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MIL TECH TRENDS: INDUSTRY EXEC Q&A ROUNDTABLE

The COTS Technology Authority

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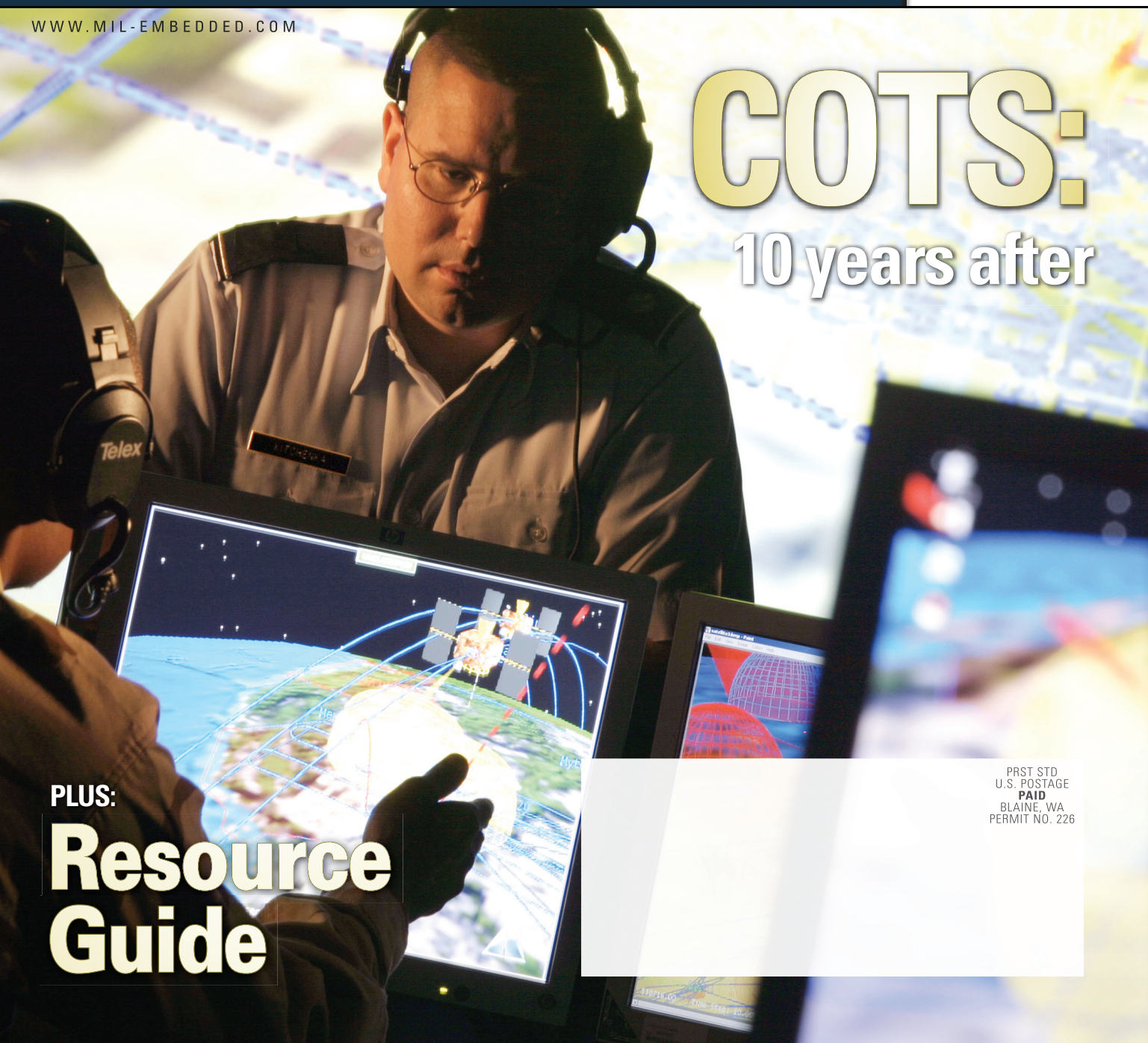

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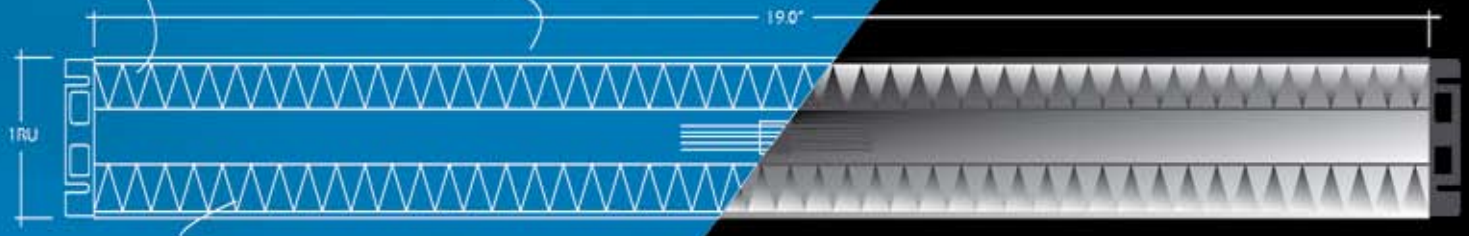

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COVER:
An Air Operations Center, whether forwardly deployed in theater or CONUS, relies on COTS technology in more ways than one can measure. From the displays to the computers and consoles to the backbone networks and infrastructure, these mil systems mirror leading-edge desktop, server, and telecom equipment. Before COTS, an AOC would've been built with MIL-SPEC technology, and its capabilities probably would have been years behind that available in the civilian world.

Today, the military relies on COTS as an underlying enabler. But what have we learned in the past 10 years? And, where will we be heading in the next 10 years? See our executive *roundtable* Q&A in Mil Tech Trends, starting on page 34.

(Photo courtesy of Lockheed Martin Corporation)

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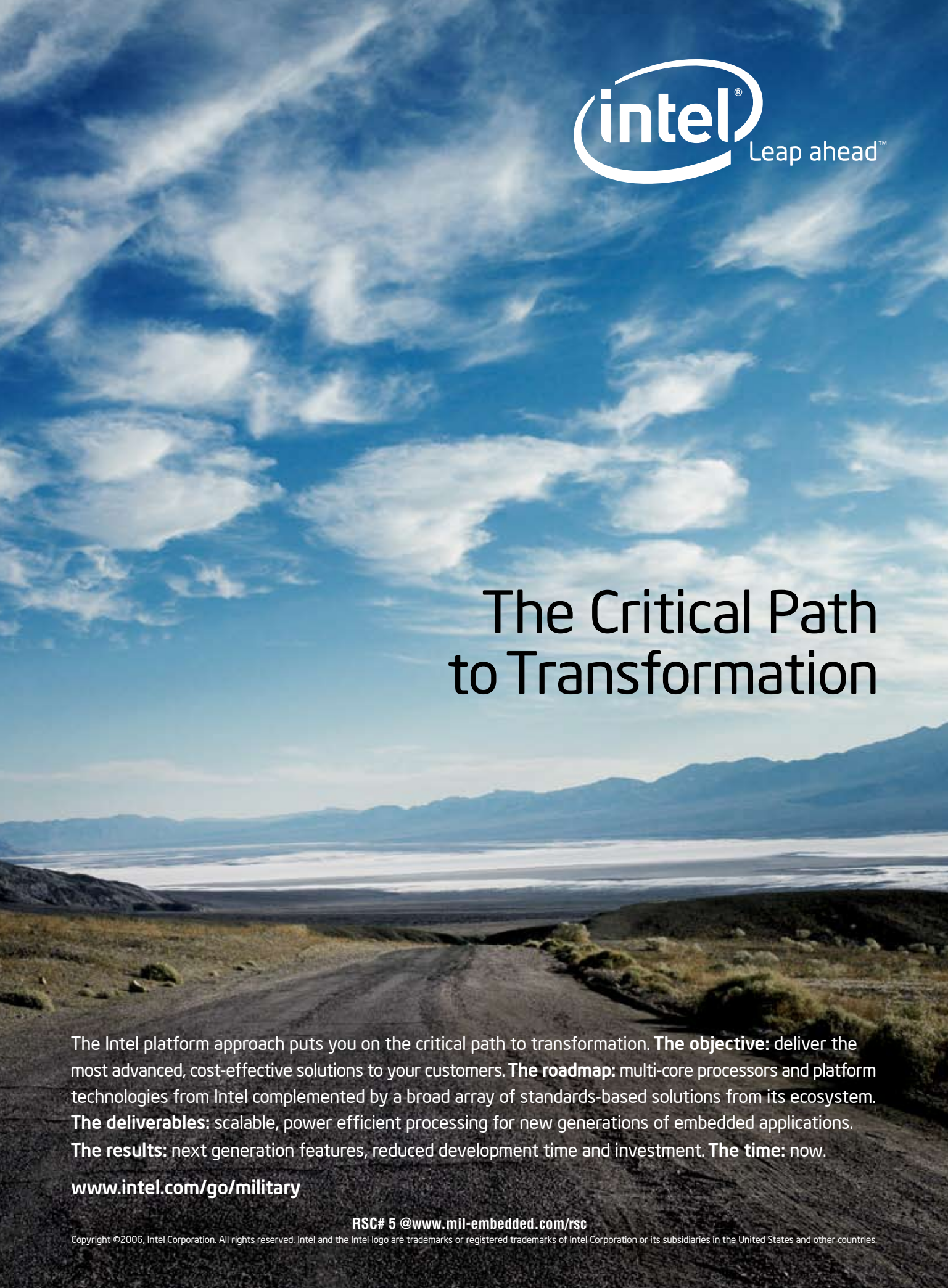

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sec

Improving system reliability and availability with hardware platform management

By Joe Pavlat

The nature of global conflict is changing in very fundamental ways. The Cold War that most of us grew up with wasn't a war at all, but rather a political and diplomatic conflict between two large countries that ended with the collapse of communism. It was not a result of outright military victory. The Global War On Terror (GWOT) often does involve more direct armed conflict, but it tends to occur on a relatively small scale over wide geographies. Waging war is increasingly precise and based on near real-time intelligence and communication. Precision munitions can target small and specific targets based on information gathered only minutes or a few hours before. All of this requires sensor platforms and weaponry that work together.

As a result, military electronics systems are becoming ever more sophisticated. Computers and communications are fundamental to today's warfighters and warplanners, and previously isolated systems are being integrated and interconnected at a rapid rate. Military computer systems range from ordinary desktops and laptops to extremely rugged mobile and airborne platforms that can withstand extremes of shock, vibration, and temperature. Reliability is no longer a simple matter of determining the Mean Time Between Failure (MTBF) of a single box, and the robustness of entire networks has become extremely important.

A key ingredient to managing any network, military or civilian, is the ability to constantly maintain the health and continuous operation of network elements. Network operators must be able to remotely monitor everything from data flow through communications links down to the temperature inside a chassis and its power supply voltages. Networks must be capable of a variety of repairs, including reconfiguration in the event of hardware failures, software rebooting or upgrading, and dispatching a human to replace failed components or systems.

This capability, known as *hardware plaform management* (the lowest layer of the much bigger area of overall system management), is at the core of any robust network. It consists of a combination of hardware, software, and human intervention.

Hardware platform management typically monitors low-level functions such as power supply voltages and currents, temperatures, fan operation, and watchdog timers. Instead of discrete control lines that are different for every application, system designers increasingly use standardized interfaces such as the Intelligent Platform Management Interface (IPMI), a specification for the equipment that monitors the physical environment and behavior of a computer hardware server. The specification, developed jointly by Intel, Hewlett-Packard, Dell, and NEC, is intended to cover the regulation of temperature, voltage, and power, and to ensure the proper operation of the firmware and the Intelligent Platform Management Bus (IPMB), a specification that defines an internal management bus for extending platform management within a chassis.

Management information is requested and provided in packets, often via a dedicated microcontroller. Managed devices can be either connected in a bused fashion or over dedicated radial lines. Radial lines are individual lines that *radiate* from a central controller. Each managed device uses a dedicated radial line to communicate with the management controller. In this fashion, one failed/shorted line will not fail the entire system. In order to keep the management subsystem operating in the event of a failure, dual redundant IPMBs are often implemented. PICMG's AdvancedTCA specification embodies advanced hardware platform management concepts and uses IPMI and IPMB for low-level control.

Within AdvancedTCA, the hardware platform management system does more than just monitor performance. It is capable of analyzing backplane topologies and interconnect technologies and determining if a board should be connected to the backplane. It can also compare the power a board needs and the power a chassis can deliver, and determine if the board should be powered-up. Board and software revision levels can also be monitored to determine if a board is proper for the specific application. It can also interact with high-availability middleware or even act autonomously to switch out failed resources and switch in redundant backup, sometimes in just milliseconds. For more information on the AdvancedTCA specification, visit www.picmg.org/specifications.stm.

Low-level hardware platform management subsystems based on IPMI and IPMB generally interact with higher-level system software that manages larger parts of the network or the entire network itself. One common networking standard used for this interaction is called Simple Network Management Protocol or SNMP. Most AdvancedTCA shelves (AdvancedTCA speak for *chassis*) support SNMP access to the components installed in the shelf. For more information, visit www.snmplink.org.

Another potential protocol for communication between the hardware platform management layer and an overall system manager is the Remote Management Control Protocol (RMCP). RMCP is based on User Datagram Protocol (UDP) and is mandatory in all AdvancedTCA shelves.

The higher-level management messages using these or other protocols collect information about elements in a network, including the state of processing resources, storage devices, and network links. Messages can be either *in-band*, wherein they are carried over the main data transport paths, or *out-of-band* via specialized management channels. IP-based messaging over Ethernet is the most common messaging method. A wide range of tasks can be performed that

range from keeping a log of significant exception events and overall network performance to e-mailing or paging a repair depot in the event that some hardware must be replaced.

Military computing networks have become the backbone of modern warfare. Keeping them operating continuously, reconfiguring them transparently, and updating software automatically have become essential, and system management at all levels is no longer an option. AdvancedTCA's mandatory and thoroughly architected hardware platform management facilities provide an excellent base for these much-needed management functions.

Special thanks to Mark Overgaard, Pigeon Point Systems, for his review of this column and his comments.

For more information, contact Joe at jpavlat@opensystems-publishing.com.

Board-level vendors fail the integration challenge

By Duncan Young

Many of today's defense and aerospace embedded computer vendors, such as Radstone, SBS, and others, were in business long before COTS was invented in 1995 by then-Secretary of Defense Dr. William Perry. The concept of deployable, modular, board-level, embedded computers has been around since the Intel 8086 and Multibus. As a result of the momentous shift in component selection from MIL-STD to commercial specification, embedded computing product lines such as VMEbus and CompactPCI have flourished. However, after a decade of steady growth, the majority of COTS vendors' revenues still come from board-level sales. This is counter to accepted business wisdom that in order to accelerate growth and avoid stagnation, high technology companies must move to higher levels of integration and, hence, greater intellectual content and added value.

Progression up the food chain happens naturally as the skills and technologies required at a particular level of design, manufacture, or development become common industry practice or become commodities. A good example of this is the manufacture of semiconductor devices: Defense contractors like Boeing or Raytheon don't manufacture silicon devices anymore because the vast majority of parts used in their systems provide no added value or market differentiation. This natural progression is no threat to vendor or customer, just an opportunity for both as each moves into more profitable business activities. Generally prices fall and diversity of choice improves as the product or service that has become an industry standard becomes more widely adopted across many different segments of industry – both commercial and military.

That defense contractors no longer need to be vertically integrated to be profitable is demonstrated by their widespread and successful adoption of COTS assemblies and software for use in embedded computing applications. The next logical step in the defense system integration process – which today is performed by the defense contractor – is to take COTS assemblies and software and integrate them into a subsystem in a chassis with firmware, operating systems, drivers, and middleware. If they were offered an appealing proposition for this subsystem integration, few well-managed defense contractors would pass up the opportunity to become more competitive, earn more revenue, make more profit, and/or save costs in this way.

> "After a decade of steady growth, the majority of COTS vendors' revenues still come from board-level sales."

Hindsight suggests that until recently, board-level vendors were unable to offer such a subsystem integration proposition for two primary reasons:

- An overly complex approach to providing the end product – the one-stop shop approach
- Failure to standardize

The one-stop shop approach

Embedded computing requirements for defense and aerospace projects vary enormously from application to application. The assembly for a handheld radio will be very different from a combat aircraft's mission computer, which will be very different again from a naval combat system console. These all have different board sizes, connectors, chassis types, environmental requirements, performance, operating systems, drivers, and application software. However, in the final analysis, this level of subsystem integration boils down to executing a common set of tasks to produce an embeddable computer. In order to preempt any possible customer requirements, various COTS vendors tackled the problem head-on with an ambitious action plan, depicted in Table 1.

But, of course, developing all the elements of such an action plan rapidly becomes unsustainable. This forces a reduction of scope downwards to the support of only one operating system, one processor type, fewer I/O products, fewer chassis, limited middleware, built-in-test and diagnostics, plus the integrated product being offered to only one bounded application segment. Unfortunately, this places the COTS vendor and the military contractors within that application segment head-to-head in competition – not the appealing proposition for subsystem integration that the COTS vendor would like to offer.

Failure to standardize

Military subsystem integration is so complex because there are so many variables with which to contend. Industry bodies such as VITA and PICMG have made laudable efforts to standardize many aspects of embedded computing within their respective spheres of influence, but they have fallen short of defining interoperability for the next level of subsystem integration.

Too much is left to be user-defined, whether it is the inclusion of a function, connector pin-out, driver support, standard use of features, environmental standards, or power requirements.

Item	COTS vendor action plan
Third-party products	Support a broad range of third-party products and integrate them with all operating system ports
Applications	Develop applications expertise in order to relate to the customers' specific application needs
Built-in-test	Develop built-in test for power-up and background operation during application execution
Chassis	Offer a broad range of chassis types covering all environmental possibilities, from commercial/benign to fully ruggedized, and support many different slot counts and primary power sources
Development environment	Offer an off-the-shelf development environment tailored to the integrated product offering
Diagnostics	Develop diagnostics and prognostics for all combinations of supported products
Drivers	Add functionality to cover as many eventualities as possible
Manufacturing	Develop manufacturing procedures and universal test environments in order to manufacture deliverable, integrated subsystems
Middleware	Develop universal middleware to insulate customers' applications from the hardware specifics
Operating systems	Port all potential real-time operating systems to entire board-level product range
Partner program	Develop a tiered partner program

Table 1

The nature of embedded computing and the natural competitive forces that exist between COTS vendors encourage innovation and differentiation at the expense of ease of integration and, hence, ease of use.

Tackling the integration challenge

The all-or-nothing approach by COTS vendors has been demonstrated not to work for military embedded computing applications as the resultant price for an integrated subsystem, including recovery of investment, makes it unattractive to the contractors. However, other more pragmatic approaches to subsystem integration are being adopted by board-level vendors, resulting in cooperative partnerships that avoid competitive conflict and offer each party the opportunity to focus on the next level of their business.

SBS Technologies of Albuquerque, New Mexico has developed a set of principles for successful subsystem integration that has helped to secure recent contract awards for integrated subsystems supply and support. These programs include a dual vehicle management computer for an advanced, multi-role Unmanned Aerial Vehicle (UAV) being supplied to the Navy, plus a program to supply a replacement mission computer for a highly agile combat aircraft. In the case of the replacement mission computer, SBS is supplying the application software in partnership with a major software vendor and also supplying the integrated computer hardware. SBS' approach is outlined as follows:

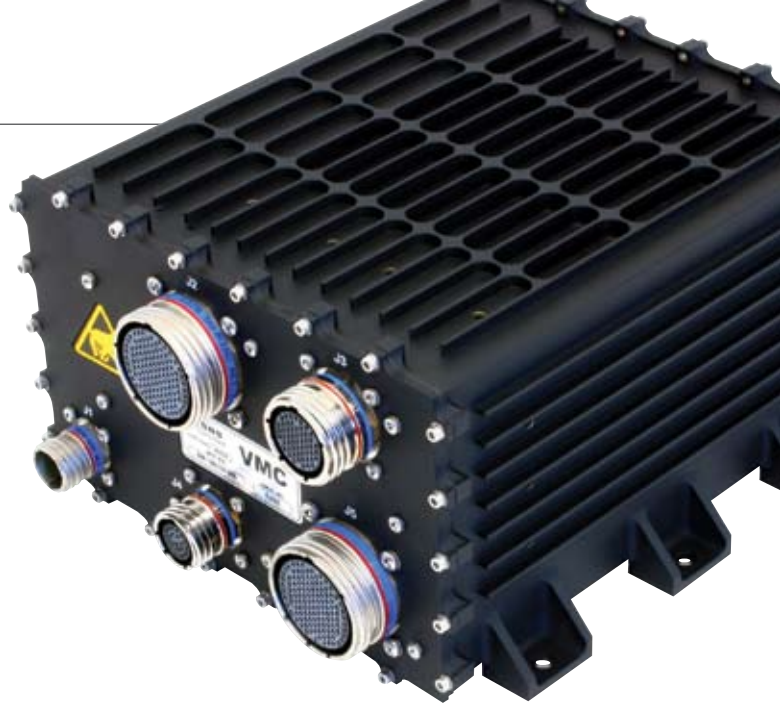
» **Infrastructure development –** Develop an infrastructure and mindset that encourages subsystem integration business development. This mindset is used to anticipate and accumulate knowledge of integration issues and may take many forms: recruit or develop experienced integration staff, recruit or develop an understanding of just how contractors use products in their projects, consider the impact of integration at every new product design step, create in-house standards where none exist, and seek out partners who can fill in essential capability gaps.

