proper cell selection and careful battery pack design are of particular importance when the device is exposed to rugged conditions.

The importance of the usage profile

Proper choices, with respect to the BMU and battery chemistry, will determine the reliability of an MBITR radio or any other military device. Manufacturers typically specify cell performance at an ideal constant current rate of 1/5 of the battery's capacity per hour and +20 ˚C external temperature. However, most portable devices are expected to operate in a range from -20 ˚C to +40 ˚C. Military requirements are often -40 ˚C to +80 ˚C, and there are higher, pulsating currents; therefore, testing the performance profile of cells and the assembled battery pack in simulated use is necessary to ensure reliability. The first step in ensuring a proper battery choice is to fully describe the "real-world usage profile" of the device. The usage profile includes temperature ranges, discharge profiles, charging regimens, expected shelf life, and transportation requirements and should account for foreseeable misuse as well as intended use. For example, temperature extremes can cause similarly rated cells from different manufacturers to demonstrate widely varying performance results, such as voltage output and runtimes. Shelf life plays a critical role in the selection of the appropriate cell chemistries, so the self-discharge rate of the cell chemistry may be the determining factor in selecting the optimal chemistry.

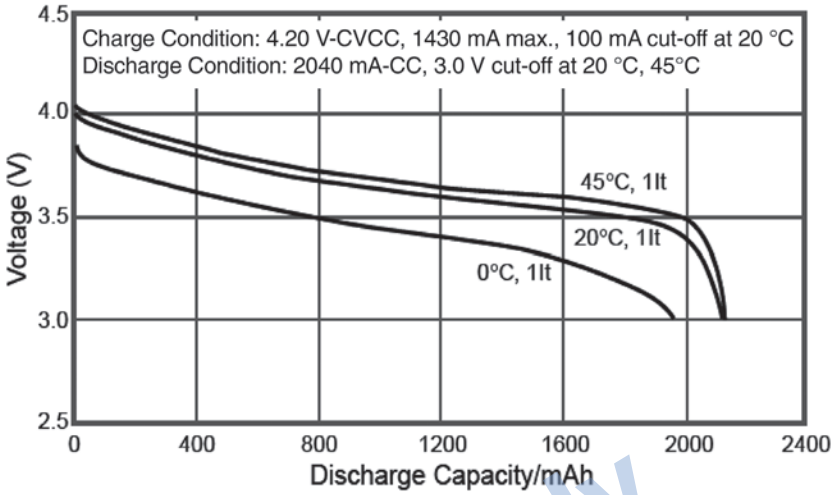

Figure 2

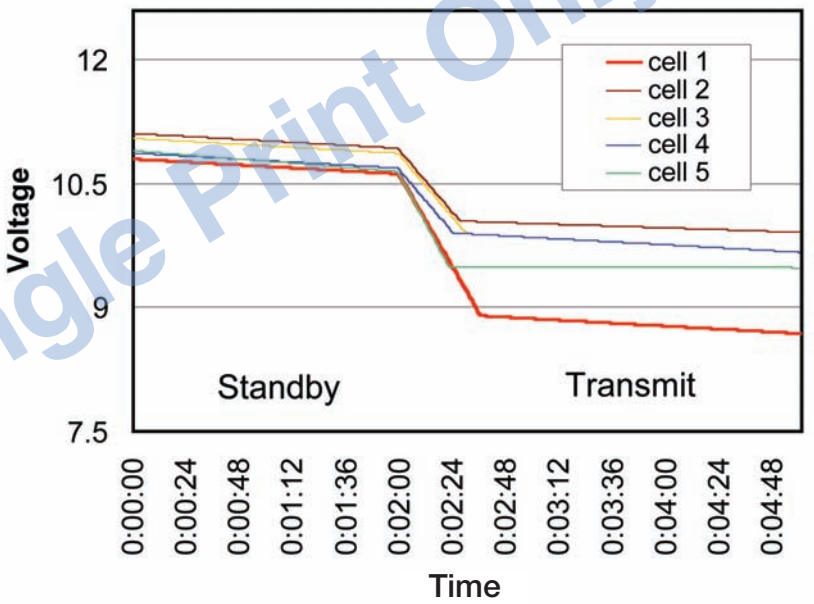

Figure 3

If high current is flowing through the battery, low voltage cutoff will be reached earlier because of I*R voltage droop. External battery voltage can be modeled as $V=V_0$-I*R where R is internal resistance of the battery and R is dependent on state of charge, temperature, and battery age. Performance of rechargeable Li-ion chemistry starts to suffer as the temperature drops below freezing. As the temperature drops below 0° C, the battery's internal impedance increases. The result of this effect is shown in Figure 2, where a 2 A load causes the voltage to droop. This "voltage droop" is more pronounced at -20 ºC, and the electrolytic material within the cell will freeze with further temperature declines. Figure 3 demonstrates the importance of well-characterized cells in the design of an MBITR battery pack. In this case, cell 1, the red curve, was chosen by the radio's manufacturer and performed adequately at room temperature. Also, it seemed to work well at colder temperatures until the user transmitted a radio signal. At that time, the higher current and low temperature combined to make the pack reach its low voltage cutoff of 9 V. Micro Power Electronics tested four cells from two alternate cell suppliers against this specific usage profile, and all were found to be adequate. Although, it should be noted, they all displayed some variability even among the same manufacturer.

On the other hand, extremely high temperature operation provides equal challenges for cells based on lithium chemistry. The upper range of safe operation for Li-ion and lithium primary cells is 60 °C. Cells provide energy through the electrochemical shuttling of lithium ions between the anode and the cathode materials. However, at high discharge rates, this chemical reaction generates heat, and the effects of this heat must be factored into a sound battery pack design. Care must be taken that the combined ambient and generated heats do not take the cells out of the safe operating temperature range. The effects of the generated heat are compounded when numerous cells are assembled into a multicell pack.

To demonstrate the typical temperature rise in a multicell pack, Micro Power has assembled a pack and monitored the temperature rise using our environmental and electrical test chambers. This testing should be performed on packs that must operate near

the upper or lower boundaries of the cell specifications. The pack assembled for the test was a 4S6P (four cells in series, six strings in parallel) Li-ion pack using 18650 (18 mm diameter, 65 mm length) 2.4 A-Hr cells, resulting in a pack that provides 14.4 V and 14.4 A-Hr of capacity. Testing was conducted at a condition of 145 W discharge at 45 ˚C ambient temperature. Thermistors were placed within the pack core and around the outside edge of the cells. The pack was wrapped in packing material to simulate a plastic enclosure, and an additional thermistor was placed on the outside of the packing material to capture the temperature outside the simulated enclosure. Temperature and performance data were recorded on automated Maccor battery testing equipment.

The results of the testing are presented in Figure 4. The thermistor placed within the cells in the center of the pack registered a core temperature of 65 ºC. The two thermistors placed at the edge of the assembled cells registered a perimeter temperature of 64 ºC and 65 ºC. Note that the temperatures at the core and edge of the pack are similar. Figure 4 also presents a thermal image of the pack during the test, and one can see that the temperature of the interior and edge cells are similar. Finally, the thermistor outside the packing material registered a temperature of 54 ºC.

Hence, this test demonstrates that one can expect up to a 20-degree rise in temperature when the pack is in operation, and this can result in a 9-degree temperature rise of the pack enclosure. Note that the temperature changes are dependent on the amount of current drawn from the pack (for example, greater current results in greater heat generation). These temperature increases, both within and outside the pack, must be factored into the design of the battery pack and portable device. This level of testing and analysis should be performed on all pack designs that must operate in low- or high-temperature conditions such as those of an MBITR radio. Intimate knowledge of the usage profile allows the pack to be designed in a way that avoids stressing the pack thermally.

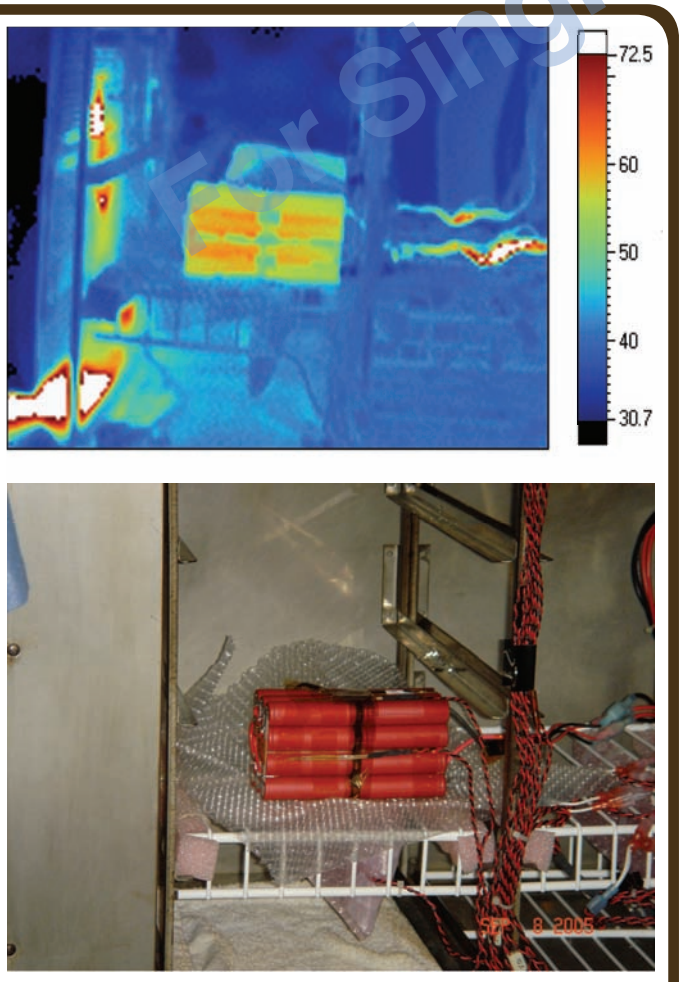

Figure 4

Working with new technology

There are several new technologies available for Li-ion battery pack designers. New materials are improving the cost, capacity, and rate capabilities of cells while new electronics for power management are improving monitoring and efficiency. New choices bring more variability to cell performance, so the usage profile and cell characterization's importance is increased. Li(CoMnNi)O_2 (NCM) is a safer and less expensive cathode material that will be featured in cells offered by a number of the tier 1 cell suppliers. The new cells will originally be offered in the common 18 mm diameter and 65 mm long size, but eventually they will be offered in both cylindrical and prismatic shapes so that they can be designed into the more restrictive form factor of a handheld device. NCM experiences a significantly lower voltage droop when power is drawn at 0 ˚C compared to standard cobalt systems, indicating lower cell impedance. Under certain circumstances, the higher internal impedance of the traditional $LiCoO_2$ cells can work in the user's favor. The increased I^2R heating effectively raises the temperature of the cobalt cell above the ambient, which in turn reduces electrolyte viscosity.

Figure 5 shows that the cobalt cells are capable of yielding more of their stored energy at 0 ˚C ambient compared to the NCM cell, but the NCM cell might be the safer choice in high ambient temperature conditions. This information gives the battery designer a choice. Depending on the usage profile of the end device, either the standard cobalt cell or the NCM may be a better choice. For example, an application with high-current pulses, such as an MBITR radio, might benefit from the smaller voltage droop of the NCM; for an application requiring a continuous low drain rate at 0 ˚C, the standard cobalt cell would be a better choice.

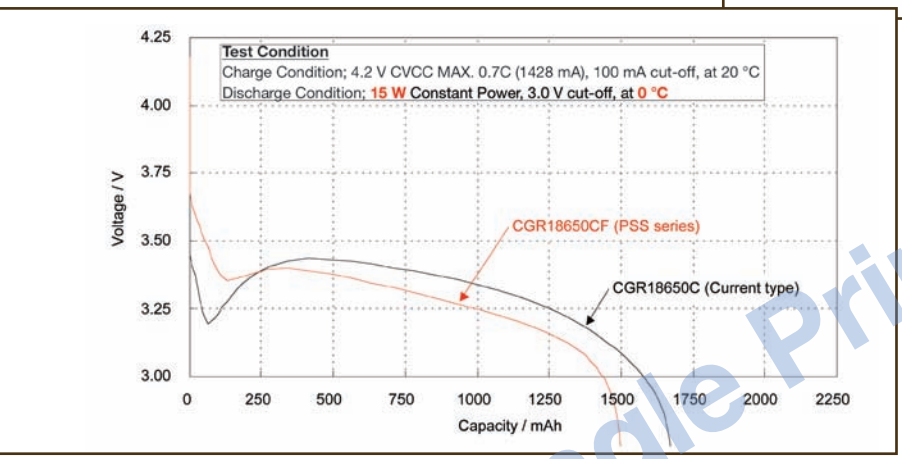

Figure 5

Engineers are making great strides in power management technologies that complement novel battery chemistries. The battery schematic shown in Figure 1 depicts the circuit board that controls safety and power management. The battery systems for military applications must incorporate redundant safety systems and reliable protection circuitry because the device's operation is critical to the military mission. The printed circuit board not only has protection circuitry and thermal sensors, but it also provides the system intelligence for advanced functions such as fuel gauging, cell balancing, and communication via a serial data communications bus. Smart battery systems are the preferred choice for military applications. A valuable smart battery pack feature, to users of MBITR radios, is the pack's ability to monitor its status, accurately predict its remaining runtime, and communicate its operational status to the host device. Traditional fuel gauges either monitored the voltage or the capacity, and the accuracy was quite limited.

Low-frequency impedance is a critical factor for DC performance of batteries, but low-frequency impedance increases rapidly with battery aging. During the first 100 cycles, low-frequency impedance increases more than twice, as shown in Figure 6. However, battery chemical capacity changes very little during the same period; therefore, the voltage is a very bad indication of the battery's state of charge for an application with variations in load, such as the MBITR radio. A new "gas gauge" monitors the number of coulombs transferred and opportunistically calibrates with the open circuit voltage of the Li-ion pack. When no load or

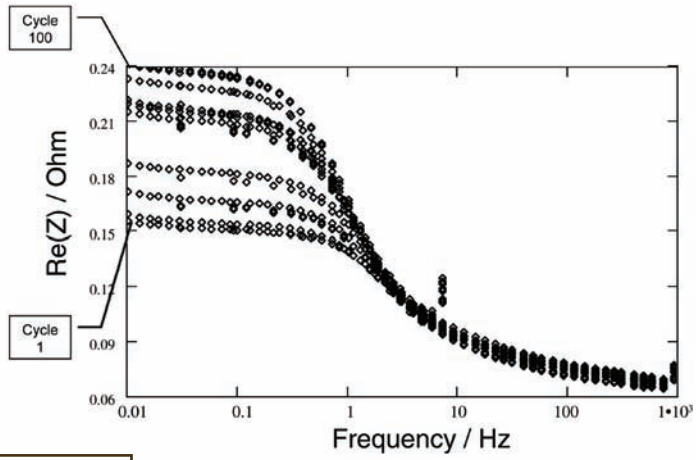

Figure 6

standby load is applied to the battery, these newer fuel gauges use the voltage-based method to determine starting State Of Charge (SOC) and no-load capacity degradation. When under a subsequent load, the fuel gauge uses a current integration-based method and updates the impedance at every cycle using voltage and current information. Texas Instruments claims an accuracy of 99 percent for its Impedance Track technology. These features allow the end user to intelligently manage device use and avoid unexpected failures or shutdowns.

Battery packs and today's mobile military applications

The military is demanding higher performance, lower weight, longer effective usage times, and absolute reliability from mobile, handheld applications such as MBITR radios. These systems rely on increasingly sophisticated battery packs for their power requirements, yet they present unique design challenges because of the extreme environments to which they are exposed. Design engineers are faced with an array of challenges in designing effective battery systems – from cell and cell pack selection to intelligent power management, from safety concerns to charging systems. Armed with an understanding of these demands, however, designers can make the best choices for battery-supplied power in today's rugged military applications.

Robin Sarah Tichy *is technical marketing manager at Micro Power Electronics in Beaverton, Oregon. She has developed an expertise in translating market drivers into technical solutions in the battery and charger industry. Prior to joining Micro Power, Robin applied technical and project management skills to orchestrate and implement solutions to solve vital business problems at Hewlett Packard and International SEMATECH, in the semiconductor, nanotechnology, and MEMS verticals. She holds a PhD from the University of Texas for her work in solid oxide fuel cells.*

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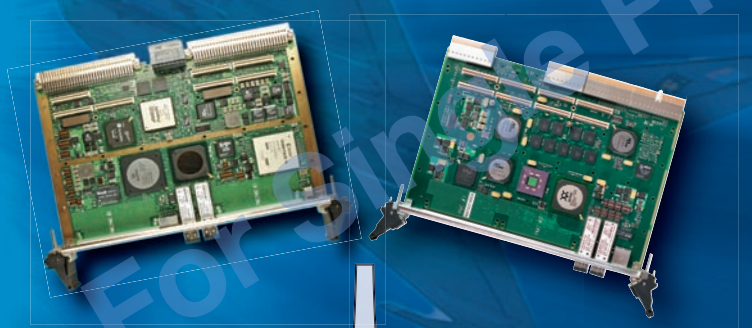

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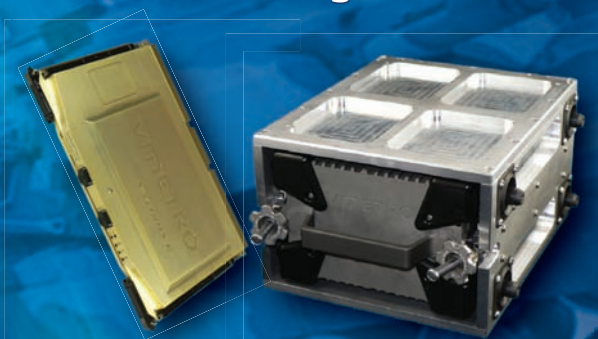

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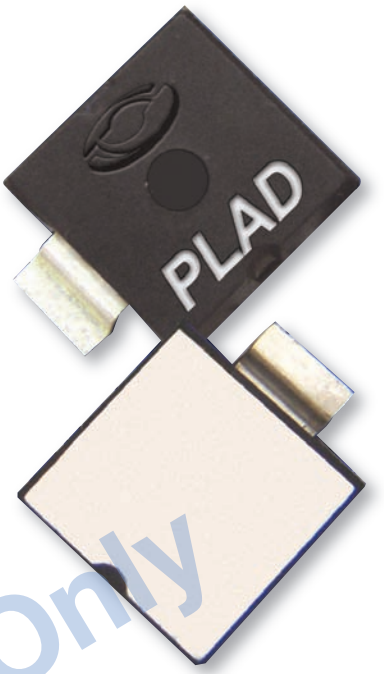
New surface mount power components drive military power supply modules

By Tracy Autry



Hermetic surface mount packaging technology is replacing traditional hermetic through-hole technology in military power systems. These new hermetic surface mount packages have brought the advantages of better thermal dissipation, lighter weight, and smaller volume to the next generation of military power systems.

While surface mount components have been in use in commercial power supply applications for many years, designers of the more demanding military power systems have been forced to continue to rely on a range of discrete hermetic through-hole components to implement their power solutions, since commercial surface mount components fail to survive in stringent military environments. Through-hole solutions, however, have poor thermal transfer characteristics, are heavy, always use wire bonds (including two terminal devices), and require significantly greater board space than surface mount devices.

This is changing, however, with the emergence of a range of hermetically sealed surface-mount packages for power applications. These advanced packages include solutions for two-terminal devices such as rectifiers, Schottky diodes, and Transient Voltage Suppressors (TVSs), as well as three-terminal devices including MOSFETs, SCRs, and IGBTs. Together, they are rapidly transforming military power supply solutions, providing better thermal transfer characteristics, lighter weight, and smaller volume. Targeted for military applications, these packages are designed for life cycles that avoid obsolescence in these long-life programs. They can also be supplied in power module assemblies, providing a modular circuit solution with the advantages of surface mount components.

Hermetic SMT packages

Two-terminal packages can take one of two forms – a disk version often designated DO-217 for moderate-to-high power ratings, and a larger square configuration for higher-power applications. Both have an integral strap on the top to provide a contact lead to the surface of a printed circuit board. Figures 1a and 1b show the cross-sections of two-terminal packages having multiple and single die.

These rugged components sandwich one or more silicon die between tungsten slugs that serve as anode and cathode. In multi-die applications, the silicon dice are thermally separated from each other

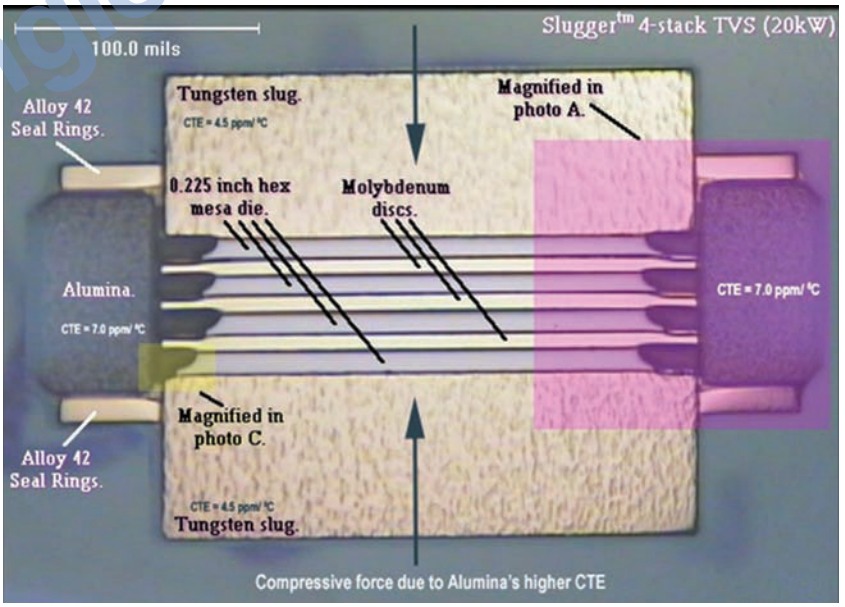


Figure 1a

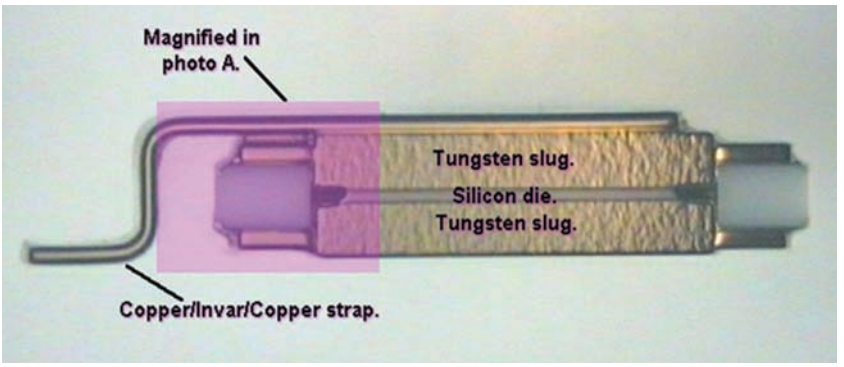


Figure1b

using molybdenum discs. The package seal construction causes compressive forces between these disks and the silicon dice, improving overall heat transfer within the package. Their junction temperature (Tj) can be as high as 200 ˚C. Thermal resistance junction to case ($R_{\Theta jc}$) can be as low as 0.2 ˚C/W. The Coefficient of Thermal Expansion (CTE) is designed to match the silicon chip, which is 4.5 ppm/˚C.

Since their double-plug construction has no internal wire bonds from the die or dice to external contacts in two-terminal devices, these packages are impervious to the effects of acceleration internally and exhibit lower inductance and higher surge capabilities than through-hole solutions.

Unlike commercial surface mount packaging that employs soft solder, these components use hard solder (Au/Sn or Au/Ge) throughout, eliminating solder creep and recrystallization problems that can be caused by power cycling and high-temperature operation in military applications. With hard solder, the thermal resistance junction to case ($R_{\Theta jc}$) doesn't increase in operation, providing longer service life.

Microsemi's ThinKey package is representative of a higher power square implementation of this double-plug ceramic and metal construction. In this case, the silicon die is hard soldered to a molybdenum disk, and this assembly is then soldered between two square molybdenum pads that serve as the external terminal connections. A copper-clad strap brings the top terminal down to make contact on a circuit board. Typical applications are with Schottky die (Figure 2).

Larger rectangular surface mount packages are designed for three-terminal devices. Here, the side of the die with the drain is soldered onto a copper/molybdenum pad to create one terminal, while the source and gate on the other side of the die are wire-bonded across an insulating alumina bridge to pads that serve as the other two terminals – all within the hermetically sealed cavity.

Even though wire bonds are employed here, this package exhibits low inductance due to the lack of ferrous materials. All wire bonds within the package are monometallic Al-to-Al bonds. This package is suited for integrating gate resistors and protection or zener diodes.

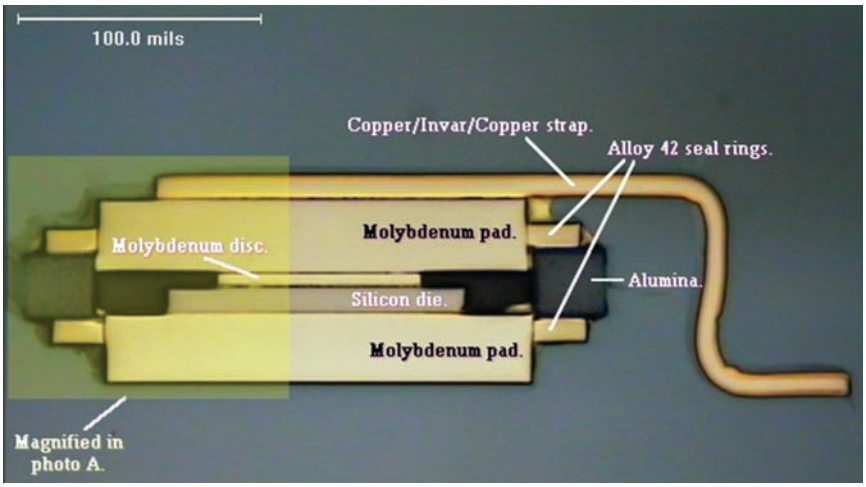


Figure 2

Table 1 provides a comparison of three hermetic surface mount packages with standard through-hole packages like the DO-4 for two terminal devices or the TO-254 for three-terminal components. It can be seen that these surface mount devices provide a 6x improvement in weight, 3.5x in thermal resistance, and 2.5x in volume.

Power module assemblies

In addition, these surface mount components can be used as building blocks for space-saving hermetic surface mount power modules, utilizing standard materials and processes to create application-specific power circuits of high reliability. This construction employs a five-step process designed to pass Quality Conformance Inspection (QCI) tests for Commercial, TX, TXV, and JANS equivalent screening levels:

1. Hermetic discrete devices are screened to the required level (for example, TX or S-level equivalent) so that only "known good" devices are used in the module's construction.
2. Terminals are brazed to the substrate at 800 ˚C using Cu/Ag eutectic.
3. To prevent voiding, the substrate is bonded to its heatsink in a vacuum and is verified with 100 percent X-ray inspection.
4. Module is populated with the screened discrete devices at 215 ˚C.
5. Completed module is tested and screened to the appropriate level, including QCI samples.

Since these hermetic power modules can be fabricated on ceramic (either metalized or direct bond copper) substrates and use aluminum composite or copper laminate heatsinks, their coefficients of thermal expansion will closely match that of the surface mount components. Integral contact terminations can be crafted easily from copper alloy or steel to provide an easy-to-connect final assembly.

Employing these surface mount hermetic packages in military power modules greatly reduces complexity and cost, while simplifying testing and qualification. Up-front costs such as tooling and nonrecurring engineering charges are much less than for conventional hybrid, or multichip module designs. In addition, since the power module approach uses individual hermetic discrete devices, the modules can be reworked with relative ease and minimal costs.

Prototype units can be built rapidly for in-circuit testing. If one or more of the discretes need to be changed to optimize circuit performance, the modules can be returned to install new discrete devices for additional testing.

Military-grade reliability with surface mount performance

In short, today's hermetic power module technology can provide military applications with all the advantages of commercial surface mount assembly, but with military-grade reliability, faster prototype development, reduced costs, weight, and size compared with conventional through-hole hybrid solutions – the best of both worlds.

Tracy Autry *is a module development manager with Microsemi Corporation. He has 15 years of experience in electronic packaging development and 13 years of experience in designing and manufacturing high-reliability power modules for the military and aerospace markets. He received a BS in Ceramic Engineering from the University of Missouri-Rolla.*

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Package type	Weight (grams)	Thermal resistance (C/W)	Volume (cubic inches)
DO-4	10	1.5	0.25
TO-254	9	1.5	0.125
3-terminal SMT	1.5	0.3	0.05
Schottky SMT	1	0.3	0.02
Diode SMT	0.9	0.4	0.012

Table 1

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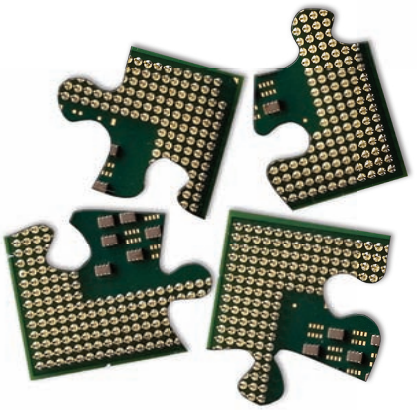
Part 2: Design and implementation of an SCA core framework for a DSP platform



By Carlos R. Aguayo Gonzalez, Francisco M. Portelinha, and Jeffrey H. Reed

(This article is based on a paper presented at the SDR Forum Technical Conference, November 2006, Orlando, Florida.)

Editor's note: This is Part 2 of a two-part article. Part 1 ran in the March/April 2007 issue of Military Embedded Systems. *You can read Part 1 online at: www.mil-embedded.com/articles/id/?2065.*

The authors present the design and implementation of the SCA 2.2 Core Framework for a TI DSP platform and provide the rationale behind design decisions and initial profiling results.

Results

Profiling was performed on the framework and applications using two different metrics: memory footprint and cycle count. All results were obtained from a single-chip configuration. That is, all framework and waveform components were collocated within the same processor. Hence, these results do not include the effects of a transport layer. *No optimization was performed* in either the framework or the waveform components and they include debug information. It is very important to emphasize that these results represent initial measurements and are subject to further investigation, validation, and optimization.

Memory footprint

The total memory used by the system is little more than 1.46 MB, which represents less than 2 percent of the available memory per DSP (128 MB) in the platform. Table 1 shows the memory breakdown by major software components. The .ERAM$heap field represents the total memory available to serve dynamic memory allocation requests. The footprint contribution from support libraries (Generic Runtime Library, Math Library, and so on) is considered under the "Other" category. Figure 4 shows a graphical representation of the main components' contribution to total memory allocation.

SW Component	Footprint (Bytes)
CF	556555
Parsers	31511
ORB	212412
Application	385624
Subtotal	**1186102**
.ERAM$heap	131072
Other	144067
Total memory	**1461241**

Table 1

In analyzing the Core Framework's (CF's) memory requirements, we found that almost 70 percent of total memory allocated for the CF came from the C++ mapping of the SCA CF IDL interfaces. It is important to note that the CF IDL descriptions contained all the interfaces defined in the SCA CF, including some that were not used in single-processor operation (for example, DeviceManager, Device). It is possible to optimize the C++ bindings of IDL interfaces by adding more control to the IDL compiler, enabling more selective code generation (such as for specific interfaces generate stub only, or skeletons only, or nothing). This approach opens the door for potentially large improvements, depending on how much of the IDL interfaces are used. This is a well-understood approach, although it was not implemented in this project. Another important qualifier for these results is the absence of Device-related interfaces. No DeviceManager or Device interfaces were implemented. The methods in DomainManager relative to Device and service registration were not implemented either.

The memory requirement results for the application include BPSK and QPSK components, along with Assembly Controller, Channel, Demodulator, Resource-

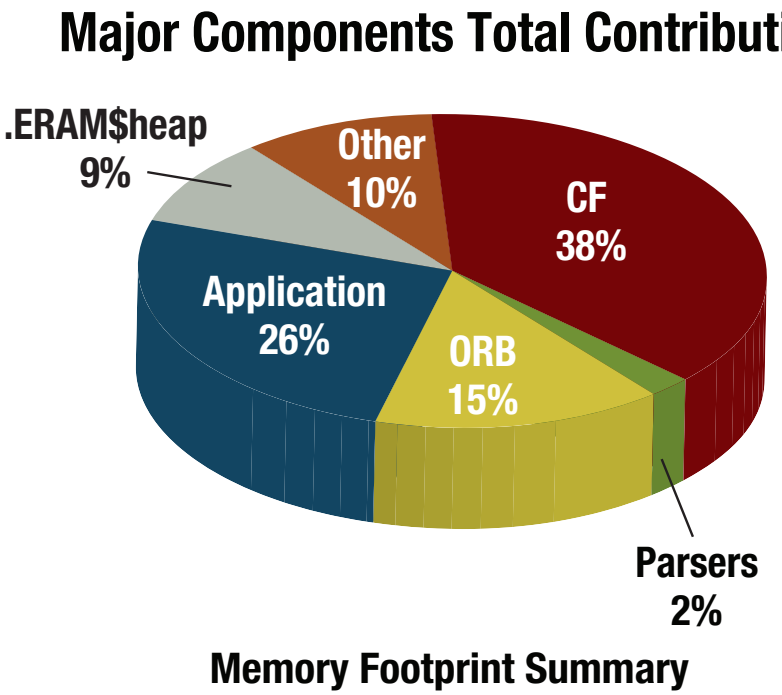


Figure 4

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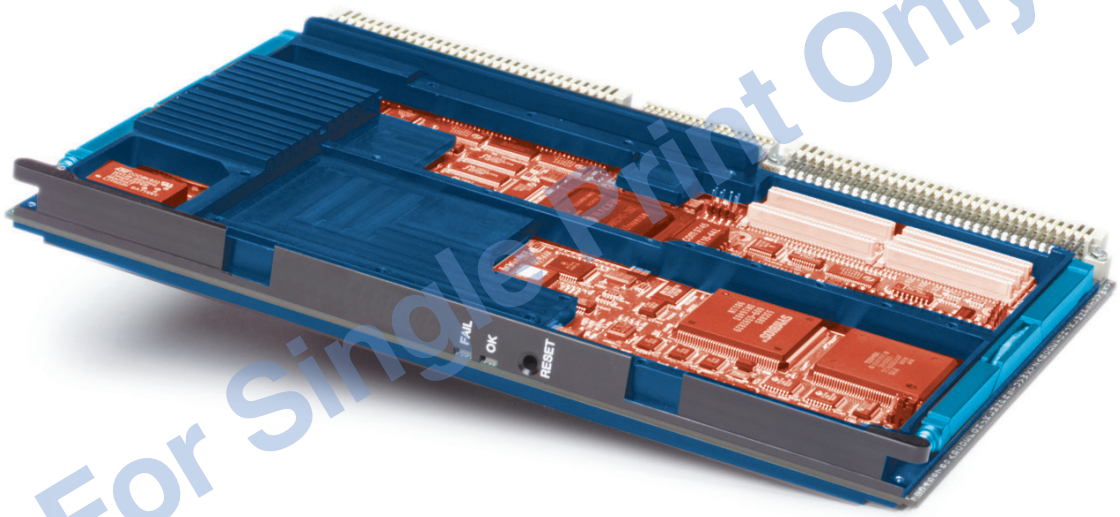

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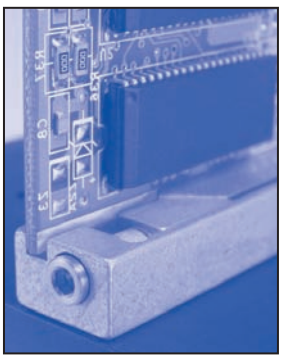

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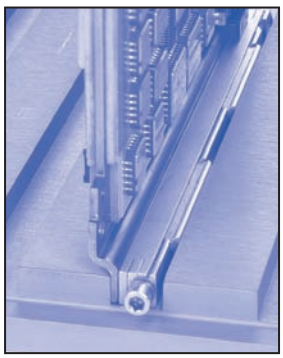

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Factory, and the user interface. The main waveform components have very similar footprints as expected. However, the functionality of these components is extremely simple. More complex waveforms will require more memory.

Performance profile

CPU cycle requirements were collected from the CF's startup tasks: domain initialization and waveform creation. The results are shown in Table 2. Domain initialization includes the instantiation of Domain Manager, ApplicationFactory, and ResourceFactory, which durations are independent of the waveform deployed. Waveform creation represents the execution of ApplicationFactory's create(). It includes descriptor parsing, task scheduling and initialization, and component connection. Keep in mind that waveform creation is waveform-specific, and these results only apply to our test waveforms.

Task	Cycles	Time (sec) @ 720 MHz
Domain Initialization	2,365,664	3.286E-03
Create Application	10,997,946	1.527E-02

Table 2

Opposite to initialization tasks, ORB performance had a great impact on the system throughput because all intercomponent communications were established using CORBA messages. Two specific scenarios were profiled:

- **Invocation**: Round-trip cycle count for a simple method invocation with no arguments
- **Marshaling**: Round-trip cycle count for a simple method invocation with basic arguments

Two different argument types were evaluated:

- Single data type
- Sequence (1,024 elements)

In our version of e*ORB, even for interfaces with no arguments in their IDL definitions, a CORBA::Environment variable must be sent as an argument because of the lack of exception support. In both scenarios, client and server were launched as separate DSP/BIOS tasks with priorities 2 and 1, respectively. The e*ORB profiling results for different primitive data types are summarized in Tables 3 and 4.

Task	Clock Cycles
Initial Invocation	4,184
Subsequent Invs.	4,081

Table 3

	Float	Char	Short	Double
Basic Marsh.	4,208	4,127	4,142	4,124
Sequence Marsh.	6,908	5,732	6,072	8,342

Table 4

An interesting point is that the very first time a client makes a request to a server, the execution takes longer than subsequent requests, as shown in Table 3. This extra delay is because of the new connections' binding, which happens only once per connection. A graphical representation of the marshalling profile results is shown in Figure 5. After observing these results, the need for block processing in an SCA system is evident.

It takes 4,208 clock cycles to make a round-trip marshalling call with a single float, while it takes 6,908 clock cycles to send a sequence with 1,024 floats. Averaging, it only takes 6.74 clock cycles to transfer each element in the sequence.

Impact on data rate performance

The framework overhead incurred during instantiation and waveform deployment can be arranged to happen off-line. The only aspect of the SCA that impacts system throughput is the dependency on CORBA for intercomponent communications. The maximum system data rate depends on many factors: algorithm processing delays, framework delays, analog-to-digital conversion rate, and so on. To isolate the impact of the framework, we used the results shown in Table 4 to estimate an upper bound for the system data rate.

Ignoring processing delays, the maximum achievable data rate is given by:

$$R_{max} = \frac{1}{T_m + T_{tr}}$$

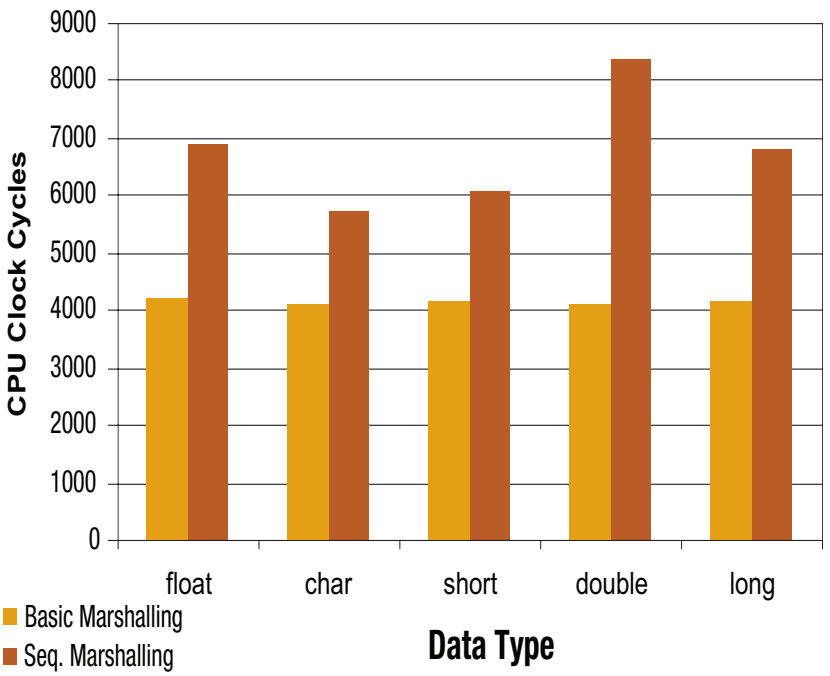

Figure 5

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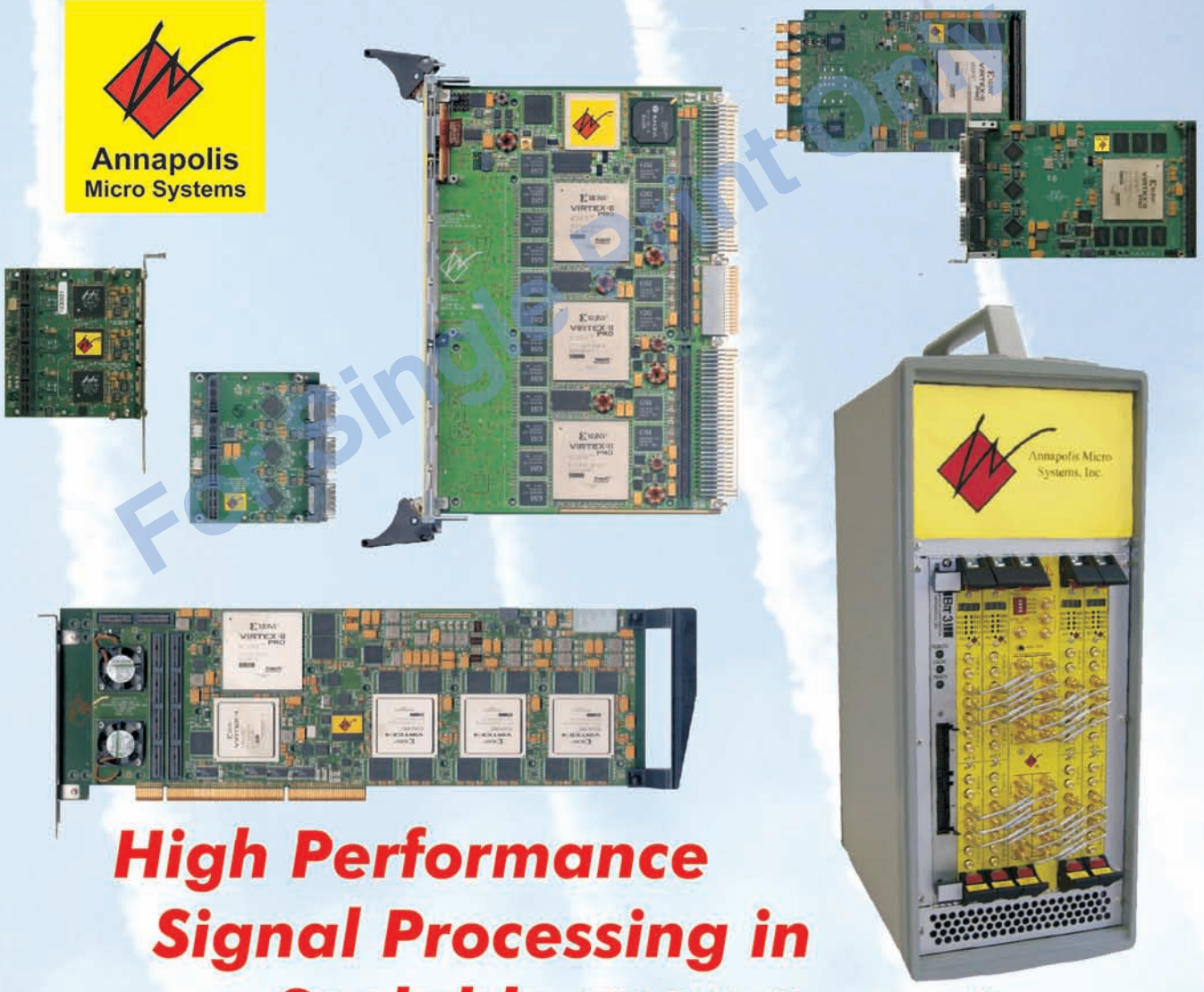

High Performance Signal Processing in Scalable FPGA Computing

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where T_m is the delay due to middleware processing and T_{tr} is the delay due to transport mechanisms. In our system, we only considered T_m because no transport mechanisms had been developed at the time.