» **Attention and focus –** Focus attention on specific programs that fit well with existing or planned product lines and business objectives.

» **Long-term nature –** Recognize the long-term nature of program-oriented business. The Return On Investment (ROI) on the development of a board-level product is relatively short-term compared to the ROI on an integrated subsystem for a particular program. However, as the volume of board-level product is typically quite stable from year to year, revenue-growth opportunities are limited.

» **Complete solutions –** Offer whole solutions to military contractors, not lists of products and services.

» **Increasing responsibility –** Accept greater responsibility for the contractor's success. Although military COTS business is often believed to be as simple as the delivery of boards complying with the vendor's specification, this is

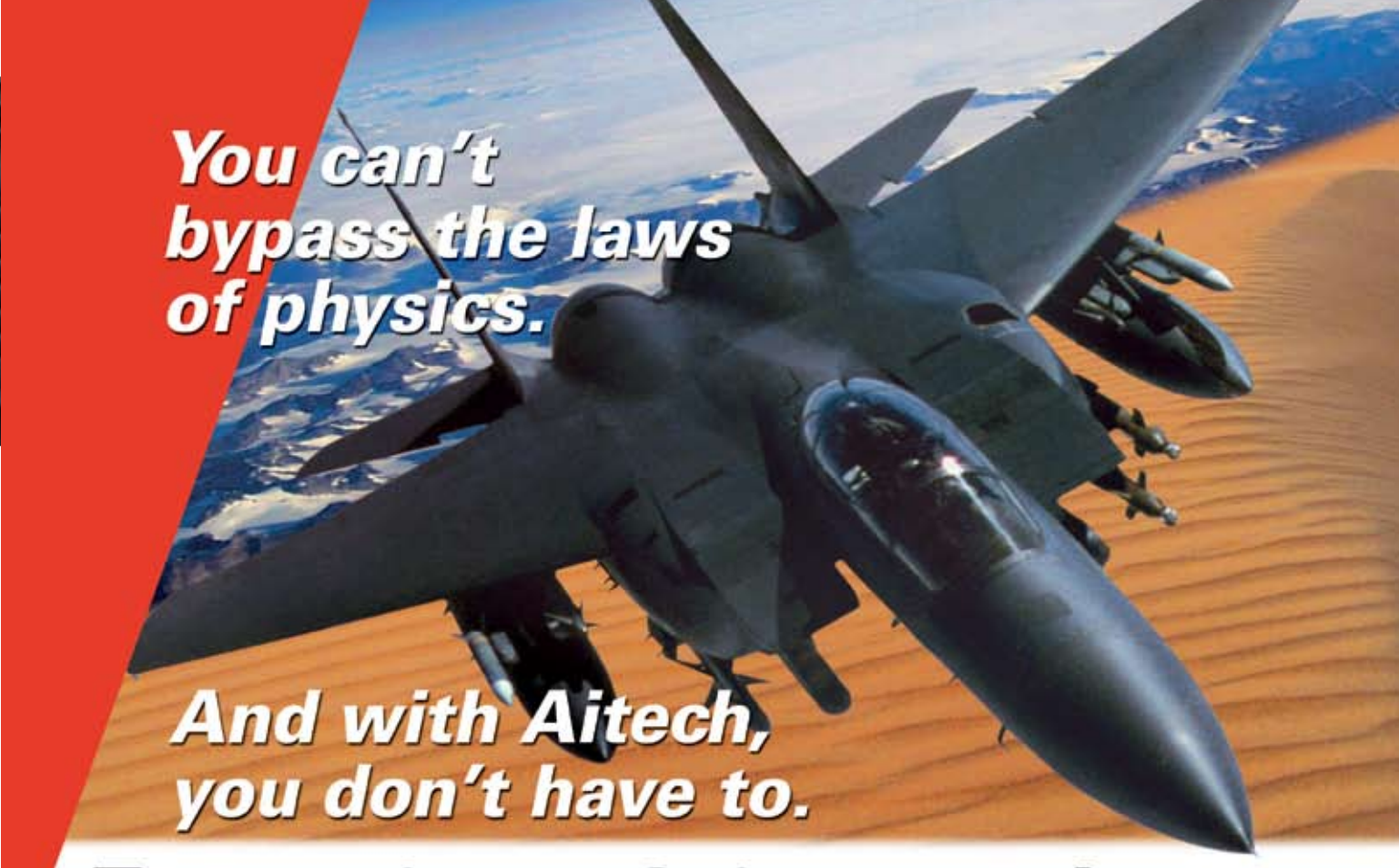


> **"The next logical step in the defense system integration process…is to take COTS assemblies and software and integrate them into a subsystem."**

not the case in practice. The long-term nature of programs requires strict configuration management, longevity of supply and repair promises, technology refresh roadmaps, and long-term technical support. An integrated subsystem takes this to a further level: long-term support of all hardware and software components, including items from third parties, Integrated Logistic Support (ILS) services, repair and maintenance procedures, and depot repair support.

Board-level vendors are now stepping up to the challenges of integration, offering a compelling business case to defense contractors who follow the natural order of growth and prosperity. There is further work to be done by the industry organizations to standardize the integration of COTS products from the wide variety of vendors in the marketplace. Recent VITA initiatives such as VITA 41, 46, and 48 represent real progress, though it is perhaps a reflection of VITA's membership that efforts in the past have been targeted toward hardware. In contrast, today's and tomorrow's real challenges lie with software. Standardization through collaborative efforts between the COTS industry and the military contractors will be one of the keys to unlock the transition to the next level of integration.

To learn more, e-mail Duncan at young.duncan1@btinternet.com or visit www.sbs.com.



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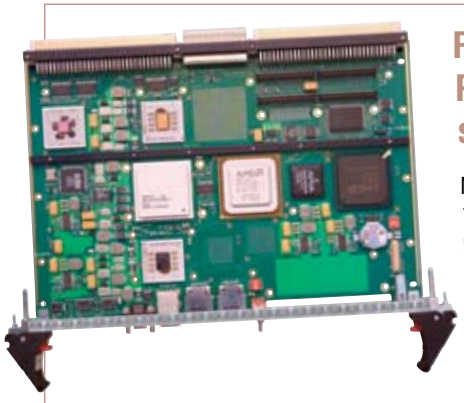


Rugged PowerPC blade server

Not every VME application flies an aircraft or fires a gun. In fact, a large part of military equipment pertains to the network that interconnects battlefield assets. Often, these connectivity nodes or command and control computers are rugged versions of existing servers and LANs. The Thales PowerNode5 goes one better than that: It is a fully binary-compatible yet rugged version of IBM's JS20 blade design. Based upon twin G5 IBM 970FX processors, this *VME clone* is available in extended temperature air- and conduction-cooled versions. Thales has a long-standing collaborative relationship with IBM.

The two 1.6 GHz processors offer a multiprocessor architecture that promises more horsepower than G3 or G4 units but with upward and backward compatibility. There are up to 2 Gb of DDR SDRAM with ECC, boasting a 6.4 Gbps peak bandwidth. And since this is a server product first and a harsh product second, the board has a Red Hat Linux SMP BSP – or Wind River's VxWorks, if you prefer. Other transport and management software includes MPI and HTTP. Input/output connectivity includes a Serial RapidIO switch for scalable build-outs, along with two GbE ports.

Thales Computers
www.thalescomputers.fr
RSC# 25641

ESC protection for high-speed PCI and memory buses

So the question is: Who doesn't have high-speed memory buses these days? Even though Intel has stopped its march toward faster and faster CPU clocks, the data to and from memory is going as fast as ever. Effective bus termination is essential to prevent ringing and other electromagnetic nasties. More importantly, ESD protection is paramount as IC oxides get thinner and become more susceptible to shock damage. The QDN Series termination networks from TT electronics IRC Advanced Film Division are designed to provide effective termination and ESC protection for both controlled and uncontrolled line terminations.

Capabilities of the QDN Series include load impedance terminations. High- and low-state reflection and noise clamping are key features. And no impedance matching is needed, making the networks ideal in high-speed SDRAM or PCI bus applications. The networks also reduce overshoot and undershoot for all data line types while they consume very little current themselves. The QDN series is available in three flavors: QDN001 with 36 Schottky diodes, QDN002 as a 17-channel ESC protection network, and QDN003 as an 18-channel Schottky diode termination net with 15 kV of HBM protection and 8 kV of ESC discharge protection.

TT electronics IRC Advanced Film Division
www.irctt.com
RSC# 30015

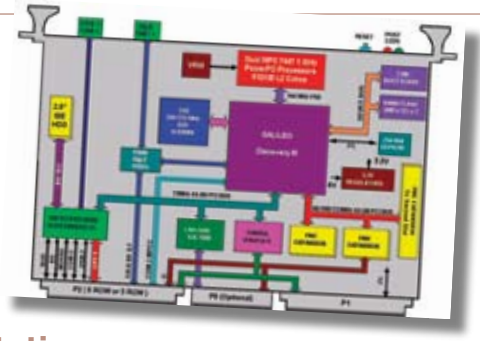
SecureDoc

Lock down disk drives

Even though solid-state media such as CompactFlash or solid-state disk drives are commonplace in small form factor embedded systems, newer and larger formats such as EPIC and Mini-ITX may rely on rotating magnetic disks. Often based upon 2.5" IDE notebook computer drives, sensitive data can sometimes fall into the wrong hands. To protect the data in these embedded systems, full-disk encryption software can be highly effective.

WinMagic's SecureDoc software is designed to encrypt an entire disk while employing secure user authentication during a computer's pre-boot sequence. This pre-boot authentication is unique and can utilize multifactor authentication such as a combination of password, hardware token (such as a USB or other key), biometrics (such as a fingerprint reader), and Public Key Infrastructure (PKI). Although not necessary, when combined with silicon hardware capabilities such as Trusted Platform Computing, an embedded system's sensitive data is securely locked down and encrypted. SecureDoc is bundled in Toshiba notebooks sold in Japan.

WinMagic
www.winmagic.com
RSC# 29706



Workstation functionality, single board footprint

VME innovator General Micro Systems has a Houdini-like reputation for cramming 10 pounds into a 5-pound VME box. And their Maverick V394 is no exception (see block diagram). The workstation-like single board computer includes dual 1 GHz 7447 AltiVec PowerPCs, up to 1 Gb of DDR SDRAM in SODIMM modules, multiprocessing support, and a Swiss Army Knife Discovery III system controller. The list of features is – as usual for GMS – astounding. Here goes:

There are 32 Mb of application flash and 2 Mb of boot flash, along with two 64-bit 66/100 MHz PMC sites – one of them with rear I/O routing. There are also two USB ports, IDE, serial ports, PS/2 and keyboard ports, ultra SCSI, three GbE ports, a parallel port, and 21 digital I/O lines. Front-panel LEDs provide status and power on self-test results. Frankly, we wouldn't be surprised if there's even more functionality than what's listed here, discovered only by digging through the V394's user manual.

General Micro Systems
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Military sets sights on JTAG to meet test coverage challenges imposed by COTS design

By Dominic Plunkett

The increasing deployment of FPGAs and other JTAG-enabled ICs across aerospace and defense products is forcing board designers to think again about boundary scan/JTAG test solutions.

Designers of military electronic systems are under intense commercial pressure to deliver advanced systems on time and on budget. Using leading-edge COTS semiconductor components is an effective way to achieve very high performance targets within tight time constraints, particularly for network-centric and C4ISR systems.

However, the prevalence of fine-pitch and Ball Grid Array (BGA) package styles among COTS devices restricts physical access to connect test probes during development and in production. This can hamper development work and may also prevent test engineers from achieving the levels of test coverage stipulated in the product or board specification.

Since modern boards afford negligible real estate for dedicated test access points, an alternative test technology is required that does not rely on extensive physical access to the board. Boundary scan or JTAG testing, as described in the IEEE1149.1 standard, offers a solution.

Boundary scan testing

The techniques for boundary scan testing were developed by the Joint Test Action Group (JTAG) and ratified by the IEEE in 1990. Test access was already under threat, but today's surface mount packages add an even greater sense of urgency. It appears that JTAG's time has come – an impression reinforced by the growing number of JTAG-compliant ICs now entering the market.

FPGA vendors are notable for offering a large number of JTAG-compliant components. Since these devices, such as the FPGA shown in Figure 1, can have more than 1,000 I/Os, it is not too surprising that board and test designers are turning to boundary scan testing in preference to alternatives that require physical probe access.

Testable, custom military silicon

With increasing use of military-qualified, JTAG-compliant devices, JTAG test gear can be used to test military boards even more extensively as the number of such nets continues to rise. Early collaboration between military chip designers and production test engineers can improve this situation still further.

Figure 1

For example, designers of Application Specific Integrated Circuits (ASICs) for military projects can directly influence test coverage for the better by designing JTAG circuitry into the silicon from the outset. This will significantly ease the task of ensuring the board reaches its testability targets. Military designers also have greater freedom than their commercial counterparts to implement JTAG circuitry on-chip because low production volumes and the high value of each component mean there is less price pressure to minimize die area.

About boundary scan testing

The IEEE 1149.1 standard defines a standard test access port and boundary scan architecture comprising shift registers and a state machine to execute boundary scan functions, which must be implemented in the silicon of a complex IC.

This circuitry allows a sequence of test bits to be clocked serially through the device. The test sequence can be designed to stimulate the device core, drive and sense device outputs, and sense inputs. The Printed Circuit Board (PCB) must be designed to connect multiple ICs via this integrated boundary scan logic, thereby setting up a serial scan chain that supports electrical access to all pins on each IC included in the chain. Hence, boundary scan testing must be considered early in the design cycle, as part of a Design For Test strategy. When the board is functioning normally, the boundary scan circuitry is disabled.

Connection testing and In System Programming (ISP) are the two applications most commonly associated with boundary scan. However, by using the interconnecting nets between the devices in the JTAG chain and other devices in the circuit, it is also possible to access non-JTAG-compliant sections of a circuit using boundary scan. This significantly extends technology power by allowing a greater proportion of each board to be tested, thereby increasing test coverage without requiring physical access to individual pins. With more JTAG-compliant devices on the PCB, the number of noncompliant devices that can be accessed using the boundary scan chain also increases.

With growing rates of JTAG compliance among COTS and custom ICs, boundary scan testing has the potential to deliver great benefits, in a short space of time, to the military electronics community.

More power from boundary scan

However, to derive the greatest benefits from using this approach, military designers as well as commercial designers need powerful JTAG test tools that are easy to learn and use. In addition, boundary scan test gear can potentially extract a great deal of information about the unit under test by analyzing the responses of JTAG-compliant devices. User-friendly features, for example speeding up test compilation and supporting easy reuse of test scripts, will also help maximize test coverage, reduce development time, and minimize errors during test generation in the face of decreasing access for test fixtures, flying probes, or manual probing with a logic analyzer or oscilloscope.

Next generation JTAG tools, such as the XJTAG development system from XJTAG Ltd. of Cambridge, UK, support high-level languages for test generation, allowing tests to be easily compiled and also readily modified, for example, in response to design changes. Enhanced graphical tools also allow engineers to view the states of individual pins in real time and to group and monitor sets of pins as a bus.

High-level test development

Without these capabilities included in the test tool, engineers must work hard to construct a suitable binary test sequence to exercise all the devices in the JTAG chain. In addition, a change to the board – such as adding or removing a component from the chain or moving a component to a different location by altering the routing – would require a new JTAG sequence. Hence, the most basic implementation of boundary scan implies a *board-centric* view of test compilation.

However, the XJTAG system was one of the first tools powerful enough to abstract engineers from the level of the JTAG bitstream and make JTAG easier and more intuitive to use. Instead of constructing the bitstream from the ground up, as it were, tests are now compiled automatically from input data that includes CAD netlist information and a test script for each non-JTAG device attached to devices in the JTAG chain. In this way, tests can be quickly recompiled following any change to the board layout, and test scripts can also be saved and reused on other projects because they are specific to the device. This is a *device-centric* use of JTAG and allows boundary scan testing to become much more powerful as well as easier to use.

Reusable tests

Since device-centric tests can be reused in future tests written for any board using the same device, engineers can save time and avoid potential errors. Organizations can build libraries of proven

```
Test(){INT result}

  INT returnCode;

  PRINT("Checking ", SIZE_MB, " MByte SDRAM (", DEVICE_REF, ")\n\n");

  IF DEBUG THEN
    PRINT(DATA_PINS,     " data pins\n");
    PRINT(ADDRESS_PINS,  " address pins\n");
    PRINT(DQM_PINS,      " DQM pins\n");
    PRINT(BANK_WIDTH,    " bank pins\n");
  END;

  PRINT("Initialising SDRAM...\n");
  result := RESULT_PASS;
  Initialise();

  PRINT("\nTesting ", DATA_PINS, " data pins... ");
  TestData(){returnCode};
  result := result | returnCode;

  PRINT("\nTesting ", ADDRESS_PINS, " address pins... ");
  TestAddress(){returnCode};
  result := result | returnCode;

  PRINT("\nTesting random data/address... ");
  TestRandom(256){returnCode};
  result := result | returnCode;

  Initialise();

  IF (result = RESULT_PASS) THEN
    PRINT("SDRAM tests passed.\n");
  ELSE
    PRINT("SDRAM tests failed.\a\n");
  END;

END;
```

Figure 2

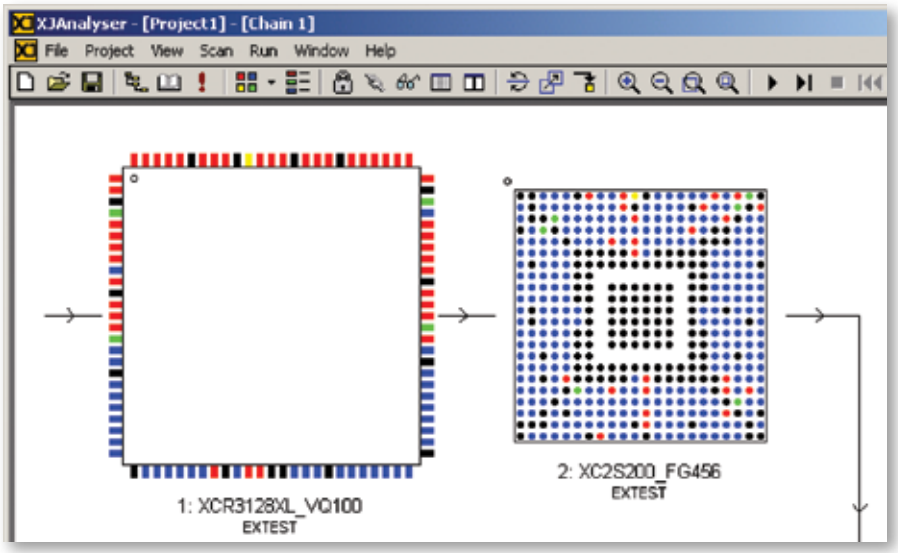

Figure 3

test scripts that can be readily incorporated into new routines. Figure 2 shows a sample test for a 90-pin BGA SDRAM device written in a high-level language.

In addition, non-JTAG devices that connect to JTAG-compliant devices can also be tested because the XJTAG system can automatically calculate which JTAG pins need to be manipulated in order to access those nets.

Development and production roles

To execute a boundary scan test, whether generated manually or automatically by a tool such as XJTAG, the board does not have to be running. This makes it a powerful technique for development engineers, who can use it to quickly verify basic functionality as soon as the first prototypes return from assembly. The time-consuming process of debugging the processor or memory system and problems that will prevent the board from booting up at all can be quickly pinpointed.