The average delay per bit due to middleware message passing T_m is given by:

$$T_m = \frac{D_t \cdot S_S}{N_p \cdot n}$$

where D_t is the measured transfer delay as shown in Table 4. S_s is the number of samples per symbol. N_p is the packet size, and n is the number of bits per symbol. To estimate the maximum data rate allowed by the framework, we assumed $S_s = 8$ and $n = 1$. The clock speed in our system is 720 MHz. Substituting these values into the expression for T_m for a single float type transfer that according to Table 4 takes 4,142 cycles, the maximum data rate achievable is $R_{max} = 21{,}728$ bits per second. However, if we consider sending a sequence of 1,024 floats, the transfer takes 6,072 clock cycles allowing a maximum data rate $R_{max} = 15{,}177{,}865$ bits per second. These results highlight the need for block processing within the SCA, trading off latency and performance.

The future of SCA on DSP

One of the main concerns of following the SCA is the heavy infrastructure required to support it. To ease requirements in terms of performance, cost, and power consumption, we propose an implementation of the SCA Core Framework for a TI C64 DSP platform. This approach is feasible thanks to the latest developments in software tools and ORB technology. By having an SCA core framework in a DSP, all the benefits in software reuse and deployment flexibility brought by the SCA can be achieved in a more efficient platform. In terms of performance, our complete implementation requires about 1.5 MB, which represents about 1 percent of the total memory available per DSP in our platform. Even though CORBA introduces some delays and overhead, the overall effect can be reduced by sending data packets instead of single elements. The source code for the framework and sample waveforms is available at http://ossie.mprg.org.

Finally, it also needs to be noted that SDR technology continues to rapidly evolve and improve. The work referenced herein was conducted and profiled about a year ago. If the design and implementation were repeated today, the results (such as performance, memory footprint, and so on) would be that much more impressive in validating the SCA on DSP.

Acknowledgments

This work was supported by Lyrtech, Mercury Computer, Texas Instruments, and the National Institute of Justice.

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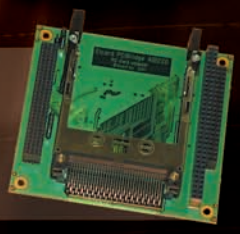

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10 GbE for high-performance real-time embedded systems:

What you need to know

By Rob Kraft

Ethernet is now running at 10 Gb rates, making it a viable option for high-speed interprocessor and I/O communications. To help ensure a successful system implementation, designers should consider an FPGA-based protocol offload architecture.

10 Gigabit Ethernet (10 GbE) technology, which is still relatively new in the server space, is now emerging in the real-time embedded space and overlapping the emergence of other proprietary and standard system interconnect fabrics such as RapidIO and PCI Express. What makes 10 GbE so exciting is that for the first time, the world's most widely understood, deployed, accepted packet-based communications protocol can address the requirements of the high-performance real-time space.

10 GbE has different appeal for different users. The designer simply seeking a really fast subsystem interconnect now gets a leading-edge 10 Gb fibre or copper fat pipe. The program manager struggling to find developers familiar with high-speed protocols – while surrounded with those possessing Ethernet experience – suddenly finds that the latter group has the sought-after skills. The system architect who has for years employed Ethernet for the command, control, and status plane while relying on a variety of other technologies for the high-speed data plane can now ease future software migration by basing both on a common technology.

Unfortunately, the act of processing the communication protocol stack at 10 Gb rates heavily taxes modern processors, leaving them very few, if any, cycles to perform signal processing. I/O modules, such as ADCs, could also benefit from using 10 GbE as a communications fabric; however, these modules typically lack processors that could perform the stack processing – for *any* speed of Ethernet. Employing a discrete processor as an intermediary in the data path to facilitate 10 GbE communication – or even a processor dedicated solely to stack processing – are not practical solutions.

So, when it comes to successfully implementing 10 GbE as a fat pipe in high-performance, real-time embedded systems, there are several key considerations:

- ➔ One, UDP is often the appropriate choice of protocol.
- ➔ Two, protocol acceleration/offload is typically required.
- ➔ Three, when being employed to transfer data to or from an I/O module, an architecture that permits direct data streaming between the I/O module and 10 GbE is required.
- ➔ Four, although ASICs, network processors, and FPGAs are all candidates for the offload technology, there are some key *system-level* benefits that make the FPGA particularly appealing in this space.

UDP protocol

When most people think of Ethernet, they tend to think of TCP/IP, which is probably the most common protocol that runs on it. TCP is a reliable, connection-oriented protocol that ensures a link between the two points that are communicating. The protocol guarantees delivery of packets, in the order they were sent, and it will request resends if packets are not received. Overall, it is a protocol well-suited to control and initialization. But is it necessarily the best choice for high-speed, real-time data flows?

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Unlike TCP/IP, UDP/IP is a "best effort," connection*less* protocol and by design does not guarantee the receipt of packets nor that they will be received in the order they were sent. So, using UDP/IP, there is generally no way for the receiver to know that a packet is received out of order or is missing altogether. Packets just show up at the receiver (or not), and they are processed in the order they arrive. (Note that when using a point-to-point link, ordering is not a concern.) High-performance, real-time embedded applications typically lend themselves to a best effort communications channel. In these applications, such as an ADC continuously sampling data, there is no opportunity for a second chance. The data is just sent and errors must be coped with at a higher application layer (for example, signal processing, filtering, defining a sequence number within the payload, and so on). For such applications, UDP is a good match.

UDP, unlike TCP, also supports a multicast functionality, useful in applications such as beamforming or direction–finding where one or many data channels need to be aggregated at one or many processing destinations. Multicast support is in addition to the inherent addressing features supported by both UDP and TCP. These addressing features can be useful in applications requiring the transport of multiple sources or *channels* of data (for instance, multiple ADC channels or down converter channels) to different or multiple destinations over a common data pipe. The protocols' addressing scheme provides a means of logically identifying and isolating the individual data channels. Users are also free to implement a custom scheme within the data payload.

Protocol offload

Empirical studies have shown that when using the native operating system protocol stacks to run 10 GbE on a network adapter card, modern server class CPUs can achieve unidirectional data transfer rates of 3 to 5 Gbps, at 100 percent utilization. The CPU is completely occupied traversing through the protocol stack, assembling the data into properly formatted packets, calculating checksums, handling interrupts, and moving data to the adapter. In other words, the CPU can do no other useful work besides manipulating packets for communication. Even so, it is unable to realize the bandwidth available on the data pipe.

Two high-level approaches for accelerating the protocol processing include:

- Modifying the stack
- Offloading the stack to a specialized external protocol engine

The degree of acceleration required for 10 GbE and a strong preference to maintain compatibility with the large Ethernet ecosystem make the latter approach desirable. In a typical implementation, the processor would move payload data to or from the protocol processing engine where the majority of the stack processing would occur. Figure 1 illustrates the movement of the boundary between software and hardware stack processing as a result of the

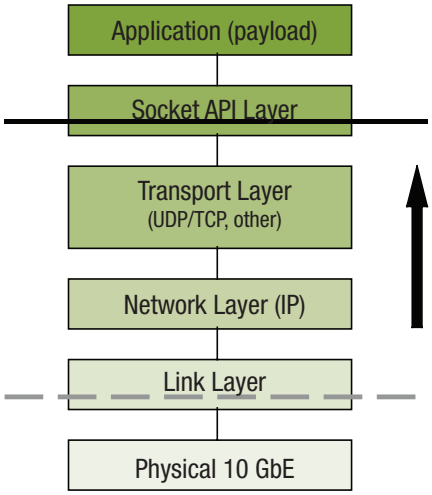

Figure 1

stack acceleration process. The gray dashed line represents the original location of the hardware/software border when stack processing was primarily occurring on the processor. The black line illustrates the end result, leading to a decrease in processor utilization and improved throughput.

Direct data streaming

While CPUs require *accelerated* protocol processing to effectively utilize 10 GbE, I/O devices have the even more fundamental need to access the protocol processing functionality altogether.

Figure 2 illustrates why a CPU typically cannot function as the gateway to 10 GbE for an I/O module. Using an example of an ADC mezzanine module, of which many such off-the-shelf examples can be found in the embedded space, the data flow consists of:

1. Data is moved from the ADC module to the CPU RAM (likely through a bridge, not shown);
2. The CPU must read the data into cache for processing;
3. The CPU processes the data, wraps it in the Ethernet protocol, and then writes it out to RAM;
4. The data is moved from CPU RAM to the external 10 GbE interface module (again, through a bridge, not shown).

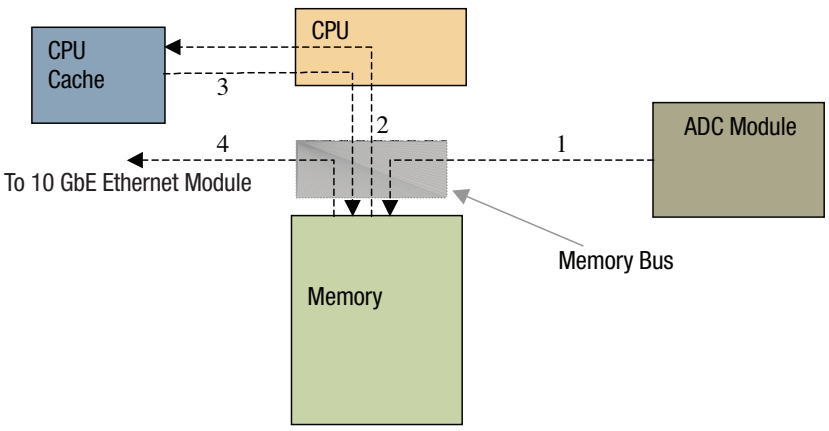

Figure 2

The net result is a quadruple trip on the CPU's memory bus, where the first two trips involve payload data and the latter two involve the necessarily larger amount of protocol-wrapped data. So, before we even begin to account for any other bus overhead (interrupts and cycles lost due to bus direction turn-arounds, arbitration, and so on), a theoretical 2 GBps CPU memory bus already becomes effectively a sub-500 MBps bus, constricting the ADC-to-Ethernet data path to a theoretical maximum of 4 Gbps. If the application were full-duplex, the maximum would be just 0.5 Gbps.

A performance solution requires a direct data path from the I/O module to the 10 GbE interface, which is only possible if the interface itself is capable of performing the entire protocol offload. The system CPU's job is to perform some setup functions and get out of the way, allowing the I/O module to transfer data directly to and from the 10 GbE module (as illustrated in Figure 3). Note that beyond control and setup, the system CPU is also highly desirable during development and debug and to support additional features such as the analysis of data snapshots and test and maintenance modes.

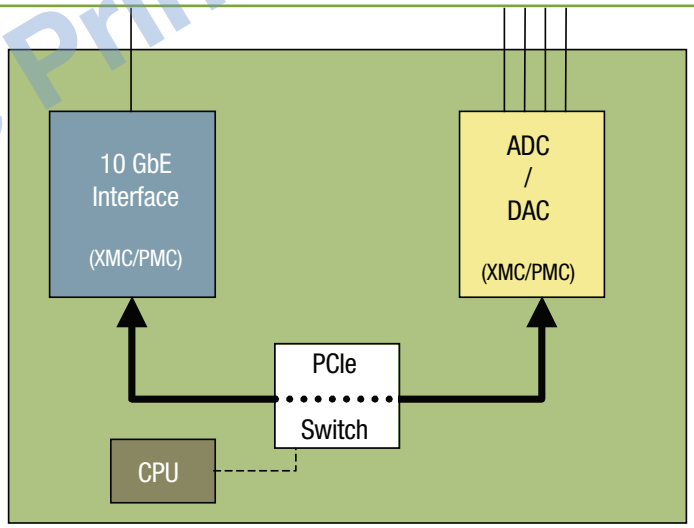

Figure 3

FPGA-based acceleration

Our discussion has focused on functionality and architecture. We indicated earlier that there are several implementation technology choices. However, there are some important benefits that make an FPGA particularly well-suited as the engine for 10 GbE solutions in the military and other high-performance spaces. Because of problem complexity in these spaces, systems tend to consist of an integration of several hardware and software components. FPGAs, being *both* programmable *and* capable of 10 GbE line-speed processing, enable three critical features to facilitate the successful design and implementation of such systems: (1) Protocol customization; (2) project de-risking; and (3) integration of higher-level system functionality.

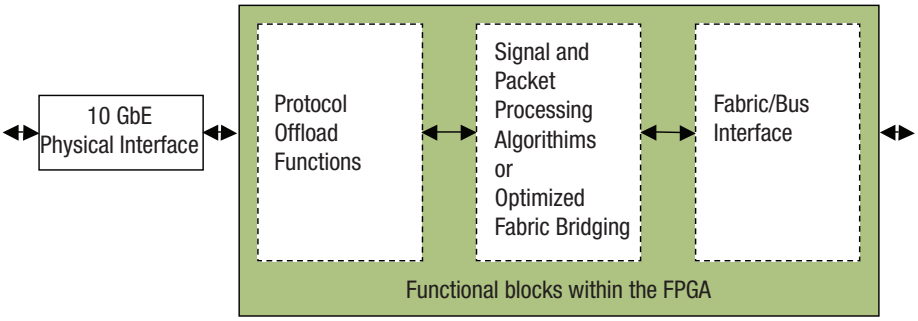

Figure 4

Protocol customization

The term "customization" may conjure memories of systems past that consisted of proprietary, noninteroperable protocols. However, customization need not be nearly so drastic, and can in fact consist of additions or modifications *within* the payload or headers that do not in any way make the messages incompatible with standard 10 GbE. Examples include adjustable delays between sending packets, padding for byte alignment, disregarding certain header fields, and the addition of sequence numbers or timestamp information as part of the payload.

Generally, the decision to perform any customization should be done only after an overall system-level analysis is performed. The following example of a receive-side-only customization is completely nonsensical for many applications but might make good sense in a system receiving streaming ADC data over 10 GbE. Under the standard UDP/IP protocol, fragmented packets that are received incomplete or with checksum errors are tossed out by the receiver rather then being passed onto upper layers of software. However, if the packet consisted of a series of ADC samples headed into a signal processing block at the receiver, it might be preferable to incorporate a modification to retain the packet, rather than losing it in its entirety. The reason is that the decoding, filtering, or other signal processing algorithm might be more amenable to handling a packet with individual sample errors rather than enduring an entire missing sequence of samples (burst error). FPGA use enables such customizations, which only make sense when the payload is viewed in the context of the whole system, to be incorporated and tested.

Project de-risking

The de-risking feature is a result of the FPGA's reprogrammability. Specification oversights, yet-to-be-ratified protocol updates, and late-stage "fires" can often be directly addressed or worked around between software and FPGA code; with an ASIC-based solution, this may not be possible. Some examples of small, late-stage oversights that can represent significant hurdles when discovered at integration time are byte alignment or a need to complement data. An FPGA could be used to fix such problems as the data streams by. However, if the task were left to a general purpose processor, the number of cycles required for such seemingly simple operations could be a show stopper.

Integration of higher-level system functionality

FPGAs are widely recognized and used for their real-time signal processing ability. Functional blocks such as filters, digital up and down converters, and synchronization circuits can be added as custom pre- or postprocessing algorithms in the FPGA used for the protocol offload, as depicted in Figure 4. In addition to *signal* processing, *packet*-processing functions like inspection, classification, and optimized fabric bridging can also be incorporated within the FPGA. Depending on the nature of processing, the importance of colocating the algorithmic and the protocol offload functions may vary from a convenience to an absolute necessity. The net effect is that FPGA use enables the protocol offload module to assume a higher-level, portable signal or packet processing functionality well beyond that of a data mover.

A practical 10 GbE implementation

Ethernet has now reached the level of performance required by many high-performance embedded real-time applications. When appropriately architected and integrated into a system, 10 GbE offers new capabilities and advantages. Figure 5 shows the AdvancedIO Systems V1020 10 GbE XMC module. The module, which has been integrated on COTS carriers, is currently shipping with UDP offload capability for processor-based applications as well as data streaming from I/O modules. The module supports both PCI-X and PCIe interfaces and, as you may have guessed from the rest of the article, is based on an FPGA.

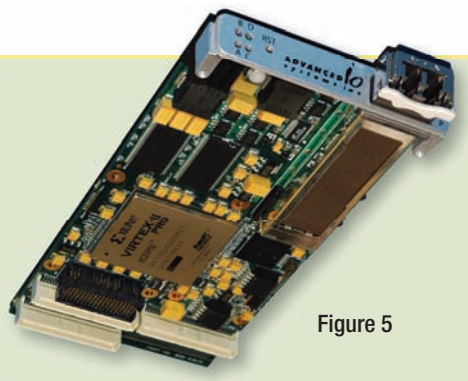

Figure 5

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Combating obsolescence in high-performance multiprocessor software

By William Lundgren, Kerry Barnes, and James Steed

When software is customized to its hardware, it is difficult to break that bond. Software is then at risk for becoming obsolete just like the hardware. Three methods for combating this obsolescence are presented: specification documents, middleware, and model-driven development. Only model-driven development is capable of addressing this issue while simplifying software development, making global-level optimizations to the application's structure and providing a general purpose solution instead of a finite set of algorithms.

One doesn't think of software becoming obsolete in the same way that hardware becomes obsolete. With hardware, once the circuit is no longer fast enough or no longer suited to the desired application, it has to be thrown away. Meanwhile, software can be rewritten. On the surface, rewriting software seems like a cheap and simple task. However, usually when software becomes obsolete, it is not just a matter of changing a few lines of code.

Take a hardware refresh many engineering teams may be considering right now: moving a deployed application from a quad DSP board (for example, PowerPCs or TigerSHARCs) to a multicore architecture like the IBM/Sony/Toshiba Cell Broadband Engine (Cell BE). To write a real-time program on four DSPs, the development team must make many architecture-specific optimizations. First, they must optimize compute-intensive subroutines to execute efficiently on a single DSP, for example vectorizing the arithmetic in the code and observing byte alignment to best utilize the four ALU data paths on the PowerPC processor. Portions of the code might even be written in Assembler instead of C or Fortran in order to milk each ounce of performance possible. Second, they must partition the code to run on four processors and coordinate data movement and sharing. Porting this type of DSP application with all its architecture-specific optimizations to a processor with a completely different architecture and completely different optimizing strategies is no easy task. If a new development team is handed the DSP code and asked to retarget it to the Cell, divining the algorithmic IP from the current DSP code is likely impractical and may even be impossible. This type of software retargeting likely involves beginning at square one: algorithm development.

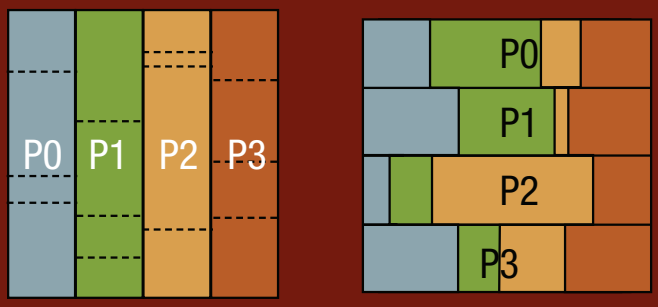
Several software development methodologies have been developed to combat this type of software obsolescence, though, including software spec documents, middleware, and model-

The challenge of multiprocessor software portability

If software is portable, it can be run on multiple types of hardware. Software portability reduces the risk of obsolescence if that portability includes future types of hardware. To study the challenge of software portability, let's look at a simple example: a distributed sort application. Assume that the data set is very large and at the beginning of the sort, each processor has N/P data elements where N and P are the data size and number of processors. There are two sections to this algorithm: First, the processors must decide together how to redistribute the data, then they must partition and redistribute their arrays accordingly.

In the first section of this algorithm, each processor locally calculates a histogram, and the histograms are collected to determine how the data should be redistributed. To perform this communication, an adder tree is formed where sibling processors combine their histogram with their neighbor and send the result up the tree's hierarchy. After the histograms are combined and collected, they are broadcast to all the processors.

In the algorithm's second section, each processor partitions its array and distributes the data to the other processors. This communication is very similar to a corner turn (a distributed matrix transpose) as each processor is sending and receiving part of its row of data to every other processor. An important difference is that the matrix rows in this transpose are broken into segments of varying lengths. At most, N/P data elements can be included in each transfer, but the actual number of elements transferred is usually much less than N/P. An illustration of this variable-width corner turn is shown in the figure.



To perform this algorithm, three communication protocols are used: a collect, a broadcast, and a variable-width corner turn. This communication is central to the algorithm; the only other functions used in the algorithm are calculating the histogram, partitioning, and sorting.

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driven development. We will present an example application and explore how these three methods for combating software obsolescence address porting the application to a new architecture.

Documenting the software

One approach to battling obsolescence is through the use of detailed specifications. Commonly, software development teams require the algorithmic IP be specified in a detailed document and then insist the implementation exactly follow the specification document. This approach prevents the new development team from having to divine the meaning of legacy code. However, it does not serve the primary objective of reducing cost; the development team still is left with the task of rewriting the code, in its entirety, for the new processor.

For the distributed sort application (see sidebar, page 34), a document could be created that describes the distributed histogram, the variable-width corner turn, and all the other functions in the algorithm. To implement a distributed sort on new hardware, the engineer creates the software that realizes each of these specifications.

This solution relies on the engineer to deal with much of the complexity of implementing distributed software. The programmer must know how to best utilize the parallel processing paths and communications bandwidth of the multiprocessor system. This knowledge is very specialized; a programmer with expertise in programming one DSP system from one vendor does not necessarily have equivalent knowledge for a DSP system from another vendor, let alone a multicore processor with radically different hardware.

Corralling the software architecture in middleware

Another methodology for dealing with obsolescence is to use middleware to separate the architecture-specific code from the algorithmic IP using a layer of software. This approach addresses many issues in software portability. However, if the task at hand is moving from a board of four DSPs, where each processor has large memories, to eight lightweight processing cores with tight memory restrictions on both program size and data size, then middleware offers no assistance. The software architecture – how the software is distributed across the processing elements – must be changed to meet the architecture of the hardware system, and middleware cannot abstract away the software architecture.

Middleware addresses the portability of the application by providing a platform-independent method of specifying common operations. For example, functions for common routines like local sorting or broadcast are provided out of the box, and if code is written using these functions, the code is portable. Less common functions are not supported.

Middleware likely doesn't support the variable-width corner turn from the distributed sort algorithm. The standard corner turn (with fixed-width rows) might be supported, but data must be padded to use the routine, losing efficiency. The routine could be hand-coded, but this coding is difficult and likely presents a trade-off between efficiency and portability. Also, if

hand-coding is chosen, while the corner turn from a middleware library might provide portability from four processors to eight, foresight is required to parameterize the parallelism of the system into the hand-coded routine.

Similarly, a histogram adder tree is not likely to be supported. The adder tree can be hand-coded, combining the calls to the middleware communications library with calls to the middleware vector arithmetic library. However, this combination is inserting the software architecture into the code. If the number of processors increases, the code must be reviewed and rewritten to include the additional levels to the tree. If the interconnection of the architecture changes from a token ring to a bus or other connectivity, the tree structure might change according to which processors are now nearest neighbors in the new interconnection.

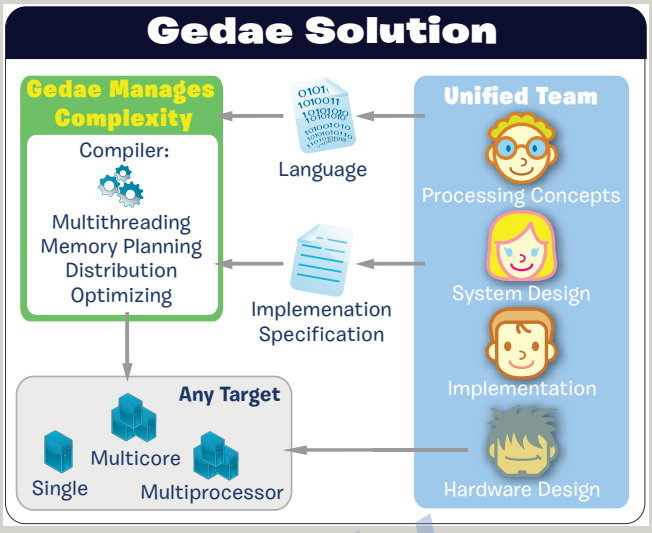

Figure 1

As software gets more complex, the struggle to keep the software architecture out of the algorithms gets harder. Consider a complete radar application with multiple modes of operation, such as searching for targets and tracking them once they are found. It is not just one algorithm like sorting, but multiple algorithms running at the same time, with each one requiring a different number of processors and different distribution across those processors. In a real-world application, the impact of adding the software architecture to the code is essentially irreversible.

Automating the software architecture with model-driven development

The third approach to thwarting software obsolescence issues is that of model-driven development. This approach captures the algorithmic IP in a functional model that is very much like an executable version of a specification document. The toolset includes a multiprocessor compiler, which uses its global view of the application along with its knowledge of the target hardware to transform the functional model into a target-optimized implementation.

Model-driven development accomplishes its mission by incorporating the software architecture during compilation instead of directly inserting it into the code. The removal of the software architecture from the code increases portability, allowing one functional model to be used on any multi-CPU system, regardless of processor type,

interconnect, or other fine details of the hardware. The compiler has a unique global view of the application and is able to use that information to automate and optimize much of the application's structure – optimizations that are difficult when hand-coding, even with middleware. Let's consider how Gedae, a programming language and multiprocessor compiler, assists in implementing the same sorting algorithm.

Gedae's compilation process and how it affects software development teams is shown in Figure 1. Application algorithms are captured in a functional model. To form the application from the model, the Gedae compiler first turns groups of algorithms into threads. Forming threads is an essential part of parallelizing code, and this type of compiler is able to do it automatically by analyzing the relationships between the data streams in the algorithms to plan the structure of the threads. In the distributed sort algorithm, the corner turn presents a natural boundary to separate the application into threads that can be processed concurrently.

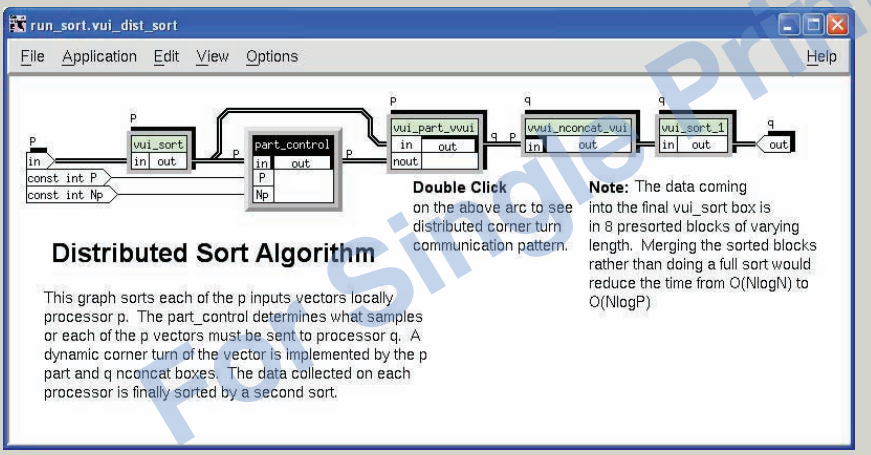

Figure 2

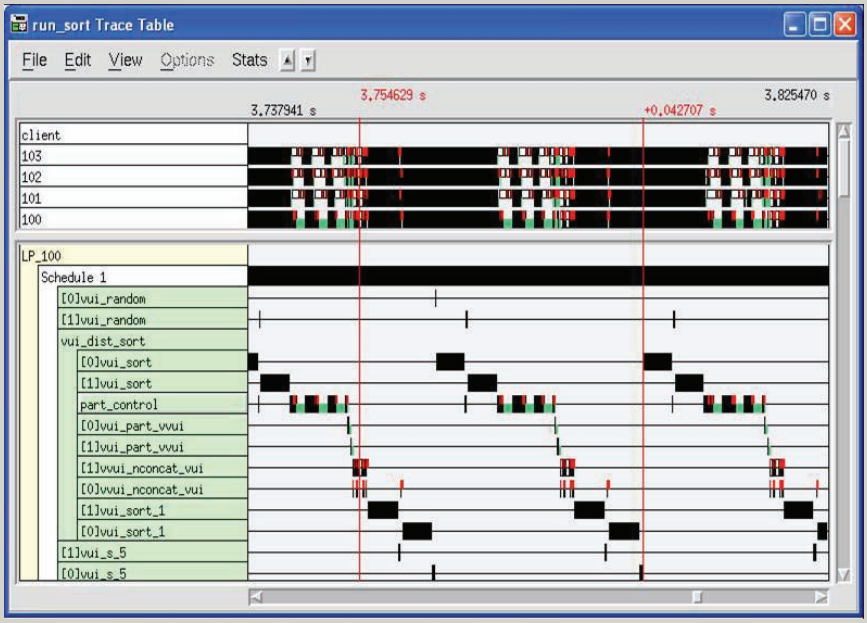

Figure 3

To implement this application for an architecture like the Cell BE, the developer must use memory very efficiently. Model-driven development tools use their global view of the application to analyze the size and time of use of each buffer. Using this information, the compiler is able to preplan memory usage so it can be statically allocated and shrink the total memory footprint by reusing buffers as much as possible.

Next, the compiler automatically inserts and manages all communication needed to sort the data. While this variable-width corner turn can be seen as a gap in the middleware library, a model-driven development tool is able to automatically generate an efficient implementation. Gedae's graphical language breaks processing into components, and any connection between components – even if those components are in the same thread – can be turned into a transfer between processors in the generated application. Figure 2 shows the portion of the flow graph from which the corner turn is created during compilation. There are P instances of the `vui_part_vvui` (partition) and `vvui_nconcat_vui` (concatenate) components, one for each processor. The connection between the two sets of components creates the (p,q)-to-(q,p) pattern necessary for a corner turn, allowing the compiler to automate the rest of the implementation. Using its global view of the application, model-driven development is also able to provide a rich set of debugging and analysis tools. For example, the Gedae Trace Table in Figure 3 shows all timing information including communication [green (send) and red (receive) bars].

In this example, Gedae has minimized the work required to implement the intricate communication patterns. The compiler has automatically created P sets of threads to distribute to the P processors and will automatically manage the concurrency of the threads. Because Gedae is managing the distribution of the application at build time, the functional model loses no portability, and the software architecture is not inserted into the functional model. Software development's complexity is mitigating without losing any performance, and the same software can easily be moved from one system to another, whether it's a quad DSP board, the Cell BE, or a future architecture.

Model-driven development future-proofs software

The rise of multicore processors like the Cell BE and the Intel Core 2 Duo/Extreme increases the challenge of software portability and will cause more software products to be at risk for obsolescence. Dealing with different multiprocessor systems is no longer limited

to massive software projects built for embedded hardware or supercomputers; all software must address these issues as we can no longer assume code will run on only one processing core. If software developers do not address these portability issues, they risk adding significant costs to maintain their software when their current chip is no longer fast enough. To avoid these issues, three methodologies have been developed: specifications documents, middleware libraries, and model-driven development. While all three methods help address the issues of porting software to new architectures, model-driven development tools like Gedae present unique advantages. These tools can both automate much of the work of creating the new implementation and use their global view of the application to make optimizations that are difficult when using the other two methods.

William Lundgren *is cofounder, president, and CEO of Gedae, Inc. William started his professional career at Corning Glass Works as a product development physicist. He later worked at the U.S. Air Force Institute of Technology and the U.S. Air Force Research Laboratories developing new speech and audio processing technologies. After leaving active duty in 1985, he moved to RCA Advanced Technology Laboratories, which became Lockheed Martin. He then spent the past 16 years leading Gedae development. William has a BS in Physics from Rensselaer Polytechnic University, BS and MS degrees in Electrical Engineering from the U.S. Air Force Institute of Technology, and is All But Dissertation for his PhD in Electrical Engineering from the University of Pennsylvania.*

Kerry Barnes *is chief scientist and a founding member of Gedae. Before joining Gedae, Kerry was a principal member of the engineering staff at Lockheed Martin, ATL where he was responsible for signal processing systems software/hardware, single-chip FFT design, direct digital frequency synthesizer design and implementation, and various software tools and applications development projects. He earned a BS in Electrical Engineering from Lehigh University and an MS in Computer and Information Science from the University of Pennsylvania.*

James Steed *is director of software development and a founding member of Gedae. Prior to Gedae, James worked at Lockheed Martin where he was responsible for developing the embeddable library of functions, including testing and creating a database and search utility. His most prominent project is the development of Gedae's new RTL language. James earned a BS in Computer Science from Cornell University and an MS in Computer Science from North Carolina State University.*

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Agile software development of military embedded systems

By Dominic Tavassoli

Although agile software development methods work well for small projects where developers are only a cubicle away, can they be successfully applied to large military systems? The answer is yes, but only with some serious support from robust change and configuration management tools.

Developers creating software for today's complex military embedded systems are under increasing pressure to control costs and shorten development cycles. At the same time, they are expected to produce high-quality, bug-free software while responding rapidly to changes during every phase of the project's life cycle.

Most teams developing military embedded systems follow the waterfall model developed in the 1970s, which takes a step-by-step approach. Developers move from one phase to the next – from requirements capture and analysis to design, coding, and testing – in a strict sequential fashion. Proponents of the waterfall approach often regard some of the relative newcomers to the scene – such as agile software development with its emphasis on many rapid iterations – as being too unstructured for developing complex military systems. But as Figure 1 indicates, the waterfall approach can have the opposite effect by creating a series of silos.

This is one of the reasons that software development and life-cycle managers at many of today's military embedded systems organizations are investigating the agile approach. They are drawn by the potential for greater flexibility that will allow them to control costs and shorten development cycles while still delivering highly reliable systems.

Agile development methods (Figure 2) have an excellent track record for handling small, co-located projects. But the big question is: How do you adapt the practice to deal with large, complex projects, especially if your developers are scattered across multiple sites and the project has constantly changing requirements?

Agile life-cycle management and traceability

Change and configuration management solutions are necessary for organizations that want to successfully deliver large-scale agile development projects. These solutions are particularly important for complex projects that are distrib-

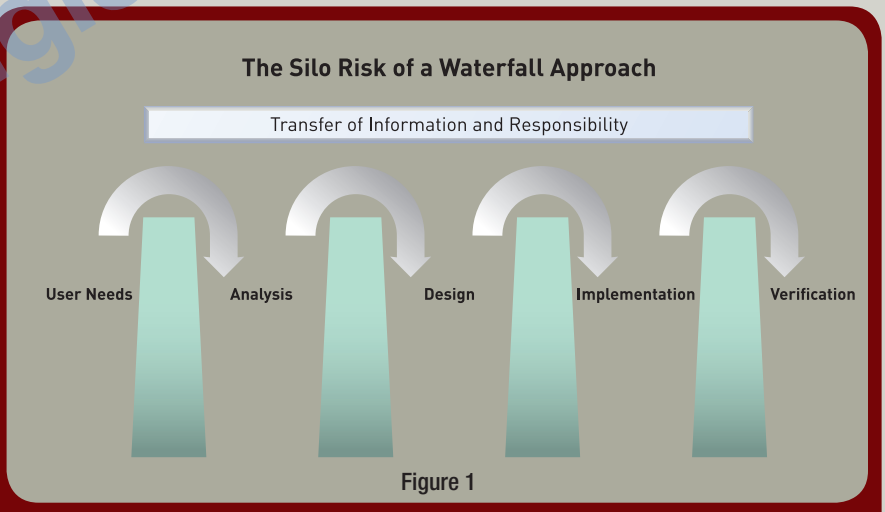

Figure 1

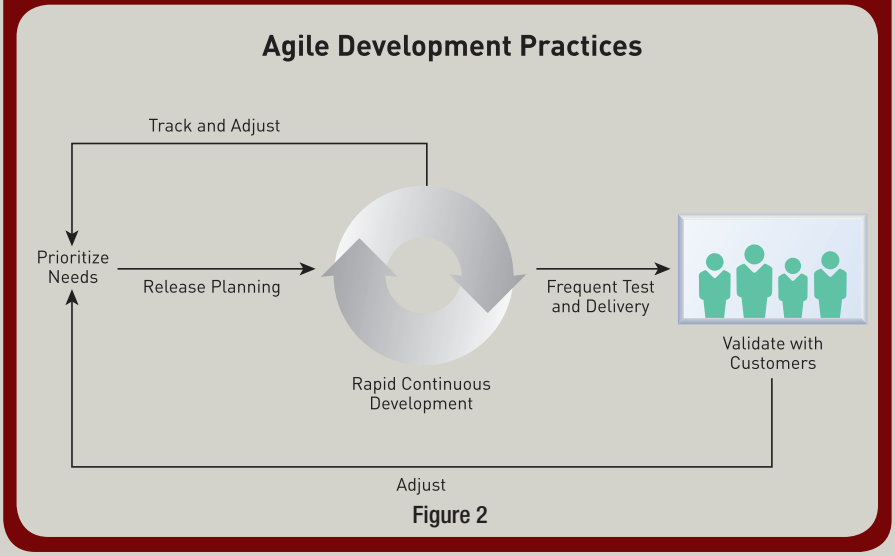

Figure 2

Realizing agile life-cycle benefits

According to the Agile Alliance (www.agilealliance.org), agile software development "emphasizes close collaboration between the programmer team and business experts; face-to-face communication (as more efficient than written documentation); frequent delivery of new deployable business value; tight, self-organizing teams; and ways to craft the code and the team such that the inevitable requirements churn was not a crisis."

The benefits of agile life-cycle management can be achieved on military embedded systems with help from a combination of task-based configuration management, enterprise change management, and agile requirements management solutions that follow the fundamental premises of agile software development. Out-of-the-box agile processes and templates greatly increase the likelihood that the development process will move along quickly and smoothly, despite challenges presented by scalability, geographic distribution of human resources, project criticality, and compliance requirements.

uted geographically and organizationally, require extensive documentation and traceability, and have continually changing requirements. Table 1 lists the benefits of implementing an agile development approach, while Table 2 illustrates factors in handling agile development challenges.

Change and configuration information needs to be captured in a central, scalable repository, ideally with a configurable workflow and a Web interface to ensure that objectives and priorities are recorded and analyzed in a consistent, repeatable process.

To start the process, agreement must be reached regarding priorities, and features and fixes assigned to releases. To limit overhead and guarantee traceability, enterprise change management is integrated with configuration management by linking

Benefits of Agile Principles

Agile Principle	Benefit
Strong end user participation	Increased project success rate and user acceptance
Increased collaboration among team members	Reduced rework, higher productivity
Highly iterative releases, frequent integration and test	Better risk management
Responding to changes, whether market, external,or internal	Better positioning of final system or product
Regular deliveries and validation with end user	Increased confidence for team, management,and client
Rigor and shared commitment	Improved quality across all teams

Table 1

Adapting to Challenges

Speed	Deliver quality content on time
Control	Meet compliance needs for traceability and documentation
Efficiency	Coordinate complex projects across the globe
Agility	Adjust to changing requirements and environment

Table 2

tasks to the change requests. Developer tasks are stored in the CM repository. This provides a consistent mechanism for communicating among team members rather than relying on a mix of e-mails, phone calls, sticky notes, and water-cooler conversations. The developer simply selects the task in his to-do list, and all work is automatically grouped in a consistent change set. To deliver changes to the rest of the team, the developer simply checks in the task. This provides full traceability while minimizing overhead as depicted in Figure 3.

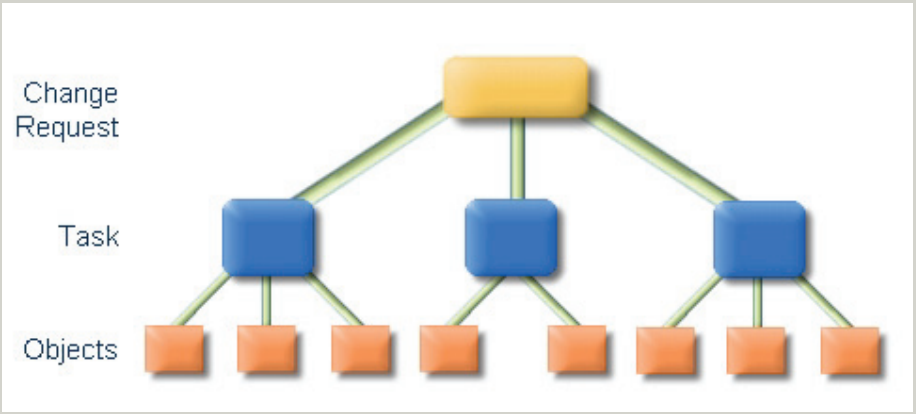

Figure 3

Advanced change and configuration management systems, such as Telelogic Synergy, provide invaluable functionality for agile teams, enabling them to switch to an urgent assignment or quickly check compatibility with changes made by coworkers.

Roundtrip traceability

Typically, traceability is accomplished using a top-down approach. Best practices and tools are used to link code to features and requirements as soon as they are created. However, for most quality, audit, and test validation procedures, this approach falls short. It does not analyze what was actually produced to confirm that the expected requirements, fixes, or requests have been delivered as planned – at least not before the costly testing phases. This can prompt unnecessary and costly regression testing.

Round-trip traceability solves this problem by taking both a top-down and bottom-up approach. Because it provides complete visibility into the software development life cycle, this practice enables development team members and their customers to quickly assess the impact of a system change and to report and monitor development to ensure continuous improvement – essential criteria for implementing Capability Maturity Model Integration (CMMI) and International Standards Organization (ISO) improvement programs.

The process starts top-down by linking requirements and implementation requests to code, documentation, or test artifacts as the implementation proceeds.

Once the team and the customer have allocated features and bug fixes to releases, the developers then work on implementation, assembly, and delivery. This ensures that requirements changes are managed properly and traced to change requests – and eventually to software code.

The bottom-up approach complements the top-down approach. Bottom-up traceability not only allows development teams to confirm the integrity of their configurations, but also allows test and quality assurance engineers to ensure that the delivered code conforms to approved requirements. Applied at every stage of incremental testing, this approach allows the team to confirm that requirements are being met. It works hand-in-hand with iterative development processes and test-driven development environments dependent on demonstrating features early in the life cycle. This lowers the costs of changes.

Other aspects of the bottom-up approach include:

- Build verification to catch problems early, including a baseline compare with the CM system as well as advanced build analysis and reporting
- Feature verification at every stage of the process
- Requirements verification to improve customer satisfaction
- Improved visibility and predictability across the entire development life cycle

By enabling round-trip traceability, development teams can perform complete impact assessment of a change and provide visibility and enhanced predictability for project management. It provides the rigor that enables developers to experience the full benefits of agile software development for even the most complex embedded systems.

Causal analysis and resolution

Another major best practice supporting agile software development is causal analysis and resolution. This identifies the causes of defects and other problems and takes action to prevent their future occurrence. Integrated life cycle solutions ensure that issues uncovered during the requirements phase in a CMMI development process are identified and resolved by this best practice.

"How do you adapt the practice to deal with large, complex projects, especially if your developers are scattered across multiple sites and the project has constantly changing requirements?"

To implement causal analysis and resolution, one needs to capture defect data in a consistent, centralized fashion. This is best done with an Enterprise Change Management (ECM) solution that provides a repeatable, documented, and reliable process for capturing both defect data and change requests of all types. The collected data can be used to ensure

that future project teams learn from past mistakes. Figure 4 shows the enterprise change request life cycle.

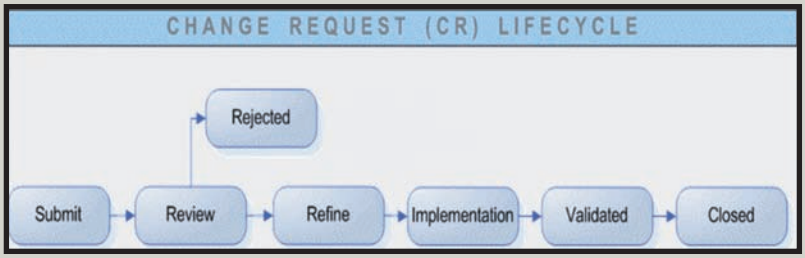

Figure 4

Managing and coordinating the agile project

Agile development leverages constant and frequent communication as a key success factor. This can be challenging if the team is distributed across sites, countries, and time zones.

However, when teams work with task-based configuration management, all activity is automatically logged in a central repository. Agile teams can view real-time reports regarding tasks that have been completed, are in progress, or are in the queue. The change request status in the life cycle can also be displayed in an actionable Web-based interface. The team can make online decisions during the meeting, instead of later. Information available is shown in Table 3.

Automated Documentation

Progress reports	Display real-time team progress and status of assignments
Test reports	Indicate exactly what has changed between two baselines, helping focus test resources
Build reports	Indicate the functionality added to a build, helping communicate project progress
Delivery reports	Provide the list of all features, bug fixes and enhancements included in a given release or iteration

Table 3

These capabilities dispel one of the myths about agile development – that its low level of documentation makes it unsuitable for critical projects or meeting compliance requirements. If the team works with appropriate solutions, the levels of reporting and metrics automatically ensure that the team is in complete control of the process and is generating all the backup documentation required.

Agile development stresses the importance of dialog with the customer, and capturing good re-quirements in the form of stories and use cases. Once the agile team and the customer have allocated features and bug fixes to releases, the next step is to create requests for the development team, covering implementation, build, assembly, and delivery. This bidirectional traceability and impact assessment helps agile teams adapt to changes in priorities, and ensures that they deliver the right product, at the right place, at the right time.

Dominic Tavassoli *is Director of Product Marketing, Change and Configuration Management Applications, at Telelogic, where his job duties focus on RM, CM applications, and application life-cycle management. His primary responsibility is ensuring that current and new software releases are in line with market needs and determining how all the best of breed products can be used together to support the management of the application development life cycle. He has more than 15 years of experience managing and adapting advanced software products and solutions in the defense, automotive, financial, and commercial industries. Dominic graduated magna cum laude from Louis-Le-Grand and the Ecole Centrale in France, with an engineering degree in systems and software engineering.*

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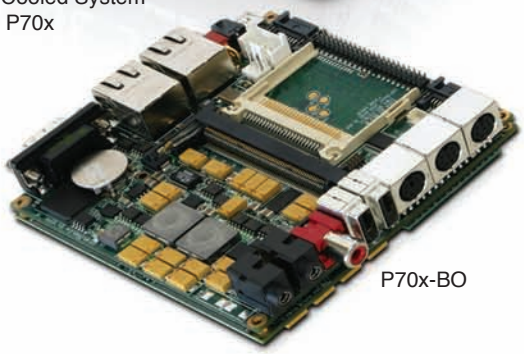

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In it for the long term:

The challenges of providing extended program support

By Martin Holmes and Richard Kirk

Photo courtesy of NASA

It is far from unusual for a military program to extend for decades from first introduction to final withdrawal. In an electronics market increasingly dominated by products that have a lifespan measurable in months, COTS solutions are severely challenged to deliver long-term support. However, more than one strategy is available to significantly mitigate – even eliminate– the risks posed by component obsolescence.

The embedded military computing marketplace presents unique challenges to technology vendors. After all, in which other market are technology-based products and platforms expected to still be in regular service decades after their introduction? The B-52 bomber, for example, was introduced in the 1940s – and is still flying today. The first member of the SSN 688 Los Angeles class of submarines (Figure 1, courtesy of the U.S. Navy) was launched in April 1974 – and is expected to be with us for many years to come. And the situation is exacerbated by changes in military strategy and available funding that mean a program's life can often well exceed the original plan.

Maintaining and upgrading these platforms was always going to be challenging during a time when the military was designing and building its own technology. The military's adoption of COTS has, in many ways, increased the challenges exponentially with its reliance on consumer electronics and consequent focus on high-volume, short life-cycle technology.

Progressive and defensive long-term support

For technology vendors such as Radstone – now part of GE Fanuc Embedded Systems – ensuring long-term program support has to do with much more than just technology, though. It has everything to do with two factors:

- ***Mindset –*** A recognition of the issues and their implications, and a willingness to build a business model around that recognition
- ***Close working relationships with customers –*** The ability not only to understand customers' always-changing needs but to respond to them as well

Every customer is unique, but that doesn't make it any easier to provide the extended support vital for continuing viability of multi-billion dollar programs. The problem of COTS component obsolescence and long-term support is a shared one.

So how does mitigating the impact of component obsolescence work? There are two clearly delineated approaches to extended program support. The first can be called *progressive*. At the heart of progressive long-term support is an approach to designing new products that has at its heart the principle that form, fit, and function compatibility with preceding products is design goal number one. It's most often referred to as *technology insertion*.

The second approach can be called *defensive*. This approach recognizes that no product can remain in production forever, and puts in place the structures and processes necessary to manage mature products through to their end of life in order to ensure continuity of supply, service, and support over the long term.

Figure 1

It should be said that it is very seldom the case that any customer will elect to uniquely follow either a progressive or a defensive approach to mitigating the impact of obsolescence: A mixture – in varying degrees – is almost invariably the preferred route. Equally, it should be noted that a defensive strategy in and of itself contains multiple possible strategies for obsolescence mitigation, and these are typically mixed and matched according to the specific needs of each customer and program.

The progressive approach

So what exactly is involved in a progressive long-term support strategy for a COTS manufacturer? As noted earlier, the key is mindset. For every new product, there must be a long-term roadmap: No product is designed as a point solution that is incapable of further development and that will not allow ongoing technology insertion opportunities. When product ABC-1 is on the drawing board, there must already be – in concept at least – ABC-2, ABC-3, and beyond. Future compatibility is designed in at the outset. The question in the designer's mind has to be: "Will this approach/architecture still work in five years?"

One of the most significant considerations in the design of a new embedded computing board, if long-term viability is at the heart of the design process, is technology and component selection. If the product is to have a roadmap, the components that the product will use must have a reliable – if not guaranteed – roadmap of equal or greater length.

Take, for example, the PowerPC processor. A large part of the reason for its ubiquity in military computing is that, for a long time, the PowerPC has had a roadmap that board designers could rely on. This roadmap created the basis for stability, compatibility, and forward technology insertion opportunities. From Radstone's point of view, it has represented 12 years of continuity. Part of the reason that Intel has a relatively smaller presence in the military embedded space is that, historically, the necessary commitment to long-term support was not there – and the fact that Intel is now gaining significant traction in the market is because the company is now prepared to guarantee the availability of products on its roadmap for five years.

Of course, no COTS board designer will want – or could afford – to implement every new iteration of a given component or technology that appears on a roadmap. The art is to pick the "sweet spots" – the points at which the designer believes that the additional functionality and performance offered by the new generation will deliver the benefits desired by the customer at the appropriate time.

From a technology insertion point of view, there are three key factors:

- ***Form factor*** – A given in the VMEbus world, ensuring that the physical fit of a board within a chassis or enclosure is maintained from one generation to the next.
- ***Maintaining pin-out consistency*** – Ensures that the same signals are routed to the same pins throughout successive generations of product. An example of this can be found in Radstone's SBC family. When first designed in the 1990s, SCSI was in demand. However, customer demand for SCSI functionality has dwindled in the intervening years as flash and CompactFlash memory have become available. Meanwhile, the requirement for USB technology has increased, especially since the introduction of the USB 2.0

specification in 2000. So, the SCSI capability was, for all intents and purposes, replaced by USB capability. But in line with maintaining the ongoing commitment to simple and straightforward technology insertion, today's customers who still require SCSI functionality can implement it through a daughtercard – and the SCSI signals are still routed to the same pins they were originally.

- ***Software compatibility*** **–** Enables customers to simply load their application unchanged onto the new hardware. Here, the approach is to create a software *layer* (Figure 2) that sits between the underlying hardware and the application software, "insulating" changes in the hardware from the application. The benefits are twofold: The hardware designer is not constrained by the specifics of the application software – and customers achieve improved performance without the need for changes to their software.

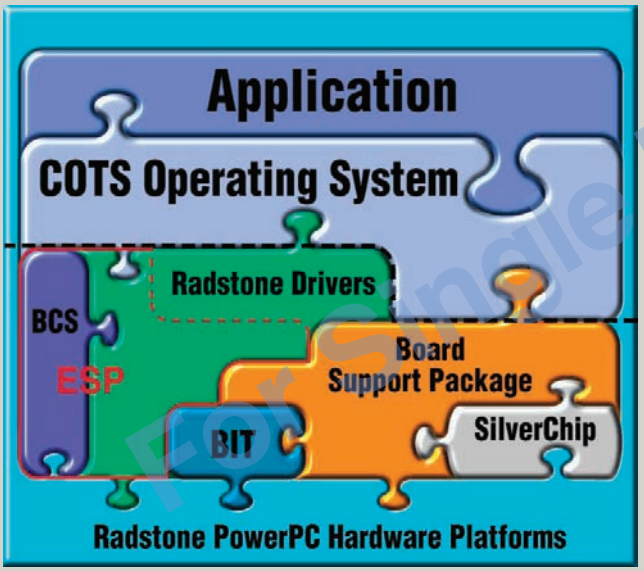

Figure 2

It's important at this point to understand a distinction that's often muddied in the industry: *Technology insertion* means simply that the new generation board can simply be inserted into the existing system or application with neither hardware nor software changes. That's very different from *technology refresh* where an existing board is "respun," responding to impending component obsolescence or taking advantage of an updated processor device.

A defensive line of attack

So much for progressive long-term support. What about defensive long term support – the support that kicks in at the point where a COTS product is no longer manufactured for general sale and is considered "mature"? The optimum approach to defensive long-term support is to offer a range of choices to customers – a last time buy, for example – but to do so simply. From an organizational point of view, this element of the total support program is best handled by a separate entity within the supplying company that is dedicated to long-term support, freeing design engineers to do what they do best and focusing dedicated resources on what is a different set of issues.

This, however, provides an important challenge. Typically, the expertise and knowledge in relation to a specific product resides with the engineer who designed it. Not only is it a poor use of that engineer's talents to expect him to provide continuing consultancy over a period of years about that product, but there may also come a point when the original engineer is no longer available to be consulted. This demands the creation of a formal hand-off process of all products from the design group to the long-term support group in order that the original knowledge is retained.

What is the range of options that defensive long-term support should offer? Although COTS component obsolescence risk is assessed at the original product design stage to maximize longevity through an extended roadmap, this is where the majority of issues will eventually lie. It impacts both the ability to continue to build a product long after it has ceased active manufacture, as well as the ability to repair the product. As such, many customers ask the vendor to undertake monitoring and reporting, providing the earliest possible notification of an impending obsolescence. The vendor provides the information, then works with the customer to develop a solution that best suits the customer's program needs at that point in time.

Of course, a manufacturer will hold an inventory of parts, both to support day-to-day production needs and as an initial insurance against component obsolescence. However, once a component is identified as obsolescent, a range of options becomes possible:

- A last-time buy of either the product itself or the component in question: Components requiring special storage conditions – such as controlled temperature or humidity – can be kept on the manufacturer's premises.
- Identify an appropriate replacement part, or design and build one using an ASIC approach.
- Redesign the original product to provide form, fit, and function compatibility using an equivalent COTS component.
- Or, if funding can be made available, the customer can move to his next technology insertion more quickly than planned.

The important thing is that the customer has the information on which to base a decision. In any event, the manufacturer will expect to retain the capability to build and test boards for as long as they can practicably be expected to do so. The availability of long-term technical support is, of course, a given.

Much will depend on the nature of the program in terms of its projected longevity and the level of its funding, but neither of these is either fixed or predictable. Changes in either may cause an alternative long-term support strategy to be adopted.

Not either/or, but both

The fact is that for virtually every program, a mixture of both the progressive and defensive approaches will be the strategy that will deliver the most benefit. The two approaches are highly complementary. Nowhere is this better illustrated than by the U.S. Army's Multiple Launch Rocket System (MLRS) program.

Having been initially selected by Harris Corporation in 1997 to provide a derivative of Radstone's PPC2 SBC, Radstone alerted Harris in 2000 that the PPC2 was going to become obsolete. The obvious – progressive – approach was for the program to move to the PPC2's successor, the PPC4, introduced in 1998. But program constraints meant that this was not feasible. An alternative – defensive – approach was chosen to ensure the continuity of the program in the "medium term," But Harris reverted to the progressive approach when the constraints were removed, migrating to the PPC4's successor, the PPC7 (Figure 3) after it was introduced in 2003. The MLRS program is still in production.

Figure 3

This combination of progressive and defensive approaches to long-term support – known within the company as *Whole Program Life COTS* – has allowed Radstone to ensure backwards compatibility through five generations of SBCs and to continue providing support for products first installed some 20 years ago.

***Martin Holmes** began his career with Plessey Radar in the UK, before moving to Plessey Microsystems – the company from which Radstone Technology (now part of GE Fanuc Embedded Systems) was born. Having been closely involved in 1995 in the development of Radstone's long-term support strategy, Martin became business manager for the Product Lifecycle Management group at Radstone. He is a director of COG International, an industry body focused on the issues associated with component obsolescence.*

***Richard Kirk** earned a BSc in Physics from Manchester University in the UK, joining Plessey Optoelectronics as an engineer in 1986. He later joined Radstone – now part of GE Fanuc Embedded Systems – where he fulfills product management responsibilities for the company's family of single board computers.*

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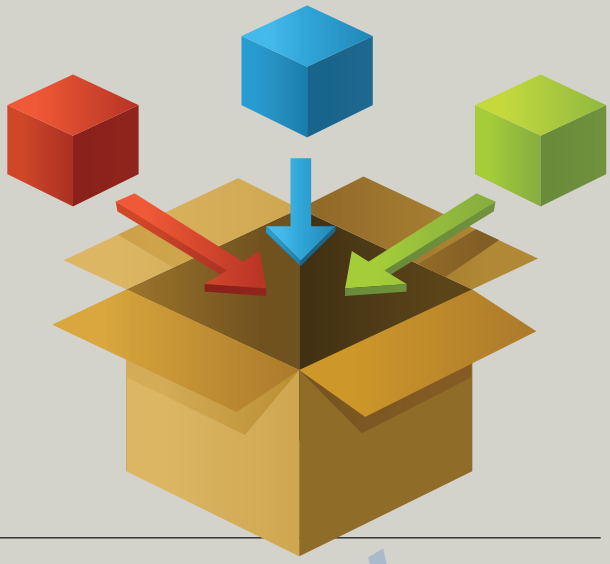


Proper long-term IC storage:
Better plan carefully

By Edwin Slipher

The mismatch between rapid civilian technology obsolescence and the typical 10-plus year military program often forces system integrators and program offices to procure lifetime buys of ICs and store them for future use. For Diminishing Manufacturing Sources (DMS) devices, long-term storage presents problems – practical, mechanical, and financial, and counterfeit products. But is it possible to successfully store ICs for the long term?

The simple answer is "yes," if proper conditions are met. Long-term storage of integrated circuits at the die/wafer level, in plastic packages, or in hermetic (airtight seal) packages can be accomplished, and in many cases some times exceeding 20 years. The process is not as easy as it sounds, but anything is possible, given enough time and money. So, what do we mean by *long-term storage*? This is a highly variable subject depending on the industry segment.

For standard commercial plastic ICs, many market segments want materials less than a year old and refuse to purchase older materials. Unfortunately, for military systems users, the commercial markets only need up to two years of storage, thus processes and methodologies aren't designed to support long-term storage in the ranges of 5, 10, and 20 years. For instance, Sharp North America has a Technical Bulletin[1] titled "Long-term IC Storage," which recommends "… that the customer perform their own reliability and manufacturability analyses on any product that is older than two years …"

Successful storage methodologies encompass special bagging materials and environmental controls. There are effective long-term methods for IC preservation including storage at the die/wafer level, as Plastic Encapsulated Microcircuits (PEMs), or in hermetic packages. (Table 1 shows a comparison of storage options.)

Storing ICs in die/wafer form

There is extensive long-term storage experience among military integrated circuits manufacturers, as most have used "die banking" for products no longer supported by their "commercial" divisions. Companies like TRW, Raytheon, Fairchild, National Semiconductor, Siliconix/Vishay, Signetics, and Philips have all had products based on long-term die banking at the die or wafer level. All of the "aftermarket" suppliers similarly base significant numbers of products on "banked" wafers and die.

Die/wafer storage can exceed 20 years and routinely exceeds 10 without product degradation when stored properly and under controlled, benign conditions. Proper storage requires either controlled atmosphere "dry boxes" (dry nitrogen purged storage) or storage in "dry bagged/vacuum storage." In addition, there are oxygen barrier bags available that are designed specifically for this type of long-term storage.

It is obvious that storage at the die/wafer state requires care, cleanliness (both in particulates and gases), and benign temperatures. Since the same storage conditions are required both for long-term and short-term storage, Integrated Device Manufacturers (IDMs) have proper facilities available. The same is not true for most end users, as the long-term storage facility is not a side benefit of other day-to-day activity. However, there are businesses that offer appropriate storage of die/wafers as a service.

There are significant benefits to storage of DMS materials at the die/wafer level. The materials are compact, making the capital infrastructure investment and long-term storage costs economical. The product cost is lower than for packaged products.

As an example, in Figure 1, a single 6-inch wafer storage container is shown. This container holds nine wafers with nearly 64,000 gross die. Notice the relative size

Storage options: Lifetime comparisons

	Die/Wafer	Plastic	Hermetic
Total Cost	Low	Medium	High
Form Factor Flexibility	High	Low	Low
Stability/Lifetime	High	Low	High
Storage Space	Small	Large	Large
Storage Infrastructure	Moderate	Difficult	Easy

Table 1

Figure 1

comparison to a standard data CD. The canister shown has been in active storage for 10 years. A recent build of one of the wafers had the same good yield performance as 10 years previous.

A key benefit of this strategy is that the end user has not committed to the final form factor. Often, the use rate during 10 to 20 years is not predicable relative to package type. With the die/wafer storage model, the final package selection can wait until just before use, ensuring that the critical "last units in the world" are available in the needed package type, not one selected by a guess 20 years earlier.

Storing ICs in hermetic packaging

Hermetic packages include the metal TO "can," and the ceramic and side-brazed packages (DIP, LCC, flat pack, and PGA) are designed to minimize moisture ingress. Storing hermetic packages for 10 to 20 years is routine. Additionally, based on several product analyses with which the author has been involved, storage for more than 10 years prior to use is not unusual for several major defense systems suppliers. In one case, the IC involved had been in storage 17 years. Solderability was marginal in several instances because the packages had not been stored in dry, uncontaminated environments, likely because the long-term storage was incidental rather than planned.

With reasonable care – keeping hermetic ICs dry in environments low in sulfur, chlorine, and hydrocarbons – long-term storage should result in the same performance the IC would have provided as the day it was completed by the original device manufacturer.

Storing ICs in plastic packaging

PEMs have much more variation in raw materials that create challenges for successful long-term storage. Unlike hermetic devices, plastic products are *hygroscopic* (the ability of a material to attract water molecules from the surrounding environment). In general, PEMs come to equilibrium with their environment in about 4 to 28 days, depending on package design and molding compound. Normal room environments are what would be considered "wet" for plastic integrated circuits, which leads to storage of moisture-sensitive parts in "dry bags" or <10 percent RH environment (see Figure 2).

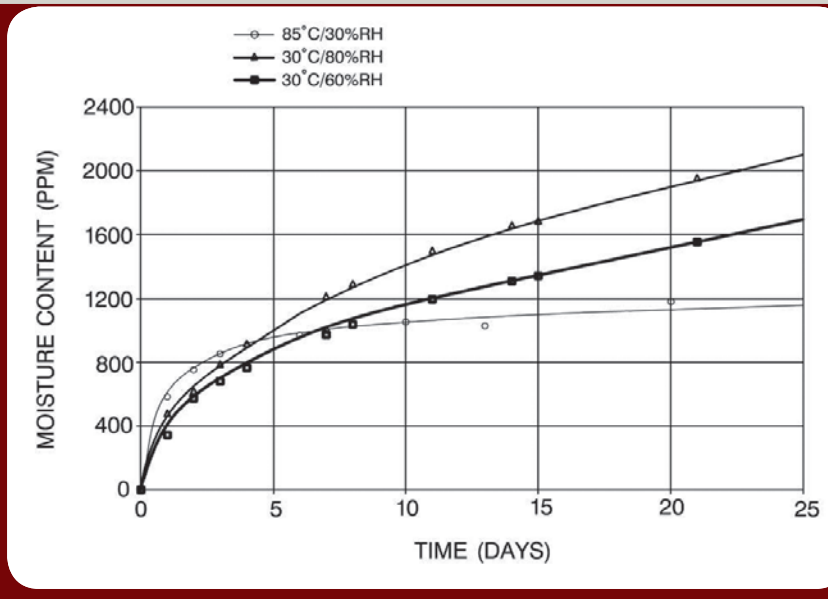
Many plastic devices are "rated" as nonmoisture sensitive, but this is related to resistance to solder heat/delamination/popcorning, not for long-term storage. The author recommends dry bagging all PEMs for long-term storage, since the storage medium not only keeps the parts dry but prevents contamination from other sources.

The common misunderstanding is that moisture is only a problem when a device is exposed to the heat of solder reflow. In reality, moisture is a problem when combined with long-term leaching of materials in the mold compound, harmful gases, or materials contaminating the exterior of the plastic package, which can result in degradation of product lifetime.

Unlike hermetic packages, there is a variety of PEM packaging materials. The specific PEM resin used, the type of filler, the size(s) of that filler, and the type of flame retardants used have dramatic effects on the success of long-term storage.

Considering storage materials

The quality of the storage material (for example, bagging materials, desiccants, moisture monitors, trays, and tubes), its permeability over time, and the external



Source: Plastic Package Moisture-Induced Cracking, April 2006, National Semiconductor, Application Note

Figure 2

environment to which the storage material is exposed can all lead to early failure of the material, exposing the plastic ICs inside to external conditions earlier than predicted. Because of these issues, most manufacturers of products packed in Moisture Barrier Bags (MBBs) recommend periodic checks of the integrity of the partial vacuum or partial pressure applied to the bag/devices during sealing as well as the condition of the moisture-sensing card to ensure that the bag has not failed.

The expectation is that materials would be dry baked and repackaged periodically, potentially, every five years.

Challenges of ICs in storage

Storage for 5 to 20 years should have planned, periodic monitors with dry baking and repackaging upon failure. Periodic inspection and repackaging can be problematic for some packing schemes, like tape and reel, where the devices have to be demounted from the tape and reel to be re-baked and then remounted on new tape. Devices that have coplanarity requirements are easily damaged during any handling related to dry baking or repackaging, so lead inspection and lead scanning must be planned into their long-term storage requirements.

While the hermetic devices in long-term storage are primarily subject to changes in interconnect solderability, plastic products are subject to a number of additional failure mechanisms (Table 2).

Interestingly, several studies of long-term PEM use basically state that PEMs are appropriate for long-term storage, "especially when the continuous improvements in materials are considered."[2] They assume that the only motivating market force is continuously improving quality.

Recent regulatory pressures have resulted in changes in lead finish (removal of Pb), changes in flame retardants (elimination of antimony- and bromine- based compounds), and market-driven reductions in plastic package form factors. Unfortunately, this has not increased product reliability relative to long-term storage (see sidebar, page 54).

Associated risks

Long-term storage of integrated circuits in any form (plastic, hermetic, and/or die/wafers) is feasible, but each carries risk. These risks must be mitigated by thoughtful, preplanned, formalized methodologies and require long-term commitments from the organization stockpiling these valuable and often irreplaceable products.

Long-term storage of PEMs requires attention to detail, initial capital investment in the finished product, a physical storage facility, and periodic verification that the storage conditions remain as designed. PEM storage is similar to storing die/wafers, except that the physical size grows exponentially

remain as designed. PEM storage is similar to storing die/wafers, except that the physical size grows exponentially (a single 6-inch wafer may contain more than 7,000 good die, yet 7,000 14-pin plastic dip packages could require space approximating a full file drawer). As another example, two standard shipping boxes contain about 20,000 good packaged products. All are in sealed bags but will require annual checks of approximately 40 bags versus checking one wafer canister bag for nearly three times the storage quantity (Figure 3).

There is one last impediment that leads

Failure Mechanism	Die/IWafer	Hermetic	PEM
Corrosion	Bond pads	Leads may corrode when not properly stored	Same as Hermetic, Internal – die, lead frame, die attach
Cracking	Mishandling, scratch	Mishandling	Mishandling, passivation, dielectric
Delamination	None	None	Moisture induced and temp cycle related
Outgassing	None	None	Molding agents, die attach materials
Solderability	N/A	Improper storage leads to failure	Copper intermetallic diffusion (temp accelerates); chlorine, sulfur, hydrocarbons, oxidation
Metallic	N/A	None	Gold/Aluminum intermetallic diffusion
Tin Whiskers	N/A	Exempt from RoHS, not pure tin	Pure tin plating – lead (Pb) free

Table 2

Figure 3

often limits procurement to one or two years. Systems manufacturers have rarely funded this long-term procurement on their "own dollar."

So, in the "real world," the long-term storage often occurs in "broker" storage, for example, in unqualified and uncontrolled environments as material changes hands many times over a 10- to 20-year "storage" time frame. Because of this, there has been rife opportunity for unscrupulous brokers to supply improperly stored parts or, worse, counterfeit products.

In the author's opinion, often what is meant by "long-term storage" is really not that, but justification for trying to use undocumented, nontraceable materials because the programs involved could not by either resource or regulation (often both) put in place long-term support for their semiconductor requirements.

Making the case for die/wafer storage

Because mil/aero production lifetimes far exceed those of commercial products, creating a proper long-term IC storage strategy is necessary. There is a long list of storage requirements for PEMs, for instance, which differs from the storage challenges associated with the more ruggedized hermetic ICs. Die/wafer storage, while similar in methodology to PEMs, is simpler and actually offers some advantages: The needed physical storage space is smaller, the capital outlay is less, and there's the flexibility of changing physical packages at time of use. Wouldn't this be the better long-term storage methodology?

Edwin Slipher is chief technologist and director of engineering at QP Semiconductor. During his more than 28 years in the mil/aero industry, he has published technical papers on military ICs, codesigned a ceramic TO-5 package, discovered a new failure mechanism (embrittlement of hybrid solder joints), and designed ESD networks for 10K MECL, improving ESD performance from 900 V to 2,500 V. Edwin attended Arizona State University.

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1. ©2007 by SHARP Corporation Reference Code SMA06024
2. "Commercial Plastic Encapsulated Microcircuits for Naval Aviation Applications," Johns Hopkins APL Technical Digest, Volume 18, Number 1 (1997)

An unintended consequence:

Case example[1]

In the late 1990s and early 2000s, many major IC manufacturers including Fujitsu, Fairchild, Cirrus Logic, and Amkor[2] were involved in litigation with Sumitomo over the introduction and use of a molding compound that used red phosphorus as a significant component. The change in Sumitomo's molding compound was motivated by increasing regulatory restrictions in materials, to meet more stringent environmental regulations.

While early qualification results by many manufacturers approved use of this mold compound, virtually every company found that long-term reliability was compromised as indicated by high field failure rates.

The first symptoms were intermittent failures, which were difficult to identify. Variations in different lots of molding compound increased variability of the latent period prior to failure. Detection was difficult and slow in coming, resulting in millions if not billions of plastic ICs being manufactured with this built-in failure mechanism.

The problem described impacted virtually every IC manufacturer to some degree. Depending on the marketplace, sensitivity to the problem could take as little as a few months to manifest if conditions were ideal, to several years in more benign (drier) environments.

This is an example of a raw material supplier reacting to regulatory pressure to provide a more environmentally friendly product that has more reliability challenges than the preceding technology. The common perception that "things always get better over time" isn't necessarily true when faced with external pressures to address environmental concerns.

Unfortunately, many components with red phosphorus mold compound are still available in the broker market today.

[1]Failures in Semiconductor Device Encapsulated with Red Phosphorus Flame Retardant - Yuliang Deng and Michael Pecht, CALCE Electronic Products & Systems Center, University of Maryland, November 2005

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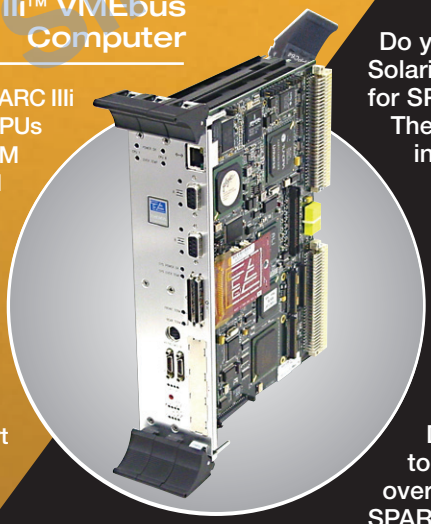

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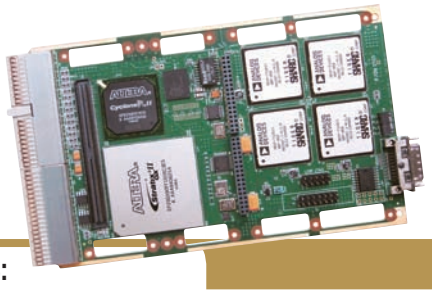

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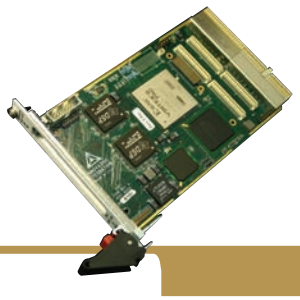

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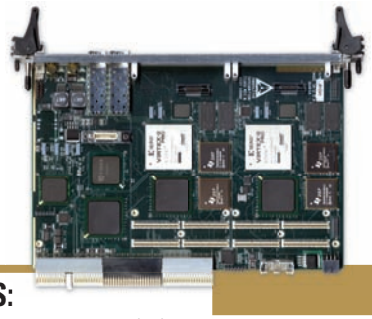

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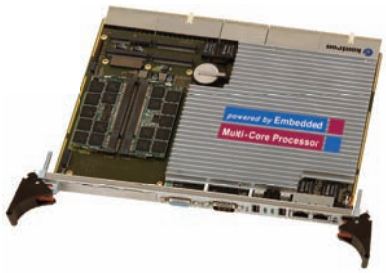
The latest addition to Kontron's 6U CompactPCI family, the Kontron CP6012[64] boasts an Intel® Core™ 2 Duo processor and meets the highest performance standards. In combination with the E7520 chipset, the Kontron CP6012[64] manages data throughput with server quality. The PICMG 2.16-compatible Kontron CP6012[64] features an L2 cache that is twice as large (4 MB), a much improved internal architecture, and 64-bit Intel technology for increased performance over the Intel Core Duo option.

Designed for bandwidth-intensive applications, the Kontron CP6012[64] provides hot swap, IPMI (Intelligent Platform Management Interface) support, and meets the highest standards for the management of high-availability military applications.



FEATURES:

- Scalable processor speed, Intel® Core™2 Duo up to 2.16 GHz; support of latest PSB performance with 667 MHz
- 4HP, single slot CPU with passive cooling
- Up to 4 GB DDR2 400 MHz SDRAM via two SODIMM sockets
- 4x GigEthernet Interfaces via PCI Express
- Latest I/O technology with USB 2.0 channels and SATA; rear I/O supporting PICMG 2.16
- XMC/PMC + onboard HDD + CompactFlash configuration possible

MEMBER OF THE YEAR 2006

For more information, contact: info@us.kontron.com

RSC# 33133 @ www.mil-embedded.com/rsc

General Dynamics Canada

3785 Richmond Road • Ottawa, ON K2H 5B7
613-596-7131
www.gdcanada.com/3UM

GENERAL DYNAMICS
Canada

PC3010 3U cPCI SBC

NEW PC3010 MIL-STD 3U Core 2 Duo CompactPCI SBC
General Dynamics Canada announces the PC3010. The first military 3U CompactPCI SBC based on Intel's Core 2 Duo architecture. It is a conduction cooled, MIL-STD-810F tested package supporting temperatures from -46 °C to 85 °C. The PC3010 is pin-compatible with our existing PC3000 Pentium M based single board computer to provide our existing customers an economical upgrade path.

General Dynamics Canada's products include 3U and 6U single board computers, computer chassis, displays, and displays with embedded computing, all designed and tested for extreme military conditions. These units are in service in Abrams Main Battle Tank, the USMC EFV, and the Stryker MGS. What can we do for you? Call Robert at 613-596-7131 or Robert.Rohonczy@gdcanada.com.

FEATURES:

- Conduction Cooled, -46 °C to +85 °C operating; 3U CompactPCI single slot SBC Core 2 Duo 1.5 GHz+; up to 2 GB DDR2 ECC
- TPM, IPMI 2.0, onboard flashPorts: 2 SATA, 2 Gigabit Ethernet, 3 USB 2.0 portsPMC, and VITA 42 (XMC) site
- Contact General Dynamics Canada for current specifications, feature availability, and pricing information
- Ask about our other products for military applications: 3U conduction-cooled single board power supplies
- Military computer units – Military displays with embedded computers – Military displays
- For product technical details on all of our 3U and 6U SBCs and Power Supplies, Navigate to: www.gdcanada.com/3UM

For more information, contact: robert.rohonczy@gdcanada.com **RSC# 32209 @ www.mil-embedded.com/rsc**

GaGe

900 North State Street • Lockport, IL 60441
514-633-7447
www.gage-applied.com

GaGe

High-speed Digitizers

GaGe's next-generation of high-speed PCI bus digitizers features 8-bits vertical resolution, 2 GS/s sampling, and more than 600 MHz bandwidth. The fast sampling rate enables the capture of high-speed signals with ultra-high timing precision at an affordable price. GaGe digitizers are available with up to 4 GB of on-board memory and eXpert™ on-board Signal Averaging firmware.

Programming-free operation is provided via GageScope Windows-based oscilloscope software. Also available: SDKs for C/C#, LabVIEW, MATLAB, and other programming environments.

GaGe digitizers are ideal for applications such as radar, lidar, storage media testing, fast electrical component testing, high-speed communications testing, nuclear and particle physics, and high-speed ultrasonic testing.

FEATURES:

- High-speed digitizer with high bandwidth: 8 bit, 2 GS/s sampling with more than 600 MHz bandwidth
- Up to 4 GB of on-board memory for acquisition of extremely long signals or multiple sequential signals
- Multi-card synchronization with simultaneous sampling on all channels using a common internal sampling clock
- FPGA Signal Averaging option for extracting small signals from a background of high-amplitude noise
- Advanced features such as time-stamping, fast 200 MB/s PCI transfer speeds, and pre-trigger Multiple Record
- Includes GageScope programming-free oscilloscope software – Optionally available C/C#, LabVIEW & MATLAB SDKs

For more information, contact: prodinfo@gage-applied.com **RSC# 33120 @ www.mil-embedded.com/rsc**

GaGe

900 North State Street • Lockport, IL 60441
514-633-7447
www.gage-applied.com

Low-cost Digitizer

GaGe's Octopus family of multi-channel digitizers features 2 to 8 channels in a single-slot PCI card, 12 or 14-bit resolution, 10 to 125 MS/s sampling per channel, and 256 MB to 4 GB of memory.

With more than 35 new digitizers to choose from, users can select the digitizer best suited to their needs at the lowest price possible – starting at less than $1,000/channel. This flexible and cost-effective solution is ideal for integration into OEM products.

GaGe's new eXpert on-board FPGA technologies are optionally available: Peak Detection, Finite Impulse Response Filtering, or Signal Averaging.

Programming-free operation provided with GageScope oscilloscope software. SDKs for C/C#, MATLAB, and LabVIEW are also available for creating custom applications.

FEATURES:

- Low-cost 12 or 14-bit multi-channel digitizers – pricing starts at less than $1,000 per channel
- 2 to 8 digitizing channels (highest channel count in a single digitizer card available on the market today)
- 10 to 125 MS/s sampling per channel (highest rate available on the market today for an 8-channel digitizer)
- 128 MS to 2 GS of on-board acquisition memory (highest amount available in a digitizer on the market today)
- Optional on-board FPGA signal analysis features such as Peak Detection, Signal Averaging, and FIR Filtering
- Includes GageScope programming-free oscilloscope software – optionally available C/C#, LabVIEW, and MATLAB SDKs

For more information, contact: prodinfo@gage-applied.com

RSC# 33121 @ www.mil-embedded.com/rsc

KineticSystems

900 North State Street • Lockport, IL 60441
815-838-0005
www.kscorp.com

cPCI/PXI Products

The CP213 is a cPCI/PXI module with 32 or 64 differential analog input channels that can be configured as 64 or 128 single-ended analog input channels. A 16-bit ADC scans each channel at a user-selected scan rate. Scans may be triggered from the internal clock, 1 of 8 PXI backplane triggers, the PXI star trigger bus, or an external SMB connector. Plug and play drivers are included.

The CP213 has programmable gain and two channels that are configurable as isothermal reference channels for temperature measurements.

The CP213 also includes 16 digital I/O channels that may be configured as digital I/O or attached to a frequency in, counter in, or timer out channel.

Other cPCI/PXI cards available are digital I/O, analog output, and high-speed digitizers.

FEATURES:

- CP213: 32, 64, or 128 channels of analog input with 16-bit resolution filter and programmable gain per channel
- CP213: 16 multi-function digital I/O channels; can be attached to 2 frequency, 2 counter and 2 timer channels
- CP387: 6U, 256-channel Digital I/O supports TTL, isolated I/O, relay output, and differential I/O
- CP266: 6U, 32- or 64-channel, 16-bit D/A Converter, ideal for automotive test cells, industrial control, and ATE
- CP199: Rugged 14-slot, 3U/6U, dual stack, 800 Watt PXI system with high-pressure 220 CFM cooling
- PMC200/202: 8-channel, 24/16-bit PMC-based Sigma-Delta ADC at 200 kS/s (PMC200) or 1 MS/s (PMC202) per channel

For more information, contact: mkt-info@kscorp.com

RSC# 33130 @ www.mil-embedded.com/rsc

RTD Embedded Technologies, Inc.
103 Innovation Blvd. • State College, PA 16803
814-234-8087
www.rtd.com

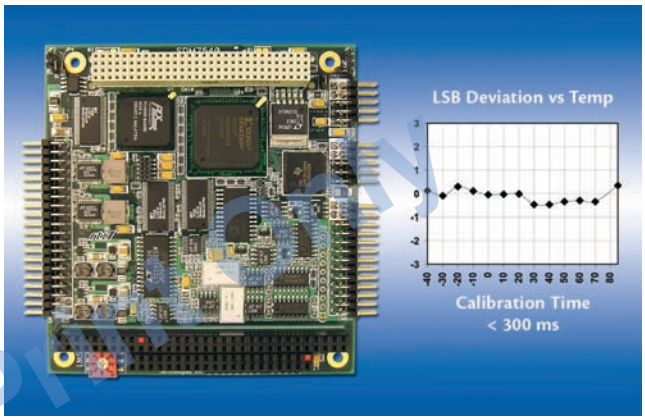
SmartCal & Analog

Autonomous SmartCal™ and Analog I/O dataModules®: RTD was founded on data acquisition over 20 years ago, and has since been providing the PC/104 industry with dataModules second to none. We provide a wide array of data acquisition and control modules with auto-calibration, advanced Digital I/O (aDIO™), Syncbus for simultaneous sampling, and McBSP serial ports. In today's high accuracy environments, where discerning signal from noise at high throughput rates is the difference between success and failure, RTD is continually redefining the DAQ industry.

Autonomous SmartCal: SDM series Smart dataModules feature a DSP for operating system and driver-independent, multirange auto-calibration. An onboard temperature sensor enables triggering auto-calibration in dynamic thermal environments. The OS-independent Autonomous SmartCal performs an in-circuit offset and gain adjustment for all ranges in under 300 ms. Calibration values acquired from the last user calibration are loaded at power-up. Factory calibration defaults can be loaded. Smart dataModules feature onboard memory for user DSP applications.

Analog I/O: Analog I/O solutions feature 12- or 16-bit resolutions, with FIFO buffers, sample rates up to 1.25 MHz, and 16/32 single-ended or 8/16 differential inputs. Analog outputs feature 12- or 16-bit resolution with up to eight outputs. A channel-gain table allows for unique scanning patterns, where a single trigger can initiate one scan (burst mode) or multiple scans (multi-burst mode) of the channel-gain table. Pre-, post-, and about-trigger modes ensure that you collect only the data you want.

aDIO™: The aDIO port provides 16 digital bits configured as 8-bit-programmable and one 8-bit port giving you any combination of inputs and outputs. Match, event, and strobe interrupt modes, with bit masking options, mean no more polling digital inputs. Interrupts are generated when the 8-bit-programmable digital inputs match a pattern or on any value change event. The strobe input latches data into the bit-programmable port and generates an interrupt.



FEATURES:

- 12-bit or 16-bit resolution A/D and D/A converters
- Fast operating system and driver-independent, multirange auto-calibration by onboard DSP (< 300bms)
- 1 k/8 k FIFOs for data buffers and channel-gain table
- 16/32 single-ended or 8/16 differential inputs with programmable gains of 1, 2, 4, 8, 16, 32, or 64
- Versatile triggering for advanced sampling, including SyncBus for multi-board simultaneous sampling
- Analog input ranges: ±5, ±10, +10 V; analog output ranges: ±5, +5, ±10, +10 V
- High speed McBSP serial port interface to dspModules
- aDIO with event and match interrupts and three 16-bit user timer/counters
- Critical analog layout and precision low-drift parts yield excellent low noise characteristics
- Windows, Windows CE, DOS, Linux, and various RTOSs
- Architecture: PC/104, PC/104-*Plus*, and PCI-104
- Operating temperature: -40 °C to +85 °C

KineticSystems

900 North State Street • Lockport, IL 60441
815-838-0005
www.kscorp.com

VXI Controllers

KineticSystems provides computer interfaces and VXI controllers, including plug-and-play drivers and full VISA library support, for high-performance data acquisition, control, and ATE systems.

Choose from our PowerPC-based VXI slot-0 controllers, or the V153 VXI slot-0 controller, featuring a high performance Pentium® 4 embedded processor as well as the economical V155 Pentium M-based embedded module.

Complete Fiber-optic Interface Systems (FOXI™) are available to support distances between nodes up to 2 Km (6560 feet) with an I/O throughput up to 10 Mbps. The FOXI system includes a V122 FOXI PCI Host Adapter that is capable of linking up to 126 V120 VXI Slot-0 controllers via a fiber-optic highway.

VCDS and V15x VME to VXI adapters are also available.