Modern JTAG tools also provide a convenient means to toggle individual pins or buses and view pin states on screen to quickly locate bridges, breaks, poor joints, or incorrect connections. The screenshot in Figure 3 demonstrates viewing the status of all BGA and fine-pitch leaded device I/Os. This can be accomplished more quickly than laboriously checking using a continuity tester, even assuming that sufficient physical access is possible. The results are also readily recorded for future reference. Users can also quickly and easily repeat any or all of the tests for a board, to enable them to track down a fault.

Another benefit is that test development can begin concurrently with prototype debugging, and production tests can be quickly finalized when the design is fixed. In this way, Design For Test (DFT) becomes more intrinsic to the project.

Programming with JTAG

Another feature of boundary scan or JTAG testing is the ability to program devices such as CPLDs, MCUs, or flash memories by shifting in the required bits using the JTAG chain. But there is even greater power and flexibility to be gained by communicating via the JTAG port of compliant devices in yet more sophisticated ways. For example, given suitably powerful tools, it is possible to step through or over test code a line at a time while controlling the device through the JTAG port. Break points can also be created and edited, and the values of variables in the code can also be checked or modified.

Modern JTAG equipment in practice

Thales UK has used the XJTAG Development System as the basis for a common DFT strategy spanning development, first article build, production, and field service. The first project to benefit from this tool was the Thales MSN 8100-H, Europe's first operational Software Defined Radio (SDR), which will be used on the Royal Navy's next class of Destroyers, the Type 45, scheduled to enter service in 2009. Figure 4, provided by BAE Systems, shows an artist's impression of the Type 45 Destroyer. During development of signal processing boards for this SDR, engineers saved around 20 percent of debugging and testing time by applying boundary scan testing using the XJTAG system.

The MSN 8100-H signal processing boards are densely populated and use fine-pitch, high-density connectors as well

Figure 4

as FPGAs in high-I/O BGA packages. These make the boards difficult to test by traditional methods. According to engineers at Thales, the number of JTAG-compliant devices per board has been steadily increasing with each new project. On the MSN 8100-H project, there were enough to use the JTAG chain for debug and testing. Thales was very quickly able to establish test coverage of around 80 percent. Fault-finding capabilities also proved effective, such as circuit visualization tools that allow reading and writing to all of the JTAG pins in the chain and display the status of each pin graphically.

Using JTAG, the engineers at Thales UK were able to begin test development and design validation of CAD netlists at a much earlier stage in the project. In addition, the ability to quickly generate complex functional tests also helped shorten the time for development and first article build. Because the tests are automatically compiled using scripts specific to each device, a script can be reused any time that device is used, whether this is at other locations on the same board or on a completely different board. The scripts are also portable to other projects.

Military response unavoidable

The test challenges facing commercial equipment designers are now hitting home in the military sector. Increasing board complexity and difficult physical access are forcing adoption of new test techniques in order to maintain coverage. Solutions that continue to depend on physical access have only a limited lifetime before the number of accessible pins and test points becomes inadequate to sustain test coverage. With the number of available JTAG-compliant components increasing steadily, as well as the advent of enhanced boundary scan test equipment, migration to JTAG testing is another commercial trend the military is likely to adopt in the near future.

***Dominic Plunkett** is chief technology officer at XJTAG, a leading boundary scan test system developer. An electronics systems engineer, Dominic has spent the past decade designing electronic circuits for a variety of high-technology clients. In the mid-1990s, faced with the challenge of testing tightly-packed circuits populated with BGA devices, Dominic developed a novel test system utilizing the JTAG port to speed development cycles. This proved so successful that the XJTAG system was launched commercially.*

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FLOSS helps you take control of your bytes

By Dr. Robert Dewar

Software licensing terms matter. When you acquire a software product, what you can and cannot do with it is established by its license. With proprietary software, the emphasis is on the *cannot*: The license is designed to protect the vendor's interests, not yours. However, other approaches are available. Recent years have seen the emergence and spread of FLOSS (Freely Licensed Open Source Software), whose licensing terms are much more oriented toward the user. A FLOSS product offers vendor independence, source code availability, and source code modification/redistribution rights. It gives you these freedoms while still allowing you to use the product to develop your own applications and without necessarily obligating you to reveal/redistribute your applications' source code.

The term *FLOSS* refers only to the licensing arrangements and does not imply any specific development approach or pricing model. It is a common misconception that *open source* means chaotic, bazaar-style software production. In fact, the licensing terms and the development approach are completely independent. FLOSS software can be designed, implemented, and maintained through a rigorously controlled regimen with careful configuration management and quality control, and there are examples of such products in the marketplace. Proprietary software can be developed in a loosely managed fashion with low standards for quality control; unfortunately, there also seem to be examples of this practice in the marketplace. Further, the term *free* in *freely licensed* does not imply *no charge:* FLOSS software can be sold (for profit) in the same way as proprietary software.

A FLOSS product comes with full source code; the license includes at least the following:

- Permission for the user to copy and distribute the software
- Permission for the user to modify the software
- Permission for the user to distribute the modified software

Proprietary products do not include source code and thus their licenses provide none of these freedoms. Although some companies may offer to make their source code accessible, they generally do so only under restrictive nondisclosure agreements; the source code remains the intellectual property of the vendor.

Why is FLOSS licensing good for you? In short, because it puts you, as project manager, in control. A proprietary product is basically *take it or leave it*. If the vendor upgrades to a new release, you need to go along or else be prepared to pay expensive support fees to continue with a baseline version. You are locked into the original vendor. If you encounter a problem, you do not have access to the source code to investigate a possible workaround. You need to rely on the original vendor, which is a potential bottleneck in projects that have tight deadlines. These issues are especially important when the software is a development tool such as a compiler; the inability to see the source code for (and possibly adapt) a runtime library component can be a source of delays and expense.

These issues do not arise with FLOSS licensing. The accessibility of source code offers you vendor independence, since other providers (or even your own internal staff) may be available as alternative resources. The ability to modify the software gives you further freedom: You can adapt it as necessary to meet any project-specific requirements. If you choose to baseline a specific version of the tool, you can do so and not feel pressured to upgrade to a new release.

Are there any disadvantages to FLOSS licensing? Since the FLOSS concept is rather general, it is possible that the specifics of a given license may be inappropriate in some contexts. For example, the GNU General Public License (GPL) is a FLOSS license but has an important restriction: A user who modifies the software can only distribute the result under the terms of the GPL. For most mission-critical applications – and clearly in the case of a classified system – distributing source code is unacceptable. (Note that redistribution is not required; GPL software may be used internally without any problem.) Of course, the specifics of a given proprietary license may also be inappropriate; it is essential in any case to carefully review the license and make sure that it meets your requirements.

In summary, FLOSS puts you in control of your own destiny. You are not dependent upon a single vendor, and you have the right to adapt the software as needed. Contrary to a common misconception, you can use a FLOSS product to develop software that is proprietary or is subject to other restrictions. FLOSS licensing increases your freedom, and that can only be beneficial.

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New multi-gigabit wireless systems satisfy high-security rapid response applications

By Dr. Jonathan Wells

E-Band wireless communications is a new technology that allows gigabit per second (Gbps) data rates to be transmitted with very high weather availability over distances of a mile or more. Characterized as Low Probability of Detect/Low Probability of Intercept (LPD/LPI), it is a perfect technology to satisfy hostile territory battlefield situations where there's a need for high security, high speed, point-to-point, non-wire-line communications. A novel licensing structure coupled with an ability to quickly deploy links permits rapid response to homeland defense and other time-critical security applications.

We live in a digital world. Essentially all communications, from telephone calls to personal e-mails to e-commerce transactions, are carried on digital networks. The ubiquity and ease of access to digital networks coupled with the sensitivity of much of the transmitted data means that security is now a prerequisite for many digital systems.

Wireless communication systems traditionally have not provided any level of security. In fact, the early value of wireless was its ability to be widely detected and decoded (for example, terrestrial TV and radio broadcasts). However, the growth of data communications for Internet and e-commerce services has forced systems designers to start considering security as a primary system requirement.

Operating in the relatively unused 70, 80, and 90 GHz regions of the spectrum, E-Band wireless communications is a new technology that offers both gigabit-speed wireless connectivity and a level of security that can be classified as LPD/LPI. Very high data rates, portability, and ease of deployment make E-Band communications ideal for rapid response and other time-critical homeland defense security purposes.

Wireless E-Band: An overview

In October 2003, the Federal Communications Commission (FCC) made an historic ruling that 13 GHz of spectrum at 71 to 76 GHz, 81 to 86 GHz, and 92 to 95 GHz was available for commercial high-density fixed wireless services in the United States. The very high bandwidth allocated allows true gigabit-speed wireless communications to be realized. Transmission at 1 Gbps or higher is possible, equivalent to 647 T1 links or 1,000 DSL connections. The FCC ruling also permitted a novel licensing scheme, allowing cheap and fast allocations to prospective users. License applications are made via a simple Web portal and are generally approved within 30 minutes of filing, providing the user with full federal protection against both unintentional and malicious interference. New commercial markets for fiber replacement or extension, point-to-point wireless local area networks, and broadband Internet access at gigabit data rates and beyond have been opened up. Then-FCC Chairman Michael Powell heralded the ruling as opening a *new frontier* in commercial services and products for the American people.

Although intended to enable high data rate, commercial point-to-point applications, E-Band atmospheric and propagation properties make equipment designed for these frequencies very useful for secure military applications.

Why 70 and 80 GHz?

Atmospheric absorption varies significantly with frequency, as shown in Figure 1[1]. At conventional microwave frequencies, atmospheric attenuation is reasonably low, until a peak is seen at around 60 GHz, where absorption by oxygen molecules results in 15 dB/km attenuation, seriously limiting radio transmission distances.

After this peak is a large window where attenuation drops to less than 1 dB/km (effectively negligible) before rising again due to other molecular effects. This window has a minimum at

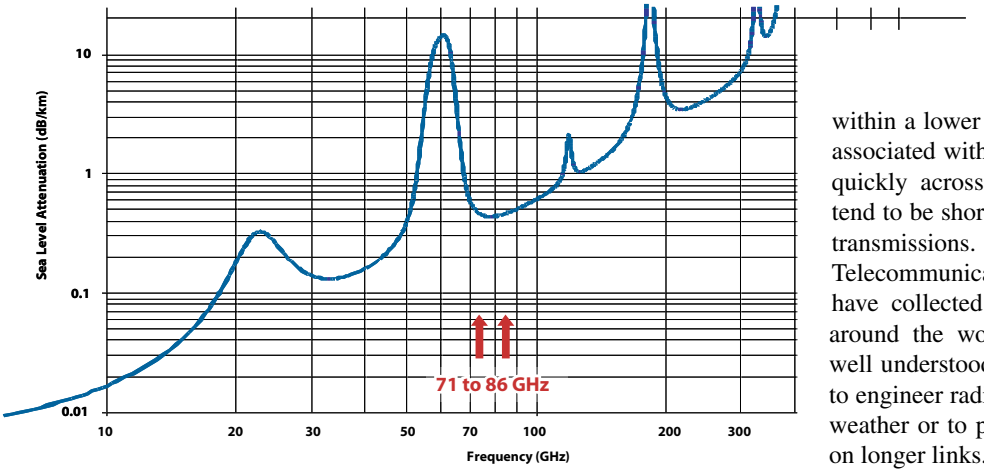

Figure 1

94 GHz, which is why this frequency has been previously exploited for military applications. It can be seen that the spectrum from around 70 GHz up to around 120 GHz exhibits low atmospheric attenuation and fortunately is relatively unused.

Due to the unprecedented bandwidths allocated by the FCC, the 70 and 80 GHz bands are ideal for very high capacity data distribution. With 5 GHz of bandwidth centered at both 73.5 and 83.5 GHz, gigabit and higher data rates can easily be accommodated with reasonably simple radio architectures and modulation schemes. This results in low-cost, high-reliability systems.

As with all high-frequency radio propagation, rain will limit link distances. E-Band transmissions can experience 30 dB/km attenuation when in the presence of intense rain, as shown in Figure 2[2]. Such intense rain tends to form in small clusters within a lower intensity rain cloud, and is usually associated with a severe weather event that moves quickly across the link. Therefore, rain outages tend to be short and only occur on longer distance transmissions. Fortunately, the International Telecommunication Union (ITU) and other bodies have collected many decades of rain data from around the world, so rainfall characteristics are well understood. With such information, it is easy to engineer radio links to overcome even the worst weather or to predict the levels of weather outage on longer links.

E-Band systems (70/80 GHz) are available for both commercial and military applications. One such product, GigaBeam's WiFiber radio[3], combines high output transmitters with advances in signal processing to overcome rain limitations and achieve the best link distances in the industry. Distances of one mile or more can be achieved across 80 percent of the United States with 99.999 percent weather availability, equivalent to five minutes of rain outages per year. Longer links can be engineered for less demanding weather availability.

Secure applications

E-Band systems offer huge military and government potential. Very high data rates, portability, and ease of deployment make E-Band communications ideal for homeland defense and other security purposes. Rapidly deployable, high-definition video links for high data rate event security (for example, facial mapping for recognition purposes) is one such application. Another is high

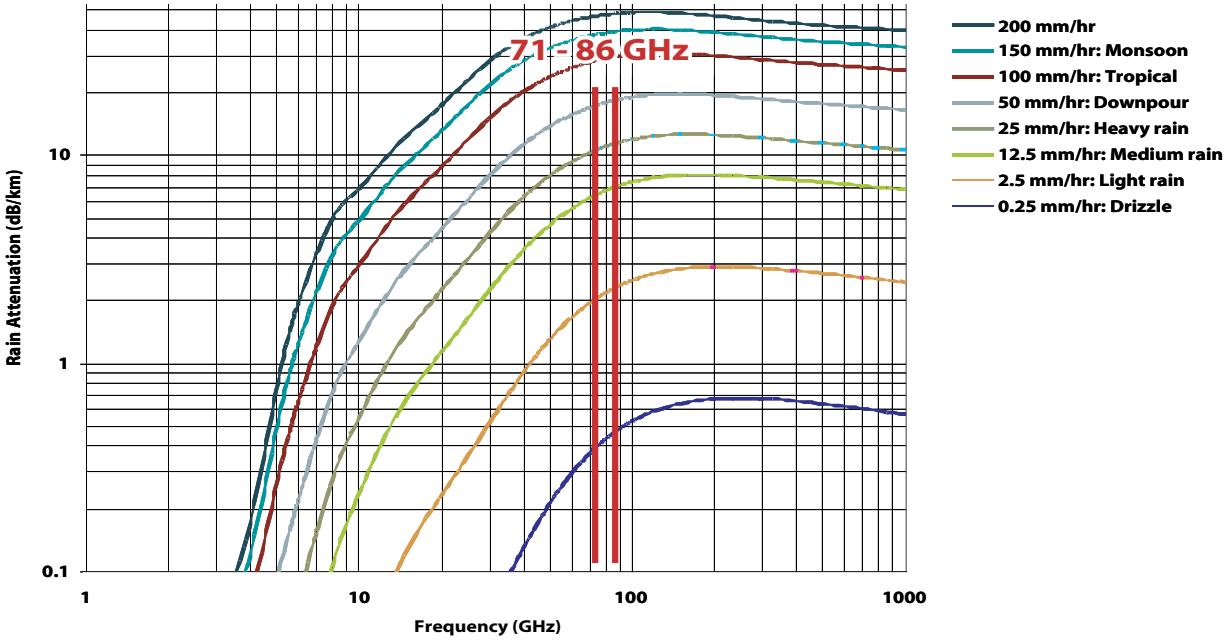

Figure 2

data rate battlefield data distribution from satellites. This list of possible applications is endless.

E-Band systems excel in military applications since the millimeter-wave properties allow the radio to be classified as LPD/LPI. For any point-to-point technology, antennas generally have to be placed on high towers or masts, so a clear line of sight can be achieved. By necessity, this means that few buildings or possible interception points can be close to the radio path. However, the *ether* between any two antennas is never secure, and a determined hacker with a basic understanding of the particular radio system architecture will be able to *sniff* off part of the broad transmission radio signal.

E-Band systems, however, are of a frequency much higher than conventional wireless systems, resulting in antennas that have much greater focusing ability. A typical application with a two-foot dish antenna has a very narrow 0.3° beamwidth, meaning that transmitted signals propagate as highly focused and directional *pencil beams* from the antenna. Transmitted signals do not form broad diverging beams that illuminate large areas as at lower frequencies. Contrast this two-foot, 0.3° E-Band scenario to a similar two-foot dish at L-Band (1.5 GHz, a common military frequency). Here the beam will spread in a cone shape over 30°. Thus, an E-Band product's narrow pencil beams, which, of course, are invisible, are inherently much harder to locate and far more difficult to intercept.

Rapid deployment applications

The ease of deployment of E-Band wireless systems coupled with the fast and easy licensing scheme enables the technology to operate well as a rapid response system for defense or security applications. The E-Band system can be used as either the primary communication link or as backhaul to a lower data rate but longer range technology. An example of one such rapid response communication application is shown in Figures 3 and 4. Here two GigaBeam WiFiber radios are installed on an Integrated Tower Systems mobile mast[4], each providing a gigabit connectivity link to another mobile tower. An Adaptix

Figure 3

Figure 4

Comparison of competing technologies

	E-Band (70/80 GHz)	Microwave radio (18-38 GHz)	60 GHz radio	Free Space Optics
Max data rates	1 Gbps	322 Mbps	1 Gbps	1 Gbps
Typical link distances (99.999% availability/5 minutes outage per year)	1 mile	3 miles	400 yards	200 yards
Typical link distances (99.9% availability/8 hours outage per year)	2.5 miles	5+ miles	600 yards	500 yards
LPD/LPI	Yes	Not usually	Yes	Yes
Regulatory protection	Yes	Yes	No	No
Licensing, installation, and commissioning time	Hours	Weeks	Hours	Hours
Relative product complexity for max data rate and max link length	Simple	Complex	Simple	Complex
Suitable for rapid deployment	Yes	No	Yes	No

Table 1

WiMAX system[5] provides local point to multipoint coverage from the gigabit backhaul provided by the WiFiber radios. This system, 106-foot-tall when extended, can be fully installed and commissioned within an hour and can withstand winds to 120 mph when properly secured with guy wires.

Alternative technologies

There are several other wireless gigabit alternatives to E-Band. Conventional microwave wireless operating up to 40 GHz only offers data rates to around 300 Mbps. Because of the divergent nature of their beams, unless the system possesses a huge antenna, microwave radios cannot be classified as LPD/LPI. Since the oxygen absorption limits link distances of only one-fourth to one-half mile, 60 GHz radios are suitable for short-range communications. Such short distances and high attenuation does, however, limit the ability to eavesdrop on the signal. Free Space Optics (FSO) is another LPD/LPI technology by virtue of its transmission of data across a laser link. However, FSO equipment has limitations in system availability – it is severely affected by fog, cannot transmit through optical blockages, and is restricted by particles such as sand and dust – and requires complex and unwieldy active tracking mounts to maintain the precise alignment of the narrow transmission beam.

A comparison of typical E-Band radio's performance against main competing technologies is illustrated in Table 1. It can be seen that of several technologies suitable for both LPD/LPI and rapid response situations, only E-Band radios offer the ability to reliably transmit at distances of a mile or more, plus provide the benefits of full license protection.

E-Band is ready

E-Band is a new technology that offers point-to-point wireless gigabit data with very high availability over distances of a mile or more. Being a highly directional wireless technology, with pencil beam transmissions, E-Band can be classified as LPD/LPI. It is a perfect technology to satisfy hostile territory battlefield situations where there's a need for high bandwidth, point-to-point, non-wire-line communications. Being a quick and easily deployable technology with an associated fast, online licensing scheme, E-Band products also satisfy rapid deployment or time-critical homeland security and defense applications.

References

[1] FCC Bulletin 70, "Millimeter Wave Propagation: Spectrum Management Implications," July 1997. See Figure 4 at http://www.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet70/oet70a.pdf
[2] Ibid. See Figure 10.
[3] See www.gigabeam.com
[4] See www.intelcotowers.com
[5] See www.adaptix.com

Jonathan Wells *is director of product management for GigaBeam Corp., a provider of high-performance wireless solutions that operate in the licensed 71 to 76 GHz and 81 to 86 GHz E-Band radio spectrum. Jonathan has a PhD in Millimeter-wave Electronics for work on novel 94 GHz receivers and an MBA with specialization in strategic R&D management. He is a senior member of the IEEE and is active on the WCA's Above 60 GHz Spectrum Development Committee. He has held a variety of technical and managerial roles in a number of countries around the world.*

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Efficient and authenticated key agreement:

Meeting new government security requirements

By William Lattin

In early 2005, NSA announced Suite B, a set of commercial cryptographic building blocks suitable for use in protecting both sensitive but unclassified information as well as classified information. Developers and enterprises should aim to meet these standards, which include recommendations for key agreement, a specific cryptographic function required for most security systems. This article focuses on the two key agreement schemes that are in the Suite B recommendations: the Elliptic Curve Diffie-Hellman (ECDH) and Elliptic Curve Menezes-Qu-Vanstone (ECMQV).