FEATURES:

- V151, V152, V154: Single-width C-size slot-0 controllers with embedded PowerPC processors
- V153/V155: New high-performance Pentium 4/M-based slot-0 controller from 1.1 to 2.2 GHz clock options
- Includes Ethernet, RS-232 serial port, real-time clock, timers, and counters
- Two PMC card options for fast/wide SCSI, IEEE 488, Fast Ethernet, and USB
- V15x: Converts VME controllers into slot-0 VXI controllers; compatible with other VME modules
- FOXI: PCI host interface and high-performance controllers connected via a 10 Mbps fiber-optic highway

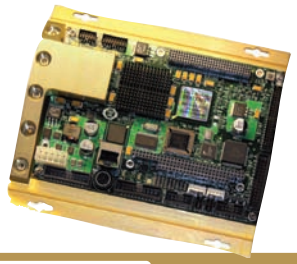
For more information, contact: mkt-info@kscorp.com **RSC# 33131 @ www.mil-embedded.com/rsc**

Octagon Systems

7403 Church Ranch Blvd. • Westminster, CO 80021
303-430-1500
www.octagonsystems.com/products/xe-900-1ghz.aspx

EPIC XE-900

The XE-900 single board computer offers the mid-sized EPIC form factor with an x86 processor. It is a high-performance, low-power SBC that supports PC/104 and PC/104-*Plus* expansion. For fanless applications, an integrated conductive cooling system conducts heat to a base plate. This embedded PC offers a rich family of industrial I/O functions. It integrates video, serial ports, Ethernet, digital I/O, CompactFlash, and USB networking into a single card. Support for three hard drives gives this card the versatility to adapt to any application. The CPU provides enough computing power for virtually any embedded application, while operating in extreme temperatures and under heavy shock and vibration. The XE-900 is ideal for military and security applications.



FEATURES:

- Conduction cooling kit for the XE-900 permits 1.0 GHz operation without a cooling fan
- Significant I/O expansion capabilities for PC/104 and PC/104-*Plus* systems
- -40 °C to +75 °C operating temperature
- Small footprint, all connectors are vertical; Linux and Windows® XPe accepted
- All Octagon EPIC cards are bootable from CompactFlash
- Tell us about your application; call Ray Agnew in Sales at 303-430-1500

For more information, contact: sales@octagonsystems.com **RSC# 33224 @ www.mil-embedded.com/rsc**

RTD Embedded Technologies, Inc.
103 Innovation Blvd. • State College, PA 16803
814-234-8087
www.rtd.com

RTD dspModules

RTD DSP Accelerators and Coprocessors are based on Texas Instruments' high performance TMS320C6202 and 6416 DSP processors operating at up to 1 GHz with 256 MB of SDRAM. These modules unburden the CPU and speed up math-intensive operations. dspModules may be used in stand-alone mode by using the 2 MB or 4 MB onboard Flash memory that stores the users application program. All dspModules are programmable in C/C++ using Texas Instruments' Code Composer Studio and RTD dspFramework libraries to streamline software development.

dspModule Coprocessor or Accelerator: DSP Coprocessors are PC/104-*Plus*, and provide a pass-through ISA connector, allowing the dspModule to be located anywhere in the system. DSP Accelerators are PCI-104, and provide a PlatformBus™ to directly connect front-end cards to the dspModule.

Communication I/O Ports: McBSP™ (Multi-channel Buffered Serial Ports) provide extensive I/O bandwidth up to 100 Mb/s each. Selected modules offer RS-232/422/485 serial ports, aDIO™, and stereo audio I/O using an AC'97 CODEC for additional functionality. Optional stack-through connectors allow direct communication to RTD dataModules® without burdening the PCI bus. The SyncBus™ provides synchronization of RTD datamodules. Multiple dspModules™ can be stacked for parallel processing through the PCI bus.

PlatformBus™: The PlatformBus allows up to four expansion cards, and provides a dedicated 32-bit bus that connects directly to the DSP, enabling high speed data transfer and simplifying development of custom analog front-end cards to be used with the dspModule.

RTD dspFramework SDK: RTD dspFramework SDK supports single-threaded applications and multi-threaded DSP/BIOS applications. It includes a library of C functions and macros for access to the DSP's peripherals. dspFramework includes a matching host side library that simplifies communication with the DSP and manages all low-level initialization and setup. Functions are exposed via standard C++ class members, and all host/DSP communication is handled by the dspFramework. Example programs with full source code are provided.

FEATURES:

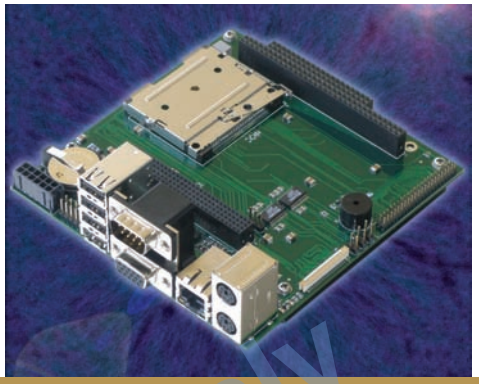
- 1.0 GHz, 8000MIPS DSP with eight processing units
- Fixed point TI TMS320C6416 and 6202 processors
- RS-232/422/485 serial ports and aDIO™
- Stereo audio I/O using an AC'97 CODEC
- 2 MB or 4 MB onboard Flash memory
- All DSP resources accessible from PCI bus
- PCI bus master or target only and boot from PCI or onboard Flash memory
- Three Multi-channel Buffered Serial Ports (McBSP)
- SyncBus to sync with RTD dataModules®
- JTAG emulator connector, Watch-dog timer, and Power connector for stand-alone operation
- Software support via RTD dspFramework SDK
- Operating Temperature: -40 °C to +85 °C: 233, 600, and 850 MHz – -20 °C to +70 °C: 1 GHz

ACCES I/O Products

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

ETX-NANO-104

The ETX-NANO-104 is one of the smallest embedded motherboard systems and designed to support all PC/104 I/O modules and the ACCES I/O line of USB/104 OEM boards, along with the high performance benefits of ETX. This motherboard/baseboard is only 120 mm across. The NANO right-angle mounted connectors include VGA, RS-232/422/485, four USB 2.0 ports, standard audio, PS/2 mouse and keyboard, and Ethernet. The NANO I/O Server is unique, due to the capability of utilizing any embedded ETX CPU board that meets the ETX standard for its processing, while providing PC/104 I/O module expansion. In addition to the rear motherboard I/O, the NANO has supplemental onboard I/O connectors for flat-panel support, IDE, CompactFlash, and an extra RS-232 serial port.



FEATURES:

- Wide range of ETX CPUs – fanless up to 1.66 GHz Intel Core Duo with full PC/104-*Plus* I/O expansion
- Small size only 120 mm by 125 mm (4.72" by 4.92")
- Four rear-mounted USB 2.0 ports, VGA, PS/2 mouse and keyboard
- One RS-232 port and one RS-232/422/485-selectable COM port
- 10/100 Ethernet LAN, flat panel, IDE, and Compact Flash support
- Standard 1/8" (3.5 mm) audio with Line In, Line Out, and MIC

For more information, e-mail: contactus@accesio.com **RSC# 32940 @ www.mil-embedded.com/rsc**

Active Silicon Ltd

17 Wilson Street, Suite 13 • Chelmsford, MA 01824
978-244-0490
www.activesilicon.com

Phoenix

The powerful Phoenix frame grabber series has support for the latest generation of Camera Link and LVDS cameras. The boards are available in a wide variety of industry standard formats, including PCI Express, PCI, PMC, CompactPCI, ETX, and PC/104-*Plus*.

The Phoenix range is supported worldwide and compatible with all the most popular (and many specialist) operating systems, including Windows XP, XPe, Vista, and Linux (both 32-bit and 64-bit variants), plus DOS, VxWorks, Solaris, Mac OS X, and QNX. Other advantages include an easy-to-use software development kit, which allows integrators to develop applications quickly and simply. Together with a range of built-in third-party image analysis software drivers, this will facilitate even shorter development times.

FEATURES:

- Support for Dual Base, Medium and Full Camera Link plus 36-bit LVDS image sources
- Power over Camera Link (PoCL) with SafePower
- Extensive opto-isolated, TTL, and LVDS triggering and I/O lines
- Third-party image analysis drivers such as DirectShow, CVB, StreamPix, MATLAB, LabVIEW, and Image-Pro Plus
- Accepts multi-tap and multi-channel camera formats, including line and pixel interleaved
- Full Software Development Kit (SDK) supports various operating systems including Windows XP/XPe/Vista, Linux, VxWorks, QNX, and many others

For more information, contact: info@activesilicon.com **RSC# 33210 @ www.mil-embedded.com/rsc**

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

WILDSTAR II Pro VME

Annapolis Micro Systems is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Our ninth-generation WILDSTAR II Pro for VME uses Xilinx's newest Virtex-II Pro FPGAs for state-of-the-art performance. It accepts up to two I/O cards in one VME slot, including Dual 1.5 GHz A/D, Dual 1.5 GSps D/A, Quad 105 MHz, Universal 3 Gb (Rocket I/O, 10 GbE, InfiniBand), Quad FC2, Quad GbE, and LVDS. Our boards work on a number of operating systems, including Win NT, 2000, XT, Linux, Solaris, IRIX, ALTIX, and VxWorks.

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

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

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

FEATURES:

- One to three Virtex-II Pro Xilinx FPGA processing elements – XC2VP70 or XC2VP100
- Up to 144 MB DDRII or QDRII SRAM
- Up to 768 MB DDR SDRAM
- Programmable flash for each processing element to store FPGA images
- Works with VME64x backplane
- High-speed multichannel DMA controller
- Host software: Win NT, 2000, XP, Linux, VxWorks
- Full CoreFire board support package for fast, easy application development
- VHDL model, including source code for hardware interfaces and ChipScope access
- Save time and effort and reduce risk with COTS boards and software
- Achieve world-class performance – WILD solutions outperform the competition
- Includes one-year hardware warranty, software updates, and customer support; training available

For more information, contact: wfinfo@annapmicro.com **RSC# 19242 @ www.mil-embedded.com/rsc**

RTD Embedded Technologies, Inc.

"MIL Value for COTS prices"™

Geode cpuModules™

Pentium® M cpuModules™

8000 MIPS dspModules™

cpuModules™ –40 to +85°C

		Pentium® M				Intel® Celeron®						AMD Geode		
		CMX158886PX1400HR	CMD158886PX1400HR	CMX158886PX1400HR-BRG	CMD158886PX1400HR-BRG	CME147786CX400HR	CME147786CX650HR	CML147786CX400HR	CML147786CX650HR	CMX147786CX400HR	CMX147786CX650HR	CME26686CX333HR	CME27686CX333HR	CMC26686CX333HR
Bus	AT Expansion Bus			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	PCI Universal Expansion Bus	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	
	PCI Bus Masters	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			
CPU and BIOS	CPU Max Clock Rate (MHz)	1400	1400	1400	1400	400	650	400	650	400	650	333	333	333
	L2 Cache	2MB	2MB	2MB	2MB	256k	256k	256k	256k	256k	256k	16K	16k	16k
	Intel SpeedStep Technology	✓	✓	✓	✓									
	ACPI Power Mgmt	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0			
	Max Onboard DRAM (MB)	512	512	512	512	512	512	512	512	512	512	256	256	256
	RTD Enhanced Flash BIOS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Nonvolatile Configuration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Quick Boot Option Installed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	USB Boot	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Peripherals	Watchdog Timer & RTC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	IDE and Floppy Controllers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	ATA/IDE Disk Socket, 32 DIP	1	1	1	1	1	1	1	1	1	1	1	1	1
	Audio	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	Digital Video	LVDS	LVDS	LVDS	LVDS			TTL	TTL	LVDS	LVDS	TTL	TTL	
	Analog Video	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	
	AT Keyboard/Utility Port	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	PS/2 Mouse	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	USB Mouse/Keyboard	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
I/O	RS-232/422/485 Ports	2	1	2	1	2	2	2	2	2	2	2	2	2
	USB 2.0 Ports	2	4	2	4									
	USB Ports					2	2	2	2	2	2	2	2	2
	10/100Base-T Ethernet	1		1		1	1	1	1	1	1	1	1	
	ECP Parallel Port	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	aDIO(Advanced Digital I/O)	18	18	18	18	18	18	18	18	18	18	18	18	18
	multiPort(aDIO, ECP, FDC)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SW	ROM-DOS Installed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DOS, Windows, Linux	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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- Analog VGA
- TTL and DVI panels

Communication Modules
- Copper or fiber Ethernet
- USB 2.0 and Firewire
- CAN Bus & CAN Spider
- Dual Synchronous Serial
- Quad Serial w/ Ethernet
- Octal PCI Serial

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

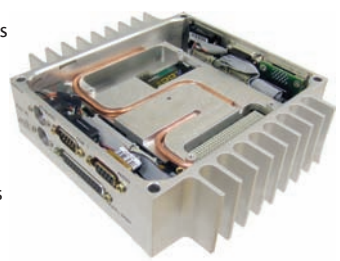
Motion Controllers
- DC motor controllers
- Synchro, resolver, LVDT

Power Supplies
- 50/75/83/88/100 Watts
- Wide input range
- ATX Power Supply
- UPS backup
- MIL-STD-704/461

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

IDAN™— Intelligent Data Acquisition Node

- Easily build your PC/104 system
- Rugged PC/104 stackable framed modules
- Quick interchangeability and expansion
- Structural heat sinks and heat pipes
- Optional cooling fins
- Milled aluminum frames
- Standard PC connectors
- Optional MIL-SPEC paint & shock mounts
- –40 to +85 °C



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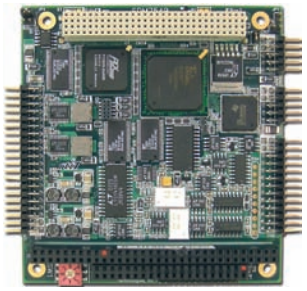
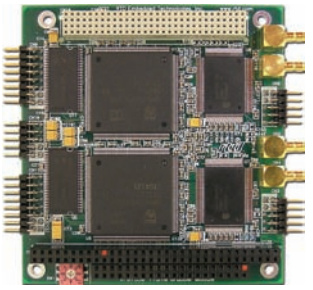
HighRel PC/PCI-104 Modules and Systems

–40 to +85°C



Autonomous SmartCal™

Wireless Telematics



Frame Grabbers

	dataModules® –40 to +85°C	Smart A/D		Analog I/O					Digital I/O					
		SDM7540HR	SDM8540HR	DM6210HR	DM6420HR	DM6430HR	DM7520HR	DM6620HR	DM6812HR	DM6814/16HR	DM6856HR	DM6888HR	DM6956HR	DM7820HR
Bus	AT Expansion Bus	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	PCI Expansion Bus Master	✓	✓				✓							✓
	McBSP Serial Ports	✓	✓				✓							
Analog Input	Single-Ended Inputs	16	16	16	16	16	16							
	Differential Inputs	8	8		8	8	8							
	Max Throughput (kHz)	1250	1250	40	500	100	1250							
	Max Resolution (bits)	12	12	12	12	16	12							
	Input Ranges/Gains	3/7	3/7	3/1	3/4	1/4	3/6							
	Autonomous SmartCal	✓	✓											
	Data Marker Inputs	3	3		3		3							
Conversions	Channel-Gain Table	8k	8k		8k	8k	8k							
	Scan/Burst/Multi-Burst	✓	✓		✓	✓	✓							
	A/D FIFO Buffer	8k	8k		8k	8k	8k							
	Sample Counter	✓	✓		✓	✓	✓							
	DMA or PCI Bus Master	✓	✓		✓	✓	✓	✓						✓
	SyncBus	✓	✓				✓							
Digital I/O	Total Digital I/O	16	16	16	16	16	16	16	48	18/9	32	64	32	48
	Bit Programmable I/O	8	8		8	8	8	8	24	6/0				48
	Advanced Interrupts	2	2		2	2	2	2	2					2
	Input FIFO Buffer	8k	8k		8k	8k	8k							4M
	Opto-Isolated Inputs										16	48	16	
	Opto-Isolated Outputs										16	16		
	User Timer/Counters	3	3	3	2	3	3	3	3	3				10
	External Trigger	✓	✓		✓	✓	✓	✓	✓					✓
	Incr. Encoder/PWM									3/9				
	Relay Outputs												16	
Analog Out	Analog Outputs	2	2		2	2	2	4						
	Max Throughput (kHz)	200	200		200	100	200	200						
	Resolution (bits)	12	12		12	16	12	12						
	Output Ranges	4	4		3	1	4	4						
	D/A FIFO Buffer	8k	8k				8k	8k						

RTD FieldPads™

- Ruggedized, embedded computer systems
- User-specified CPU and PC/PCI-104 expansion
- Weathertight components
- Integrated 6.5-inch video panel, keyboard
- Heat pipes for high performance CPUs
- User-defined MIL connectors
- Internal and external battery packs
- Expand with any RTD PC/PCI-104 product

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Ideal for control and monitoring of processes on factory floors or industrial installations. Mounting flanges allow the unit to be installed on machinery or walls, enabling standard PC access in a rugged enclosure resistant to industrial environments.

Tactical FieldPad™

Designed for mobile and portable applications where the angled panel and ergonomic design allow for optimal viewing with flexible positioning. Data collection/downloading and information access accomplished through wired or wireless connections.

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- HiDAN*plus* combines the modularity of IDAN with the environmental ruggedness of HiDAN
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- Structural heat sinks and heat pipes
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- **Stackable signal raceway**
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- MIL I/O connectors
- Shock-mount optional
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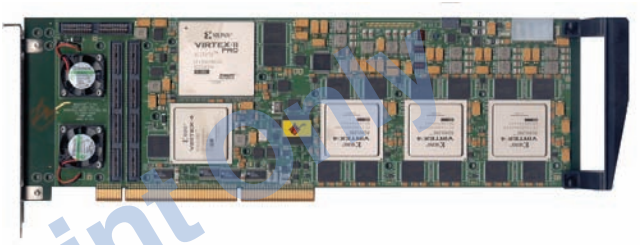
WILDSTAR 4 for PCI

Annapolis Micro Systems is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Our 10th-generation WILDSTAR 4 for PCI-X uses Xilinx's newest Virtex-4 FPGAs for state-of-the-art performance. It accepts one I/O card in one, or up to two I/O cards in two, PCI-X slots, including single 1.5 GHz 8-bit ADC, quad 250 MHz 12-bit ADC, dual 2.3/1.5 GSps 12-bit DAC, Universal 3 Gbit serial I/O (Rocket I/O, 10 GbE, InfiniBand), and Tri XFP (10 GbE, 10G FC). Our boards work on a number of operating systems, including Windows, Linux, ALTIX, and VxWorks. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models.

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

Our extensive IP and board support libraries contain more than 1,000 cores, including floating point and the world's fastest FFT. CoreFire uses a graphical user interface for design entry, supports hardware-in-the-loop debugging, and provides proven, reusable, high-performance IP modules. WILDSTAR 4 for PCI-X, with its associated I/O cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.

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



FEATURES:

- Four Virtex-4 FPGA processing elements – One XC2VP70, XC2VP100, XC4VFX100, or XC4VFX140, and three XC4VSX55 or XC4VLX40 – 100
- Up to 3.5 GB DDR2 DRAM in 14 Banks or up to 96 MB DDRII or QDRII SRAM
- PCI or PCI-X bus – 133 MHz
- High-speed DMA multichannel PCI controller
- Programmable flash for each FPGA to store FPGA images and for PCI controller
- Auxiliary connector for additional power/Integrated heatsink for cooling and stiffness
- Full CoreFire board support package for fast, easy application development
- VHDL model, including source code for hardware interfaces and ChipScope access
- Available in both commercial and industrial temperature grades
- Proactive thermal management system – board-level current measurement and FPGA temperature monitor accessible through host API
- Save time, effort, reduce risk with COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition
- Includes one-year hardware warranty, software updates, and customer support; training available

For more information, contact: wfinfo@annapmicro.com **RSC# 31247 @ www.mil-embedded.com/rsc**

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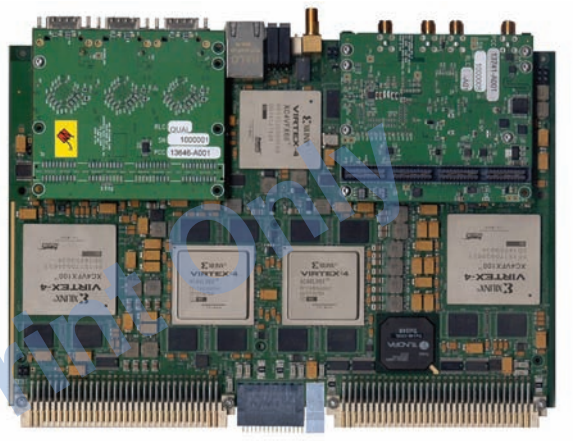
WILDSTAR 4 VXS

Annapolis Micro Systems is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Our tenth-generation WILDSTAR 4 for VME64X/VXS uses Xilinx's newest Virtex-4 FPGAs for state-of-the-art performance. It accepts one or two I/O mezzanine cards in one VME64x or VXS slot, including Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (Rocket I/O, 10 GbEthernet, InfiniBand), and Tri XFP (OS 192, 10G Fibre Channel, 10Gb Ethernet). Our boards work on Windows, Linux, Solaris, IRIX, ALTIX, VxWorks and others. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

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

Our extensive IP and board support libraries contain more than 1000 cores, including floating point and the world's fastest FFT. With a graphical user interface for design entry, hardware-in-the-loop debugging, and proven, reusable, high-performance IP modules. WILDSTAR 4 for VME64x/VXS, and its I/O Cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.

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



FEATURES:

- Four Virtex-4 FPGA Processing Elements – Two XC4VFX100 or XC4VFX140, and two XC4VSX55 or XC4VLX40, LX80, LX100 or LX160
- Up to 6 GBytes DDR2 DRAM in 12 Banks or up to 2 GBytes DDR2 DRAM and up to 64 MB DDRII or QDRII SRAM
- Available for either VME64x or VXS Backplane
- High Speed DMA Multi-Channel PCI Controller
- Programmable Flash to store FPGA images and for PCI Controller
- Full CoreFire Board Support Package for fast and easy application development
- VHDL model, including source code for hardware interfaces and ChipScope Access
- Host Software: Windows, Linux, VxWorks, etc.
- Available in both commercial and industrial temperature grades/ Integrated heatsink for cooling and stiffness
- Proactive Thermal Management System - Board Level current measurement and FPGA temperature monitor, accessible through Host API
- Save time and effort. Reduce risk with COTS boards and SW. Achieve world-class performance – WILD solutions outperform the competition
- Includes one year hardware warranty, software updates, and customer support; training available

For more information, contact: jdonald@annapmicro.com **RSC# 33233 @ www.mil-embedded.com/rsc**

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XG-5000K

Jacyl Technology proudly introduces our most advanced FPGA based PC/104 board, the XG-5000K.

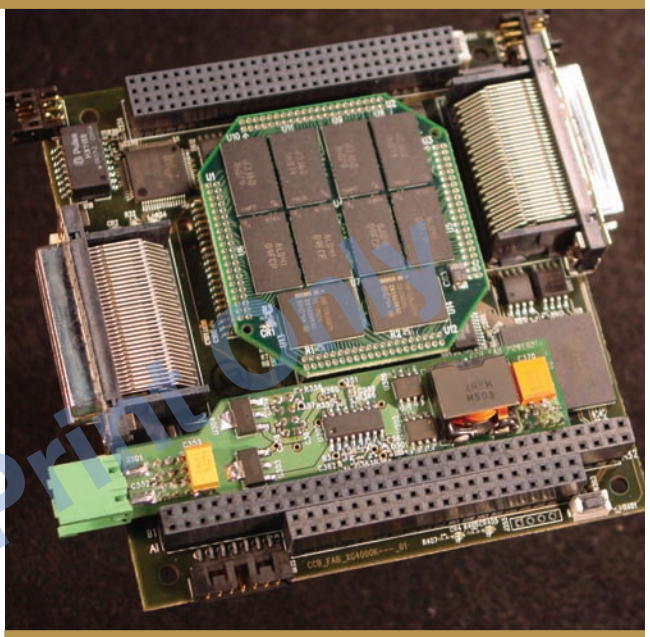
Centered around a 5 Million Gate Spartan-3 FPGA, the XG-5000K is the ultimate PC/104-*Plus* FPGA board that is ready to meet the most demanding of system designs. The board features a 5 Million Gate Spartan-3 FPGA, 256MByte of onboard Micron SRAM, 32MByte of on-board Intel FLASH, 264 user programmable I/O, Type 1 Compact Flash connector, a secondary 400K Gate Spartan-3 FPGA, 10/100T Ethernet interface, two RS-232 interfaces, PC/104 connector, PC/104-*Plus* connector, 0-25MHz programmable DDS master clock source, 6MByte of secondary Serial Page DataFlash, and a 25MHz initial master clock.

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

The XG-5000K also incorporates a secondary 400,000 gate Spartan-3 FPGA. This second FPGA is configured to control the design revisioning features of the XG-5000K. But the secondary Spartan-3E FPGA can be reconfigured by the user to meet the requirements of a particular system design.

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

For system designs that demand the most versatile, the most powerful, and the most capable FPGA based PC/104-*Plus* board, the XG-5000K is your projects solution.



FEATURES:

- Xilinx Spartan-3, 5 Million Gate FPGA
- 264 User Configurable I/O
- 256 MByte of SRAM, 32 MByte of Flash, 6 MByte of Serial Page DataFlash
- CompactFlash Type 1 Connector
- Secondary Xilinx Spartan-3, 400,000 Gate FPGA
- 10/100Base-T Ethernet
- 2 RS-232 Ports
- 25MHz FPGA Master Clock Source and a secondary 0-25MHz user programmable DDS FPGA Master Clock Source
- Incorporates Xilinx's design revisioning technology and can retain onboard as many as 16 partial or 4 complete FPGA design BIT files
- Can be powered from the PC/104 connector or an external DC power supply
- PC/104-*Plus* Form Factor; ISA and PCI 33MHz Bus Interfaces
- Extended temperature -40 °C to +85 °C

For more information, contact: sales@jacyl.com **RSC# 33237 @ www.mil-embedded.com/rsc**

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STABLCOR® Thermal Management Solutions

Hunter Technology is a fully integrated Electronic Manufacturing Services Provider with Mil-Qualifications, J-Standard Certifications, and Licensed Fabricator of STABLCOR® Thermal Management Solutions.

STABLCOR® Carbon Core Laminates provide unique solutions to today's thermal and reliability challenges.

STABLCOR® allows you to tailor the thermal expansion rate of your PCB to match the assembled components, increasing reliability.

Contact Hunter Technology to discuss how best to utilize the STABLCOR® solution on your next project or to take an existing design and STABLCOR it.

FEATURES:

- STABLCOR® is the perfect replacement solution for your THERMOUNT Designs, which now face obsolescence due to product discontinuation
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Freescale Power Architecture™ Products

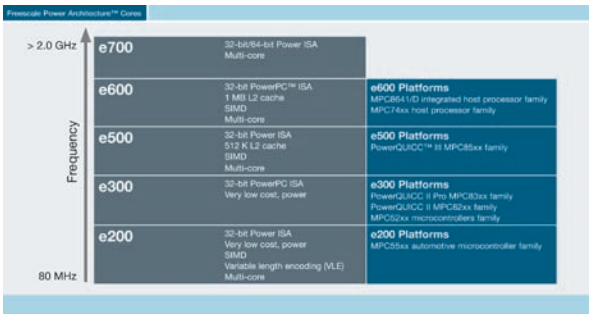
Power Architecture™ technology delivers reliable, high-performance processing with low power and low heat output – that's what makes it the de facto processing architecture in Aerospace and Defense.

Freescale has supplied products to the Aerospace and Defense Industry from our inception in 1953, and we are the #1 supplier of 32-bit processors to this industry.

Freescale's products range from low-end PowerQUICC™ devices to high-performance host and integrated processors with AltiVec™ technology.

Freescale understands that time-in-market is as important as time-to-market.

Whether building space systems or protecting nations, Power Architecture™ technology is at your service.



FEATURES:

- A full complement of price/performance/power options built on the Power Architecture™ technology
- MPC8641D – Dual e600 core with up to 1 .5 GHz performance per core and AltiVec™ technology
- MPC85xx E – e500 core up to 1.33 GHz performance with 256KB L2 Cache
- MPC836x E – e300 core up to 667MHz performance with QUICCEngine™ technology
- MPC83xx – e300 core up to 667 MHz performance with Gigabit Ethernet
- MPC55xx – e200 core with embedded flash

For more info, go to www.freescale.com/powerarchitecture **RSC# 33252 @ www.mil-embedded.com/rsc**

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Tri XFP I/O Card

Annapolis Micro Systems, Inc. is a world leader in high-performance Commercial Off-the-Shelf FPGA-based processing for radar, sonar, SIGINT, ELINT, digital signal processing, FFTs, communications, software radio, encryption, image processing, prototyping, text processing, and other processing intensive applications.

The Annapolis Tri XFP I/O Card, which works with the WILDSTAR 4/5 Family Architecture, has three 10 Gb individually configured XFP connectors, each with its own XAUI to XFI converter. Industry-standard pluggable fiber optic transceivers can be purchased from Annapolis or from other vendors. The Tri XFP provides up to 30 Gb Full Duplex I/O directly between the outside world and the Rocket I/O pins on the Xilinx Virtex-II Pro or Virtex-4 I/O FPGA on the WILDSTAR 4 main board. No other vendor provides that volume of data straight into the heart of the processing elements and then back out again.

Two I/O cards can reside on each WILDSTAR 4 or WILDSTAR 5 VXS or PCI-X/E board, with up to 30 million user reprogrammable gates.

The Tri XFP card will support 10 Gb Ethernet, 10 Gb Fibre Channel, and OC 192. Although the protocols will be provided as black box solutions with few modifications by users allowed, more adventurous users who choose to develop their own communications protocols from the basics already have access to all the board resources through VHDL source for the interfaces to SRAM, signal conditioners, LAD bus, I/O bus, and PPC flash. CoreFire users will have the usual CoreFire board support package.

The Tri XFP is the first of many I/O cards Annapolis will be releasing for its new WILDSTAR 4/5 Architecture Family, which uses Xilinx Virtex-4 and Virtex-5 FPGAs for processing elements. WILDSTAR 4 is the 10th generation of Xilinx FPGA processing-based COTS boards from Annapolis.

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

FEATURES:

- Up to 10 Gb Full Duplex Ethernet per connector
- Up to 10 Gb Fibre Channel
- OC 192
- Three 10 Gb XFP connector
- Accepts industry-standard pluggable transceivers
- Available in both commercial and industrial temperature grades
- Includes one year hardware warranty, software updates, and customer support
- One or two I/O cards fit on a single WILDSTAR 4/5 processing board
- New I/O form factor for improved thermal performance
- First of many WILDSTAR 4/5 Family I/O cards, including superior performance A/D, D/A, and additional high-speed communication cards
- Save time and effort and reduce risk with COTS boards and software
- Achieve world-class performance; WILD solutions outperform the competition

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Universal 3Gbit IO

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. The Annapolis Universal 3Gbit IO Card provides up to 36 Gb full-duplex I/O directly between the outside world and the Rocket I/O pins on the Xilinx Virtex-II Pro FPGA processors. No other vendor provides that volume of data straight into the heart of the processing elements and then back out again. The card has three individually configurable, industry-standard 4x connectors, providing four lanes per connector, with dedicated signal conditioners to ensure clean communication. It supports a wide variety of readily available cables: copper for short haul (.3-5 m) or fiber for long haul (10-300 m). Two I/O cards can reside on each WILDSTAR II Pro or WILDSTAR II FPGA-based VME or PCI board with up to 30 million user reprogrammable gates.

Initial release of the Universal 3Gbit Card will come with an easy-to-use Rocket I/O protocol supporting up to 12 Gb full duplex per connector. Available protocols are up to 10 G full-duplex InfiniBand per connector, up to 10 G full-duplex Ethernet per connector, and Serial FPDP. Although the InfiniBand, Ethernet, and Serial FPDP protocols will be provided as black-box solutions with few modifications by users allowed, more adventurous users who choose to develop their own communications protocols from the basics already have access to all the board resources through a VHDL source for the interfaces to SRAM, signal conditioners, LAD bus, I/O bus, and PPC flash. CoreFire users will have the usual CoreFire board support package.

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FEATURES:

- Up to 12 Gb full-duplex Rocket I/O per connector
- Up to 10 Gb full-duplex InfiniBand per connector
- Up to 10 Gb full-duplex Ethernet per connector
- Three individually configurable 4x connectors – four lanes per connector
- Three fundamental oscillators – 100.00 MHz, 125.00 MHz, and 156.25 MHz
- One Xilinx Virtex-II Pro 70-5, -6 or -7, or Industrial 70-5I or 70-6I
- Up to 4 GB DDR SDRAM in four banks
- Two PowerPC 405s in FPGA with onboard flash for program storage
- JTAG, ChipScope, and serial port access
- Proactive thermal management system
- Available in both commercial and industrial temperature grades
- Includes one-year hardware warranty, software updates, and customer support

For more information, contact: wfinfo@annapmicro.com **RSC# 30041 @ www.mil-embedded.com/rsc**

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Rugged Switches

Ethernet Switches are the backbone of network-centric system architecture. Access to real-time information is critical in today's network applications. ACT/Technico's line of Ethernet switches and our expertise in embedded sub-systems integration help mitigate the risk in your development time line. Whether managing joint operations in a theater of war or a transportation logistics network, network-centric computing is the new paradigm in embedded systems, providing the speed, scalability, reliability, and security necessary.

New network requirements such as IPv6 and multicast are well supported by ACT/Technico's complete line of Ethernet switch and interface products. Custom designs are also available. Please visit our website or call us for details.

FEATURES:

- Up to 26 ports in a single slot 10/100 (Fast) or 10/100/1000 (Gigabit)
- Extended temperature and conduction cooled version for rugged environments
- Solutions based on VMEbus, VITA 31.1, VXS, PICMG 2.16, and CompactPCI
- Configurable, fully managed (Layer 3), IPv6, multicast, wirespeed, and low-cost unmanaged versions
- Flexible management tools such as user-defined, built-in tests
- LED and thermal sensors for easy networking

For more information, contact: sales@acttechnico.com **RSC# 33105 @ www.mil-embedded.com/rsc**

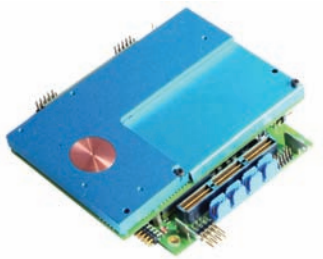
DIGITAL-LOGIC AG

Nordstrasse 11/F • CH-4542 Luterbach/Switzerland
++41 (0)32 681 58 00
www.digitallogic.com

MICROSPACE® MSM945, PC/104-EXPRESS

DIGITAL-LOGIC AG offers the PCI-104 Express CPU module with Celeron® M LVU Core™ Duo and Core™2 Duo. Designed for harsh environments, the MSM945 provides 4x 1-lane PCI Express and PEG (RA6) – all the interfaces for modern applications. CPU and RAM are protected to resist shock and vibrations. With a typical power consumption as low as 10W to 20W, extended temperature solutions (-40 °C to +70 °C) can be realized. Many smart technical details in hardware and BIOS support the integration and make the engineer's life easy.

The MSM945 module is perfectly suited for embedded computing with high CPU and graphics performance in transportation, telecommunication, medical, aerospace or military applications.



FEATURES:

- MICROSPACE® MSM945 baseboard with exchangeable Computer-On-Module, smartModule SMX945
- Intel® Processor Celeron® M Core™ Duo and Core™2 Duo 1 GHz up to 2x 1.6 GHz
- Intel® 945GM, ICH7-M, 512-204 8MB DDR-RAM, Extreme Graphic, 8-224MB (UMA), DirectX 9 compliant, CRT and DVO/LVDS
- 4x1 Lane PCI Express, 1x P-ATA, MS, KB, FD, 2x S-ATA, COM1-2, LPT1, 6x USB V2.0
- LAN Ethernet 10/100BASE-T, AC97-7.1HDA, EEPROM support
- Optimized thermal concept and cooling feature for operating temp. of -25 °C to +60 °C, opt. -40 °C to +70 °C

For more information, contact: brigitte.kocher@digitallogic.com **RSC# 33231 @ www.mil-embedded.com/rsc**

Ampro Computers, Inc.
5215 Hellyer Avenue, Suite 110 • San Jose, CA 95138
408-360-0200
www.ampro.com

PC/104, EBX, ETX®

Rugged PC/104, EBX SBCs and ETX® COMs

Ampro believes that ruggedness should be inherent in the design of a board. Ampro's rugged products are subject to extensive voltage and temperature margin tests during the new product development process, along with shock and vibration testing and the Highly Accelerated Life Test (HALT).

At the frontline or back home training, Ampro's rugged boards are able to withstand the intense conditions experienced by the military. With the ability to endure extreme temperatures, our SBCs and COMs are able to perform precisely in conditions experienced by today's military. Used to control targets at the practice range or as a key component of land and air defense, Ampro's rugged boards provide the unparalleled reliability that we are known for in the industry.

ETX® 802 is for custom embedded applications that need ISA expansion, ACPI, and Centrino® performance without a heat pipe. ETX® 802 COM (Computer-On-Module) gives you the choice of high performance processors with advanced networking, embedded graphics, and all of the PC-compatible component subsystems in a modular format that plugs into your custom baseboard.

LittleBoard 800 EBX SBC gives you a choice of high-performance, low-voltage Centrino® processors with Gigabit Ethernet, high performance graphics, USB 2.0, DDR memory, and all of the PC-compatible component subsystems.

The PCI-104 form factor ***CoreModule 800*** gives the user a choice of ultra low-voltage Celeron® M processors with advanced networking, high performance graphics for space-constrained applications.

CoreModule 620 PC/104 SBC is for full-featured embedded applications requiring low power in a compact size and is RoHS compliant. This SBC uses the AMD Geode™ LX 800 highly integrated processor with DDR RAM.

CoreModule 420 is for rugged space constrained, full-featured embedded systems with modest CPU performance requirements. This product is based on STMicroelectronics' STPC® Atlas microprocessor running at 133 MHz.

FEATURES:

- ETX® 802 Pentium® M Module: 50% thicker PCBACPI 2.0 including S3 suspend-to-RAM; -40° to +85° operation; PCI and ISA expansion
- LittleBoard™ 800 Pentium® M SBC; Ampro BIO extensions; PC/104-*Plus* expansion; (4) RS-232/422/485 Serial; (4) USB 2.0 ports
- PC/104 CoreModule™ 800 Celeron® M SBC; Ampro BIOS extensions; thick rugged no wings; Gigabit Ethernet; (2) RS-485; (2) USB 2.0 ports
- CoreModule™ 620 Geode PC/104 SBC; 10/100 Ethernet, Video; 2 Serial, 2 USB ports; CompactFlash socket; PC/104 expansion; fanless operation; PCI-to-ISA Bridge
- CoreModule™ 420 486 PC/104 SBC; -40 °C to +85 °C operation; 10/100 Ethernet, Video; 4 Serial, 1 USB, 8 GPIO; PC/104 expansion; rugged
- Designed for embedded applications; soldered CPU; fanless
- Shock, vibration, HALT testing; high MTBF
- Conformal coating available; product change notification and last time buy opportunity

For more information, contact: info@ampro.com **RSC# 33214 @ www.mil-embedded.com/rsc**

DSS Networks, Inc.

23 Spectrum Pointe, Suite 202 • Lake Forest, CA 92630
949-716-9051
www.dssnetworks.com/v3/Products.asp

Ethernet Switches

DSS Networks designs and manufactures high speed, Intelligent Gigabit Ethernet Switches and NICs for embedded computing platforms. All of our switches offer various levels of management from the VLANs, aggregation and failover all the way to switch chips with on-chip, content-aware packet engines for fast filter process, routing, QOS, and much more. Coupled with our broad line of interface cards with various port densities across a number of bus architectures in both copper and fiber interface, DSS Networks deploys the best total networking solutions for your embedded requirements.

Please call or email sales at sales@dssnetworks.com or visit our website for more details.

FEATURES:

- PMC 8 port GigE Layer 2 Switch: 4 Independent external ports, 2 Host ports via PCI-X, 2 1000X via PMC P4
- VME VITA 31.1 & CompactPCI PICMG 2.16 solutions: 12 port Gigabit Ethernet Switch, with Fiber Uplink Options
- PCI Express GigE Layer 2 Switch: 4 Independent external ports, 4 Host ports via PCI Express
- Add a GigE switch to your VME system without changing out your backplane or burning a slot!
- Ruggedized extended temperature models available (-40C - +85C) and MIL-SPEC conformal coating (-R1, -R2)
- Aggregate up to 4 GigE ports in a single PMC site; send your requirements for a custom application by calling or emailing sales at sales@dssnetworks.com

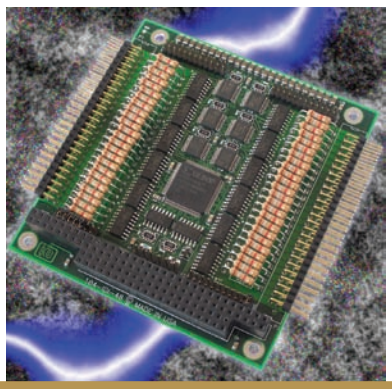
For more information, contact: sales@dssnetworks.com **RSC# 33226 @ www.mil-embedded.com/rsc**

ACCES I/O Products

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

104-IDI-48 Series

The 104-IDI-48 series of PC/104 I/O boards provides 48 individually optically isolated digital inputs for applications where high common-mode external voltages are present. Channel-to-channel and channel-to-ground isolation guards electronics from transient voltage spikes and offers greater common-mode noise rejection in electronically noisy surroundings containing industrial machinery and inductive loads. Applications include factory automation, energy management, industrial ON/OFF control, security systems, manufacturing test, and process monitoring. These boards support most operating systems and include free DOS, Linux, and Windows 98/NT/2000/XP/2003 compatible software package.



FEATURES:

- Polarity insensitive AC/DC inputs accept up to 60 VDC or AC rms
- Change-of-state detection (IRQ) on selected inputs (certain models)
- AC or voltage transient filtering
- Optically isolated channel to channel and channel to ground
- Optional -40 °C to +85 °C operating temperature
- Compatible with industry-standard I/O racks

For more information, e-mail: contactus@accesio.com **RSC# 33104 @ www.mil-embedded.com/rsc**

DataMetrics Corporation
1717 Diplomacy Row • Orlando, FL 32809
407-251-4577
www.datametrics.com

Model 1041

The unique DataMetrics™ Model 1041 PC-104 USB 2.0/FireWire/Ethernet combo card for PC/104-*Plus* systems provides an abundance of high-speed expansion options. This low cost I/O module provides three extremely fast connection options for the price typically charged for just one.

Perfect for imaging applications, the I/O board provides the following high speed interfaces:

- (4) USB 2.0 (480 Mbit/s)
- (2) FireWire 400 (400 Mbit/s)
- (1) Ethernet (10/100 Mbit/s)

The I/O Board supports Linux, Win 9X, Win NT, Win XP, Win 2000, and QNX operating systems.

FEATURES:

- Four USB 2.0 Ports
- Two IEEE 1394 FireWire Ports
- One 10/100 Mbit/s Ethernet Port
- PCI Interface (Master) for Fast Connectivity
- Standard 0.1" Headers Optional for All Ports
- Two 32-bit 33 MHz PCI buses up to 4 secondary bus masters, supports secondary bus arbiter

For more information, contact: info@datametrics.com **RSC# 33115 @ www.mil-embedded.com/rsc**

DIGITAL-LOGIC AG
Nordstrasse 11/F • CH-4542 Luterbach/Switzerland
++41 (0)32 681 58 00
www.digitallogic.com

MICROSPACE® MSM855, PC/104-*Plus*

DIGITAL-LOGIC offers the PC/104-*Plus* CPU module MSM855 with Intel® processors Celeron® M or Pentium® M. Designed for harsh environments, the MSM855 provides all the interfaces for modern applications. CPU and RAM are protected against shock and vibrations. With a typical power consumption as low as 12 W to 25 W, extended temperature solutions (-40 °C to +70 °C) can be realized. Many smart technical details in hardware and BIOS support the integration and make an engineer's life easy.