Today, systems architects and design engineers have many cryptographic algorithm and protocol decisions to make when developing secure products for government use. Such considerations begin with the sensitivity and lifetime of the information that will be processed by the proposed system. Additional considerations include the types of security services, such as confidentiality and integrity, that the system must provide.

To provide security services and build trust into an embedded military system, a variety of fundamental cryptographic building blocks (primitives) are required, ranging from symmetric ciphers to hash functions to public key management and digital signature algorithms. The selection of these primitives should be the result of careful analysis. Unfortunately, when these primitives are not explicitly specified by a government source, the typical engineering practice is for designers simply to choose their favorite symmetric cipher, pick a key management system, and produce a *secure* product that fails to meet the actual information security requirements.

Even when using standardized protocols such as IPSec or TLS, care must be taken to select the appropriate underlying cryptographic primitives in order to configure these protocols to provide the necessary cryptographic strength for the applications. In addition to general cryptographic strength, selection criteria must also consider the capabilities of the underlying platform to perform the cryptographic operations in terms of CPU power, bandwidth, power consumption, and memory requirements; improper selection can adversely affect system performance, cost of goods, and the user experience. All of these are critical design parameters for embedded systems such as manpack radios, satellite systems, and covert communications systems.

This article examines one specific cryptographic function that is required in most security systems: key agreement. Key agreement is a mechanism for two communicating parties to establish a symmetric key in common so that they may encrypt and decrypt information. But before we get into specifics, it's important to look at the context in today's security market and the paradigm shift currently underway in public-key cryptography.

New government requirements

In early 2005, the National Security Agency (NSA) announced Suite B, a set of commercial cryptographic primitives suitable for use in protecting both sensitive but unclassified information and classified information. The Suite B primitives are shown in Table 1.

The announcement of Suite B is significant for several reasons:

- RSA, Diffie-Hellman, and DSA are not allowed; only ECC-based public key cryptography is allowed.
- Triple DES is not allowed; only AES is allowed.
- MD5 and SHA-1 are not allowed; only SHA-256 and above are allowed.

This set of primitives *raises the bar* for what must be considered for use to protect sensitive data. Most commercial systems today use triple DES or AES, SHA-1 and RSA with at most a 2048-bit modulus. (If it were allowed, the RSA Suite B equivalent for use with AES-128 would be 3072 bits.) These combinations are insufficient according to these recommendations by the U.S. government.

Suite B primitives

SUITE B Classification Level	SECURITY LEVEL	BLOCK CIPHERS (Minimum)	HASH ALGORITHMS (Minimum)	RSA & DIFFIE-HELLMAN KEY SIZES	ECC KEY MANAGEMENT & SIGNATURE PROTOCOLS	ECC FIELD SIZES
Sensitive but Unclassified	128-bit	AES-128	SHA-256	Not Allowed	ECDH or ECMQV ECDSA	≥ 256 bits
Classified	256-bit	AES-256	SHA-384	Not Allowed	ECDH or ECMQV ECDSA	≥ 384 bits

Table 1

From a historical perspective, it is interesting to note that DES was introduced in 1977 for the protection of sensitive but unclassified information. After almost 30 years, Suite B provides a critical update to these aging systems.

The need for key agreement protocols

All secure systems, such as the STU-III, GPS SAASM, IFF, and others, use cryptography to protect the integrity and confidentiality of the data. In its Suite B algorithm selection, NSA chose the symmetric algorithm, Advanced Encryption Standard (AES), because it can provide strong cryptanalytic protection beyond the year 2031. Symmetric ciphers, such as AES, use the same secret key to both encrypt and decrypt data. Therefore, some key management method must be used so that both the sender and receiver can use the same AES key.

While a courier could be used to manually distribute the keying material, this is not practical for a variety of reasons, including:

- Modern networked systems require frequent key changes, often per communications session.
- Certain systems, such as space-based platforms, are inaccessible for manual key distribution.

(continued on page 30)

Glossary

AES (Advanced Encryption Standard) – A NIST-standard symmetric data encryption cipher that uses key sizes of 128, 192, and 256 bits. NIST chose Rijndael as the block cipher for AES. AES provides a very high level of security for the foreseeable future.

ECC (Elliptic Curve Cryptography) – A public-key cryptosystem based on the properties of elliptic curves for efficient encryption and digital signing. The security of ECC is based on the difficulty of the elliptic curve discrete logarithm problem. ECC is the only proven public key technology that scales in a practical way over time.

IFF (Identity Friend or Foe) – Identifier schemes used to distinguish friendly troops and vehicles from those of the enemy.

IPSec (IP Security) – A set of protocols developed by the IETF to support secure exchange of packets inside IP at the network layer. IPSec turns an Internet connection into a private, secure connection. IPSec is used to provide a Virtual Private Network using the public Internet for connectivity. IKE (Internet Key Exchange) is key exchange protocol that is used to set up an IPSec secure connection.

PIV (Personal Identity Verification) – A smart-card-based system used for access control.

RSA – A legacy public-key cryptosystem based on the factoring problem, named after its developers, Rivest, Shamir, and Adleman.

SHA (Secure Hash Algorithm) – The algorithm used in the Digital Signature Standard to produce a hash value. SHA-1 produces a 160-bit hash value but is under cryptographic attack and therefore should not be used for new applications. With the introduction of the AES, which offers three key sizes (128, 192, and 256 bits), there has been a need for a companion hash algorithm with a similar level of security. The newer SHA-256, SHA-284, and SHA-512 hash algorithms, proposed by NIST in 2001, comply with these enhanced requirements.

Suite B – A set of algorithms for protecting classified and sensitive but unclassified information, specified by the National Security Agency under its cryptographic modernization program. The protocols included in Suite B are Elliptic Curve Diffie-Hellman (ECDH) and Elliptic Curve Menezes-Qu-Vanstone (ECMQV) for key transport and agreement, the Elliptic Curve Digital Signature Algorithm (ECDSA) for digital signatures, the AES for symmetric encryption, and the SHA. It is important to note that the RSA algorithm is not included in Suite B.

TLS (Transport Layer Security) – An IETF standard cryptographic protocol that provides authentication, integrity assurance, and confidentiality for data exchanged by client/server applications.

» A lack of scalability exists: The distribution work grows roughly quadratically with the number of independently keyed nodes.

Therefore, it's essential to support symmetric algorithms with an automated key management scheme. Appropriate schemes may be either key agreement or key transport.

Key agreement protocols are those key management schemes in which each party contributes keying material to produce the final secret key; neither party can predetermine the final secret key. This is in contrast to a *key transport* protocol in which one party unilaterally determines the secret key and sends it to the other party to the protocol. Diffie-Hellman (DH) and its elliptic curve analogs are common examples of key agreement protocols, whereas RSA is an example of a key transport protocol. The secret key that results from the protocol is then used with a symmetric cipher, such as AES, to provide bulk data encryption.

There are a number of different options for key establishment, each one having several desirable security attributes. However, to help developers meet Suite B recommendations, this article focuses on two schemes for key agreement: the Elliptic Curve Diffie-Hellman and Elliptic Curve Menezes-Qu-Vanstone.

Elliptic Curve Diffie Hellman key agreement protocol

ECDH is the elliptic curve analog of the traditional Diffie-Hellman key agreement algorithm. The Diffie-Hellman method requires no prior contact between the two parties. Each party generates a public key and a private key and they exchange the public keys. Each party then combines its private key with the other party's remote key to form the shared secret. This method is also known as carrying out an ECDH key agreement. The ECDH protocol is shown in Figure 1. Here P is a point on a suitably selected elliptic curve.

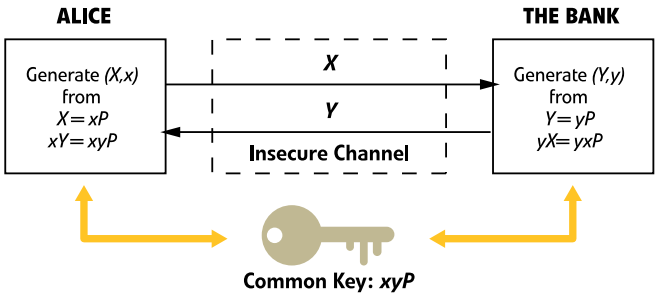

Figure 1

In the ECDH protocol, Alice and the Bank generate their public and private key pairs (X, x) and (Y, y) respectively. When a communications session is initiated, Alice and the Bank exchange their public numbers. Alice then combines the Bank's public number, Y, with her private key, x, to create the shared secret $xY = xyP$. The Bank performs a similar computation. This shared secret is known only to Alice and the Bank; no third party observing the exchanged public numbers can calculate the shared secret.

It is important to note that the shared secret, or a portion of it, must not be used directly as a key for a symmetric cipher. Instead, the symmetric key should be produced from a function that uses all bits of the shared secret and removes any positional bias. Specifically, a Key Derivation Function (KDF), such as that specified in ANSI X9.63, should be used to create the key for the symmetric cipher.

One can see that the main property of the ECDH protocol is that two parties can exchange public information (their public keys) and create a shared secret in common; however, it must be noted that this property alone is insufficient to create a secure key management protocol.

For instance, these protocols are subject to a *man-in-the-middle* attack in which an attacker inserts himself in the communications path between the parties so that Alice and he exchange public numbers and he and the Bank exchange another set of public numbers. This will result in Alice sharing a secret key with the attacker, the attacker and the Bank sharing another secret key, and the attacker being able to read and substitute all data sent between Alice and the Bank.

Therefore, when selecting a key management protocol, one must consider this and other properties such as authentication, forward secrecy, and key confirmation. The more of these properties that can be achieved by a key agreement protocol, the more secure and the more trusted the protocol will be.

For example, ANSI X9.63 defines 13 key agreement protocols involving static keys only, ephemeral keys only, static and ephemeral keys, unidirectional data flow, and bidirectional data flows. Of these, only two of the bidirectional protocols can achieve all the desired security properties: the Station-to-Station Scheme and ECMQV with key confirmation. Of these two schemes, ECMQV is computationally the most efficient. The security and performance reasons are likely why NSA selected ECMQV for inclusion in the Suite B cryptographic primitives.

Elliptic Curve Menezes-Qu-Vanstone key agreement protocol

The ECMQV key agreement method is used to establish a shared secret between parties who already possess trusted copies of each other's public keys. Both parties still generate public and private keys and then exchange public keys. However, upon receipt of the other party's public key, each party calculates a quantity called an *implicit signature* using their own private key and the other party's public key. The shared secret is then generated from the implicit signature. The term *implicit signature* is used to indicate that the shared secrets will not agree if the other party's public key is not employed, thus giving implicit verification that the remote secret was generated by the remote party. An attempt at interception will fail as the shared secrets will not be the same shared secrets because the adversary's private key is not linked to either trusted public key.

Let's return to the example of Alice communicating with her Bank. If Alice has the Bank's public key and the Bank has Alice's public key, then the ECMQV key exchange may be used.

Anyone intercepting the transmissions and substituting another remote key is unable to communicate because the resulting shared secrets differ.

ECMQV protocol is shown in Figure 2.

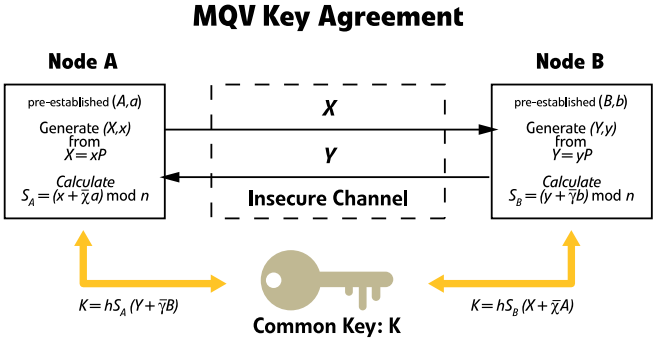

Figure 2

In this figure, the following nomenclature is used:

A, B	Long-term public keys
a, b	Long-term private (secret) keys
X, Y	Ephemeral public keys
x, y	Ephemeral private (secret) keys
h	The integer $h = \#E(F_q)/n$ where $\#E(F_q)$ is the order of the elliptic curve E and n is the order of the base point P.
$\bar{\chi}$,$\bar{\gamma}$	The integers derived from the *X,Y* public keys as follows:

i. Convert the x-coordinate of the public key to an integer (note this is not the private key, *x*);

ii. Calculate $x' \equiv x \bmod 2^{\lceil (\log_2 n)/2 \rceil}$

iii. Calculate $\bar{\chi} = x' + 2^{\lceil (\log_2 n)/2 \rceil}$

iv. Calculate $\bar{\gamma}$ similarly using the *Y* public key.

In the ECMQV scheme, Alice possesses a long-term key pair *(A, a)* with *A* being her public key and *a* being her private key. Similarly, the Bank possesses a long-term key pair *(B, b)* with *B* being his public key and *b* being his private key. Alice generates an ephemeral session key pair *(X, x)* by randomly generating *x* and calculating $X = xP$ where x is an integer and *P* is a point on an elliptic curve. The Bank generates its ephemeral key pair *(Y, y)* by randomly generating *y* and calculating $Y = yP$. *P* is a generating point on the elliptic curve.

Alice sends *X* to the Bank and the Bank sends *Y* to Alice. It is assumed that Alice already has the Bank's public key *B* and that the Bank already has Alice's public key *A*. The public keys have been received in some trusted manner. The calculation to derive the shared secret K is shown in Figure 3.

ECMQV primarily owes its efficiency over the Station-to-Station (STS) protocol to the fact that it uses implicit signatures to ensure that the data contributed by the parties is authentic and complete. STS must use a standard-explicit signature, such as ECDSA, which is computationally more expansive. In fact, the dominant calculations in ECMQV are only 1.5 scalar point multiples. As can be seen, the quantity SA acts as a signature on Alice's ephemeral public key, and only Alice can produce it. The implicit nature of the signature is because the Bank indirectly verifies it when deriving the shared secret since each party's shared secret will not agree if these signatures are invalid.

Alice calculates S_A (called the implicit signature):

$$S_A = (x + \bar{\chi} a) \bmod n$$

where h is a co-factor defined in P1363.

The Bank calculates S_B in a similar manner:

$$S_B = (y + \bar{\gamma} b) \bmod n$$

Both Alice and The Bank calculate a shared secret K:

$$K = hS_A(Y + \bar{\gamma} B) = hS_B(X + \bar{\chi} A).$$

Figure 3

ECMQV: Security and performance

ECMQV has all the security attributes desired in a key agreement protocol, making it trusted and secure. ECMQV also has many desirable performance attributes, including that the dominant computational steps are not intensive, the protocol has low communication overhead, is role-symmetric, noninteractive, and does not use encryption or time-stamping.

While based on DH, ECMQV offers attributes that are not found with DH. This allows protocols that use ECMQV for key agreement to offer stronger authentication and ensure that malicious entities cannot masquerade as a third party to the entity whose key was compromised.

When it is computed using Elliptic Curve Cryptography, ECMQV offers significant performance advantages over other key establishment schemes, which makes it ideal in the development of security protocols and systems that require efficient and authenticated key agreement.

Selecting and implementing the optimum scheme

But what does all this mean to implementing key agreement within a security system? How do you choose the right key agreement protocol? A good starting point is whether or not your system must interact with legacy systems using traditional RSA or Diffie-Hellman schemes. If so, you will need to plan for algorithm agility to accommodate these schemes as well as use ECC in order to provide both backward compatibility and Suite B compliance for the future.

For new designs, the Suite B algorithms are the clear choice. Because of its smaller data quantities and efficient computational characteristics, ECC is also a clear choice for devices that are CPU, bandwidth, and/or battery power constrained such as munitions-embedded systems, PIV cards, or IFF devices. Also keep in mind that you must use homogeneous levels of security among your cryptoprimitives: Specifically, AES-128 must be used with at least SHA-256 and ECC functions using a 256-bit field size.

In terms of whether to use ECDH or ECMQV in your system, this selection should be governed by the security properties you need the key agreement scheme to meet, and whether or not you will be using both static and ephemeral keys. ECDH can be used with either or both static and ephemeral keys with differing security properties for the various combinations. ECMQV requires the use of both static and ephemeral keys.

As an example of meeting security properties, ECDH, using just ephemeral keys, can only achieve the security property of known key security. This property provides the assurance that the resulting secret key will not be compromised if other secret keys are compromised. On the other hand, ECMQV, using both static and ephemeral keys, can meet the full spectrum of security properties, thus making it the preferred choice for systems demanding complete security. Both ECDH and ECMQV are widely supported in standards, including those for TLS and IKE.

The bottom line is that you need to carefully consider key establishment schemes whenever you are designing a protocol or implementing a security system. As we have shown, there are many different key establishment schemes endorsed by the standards. So your choice comes down to carefully weighing the tradeoffs between the different security attributes and the performance attributes. Generally, key establishment using ECC and ECMQV yield the best results in terms of the security performance tradeoff.

William Lattin *is chief technology officer of Certicom Corp. and is responsible for leading Certicom's technology strategy.*

During the past nine years, William was the managing director of SecureField, an information security consultancy that specializes in cryptographic product design and network security. He is chair of the Standards for Efficient Cryptography Group (SECG), an industry consortium that develops commercial standards to facilitate the adoption of efficient cryptography and interoperability across a wide range of computing platforms. He holds a BSEE and an MSEE from Stanford University and UC Santa Barbara respectively.

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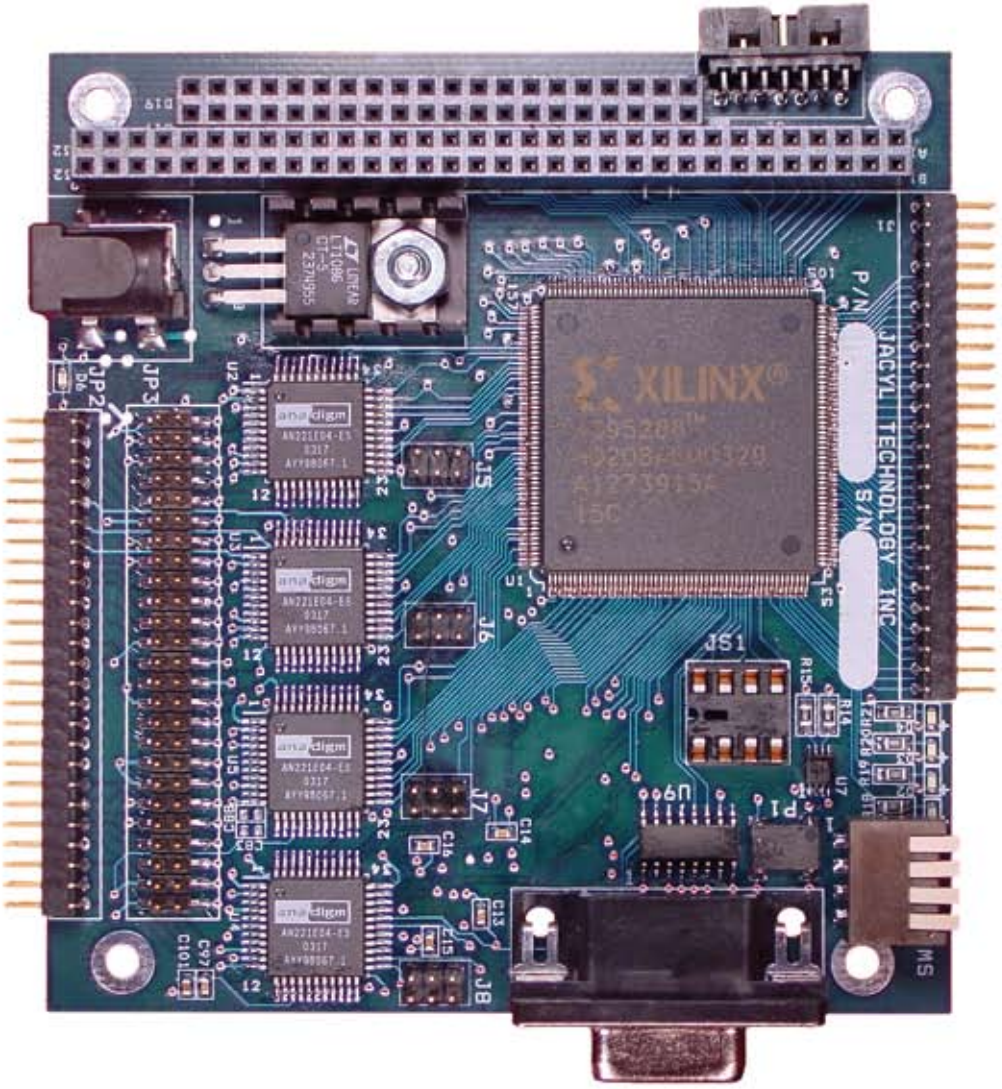

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Hybrid signal processing uses FPGAs and processors

Q & A with Jeffry Milrod, President and CEO, BittWare, Inc.