The MSM855 module is perfectly suited for embedded computing with high CPU and graphics performance in transportation, telecommunication, medical, aerospace or military applications.

FEATURES:

- MICROSPACE® MSM855 baseboard with exchangeable Computer-on-Module, smartModule SM855
- Intel® Processor Celeron® M or Pentium® M from 600MHz up to 1800MHz
- Intel® 855GME, ICH4, 512-1'024MB DDR-RAM, Extreme Graphic, 64 MB, DirectX 9 compatible, CRT and DVO/LVDS
- MS, KB, FD, 2xP-ATA, COM1, COM2, LPT1, 6xUSB V2.0, LAN Ethernet 10/100BASE-T, Audio AC97 5.1
- Thermal concept, operating temperature -25°C to +50°C (optional -40 °C to +70 °C)
- EEPROM support; watchdog

For more information, contact: brigitte.kocher@digitallogic.com **RSC# 33232 @ www.mil-embedded.com/rsc**

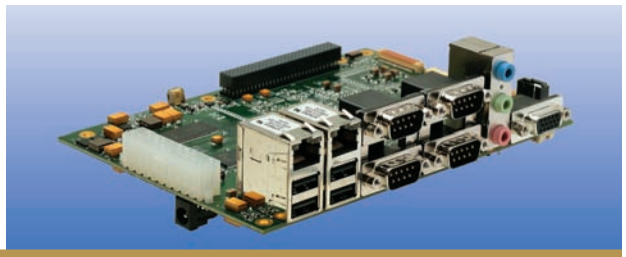
Embedded Planet
4760 Richmond Road, Suite 400 • Cleveland, OH 44128
216-245-4180
www.embeddedplanet.com

EP440K

The EP440K is a feature-packed EPIC form-factor computer, delivering high levels of performance and reliability in a small and power efficient package. With a complete set of I/O, including audio, video, serial, USB, and CAN, the EP440K is suitable for a large range of applications, including industrial control, gaming, and kiosk applications. For additional expansion, a PCI-104 stackable connector allows inclusion of 3rd party I/O boards.

At the heart of the EP440K is the PowerPC 440GR from AMCC, running at 667 MHz and producing up to 1,334 DMIPS, while consuming approximately 3 W, making it a fanless solution.

All of the board devices are supported by Embedded Planet's software expertise, allowing you to rapidly develop your application on a solid platform.



FEATURES:

- AMCC PowerPC 440GR at 667 MHz with 256 MB of DDR RAM, and 128 MB of flash
- 2 10/100 Ethernet ports, 2 software selectable RS-232/RS-485 ports, 4 USB 2.0 Host Ports, and 2 CAN ports
- VGA, LVDS, and TTL video, for resolutions up to 1280 x 1024, 16-bit color, and 4-wire resistive touch screen
- Audio Line I/O and Mic In via 3 standard stereo jack connectors
- ATX connector for full power supply, including LCD backlight and 5V only option for powering board stand-alone
- U-Boot bootloader and complete Linux BSP available. VxWorks and Green Hills INTEGRITY available upon request

For more information, contact: info@embeddedplanet.com

RSC# 32939 @ www.mil-embedded.com/rsc

PC/104 MILITARY EMBEDDED SYSTEMS Resource Guide 2007

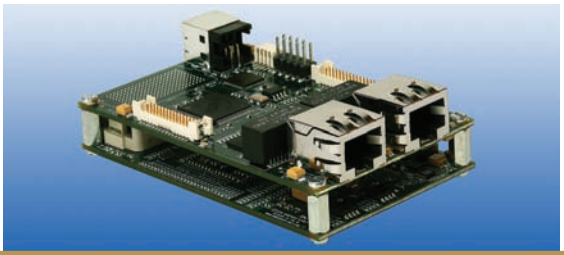
Embedded Planet
4760 Richmond Road, Suite 400 • Cleveland, OH 44128
216-245-4180
www.embeddedplanet.com

EP440xS

The EP440xS and its companion I/O board create a compact, cost-effective, and powerful platform for developing high performance networked control platforms. At only 3.5" x 2.2" x 1.5", the board stack will fit into compact spaces, while 13 serial ports, 2 USB ports, and 2 Gigabit Ethernet ports provide the necessary control I/O.

At the heart of the EP440xS is the AMCC PowerPC 440EPx. The 440EPx is a highly integrated SoC that includes a PowerPC core at speeds up to 667 MHz, a floating point unit, NAND flash controller, DDR2 RAM controller, USB 2.0 host and device controllers, and dual Gigabit Ethernet MACs. The high level of integration increases performance, while lowering system power consumption and cost.

The board stack is supported by the U-Boot and Linux.



FEATURES:

- AMCC 440EPx PowerPC processor at up to 667 MHz and hardware floating point support
- Up to 256 MB of DDRII RAM with ECC for a high bandwidth reliable memory interface
- Up to 128 MB of flash on the processor board with an additional 512 MB of NAND flash on the I/O board
- One RS-232 on the processor board with additional 12 ports available on the I/O board
- USB 2.0 host and device ports available on the I/O board
- Industrial temperature rated module with U-Boot and Linux support

For more information, contact: info@embeddedplanet.com

RSC# 33082 @ www.mil-embedded.com/rsc

Eurotech S.p.a
Via Fratelli Solari 3/A • Amaro (UD), 33020 Italy
0039 0433 485411
www.eurotech.it

EuroTech
A MEMBER OF EUROTECH GROUP

CPU-1474/CPU-1472

The CPU-1472 and the CPU-1474 are PC/104-*Plus* boards designed for harsh environments such as demanding mobile military applications that involve high shock/vibration and high/low temperature extremes.

The CPU-1472 and the CPU-1474 are embedded RoHS compliant boards based on two modules: a mezzanine CPU module combined with a PC/104-*Plus* form factor carrier.

The CPU module features an Intel® ULV Pentium® M 1GHz processor or the Celeron® M 1GHz and the Intel® i855GME chipset.

The system comes with 512MB DDR-266MHz soldered onboard to enhance shock/vibration resistance.

These high reliability CPU modules are designed to operate without any active cooling (fanless) over standard (0 to +60 °C) and extended (-40 to +85 °C) operating temperature ranges. All extended temperature range versions are tested and qualified individually before shipping to ensure reliability.

These CPU modules are compatible with Linux®, Windows XP Embedded®, Windows CE®, VxWorks® and QNX® operating systems.

The BIOS and the set-up parameters are located in a 1MB Flash EPROM fully re-programmable onboard to operate without a battery.

The CPU-1474 and CPU-1472 carriers implement all the interconnections including 2 serial ports, analog VGA and Flat Panel LVDS outputs, 1 AC97 interface, keyboard/mouse connectors and a fast ATA 100 interface to support fast Flash devices (Disk-On-Module, CompactFlash and Flash Disk).

The CPU-1474 features 4 USB 2.0 ports, 1 Gigabit Ethernet interface (1000/100/10Mbps), 1 Fast Ethernet interface (10/100Mbps), whereas the CPU-1472 implements 8 USB 2.0 ports and 1 Fast Ethernet interface (10/100Mbps).

Both versions provide support for hardware user programmable Watchdog and a Real Time Clock (with external backup battery).

FEATURES:

- Architecture: PC/104-*Plus* compliant
- Dimensions: 90 x 96 mm (3.6" x 3.8")
- Height: 18.6 mm (0.7")
- Power Supply: single +5V DC ±5%
- Supported Operating Systems; WinCE, WinXPE, Linux, QNX and VxWorks
- Standard Operating Temperature: 0 ~ + 60 °C; Extended Operating Temperature: -40 ~ +85 °C
- Humidity: Up to 95% non-condensing
- Designed to meet MIL-STD-810
- Custom BIOS with embedded features
- Custom carrier
- Conformal coating
- Custom connectors

Jacyl Technology
P.O. Box 350 • Leo, IN 46765
1-800-590-6067
www.jacyltechnology.com

AXR-16

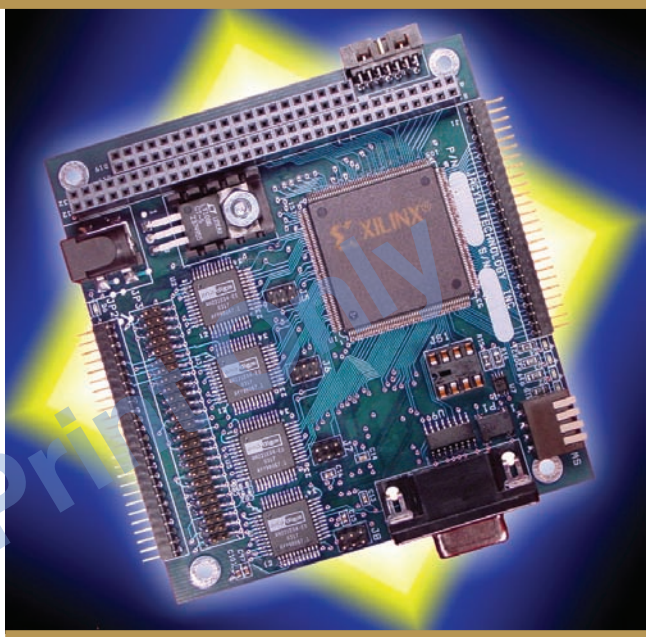
Jacyl Technology, Inc. has developed a PC/104 board based upon the Anadigm FPAA. The AXR-16 harnesses the power of the FPAA's fundamental characteristic of being a reprogrammable and reconfigurable based technology and combines this with the small form factor of the PC/104 platform. The AXR-16 features 4 Anadigm AN221E04 FPAA components, a Xilinx FPGA, a programmable Direct Digital Synthesis (DDS) component (programmable up to 33Mhz), 25 differential or single-ended analog inputs/outputs, and 5 additional dedicated differential or single-ended analog outputs.

The AXR-16 features four Anadigm AN221E04 FPAAs. On the AVX-16 each FPAA can be configured to function independently of each other or can have all four of the FPAAs cascaded together.

The Xilinx Spartan 3 is incorporated on the AXR-16 as a central signal routing, source clock control, FPAA configuration logic interface and PC/104 bus interface for the entire board. All configuration control lines for each Anadigm AN221E04, all clock signals, configuration control lines for the DDS and defined PC/104 data, address and bus logic signals are routed to the FPGA. The AXR-16 was designed with the Xilinx FPGA in order to allow the AXR-16 to be as versatile as possible.

The AXR-16 provides 3 separate digital clock sources for the FPGA for each of the FPAAs: a 50MHz digital clock source, the 12MHz master clock from the PC/104 bus and a programmable Direct Digital Synthesis (DDS) component. Each of the clock sources is routed through the FPGA and can be utilized in multiple combinations for each of the FPAAs.

The AXR-16 has the versatility of being powered from the PC/104 bus or can be powered from an external DC source. This provides the capability of the AXR-16 to be utilized as a stacked module in PC/104 applications or as a stand-alone product design platform allowing the AXR-16 to be an integral part of a larger embedded PC/104 stack or to be utilized as a stand-alone circuit board for development platforms, design prototypes, or production products.



FEATURES:

- Configured with 4 Anadigm AN221E04 Field Programmable Analog Array (FPAA) components
- 25 Differential or Single-ended analog inputs/outputs (16 dedicated inputs/outputs, 9 additional muxed inputs/outputs)
- 5 additional dedicated Differential or Single-ended analog outputs
- The outputs of the 8 bit A-D converter located within each AN221E04 can be sent directly into the CPLD for digital signal processing
- Each FPAA is completely configurable and programmable through the FPGA
- CPLD Global Clocks include PC/104 bus, 50Mhz onboard oscillator, and the 0 to 33Mhz DDS programmable output
- FPAA can be programmed and configured through the PC/104 bus, an onboard FPGA serial PROM, or directly by the AnadigmDesigner 2 software
- FPAAs are fully supported by the complimentary AnadigmDesigner 2 software
- FPGA is supported by the Xilinx free ISE Webpack software
- Can be powered through the PC/104 bus or by an external DC power source
- Available in industrial temperature

For more information, contact: sales@jacyl.com **RSC# 33239 @ www.mil-embedded.com/rsc**

Jacyl Technology
P.O. Box 350 • Leo, IN 46765
1-800-590-6067
www.jacyltechnology.com

LT-300K

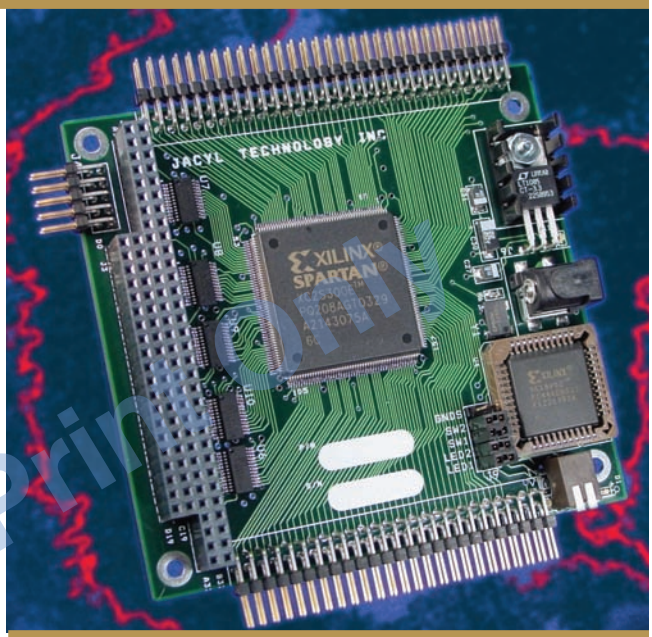
The Jacyl Technology LT family includes PC/104 based boards featuring a Xilinx Spartan-IIE FPGA and 101 programmable I/O pins. The LT family of PC/104 boards was designed to meet the system requirements of the maximum number of programmable I/O pins and the choice of FPGA gate densities. The Xilinx Spartan-IIE family of FPGAs complements the LT family by providing high performance, abundant logic resources, and a rich feature set.

The LT Family of PC/104 boards can be powered from the PC/104 bus or can be powered from an external DC source, allowing the board to be utilized as a stacked module in PC/104 applications or as a stand-alone product design platform. This allows the board to be ideal in embedded PC/104 applications or to be utilized in development platforms, design prototypes or production products.

The Spartan-IIE FPGA's 4 Global Clock inputs are configured with the PC/104 Master Clock, a 100Mhz onboard oscillator, and two user defined clock inputs. This allows the LT family to be very flexible on single or multiple system clock requirements or system clock configurations.

Jacyl has introduced new variations of the LT family to provide the most versatile product array anywhere. The original LT boards are configured with all user programmable I/O from the FPGA to be only interfaced with 3.3 TTL logic level systems. The new variation of LT boards allows all user programmable I/O from the FPGA to be also interfaced with 5V TTL and 5V CMOS logic level systems. Both versions of LT boards are available from Jacyl Technology and allow the system designer to select a version of the LT family that meets the FPGA size and logic level interface that their design requires.

The small size and versatility of the LT family makes it a prime target for embedded applications or as an integrated part of a larger system.



FEATURES:

- Total of 101 programmable I/O pins
- Xilinx Spartan-IIE 300,000 Gate FPGA (LT-300K) or the Xilinx Spartan-IIE 50,000 Gate FPGA (LT-50K)
- Can be utilized as a PC/104 module or as a stand-alone circuit board
- FPGA Global Clocks include PC/104 bus, 100Mhz onboard oscillator and 2 user defined clock inputs
- Supported by the Xilinx free Webpack software
- Xilinx XC18V02 Series In-System Programmable Configuration PROM
- 2 sets of user defined LEDs and switches
- Can be powered through the PC/104 bus or by an external DC power source
- Available in commercial or industrial temperature
- New versions of the LT family now allow the 101 programmable I/O to be interfaced with 3.3V or 5V compliant systems

For more information, contact: sales@jacyl.com **RSC# 33235 @ www.mil-embedded.com/rsc**

Jacyl Technology
P.O. Box 350 • Leo, IN 46765
1-800-590-6067
www.jacyltechnology.com

XG-300K

The XG-300K is a PC/104 based board featuring an Xilinx 300K Spartan IIE, 4Meg of high speed RAM, 512K of EEPROM, programmable Direct Digital Synthesis (DDS) component, 44 I/O pins, and dedicated differential inputs and outputs. The board uses the Xilinx Spartan-IIE, XC2S300E-6PQ208, which has extensive features including: 6,912 Logic Cells; 98,304 Distributed Ram Bits; 64K Block RAM Bits and four Delay-Locked Loops (DLLs).

The XG-300K can be powered from the PC/104 bus or can be powered from an external DC source, allowing the board to be utilized as a stacked module in PC/104 applications or as a stand-alone product design platform. This allows the board to be ideal in embedded PC/104 applications or to be utilized in development platforms, design prototypes or production products.

The Spartan IIE FPGA's 4 Global Clock inputs are configured with the PC/104 Master Clock, a 100Mhz onboard oscillator, and two outputs from the DDS. This allows the XG-300K to be very flexible on single or multiple system clock requirements or system clock configurations.

Jacyl has introduced new variations of the XG-300K to provide the most versatile product array anywhere. The original XG-300K is configured with all user programmable I/O from the FPGA to be interfaced with 3.3 TTL logic level systems. The new variation of XG-300K allows all user programmable I/O from the FPGA to be also interfaced with 5V TTL and 5V CMOS logic level systems. Both versions of XG-300K are available from Jacyl Technology and allow the system designer to select a version of the XG-300K that meets the FPGA size and logic level interface that their design requires.

The small size and versatility of the XG-300K makes it a prime target for embedded applications or as an integrated part of a larger system.

FEATURES:

- Xilinx Spartan-IIE 300,000 Gate FPGA
- 4Meg (256K x 16bit) high speed RAM.512K (64K x 8bit) EEPROM
- Programmable 0 to 33MHz Direct Digital Synthesis (DDS) component
- Total of 44 programmable I/O pins
- 2 pairs of differential inputs and outputs (differential I/O can be utilized as 6 additional general I/O)
- FPGA Global Clocks include PC/104 bus, 100Mhz onboard oscillator and the DDS outputs
- Supported by the Xilinx free Webpack software
- New versions of the XG-300K allow the programmable I/O to be 3.3VDC or 5VDC compliant
- Xilinx XC18V00 Series In-System Programmable Configuration PROM
- 2 sets of user defined LEDs and switches
- Can be powered through the PC/104 bus or by an external DC power source
- Available in commercial or industrial temperature

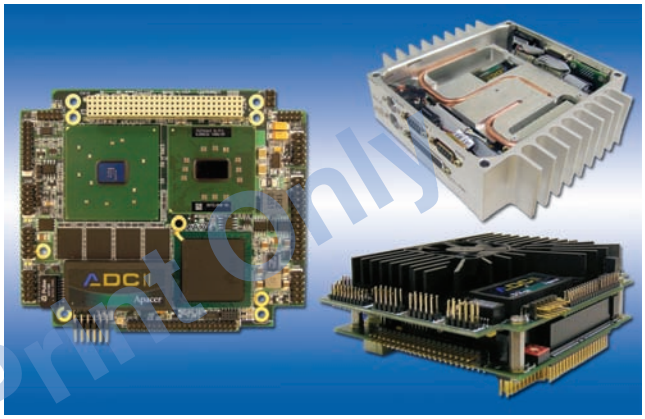
RTD Embedded Technologies, Inc.
103 Innovation Blvd. • State College, PA 16803
814-234-8087
www.rtd.com

RTD Pentium M

RTD offers high-performance PCI-104 cpuModules and controllers with the Intel® 1.4 GHz Pentium® M and 1.0 GHz Celeron® M, featuring 512 MB of surface-mount BGA DDR SDRAM with ECC and one ATA/IDE Disk Chip socket for an onboard true IDE flash drive, which is natively supported by all major GPOSs and RTOSs. Latest I/O technologies include two or four USB 2.0 ports, two RS-232/422/485 serial ports, and a multiPort™ with ESD protected Advanced Digital I/O (aDIO™). Nonvolatile BIOS settings and storage of CMOS settings require no battery.

The Pentium M features the latest in power management including Enhanced Intel SpeedStep® Technology. Support for standby power allows most of the cpuModule and all add-on cards to power down during standby. Wake events include aDIO interrupt, Ethernet, power button, serial port activity, USB, and real-time clock. Advanced thermal management enables thermal throttling, auto-fan control, and temperature monitor for CPU and board. Standard I/O include two or four USB 2.0 ports, SVGA, LVDS flat panel, EIDE, 10/100BASE-T Ethernet, AC'97 audio, BIOS-selectable RS-232/422/485 serial ports, keyboard, and PS/2 mouse. A stackable transition module with PCI/ISA bridge makes this PCI-104 single board computer compatible with any PC/104 and PC/104-*Plus* interface.

BIOS-selectable multiPort:
RTD's multiPort allows the parallel port to be configured as an aDIO, an SPP/ECP/EPP parallel port, or a floppy drive. aDIO is 18 digital bits configured as 8-bit-programmable and 8-bit port-programmable I/O giving any combination of inputs and outputs. Two strobe inputs latch data into the bit-programmable port and generate an interrupt or can be used as two general purpose digital inputs. Match, event, and strobe interrupt modes mean no more wasting valuable processor time polling digital inputs. Interrupts are generated when the 8-bit-programmable digital inputs match a pattern or on any value change event. Bit masking allows selecting any subgroup of 8 bits. Custom aDIO features include incremental encoder interfaces and pulse width modulators.



FEATURES:

- 1.4 GHz Pentium M and 1.0 GHz Celeron M processors
  - Pentium M internal cache: L1 – 32 KB; L2 – 2 MB
  - Celeron M internal cache: L1 – 32 KB; L2 – 2 MB
- 400 MHz, source-synchronous Front Side Bus
- 512 MB 333 MHz surface-mount DDR SDRAM
  - Single-bit Error Correction – SEC ECC
  - Double-bit Error Detection – DED ECC
- RTD Enhanced AMI BIOS with USB Boot, Quick Boot, ACPI, and nonvolatile storage of CMOS settings without battery
- multiPort – BIOS selectable parallel port, floppy, 18-bit aDIO with match/event/strobe interrupts and bit masking
- USB 2.0, 10/100BASE-T Ethernet, RS-232/422/485 serial, AC'97 audio, keyboard/mouse, EIDE controller supporting UltraDMA 100
- LVDS flat panel and analog SVGA controller with 3D accelerator and 64-bit AGP graphics accelerator
- ATA/IDE Disk Chip socket for an onboard true IDE flash drive, which is natively supported by all major GPOSs and RTOSs
- Enhanced Intel SpeedStep® Technology reduces CPU speed and core voltage when idle
- ACPI 2.0 power suspend modes featuring wake from aDIO, Ethernet, power button, USB, or RTC
- Advanced thermal management enabling thermal throttling, auto-fan control, and temperature monitor for CPU and board
- Operating temperatures: -40 °C to +85 °C IDAN, HiDAN, HiDANplus; -40 °C to +85 °C, 1 GHz; -40 °C to +75 °C, 1.4/1.0 GHz

For more information, contact: sales@rtd.com

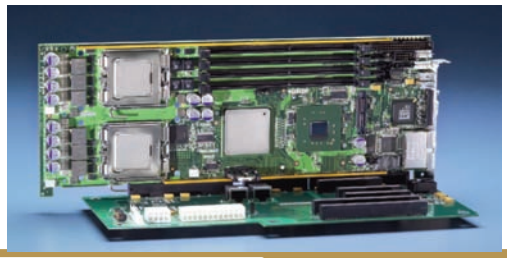
RSC# 32009 @ www.mil-embedded.com/rsc

Trenton Technology

2350 Centennial Drive • Gainesville, GA 30504
770-287-3100
www.TrentonTechnology.com

MCX/MCG

Trenton's MCX/MCG series of PICMG® 1.3 or SHB Express™ System Host Boards (SHBs) offers a wide variety of board configurations designed to excel in your most demanding and diverse server-class and graphics-class computing applications. Dual-Core processor options provide two and Quad-Core processors provide four execution cores per CPU. For dual-processor board configurations, each CPU has its own independent system bus to reduce data bottlenecks while maximizing processing throughput. The four-channel memory interface features DDR2-667 FB-DIMMS with a maximum of 16 GB. An extended memory SHB configuration is available that supports up to 32 GB of system memory.



FEATURES:

- One circuit board plus two quad-core processors deliver eight excution cores of outstanding performance
- Single circuit board SHB design featuring dual-or quad-core Intel® Xeon® processors with independent FSBs
- Quad channel DDR2-667 Memory Interface supports up to 32 GB of system memory
- Supports 32-bit /64-bit applications and x16, x8, x4, and x1 PCI Express links to a PICMG® 1.3 backplane
- Six Serial ATA/300 Interfaces with RAID 0, 1, 5, and 10 support and eight USB 2.0 interfaces
- Supports three Gigabit Ethernet interfaces: two to the board's I/O bracket and one down to the backplane

For more information, contact: jrenehan@TrentonTechnology.com **RSC# 32706 @ www.mil-embedded.com/rsc**

Innovative Integration

2390-A Ward Avenue • Simi Valley, CA 93065
805-578-4260
www.innovative-dsp.com

PMC/XMC Cards

VelociaPMC - Ultra-fast Reconfigurable I/O PMC/XMC Cards

The PMC module family integrates ultra-fast signal capture, generation, and co-processing on an advanced PMC architecture. Each card combines new generation analog devices with large user-reconfigurable Virtex-II Pro FPGA, ample DDR memory, and low jitter clocks/triggers on a 64/66 PCI with a private JN4 64-bit user I/O port and an XMC 4-lane Rocket I/O (per VITA 42) that connects straight to the FPGA of our Velocia CompactPCI boards or other carriers. This ultimate connectivity allows for rapid deployment of the most advanced systems.

FEATURES:

- DR Module – 16 Channel Digital Receiver Four A/D 125MHz
- UWB Module – Ultra-wide Digital Receiver Dual A/D 250MHz
- TX Module – Digital Transmitter/Arbitrary Waveform Generator, (4) 1GHz DAC
- CG Module – Programmable Precision Clock Source; four clock outputs
- Best-in-class speed and analog fidelity; ample resources for hardware-assisted DSP
- Ultra-fast data stream with low latency; ultra-fast serial link to host card

For more information, contact: sales@innovative-dsp.com **RSC# 33240 @ www.mil-embedded.com/rsc**

Technobox, Inc.
140 Mount Holly Bypass, Unit 1 • Lumberton, NJ 08096
609-267-8988
www.technobox.com

4720 Serial ATA Controller

The 4720 Serial ATA controller provides four 1.5 Gb per second links. Built around an Intel 31244 controller, the 4720 supports PCI-X as well as 33 MHz and 66 MHz PCI in 32-bit and 64-bit modes. Both 5 V and 3.3 V bus signaling are supported. The 31244 controller uses an SPI bus to connect to a 128Kx8 EEPROM memory that holds a BIOS image. Four status indicators convey the activity associated with each port.

The front panel interface features a Small Form Factor 8470 connector that affords a robust connection for a 4-lane SATA cable using screwlocks and jackscrews. A breakout board (P/N 4787) can be used to split the four lanes into individual SATA connections.

FEATURES:

- Supports up to Four SATA Devices
- Small Form Factor (SFF) 8470 Interface
- Intel 31244 Controller
- PCI-X Compatible
- On-board EEPROM for Storage of BIOS Image
- Optional Breakout Board (4787) to Split SFF-8470 into Individual SATA Connections

For more information, contact: info@technobox.com

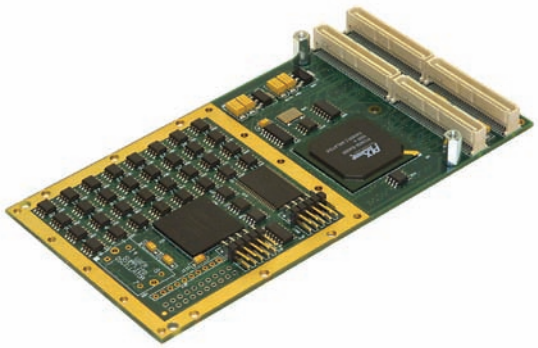
RSC# 33230 @ www.mil-embedded.com/rsc

MILITARY EMBEDDED SYSTEMS Resource Guide 2007 PMC

Technobox, Inc.
140 Mount Holly Bypass, Unit 1 • Lumberton, NJ 08096
609-267-8988
www.technobox.com

4792 Reconfigurable RS422/485 Digital I/O

The conduction-cooled, 32-channel, reconfigurable RS-422/485 digital I/O PMC provides a vehicle for implementing complex user-specific digital designs requiring a differential interface. Thirty-two general-purpose RS-422/485-driven digital I/O differential pairs are wired to the rear PN4 connector. For each of the 32 channels, the bidirectionality is controlled by an output from the FPGA. This product is a conduction-cooled version of the P/N 4289 board. All features of the 4289 are retained, except the ICS1522 PLL has been eliminated in favor of Cyclone internal PLLs, and the differential I/O is available at PN4 only. For ease of migration, the Cyclone BGA pinout is the same as on the 4289 board.



FEATURES:

- 32 channels of general-purpose RS-485/422 digital I/O
- Conduction-cooled, industrial temperature
- 64-bit/66 MHz PCI
- Altera 12 K logic element FPGA
- Reprogrammable by host, onboard flash, or byte blaster cable
- Sample FPGA design and host C code

For more information, contact: info@technobox.com

RSC# 30696 @ www.mil-embedded.com/rsc

Technobox, Inc.
140 Mount Holly Bypass, Unit 1 • Lumberton, NJ 08096
609-267-8988
www.technobox.com

4821 x8 XMC-to-PCI Express Adapter

The Technobox 4821 is a passive x8 XMC-to-PCI Express Adapter, which permits the use of an XMC card in a PCIe slot. The 8 PCI Express lanes on the P15 XMC connector are routed to the male PCI Express edge finger connector.

The 4821 also provides user access to all the signals on the XMC P16 connectors via two 64 pin headers. All the lanes are fixed at 2.5 Gbps per lane in each direction. This adapter provides +12V on VPWR to the XMC card. Several activity LEDs located at the edge of the board give an indication of key XMC and PCIe signals and voltages. The JTAG and I2C signals from the XMC bus and the PCIe bus are brought out to headers to permit test access. An optional fan assembly (P/N 4936) is available to augment cooling.

FEATURES:

- Adapts an XMC card to PCIe slot
- Supports up to 8 PCI Express lanes
- 2.5 Gbps per lane in each direction
- XMC signals from P16 are accessible via two 64-pin headers
- Headers provide access to JTAG and I2C signals
- Status LEDs show XMC and PCIe status and activity
- RoHS compliant

For more information, contact: info@technobox.com **RSC# 32979 @ www.mil-embedded.com/rsc**

PMC MILITARY EMBEDDED SYSTEMS Resource Guide 2007

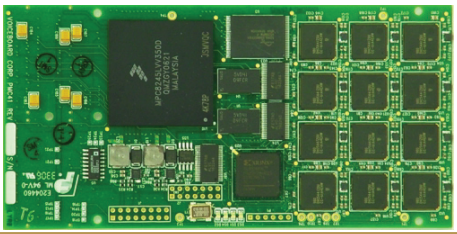
Voiceboard Corporation
473 Post Street • Camarillo, CA 93010
805-389-3100
www.Voiceboard.com

PTMC41

MediaPro PTMC41, a PICMG 2.15 PTMC standard DSP resource board, supports VoIP Media Gateway, wireless, and military communications applications. It is equipped with 2,048 channelized or unchannelized TDM inputs, local PCI bus, and embedded PowerPC controller.

Voiceboard offers carrier class implementations of VoIP, SIP, MEGACO, H.323, V.90 modem, FAX, conferencing, and a variety of VoIP, wireless, and military vocoders. An embedded TCP-UDP/IP stack supports dual GbE ports, IPv4/6, encryption options, RTP/RTCP, web server, and more.

Customer proprietary solutions may be developed for the PTMC41 via Voiceboard's Software Development Kit (SDK). SDK with telephony functions include echo canceller, tone generation/detection, AGC, VAD, vocoders and more.



FEATURES:

- Offers TEMs the benefit of reducing design risk, development cost, manpower resources, and time-to-market
- PowerPC Executive controller implements a full Media Gateway (SIP, H.323, MEGACO) in a single PTMC module
- PowerPC software controls DSP resources, flash files, TDM switching, IP stack, Web Server and more
- Software libraries available include VoIP, SIP, MEGACO, H.323, modems, G3 FAX, conferencing, vocoders, and more
- SDK customer software development kit includes board drivers and optional VoIP, telecom, and vocoder library
- Customized hardware and software configurations available under special arrangement

For more information, contact: Ltomon@voiceboard.com **RSC# 32204 @ www.mil-embedded.com/rsc**

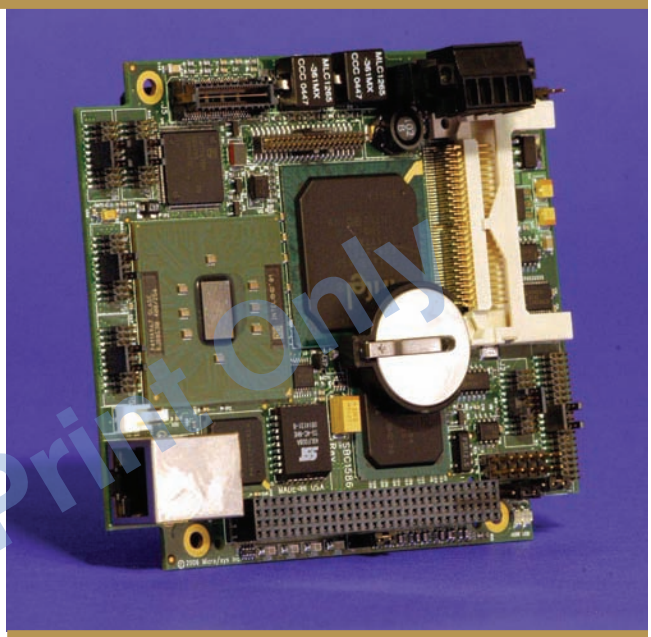
Micro/sys, Inc.
3730 Park Place • Montrose, CA 91020
818-244-4600
www.embeddedsys.com

SBC1686

Micro/sys has released the first StackableUSB™ CPU board on a Pentium® III processor, creating a powerful, high-speed, RoHS compliant single board computer that provides I/O expansion via StackableUSB™ peripherals. In addition to all standard PC features, the SBC1685 also includes a Gigabit Ethernet port, four USB 2.0 high-speed (480Mbits/s) ports, four USB 1.1 full speed ports, and a CompactFlash interface. With up to 256MB of socketed SDRAM, and full PC-compatibility, high performance embedded control systems can be implemented on this small industrial form factor (PC/104 size) SBC. The Intel 815E chipset enables the SBC1685 to operate systems and applications that require full disk-based GUI systems. The SBC1685 can boot Linux, Windows CE, Windows XP, VxWorks®, DOS, PharLap ETS, and other PC-compatible operating systems.

At the core of the SBC1685 is the Low Power Intel Pentium® III processor, which runs at 933MHz, or the Ultra-Low Voltage Celeron® processor, which runs fanless at 400 or 650MHz. This is the first time these powerful processors have been coupled with the new industrial quality StackableUSB™ interconnect architecture, which enables the control of up to eight StackableUSB™ peripheral devices in a rugged, bolt-together platform for embedded applications. The Intel CPU and chipset have been selected for long term availability, and include PC-compatible PCI, USB, EIDE, SDRAM, interrupt, timer, and DMA controllers, all popular embedded features. The SBC1685 also offers a printer port, keyboard, mouse, external IDE and floppy controllers, and a watchdog timer. The Gigabit Ethernet is capable of communicating with 10/100/1000BASE-T networks. The USB 2.0 stackable interfaces support high-speed (480Mbits/s), full-speed (12Mbits/s), and low-speed (1.5Mbits/s).

The CompactFlash socket allows for gigabytes of removable storage space, which can be used as solid-state storage for operating systems and large applications. Micro/sys installs a ready-to-run firmware system on the SBC1685 at no cost.



FEATURES:

- Industry's first StackableUSB™ host
- Celeron®/Pentium® III computer
- Gigabit Ethernet
- 4 USB 2.0 High speed ports, 4 USB 1.1 ports
- Two serial ports
- CompactFlash
- PCI-104 expansion
- Small 3.775" x 4.55" x 1.2" size board
- Up to 256MB of SDRAM
- DOS emulation, MSDOS 6.22, Linux, VxWorks, Windows CE, Windows XP, RTOS support

Great River Technology

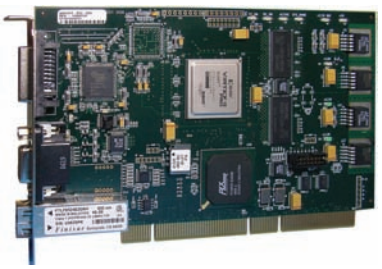
6121 Indian School Road, NE Suite 141 • Albuquerque, NM 87110
505-881-6262
www.greatrivertech.com

ARINC 818 DVI

ARINC 818 (Avionics Digital Video Bus) is the new standard developed for mission critical, uncompressed video. ARINC 818 is becoming the de facto standard for high performance military video applications.

Great River Technology offers a suite of ARINC 818 products and development tools, such as the GRAV64 DVI card. It is configurable as an ARINC 818 Graphics Generator, Frame Grabber, or DVI to 818 converter. The GRAV64 DVI card offers bandwidths up to 3.1 Gbps with the flexibility to meet a wide range of video formats.

The GRAV64 DVI can convert either DVI video from COTS graphic cards into ARINC 818 video, or convert ARINC 818 video into DVI. This card is used in ground based cockpit simulators, test equipment, flyable video recorders, and DVI converters.



FEATURES:

- Uncompressed video over fiber at 1, 2 or 3 Gbps
- Converts DVI video into ARINC 818 serial video protocol, or converts ARINC 818 into DVI to drive displays
- Low Cost Graphics Generator: Turns a regular PC into a full motion video generator for cockpit simulators
- Displays live ARINC 818 video on a standard PC monitor without loading the PC
- Frame Grabber for video recorders, or Graphics Generator for test patterns or live video
- PCI, PMC, PCIe and custom form factors available

For more information, contact: tkeller@greatrivertech.com

RSC# 33124 @ www.mil-embedded.com/rsc

BittWare, Inc.

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

T2-6U-VME

The T2-6U-VME is a 6U VME board, featuring eight ADSP-TS201 TigerSHARC DSPs from Analog Devices and the first-ever COTS VME/VXS board based on the ADSP-TS201. The board is designed for demanding multiprocessor-based operations and is targeted towards a broad range of applications including radar, sonar, communications, and imaging. To take full advantage of the high performance TigerSHARC, the T2-6U-VME implements BittWare's ATLANTiS architecture, which combines robust TigerSHARC processing with a versatile, high-density FPGA to offer ultra high performance and unprecedented I/O bandwidth. The board also provides two large on-board banks of SDRAM, flash memory for hostless boot, and a PMC site for adding additional processors or I/O capabilities.

FEATURES:

- Eight ADSP-TS201 DSPs at up to 600 MHz; 28.8 GFLOPS of floating-point power and 115 BOPS of 16-bit processing
- Two Xilinx Virtex-II Pro FPGAs (XC2VP20/30) for interfacing and coprocessing
- BittWare's ATLANTiS architecture featuring 8 GBytes/sec of external I/O throughput via FPGA routing
- One PrPMC site with PMC+ extension for BittWare's PMC+ I/O modules
- Tundra Tsi148™ PCI-X-VME bridge w/2eSST, 64-bit 66 MHz PCI interface via BittWare's SharcFIN PCI-DSP Bridge
- On-board memory: up to 512MBytes of on-board SDRAM; 16 MBytes of Flash memory for booting DSPs and FPGAs

For more information, contact: info@bittware.com

RSC# 33238 @ www.mil-embedded.com/rsc

Dynatem, Inc.

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

DPD

VMEbus Pentium Core-Duo Single Board Computer

The DPD is a VMEbus (and VME64) compatible platform based on the Intel® low-power Core-Duo (Yonah) processor. The DPD takes advantage of the Core-Duo's low 15 W power consumption as a rugged Single Board Computer (SBC). It is optionally available as an IEEE 1101.2-compliant, conduction-cooled VMEbus module with wedge locks and a full-board heat sink for high shock/vibration environments and temperature extremes.

The E7520 Memory Controller Hub (MCH) supports PCI-X and PCIe expansion, USB 2.0, ATA/100, and Serial ATA (SATA). Two Gb Ethernet ports and two USB 2.0 ports are accessible from the front panel in addition to two PMC bezels. On-board CompactFlash permits single-slot booting. Two VITA 31.1-compliant Gb Ethernet ports routed to P0.

FEATURES:

- Pentium Core-Duo Processor at 1.66 GHz
- E7520 Chipset for PCIe support, high memory bandwidth and ECC
- On-board SVGA Controller
- Two Gb LAN front panel ports plus two more routed to the backplane in compliance with VITA 31.1
- Supports two PMC sites, one of which optionally supports XMC modules
- Available in conduction-cooled versions for rugged applications

For more information, contact: sales@dynatem.com

RSC# 33222 @ www.mil-embedded.com/rsc

THEMIS

47200 Bayside Parkway • Fremont, CA 94538
510-252-0870
www.themis.com/prod/hardware/ta64.htm

Themis TA64

TA64 is the first in a new family of 6U VMEbus computer boards and is based on AMD's Turion 64 Mobile processor. It is compatible with Themis' USPIIe-USB™ Single Board Computer (SBC), at the application level, and features front panel and backplane compatibility, including all I/O, switches, and indicators. Its low power and single-slot configuration provide a performance boost with minimal or no system redesign.

TA64 is designed for a wide range of commercial/military applications. It includes the high-performance Universe II VME64x interface, dual Ultra320 interface, two 10/100/1000BASE-T Ethernet ports, two or more USB ports, AC97 audio, two serial ports, and one PS/2 port. They are available in one-, two-, and three-slot configurations offering a wide range of I/O and performance ops.

FEATURES:

- Themis' new family of 6U VMEbus AMD processor-based SBCs
- AMD Turion 64 Mobile processor running at 1.6 GHz
- Memory – Up to 4 GB ECC DDR333 SDRAM
- Low 38-watt power dissipation (without PMC)
- Supports Solaris 8, 9 10, Windows, and Linux OS
- For full information: Contact Themis at info@themis.com or call 510-252-0870

For more information, contact: info@themis.com

RSC# 33142 @ www.mil-embedded.com/rsc

THEMIS

47200 Bayside Parkway • Fremont, CA 94538
510-252-0870
www.themis.com/prod/hardware/ta64.htm

TPPC64

The TPPC64 is the industry's first commercially available 6U VMEbus computer family based on the IBM PowerPC 970FX processor. The PowerPC 970FX processor provides maximum performance for existing 32-bit applications and new 64-bit applications.

The TPPC64 is available in single-slot uniprocessor and two-slot, dual symmetric multiprocessing configurations. I/O extension and graphics boards added to either single or dual processor configurations occupy additional VMEbus slots. The TPPC64 includes two GbE ports and dual Ultra320 SCSI channels. I/O expansion is supported via a PCI riser. PMC I/O can be expanded to four slots with two different PMC carrier boards.

For more information: Contact Themis at info@themis.com or call 510-252-0870.