EDITOR'S FOREWORD

BittWare has been one of the few DSP companies blazing their own trail by exclusively sticking with Analog Devices' SHARC architecture. Over the years, the company has consistently demonstrated quantitative benchmarks showing the superiority of the SHARC over other processors such as the PowerPC, once the algorithm was forced to fetch off-chip data. Today, BittWare is expanding their offerings to include FPGAs. The company's CEO, Jeff Milrod, was one of the original founders of Ixthos, a signal processing company purchased by Dy4 Systems some years back. That was about the time I first ran into this accomplished – and often controversial – industry expert. As you'll read below, Jeff hasn't lost any of his moxie. – Chris Ciufo

MIL EMBEDDED: ***What are the characteristics of a COTS company?***

MILROD: A good COTS company must be able to innovate and lead market demands. It's simply not good enough to do what a customer asks – that defeats the primary purpose of COTS. A good COTS product isn't just a custom solution in a catalog; it's the best-of-other classes brought to your class. COTS done right provides system designers with tools and capabilities they didn't even know they wanted or could use.

The good, the bad, and the ugly?

The good: COTS allows military systems designers to use the latest, greatest technologies and quickly and easily re-architect and improve their systems as newer technology becomes available. Most programs accept this and embrace it rather than fear it.

The bad: Lack of common standards threatens the ability of systems designers to ensure a viable roadmap, jeopardizing the whole COTS concept.

The ugly: Potential for the RoHS mandate and upheaval in the semiconductor industry to force early obsolescence and restrict access to new commercial technologies. *–Jeffry Milrod*

MIL EMBEDDED: ***How has COTS changed in the past 10 years?***

MILROD: The better question might be how *hasn't* COTS changed. There's very little in common with COTS 10 years ago and now. A decade ago, COTS was basically the MIL-SPEC parts and designs on a modular interconnect standard, usually VME. Now COTS is driven by commercial technology developments in PCs and telecom, then repackaged by COTS vendors, making them available and accessible to rugged and longer-life embedded applications.

This transition hasn't been particularly smooth or elegant and has resulted in the loss of clear standards and universal modularity. But the same customers who, 10 years ago, cringed when we proposed relatively new technology are now pushing us for more aggressive roadmaps and technology insertion plans – proof that the COTS concept has been a tremendous success.

MIL EMBEDDED: ***You mention some COTS successes. What are the top three* disadvantages *of COTS?***

MILROD: First, customers must limit system design to what's available from COTS vendors; this means what they can sell to other systems as well showing that really unique requirements are hard to solve with pure COTS. Second, limited support for old and odd interfaces, which will resolve itself as more standard technologies are adopted. Third, limited support for extreme environments and life cycles.

MIL EMBEDDED: ***Signal processing remains a difficult system problem to address. Do you see this changing in the future?***

MILROD: Simple answer – no. Signal processing is extremely demanding and diverse, so I don't foresee a one-size-fits-all solution any time soon. People have been pushing increasingly powerful CPUs for native signal processing for many years with limited success. High clock rates are not enough to guarantee high throughputs in hard real time. FPGAs are compelling for many algorithms and applications but still aren't a panacea due to complexities of development, lack of support for floating point, and power inefficiencies that come with flexibility. DSPs aren't advancing as fast as they once were and appear to be approaching some fundamental limitations.

The future of signal processing is *hybrid*, meaning using different types of technology, namely processors and FPGAs. The right technology for the right part of the problem: This is easier said than done so we have a lot of work to keep us out of trouble.

MIL EMBEDDED: ***Can you comment on managing technology, COTS or otherwise, over a long-life military program?***

MILROD: Of all the issues, RoHS has the potential to wreak havoc with the semiconductor industry, causing a much greater occurrence of critical components going obsolete much sooner and with far less warning. Right now, many of our military customers don't want RoHS processes for good reason: No one really understands how these assemblies will perform over time. So like other COTS vendors, we're studying the problem and are trying to figure out what to do. Frankly, anyone who tells you they know how to manage technology life cycles over the next 10 years is either naive or lying.

I don't worry too much about new designs since virtually all of these parts will ultimately and easily migrate to lead-free. I worry about designs we did three to five years ago with parts that vendors probably won't release in lead-free packages. These boards may require a complete, ground-up redesign and possibly even need to be redesigned.

MIL EMBEDDED: ***Will the military ever move backwards away from COTS?***

MILROD: It appears to me that most everyone still agrees COTS is a good idea. However, the fragmentation of formats and board interconnect standards is giving some system designers cause for pause. In some ways, many of these new standards aren't really COTS anymore since they require custom backplanes and/or interconnects and the boards need a special pinout to work in that system. Either we need to converge to one or two true open standards for format and interconnect or COTS will have to move to the system level rather than the board level.

MIL EMBEDDED: ***Do vendors ever fight the NDI, open standards, or other COTS battles?***

MILROD: As I mentioned earlier, there's definitely a need for more standardization. Since we only get brought into customers who plan to use COTS already, we don't fight the COTS conceptual battles. However, I do find that we often fight the standards battles. Unlike 10 years ago, there's no *de facto* standard format and board interconnect. We spend a great deal of time internally, and with customers, trying to figure out which open standard will actually be standard.

Jeffry Milrod, *president and CEO of BittWare, Inc., joined BittWare in 1998. He gained extensive design experience at NASA and business experience at Booz, Allen & Hamilton. He then merged his technical expertise with his business savvy by starting Ixthos in 1991, which he ran until it was acquired by DY4 Systems in 1997. Jeff holds a BA in Physics from the University of Maryland and an MSEE degree from The Johns Hopkins University.*

BittWare (www.bittware.com) has been exclusively focused on high-throughput, hard real-time signal processing COTS board-level solutions for more than 15 years. Until recently, this has been accomplished primarily by packing as many SHARC-based DSPs on standards-based boards as possible. The company's latest offerings also leverage innovations in FPGA design and architecture to create hybrid signal processing solutions using both DSPs and FPGAs providing tremendous performance, throughput, and ease-of-use while operating within a reasonable power budget.

Pay attention to interoperability, life-cycle planning

Q & A with Lynn Patterson, Curtiss-Wright Controls Embedded Computing

EDITOR'S FOREWORD

Lynn Patterson is a quiet force behind some of the embedded industry's highest technology products, though you might never know it because she's too polite to mention it. A veteran executive with more than 15 years of experience in the COTS industry, she has a strong technical background and is now responsible for three of CWCEC's six acquisitions during the past several years. In effect, Lynn steers CWCEC's boards business, which comprises four business units, including the company's core services commonly called ilities*. I had the opportunity to speak with Lynn via cell phone as she was en route between offsite meetings.* – Chris Ciufo

MIL EMBEDDED: ***What constitutes a COTS company?***

PATTERSON: A COTS company sells multiple solutions off-the-shelf to the broad merchant market and re-invests in their product lines. It sells its products to the open industry, meets open standards, and truly has products available off-the-shelf. A true COTS company is committed to the market: It participates in standards organizations and develops truly interoperable products.

MIL EMBEDDED: ***How has COTS changed over the past 10 years?***

PATTERSON: COTS has really matured over the last 10 years. It's now the *de facto* embedded computing solution choice for the broad range of new military programs and the larger market of legacy platform upgrades. The defense industry recognizes that COTS references both commercial products and products aimed at rugged environments because they embrace the same business practices. It's understood that COTS products can offer long life-cycle availability, and they can meet extended temperature, shock, and vibration requirements.

MIL EMBEDDED: ***What has been one of the most complex challenges in COTS?***

PATTERSON: Planning for interoperability is a key challenge. It's an essential element of any successful life-cyle maintenance program and it drives technology roadmaps. Easing interoperability makes customers more productive and lowers their risk; this is the philosophy behind our COTS Continuum initiative. Our *Common Software Architecture* approach provides a common API layer to lower development costs and speed software porting. We define common hardware interfaces across product lines and provide consistent I/O cabling to ease the out-of-box experience and technology insertion. We also deploy advanced features such as our new Class 300 level of ruggedization for *2-Level Maintenance* across an entire product line to improve interoperability.

MIL EMBEDDED: ***From the military's perspective, what are the top three advantages of using Commercial-Off-The-Shelf?***

PATTERSON: Number one is faster time-to-market. COTS delivers the most advanced and cost-effective technology to the warfighter sooner. Second, since development costs and life-cycle obsolescence management costs are shared among all users, COTS eliminates NRE and lowers costs. Third, for interoperability, COTS addresses and provides an ongoing technology roadmap for technology insertion/refresh.

MIL EMBEDDED: ***How has the industry improved life-cycle management?***

PATTERSON: COTS industry leaders now recognize the importance of committing significant resources to life-cycle management services. Curtiss-Wright has

The good, the bad, and the ugly?

The good: COTS has spawned a vital, growing industry that has enriched all of its stakeholders: principally the users and their customers, the individuals and organizations that have invested in and supported the initiative.

The bad: Has simply been the normal process of maturation that required time and experience. COTS has had the time to pass through its early stages and its adolescence, and while many wish that it happened faster, COTS has reached an undeniable level of sophistication and success. Any new industry takes time, especially one on military cycles, so this process is a good *lesson learned* for new players in the market.

The ugly: For lack of a better word, is simply the ongoing educational process required to inform designers with an NIH [Not Invented Here] philosophy of the real benefits and ROI that COTS offers. – *Lynn Patterson*

Advance Announcement

The 8th European CMSE Conference is devoted to providing training workshops focusing on current topics of interest presented by knowledgeable and respected leaders in the electronics field. Peer presented technical sessions discuss the latest developments and practices concerning components in the industry. Exhibitions will provide an up-close view of the current equipment, information, services, and advancements of components for the military and space environment.

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MIL EMBEDDED: ***How does one manage technology (COTS or otherwise) over a long-life (> 10 years) military program?***

PATTERSON: First, a mature life-cycle management program, like our Guardian Select program, is critical. We can save on NRE at the front end, and we can save on life-cycle management costs at the back-end. Life-cycle programs should manage for lifetime buys of component stock, notify of COTS EOL and last-time-buy announcements, and declare a technology roadmap well in advance so customers can plan properly. Roadmaps must offer backward compatibility, including backward pinout and software compatibility to ease the technology refresh cycle.

MIL EMBEDDED: ***What kinds of systems don't or won't use COTS? Why?***

PATTERSON: Some systems with volume or unique requirements, such as radiation-hardened, space-bound applications and certain missile and smart ordinance programs aren't usually a good fit for COTS. That said, VPX-REDI [a new VME standard, also known as *VITA 46/48*] addresses many of the major programs that previously haven't used COTS because they needed open standards-based 2-Level Maintenance or liquid flow-through cooling.

MIL EMBEDDED: ***Do you ever fight NDI battles anymore? What's changed?***

PATTERSON: The term *NDI* [Non-Developmental Item] has mostly disappeared, so in that regard we've been successful. Open standards is a prerequisite decision driver that endorses COTS as the answer to achieve NDI. Even customers that stay in-house or select non-COTS solutions witness the benefits of open standards at the chip level, which inherently promotes the concept of open standard modules and subsystems. Years ago, the military wouldn't even consider commercial components. In most situations today, we no longer have to sell the COTS concept. Typically the customer now considers the COTS approach first.

MIL EMBEDDED: ***What do you see as the next stage in the COTS business model?***

PATTERSON: COTS is now able to support much broader business models that leverage core COTS intellectual property IP. We see many opportunities to provide custom versions of our standard products. Other business opportunities that are more common today include joint designs and technology licensing.

MIL EMBEDDED: ***Do you think the military will ever move backwards, away from COTS?***

PATTERSON: No, we don't see that as likelihood. We simply don't see any reasons on the horizon that would encourage the military to retreat from COTS.

***Lynn Patterson** holds a BS in Electrical Engineering from Penn State and an MSEE from George Mason University. Lynn joined Ixthos, a Leesburg-based, DSP-focused business in 1991, which was subsequently acquired by Dy 4 in 1997. While at Dy 4, she has held increasingly responsible design and management positions for development, marketing, sales, production, and support. Prior to that, she had a successful career with Avtec Systems and Westinghouse.*

Curtiss-Wright Controls Embedded Computing (www.cwcembedded.com) is a leading vendor of ruggedized and benign-class modules and subsystems for the defense, aerospace, commercial, and industrial markets. The company offers a comprehensive and experienced single source for embedded products, ranging from processing, subsystems, data communication, dsp, and video and graphics to the most advanced board-level components and fully integrated custom systems. The Embedded Computing division designs, develops, and manufactures embedded computing board-level modules and integrated subsystems. Curtiss-Wright also offers a supporting array of services that include: life-cycle management, technical support, training, and custom module development based on COTS.

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Open systems require software APIs

Q & A with Steve Blackman, Director of Business Development, LynuxWorks, Inc.

EDITOR'S FOREWORD

I've known Steve Blackman for many years, throughout his career working for software companies while focusing on the military market. A sought-after panelist and speaker at defense conferences, Steve is one of the foremost authorities on operating systems used in military programs. Now at LynuxWorks, Steve is a driving force behind the company's rapid march into security-based products. – Chris Ciufo

MIL EMBEDDED: ***Please define the term* COTS.**

BLACKMAN: *COTS* [Commercial-Off-The-Shelf] means a hardware or software product that's ready-made and available for sale to the general public. They are often used as alternatives to in-house developments or one-off government-funded developments called *Government-Off-The-Shelf* or *GOTS*. Definitions vary, but here's the one I use:

- There's a part number for purchasing.
- The product is maintained by the vendor in its normal course of business (not NRE-based), and it's supported and has documentation.
- It has more than one customer using it, and there are competitors for the product.
- It's typically used as-is or with minor modifications.

MIL EMBEDDED: ***From the military's perspective, what are the top three advantages of using COTS?***

BLACKMAN: The biggest advantage is that product development is not paid for by the military, and there are no NRE costs. Second, there are no ongoing costs. Finally, reliability is enhanced because the product is proven by use with many users.

MIL EMBEDDED: ***What is the impact of Linux on the industry? How about on the DoD?***

BLACKMAN: Linux has changed the industry dramatically by providing a viable alternative to proprietary operating systems. Business models are being forced to change – vendors are increasingly pressed to eliminate runtime royalty fees; some now sell a bundled project license instead. Since Linux is *free*, vendors are hard-pressed to find a profitable OS business model.

The good, the bad, and the ugly?

The good: Utilization of COTS technology continues to help the defense budget.

The bad: Procurements that require COTS and open systems but ignore it in implementation.

The ugly: Procurements that require COTS and open systems, ignore it in implementation, *and claim to be open.*
– Steve Blackman

Some of the pioneers in the embedded Linux market such as Lineo, TimeSys, and MontaVista have either fallen by the wayside or are very visibly struggling to grow. OS vendors will add special niche capabilities to provide value to customers and evolve products such as middleware or tools to maintain profitability. Continued investment in generic OSs will decrease as Linux becomes a standard.

As far as the military is concerned, while some vendors have raised GPL [General Public License] and security flags to scare away customers, the government in general, and the DoD specifically, has embraced Linux. Security aspects are starting to be addressed, and performance requirements of many military systems are sufficiently low that Linux can and is being specified in many military programs.

MIL EMBEDDED: ***Can you comment on program life-cycles from a software standpoint?***

BLACKMAN: To utilize commercial technology over a long life cycle, the architecture of the system must be designed to allow COTS components to be swapped out easily with newer versions and/or with newer technologies. From a software perspective, the change is typically harder than with hardware. Adherence to open systems APIs allow newer technologies to be more easily inserted – such as swapping out OS A for OS B. Most software systems in the past failed to utilize open standards because it's in the best interest of the vendor and integrator to create lock-in technology.

MIL EMBEDDED: ***Early on, there were dire predictions of doom and disaster if COTS was used by the military. Did any problems actually occur?***

BLACKMAN: Utilizing the Intel 960 on the F-22 was a problem because the processor was discontinued before the jet fighter was completed. The programs reached DMS (Diminished Manufacturing State) before the development was completed. A lifetime buy was not viable. Processor and software changes were required, adding to costs/schedule delays.

MIL EMBEDDED: ***What kinds of systems don't or won't use COTS? Why?***

BLACKMAN: Typically, programs with high information assurance requirements avoid certain COTS components. The NSA may not want wide availability of the technology they are utilizing (such as encryption chips).

Also, programs where the technology does not yet exist are typically funded by the government and forgo COTS. An example is Software-Defined Radio [SDR]. When JTRS [Joint Tactical Radio System] started, each prime that was awarded a contract wrote their own Software Communications Architecture [SCA] framework rather than fund the commercial industry to develop a framework. This has hampered the growth of COTS SCA products in the market because the primes already have in-house products which are funded by the government. At the same time, software developers are reluctant to invest in development of an SCA framework if their potential customers already have in-house solutions.

MIL EMBEDDED: ***At one time vendors had to argue against NDI [Non-Developmental Items], then argue in favor of open standards, then finally argue in favor of COTS. Do you ever fight these battles anymore? What's changed?***

BLACKMAN: I still see leading incumbent vendors avoiding open standards in the software industry. The only change comes when they lose business and are forced to provide the solution, as seen in the Navy's Open Architecture Computing Environment, which mandated POSIX 54. The leading embedded vendor only agreed to add the API for POSIX 54 after they'd seen significant business go away.

> "Apparently the military program offices do not fully understand what *open systems* is about and believe a modular interface will suffice."

I also still see incumbent vendors and primes avoiding open standards after they are awarded the program. Apparently the military program offices do not fully understand what open systems is about and believe a modular interface will suffice. The result is a proprietary-based system that continues to be developed and fielded, adding significant cost to the DoD ($17 billion last year).

MIL EMBEDDED: ***Do you think the military will ever move backwards, away from COTS?***

BLACKMAN: No, COTS will be here for a long time and is driven by cost advantages.

Steve Blackman *is director of business development, mil/aero for LynuxWorks, Inc. With more than 25 years of relevant industry and technology experience in the embedded industry, Steve has managed sales and marketing organizations, selling both hardware and software to the commercial and defense communities addressing applications from networking to safety-critical avionics to security.*

LynuxWorks (www.lnxw.com) is a leading provider to the defense community of embedded operating systems and tool suites that are based on open standards – POSIX, JTA, Navy OACE, Linux LSB, ARINC 653, MILS, and Eclipse. The company's products are uniquely positioned to provide Linux compatibilities with hard, real-time performance, and they address numerous applications from weapons systems and C4ISR to safety-critical avionics and Common Criteria security.

Counterfeit ICs are a real problem for the military

Q & A with John Stannard, President and Cofounder, QP Semiconductor

EDITOR'S FOREWORD

QP Semiconductor is one of the few semiconductor companies in Silicon Valley embracing the military with open arms. Where many IC suppliers have been running from the DoD's requirements for MIL-SPEC devices since the mid-1990s, QP is building their business around high-rel devices. While the company is new to me, they're not new to the defense supplier base. In fact, during my interview with John, I learned that many of his executives are from former valley companies – and they have vast experience in dealing with such military specifications such as MIL-STD-883 or MIL-PRF-38535, the QML spec. John provides our executive roundtable *with the refreshing view that only a component supplier can offer. Even though QP Semiconductor offers full MIL-SPEC devices, they are still COTS devices because there is no government funding provided for development or production – it's all done on QP's* nickel. – Chris Ciufo

MIL EMBEDDED: ***Please define the term* COTS.**

STANNARD: *COTS* to us means Commercial-Off-The-Shelf. That's standard, commercial devices with no additional customization procured through commercial channels. From a components standpoint, *standard products* can be purchased through distribution as well as from the manufacturer.

MIL EMBEDDED: ***I'm wondering if your answer to this question will be different from some of our other roundtable executives, simply because you are a component supplier. What are the characteristics of COTS, and what constitutes a COTS company?***

STANNARD: COTS parts are state-of-the-art commercial devices that, initially, are less expensive than *MIL-SPEC* devices. Virtually every manufacturer is a *COTS* company. Any company that offers *catalog* standard products via multiple market channels (direct sales, distribution, reps, etc.) is a COTS company. These are products designed for commercial markets, where the buyer is both the qualifying activity, where the product is what they want, and the procuring activity.

MIL EMBEDDED: ***How has COTS changed over the past 10 years?***

STANNARD: Some COTS devices are no longer available in the market. Additionally we believe that the ever-shortening parts life cycle has come as a real surprise to users. The *COTS* suppliers respond to rapidly changing commercial markets, where their customers' product life-cycle is short, upgrades occur rapidly and time to-market is very short. These items force changes in the availability of COTS much faster than just the funding cycle of normal military systems, much less the design to production cycles.

COTS parts support products with shorter actual use lifetimes as well, where the fielded product is replaced prior to wear out by *Featureout*. That's where new features are desired so the product is replaced every two years. Or the lifetime of another portion of the system governs the replacement cycle. For example, replacement cell phone batteries aren't purchased because a new phone is available and is less costly than the battery alone.

MIL EMBEDDED: ***Has COTS become accepted within the military? Why or why not?***

STANNARD: Yes, COTS now makes up something like 60 percent to 70 percent of the total shipments of semiconductor

The good, the bad, and the ugly?

The good: Provide same state-of-the-art technology to military OEMs that commercial OEMs get while being cost-effective, and mil OEMs procure advanced technologies right along with their commercial counterparts so they obtain low cost commercial devices which are readily available at the beginning of a program.

The bad: Many military semiconductor manufacturers are closing operations so mil OEMs are faced with *up-screening* standard parts which both adds cost and removes them from being low cost *standard commercial* parts. Also some IDMs [Integrated Device Manufacturers] refuse to sell parts to be up-screened (they still hold the ultimate liability). And due to the short life cycle of commercial products, some devices are exhausted before the end of a program (sometimes before they start!), which may force a costly redesign and costly requal.

The ugly: Not shelf stable; moisture problems; bromide/fire suppressant problems; and unscrupulous vendors. – *John Stannard*

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devices to military applications. There has been some controversy as to the acceptance; however, COTS is a viable solution for certain military programs and will continue to be acquired and deployed.

MIL EMBEDDED: ***Why do you think there is such a problem with counterfeit devices?***

STANNARD: There exists a problem with counterfeit for the oldest reasons in the book: supply and demand combined with greed. Commercial devices, which sell for a modest price, say $1 to $2, can be remarked, and sometimes repackaged, to look like Mil-Spec, hermetic parts and sold for tens of dollars, thus providing adequate incentive for counterfeit artists to *knock-off* the more popular part numbers. Additionally buyers are anxious to get a good deal and so they don't always check the credentials of the vendor. Or they're desperate for a source for hard-to-get materials.

MIL EMBEDDED: ***What do you think can or should be done about it?***

STANNARD: Well, one thing that should definitely not be done is to make more stringent test requirements for Mil-Spec parts as has been proposed. This will only provide a larger profit margin for the copycats and will even give them more incentive to make the parts look more and more like the originals. Today it is often possible to spot a counterfeit just looking at the inferior markings or other package details. Like it is easy to spot the cheap Rolex copy (priced < $20), but the good copy (priced around $100) is much harder. We'd suggest making sure the vendor is a legitimate supplier with excellent credentials and *bona-fides.*

Support the JEDEC G-12/JC-13 task group to develop supportable traceability for materials. The aviation community is having the same problems with mechanical hardware, and traceability is required for that the same as must be required for microelectronics. One of the reasons the normal COTS market is less sensitive is that the high-volume commercial users buy the product through a known chain, use the product quickly, and detect problems very quickly. This is not true in the military world where it's not unknown for product built in the 1980s to be found and used via the broker market.

MIL EMBEDDED: ***Please comment on managing technology (COTS or otherwise) over a long-life (> 10 years) military program.***

STANNARD: The long-term availability of the devices is a real problem; equipment manufacturers must be proactive to procure sufficient stores of devices to last the projected lifetime of the system. Too few spares and they run the risk of costly redesigns, and too many and they face large and continuing expenses associated with inventory management. Combine the long-term needs with the poor long-term storage prognosis of plastic COTS devices and the problem is further exacerbated.

Current federal regulations don't support the move to COTS because of limitations on years of inventory that can be supported for raw materials. This means equipment manufacturers would have to fund this from their own funds, and currently do not.

MIL EMBEDDED: ***Do you know of any problems because COTS was used?***

STANNARD: COTS has worked fine in many applications. In commercial space, the first commercial vendors reportedly experienced difficulties using plastic, commercial parts in satellites, which may have contributed to the demise of the initial LEO satellite programs.

***John Stannard** is president and cofounder of QP Semiconductor, which celebrated its 20th anniversary in 2005. Stannard is an industry veteran for more than 39 years. His career in the semiconductor field began at Fairchild Semiconductor in 1967, and he was an executive vice president at Microtest prior to starting up QP Semiconductor in 1985 .*

QP Semiconductor (www.qpsemi.com) offers a broad array of DSCC certified standard products as well as custom solutions for military and high reliability applications. QP Semiconductor manufactures QML, SMD and MIL-STD-883 compliant products and provides full support for customer source controlled drawings.

COTS moves up the food chain to include subsystems

Q & A with Peter Cavill, President, Radstone Embedded Computing

EDITOR'S FOREWORD

These days, I'm equating Radstone to that quiet company *from TV ads that works consistently behind the scenes to achieve success through steady progress forward, without a whole lot of fanfare. Since the company was created in the late 1980s, Radstone has developed a reputation for quiet innovation. In the past 12 months, the company has completed its integration of ICS and established a beachhead for U.S. operations in Massachusetts. As in the last decade, I expect to see Radstone push forward with NextGen VME, VXI, and VPX products and broaden its FPGA offering substantially. I recently had the pleasure of chatting with Radstone's ever-gentlemanly president, Peter Cavill. The man certainly knows COTS from NDI.* – Chris Ciufo

MIL EMBEDDED: ***Please define the term* COTS.**

CAVILL: *COTS* means a range of products, conforming to an open industry standard, with published and proven functional, performance, and environmental specifications available for sale from a published price list and deliverable on short lead times. In practice, since no one product can possibly meet every requirement of every program, COTS suppliers like Radstone need to provide an efficient custom tailoring service.

MIL EMBEDDED: ***In practice, how are COTS products identified?***

CAVILL: COTS, with respect to embedded computing products, can be characterized as follows:

1. Products conform to an open industry standard such as VME, CompactPCI, VPX, and so on.
2. Products are delivered application-ready, including BSPs, drivers, manuals, cables, and other accessories.
3. Technical support and long-term program support are provided.

The good, the bad, and the ugly?

The good: A healthy, competitive market of (mostly) good quality COTS suppliers driving technology forward and costs down.

The bad: Too many competing *standards*. VME, CompactPCI, VXS, VPX, AdvancedTCA …

The ugly: COTS consolidators trying to turn themselves into Tier 3 primes and competing with their current customers. – *Peter Cavill*

MIL EMBEDDED: ***How has COTS changed in the past 10 years?***

CAVILL: Probably the most significant change has been the way in which COTS has moved up the value chain. Where once programs would source maybe just a commodity product, such as an SBC [Single Board Computer], from a COTS vendor and develop the rest of the system in house, they have progressed to using COTS for all but the most esoteric of functions. Today, there is a trend toward using COTS even more widely to procure complete integrated subsystems with an increasing amount of application-enabling middleware. Clearly, this somewhat favors the broad line suppliers who also have a high degree of systems and software expertise.

Offsetting this is an increasing trend for primes to insist on COTS, but modified to their precise requirements. This gives them the best of both worlds – they can leverage the COTS suppliers' continuous product improvement but get them adapted at relatively minimal cost to meet their exact needs.

MIL EMBEDDED: ***Has COTS become accepted within the military? Why or why not?***

CAVILL: Yes and no. COTS is accepted if it happens to meet the program requirements. If there is no COTS product that is an exact fit, then the program will specify what it wants and persuade someone to build it and call it *COTS*.

Most primes also have a problem with the fact that COTS products evolve. They demand *continuous improvement*, but they don't want anything to change. So when a COTS manufacturer makes a change to improve production yield, for example, the prime won't accept it. What they really want is *continuous improvement* up to the point they want to use the product and *Frozen COTS* from that point to the end of time.

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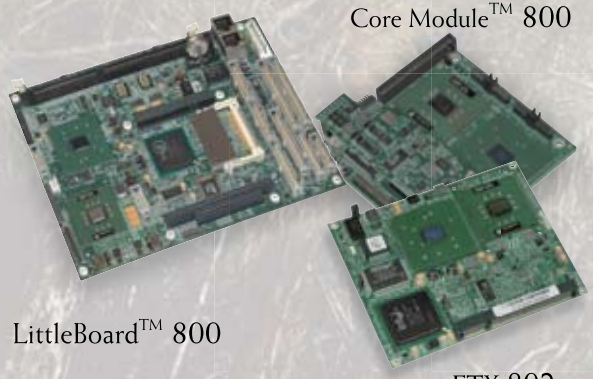

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MIL EMBEDDED: ***From the military's perspective, what are some advantages and disadvantages of COTS?***

CAVILL: The main advantage is leveraging the COTS market's continuous investment in product development. The prime can concentrate R&D dollars on areas that add the most value – systems integration, applications software, program management, and ILS [Integrated Logistics Support].

MIL EMBEDDED: ***Early on, there were dire predictions of doom and disaster if COTS was used by the military. Did any problems actually occur?***

CAVILL: Certainly none with Radstone. Radstone has many COTS success stories. Three notable examples include the Abrams tank CEEP program, the ADCAP torpedo program, and the MLRS/HIMARS program. None of these could've been successfully solved without a COTS approach.

For example, in the case of Abrams and MLRS/HIMARS [both are U.S. Army vetronics programs], the systems use modified versions of Radstone standard COTS products. The programs could probably have been implemented without COTS, but the time to deployment would have been significantly longer and the total program would have incurred significantly more risk.

MIL EMBEDDED: ***What kinds of systems don't or won't use COTS? Why?***

CAVILL: Those where the prime has a vested interest in keeping all design in-house. Another might be highly specialized and low-volume systems, and those that cannot use a standard form factor, although this can almost always be addressed through tailored COTS. There are others, but you get the idea.

MIL EMBEDDED: ***Where do you think military growth will come from in the next few years?***

CAVILL: Smart weapons, remotely piloted/driven vehicles, remote surveillance using radio, radar, infrared, and imaging. These are all applications that require sensor data acquisition and conversion, analysis using massive digital/FPGA processing power, networking and communications, command, and control coupled with high-definition situational awareness displays. All the things COTS is good at.

MIL EMBEDDED: ***I have to ask: Will VME go on forever? And, what about the new VPX, VITA 46?***

CAVILL: To your first question: Certainly not in its current form. Plain old VME will probably still be lingering around in legacy systems 20-30 years from now. It may be that something that calls itself VME is still around 50 years from now, but it won't be VME as we know it today.

As for VPX, it's needed to properly exploit new silicon technology, and that requires a packaging format that can handle higher density of I/O, cope with much higher off-board signaling speeds (10 Gigabit Ethernet, high-speed fabrics, high-res graphics), handle much higher power, and supply higher raw voltages.

VPX does all this without requiring any major changes to the mechanics of existing enclosures. Maybe it's what VME will morph into.

MIL EMBEDDED: ***Do you think the military will ever move backwards, away from COTS?***

CAVILL: No, I think they will gradually embrace COTS still further. Economics and the pace of technology change will persuade them to release an increasing proportion of their development requirements to the COTS market. You might as well ask, "Will people go back to making their own clothes?"

***Peter Cavill** joined Radstone Technology as director of the Industrial Products division in 1993, and is now president of Radstone Embedded Computing. After periods spent at GEC Semiconductors and Fairchild, Peter worked at Inmos, where he became director of the microsystems business and led the team that developed and marketed the transputer. Peter received a BS in Electrical Engineering from Loughborough University in 1968 and an MS in Microelectronics and Semiconductor Technology from Southampton University in 1970.*

Radstone (www.radstone.com) is an industry leader in developing embedded computing solutions for defense OEMs around the world and a key supplier to many DoD programs and military systems. The company has an extraordinarily broad range of COTS solutions and significant applications expertise in areas such as sonar, Software-Defined Radio (SDR), and applied image processing. Radstone also has real strength in rapid customization, complete subsystem integration, and long-term program support.

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Q & A with Clarence Peckham, Director and CEO, SBS Technologies, Inc.

EDITOR'S FOREWORD

Clarence Peckham is arguably the architect of SBS' methodology for crafting COTS solutions to military problems. Clarence has long held the view that Commercial-Off-The-Shelf rugged products can be adapted to harsh environment problems by using an out-of-the-box way of thinking about manufacturing and test methodology. In previous discussions with Clarence over a period of many years, he has convinced me that the SBS way provides robust products with fewer steps involved. Clarence has also overseen the consolidation of his company's numerous acquisitions into a cohesive top 5 *supplier of COTS products to the world's militaries. (Full disclosure: Clarence and I once worked together at the same company.)* – Chris Ciufo

MIL EMBEDDED: ***Please define the term* COTS.**

PECKHAM: *COTS* really means whatever the customer thinks it means. Ten years ago we might have agreed on a single definition, but lately it seems to have evolved into several definitions. Today, our COTS products are truly commercial products that can be purchased by any customer across multiple market sectors. Although some vendors in our industry use the term *custom-off-the-shelf*, we don't feel these products are so much *custom* as they are *configured*. A COTS component is designed to an open standard so that systems can be built from standard products, or their derivatives.

MIL EMBEDDED: ***What are the characteristics of COTS, and what constitutes a COTS company?***

PECKHAM: Using COTS products reduces overall system cost and the time it takes to design and build the system. COTS companies are in the standard product business, not the engineering services business, so whenever possible, COTS suppliers develop for the widest set of market requirements to satisfy the largest set of applications with a standard product.

MIL EMBEDDED: ***How difficult has it been for SBS to transition from a board supplier to system supplier for the military?***

PECKHAM: For SBS, it was a natural progression. Given the large variety of products we offer, many of our customers were coming to us for more than one of the components in their systems. Not only have we simplified their procurement process, but we have introduced several packaging innovations in the rugged subsystems that we build, streamlining a number of our customers' systems.

MIL EMBEDDED: ***How has COTS changed over the past 10 years?***

PECKHAM: Over time, the COTS market has become more realistic about what should and should not be a COTS product. Some products simply need to be kept proprietary and custom. Today, however, there are many acceptable COTS products for interconnects, bus architectures, fabrics, and environmental conditions. The choices available for COTS procurement span from a simple Dell PC to a highly ruggedized flight computer with very specific I/O and processing capabilities.

MIL EMBEDDED: ***What are some disadvantages to the military in using COTS?***

PECKHAM: One real challenge is the issue of component life cycles for COTS products. We pay careful attention to component availability so that we can meet a program's needs until it is completed. Also, interoperability between multiple COTS supplier products continues to be a challenge for all of the COTS market.

MIL EMBEDDED: ***Will technologies developed in the communications market find a home in the COTS market?***

PECKHAM: Absolutely! We are seeing as much interest from the military markets in the new AdvancedMC modules as we see from other markets. The military may not be interested in ATCA [Advanced Telecom Computing Architecture, a PICMG standard], but emerging packaging solutions like MicroTCA will make high-performance, high-volume AMC modules very attractive to certain military applications.

The good, the bad, and the ugly?

The good: We proved it really can be done. Today our military is taking advantage of every technology it can get its hands on – no matter where it comes from. The COTS approach really does work; we've seen the economic and developmental advantages.

The bad: When a prime contractor tries to futilely implement something and cannot get to the point of letting us help them with a solution that we already have designed.

The ugly: When a great commercial technology is developed and it is perfectly suited to military needs but fails to get market traction in the commercial markets it was created for. *–Clarence Peckham*

MIL EMBEDDED: ***Early on, there were dire predictions of doom and disaster if COTS was used by the military. Did any problems actually occur?***

PECKHAM: Early on during the adoption of COTS products, the prime integrators faced numerous issues like poor product interoperability, discontinuance of products sometimes even before a program entered production, advertised functionality not always meeting real performance, and so on. These early problems unfortunately created uncertainty about the use of COTS products. Over time, the military and aerospace COTS industry took the necessary steps to address these concerns, and today COTS products are now the preferred choice.

MIL EMBEDDED: ***Talk about some COTS successes. Could these have been solved without COTS?***

PECKHAM: Given enough dollars and time for development, most of the successful uses of COTS products could have been satisfied without the use of a COTS approach, but as we have seen, time and dollars are major driving factors for the use of COTS products. Some COTS successes are the M1A2 SEP tank upgrade, F-16 COTS Fire Control Computer, AV-8B OSCAR program, and the Global Hawk UAV. Each of these programs represents a diversity of applications that have benefited greatly from a COTS approach.

MIL EMBEDDED: ***Will commercial communications technologies like Ethernet coexist with traditional avionics communications or will one dominate that market?***

PECKHAM: For now they will coexist. Each technology has its niche. If Ethernet is sufficient, customers will use it. Other applications, though, will continue to require better real-time performance or hard interrupts and will remain with traditional technologies or enhanced versions of them for some time.

MIL EMBEDDED: **Do you think the military will ever move backwards, away from COTS? Why?**

PECKHAM: I think a backwards move is not possible now. Military customers have gotten spoiled by the advanced technology we can get off-the-shelf today. When you consider the man-hours and carried-forward technology that goes into a technology as common as Gigabit Ethernet, it becomes very clear that it is impractical to build a similar technology from scratch.

Clarence Peckham is a director and the chief executive officer of SBS Technologies, Inc. Before his appointment as CEO, he served as the president of SBS' Commercial and Government group. Before joining SBS in 1997, Clarence was vice president of engineering and chief technologist at DY4 Systems in Canada. He has more than 30 years of experience in the embedded computing field, and he holds a BS degree in Electrical Engineering from Northeastern University.

***SBS Technologies** (www.sbs.com) has grown from a board manufacturer that supplied avionics hardware to a complete turnkey COTS system supplier. Today the company offers more than 500 core products that are used to build complete rugged COTS systems. SBS designs and manufactures a wide variety of network communications modules, single board computers, graphics cards, and complete embedded systems.*

Software *components* enable SDRs

Q & A with Francis Bordeleau, CEO, Zeligsoft

EDITOR'S FOREWORD

I first met Francis at last year's Software Defined Radio Forum. At an evening event sponsored by Zeligsoft, Francis was kind enough to give me time out of his schedule while a room full of people waited for him. Zeligsoft is at the forefront of the growing SDR movement, and the company is positioning itself as a COTS provider of tools and services. Perhaps more so than our other participants in this year's executive roundtable, *Zeligsoft is a newer entrant to the mil market and offers an interesting, software-centric view of COTS.* – Chris Ciufo

.

MIL EMBEDDED: ***What do you think constitutes a COTS company?***

BORDELEAU: A COTS company sells something that is ready to use and that is not customized. A COTS vendor invests its own dollars in R&D and sells their product at fair market value in a competitive market and customers do not pay NRE. Customers of COTS vendors benefit from competitive price points when adoption takes place. They also benefit from more comprehensive testing and product evolution that results from multiple customers having the same product.

To sum it up, COTS is about getting something less expensively, quicker, and with higher quality.

MIL EMBEDDED: ***How has COTS changed during the past 10 years?***

BORDELEAU: Initially COTS adoption moved fast and then as the technology changed and as programs changed, it slowed down a bit. In the case of the JTRS [Joint Tactical Radio System, the military's key SDR program], primes got into ground-up development themselves, so the COTS waters are a bit murky.

The process has changed. Customers used to have to pay a lot for companies to integrate the COTS pieces. There is less and less in-house development. When needing to make a buy vs. build decision, they like to buy. Now the COTS vendors are doing integration as a value-add to their customers.

MIL EMBEDDED: ***What are some of the advantages and disadvantages of COTS?***

BORDELEAU: Reuse of expertise is a key advantage. People with expertise can sell, people with need can buy. The military has much less of a burden to train human resources. The vendors invest and develop their specialization, which the military benefits from.

As a downside, there is considerable integration involved in a COTS solution, and the military no longer controls the life cycle of product.

MIL EMBEDDED: ***How are open standards affecting the military?***

BORDELEAU: What will ensure COTS success is standardization; users have to accept a standard interface so that there can be multiple sources.