FEATURES:

- IBM PowerPC 970FX processor – 1.8 GHz clock rate in single and dual processor configurations
- Up to 4 GB of DDR400 SDRAM memory
- Two Gb Ethernet ports, two USB ports, two serial ports, and one SCSI port on front panel
- Carrier board PCI expansion supports up to three additional PMC slots
- Support for Linux OS
- Rugged design for reliability in harsh operating environments – up to 30 G shock

For more information, contact: info@themis.com **RSC# 33141 @ www.mil-embedded.com/rsc**

VMEbus MILITARY EMBEDDED SYSTEMS Resource Guide 2007

VMETRO

1880 South Dairy Ashford, Suite 400 • Houston, TX 77077
281-584-0728
www.vmetro.com/phoenix/vpf1

Phoenix VPF1

The Phoenix VPF1 is a 6U VME64x digital signal processor supporting VITA 41 backplane switch fabric communications via VXS over P0. The VPF1 is based on two PowerPC 7447 CPUs and two Xilinx Virtex-II Pro FPGAs. Each processor has fully distributed memory and each FPGA supports multiple inter-node communication channels via RocketIO. These channels bind together local processors and those on separate boards for seamless and scalable processing.

A PMC site, GbE, and P2 resources enable I/O. A comprehensive suite of PowerPC and FPGA tools facilitate rapid development and deployment. Phoenix VPF1s are available in air or conduction-cool builds, enabling easy migration from development to production.

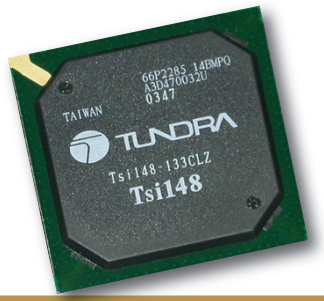
FEATURES:

- 6U VME/VXS (VITA 41) Signal Processor with 2x PowerPC 7447A CPU and 2x Xilinx Virtex-II Pro FPGA nodes
- 8x 2.0-3.125Gbit/sec off-board serial communications channels
- Ethernet, RS-232, RS-422 and 64-bit 66MHz PMC site
- Multiple banks of high-speed DDR SDRAM and QDR SRAM for processing and data buffering
- VxWorks and Linux support with support for optimized VSIPL DSP libraries
- Air-cooled and rugged conduction-cooled build variants

For more information, contact: info@vmetro.com **RSC# 33217 @ www.mil-embedded.com/rsc**

Tundra Semiconductor
603 March Road • Ottawa, ON K2K 2M5 Canada
613-592-0714
www.tundra.com

Tundra Tsi148 VME-to-PCI/X Bridge



The Tsi148 is the industry's leading PCI-X to VMEbus bridge and the successful next generation offering to the Universe™ II, the leading VMEbus bridge for embedded systems customers. Fully compliant with VMEbus standards, the Tsi148 implements the 2eSST protocol that allows the VMEbus to run at a bandwidth up to 320 MBps. The Tsi148 is a full featured master, slave, and system controller that can be used in any VME application and provides an increase in overall processing capability on legacy backplanes, while transparently enabling the high performance distributed processing that new applications demand.

FEATURES:

- ➔Industry's best sustained transfer rate of 305 MC/x in 2eSST – higher system bandwidth
- ➔Multithreading – capable of a number of simultaneous transactions while optimizing bus utilization
- ➔Full-featured master, slave, and system controller – can be used in any VME application
- ➔PCI-X local bus supports two loads at 133 MHz – reducing component count
- ➔Small device footprint – saves board space
- ➔Proven VME backwards compatibility – preserves legacy investment

For more information, contact: sales@tundra.com. RSC# 31131 @ www.mil-embedded.com/rsc

Nothing empowers performance like PowerMP!

The PowerMP is designed to provide off-the-shelf, off-the-chart performance for your critical computing needs in all kinds of demanding environments. Each PowerMP system is a high-performance, low-cost COTS-based multiprocessor computing solution leveraging industry standards with Intel and/or PowerPC architecture. It includes tools geared for such tasks as real-time performance analysis, remote control operations and monitoring system management.

The PowerMP6 - an Intel "plenty-core", ready-to-use solution
When you place a premium on software productivity and performance turn to the turnkey computer system with dazzling performance—PowerMP6. The PowerMP6 is made of multiple Dual-Core Intel Xeon Processor-based boards in a 19-inch rack. Powered by Red Hat Enterprise Linux, it supports software productivity and portability through an extensive set of open source and commercial tools and libraries. PowerMP6 is available in various customized configurations of up to eleven processor boards in a single chassis…

The PowerMP4 - RapidIO™ entry range system
The PowerMP4 fills the embedded industry's need for reliability, increased bandwidth and faster bus speeds. It combines PowerPC (for legacy Altivec based signal processing) and Intel Architecture processors (for software productivity and connectivity). PowerMP4's RapidIO™ high-performance and packet-switched interconnect technology will meet your demanding embedded system needs.

The PowerMP9 - RapidIO™ PowerPC 64-bit system
This member of the PowerMP family is geared towards high performance PowerPC computing with demanding memory bandwidth requirements. Featuring computing boards with a dual PowerPC 970 processor architecture, PowerMP9 flies high above competitor's solutions, thanks to the highest PowerPC memory bandwidth offered by this processor. This solution in its rugged conduction cooled version makes it the ideal embedded computers for airborne signal processing applications. It features Linux on PPC64 and can also host Gedae, a framework for data flow processing mapping on parallel computer hardware.

The specialists in embedded performance
Thales Computers is unequalled in the development of commercial and ruggedized VMEbus and CompactPCI systems solutions based on PowerPC and Intel microprocessors. Thales' products are optimized for a wide variety of applications in the military, aerospace, transportation, communications, and industrial markets and are used by blue chip customers worldwide, especially those who put a premium on long term support for computers.

For more information please contact:
Vincent Chuffart
Tel: 33 (0)4 98 16 34 31
e-mail:
vincent.chuffart@thalescomputers.fr

www.thalescomputers.com

THALES

RSC# 91 @ www.mil-embedded.com/rsc

Intel Corporation
2200 Mission College Blvd. • Santa Clara, CA 95052
800-628-8686 or 916-356-3104
intel.com/design/intarch

Intel® Core™2 Duo Processor

Intel® Core™2 Duo processors – based on Intel® Core™ microarchitecture – deliver breakthrough energy-efficient performance for embedded platforms. 65nm process technology makes it possible to integrate two complete execution cores in one physical package, providing advancements in simultaneous computing for multi-threaded applications and multi-tasking environments.

To achieve network-centric focus, developers for military, aerospace, and government applications must cost-effectively deploy solutions that can integrate with a vast array of existing systems and adapt as new technologies become available. These dual-core processors meet the needs of a wide range of performance-intensive, low-power embedded applications in smaller form factors, providing ruggedized, interoperable standards-based building block solutions at multiple levels of integration, with a clear upgrade path and long-term road map.

With a core speed of up to 2.16 GHz, Intel Core 2 Duo processor-based platforms offer excellent storage speed, reliability, remote asset management capabilities, and an integrated 32-bit 3D graphics engine. To meet the requirements of network-centric environments, Intel® processors and chipsets provide high-bandwidth I/O interfaces including PCI Express® graphics, Serial ATA and Gigabit Ethernet while maintaining support for legacy I/O technologies.

Intel Core 2 Duo Processors T7400 and L7400 are validated with Mobile Intel® 945GM and 945GME Express chipsets, providing superb graphics, I/O bandwidth, and up to 4 GB of 400/533/667 MHz DDR2 SODIMM system memory. These processors are also validated with the Intel® E7520 chipset for high-performance, low-power platforms within small form factor designs. The L7400 version, with a core speed of 1.5 GHz and TDP of 17W, offers a low-power, value-sensitive solution for thermally sensitive applications.

FEATURES:

- Intel® Wide Dynamic Execution performs four instructions per clock cycle to improve execution speed and efficiency
- Intel® Advanced Smart Cache improves system performance by significantly reducing memory latency to frequently used data
- Intel® Smart Memory Access optimizes use of available data bandwidth from the memory subsystem to accelerate out-of-order execution
- Intel® Advanced Digital Media Boost accelerates execution of SSE/2/3 instructions to significantly improve multimedia performance
- Intel® Intelligent Power Capability turns on computing functions only when needed to manage runtime power consumption of execution cores
- Intel® Virtualization Technology lets one hardware platform function as multiple "virtual" platforms to improve manageability
- Intel® 64 Architecture supports 64-bit instructions, providing flexibility for 64-bit and 32-bit applications and operating systems
- Execute Disable Bit allows memory to be marked as executable or non-executable when combined with a supporting operating system
- Digital Thermal Sensor (DTS) measures maximum temperature on the die at any given time
- Embedded lifecycle support protects system investment by enabling extended product availability for embedded customers
- Intel® Communications Alliance (intel.com/go/ica) provides a strong ecosystem of hardware and software vendors

MODULAR SOLUTIONS FOR MIL-STD-1553

MAXIMIZE YOUR SPACE CUSTOMIZE YOUR 1553

PMC-1553 Dual SUMMIT
Dual UTMC 1553 SUMMIT Controller
Bus Controller, Remote Terminal,
Bus Monitor modes
- 1 or 2 UTMC SUMMIT
- UT69151DX-GPC
- BC / RT / BM
- On-chip Transceivers

CPCI-1553 SUMMIT
Single or Dual UTMC 1553
SUMMIT Controller
Bus Controller, Remote Terminal,
Bus Monitor modes
- UTMC SUMMIT
- UT69151DX-GPC
- 128Kbytes SRAM
- On-chip Transceivers

PMC-1553 DDC
Single or Dual DDC ACE 1553 Controller
Bus Controller, Remote Terminal, Bus
Monitor modes
- DDC ACE BU61580S3
- 128Kbytes SRAM
- On-chip Transceivers

Whether for PCI, CPCI, IP or PMC, **ALPHI** provides the MIL-STD-1553 solution that you need for your Mission Critical Systems.

From 1 to 4 channels, Aeroflex SUMMIT, or DDC ACE, MiniACE and Micro ACE.

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RSC# 93 @ www.mil-embedded.com/rsc

Targa Systems
2081 Merivale Road, Suite 200 • Ottawa, ON K2G 1G9 Canada
613-727-9876
www.targasystems.com

L3 communications
Advanced Products & Design

Ethernet NAS DTU

Network Attached Storage (NAS) Data Transfer Systems

Two versions of the NAS DTU's are offered by Targa:

Series 3 PC Card NAS DTU's
The Targa Series 3 PC Card Data Transfer System is the perfect Network Attached Storage (NAS) device for your military and aerospace systems, replacing Server Attached Storage in most airborne platform application systems. These systems include flight management, cockpit instrument display, terrain awareness and warning, map systems, radar systems, cockpit/ground communications, navigation positioning, and satellite communications.

Targa's PC Card Data Transfer Units (DTUs) provide a compact, self-contained system to store and retrieve data from industry standard PCMCIA/ATA cards and have been qualified to meet the most demanding MIL-STD-810 and RTCA DO-160 environments. With PC Card capacities now at 16 GB, the removable PC Card feature of the Series 3 product line allows for easy updating of files.

Series 4 Removable Disk NAS DTU's
In those applications requiring higher storage capacity and/or greater read/write speeds than PC Cards can offer, Targa offers its Series 4 Removable Disk NAS DTU's. The Series 4 offers capacities up to 64 GB in a compact, rugged and removable 2.5" flash disk. The removable disk feature of the Series 4 product line allows for easy updating of files. Data Transfer rates over 20 GB/sec. Targa's Series 4 Gigabit (Gb) Ethernet, Network Attached Storage, Data Transfer System (DTS) provides a compact self-contained system to store and retrieve data from a removable Serial ATA (SATA) flash disk in the most demanding environments.

FEATURES:

- Storage Media: PC Cards (ATA) all capacities (current max 16 GB) and ATA Flash Disks (96 GB)
- Interfaces: Dual port 10/100/1000 Ethernet IEEE 802.3ab
- Power fail detect with DOS FAT & Directory auto-save to prevent file corruption
- Input Power +28 Vdc, with 50 msec holdup
- Mounting: Hard mount and Panel mount (Dzus rail)
- Power fail detect with DOS FAT & Directory auto-save to prevent file corruption
- Locking access door with door open detect and PC Card/ Disk shutdown
- Small, lightweight, rugged construction providing reliable data storage
- Data Transfer Rates: > 20 MBytes/sec over FTP (Gb Ethernet)
- Targa's Network Attached Storage (NAS) device functions as a "server" dedicated to file sharing
- Targa's NAS provides removable SATA Flash disk data storage for single or multi-client users over a dual IEEE 802.3ab Ethernet link
- MIL-STD and RTCA

Phoenix International

812 W. Southern Avenue • Orange, CA 92865
714-283-4800
www.phenxint.com

eStor-NAS

The Phoenix-eStor NAS/iSCSI Combo combines the power of Network Attached Storage and iSCSI on a single system. This functionality increases iSCSI target efficiency by supporting multiple iSCSI initiators on different volumes without sacrificing NAS performance (CIFS, NFS). It is ideal for applications with extensive mass storage requirements, file sharing, allocation of storage pools among users, and cost-efficient scalable storage.

It supports the highest storage capacity available with front-loaded hard disk access. Phoenix-eStor is shipped with network, storage, and user management software. It is designed for ease of use and can be flexibly adapted to different environments.

Storage management is flexible, easy, and secure with Phoenix-eStor.

FEATURES:

- ➜High performance 64-bit NAS/iSCSI Combo
- ➜1U form factor with hot-swap disk drives and dual redundant power supplies
- ➜Supports RAID levels 0, 1, 5, and 6 and remote replication
- ➜Management features include LDAP client support and Access Control List (ACL) security
- ➜Multiple Snapshot capability
- ➜Interoperable with all popular operating systems

For more information, contact: info@phenxint.com **RSC# 33139 @ www.mil-embedded.com/rsc**

MILITARY EMBEDDED SYSTEMS Resource Guide 2007 Complete packaged system

VMETRO

1880 South Dairy Ashford, Suite 400 • Houston, TX 77077
281-584-0728
www.vmetro.com/vmdrive

VMDRIVE 6U Storage

The VMDRIVE deploys 40 or 80 GB solid state storage in rugged conduction-cooled or commercial air-cooled environments. The single slot 6U VME or CompactPCI VMDRIVE incorporates dual channel 2 Gbps Fibre Channel interfaces to store data up to 70 MBytes/s. The dual Fibre Channel ports allow the VMDRIVE to connect to Fibre Channel Storage Area Networks (FC SAN) for use in data recording applications.

FEATURES:

- ➜40 or 80 GB Storage for 6U VME or CompactPCI form factors
- ➜Dual 2 Gbps Fibre Channel interfaces
- ➜70 MBytes/s bandwidth
- ➜Commercial air-cooled or rugged conduction-cooled build options

For more information, contact: info@vmetro.com **RSC# 33216 @ www.mil-embedded.com/rsc**

ACT/Technico

760 Veterans Circle • Warminster, PA 18974
215-956-1200
www.acttechnico.com

Rugged Storage

ACT/Technico's family of rugged, solid state, flash storage solutions are suitable for airborne, shipboard, underwater, and ground applications. The PMCStor, RAIDStor, and ShuttleStor family use solid state flash technology to provide solutions for the harshest environments.

ACT/Technico offers rugged storage solutions on PMC, VME, CompactPCI, and emerging standard platforms; ask about stand-alone drive availability. Capacities run up to 64 GB in low profile capacities and are compatible with ATA/IDE, as well as SATA interfaces.

Board level data security solutions are possible with removable media and data write protect/secure erase functions – visit our website for details. Support available for Linux, Windows and VxWorks; ask about individual boards.

FEATURES:

- Solid state flash media in CompactFlash, 1.8", 2.5" form factors
- Currently up to 64 GB available in low profile drive formats
- Extended Operating Temperatures from -40 to +85 °F
- Conduction cooled solutions and conformal coating available
- ShuttleStor has removable media for field replacement; Secure PMCStor provides data erasure or protection
- RAIDStor: Network Attached (NAS) and RAID solutions for VME (VITA) and CompactPCI (2.16) based systems

For more information, contact: sales@acttechnico.com **RSC# 33106 @ www.mil-embedded.com/rsc**

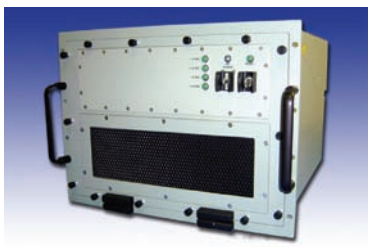
AP Labs

10864 Thornmint Road • San Diego, CA 92127
858-674-2850
www.aplabs.com

FS-1270

The AP Labs FS-1270 is an 8U-tall, ruggedized VME enclosure designed for 6U VME boards with an optional peripheral carrier available in 10- and 12-slot versions. The enclosure is provided with easy front loading access. The peripheral carrier is removable and mounts in the VME card cage. It can accommodate up to four 5.75" removable drive carriers. An 800 W power supply LRU is included with the chassis.

AP Labs designed the FS-1270 to meet MIL-S-901D in an isolated rack, MIL-STD-810E, and MIL-STD-167-1 shock and vibration specifications for severe environments. The FS-1270 meets typical MIL-STD-461 EMI requirements. Optionally, the FS-1270 can be upgraded to meet MIL-STD-108E for drip-proof requirements.



FEATURES:

- Front-load, rugged, hard-mount chassis (10, 12, or 18 slots) – 19" (W) x 14" (H) x 22.1" (with fan = 24.1") (D); weight 85 lbs
- Available with VME64X, VME64X with J0, VME64 backplanes
- Shock: MIL-STD-810, MIL-S-901D, Vibration: MIL-STD-167, EMI/RFI: MIL-STD-461
- Hinged front door for easy card access; removable peripheral carrier in 10- and 12-slot versions
- Power supply LRU(s) with blind mating connector; dual redundant power supplies available
- Front-to-rear airflow; side-to-rear cooling is an available option

For more information, contact: sales@aplabs.com **RSC# 33107 @ www.mil-embedded.com/rsc**

DataMetrics Corporation

1717 Diplomacy Row • Orlando, FL 32809
407-251-4577
www.datametrics.com

Model 7008

This 8U 21 Slot COTS chassis is rack mount or tabletop configurable and has a unique front air inlet feature that allows access to the field replaceable fan tray for sub-2 minute replacement or maintenance. The 7008 also provides front access to all 21ea 6U backplane slots and up to 15ea 6U rear transition modules. The chassis accommodates 3U and 6U x 160 mm or 220 mm plug-in boards and 6U x 80 mm rear transition modules (100 mm or 120 mm support). Backplane architectures such as VME, VME 64x, VITA 31/41/46, and CompactPCI 2.1/2.16 are available; DataMetrics™ will also design customer-specific architectures. The power supply is fully configurable to meet all output voltages and current requirements and provides optional voltage margining for circuit development.

FEATURES:

- Up to 21 Slot VME64x Backplane Standard
- Unique Front Air Inlet for Optimal Cooling and Field Replaceable Fan Assembly with 3 High-Flow DC Fans
- Full Access to All Slots for 6U x 160 Front Cards and 6U x 80 Rear Transition Modules
- Up to 1500 W Power Supply - Optional voltage margining for circuit development and system characterization
- Backplanes available include: VME, VME 64x, VITA 31/41/46, CompactPCI 2.1/2.16, or custom designs
- Optional Programmable Chassis Environmental Monitor/Controller

For more information, contact: info@datametrics.com **RSC# 33113 @ www.mil-embedded.com/rsc**

MILITARY EMBEDDED SYSTEMS Resource Guide 2007 19" rack

Optima EPS

2166 Mountain Industrial Blvd. • Tucker, GA 30084
770-496-4000
www.optimaeps.com

Cabinet Enclosures

Optima EPS, an Elma Company, is a leading designer and manufacturer of cabinet enclosures. Optima has a wide selection of cabinet enclosures and racks for Mil/Aero including Mil-Rugged, Harsh Environment, Seismic, and more. Our COTS cabinets meet or exceed MIL-STD: 810F, 167, 901D, 461D, and Tempest.

Using a unique modular construction, Optima cabinets can accommodate customer specific requirements for EMC shielding, shock and vibration, mobility, thermal management, power distribution/conditioning, and I/O cabling per the application MIL-STDs. Because custom designs are based on proven design concepts, the cost, schedule, and performance risks are substantially reduced. Heights in 12U-44U. Widths in 19", 23", and 24". Depths in 24", 30", 36", and 42". Customization available.

FEATURES:

- COTS cabinets to MIL-STD: 810F, 167, 901D, 461D, and Tempest
- Modular design platform allows cost-effective customization on a proven design concept
- Flexible design for EMC, shock and vibration, mobility, thermal management, power distribution, and more
- Options for crane lifting eyes, fork lift provisions, castors, fixed floor or shock isolation mounts, etc.
- 12 ga. all welded frame construction, 3-dimensional support braces, corner keys, removable panels available
- Integrated cable management, power conditioning, and cooling options

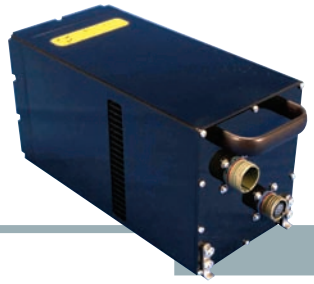
For more information, contact: sales@optimaeps.com **RSC# 33138 @ www.mil-embedded.com/rsc**

AP Labs

10864 Thornmint Road • San Diego, CA 92127
858-674-2850
www.aplabs.com

FS-5973 3U cPCI

The FS-5973 is a forced-air, conduction-cooled chassis designed for use in avionics and other environments. Specifically, the FS-5973 chassis meets the environmental requirements of MIL-E-5400 for Class 1 equipment and will withstand extremes of temperature, vibration, shock, salt spray, sand, and chemical exposure while maintaining a sealed environment. The FS-5973 chassis is designed to adapt to existing ARINC style equipment mounting trays or it can be configured with a number of application driven mounting options, including hard and shock mounted.



FEATURES:

- ARINC 404A, 1/2 ATR CompactPCI rugged chassis 4.88" (W) x 5.59" (H) x 11.46" (D); weight 9 lbs (4.09 kg)
- Five conduction-cooled 3U slots to IEEE 1101.2, .8" pitch: System slot, four spare slots for I/O and peripherals
- Meets MIL-STD-5400 Class 1, Watertight MIL-STD-108E, Storage temp: –62 °C to –95 °C, Operating temp: –55 °C to +55 °C at SL
- Vibration: MIL-STD-810E, 0.1 *g* 2/Hz, 15-2 kHz, Shock: MIL-STD-810E 20 *g*, 6-9 ms, half sine wave
- EMC: Per MIL-STD-461C; CE01, CE03, CS02, CS06, RE02, RS01, RS02, RS03
- Input: 18 to 48 Vdc, Output: +5 V 9 A, 3.3 V 5 A, +12 V 0.5 A, –12 V 0.5 A, input protection to MIL-STD-704A, MIL-STD1275A

For more information, contact: sales@aplabs.com **RSC# 33108 @ www.mil-embedded.com/rsc**

ATR MILITARY EMBEDDED SYSTEMS Resource Guide 2007

DataMetrics Corporation

1717 Diplomacy Row • Orlando, FL 32809
407-251-4577
www.datametrics.com

Model 8211 ATR

The Model 8211 is a Full-Long ATR with a 9-slot VME 64x or 8-slot CompactPCI backplane standard. The hybrid (convection and conduction) cooling system provides superior performance and a wide operational temperature range of -32 °C to +65 °C.

Like all DataMetrics™ rugged chassis, the Model 8211 is designed to meet and exceed multiple military specifications, and is custom configurable with many backplane, power supply, and other options available. An embedded shock-isolated HDD or Ethernet based system monitor/control are available as options.

In additional to the Model 8211, fully sealed, conduction cooled ATR's are also available in all 13 standard sizes. Please contact DataMetrics™ to determine your exact configuration.

FEATURES:

- Designed to Meet MIL-STD-810E for Shock, Vibration, and Explosive Atmospheres
- Designed to Meet MIL-STD-461D for EMI/EMC
- 9 Slot VME Backplane and Card Cage or 8 Slot CompactPCI Backplane Standard - Others Available
- Hybrid Conduction/Convection Cooled Design
- Optional Internal Environmental Monitor/Control and Embedded Shock-Isolated HDD Mounting
- Many Customizable Front Panel I/O Connections

For more information, contact: info@datametrics.com **RSC# 33114 @ www.mil-embedded.com/rsc**

Carlo Gavazzi Computing Solutions
10 Mupac Drive • Brockton, MA 02301
508-588-6110
www.gavazzi-computing.com

714 ATR

Carlo Gavazzi Computing Solutions 714 Series Convection Cooled ATR Enclosures offer a wide range of COTS solutions from an innovative, high strength modular frame. Designed for maximum strength and lightweight deployment, the frame and construction of the 714 Series models the fabrication techniques used in manufacturing today's commercial and military aircraft. Utilizing an aluminum frame that provides flexibility in size, the frame is assembled with solid rivet technology and reinforced with aluminum outer panels to form a rugged ATR that can withstand the most severe shock and vibration environments.

The 714 Series is available in standard ARINC sizes that include 1⁄4 ATR Short to 11/2 ATR Long and any custom form factor desired due to the flexibility of the modular frame. The 714 Series will accept a variety of bus structures and platforms including VME, VME64x, VXS, VXI, and CompactPCI technologies, providing an expansive product offering of bus standards as well as application specific custom designs.

The 714 Series is the Convection Cooled line of ATRs. Designed to direct air over conventional air cooled cards, the cooling can be configured to best meet the application requirements, whether by pressurized, evacuation, or a combination push-pull method. When challenged with non-pressurized environments, the 714 Series is configured with a high altitude cooling scheme to permit ultimate performance at altitudes up to 50,000 feet. When used in conjunction with Carlo Gavazzi's "System Performance Monitoring" technology, the 714 Series ATR can be configured to activate internal heaters in cold start-ups or performance control the outputs of the cooling fans to maintain optimal thermal environments for the circuit card assemblies.

The 714 Series utilizes an exclusive adjustable card cage to strategically position the cards for either front panel card or backplane I/O. This feature, combined with the modular rugged frame, provides flexibility that to date has not been available in the ATR format.

Innovation through design. Consult a Carlo Gavazzi representative for more information about the 714 Series.

FEATURES:

- Aircraft Frame Construction
- Lightweight Deployment
- Expansive range of ARINC sizes
- Easily configurable for custom sizes
- Modular power supply
- AC or DC filtered inputs
- High Altitude Fan offering
- System Performance Monitoring
- Multiple Bus Architectures
- Cold Start Heaters
- Avionics Isolation Tray
- Configurable I/O

For more information, contact: pr@cg-cs.com

RSC# 33218 @ www.mil-embedded.com/rsc

Elma Bustronic
44350 Grimmer Blvd. • Fremont, CA 94538
510-490-7388
www.bustronic.com

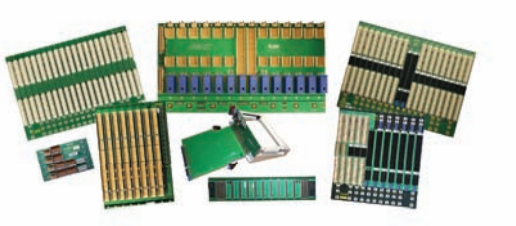
ELMA
Your Solution Partner

Backplanes

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

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

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



FEATURES:

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

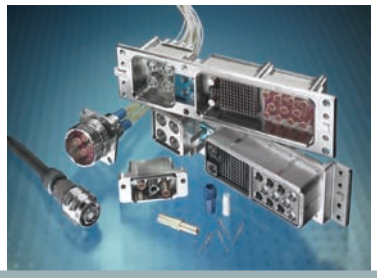
For more information, contact: sales@bustronic.com **RSC# 33118 @ www.mil-embedded.com/rsc**

Tyco Electronics
2900 Fulling Mill Road • Middletown, PA 17057
717-592-6390
www.tycoelectronics.com and www.multigigrt.com

High Speed Quadrax

A multi-signal contact system consisting of two differential pairs (matched impedance) used with quadaxial Ethernet and Fiber Channel cables. Available in contact size 8 (keyed); 24 AWG pin and socket contacts, Hex Crimp version as well as Pin PCB tail solderable versions. This is adaptable to a variety of connectors; (ARINC 600, 404, D-sub, 38999 and rectangular shell styles).

Designed for high speed applications such as Gigabit Ethernet and Fiber Channel. For use on Commercial Avionics, Aircraft Data Networks, Military Communications and In-Flight Entertainment Systems.



FEATURES:

- Fits into keyed connector inserts
- Designed per ARINC 600, Supplement 14 on 2 mm centerlines
- Rear Release/Rear Remove cable versions and Front Release/Front Remove PCB versions
- Size 8 contacts are keyed for proper orientation inside connector insert blocks
- Single piece dielectric design simplifies termination and improves reliability
- Available with silicone seal boots rated for 50,000 foot altitude immersion, or with EN4530 style seal boots

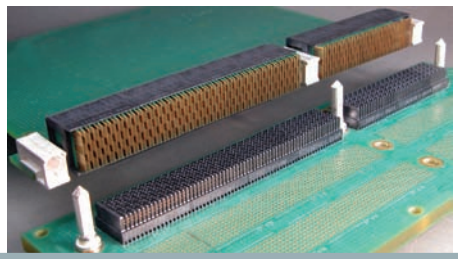
For more information, contact: eoolson@tycoelectronics.com **RSC# 33143 @ www.mil-embedded.com/rsc**

MILITARY EMBEDDED SYSTEMS Resource Guide 2007 Connectors

Tyco Electronics
2900 Fulling Mill Road • Middletown, PA 17057
717-592-6390
www.tycoelectronics.com and www.multigigrt.com

VITA 46/VPX

MultiGig RT is a new backplane interconnect family that offers levels of flexibility and customization never before seen in the industry. This printed circuit based, pinless interconnect family is comprised of modular components which can be used in a variety of combinations. VITA 46 (VPX) Compliant.



FEATURES:

- Provides density, data throughput and signal integrity
- Use of printed circuit wafers in this connector system allows for cost effective sequencing
- Wafers can be manufactured specifically for differential or single ended performance
- MultiGig RT connector family is designed specifically for 20.3 mm or 25.4 mm card pitch systems
- Superior crosstalk performance and optimized footprints for signal integrity and ease of board design
- Telcordia/Bellcore Compliant; three levels of signal contact sequencing; VITA 46 (VPX) compliant

For more information, contact: eoolson@tycoelectronics.com **RSC# 33144 @ www.mil-embedded.com/rsc**

Degree Controls, Inc.
18 Meadowbrook Drive • Milford, NH 03055
603-672-8900
www.degreec.com

Military Services

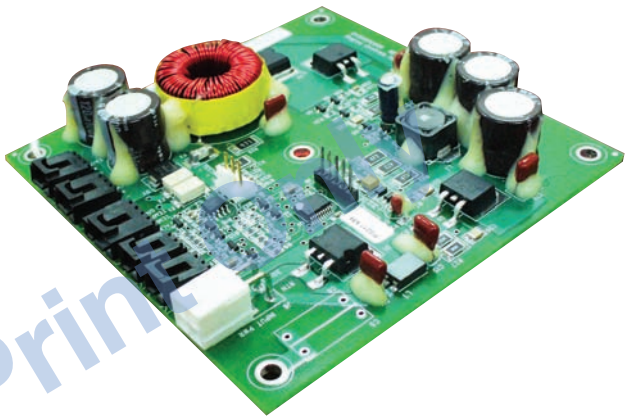
DegreeC offers Military approved cooling solutions, airflow sensors, and testing services backed by an 11 year track record of exceptional client service. As a privately held, minority owned company we are excited to offer our products and services to the DOD and the US Government. Our CAGE Code is 45R61 and we are in the process of our ITARs registration. We have a long history of developing robust and application specific solutions for our clients leveraging our diverse expertise. This expertise includes:

Custom Cooling Solutions for the Military
DegreeC has a proven design and development process for the most challenging thermal problems for products entering the most extreme environments. The design of a dependable product starts with precise thermal and airflow engineering. Our experts have extensive experience in design of airflow for thermal environments and thermal management solutions for Military applications. This includes component, board, and final chassis level investigation and testing.

We specialize in controlling fans, heaters, and other voltage-controlled devices in order to manage environmental requirements. We have developed, tested, and manufactured custom heat sinks, controllers, and fans/cooling solutions per Military Specifications. We also have a standard product line of intelligent thermal management controllers and fan trays that are fully configurable and able to meet your needs rapidly.

Airflow Sensors, Switches, and Multipoint Testing Instrumentation
DegreeC offers airflow sensors and switches for installed applications and has provided product to the marketplace under our Cambridge Accusense product line for almost 15 years. Our temperature-compensated airflow sensors with small sensor heads for remote and compact locations are well suited for military applications.

Product Reliability and Predictability Analysis
Designing a reliable product encompasses multiple facets of analysis, simulation and testing. Our product reliability service enables an organization to develop robust products for their intended operating environment.



FEATURES:

- Custom Cooling Solutions thermal design and airflow testing, mil spec approved controllers and fans, and unique heat sink designs for airflow sensors and switches
- Airflow sensors and switches for installed applications, multipoint air velocity, and temperature testing in product reliability and predictability analysis ESS, MTBF analysis, MIL-STD-1629, MIL-HBK-217F

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

µTCA Chassis

Our Rugged µTCA Chassis is a Full ATR Tall Long chassis 10.5" (W) x 10.6255" (H) x 19.65" (D) with front to rear airflow. It has a Shock Mounted MicroTCA Card Cage for rugged environments with MIL-STD-461 EMI Containment, fully EMI gasketed. The Top load MicroTCA/ AdvancedMC Cards MicroTCA Card Cage supports a front 150 mm section and rear 75 mm section, with air flowing through the two series front to back.

FEATURES:

- AC/DC front end power supply supporting 110/220 Vac operation with 48 Vdc output to DC MicroTCA Power Module
- 150 mm Front Row 3 Full Size Double Width slots for150 mm AdvancedMC Modules, 2 Full Size Double Width slots
- 75 mm Rear row 2 Full Size Single Width (75 mm) Slots for 1 DC or AC MicroTCA Power Module (1) Compact Single
- 1 Full Size Single Width (75 mm) slot for MicroTCA Carrier Hub (MCH) 4 Compact Single Width (75 mm) AdvancedMC Slots
- Designed to cool 80 W per double width full height slot and 40 W per single width full height slot at 10,000 feet
- 900 W Embedded AC/DC Power Supply

For more information, contact: cburden@hybricon.com

RSC# 33126 @ www.mil-embedded.com/rsc

Kontron
14118 Stowe Drive • Poway, CA 92064-7147
888-294-4558
info@us.kontron.com
www.kontron.com

Kontron MicroTCA Systems

MicroTCA is a new PICMG standard for open modular systems designed to address cost sensitive and physically small applications. In addition to the wide variety of form-factors offered by Kontron, MicroTCA offers extremely high communication bandwidth, high processing capacity, and high availability.

Deployed into a wide range of application spaces, including: defense, government, aerospace, industrial automation, and medical, Kontron's MicroTCA proves itself as a versatile and affordable form-factor. Applications in these spaces present similar requirements, including very high communication bandwidth and/or very high availability in a small form factor. All of these factors combine to help make Kontron's MicroTCA Systems a leading choice for demanding applications.

FEATURES:

- Wide range of form-factors from 2 slot 1U systems through 12-slot 8U systems
- Use of AdvancedMCs provides for a vast amount of computing resources
- No single point of failure and hot-swappable components
- Offers designers compute power, communication bandwidth, high availability
- Modular and serviceable

MEMBER OF THE YEAR 2006

For more information, contact: info@us.kontron.com

RSC# 33134 @ www.mil-embedded.com/rsc

Simon Industries, Inc.
1003 Morrisville Parkway, Suite 100 • Morrisville, NC 27560
919-469-2004
www.simonindustries.com

Ceres 1000

MicroTCA (Telecommunications Computing Architecture) is a PICMG standard, open architecture specification using field-replaceable, hot-swap capable Advanced Mezzanine Cards.

MicroTCA™ Table Top Development Platform

Simon Industries' MicroTCA table-top development chassis is well-suited for developing and debugging MicroTCA systems using full-height and half-height AdvancedMC modules. Utilizing the Molex Dual-Star backplane, the Simon Chassis can facilitate hardware and software development, accelerate time to market, and allow developers to evaluate various AdvancedMC cards, power supplies, and MCH products.

The Simon chassis features blind mating connectors to enable live replacement of the fan tray without powering down the chassis. The backplane features the Molex press-fit edge card connectors that are combined with precise launch geometry, minimizing reflections and enabling 10 Gbps over each differential pair. This allows the backplane to handle up to 4 times the bandwidth of other backplanes.

To minimize crosstalk, the design of the MicroTCA backplane employs spacing between pairs of at least 0.25 mm (0.010"). A Field Replaceable Unit Read Only Memory (FRU ROM) facilitates communication of all important backplane characteristics to the MCH.

Backplane Configuration

Four compact slots to allow either 10 full-height AdvancedMC cards, or 4 compact and 8 full-height payload slots for a total of 12 AdvancedMC slots. Fabric B on ports 2 and 3 is configured to support SAS or SATA drives in any of the slots, allowing customers to connect processor cards directly to storage drives. Slots for 2 MCH modules and 2 power supplies make it easy to test hand-off features to the alternate MCH or power supply.

Cooling

The removable fan-tray is equipped with 10 high-performance 12 Vdc fans mounted beneath the card cage. The arrangement of these 80 mm fans provides optimized uniformly turbulent airflow to all slots of the card cage. When installed, the rear-mounted 1000 Watt power supply has its own independent cooling fans and air circulation path.

FEATURES:

- Cabinet construction: Painted steel cabinet with stamped steel card guides
- Height: 6.98" (177 mm) Standard 4U; Width: 17.25" (438 mm); Depth: 8.50" (208 mm) without rear p/s; Depth: 10.25" (260 mm) with rear p/s
- 1000 Watt rear-mounted 115/240 Vac input p/s
- -48 Vdc to one or two MicroTCA-specified in-rack supplies
- Available for order without p/s
- Two -48V power jumper cable assemblies included

For more information, contact: jjenkins@simonindustries.com

RSC# 33223 @ www.mil-embedded.com/rsc

Carlo Gavazzi Computing Solutions
10 Mupac Drive • Brockton, MA 02301
508-588-6110
www.gavazzi-computing.com

709 Rugged Chassis

Carlo Gavazzi Computing Solutions 709 Series Rugged Rackmount Enclosures are engineered for dependability in some of the most severe and extreme environments involving airborne, shipboard, and ground mobile applications. Designed as a rugged solution to meet a broad spectrum of Military Standards, the 709 has a longstanding reputation as a commercial-off-the-shelf (COTS) product that can be easily configured to meet the most challenging deployed requirements.

Enclosures are configured as a 19" rack mount system capable of supporting a wide variety of industry bus standards such as VME, VME64x, VXS, VXI, CompactPCI, and custom bussed backplane technologies. Available in heights ranging from 8U to 14U, these systems are configurable for either rigid mount or shock isolated card cages. The 709 Series utilizes an aluminum, welded design incorporating EMI "honeycomb" filters and environmental gaskets on all access panels to meet stringent emissions requirements. Power supply options provide a wide range of inputs from AC single and three-phase to DC and provide output power up to 2400 watts. The internal rack infrastructure has been designed to meet IEEE1101.10/.11. All systems can be designed to accommodate application specific I/O requirements. Rugged, Reliable and Ready for deployment, Carlo Gavazzi Computing Solutions 709 Series of Enclosures.

FEATURES:

- VME, VME64x, VXS (VITA 41.0), VXI, CompactPCI compatible
- 8U to 14U height offerings
- 125" Aluminum welded construction
- 187" Aluminum front panel
- 350-1600 watt power supply options
- AC Input: 85-264VAC, 47-440Hz
- DC Input: 18-36VDC options
- Shock Isolated card cage
- Removable shock isolated drive bays

Elma Electronic

44350 Grimmer Blvd. • Fremont, CA 94538
510-656-3400
www.elma.com

Rugged Chassis

Elma Electronic is the industry leader in Rugged COTS and ATR system platform solutions. Our modular COTS platform allows wide variation of EMC shielding, shock and vibration, power and cooling solutions, and I/O cabling per the application MIL-STDs. Because custom designs are based on a proven design platform, the cost, lead-time, and performance risks are substantially reduced.

Elma's Rugged COTS chassis have been tested for shock, vibration, and structural integrity and meet or exceed MIL-STD: 810F, 167, 901D and 461D.

Elma offers full system integration and has Test/Validation Lab services including environmental, EMI/RFI, thermal, backplane signal integrity analysis, and more. The company also offers card handles, panels, and other components.

FEATURES:

- Rugged modular chassis in 5U-14U heights. Lightweight versions in 3U-10U heights. Backplanes in 2-20 slots
- Convection, conduction, or liquid cooling options available for rackmount applications; ATRs in many sizes
- Backplane options in AdvancedTCA, CompactPCI, MicroTCA, VME, VME64x, VPX, VXI, VXS; various slot sizes and customs
- To MIL-STD: 810F, 167, 901D, 461D; Mil-grade components; optional system monitoring
- Modular design allows cost-effective customization on a proven and tested base platform
- Leader in new Mil-related architectures such as VXS (VITA 41), VPX (VITA 46/48), and Rugged MicroTCA

For more information, contact: sales@elma.com **RSC# 33119 @ www.mil-embedded.com/rsc**

Kaparel

97 Randall Drive, Unit B • Waterloo, ON N2V 1C5 Canada
519-725-0101 ext 208
www.kaparel.com

AdvancedTCA Enclosure Family

Rittal Electronic Systems – the complete know-how.
What really counts is reliability. Rittal Shelf Management Concepts incorporates innovative components to produce reliably systems available up to Level 5 for AdvancedTCA and MicroTCA. Everything is fully assembled, ready to run, and individually configured. The same naturally applies equally for CompactPCI, VME, and VME64x. One supplier, one manufacturer, one quality standard. As the leading system supplier, Rittal is your one-stop partner for electronic know-how and a reliable promise of all-inclusive competence – worldwide.

Case solutions in 5U, 12U, 13U, or cube design. Climate control concepts up to 200 W/board and more. High speed backplanes up to 10 Gbps.

FEATURES:

- Rittal Electronic Systems – the complete know-how. What really counts is reliability
- Case solutions in 5U, 12U, 13U, or cube design; climate control concepts up to 200 W/board and more
- High speed backplanes up to 10 Gbps – Variable Shelf Management Concepts – Rittal incorporates innovative components to produce reliable systems available up to Level 5 for AdvancedTCA and MicroTCA
- Fully assembled, ready to run, and individually configured for CompactPCI, VME, and VME64x
- One supplier, one manufacturer, one quality standard: Rittal, your one-stop partner for electronic know-how

For more information contact: pkuepfer@kaparel.com **RSC# 30136 @ www.mil-embedded.com/rsc**

Vicor Corporation
25 Frontage Road • Andover, MA 01810
800-735-6200
www.vicorpower.com

28V DC-DC Chipset

The new PRM+VTM chipset provides the smallest, highest efficiency, highest density complete DC-DC power conversion for mission-critical 28 Vdc military and aerospace applications. The chipset provides the full functionality of a DC-DC converter with breakthrough performance and flexibility in a rugged, miniature package. The new M-FIAM7 filter module provides compliance to MIL-STD-1275, MIL-STD 704, and MIL-STD-461.

MIL-COTS Evaluation Boards are also available. For more information, visit www.vicorpower.com and the Mil V·I Chip product section, or call 800-735-6200 or email custserv@vicr.com.

FEATURES:

- Wide input 28 Vdc (13.5 to 50 V)
- Isolated 1 to 50 Vdc output
- Maximum power density 414 W/in³ per chip
- High efficiency: >95 percent per chip
- Full MIL temperature -55 °C to 125 °C operation
- MIL-STD-1275 and MIL-STD-461 compliance with M-FIAM7 filter

For more information, contact: custserv@vicr.com **RSC# 33145 @ www.mil-embedded.com/rsc**

VPT, Inc.
11314 4th Avenue West, Suite 206 • Everett, WA 98204
425-353-3010
www.vpt-inc.com

DC-DC Converters

VPT, Inc. provides high-density, low-profile, lightweight DC-DC converters, EMI filters, and other power conversion products for military, avionics, and space applications. VPT delivers its patented power solutions in a fast time frame, with the highest certified quality, at a comfortable cost.

VPT's products are designed for distributed power systems in challenging environments where small size, light weight, and high reliability are mission critical. Every day, leading organizations like NASA, Lockheed Martin, Boeing, the U.S. Air Force, and many more depend on quality power solutions from VPT.

Power your critical mission today with power conversion solutions from VPT.

FEATURES:

- Power output of 1.5-200 W in single, dual, and triple output configurations
- 28 V and 270 V nominal inputs
- Variety of potted, metal, and hermetic packaged converters meet your program's cost and performance needs
- Radiation tolerant modules with available radiation hardening for space applications
- Full military temperature ranges; available compliance with MIL-PRF-38534 Classes H/K; SMD modules available
- Multiple environmental screening grades to fit any high-reliability application

For more information, contact: vptsales@vpt-inc.com **RSC# 33220 @ www.mil-embedded.com/rsc**

Aydin Displays Inc.
1 Riga Lane • Birdsboro, PA 19508
866-367-2934
www.aydindisplays.com

4420R5C Panel PC

Aydin Displays' model 4420R5C Rugged Military Panel PC workstation is designed for use in severe environments as encountered by the military. The 4420R5C is designed to meet a wide variety of applications (shipboard, airborne, and ground mobile), which require a solid mechanical design to protect the workstation against shock, vibration, and temperature extremes. The model 4420R5C mounts into a 19" RETMA rack or can be mounted directly to the bulkhead for shipboard applications. The unit complies with MIL-S-901D, Grade A, Class 1, Type A for Shock, MIL-STD-167-1, Type 1 for Vibration and MIL-STD-461D for EMI including, CE101, CE102, CS101, CS114, CS116, RE101, RE102, RS101 and RS103.

FEATURES:

- 20.1" Rugged Military Panel PC
- Tested to MIL-S-901D, Grade A, MIL-STD-167-1, MIL-STD-461D
- Integrated PC Supporting Windows XP and Linux
- Up to 8GB, CompactFlash, Up to 1GB DDR RAM
- (4) USB 2.0, (4) RS232/422/485 Serial
- Ethernet Interface (Fiber Optic), 100BASE-FX

For more information, contact: sales1@aydindisplays.com **RSC# 33248 @ www.mil-embedded.com/rsc**

Phoenix International
812 W. Southern Avenue • Orange, CA 92865
714-283-4800
www.phenxint.com

VL1-250-SC-RHD

The VL1-250-SC-RHD is a rugged, high performance VME Plug-in Storage Module with dual removable hot-swap

Ultra-320 SCSI disk drives
It allows portability in transporting a data storage device (by itself) for secure or archival storage off-line or for transferring data files to operational storage arrays, servers, or host platforms.

The dual-device configuration is ideal for host based RAID 1 (data mirroring) applications, as it is designed to allow the user to hot-swap either/or hard disk drives from a standard, single slot (4HP) 6U plug-in VME module. In addition, the VL1-250-SC-RHD includes the most comprehensive set of performance features for VME products in the industry.

FEATURES:

- Multimode Ultra-320 LVD SCSI I/O
- Automatic Internal "Sensi-Term" bus Termination
- SCSI connection via Front Panel and/or P2 connectors
- Front Panel SCSI ID Select and Activity Indicators
- Shock: 60 G @ 2 ms (operating); Vibration: 5-400 Hz @ 1.5 G (operating)
- 10,000 RPM Disk Drive Spindle Speed

For more information, contact: info@phenxint.com **RSC# 33140 @ www.mil-embedded.com/rsc**

CePOINT Networks, LLC
1 W Otterson Street • Nashua, NH
603-883-7979
www.cepoint.com

CePOINT Networks

Manufacturers of Rugged Portable & Airborne DVR systems w/IRIG-B time stamp

Studio9000™ DVR IRIG-B

Real-time Digital Video Recorder (DVR) system for robust scientific image acquisition and analysis

Studio9000 DVR system performs with blazing speed, featuring uncompressed (or compressed) real-time video capture and recording with optional precision IRIG-B time stamping and GPS interface capabilities. Standard digital or composite analog video acquisition in color NTSC/PAL, SECAM, RGB YCrCB 4:2:2, or in monochrome format – CCIR (625 lines) and EIA (525 lines) – are supported. Optional SDI is also supported. Up to 240 fps (analog), and very high-speed digital video up to 1280 x 1024 resolution and 30 fps up to 500-1,000 fps (digital) is possible. Other features include: simultaneous capture/playback of four video streams; up to two or more channels of real-time simultaneous record and play; unlimited multicam editing and reediting of captured video without degradation or frame loss; captures continuous real-time video directly to system hard disk or memory; compact, rugged 2RU, 3RU, or 4RU MIL-COTS format; capture and stream directly to disk at up to 528 MBps. Capture directly to system hard drive from different video formats and sources supported by Studio9000 DVR. Monochrome or color at 8 bits, 10 bits, 12 bits,14 bits, and more, including area scan, progressive scan, and line scan. Optional interface features include analogue BNC, Digital LVDS, CameraLINK, USB, and 1394 FireWire cameras.

Applications:

- Airborne video recording
- Object tracking and time reference measurement
- Missile range testing
- Endless video program looping
- Security recorder/player
- Bullet explosion testing
- Industrial monitoring
- Portable field production
- Desktop video capture station
- Surveillance recorder

Studio9000 DVR greatly simplifies the process of time referencing object position and timing measurements by integrating real-time video acquisition, real-time IRIG time stamp, and GPS position data.

FEATURES:

- Capture continuous real-time video directly to hard disk at up to 528 MBps; 8-bit, 10-bit, 12-bit, 14-bit, 24-bit mono or color
- Analog RS-170, NTSC/PAL, RGB H and V-sync, and digital LVDS, CameraLINK, USB, FireWire 1394, and RS-644 or RS-422 camera interface options
- Video resolution: 640 x 480, up to 1280 x 1024 pixels; compressed or uncompressed video formats include: AVI, MJPEG, optional MPEG-4
- Digital clock circuitry; capture high-speed, high-resolution images from RGB or composite; progressive scan, line scan, and area scan
- Optional SDI video I/O (SMPTE 259M, 270 Mbps) with embedded AES/EBU audio
- IRIG-B and GPS formats include: Time code generator, IRIG receiver, ANT BNC input connector, and DB-9 pin RS-232 connector
- Real-time simultaneous capture of up to four channels; stream video directly to hard drive, memory, or display output
- RAID 0 storage with capacity up to 4.8 TB option, and expandable with CePOINT's optional NAS RAID storage for extended duration of video
- External event triggers; up to 4- or 8-channel digital I/O for programmable triggers
- External interface ports include: RJ-45 Ethernet, 1 x PS2 keyboard, 1 x PS2 mouse, VGA, RS-232, or RS-422
- Support for Region of Interest (ROI) video manipulation, packed and planar; YUV 4:2:2
- Rugged MIL-COTS format; lightweight, rugged 19" 2U, 3U, or 4U rack mount, airborne or portable with 24 V or 28 Vdc option

For more information, contact: sales@cepoint.com

RSC# 30127 @ www.mil-embedded.com/rsc

CES Creative Electronic Systems SA
Avenue Eugène-Lance 38 / PO Box 584
Grand-Lancy 1/Geneva, 1212 Switzerland
41.22.884.51.00
www.ces.ch

Mission Computers

CES delivers ready-to-go platforms for rugged computer systems, including all of the hardware, software, and qualification requirements, all of the way up to the application. Rugged computers are available in ATR and ARINC 600 form factors, using either VME/VXS or CompactPCI processing engines.

CES rugged computing systems are used in the most demanding applications, which combine very high processing power along with harsh environment conditions. Typical targets include UAVs, helicopters, military transporters, and refuelers.

The associated chassis fits CES ruggedized conduction-cooled VME/VXS and PMC boards to create virtually any mission computer version, from typical mission management, flight control, and communication server (data links, for example) applications to ground surveillance, naval, and SAR radar applications.

With CES tools and hardware and software building blocks, the latest product architecture allows for the design of complex high-end multiprocessing applications, combining high-speed links between computing nodes, multiple gigabit interfaces and user FPGA applications.

Typical boards used in these computers are:

CES Processor Boards
- RIO5: Radar Signal Processor Boards
- RIO3/RIO4: VME/VXS Processor Boards
- RIOC/RIOS: CompactPCI Processor Boards

CES Computing Cores
- MFCC: Multifunction Computing Core PrPMCs
- GPIO: User-Programmable I/O (FPGA-based) PMCs
- PEB: PMC/XMC Extension Boards

CES Avionic Interfaces
- AFDX®, MIL-STD 1553B, ARINC 429 and CANBUS PMCs
- Discrete and Analog Interfaces

For a customized application to your system's needs, send your requirements to ces@ces.ch or call 41.22.884.51.00.

FEATURES:

- ➜CES RUGGED MISSION COMPUTERS - Ruggedized air-cooled, Ruggedized conduction-cooled versions
- ➜SLOTS: Five, seven or twelve slots for 3U or 6U boards
- ➜HOSTS: Single or multiprocessor versions of latest generation CES real-time computers
- ➜CES PROCESSORS: Radar Signal Processor Boards, VME/VXS Processor Boards, CompactPCI Processor Boards
- ➜CES COMPUTING CORES: Multifunction Computing Core PrPMCs, User-Programmable I/O (FPGA-based) PMCs
- ➜PEB: PMC/XMC Extension Boards
- ➜CES AVIONIC INTERFACES: Any combination of AFDX®, MIL-STD 1553B, ARINC 429, CANBUS, discrete or analog avionic interfaces
- ➜BANDWIDTH: Unique CES bandwidth control and datation distribution logic
- ➜MONITORING: Advanced system monitoring unit
- ➜SOFTWARE: Complete software packages including BSPs, drivers and APIs under VxWorks®, VxWorks AE653®, INTEGRITY®, and LynxOS®
- ➜MILITARY CERTIFICATIONS: Complete certifiable packages for DO-178B up to level A
- ➜For further information, contact ces@ces.ch or 41.22.884.51.00

CSP Inc.
43 Manning Road • Billerica, MA 01821
978-663-7598
www.cspi.com

3000 SERIES

FastCluster 3000 SERIES hybrid computing solutions integrate the Freescale 8641D Multicore general purpose processor (GPP), Xilinx Virtex-5 FPGA and Myricom's 10-Gigabit Ethernet Myri-10G clustering technology on a VXS platform to deliver optimal balance between performance, interoperability, and flexibility. Open platform supports single and multiple chassis.

The hybrid computing software development environment supports a broad set of libraries, diagnostics, and tools that include the Annapolis CoreFire Development Suite for Xilinx FPGA, Wind River's Workbench open device software development suite for VxWorks & Linux for the PowerPC with AltiVec, VSIPL object oriented middleware, Myricom's 10-Gigabit Ethernet stack and MPICH-MX over Myri-10G clustering fabric.

FEATURES:

- Scalable Platform with 10-Gigabit switch fabric on VXS serial backplane and static switch for RocketIO
- Air & Conduction Cooled VXS payload Blades: PowerPC Blades and Hybrid Blades (GPP, FPGA) with PMC/XMC support
- Air & Conduction Cooled VXS Switch Modules with 16 port Myri-10G Switch (20 GBytes/s bi-section bandwidth)
- Rugged systems with Built-in 10 GbE for sensor I/O and interoperability supporting systems of systems
- Designed to MIL specs for shock, vibration, and EMI when space, power, weight, and cooling are at a premium
- High Availability provided by Control and Management Planes coupled with fault detection and live insertion

For more information, contact: info@cspi.com **RSC# 33246 @ www.mil-embedded.com/rsc**

NextComputing
4 Townsend West, Suite 17 • Nashua, NH 03063
603-886-3874
www.nextcomputing.com

Vigor ULTRA-III

Rugged, Portable SPARC Server and High-performance Workstation

Vigor ULTRA-III represents the pinnacle of high-performance, Sun UltraSPARC® mobility. Housed in a durable, rugged chassis designed for portability, the Vigor ULTRA-III is ready for your most critical deployed applications and harsh environments. With the industry's highest-resolution 15-inch integrated display, flip-down keyboard, and a wide range of storage and I/O options, this portable powerhouse is designed to meet your SPARC-based Solaris™ needs for the years ahead.

FEATURES:

- CPU: Single or dual UltraSPARC® IIIi processors, 1.33 GHz or 1.6 GHz
- Memory/Storage: Up to 16GB DDR RAM; removable internal SATA/SAS hard drives; internal DVD-R/RW
- PCI Expansion: Single 3/4 length PCI 64-bit/66MHz slot for networking or additional I/O
- Graphics/Display: Sun XVR-100 Graphics with 64MB of SDRAM; Integrated 15-inch LCD display (1600x1200)
- I/O: (2) Gigabit Ethernet ports; (4) USB ports; (1) Serial port; (1) CRT video port; (1) Audio Line-In/Out
- OS Support: Solaris™ 8, 9, 10 64-bit, and Trusted Solaris™

For more information, contact: sales@nextcomputing.com **RSC# 33215 @ www.mil-embedded.com/rsc**

Moxa Technologies, Inc.
3001 Enterprise Street, #210 • Brea, CA 92821
714-528-6777
www.moxa.com/usa

ThinkCore IA240

NEW! ThinkCore IA241/IA240 embedded computers for industrial automation feature 4 RS-232/422/485 serial ports, dual Ethernet ports, 4 digital input channels, 4 digital output channels, a PCMCIA cardbus, and SD socket in a compact, IP30 protected, industrial-strength rugged chassis. The DIN-Rail vertical form factor makes the IA241/240 a cost-effective solution for installation in small cabinets. This space-saving solution also facilitates easy wiring, and is the best choice of front-end embedded controllers for industrial applications.

In addition to the standard model, the ThinkCore IA241/IA240 also comes in wide temperature models. The IA241-T and IA240-T have an operating temperature range of -40 °C to +75 °C, making them appropriate for harsh industrial automation environments. The industrial mechanism of the ThinkCore IA241/IA240 design provides robust, reliable computing. Due to the RISC-based architecture, the ThinkCore IA241/IA240 will not generate too much heat while being used. The high communication performance and fanless design make the IA241/IA240 ideal for industrial automation environments.

The highly reliable ThinkCore IA241/IA240 comes with Moxa's solid 5-year warranty, which is 2.5 times longer than the more common 2-year warranty for industrial PCs.

Applications:

- Manufacturing Automation
- Power/Electricity Management System
- Intelligent Transportation System
- POS/ATM/Kiosk
- Environmental Monitoring System
- Medical System

FEATURES:

- ➜Reliable and industrial-grade design meets IP30 requirements
- ➜Patented Software Encryption Lock protects intellectual property
- ➜-40 °C to +75 °C wide temperature models available
- ➜4 software-selectable RS-232/422/485 serial ports
- ➜4 digital input channels and 4 digital output channels
- ➜Dual 10/100 Mbps Ethernet for redundant networking
- ➜PCMCIA, wireless LAN expansion (supports 802.11b/g)
- ➜SD socket for storage expansion
- ➜Ready-to-run Linux communication platform
- ➜DIN-Rail installation to save cabinet space; wall-mount installation is also possible
- ➜Linux 2.6.9 Support; Supports Linux Tool Chain: Gcc, Glibc, GDB
- ➜Windows Tool Chain: Gcc, Glibc, Insight

RTD Embedded Technologies, Inc.
103 Innovation Blvd. • State College, PA 16803
814-234-8087
www.rtd.com

RTD Rugged Systems

The modular IDAN™, HiDAN™, and HiDANplus™ Intelligent Data Acquisition Nodes with environmental sealing and EMI suppression are ideal for both industrial and military applications. Mobile data acquisition is placed at your fingertips when you select an industrial or tactical FieldPad™ computer. Each system is built using frames milled from solid aluminum blocks to exacting specifications ensuring that your PC/104 system is rugged and reliable. Frames for thermally sensitive components have milled heat sinks and embedded heat pipes to move heat to the outside walls of the enclosure allowing operation from -40 °C to +85 °C without active cooling.

IDAN systems:
An off-the-shelf product consisting of any RTD board mounted in an individual stackable frame with standard PC connectors. This unique PC/104 modular construction allows users to configure systems quickly using a building block approach without module-to-module wiring.

HiDAN systems:
HiDAN is a rugged, watertight enclosure for all RTD boards. Environmental sealing and EMI suppression O-rings coupled with MIL I/O connectors make HiDAN ideal for environmentally challenging applications. A custom, internal wiring harness and Mil connectors ensure reliability.

HiDANplus systems:
The modular stacking concept of IDAN combined with the environmental integrity of HiDAN systems. In addition to stackable ISA and PCI buses, module-to-module signal connections are accomplished using an internal 100-pin stackable signal raceway.

FieldPad data communication systems:
FieldPads are integrated portable computer systems with MIL I/O connectors for mobile and fixed applications. Industrial and military configurations with internal battery pack and wireless telematics make these systems ideal for field deployment to remote data sites or mobile communication hubs. User interface is provided by a 6.5" extended temperature flat panel, keyboard, and mouse. The lightweight machined aluminum construction guarantees maximum thermal dissipation and structural integrity. O-rings in a tongue and groove configuration provide EMI and environmental sealability.

FEATURES:

- IDAN, HiDAN, HiDANplus, and FieldPad systems and computers with standard PC or user-defined MIL-C-38999 I/O connectors
- Structural heat sinks and heat pipes for fanless operation
- High impact resistant milled aluminum construction using 6061 Temper-T6 alloy with clear chromate coating
- Integrated tongue and groove O-ring for environmental sealing and EMI suppression
- Breather valve to equalize internal and external pressure
- 100-pin stackable board-to-board I/O signal raceway
- Quick interchangeability using any combination of RTD PC/104, PC/104-*Plus*, and PCI-104 modules
- Custom wire harnesses and customer-defined I/O connectors
- Many mounting options for customized integration
- Optional MIL-SPEC paint, shock-mount, and cooling fins
- Windows, Windows CE, DOS, Linux, and various RTOSs
- Operating temperature: -40 °C to +85 °C IDAN, HiDAN, and HiDANplus systems

For more information, contact: sales@rtd.com **RSC# 30240 @ www.mil-embedded.com/rsc**

Transduction
www.transduction.com

TRANSDUCTION

MIL-COTS Computers

Transduction offers reliable MIL-COTS computers based on the latest PICMG technology. We have over 30 years of experience in the design of special purpose computers that are unique in terms of quality and longevity to work in mission critical applications.

Our engineering team has the combined skills of precision mechanical and computer design to produce computer systems that seldom fail. Our special skills are evident in our high power computers with a 1500W power supply that can accommodate up to 20 add-on DSP cards. The quality is so good that our warranty is 5 years.

We also offer quick response in the design and manufacture of custom systems so that our clients have the opportunity to adapt the latest technology to their particular needs.

FEATURES:

- Latest PICMG technology with up to 8 processor cores
- ISA, PCI, PCI-X and PCI-E add-on bus architectures
- Optimal thermal design with Air Chamber technology
- Superior mechanical design for shock and vibration
- Highest quality parts for maximum reliability, at low cost. Top Quality Control program
- Stringent tests of each system to client specifications

For more information, contact: 800-268-0427 **RSC# 33244 @ www.mil-embedded.com/rsc**

Octagon Systems
7403 Church Ranch Blvd. • Westminster, CO 80021
303-430-1500
www.octagonsystems.com/products/xmb-1.aspx

OCTAGON SYSTEMS

NEW XMB SERVER

HIGH RELIABILITY XMB MOBILE SERVER

The XMB is part of Octagon's line of IND-CORE™ systems that offer out-of-the-box solutions for military, security and transportation applications. The XMB is a "no-compromise" design that optimizes the electrical, thermal, and mechanical components for maximum reliability. The result is a powerful, yet fanless system in a rugged extrusion. The basic unit includes the processing power, power supply, memory, and I/O for most applications. Yet, it can be easily expanded using PC/104 I/O function blocks or Octagon's XBLOK™ half-size PC/104 expansion modules. Applications include planes, trains, buses, military, homeland security, police, communications, and SCADA markets.

FEATURES:

- Fanless system in a rugged extrusion
- Shock and vibration mounting options
- -40 °C to +75 °C operating temperature
- Removable option panel allows for custom connectors, annunciators, and controls
- Linux and Windows® XPe accepted; size is 6" (W) x 4.2" (H) x 10.8" (D)
- Tell us about your application; call Ray Agnew in Sales at 303-430-1500

For more information, contact: sales@octagonsystems.com **RSC# 33225 @ www.mil-embedded.com/rsc**

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

Clock Distribution Board

The Four Channel Clock Distribution Board distributes a common clock and synchronized control signal triggers to multiple cards in the system. This 6U VME64X/VXS board provides four high speed, ultra low jitter, ultra-low skew differential bulkhead mounted clock outputs, two ultra-low skew differential vertical SMA on-board clock outputs, and four ultra-low skew and clock synchronized singled ended bulkhead mounted control signal triggers.

A jumper set at board installation time or via optional P2 Serial Port determines which one of the 2 installed clock sources is active. Manufacturing options for Clock Source 0 are Single Ended or Differential External Clock, a PLL ranging from 700 MHz - 3 GHz with an On-Board Reference Oscillator, or a PLL ranging from 700 MHz - 3 GHz with a 10 MHz External Reference. Manufacturing options for Clock Source 1 are a PLL ranging from 700 MHz - 3 GHz with an On-Board Reference Oscillator, a PLL ranging from 700 MHz - 3 GHz with a 10 MHz External Reference or an On-Board Low Frequency Oscillator ranging up to 800 MHz.

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

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

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

FEATURES:

- 4 Synchronized Differential Front Panel Clock Outputs up to 3 GHz with Typical Skew of 5 ps
- Ultra-low Clock Jitter and Phase Noise – 275fs with 1280 MHz PLL and external 10 MHz Reference
- On-board PLL's Manufacturing Options provide Fixed Frequencies of 700 MHz - 3 GHz, Locked to Internal or External Reference
- On-board Low Frequency Oscillator provides Fixed Frequencies up to approximately 800 MHz
- Four Synchronized Trigger Outputs, always Synchronized with the Output Clock, with Typical Skew of 5 ps
- Jumper Selectable Trigger Output Levels of 3.3V PECL, 2.5V PECL, or 1.65V PECL
- Source Trigger from Front Panel SMA, Pushbutton, or Optional P2 Serial Port
- Cascade boards to provide up to 16 sets of outputs
- Compatible with standard VME64X and VXS 6U backplanes
- Universal clock input supports wide range of signal options, including signal generator sine wave
- Differential clock input permits multiple standards including: LVDS, 3.3V PECL, 2.5V PECL, and 1.65V PECL
- Clock and Trigger Outputs Compatible with all Annapolis Micro Systems, Inc. Wildstar™ 2 PRO I/O Cards and Wildstar™ 4 / 5 Mezzanine Cards

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

Dual 2.3 GSps DAC

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

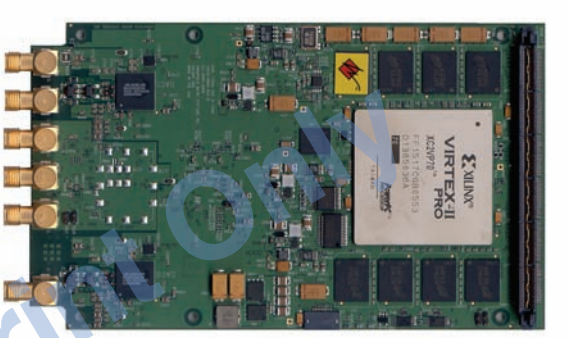
The Annapolis Dual 2.3 GSps DAC I/O card provides two 12-bit output streams at up to 2.3 GSps per stream.

The board has both a high-precision trigger for inner-board or board-to-board synchronization and a low-precision trigger. The card supports three modes: NRZ, RF, and RZ.

The Xilinx Virtex-II Pro 70 on the board provides user-configurable, real-time continuous sustained processing of the full data stream. Up to two of these I/O cards can reside on the Annapolis WILDSTAR II or WILDSTAR II Pro FPGA-based VME and PCI bus boards, which provide up to 30 million user-reprogrammable FPGA gates for onboard processing. Our boards run on many different operating systems. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models. VHDL source is provided for interfaces to SRAM, LAD bus, I/O bus, and DACs. CoreFire users will have the usual CoreFire board support package.

Develop applications with CoreFire (more than 1,000 cores), which transforms the FPGA development process, making it possible for theoreticians to easily and quickly build and test their algorithms on the real hardware that will be used in the field. The combination of our COTS hardware and CoreFire enables our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.

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



FEATURES:

- Choice of up to 2.3 GSps or 1.5 GSps output per channel
- Two individually configurable output streams of 12-bit data
- High output power and exceptional gain
- Flatness in multiple Nyquist zones
- One Xilinx Virtex-II Pro 70-5, -6, or -7
- Up to 2 GB DDR SDRAM in four banks
- Supports three modes: NRZ, RF, and RZ
- Both high-precision and low-precision triggers
- JTAG and serial port access
- Proactive thermal management system
- Available in both commercial and industrial temperature grades
- Includes one-year hardware warranty, software updates, and customer support

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

Quad 16 Bit 160 MHz A/D

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

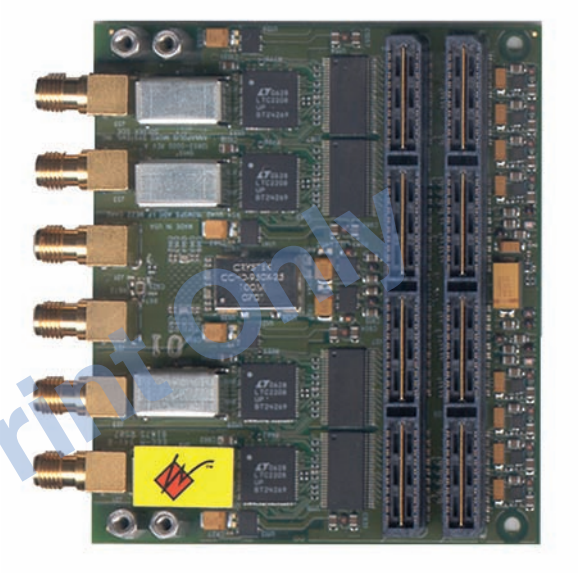
The Annapolis Quad 130/160 MHz A/D I/O card provides four channels of 130 or 160 MHz input with 16-bit resolution. The board has four LTC2208 (130 MHz) or four LTC2209 (160 MHz), each fed by its own analog input signal. There is a universal single ended 50 ohm clock input. Multiple I/O cards can by synched together via the Annapolis 4 or 8 Channel Clock Distribution Boards.

In concert with the WILDSTAR 4 for PCI-X, VME64X or VXS board, which provides Xilinx Virtex 4 FPGAs, this I/O mezzanine board supplies user-configurable, real-time continuous sustained processing of the full data stream.

Our boards run on many different operating systems. We support our board products with a standarized set of drivers, APIs and VHDL simulation models. VHDL source is provided for hardware interfaces such as SRAM, LD bus, I/O bus, and A/Ds. CoreFire users will have the usual CoreFire board support package.

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

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



FEATURES:

- Four LTC2208 (130 MHz) or Four LTC2209 (160 MHz) 16 Bit Analog to Digital Converters
- Six SMA Front Panel Connectors – Four Analog Inputs, High Precision Trigger Input, Universal Single Ended 50 ohn Clock
- Main Board PCLK Sourcing Capability
- Typical 12.5 Effective Number of Bits
- Ultra-Low Skew and Jitter Clock Distribution
- Excellent SFDR Performance – SFDR > 95dBc, @Fs=130 MHz and Fin=30 MHz
- 700 MHz Input Bandwidth per Channel
- Full CoreFire board support package for fast, easy application development
- VHDL model, including source code for board level interfaces
- Save time and effort and reduce risk with COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition
- Includes one-year hardware warranty, software updates, and customer support. Training available

For more information, contact: wfinfo@annapmicro.com **RSC# 33251 @ www.mil-embedded.com/rsc**

Degree Controls, Inc.
18 Meadowbrook Drive • Milford, NH 03055
603-672-8900
www.degreec.com

F900 Airflow Sensor

The F900 Airflow Sensor is designed to measure the velocity and temperature of airflows in applications where airflow is essential to prevent overheating. It has been used in applications such as military electronics enclosures, HVAC in military vehicles, air filtration systems, and critical containment areas such as biological safety cabinets, fume hoods, and clean rooms – anywhere heat can cause damage to components and cause burnout and shutdowns. Some of our most notable clients include the US Navy and NASA.

With standard airflow sensing ranges from 0.15-2 m/s (30-400 fpm) to 0.15-10 m/s (30-2000 fpm), depending on the setting, the Series F900 offers unparalleled price to performance, compact size, reliability, and resistance to mechanical shock and vibration.

The F900 series supports a linear 0-4V output or a digital TTL output depending on the model. The sensor is easy to install and operate with an adjustable mounting bracket included with the sensor. Do you need a remote sensing head? The F900 can be ordered with a remote sensing head option. Select the body style that fits your application – the short body style provides a plastic housing that protects the sensor from damage when a more rugged sensor is required.

FEATURES:

- Measures air and inert gas velocity and temperature
- Standard flow ranges between 0.15-10 m/s (approximately 30-2000 fpm)
- Air temperature measurements from 0-70°C
- Digital UART interface
- Linear 0-4 VDC airflow output from 0 to full-scale
- Wide voltage supply: 7-13VDC
- Temperature-compensated from 15-35°C
- Ideal for ducted or open airflow applications
- Available in multiple sensor heads
- Wide acceptance angle (±30°)

For more information, contact: customer.service@degreec.com **RSC# 33116 @ www.mil-embedded.com/rsc**

Lyrtech
4495 Wilfrid-Hamel Blvd., Suite 100 • Quebec City, Canada G1P 2J7
418-877-4644
www.lyrtech.com

SFF SDR EVM/DP

The Small Form Factor (SFF), Software-Defined Radio (SDR) Development Platform is a unique new product that addresses the special, portable SDR needs of the military, public safety, and commercial markets. It was designed around the latest DSP and FPGA technology – Lyrtech's area of expertise – as a low-cost, off-the-shelf, integrated hardware and software development solution.

The DSP and FPGA of the SFF SDR Development Platform are completely integrated to the model-based design flow, which integrates MATLAB, Simulink, and Real-Time Workshop from The MathWorks and System Generator for DSP from Xilinx. The SFF SCA Development Platform optional package allows SCA waveform development and implementation.

FEATURES:

- DM6446 system-on-chip from Texas Instruments; Virtex-4 SX35 FPGA from Xilinx
- Independent power monitoring of the processors
- 125-MSPS, 14-bit analog-to-digital converters; 500-MSPS, 16-bit digital-to-analog converters
- RF module operating between 20 MHz and 930 MHz
- Model-based design support/Optional SCA board support package
- Contact – THIERRY CASES for full information and a customized application to your product thierry.cases@lyrtech.com or 418-877-4644, Ext. 232

For more information, contact: thierry.cases@lyrtech.com

RSC# 33135 @ www.mil-embedded.com/rsc

Synplicity, Inc.
600 West California Avenue • Sunnyvale, CA 94086
408-215-6041
www.synplicity.com

Synplicity®
Simply Better Results

Synplify DSP

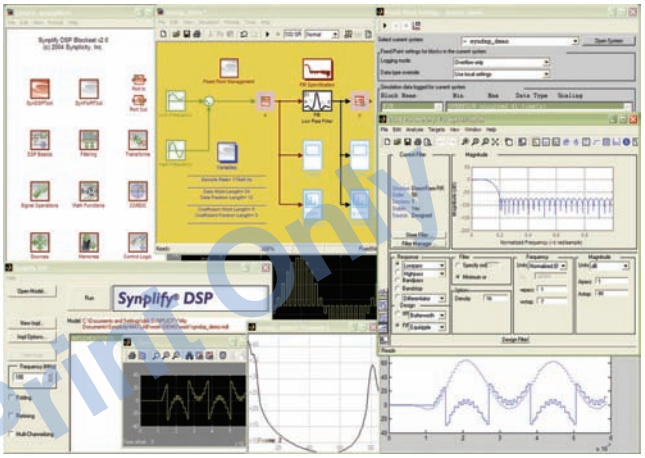
Implementing DSP algorithms into silicon is traditionally a challenging, tedious, error-prone process. The Synplify® DSP solution offers DSP algorithm designers and hardware engineers the most efficient way to get their algorithms into silicon. Synplify DSP uses a unique DSP Synthesis methodology that offers significant advantages over traditional design flows and competing DSP design tools.

Technology Independent DSP Library: Included in the Synplify DSP solution is a set of functional blocks commonly used in DSP design such as filtering (FIR, IIR), transforms, math functions, CORDIC, signal operations, memories, and control logic.

Rapid Fixed-Point Design and Verification: Synplify DSP software offers a fast and concise way to capture and verify DSP algorithms. Features like vector support and M-control allow concise expression of parallel, multichannel, or complex control logic functions. The Synplify DSP library also allows use of advanced Simulink analysis tools to help verify algorithm behavior.

Powerful DSP Synthesis Engine: The Synplify DSP product has the unique ability to apply architectural optimizations to your algorithm implementation. Based on user constraints, you can apply resource sharing and scheduling, or pipelining and retiming at the system level across the entire design. The DSP synthesis engine also has special features to effectively target ASIC technologies. In addition to the architectural optimizations mentioned above, the DSP synthesis engine also extracts memory blocks into separate modules so you can easily replace them with your favorite memory vendor technology. This enables optimized portability between FPGA and ASIC from a single Synplify DSP model.

Extensible IP Methodology: The Synplify DSP library is extensible and customizable for use as a starting point for parameterizable IP models in M and Simulink. Coupled with hardware abstraction and DSP synthesis optimizations, this methodology creates a powerful environment for customizing and maintaining complicated algorithmic IP.



FEATURES:

- Unique Synplify DSP synthesis engine – Automatically creates optimized algorithm RTL architectures from your DSP model
- Powerful DSP synthesis optimizations – Exploration of speed/area/device technology trade-offs without changing your DSP model
- Comprehensive DSP library – With full multi-rate support and advanced fixed-point quantization analysis
- M-Control feature – Enables use of M-language for concise expression of complex state machine and control logic functionality
- Vector support – Enables concise expression of parallel and multichannel algorithms common in wireless and video applications
- Design Portability – Target FPGA or ASIC hardware from a single Simulink model
- Multi-Channelization – Automatically produces a resource optimized multi-channel implementation from a single channel specification
- Integrated Quantization and Multi-rate Analysis – Accelerate design and verification of fixed-point multi-rate DSP algorithms
- Automatic Datatype Propagation – Propagates type and adjusts word width to avoid overflow saving manual calculation and implementation
- Synplify DSP Blockset – Hardware abstraction focuses on algorithm behavior, separates implementation details and enables full portability
- Extensible IP – Easily create your own reusable, optimizable custom DSP functions using Synplicity's core IP library (blockset)
- Memory Extraction for ASIC Targets – Extracts memory to allow flexible use of third party memory vendors

For more information, contact: info@synplicity.com **RSC# 33229 @ www.mil-embedded.com/rsc**

Synplicity, Inc.
600 West California Avenue • Sunnyvale, CA 94086
408-215-6000
www.synplicity.com

Synplicity
Simply Better Results

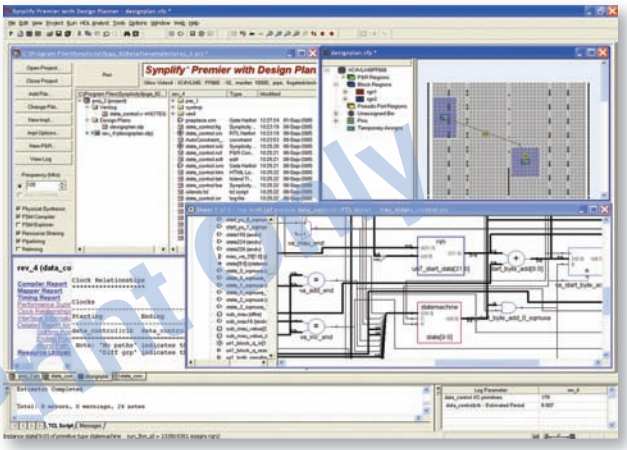
Synplify Premier

Synplicity's Synplify® Premier software is the ultimate FPGA synthesis and debug solution. It builds upon Synplicity's industry-leading synthesis technology, and adds new graph-based physical synthesis for timing closure and simulator-like visibility into operating FPGA devices for fast source-level debug.

Graph-Based Physical Synthesis: Synplicity® invented graph-based physical synthesis to improve timing closure by means of a single-pass physical synthesis flow for 90 nm FPGAs. In FPGAs, unlike ASICs, proximity of placed logic does not imply better timing. The essence of the graph-based approach is that pre-existing wires, switches, and placement sites used for routing an FPGA can be represented as a detailed routing resource graph. The notion of distance then changes to a measure of delay and availability of wires. The Synplify Premier tool's graph-based physical synthesis technology merges optimization, placement, and routing to generate a fully placed and physically optimized netlist, providing rapid timing closure and improved performance.

Superior Correlation for Faster Timing Closure:
The Synplify Premier product is a true timing-driven synthesis product, which means it delivers the timing performance you need in the smallest device. Using graph-based physical synthesis, the Synplify Premier software can predict timing with a high degree of accuracy and make the right decisions on which paths to optimize.

Simulator-Like Visibility Into a Live FPGA:
The Synplify Premier software provides a rapid method of finding functional errors in FPGA designs by providing simulator-like visibility into operating FPGA hardware. Synplicity's integrated debugging software, based upon technology from the Identify® product, allows designers to annotate signals and conditions they want to monitor directly in their RTL code.



FEATURES:

- Graph-based Physical Synthesis – Fast timing closure and a push-button performance boost of up to 20 percent
- True Timing-driven Synthesis – After meeting timing constraints, automatically optimizes your design for area/cost
- Automatic Handling of DSP Functions – Infers DSP functions from RTL and maps into vendor's DSP hardware (i.e. MACs)
- Lightning-fast Compile Times – Synthesizes even the largest design in a fraction of the time of other tools
- HDL Analyst® RTL Analysis and Debugging Tool – Instantly generates RTL block diagrams from your RTL code; helps identify critical paths
- Interactive Timing Analysis – Enables point-to-point timing analysis without re-synthesis
- MultiPoint™ Synthesis – Provides a superior block-based methodology for incremental design and better design consistency
- Automatic RAM Inferencing – Bypass tedious hand instantiation of RAM and makes your design technology independent
- FSM Explorer – Automatically finds and selects the best FSM coding style for meeting your timing and area constraints
- Automatic Retiming – Moves registers automatically within combinatorial logic to balance delay and improve performance
- Integrated RTL Instrumentation and Debug – Instrument and debug your design directly in your RTL source code
- Probe Point Creation – Allows any signal to be tied to an external pin for testing without HDL code changes

For more information, contact: info@synplicity.com

RSC# 33228 @ www.mil-embedded.com/rsc

Objective Interface Systems
13873 Park Center Road, Suite 360 • Herndon, VA 20171
Tel: 703-295-6500 • Fax: 703-295-6501
www.ois.com

ORBexpress

ORBexpress is a high-performance implementation of the Common Object Request Broker Architecture (CORBA), an open standard enabling applications in heterogeneous environments to communicate seamlessly.

Built to meet the demands of embedded and real-time developers, independent studies have proven ORBexpress the fastest ORB in the industry. ORBexpress provides critical real-time CORBA capabilities for the world's most deterministic systems. The small efficient memory footprint adds virtually no additional latency to communications.

Available on more than 1,200 different binary platforms, ORBexpress is used successfully in virtually every major Software-Defined Radio (SDR) program. It is the middleware foundation for the industry's first certified JTRS SDR.

FEATURES:

- Fast, lean: built for real-time applications with minimal overhead
- Real-time: predictable internals and end-to-end round-trip behavior
- Heterogeneous: built to bridge different CPUs, OSs, language, and media
- Reliable: errors detected earlier in the life cycle
- Bounded priority inversions: limits time that the low-priority activities suspend high-priority activities
- Quality of Service (QoS): take advantage of media-specific options on plug-in transports

For more information, contact: info@ois.com

RSC# 30143 @ www.mil-embedded.com/rsc

Ardence, a Citrix Company
266 2nd Avenue • Waltham, MA 02451
781-693-6333
www.ardence.com

Select

Delivering Multi-functional Devices on a Single Operating System

Military device manufacturers are experiencing an increased demand for standards-based devices that can perform multiple functions with instant availability. Until now, multi-purpose devices have generally required multiple operating systems, or additional hardware, to deliver the desired functionality – more complexity, longer development cycles, and additional license costs - no longer.

Uniquely, Ardence Select enables OEMs to deliver devices with multi-purpose functionality on a single operating system. Multiple boot configurations can now be pre-set by the OEM, or set by the end-users. This breakthrough reduces the time, effort, and expense required to create multifunctional devices.

FEATURES:

- Enables multi-purpose device functionality on a single operating system
- Instant On/Off minimizes boot time, ends long shutdowns
- Makes devices corruption and virus proof
- Enables immediate, full recovery by cycling the power
- Intuitive interface results in reduced time to configure and manage
- Support for Microsoft Windows® Vista™ and XP operating systems

For more information, contact: info@ardence.com

RSC# 33109 @ www.mil-embedded.com/rsc

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

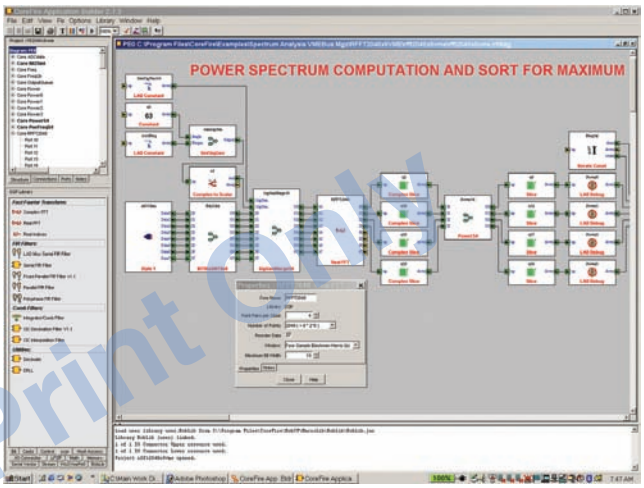
CoreFire FPGA Tool

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

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

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

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



FEATURES:

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

For more information, contact: wfinfo@annapmicro.com **RSC# 16201 @ www.mil-embedded.com/rsc**

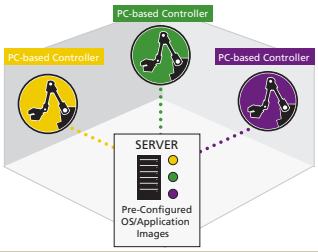
Ardence, a Citrix Company
266 2nd Avenue • Waltham, MA 02451
781-693-6333
www.ardence.com

Ardence
a Citrix Company

Software Streaming

The Device Edition of the Ardence Software-Streaming Platform revolutionizes the traditional software deployment and management model, which assumes that the OS/application image is loaded onto each embedded device. Uniquely, Ardence virtualizes the OS/application image and streams the selected image to a diskless device from the network. By eliminating the need to pre-install or maintain any software (OS or apps) on the device, military and aerospace OEMs benefit from unparalleled reliability, flexibility, security, and productivity.

Because the OS/applications are processed on the devices locally, optimal system performance is maintained (including real-time applications), while centralized management enables simplified upgrades, maintenance, and scalability.