MIL EMBEDDED: ***What is it going to take for component-based S/W development to take off?***

BORDELEAU: Just like the IT world, we think the marketplace is poised to buy *components* for S/W security, encryption, filters, and so on.

For this to take off, the community needs standardization of APIs; in fact, a standardization of a whole chain of APIs. In order for it to take off, the industry also needs to tackle testing associated with COTS. The black-box aspect of components makes it difficult to test for undesired behaviors and robustness.

COTS: The good, the bad, and the ugly?

The good: With COTS we can build more complex systems – more features, more functionality.

The bad: It has not been a free ride. COTS has a cost. That includes: always integrating, keeping the whole system together as the pieces evolve, and dependencies on providers.

The ugly: Nothing ugly to report. – *Francis Bordeleau*

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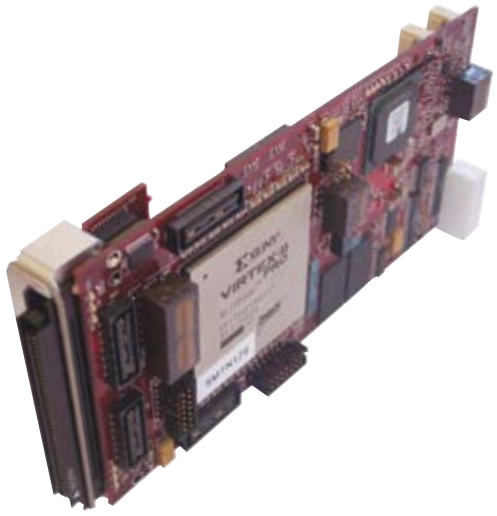
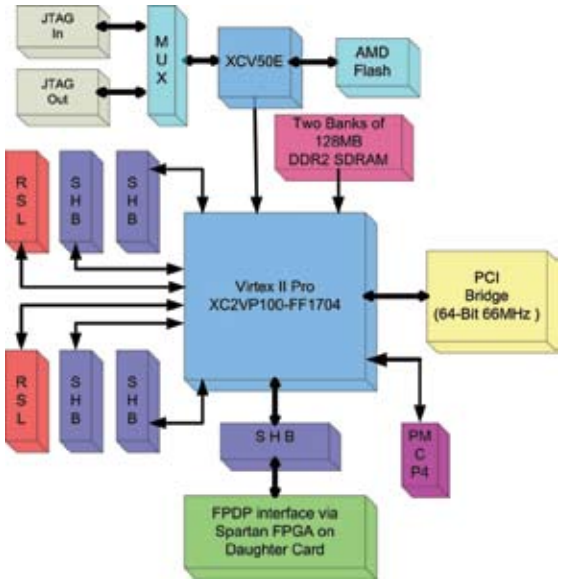
SMT498 prPMC FPGA Module





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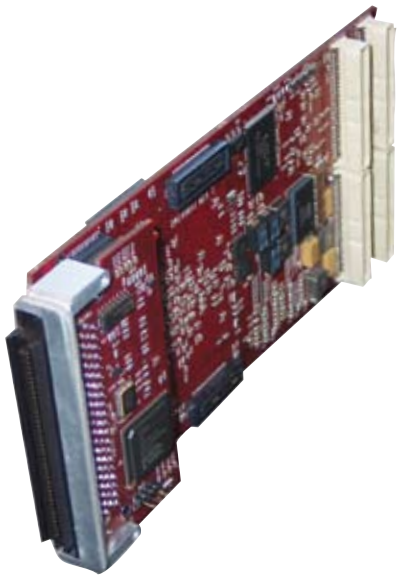
Benefits:

- Powerful pre-processing module with FPGA resources.
- In-System FPGA Configuration (System ACE SC)
- Full System Gen and Chipscope support with our special Driver
- Comm-port interface to be used with other Sundance products.
- Can also be used stand-alone in embedded systems
- Example VHDL codes are provided to show usage of various resources



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Mil Tech Trends

The JTRS standard – the SCA – is allowing vendors to market middleware such as Object Request Brokers [ORBs] and SCA Core Frameworks for use with component-based S/W systems. Real-time operating system vendors are also packaging specifically for SCA applications.

The Unified Modeling Language [UML] was accepted as a standard in the object-oriented programming world and opened the market for tools and technologies to be used off-the-shelf. If the COTS community can agree on specific interfaces, like the SCA, component-based S/W development will take off.

MIL EMBEDDED: ***What about managing over a long-life military program?***

BORDELEAU: The number one problem is keeping the technology robust, tested, and documented as the versions of the different pieces are changing. Version control is a challenge for a COTS solution. Upgrades to components need to be retested and validated against original specs. There is also a question of when to use the new version of a component.

MIL EMBEDDED: ***Will COTS S/W go through the same evolution as COTS H/W has?***

BORDELEAU: S/W components can have the same impact that COTS H/W components had. How many companies are building an SDR downconverter or an antenna controller, or an ABS system in the automobile world? The software world will mature just like the H/W world. The S/W world will get there. It isn't harder, but it will follow. For it to be successful, it needs to be domain-specific (like the JTRS SCA that is under the OMG umbrella). Feature-based specifications are needed. COTS software vendors need to build components for reuse. The mindset of reuse is key. COTS customers must design their systems with components that have been developed with the specific use/context in mind.

COTS will render product faster, higher quality, and cheaper. This is very much needed with the complexity of software systems today; just take a look at the complexities in the commercial world pertaining to home entertainment, video CODECs, and DRM [Digital Rights Management]. The embedded world follows the IT world by 10 years. The IT world is all COTS.

MIL EMBEDDED: ***What kinds of systems don't or won't use COTS? Why?***

BORDELEAU: With COTS, everything is about granularity. If you are leading the edge from a technical perspective, you need to go to less granularity.

Highly secure systems won't use COTS; it's too leading-edge. But leading-edge will change; as it becomes mainstream, it will move to COTS.

MIL EMBEDDED: ***Speaking of open standards, can the Eclipse Platform become the standard for software development tools integration?***

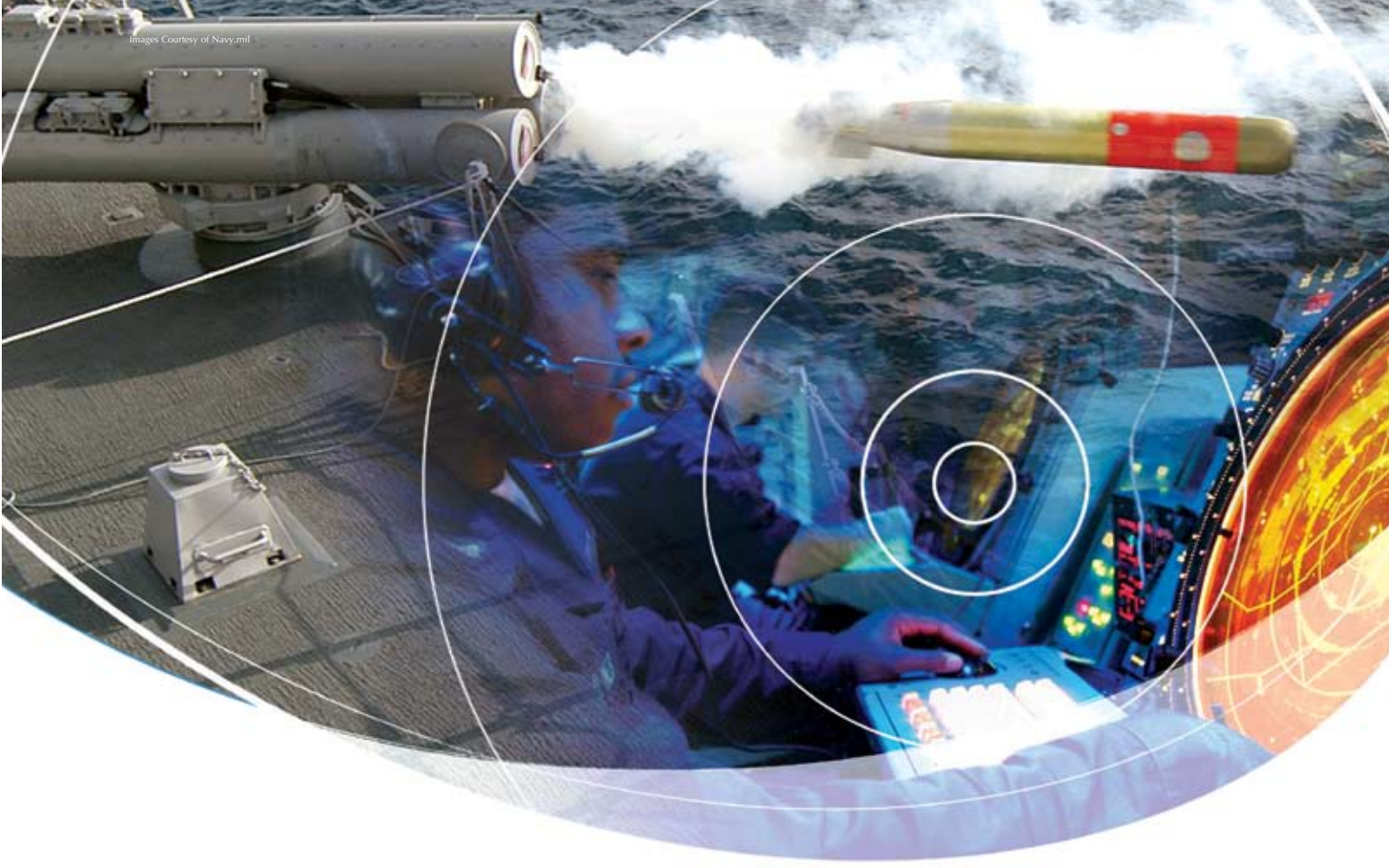
BORDELEAU: Yes it can. The tools vendors, however, must be willing to change how they do things and adopt the Eclipse Platform.

MIL EMBEDDED: ***Do you think the military will ever move backwards, away from COTS? Why?***

BORDELEAU: We don't think it will ever move back down. Innovative technologies come from specialization. There is too much to lose.

***Francis Bordeleau** is CEO of Zeligsoft. He has more than 13 years of experience managing, researching, teaching, and defining in the domain of Model Driven Development (MDD), software engineering, component-based technologies, and Software-Defined Radio systems. He has worked, consulted, and collaborated with numerous companies, including IBM, Rational Software, Mercury Computer Systems, and Nortel. Francis holds a B.Sc. Mathematics from the University of Montreal, a B.Sc.A. Computer Science from Université du Québec à Hull, and a Master of Computer Science and a Ph.D. in Electrical Engineering from Carleton University.*

Zeligsoft (www.zeligsoft.com) is a leading provider of market-specific embedded software development tools that enable the development of component-based systems. Leading aerospace and defense companies use Zeligsoft tools to build Software-Defined Radios that conform to the Software Communications Architecture [SCA].



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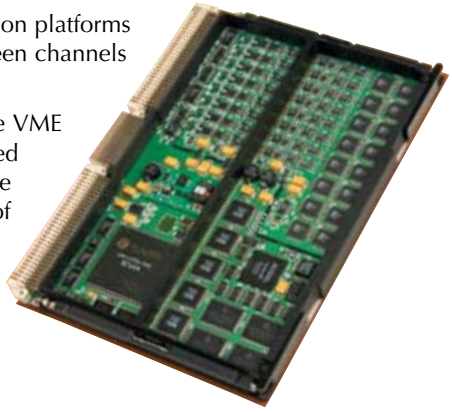
Designed and built to withstand extremes of temperature, shock and vibration in locations and on platforms that would defeat other data acquisition cards, the 6U VME form factor ICS-8145 provides sixteen channels capable of synchronous sampling at frequencies up to 2.5 MSPS/channel.

Up to 8 MBytes of onboard storage means that fast transient captures can be read back over the VME bus without data loss. Alternatively, output data may be routed through the backplane-connected FPDP II port at up to 400 MBytes/second. And as you'd expect from ICS, multiple boards can be synchronized to provide high channel count data acquisition systems for the most demanding of applications.



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Kontron AM4001 PrAMC

The Kontron AM4001 is a highly integrated AMC processor module based on the low-power Intel Pentium M combined with the server-class E7320 chip set and up to 4 GB DDR2 ECC memory. The AM4001 is ideal for I/O-intensive communication applications, packing full-scale server performance into a small AdvancedMC module.

Features include dual GbE and x4 PCI Express fabric interfaces plus high-throughput storage support via dual SATA interfaces. Fully hot swappable and IPMI 1.5 compliant, the AM4001 is the perfect building block for a wide range of applications.

FEATURES:

- Intel Pentium M processor up to 2 GHz with 533 MHz PSB, E7320 chip set, 6300ESB I/O hub
- Up to 4 GB DDR2 SDRAM memory with ECC at 400 MHz
- AMC.1/.2/.3-compliant AdvancedMC module
- Dual GbE interfaces, x4 PCI Express, dual SATA
- USB 2.0 plus optional RS-232 front-panel interface
- Write protect support for secure applications

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Kontron AM4500 SATA

AdvancedMC modules are the key to extending the value of AdvancedTCA platforms designed for multiple applications in the wireless/wireline network infrastructure. An ideal low-cost storage solution, the Kontron AM4500 module is available in full-height, single-width form factors, and offers up to 60 GB storage capacity. Built in accordance to the AMC.0 specification, the AM4500 is also AMC.3-compliant, features Native Command Queuing (NCQ) with up to 32 instructions to be queued and reordered, and is easily managed via IPMI v1.5. As a Field Replaceable Unit (FRU), the AM4500 also follows the same stringent carrier grade RASM feature set, namely – Reliability, Availability, Serviceability, Maintainability.

FEATURES:

- AMC.3-compliant in full-height, single-width (AMC.0)
- Up to 60 GB capacity
- 5,400 rpm, 12 ms average seek time (1.5 ms track to track)
- Supports 2 SATA ports with onboard selector
- S.M.A.R.T. technology
- Management through IPMI 1.5 implementation

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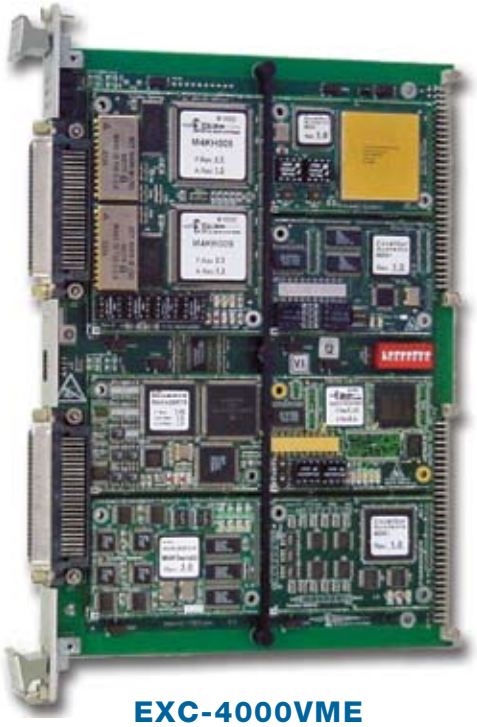
4000 Magic Plus Series

Last quarter there was a need for simulating seven MIL-STD-1553 Bus controllers on a VXI system. Next quarter they want to monitor 30 channels of Arinc-429 and two channels of Arinc-708 on a cPCI system. Next year you're looking at an integration project involving MIL-STD-1553, Discretes and Arinc-429 but the platform hasn't been selected yet. How do you handle the learning curves and risks associated with these different projects and still come up with with reasonable costs and manageable risk?

Excalibur's **EXC-4000** series was developed for just such needs. With baseboards available for PCI, cPCI, P104plus, VME and VXI moving from platform to platform is automatic. Software drivers hide all the internal system differences and present a common interface for all platforms.

Common modules snap into the baseboards to handle MIL-STD-1553/1760, Arinc-429, Arinc-708, CANbus, Discretes, H009, RS422/485/232 with more in development. Up to four modules fit onto a PCI/cPCI baseboard with up to eight modules on VME/VXI boards.


EXC-4000VME


Exalt Plus Screenshot

Exalt Windows based software can handle all the above scenarios without any additional programming. It can monitor, record, compare and with **Exalt+** transmit to handle a variety of test and simulation needs. Multiple graphical formats for viewing the data ease analysis of the bus and built in tools help identify communications and data errors.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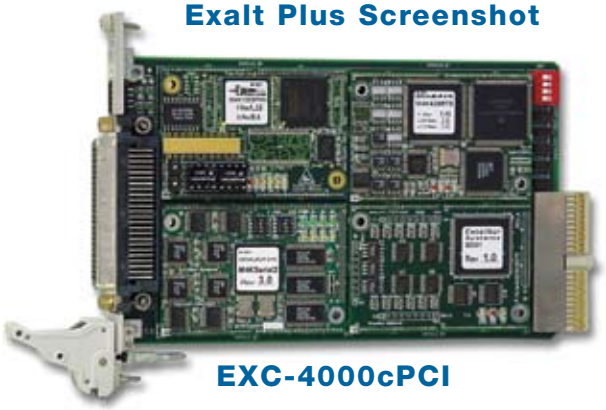
If your project requires custom software, our drivers will simplify the task. All source codes for drivers are always included and the service is an integral part of the product.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Kontron AM4300 Quad GbE I/O

AdvancedMC modules are the key extending the value of AdvancedTCA platforms designed for multiple applications in the wireless/wireline network infrastructure. The Kontron AM4300 Quad GbE module is the ideal AdvancedMC unit for network applications that require multiple ports directly from an AdvancedTCA processor blade. Available in full-height, single-width form factors, the AM4300 features four 10BASE-T/100BASE-TX/1000BASE-T ports, supports PCIe x8, x4, x2, and x1 link, and supports remote management via IPMI v1.5. As a hot-swappable Field Replaceable Unit (FRU), the AM4300 also follows the same stringent carrier grade RASM feature set, namely – Reliability, Availability, Serviceability, Maintainability.

FEATURES:

- Full-height single-width per AMC.0 specification
- PCIe x8, x4, x2, and x1 link supported
- Internal RISC processor to manage transmit and receive data path
- Management through IPMI 1.5 implementation
- Multiple configurations available

For more information, contact: sales@us.kontron.com **RSC# 21947 @ www.mil-embedded.com/rsc**

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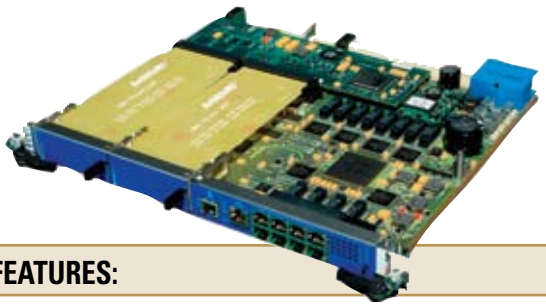
Kontron AT8902 B/F Switch

The Kontron AT8902 is a highly versatile AdvancedTCA Base and Fabric (1 x GbE, 2 x GbE) switch board that supports two AdvancedMC modules and multiple GbE switch fabric options.

Leading-edge switching technology provides full wire-speed for all load conditions and network topologies. Dual AdvancedMC slots open a wide range of applications in only a single AdvancedTCA slot. When combined with a processor, mass storage, and network interface modules, the AT8902 is the heart of many high-performance and cost-effective solutions. Dual 10 GbE fabric interlink enables multi-shelf AdvancedTCA systems. Switch management is fully supported via SNMP, Telnet, and CLI.



FEATURES:

- PICMG 3.0/3.1-compliant base and fabric interface switch
- Two AdvancedMC module slots for customization
- Nonblocking layer 2 switching with VLANs
- Dual GbE services to redundant switch board and payload slots 2-5
- Versatile front/RTM uplinks (base/fabric, 4x GbE each)
- Dual 10 GbE connection to one AdvancedMC slot

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Intel NetStructure® MPCBL0040 Single Board Computer

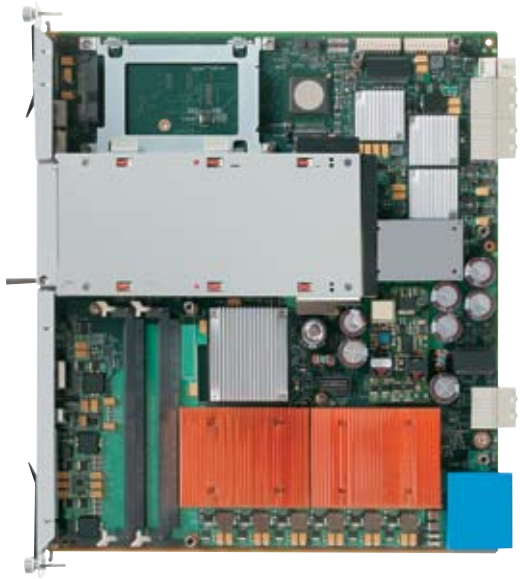
The Intel NetStructure® MPCBL0040 single board computer is the latest in a series of high-compute boards introducing powerful multicore architecture compliant with the Advanced Telecom Computing Architecture (AdvancedTCA) specification. The MCPBL0040 features two Dual-Core Intel® Xeon® processors LV 2.0 GHz for a total of four processor cores, driving significant performance improvements in multitasking compute power. Delivering this high level of processing power on a single blade provides unique scalability when designing applications for IP Multimedia Subsystem (IMS), IPTV, and wireless control plane applications.