FEATURES:

- Enables devices to change functionality in the time it takes to reboot
- Target devices process applications locally, yet require no hard disk
- Eliminates the need to make hands-on visits to devices for maintenance and upgrade
- Devices do not rely on the network for control of peripherals
- Works with existing hardware, applications and network
- Allows additional devices to plug into the network and start streaming immediately

For more information, contact: info@ardence.com **RSC# 33110 @ www.mil-embedded.com/rsc**

Ardence, a Citrix Company
266 2nd Avenue • Waltham, MA 02451
781-693-6333
www.ardence.com

Ardence
a Citrix Company

RTX

Ardence RTX is a real-time extension for Windows-based devices. Military and aerospace OEMs that demand uncompromising performance and reliability on standards-based platforms rely on RTX to deliver full control – pre-empting Windows and providing precise control of IRQs, I/O, and memory. RTX's deterministic performance ensures that specified tasks execute with proper priority and 100 percent reliability – including the ability to survive Windows crashes (blue screens).

As a true extension to Windows, not an RTOS ported to Windows, developers can benefit from the familiar standards-based Windows development environment and tools. On multi-core architectures, RTX can be configured to run in "dedicated" mode, where it can leverage the processing power of an entire core.

FEATURES:

- Robust, High-performance Windows RTOS Extension in Ring 0: sustained interrupt rates of 30 KHz
- Support for all standard Microsoft HALs: including ACPI compliant PIC, uni-processor and multi-processor APIC
- Comprehensive Microsoft Windows OS support: Windows Vista, XP Pro, XP Embedded, 2000, Server 2000, and 2003
- Complete x86 CPU support: including multi-processor and multi-core in either shared or dedicated mode
- Visual Studio 6.0, .NET 2002, 2003 and 2005: develop, compile, and debug in well-known development environment
- WinSock compliant TCP/IP stack: independent of Windows; support for IPv4 and IPv6

For more information, contact: info@ardence.com **RSC# 33111 @ www.mil-embedded.com/rsc**

SYSGO AG
Am Pfaffenstein 14 • Klein-Winternheim, D-55270 Germany
+49 6136 9948-0
www.sysgo.com

SYSGO
EMBEDDING INNOVATIONS

PikeOS

PikeOS is a powerful and efficient paravirtualization real-time operating system based on a separation microkernel. It supports multiple additional operating systems (OSs) and runtime environments (RTEs), such as Linux, ARINC 653, and POSIX, together with their associated applications. All OSs and RTEs run concurrently and cooperatively in their own partitions. The PikeOS partitioning system, in conjunction with its internal protection mechanisms, provides the highest available level of safety and security.

Safety, Security, and Virtualization

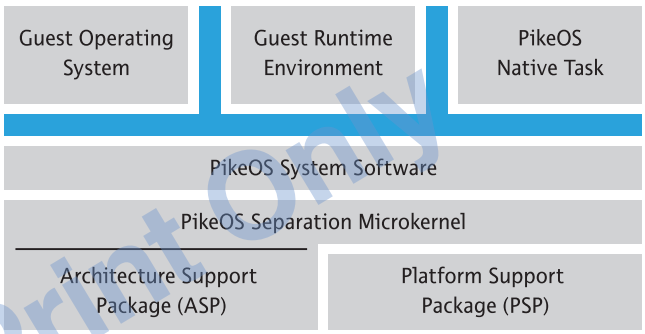
The native design of the unique PikeOS separation microkernel specifically addresses the requirements of safe and secure systems. All drivers, stacks, hard real-time applications, and hosted OSs or RTEs reside in separate address spaces with pre-defined I/O access controlled by PikeOS. The paravirtualization capabilitiy of PikeOS enables the combination of applications with different safety and security certification levels on one platform. It supports hardware convergence efforts and opens the door for open source components to be utilized in safety and security critical systems.

Choose the environment you need

PikeOS offers support for a variety of hosted OSs, RTEs and APIs. This variety enables legacy applications (for instance, Ada) to run concurrently with new applications based on standards like POSIX and ARINC 653. All these OSs, runtime environments and APIs run on the same PikeOS kernel and can be combined as needed.

End to end development solution

Developing embedded applications that use a partitioned system requires specialized support from the development environment; it's not the same as developing standard desktop or mainframe applications. Embedded developers need guided configuration, remote debugging (often down to the hardware instruction level), target monitoring, remote application deployment, and timing analyses, in addition to standard application development features such as compilers and assemblers. With the CODEO IDE and the COGNITO time and system analyzer extension, SYSGO offers a complete environment for embedded development.



FEATURES:

- Separation microkernel based
- MILS compliant
- Unique combination of virtualization and RTOS technology
- Strict time and resource partitioning
- Developed according to DO-178B and IEC 61508
- OS choices: Linux (Kernel 2.4.20, 2.6.15) and OSEK
- Runtime Environments: (RTEs) POSIX (PSE51, PSE52), Java, Ada, µITRON, Soft-PLC (CoDeSys)
- APIs: ARINC 653, VxWorks subset, PikeOS Kernel and SSW API
- Available for PowerPC, x86, and MIPS
- One Integrated Development Environment (IDE) for all OSs, RTEs and APIs

Geotest - Marvin Test Systems, Inc.

1770 Kettering • Irvine, CA 92614-5616
949-263-2222
www.geotestinc.com

ATEasy Software

ATEasy is a test executive and offers a rapid application development framework for functional test, ATE, data acquisition, process control, and instrumentation systems. ATEasy provides all the necessary tools to develop and maintain software components, from instrument drivers to complex test programs. Test applications are faster to generate and easier to maintain.

ATEasy includes a complete test development suite, which is specifically designed for test applications. The ATEasy development environment combines the ease of Microsoft Visual Basic and the flexibility of Microsoft Visual C++ – providing a complete object-oriented, 32-bit Windows programming environment for Windows® 98/ME/2000/XP and Vista operating systems.

FEATURES:

- Open architecture support for ActiveX, OCX, OLE, DDE, DLL, and .NET components; C/C++ header file support
- Rapid Application Development (RAD) environment enables short development cycles
- Supports external instrument drivers, including VXI (.fp) drivers, LabVIEW (.vi / .llb), and IVI drivers
- Support PXI, PCI/CompactPCI, VXI, GPIB, TCP/IP, RS-232, ISA, and other instrument control busses
- Instrumentation/Test System-like modular structure for easy development and maintenance
- Application Builder creates royalty-free, run-time executables (EXE files)

For more information, contact: info@geotestinc.com **RSC# 33123 @ www.mil-embedded.com/rsc**

Strategic Test

12 Alfred Street, Suite 300 • Woburn, MA 01801-1915
617-621-0080
www.strategic-test.com

UF2-6000 AWG Cards

There are eight 14-Bit resolution, Arbitrary Waveform Generator cards in the UF2-6000 range. Cards are available with one, two, or four analog outputs, maximum output rates of 125 MS/s, 60 MS/s, or 20 MS/s, and up to four GigaSamples of memory depth.

For military applications, the Multiple Replay option is a popular choice as it allows the generation of RADAR signals with Pulse Repetition Frequencies of up to 10 MHz, while the Digital Outputs option adds two, four, or eight digital outputs synchronized to the analog outputs – often used to synchronize external equipment. If the signal outputs need to be controlled by an external TTL gate signal, then the Gated Sampling option can be used.

The UF2 cards include 24 months warranty, lifetime technical support, and software updates.

STRATEGIC TEST

FEATURES:

- 66 MHz PCI cards (compatible with 33 MHz PCI); PXI and CompactPCI versions available
- 125 MS/s, 60 MS/s or 20 MS/s maximum output rates
- 1, 2 or 4 independent and synchronized 14-Bit DAC output channels
- 3 software selectable reconstruction filters
- Up to 4 GigaSamples of onboard signal memory and 225 MBytes/s data streaming from host PC
- Drivers for Windows Vista, XP64, XP, 2000, Linux, LabVIEW, MATLAB, Agilent-VEE, LabWindows/CVI, DASYLab

For more information, contact: sales@strategic-test.com **RSC# 33221 @ www.mil-embedded.com/rsc**

Geotest - Marvin Test Systems, Inc.
1770 Kettering • Irvine, CA 92614-5616
949-263-2222
www.geotestinc.com

MTS-207 Test Set

The MTS-207 is a state-of-the-art portable PXI platform for field testing and data acquisition systems. Its architecture is based on the MTS-206, which has been qualified as a flight-line tester for the Maverick Missile system. It combines the capabilities of the versatile and powerful PXI architecture in a compact, ultra-rugged, flight-line qualified enclosure. The MTS-207 is ideal for test and data acquisition applications requiring operation under harsh environmental conditions.

The MTS-207 combines the benefits of PXI with a ruggedized design. The MTS-207 includes a shock-mounted, 14-slot, combination PXI chassis with seven 3U slots and seven 6U slots. Applications include flight-line testing, field testing, and data acquisition under harsh environments.

FEATURES:

- Ultra-rugged and portable PXI platform for field and flight-line applications
- Meets MIL-STD-810E requirement for harsh environmental conditions
- Built-in, shock-mounted 14-slot PXI chassis (seven 3U and seven 6U slots)
- A wide range of PXI modules available to tackle any test or data acquisition application
- Optional touch-screen display (meets same environmental specifications)
- Universal AC power input; optional 28 Vdc input; optional UUT power supplies

For more information, contact: info@geotestinc.com

RSC# 33122 @ www.mil-embedded.com/rsc

Profile Index

The Flash Storage Leader

Features

.Ultra DMA Mode 4 Support
.Built-in Error-Correction Code
.Wear-Leveling Mechanism

Applications

.Military Application
.Embedded Application

OS Supporting

.DOS
.Linux
.Windows Vista, CE, XP
.MAC

RSC# 129 @ www.mil-embedded.com/rsc

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pqi

Ah Wind River, where have you been?

I reconnect with WRS, and it's a happy occasion.

By Chris A. Ciufo

Software is the lifeblood of the embedded industry, which itself is the foundation of modern defense systems. It's a known fact that nearly all military initiatives – from Blue Force Tracking, to Future Combat Systems, to DDG-1000 [formerly DD(X)], to JSF – do what they do because of massive computing power from embedded electronics. And since everyone uses practically the same components such as PowerPC 7447s or Intel Core 2 Duo processors, Altera Stratix III or Actel RTAX-S FPGAs, or Tundra Serial RapidIO bus peripherals, it's the *software* – particularly the operating system – that differentiates and glues together all these defense systems.

Over the past six months, I've written about and we've covered in our military magazines[1] OS environments from Green Hills' INTEGRITY, LynuxWorks' Lynx-178, AdaCore's GNAT Pro. But conspicuously absent has been much mention of RTOS heavyweight Wind River Systems. Some of you have wondered if I'm boycotting them, or if I simply forgot about Wind River. Far from it. Several years ago I got a frantic call from Wind River's then-chairman Jerry Fiddler asking me if I still had a copy of a briefing he'd given me months before, because he had a computer crash and his version had vanished. (I sent it back to him.) Clearly, Jerry and I were on a first-name basis back then, and I was routinely in touch with the company and totally up-to-speed on their strategic plans and products.

But since the year 2000, the dot-com meltdown came and went, the rise (and some would say fall) of telecom passed us by, 9/11 refocused our military attention, and many companies had personnel turnover. The software companies mentioned above – and others including Express Logic, QNX, RTI, and Aonix – aggressively cultivated editors' attention, while Wind River wasn't in my face nearly to the same degree as they had been before. All companies change priorities, and being only human (and frankly, barraged with PR), I didn't have much time or success reestablishing contact with my friends at Wind River. I learned about the company's military product reorganization around platforms, general, ARINC-653, MILS, and safety critical, but not much else.

To me, the Tornado development environment was still their crowning achievement; I halfheartedly noticed they (finally!) endorsed Linux, and I thought I remembered reading something about Eclipse. But hey: I was busy, the world was a frantic place, and it's the job of the PR professionals to stay in touch with editors, not the other way around. (There are about 20 editors and perhaps 1,000 companies).

Happily, the world has turned a few more times since then, and I've reconnected with Wind River – intentionally starting at the recent Embedded Systems Conference in San Jose and continuing through several telephone briefings and even an OSP E-cast cosponsored by Aonix and Wind River. I was especially glad to learn the company has rekindled its Aerospace and Defense (A&D) strategy. (They would argue, "We never stopped.") And they've hired my old friend Chip Downing as their senior industry military marketing manager.

"My own discussions with defense contractors plus a recent analyst report indicate that VxWorks still commands the largest share of the embedded RTOS market, followed only by Microsoft."

My own discussions with defense contractors plus a recent analyst report indicate that VxWorks still commands the largest share of the embedded RTOS market, followed by Microsoft. Wind River has converted Tornado 5.5 to Workbench 6.x, which is now Eclipse-based. That's *excellent* news. The company recently acquired FSMLabs' RTLinux real-time Linux distro and is actively partnering with the industry's leading software companies to cover all the ancillary system pieces for aerospace and defense. This includes AdaCore and DDC-I for Ada, Objective Interface Systems for CORBA, IBM and Telelogic for design tools, and all the way up to Aonix for PERC Java and Zeligsoft for SDR. The company has even *publicly* refocused on A&D with a developer conference in southern California.

This all adds up to a happy reunion for me. Having originally been a specifier of Wind River's software when I ran a VME military product line in a previous life, I'm very glad to once again be in-the-know on Wind River's military plans. Of course, you can be sure we at *Military Embedded Systems* will continue to keep you apprised of *all the RTOS companies'* future plans – in order to keep you just as equally educated and informed.

Chris A. Ciufo
Group Editorial Director

Have any other new technology ideas? E-mail me at cciufo@opensystems-publishing.com.

[1] *Military Embedded Systems*, *VME and Critical Systems,* and www.DSP-FPGA.com.

GE Fanuc
Embedded Systems

Eight 1553 channels on one PMC. Now that's something to be proud of!

New PMC can reduce system size, weight and integration time.

Sure, we're proud of our new MIL-STD-1553 PMC. After all, it's the only COTS PMC that offers this many 1553 channels. Which means you can pack 8 channels into less space, reduce your overall system weight, cut your board count and possibly save a lot of time and money.

In addition to weight, space and potential cost savings, a number of other benefits ripple out from this design concept. They include the inherent lifecycle management and technology insertion advantages of FPGAs, plus the MTBF improvement that comes with a lower component count.

This is a truly amazing card, and if we brag a little it's mostly because we know what a huge advantage the card will be for your next 1553 design project. We're extremely proud to be able to offer you this sort of breakthrough technology, and we don't care who knows it.

www.gefanucembedded.com/avionics

EPMC-1553
8 Channel PMC

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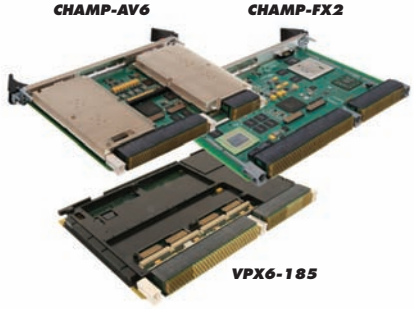
TOUGH HARDWARE EASY SOFTWARE.

Software shouldn't be hard. That's why we back our rugged boards and subsystems with all the tools you need to easily and rapidly design, integrate and support your deployed electronics systems. You can depend on our board support packages, built-in test routines, diagnostic utilities, extensive software libraries and broad operating system support to reduce design costs and get your product to market faster. That's hard evidence that makes Curtiss-Wright the easy choice.



The CHAMP-AV6, CHAMP-FX2 and VPX6-185 are three of our latest generation of VPX/VPX-REDI boards and include a rich set of COTS Continuum system and support software designed to ease integration and reduce system development time.

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EMPOWERED SOFTWARE... *ABOVE & BEYOND*

MIL/COTS DIGEST

The Defense Electronic Product Source

May/June 2007

In This Issue

New product supplement

You're looking at a reasonable facsimile of the publication *MIL/COTS DIGEST* (MCD) that was acquired in February 2007 by OpenSystems Publishing – publisher of *Military Embedded Systems*. Since its inception several years ago, the mostly product-focused MCD has filled a critical niche in the COTS market by providing a monthly "marketplace" showcasing new products, boards, systems, and software.

We plan to continue the MCD vision by making it a frequent new product addition inside of *Military Embedded Systems*. In this eight-page supplement, you'll find 26 products. System-level products were by far the most dominant, with 10 products chosen. We also included 4 board-level products (3 PMC-related, 2 FPGA-related), 2 sensor devices, 3 data recorder products, 4 component-level devices, 2 software-related products, and 1 test equipment device. I personally selected these products because they intrigued me, were unique in some way, came from companies that we don't often read about, or simply represented capabilities I thought you should be aware of.

These 26 products are a down-select of literally hundreds of recent products that were added to our online database (www.mil-embedded.com/products) or sent to me or one of our editors.

I hope you enjoy thumbing through this selection of my favorite new products. If you have any comments, please drop me an e-mail.

Chris Ciufo, *Editor*
cciufo@opensystems-publishing.com

Inside

Rugged, versatile Pentium M workstation

The Barracuda ultra-rugged series of Human Machine Interface (HMI) products integrates mobile rugged technology and versatility. It offers a Pentium M workstation that provides a removable hard drive or Compact Flash storage device. The Barracuda is ideal in military command, control, communications, and computers (Military C4) where a display or workstation must be able to withstand harsh vehicle shock and vibration. Other features include a sunlight-readable 15" display, optional modular AC/DC sealed power supply, and corrosion-proof NEMA-4, IP65 aluminum enclosure. The Barracuda operates at 0° to 50 °C, but a -30 °C low temperature option is available, along with optional water- and dust-tight circular military-rated connectors for harsh environments.

www.kontron.com **KONTRON**

Dual-head graphics PMC

The M591 is a dual-head graphics PMC providing simultaneous display of two independent graphics streams of high-resolution graphics typically used in harsh environments. Includes an ATI M9 graphics processor with high-performance processing capabilities for 2D/3D polygon generation and texture mapping acceleration. Dual DVI outputs generate independent resolutions of up to 1,600 x 1,200 pixels at 75 Hz with 32 bits per pixel and reach 2,048 x 1,536 pixels at 85 Hz with data rates up to 122 million pixels per second (Mpps). TV output supports NTSC, PAL, RS170A, and CCIR formats and interlaced/noninterlaced S-video (Y/C) signal formats. The M591 comes in various ruggedization levels, including an air-cooled version (IEEE 1386-2001) and a conduction-cooled version (ANSI/VITA 20-2001).

www.rugged.com **AITECH**

Ultra-rugged IP67 PDA

The TETRApad is an ultra-rugged, IP67 waterproof and dustproof PDA for harsh environment applications. It comes in two versions: a MIL-STD-810F certified version or an optional MIL-STD461D version. TETRApad runs on an Intel Bulverde PXA270 processor at 624 MHz and features Bluetooth v.2, WLAN 802.11b,g, GSM, GPRS, EDGE, and GPS. The PDA also offers a 4" VGA (640 x 480) transflective and resistive touch screen, high brightness, and sunlight-readable display. TETRApad operates on an Li-ion 3900 mAH battery and internal backup battery, and supports WinCE.NET 5.0/Windows Mobile 2005 premium (phone edition).

www.tetracomputer.com **LOGIC INSTRUMENT**

Data recorders

The Vortex AES-256 data encryption/decryption recording and playback system acquires data over an I/O PMC and handles it in one of three ways: encrypts the data and records it to JBOD or RAID storage devices, passes the data through to a workstation, or plays back the encrypted data from storage to a workstation with AES-256 decryption. AES-256's easy-to-use web browser GUI enables operators to have a single interface for all functions, and software is available in source code for customized applications.

www.vmetro.com

VMETRO, INC.

3RU dual-processor server

Themis' new RES-32DCX, a 3RU dual-processor server, combines the robust design of the RES family with low-power, low-voltage, dual socket, Dual-Core Intel Xeon processing power. The rugged server is ideal for use in demanding environments and combines one or two Intel Dual-Core Xeon processors – up to 3.73 GHz with 4 MB L2 Cache – with the Intel 5000X (Greencreek) and ESB2 chipset, achieving I/O configuration flexibility and high reliability in shock and vibration environments up to 25 *g*. Other features include up to 32 GB ECC registered DDRII-667 SDRAM memory, 1333 MHz front side bus, up to five removable Ultra320 SCSI or SATA-2 drives, and CD-RW/DVD-RW drive storage options. 3RU system dimensions (HWD) are 133 mm x 17.1" (19" front panel) x 20.0" (508.0 mm).

www.themis.com

THEMIS

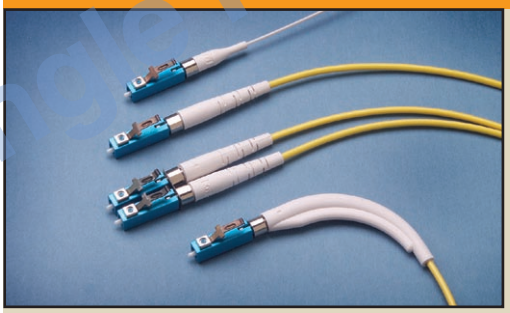
High-precision op-amp

The LMP2012WGLQMLV is a high-precision op-amp that eliminates 1/f voltage and current noise, providing ultra-high levels of accuracy and stability over time and a wide range of temperatures. The op-amp, which operates from a supply voltage of 2.7 V to 5 V, is radiation tested to 50 K rad (Si) and displays Common-Mode Rejection Ratio (CMRR) and Power Supply Rejection Ratio (PSRR) ratings of 90 dB over the full space temperature range. The LMP2012WGLQMLV offers a low input offset voltage of 60 microvolts over the extended temperature range of -55 °C to 125 °C. It also provides 4 V/microsecond slew rate and wide gain-bandwidth of 3 MHz for accurate signal amplification. Other key specifications include input-referred voltage noise of 35 nV/sqrt Hz and open-loop gain greater than 100 dB.

www.national.com

NATIONAL SEMICONDUCTOR

Metallic optical connectors



Molex has introduced its LC2 metallic optical connectors, which provide a ruggedized, all-metal housing version of its LC Small Form Factor (SFF) family. With a 1.25 mm (.049") LumaCore terminus, the LC2 connectors feature high-performance ceramic ferrules available for single-mode, multimode, and angle-polish applications, along with hex register alignment to enable individual fiber connection tuning. The connectors come in multiple boot styles and support many cable sizes including 900 µm, 1.20, 1.60, 1.80, and 2.00 mm (.079", .047", .063", and .070"). LC2 connectors can operate continuously at temperatures up to 135 °C and at short-term temperatures up to 150 °C. They are suitable for severe environment applications such as space, military COTS, aviation, and aerospace. When terminated, LC2 connectors meet the requirements of Telecordia GR-326-CORE and TIA/EIA-604-10a (FOCIS-10).

www.molex.com

MOLEX

Rugged 4U RAID server

The Raptor-R48-RAID is a rugged 4U RAID server built to meet the rigorous demands of the military marketplace. The RAID system includes eight 5.25" external hot swap drive bays that provide OEM and military customers with a great degree of flexibility in configuring a 4U rugged RAID system for a wide variety of mission-critical applications. The MIL-SPEC chassis is designed for standard 19" rack mounting with a height of four rack units and a depth of 21". The RAPTOR-R48-RAID has been designed with shock-mounted components to provide system stability in the harshest of environments, and it can also be custom configured to meet specific program requirements.

www.coresystemsusa.com

CORE SYSTEMS

GE Fanuc
Embedded Systems

Flexibility like this deserves applause

Introducing the industry's most flexible 6U Compact PCI single board computers

Of course, you could change your project. But wouldn't it be better if you didn't have to? If you could find the single board computer that precisely meets your needs? Look no further. The new Intel®-based family of PICMG 2.1-compliant 6U CompactPCI SBCs from GE Fanuc Embedded Systems is characterized by outstanding flexibility in the range of options it offers. Market-leading performance is a given – and remarkably low power dissipation, coupled with optional ruggedization, means it can perform in the most challenging environments.

But it's in its flexibility that it excels. Three choices of processor, including a state of the art Intel® Core™2 Duo processor – coupled with ATI 2D and 3D graphics. Up to 4GB memory (soldered, in order to maximize robustness and reliability). Dual Gigabit Ethernet. Flash drive or UDMA hard disk – or both. Two RAID-capable SATA channels. Two PMC sites. Four USB 2.0 ports. There's even a choice of operating system.

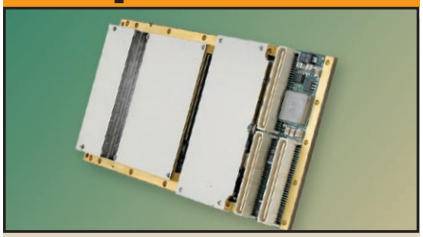
The CP11, CT11 and CR11 from GE Fanuc Embedded Systems. We designed them to be flexible so you don't have to be.

www.gefanucembedded.com

CR11
6U Compact PCI
single board computer with
Intel® Core™2 Duo or
Intel® Core™ Duo processors

GE FANUC

FPGA PMC compute nodes



Based on the Xilinx V-4 LX200, LX160, and SX55 devices, the MM-71xx series of compute nodes can be utilized on PowerPC and x86 SBCs, Altivec DSP boards, A/D converters, graphic engines, or any carrier that has a PCI Mezzanine Card (PMC) site. Targeting applications such as synthetic aperture and phased array radar, Software-Defined Radio, signal intelligence, and semiconductor and medical imaging, the combination of V-4's and the CoSine preconfigured FPGA infrastructure execute DSP operations such as FFTs, filters, and image or data compression. MM-7105, MM-7110, and MM-7115 offer more than 89 K FPGA slices (with some configurations exceeding 156 K FPGA slices), and also feature more than 600 Xtreme DSP slices. The series comes with additional platform flash to store secondary bitstreams for reconfigurable processing. Rugged convection-cooled and rugged conduction-cooled models are available.

www.micromemory.com

MICRO MEMORY

Modular PC/104 system

The Dragon is an advanced, ruggedized PC/104 and PC/104-*Plus* system in an enclosed, modular casing, ideal for data acquisition and recording under harsh conditions. The MIL-STD-1553, MIL-STD-1760, ARINC 429/575, ARINC-708 system features serial RS-485/422/232, CAN, or MMSI. The conduction-cooled Dragon, which operates at -40 °C to +85 °C, has a modular design to enable designers to build tailor-made configurations based on Excalibur's and other commercially available PC/104 and PC/104-*Plus* cards. The system comes with military-style waterproof connectors and seals and EMI/RFI protection for the inner electronics.

www.mil-1553.com

EXCALIBUR SYSTEMS

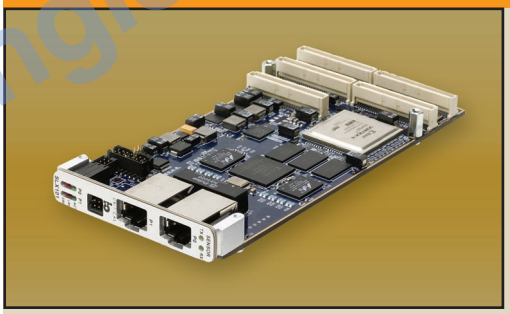
AdvancedMC WiMAX platform

NetStructure is an AdvancedMC form factor WiMAX baseband card that can be plugged into a MicroTCA backplane or used in AdvancedTCA systems. The platform runs on an Intel IXP2350 processor up to 900 MHz and features a compact form factor well suited for space-constrained environments in commercial, military, and government applications. NetStructure is ideal for creating micro, macro, and pico base stations solutions, and optical radio connections facilitate tower-mounted radio heads and/or base station hotelling deployment scenarios. Its Open Base Station Architecture Initiative (OBSAI)-compliant interfaces enable solution developers to concentrate efforts on system-level innovations. The card complies with WiMAX Forum standards for the IEEE 802.16 architecture, ensuring interoperability with WiMAX client devices, including those based on the Intel PRO/Wireless 5116 broadband interface. Remote software upgrades and Intelligent Platform Management Interface (IPMI) are included.

www.intel.com

INTEL CORPORATION

Wideband sensor I/O



SensorLink is a wideband sensor I/O that allows easy connection and management for 1 and 10 GbE networks, enabling an Ethernet sensor fabric for high-performance systems. SensorLink enables Ethernet data networks to be applied to even the most demanding real-time system applications such as radar, data acquisition, sonar, FLIR, SIGINT, video distribution, and signal processing. The sensor I/O is self-contained and offers wire-speed throughput with very low latency. It simplifies sensor management by allowing remote processors to configure, control, and monitor sensors through the same Ethernet connection without interrupting the sensors' real-time data flow. Meanwhile, built-in intelligence means that no software is required on the sensor side.

www.criticalio.com

CRITICAL I/O, INC.

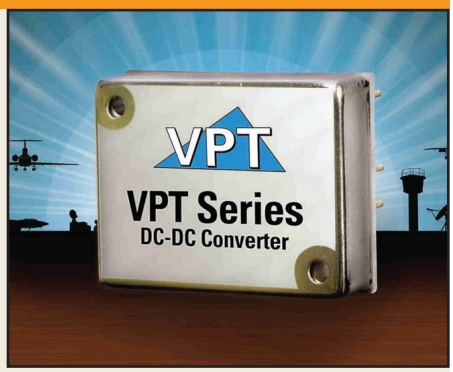
Low-power, embedded end node

The Millenial Net MeshScape EN5424 end node is a compact, low-power embedded device integrated by Trace Systems for military use, to connect sensors to a wireless sensor network. MeshScape is a complete wireless networking system based on industry standard IEEE 802.15.4 and features a worldwide license-free 2.4 GHz ISM radio band with 16 user-selectable channels. The device has ultra-low power consumption, requiring voltage as low as 4 µA on the average, and contains a robust, responsive "self-forming and self-healing" network. MeshScape can scale with the application to hundreds of sensor nodes with minimal overhead. It is ideally suited for applications including unmanned ground sensors, border security, C4ISR, and surveillance.

www.tracesystems.com

TRACE SYSTEMS

DC-DC converters and filters



The VPT Series of DC-DC converters and filters provides 5 to 100 W output power while satisfying COTS directives of less-cost-plus-high-reliability for military and avionics systems. Thirteen converters range from 5 to 100 W, and two EMI filters are at 1 A and 3 A max current. Single output configurations include 3.3 V, 5 V, 12 V, 15 V, and 28 V (100 W version only). The lightweight, compact VPT Series offers ultra-high reliability performance through a patented magnetic feedback circuit with no optoisolators. The VPT series complies with the JSTD-001 standard and is designed for the MIL-STD-704A-E input range, while its filters satisfy the requirements of MIL-STD-461C, D, and E EMC. The connectors' operating temperature range is -55 °C to +100 °C as standard.

www.vpt-inc.com

VPT, INC.

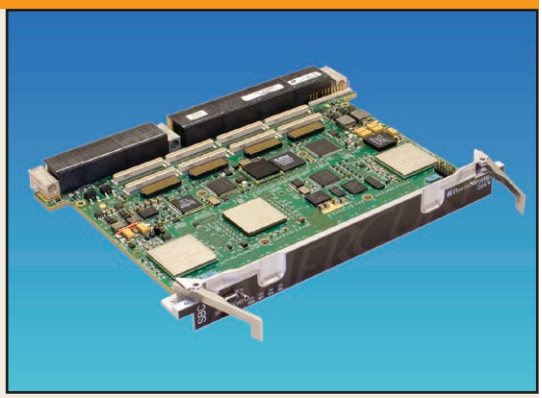
User-configurable FPGA modules

The PMC-CX is a user-configurable FPGA module featuring conduction cooling and differential digital I/O in a cost/performance mix suitable for many mid-level computing functions. Multifaceted I/O includes 32 bidirectional RS-422/485 differential I/O lines or 16 bidirectional CMOS I/O lines, along with rear I/O connection. The PMC-CX includes a customizable FPGA with 11,500 or 24,192 logic cells (Xilinx Virtex-II XC2V1000 or XC2V2000), and FPGA code loads from the PCI bus or flash memory. The module includes 256 K x 36-bit dual ported SRAM memory, and it supports dual DMA channel data transfer to CPU and both 5 V and 3.3 V signaling. The PMC-CX operates at extended temperatures of -40 °C to 85 °C.

www.acromag.com

ACROMAG

"Smart" single board computers



The PowerStream 6600 is a "smart," processor-based I/O mezzanine carrier SBC. It is powered by two MPC8548 processors at 800 MHz, which can serve as application processors or I/O engines servicing the respective mezzanine card sites. Memory includes DRAM of 512 MB, 533 MHz, DDR2 per processor; flash includes boot and diagnostics 4 MB, application 128 MB. Two mezzanine cards support 2.5 Gbaud x4 PCI Express XMC and PMC interfaces; RapidIO on XMC cards is also supported. The PowerStream 6600 provides system integrators with an established ecosystem of option cards that can be incorporated into mission and production systems.

www.mc.com

MERCURY COMPUTER SYSTEMS

Benchtop wind tunnels

The BWT-104 is a research quality, open loop, benchtop wind tunnel for thermal characterization of components, circuit boards, and cooling devices such as heat sinks, heat exchangers, and cold plates. The polynomial shape and internal flow management system include honeycombs and screens to break up turbulence and provide uniform, homogeneous flow, up to 6 m/s (1,200 ft/min) within the test section. The BWT-104 has 12 ports that allow a variety of probes – such as thermocouples, Pitot tubes, and temperature and velocity sensors – to be inserted throughout the test section. The wind tunnel is made from aluminum and Plexiglas and provides a clear view of the test section for flow visualization. Each BWT-104 fan tray is equipped with three 24 Vdc fans.

www.qats.com

ADVANCED THERMAL SOLUTIONS

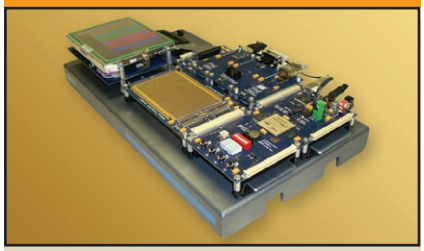
Low-profile OCXO

NV45G1480 is a 100 MHZ operating frequency Ovenized Crystal Oscillator (OCXO) in a low-profile (0.53" maximum) package. It generates optimal noise performance and supports phase-locked microwave signal sources such as Dielectric Resonator Oscillators (DROs), test equipment, microwave communication systems, and military and Doppler radar applications. The NV45G1480 oscillator provides phase noise performance (typical) of 130 dBc @ 100 Hz offset, stabilities as tight as ±50 ppb over temperature, high power output of 15 dBm, and low power consumption (1 W typical at 25 °C).

www.bliley.com

BLILEY TECHNOLOGIES, INC.

Development framework



The UnifiedLogic development framework is composed of hardware, development tools, and software to help developers move efficiently from concept to working prototype. The Eridon IDE features a powerful C/C++ code editing environment and automates the entire compilation and build process. It also includes multiple console windows and high-speed debug and target communications capabilities. The UnifiedLogic prototyping development board (Xilinx FPGA-based) runs on PowerPC and MicroBlaze processors. It interconnects with a full selection of function-specific, modular UnifiedLogic uCards and Eridon IDE to provide a complete prototyping platform. UnifiedLogic uCards interconnect with the UnifiedLogic Development Board to add various I/O capabilities, and each uCard includes FPGA IP, driver support, schematic, and full BOM. uCards are available for 10/100 Ethernet, USB 2.0 OTG, NTSC/PAL video, DVI, VGA, CANbus, and RS-485/232.

www.eridon.com

ERIDON

VME64x COTS chassis

The 7008 is an 8U 21-slot VME 64x COTS chassis with a field replaceable fan assembly including three high-flow DC fans. Full access to all slots for 6u x160 front cards and 6u x80 rear transition modules is offered, and the chassis has a front-mounted, illuminated, cover-protected power switch (up to 1,500 W power consumption). The 7008 comes with a flush-mount or 2" recessed card cage, and many backplane options such as VME and CompactPCI are offered.

www.datametrics.com

DATA METRICS

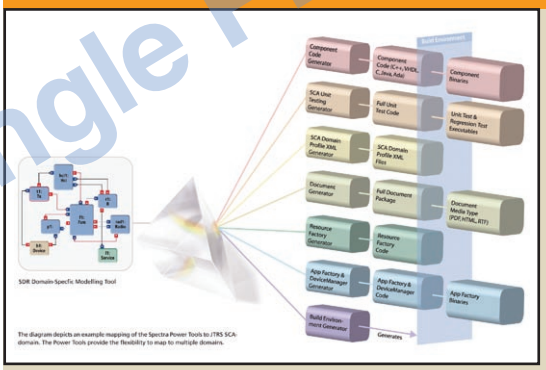
Acoustic data acquisition/conversion

daqNet is a fully integrated acoustic data acquisition/conversion system available in a rackmount 1U form factor, characterized by its high channel density analog (192 channels) and digital (240 channels) I/O. The system's compact size makes it appropriate for a broad range of sonar applications in surface ships and submarines, in vibration analysis, and in test and measurement. The daqNet server is easily configurable via the redundant dual GbE connections using the SNMP protocol. With its plug-and-play capabilities, daqNet can be connected to the network, configured with the sample application provided, and the connection tested through hardware-implemented A/D and D/A test channels. daqNet is customizable using any combination of up to four I/O modules – analog input, analog output, or digital I/O. Each daqNet supports master/slave configuration for redundancy in the event of a failure.

www.radstone.com

RADSTONE EMBEDDED COMPUTING

SDR development tools

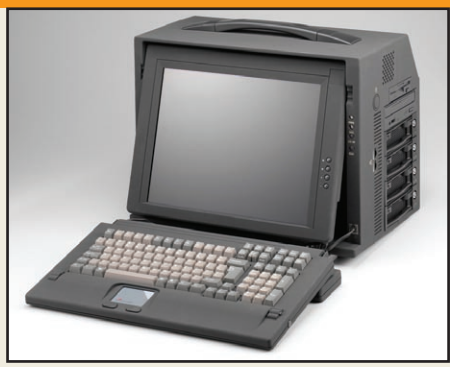


The Spectra tool for SDR application development includes SCA and IEEE standards-based embedded software platforms and MDE tools for OEM developers of reconfigurable, multimode SDRs. The Spectra operating environment provides a high-performance, low-overhead core framework and middleware implementation that runs on any mix of GPP, DSP, and FPGA processor technologies. Spectra code generators autogenerate source and test code directly from the models designed in Spectra SE and PE and are available for many languages including C/C++ and VHDL. Spectra SDR tools support tool-chain integration by leveraging the Eclipse framework to facilitate third-party tool integration to produce the required developer workflow. Spectra SDR tools raise waveform and platform developer productivity by leveraging MDA and DSL technologies to provide an advanced modeling capability designed specifically for the SDR domain.

www.prismtechnologies.com

PRISMTECH

Field/Mobile applications data recorder



The Big River P440 data recorder delivers more than 400 MBps sustained recording and playback performance for field or mobile applications. It features an Intel Core 2 Duo processor, GbE connectivity, and expansion PCI slots for optional third-party, high-speed acquisition I/O boards. Capacities up to 3.2 TB are available for hours of continuous recording. The P440 includes the StreamStor Amazon disk controller, 16 high-capacity 2.5" notebook disk drives, and a high-resolution flat panel screen display. The data recorder also supports FPDP, LVDS, and Serial FPDP (optical) interfaces and is compatible with numerous PCI bus I/O boards.

www.conduant.com

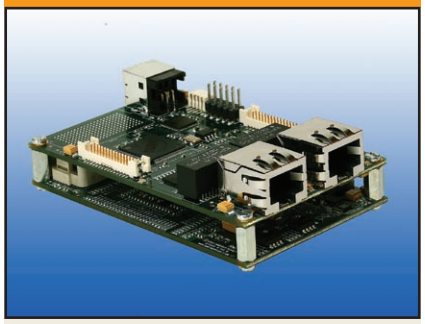
CONDUANT CORP.

Tactical Visual Computers (TVCs)

The Thermite Tactical Visual Computer (TVC), which has been selected for testing in the U.S. Marine Corps' Expeditionary Fighting Vehicle (EFV), is a multirole, small form factor, COTS computer. It is designed to enable PC-based embedded training, mission rehearsal, C4ISR, and C2 applications to be deployed in both vehicle-based and man-wearable extended environments. Thermite TVC features advanced embedded computing, mobile graphics, video capture and display, low power consumption, and extensive I/O in a lightweight, conduction-cooled alloy enclosure for operation in MIL-STD-810F and MIL-STD-461E harsh environments.

www.quantum3d.com
QUANTUM3D

PPC-based SFF serial I/O module



The EP440xS SBC and its companion I/O board create a powerful Small Form Factor (SFF) stack for developing networked RS-232 control platforms. At 3.5" x 2.2" x 1.5" (8.9 cm x 5.6 cm x 3.8 cm) and powered by an AMCC 440EPx PowerPC processor at up to 667 MHz, the stack offers up to 256 MB of DDRII RAM with ECC support and up to 128 MB of NOR flash. The I/O board provides up to 512 MB additional NAND flash, 2 GbE ports, 12 RS-232 serial ports, 1 USB 2.0 port, and JTAG support.

www.embeddedplanet.com
EMBEDDED PLANET

LCD flat panel monitor

The RoHS- and NEMA4/IP65-compliant FPM-3170G is a 17" SXGA TFT LCD flat panel monitor with 1,280 x 1,024 resolution and Direct-VGA, DVI, video, and S-video inputs. The large screen presents vivid images, and direct VGA signal transmission enables display upgrades without requiring changes to the user's system. Other features include an OSD control pad on the front panel, an anti-reflective screen with tempered glass, hard anodic coating to prevent panel abrasion and acid corrosion, and a stainless steel chassis and aluminum front panel.

www.eautomationpro.com/us
ADVANTECH, eAUTOMATION GROUP

HONORABLE MENTION PRODUCTS

The 26 products contained in this special *MIL/COTS DIGEST* supplement represent the "best of the best" of those products recently added to our database or those that fit the criteria I used for my totally subjective choices. However, there were a handful more – the eight listed below – that came so close that I've listed them here as "Honorable Mentions." That doesn't mean they are second-best; it merely means we ran out of room and I had to draw the line somewhere.

Chris Ciufo, Editor

Company	Model	Description	Website
ACCES I/O Products	104-IDI-48 Series	A family of 48-channel optically isolated digital input boards in a PC/104 form factor, featuring 48 individually optically isolated AC/DC inputs	www.accesio.com
AdaCore	GNAT Pro v 6.0.1	An Ada development environment comprising a full Ada compiler based on the GNU GCC technology, an IDE, a comprehensive toolsuite, and a set of libraries and bindings	www.adacore.com
Apollo Displays	DV-SLIM	A low-cost universal DVI controller with an ultra-low profile for TFT LCDs	www.apollodisplays.com
Core Systems	MCR1519	A 1U rugged 15" clamshell LCD in a 19" depth that meets MIL-STD-167-1 and MIL-S-901D	www.coresystemsusa.com
Logic Instrument	TETRAnote EX	An ultra-ruggedized notebook computer certified in accordance with MIL-STD-810F and MIL-STD-461	www.tetracomputer.com
PQI Corporation	Turbo SATA2.5" SSD	An industrial-quality SATA Solid State Disk (SSD) compatible with SATA interfaces with a standard 2.5" disk form factor	www.pqimemory.com
QP Semiconductor	CMOS UV PROMs	A family of high-speed CMOS UV PROMs that are pin-for-pin replacements for Cypress PROMS	www.qpsemi.com
VMETRO	AD3000 3GSPS ADC	A single-channel 3 GSps ADC utilizing National Semiconductor ADC083000 8-bit converters	www.vmetro.com

ONE OF THE MOST RUGGED PIECES OF EQUIPMENT IN ITS CLASS.

SO IS THE TANK.

Not all rugged boards are the same. Neither are the companies that make them. At Curtiss-Wright, we're fully focused on the unique and demanding requirements of the rugged defense and aerospace market. That's why our design philosophy encompasses every critical area of rugged product design. Whether it's unique thermal demands, extreme shock and vibration, or even the latest requirements for line-replaceable modules and two-level maintenance, our approach to ruggedization goes above and beyond.

The VPX6-185 single board computer is just one example in our broad range of ruggedized board-level and subsystems products. It's VPX format is expressly designed to bring advanced serial fabric I/O performance to rugged defense and aerospace computing platforms.

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