The MCPBL0040 is designed to interoperate with AdvancedTCA products from Intel and with third-party building blocks meeting the PICMG 3.0 specification.

The processor subsystem of the MPCBL0040 offers:

- Two physical processors – each supporting two processing cores, an enhanced bus arbitration protocol, a power-optimized 667 MHz Front-Side Bus (FSB), and a 2 MB shared L2 cache per physical processor
- 36-bit memory addressing to access up to 8 GB of DDR2 memory for compute-intensive applications
- FSB address, data parity, and an enhanced error reporting mechanism through Machine Check Architecture (MCA) that ensures reliability and data integrity

The MPCBL0040 has one AdvancedMC site, which supports the next-generation mezzanine card standard and is optimized for AdvancedTCA specification-based boards. AdvancedMC uses PCI Express for maximum throughput of up to 12.5 Gbps. It enables increased board area and power envelope, allowing the MPBCBL0040 to support high-density I/O and processor capabilities. It also provides full hot-swap support and allows management via an onboard IPMB bus. AdvancedMC cards can reduce time to market, providing baseboard modularity via an easy-to-use expansion slot that requires no infrastructure.



FEATURES:

- Performance boost from multicore processor technology enables superior subsystem scalability and greater density
- More subscribers/transactions per board allow more network elements in an AdvancedTCA chassis, improving system scalability
- Intel® E7520 chipset provides direct connection between the MCH, PCI Express component, and AdvancedMC modules
- Delivers higher bandwidth with PCI Express for outstanding I/O throughput and improved platform performance
- Option for enterprise-class hard drive supports Serial Attached SCSI (SAS) drives with MTBF of more than 1 million hours
- Dual-Star GbE base and fabric interfaces (PICMG 3.0/3.1) support high I/O requirements and access to high-speed storage systems
- Enterprise-class hard drive option supports high reliability, low latency data access for boot up and other local storage
- One AdvancedMC slot allows module hot-add and hot swap, higher throughput bandwidth than PMCs, and easy expandability
- Intelligent Platform Management Controller supports carrier-grade system reliability and manageability
- Redundant BIOS images, IPMC firmware images, and dual 128 MB flash drives enable high reliability for field deployments
- Onboard and external storage options (local hard drive, front SAS ports, redundant flash drives) support configuration flexibility

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Kontron AT8400 AMC Carrier

The Kontron AT8400 carrier board is a PICMG 3.0/3.1-compliant Node Board for AdvancedTCA shelves, supporting four AdvancedMC slots – full height/single width – ideal for a multitude of application requirements.

AMC – Everywhere integration for customization
With support for four AdvancedMC modules, the AT8400 provides equipment manufacturers with the exceptional flexibility to customize the design of their network applications. The AT8400 supports a wide assortment of AdvancedMC modules used for processing, storage, and I/O applications.

A prime example is RAID 5 storage using three SAS AMC modules and one Processor AMC. This setup enables quick and reliable lookup times of wireless customer information integrated into HLR/HSS network elements.

FEATURES:

- PICMG 3.0/3.1-compliant base and fabric carrier board
- Four cutaway AMC slots and full hot-swap capabilities
- PCI Express and GbE switching
- SAS controller and Telco clock for all AMC slots
- Redundant base interface and dual redundant fabric interface; IPMI version 1.5 support
- Management via SNMP, TELNET, or CLI, either in-band or out-of-band via 10/100BASE-T Ethernet or RS-232

For more information, contact: sales@us.kontron.com **RSC# 29926 @ www.mil-embedded.com/rsc**

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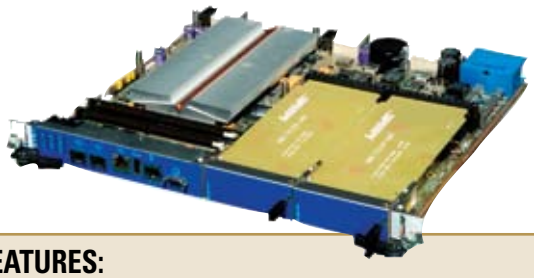
Kontron AT8001 PrATCA



The Kontron AT8001 AdvancedTCA PICMG 3.0/3.1 processor board is simply the most unique ATCA processing platform on the market. Featuring a high-performance Intel LV Xeon at 2.8 GHz, dual AdvancedMC slots, and server-class E7520 chip set, the AT8001 offers performance and flexibility for an unprecedented range of applications.

Features include dual GbE and dual Fibre Channel on fabric interface, dual GbE on base interface, and up to 8 GB of DDR-II 400 SDRAM. Combined with AMC modules from Kontron's "AMC Everywhere" line, a wide range of unique solutions can be realized in only a single ATCA slot.

FEATURES:

- Single-slot AdvancedTCA PICMG 3.0/3.1 processor board with support for two AMC.1 modules
- Intel Low-Voltage Xeon processor up to 2.8 GHz
- Dual DDR-II DIMM for 8 GB of PC2-3200 registered 400 SDRAM
- Dual GbE base interface
- Dual GbE plus dual Fibre Channel on fabric interface
- IPMI v1.5 support

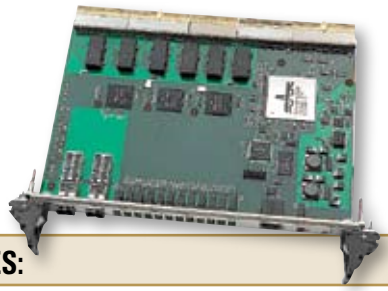
For more information, contact: sales@us.kontron.com **RSC# 24936 @ www.mil-embedded.com/rsc**

DSS Networks, Inc.

23 Spectrum Pointe, Suite 202 • Lake Forest, CA 92630
Tel: 949-716-9051 • Fax: 949-716-9052
www.dssnetworks.com

Model 8261 Switch

This is an advanced, high-performance, full-featured, multilayer, 6U GbE switch-fabric board featuring 12 10/100/1000BASE-T ports over copper with two 1000BASE-SX/LX fiber uplinks. This switch is PICMG 2.16-compliant and compatible with both standard CompactPCI and PICMG 2.16 backplanes. All 12 ports can be routed to slots on the CompactPCI backplane or externally via rear I/O. The Model 8261 uses the latest advanced high-performance, full-featured, and highly integrated 12-port Broadcom BCM5690 multilayer switch and BCM5464SR quad-port transceivers, and is fully 802.3-compliant. This switch is available with an OEM developer's kit containing onboard firmware with many features.



FEATURES:

- Fourth-generation BCM5690 switch fabric and BCM5464SRKB quad-port transceivers from Broadcom
- High-performance wire speed on all ports – 24 Gb total; up to 32,000,000 frames per second maximum switching rate
- Onboard firmware for configuration, management, and health monitoring
- Cell and packet-based *head-of-line* blocking prevention; 1 MB of onboard memory for packet buffering
- Extended Ethernet frame sizes to 9 kB; fully compliant to IEEE 802.3 specifications, including autonegotiation
- Onboard Motorola DSP56F826, 80 MHz RISC/DSP processor for local management; serial port for console CL1 and debug

For more information, contact: sales@dssnetworks.com **RSC# 20484 @ www.mil-embedded.com/rsc**

MILITARY EMBEDDED SYSTEMS Resource Guide 2006 CompactPCI

Kontron

14118 Stowe Drive • Poway, CA 92064-7147
Tel: 888-294-4558 • Fax: 858-677-0898
www.kontron.com

Kontron CP6012 Core Duo

Kontron's CP6012, a 6U CompactPCI CPU board with Intel Core Duo processor (2 GHz), meets the highest performance demands.

With its E7520 and 6300ESB chipset, it handles data throughput like a server. Compared to Intel Pentium M, dual-core technology enables approximately twice the performance at similar power consumption.

The CP6012 is designed for bandwidth-intensive applications and, thanks to hot-swap support and IPMI, meets the highest demands for the management of high-availability applications.

It offers a high degree of integration and latest interface technologies such as PCI Express, up to 4 GB/400 MHz DDR2 SODIMM RAM (6.4 GBps), and 2x fast Serial-ATA interfaces: onboard hard drive, CompactFlash slot.

FEATURES:

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

For more information, contact: sales@us.kontron.com **RSC# 30032 @ www.mil-embedded.com/rsc**

Kontron
14118 Stowe Drive • Poway, CA 92064-7147
Tel: 858-677-0877 • Fax: 858-677-0898
www.kontron.com

Kontron CP307

The Kontron CP307 is the first 3U CompactPCI processor board to offer the powerful Intel Core Duo processor, clocked at up to 2 GHz. Packed with the features of Intel's 945GM Express chipset and ICH7-R I/O hub, the CP307 offers record-breaking levels of 3U performance and feature integration.

Dual core technology puts two CPU cores in a single package for nearly twice the performance of the Intel Pentium M at nearly the same power and space footprint. Ultra-fast PCI Express insures streamlined onboard I/O data flow. Soldered CPU and memory mean a rugged, durable board fit for the toughest conditions. Optional extended temperature and long-term availability make the Kontron CP307 the perfect choice for military, aerospace, and a wide range of demanding applications.

FEATURES:

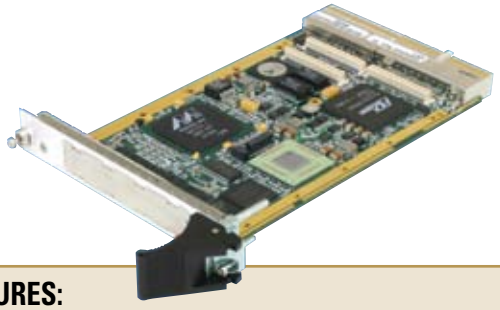
- 2 GHz/1.6 GHz Intel Core Duo (T2500/L2400) or 1.6 GHz Core Solo (T1300), 945GM Express chipset with 667 MHz FSB
- Up to 4 GB DDR2-SDRAM @533/667 MHz (10.6 GBps memory bandwidth)
- 2x GbE ports (front or rear), 2x SATA, 6x USB 2.0, CompactFlash to 8 GB, Legacy PC I/O
- Dual-headed 2D/3D integral graphics acceleration, DVI and VGA interfaces
- Single (4 HP) and dual-slot (8 HP) versions available, onboard SATA HDD (8 HP version); front and rear I/O
- Soldered processor, memory standard; extended operating temperature (-40 °C to +85 °C) optional

For more information, contact: sales@us.kontron.com **RSC# 30026 @ www.mil-embedded.com/rsc**

CompactPCI MILITARY EMBEDDED SYSTEMS Resource Guide 2006

SBS Technologies, Inc.
7401 Snaproll N.E. • Albuquerque, NM
Tel: 505-875-0600 • Fax: 505-875-0400
www.sbs.com

CV1 – 3U PPC SBC



The CV1 is a rugged 3U CompactPCI PowerPC Single Board Computer with 1 GHz MPC7447A G4 processor. The CV1 features 256 MB DDR SDRAM, 128 MB flash, and two Gigabit Ethernet ports. It can be used as a system controller or peripheral card. The CV1 also features a 32-bit PMC site with I/O lines to the backplane. Additional I/O includes RS-232 and RS-422/485 serial ports and 10 general purpose I/O ports to the backplane. The CV1 is ideal for environments that require the power of a G4 processor in a compact, 3U form factor. Its integrated PMC site provides maximum flexibility and conserves system slots.

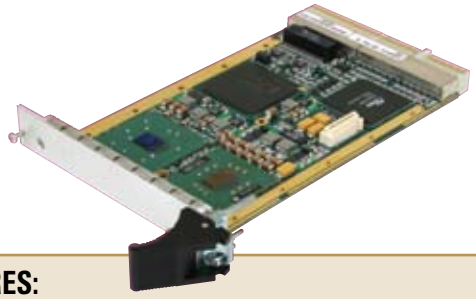
FEATURES:

- MPC7447A/7448 G4 PowerPC processor
- 256 MB DDR SDRAM and 128 MB flash memory
- System or peripheral slot operation
- Convection- or conduction-cooled configurations
- Onboard PMC site for additional I/O
- Two Gigabit Ethernet ports, plus RS-232 and RS-422/485 serial ports

For more information, contact: info@sbs.com **RSC# 30135 @ www.mil-embedded.com/rsc**

SBS Technologies, Inc.
7401 Snaproll N.E. • Albuquerque, NM
Tel: 505-875-0600 • Fax: 505-875-0400
www.sbs.com

CR4 Pentium M SBC



The rugged 3U CompactPCI Single Board Computer (SBC) with an Intel Pentium M LV 738, 512 MB DDR SDRAM, 512 kB firmware HUB, and two Gigabit Ethernet, is available in convection- or conduction-cooled configurations and can operate as system controller or peripheral card. The CR4 features:

- Intel Pentium M LV 738 processor 1.4 GHz
- 512 MB DDR SDRAM
- Type I CompactFlash on daughtercard
- Two Gigabit Ethernet ports
- Two USB 2.0 ports
- Two serial I/O (RS-232, RS-422) ports
- Serial ATA port
- Eight GPIO ports
- Convection- or conduction-cooled
- System controller or peripheral card

FEATURES:

- Rugged 3U CompactPCI SBC with an Intel Pentium M processor
- 512 MB DDR SDRAM
- Two Gigabit Ethernet ports, two USB 2.0 ports, two serial I/O (RS-232, RS-422) ports, and Serial ATA port
- Type I CompactFlash on daughtercard
- Convection- or conduction-cooled
- System controller or peripheral card

For more information, contact: info@sbs.com **RSC# 30059 @ www.mil-embedded.com/rsc**

MILITARY EMBEDDED SYSTEMS Resource Guide 2006 CompactPCI

SBS Technologies, Inc.
7401 Snaproll N.E. • Albuquerque, NM
Tel: 505-875-0600 • Fax: 505-875-0400
www.sbs.com

CK5 - Rugged 6U CompactPCI PPC Single Board Computer

CK5 is a rugged 6U CompactPCI single board computer with a high-performance processor, system bus, memory bus speeds, and system memory capacities.

The CK5 hosts the PPC G4 MPC7447A processor with core processor speeds up to 1 GHz and 512 KB of onboard L2 cache. The MPC7447A processor is supported with a 167 MHz MPX system bus.

The CK5 includes a high-speed DDR SDRAM controller with 167 MHz interface, multiple 10/100BASE-TX Ethernet MACs, and two 64-bit PCI bus interfaces. It also includes two MPSC ports. The CK5 offers DDR SDRAM of 256 MB, 512 MB, and 1 GB.

Each of eight programmable GPIO ports with independent interrupts can be programmed for direction, polarity, and masking.

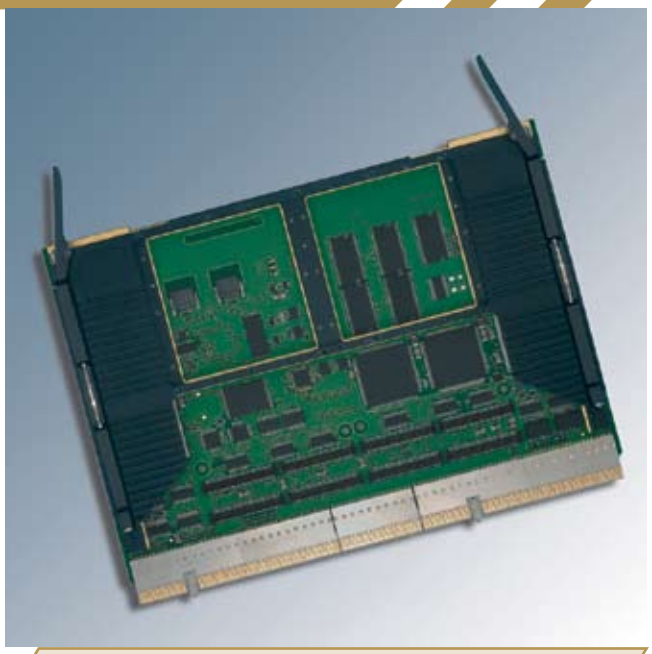
FEATURES:

- MPC7447A G4 host processor with 512 KB on-chip L2 cache
- MV64460 PowerPC system controller (Discovery III) bridge chip
- 10/100BASE-T Ethernet port to backplane (convection- and conduction-cooled versions)
- The CK5 hosts two IEEE1386.1 PMC sites for expanding I/O capability with WAN or LAN I/O
- Offered as a ruggedized conduction-cooled processor card and also in a convection-cooled configuration
- Two RS-232, four RS-422, and two USB 2.0 ports

For more information, contact: info@sbs.com **RSC# 20058 @ www.mil-embedded.com/rsc**

Creative Electronic Systems
38 Avenue Eugène-Lance • Grand-Lancy 1 / Geneva, Switzerland 1212
Tel: 41-22-884-51-00 • Fax: 41-22-794-74-30
www.ces.ch

Conduction Cooled RIOC 4070



Applications

The RIOC 4070 from CES is the first conduction-cooled version of the RIOC 4068. Compared with its ruggedized companion, it complies with extreme operating conditions (such as -40 °C to +85 °C, shocks, and vibrations) and offers additional real-time reconfiguration capabilities often required in UAVs and aircraft for real-time acquisition and processing.

Hardware specifications

Like most standard CompactPCI SBCs, the RIOC 4070 offers Ethernet, RS-232, JTAG, and the usual glue logic around a PowerPC core.

Where the RIOC 4070 differs concerns its extensive use of specific FPGAs to maximize the acquisition speed on CompactPCI as well as PCI buses. In addition, the RIOC 4070 offers seamless data transfer to the main memory through a multiport interface. The RIOC 4070 also provides real-time status monitoring sensors that relay information to the user software to take a variety of actions such as speed, control, partial disconnection of a faulty element, program reload, and so forth.

Both PCI and CompactPCI interfaces are equipped with a set of hardware and firmware building blocks to attach additional processors exchanging data at ultra-high speed (CES BP-Net logic).

Software specifications

CES, as a system company, designs in-house, both hardware and software elements (BSPs) and offers the package as a bundle, providing software support for all of the available hardware functions.

The RIOC 4070 is available with the general purpose Linux tool kit, as well as CES extended BSPs for VxWorks and Integrity. CES AE 653 BSPs are also available.

FEATURES:

- PowerPC 750Gx at maximum frequency
- 512 MB global memory SDRAM at 800 MBps peak
- CES-enhanced PowerPC-to-CompactPCI bridge
- 16 independent linked list DMA channel engine
- Two onboard PMC slots
- Power-on/power-off control logic per PMC slot
- High throughput DMA engine
- 32 MB NOR with compressor
- 256 MB NAND with high-speed file system
- Multiple thermal sensors
- Transparent multiprocessor extension with up to six MFCC 8446 companion modules
- Extended BSPs for VxWorks 6.x and Integrity 5.x

For more information, contact: ces@ces.ch **RSC# 21125 @ www.mil-embedded.com/rsc**

GaGe
900 North State Street • Lockport, IL 60441
Tel: 514-633-7447 • Fax: 514-633-0770
www.gage-applied.com

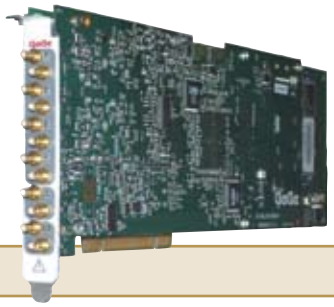
Low-cost Digitizer

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* advanced on-board FPGA technologies are optionally available: Peak Detection, Finite Impulse Response Filtering, or Signal Averaging.

Programming-free operation is provided with GageScope oscilloscope software. SDKs for C/C#, MATLAB, and LabVIEW are available for 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# 30030 @ www.mil-embedded.com/rsc**

MILITARY EMBEDDED SYSTEMS Resource Guide 2006 Data acquisition

GaGe
900 North State Street • Lockport, IL 60441
Tel: 514-633-7447 • Fax: 514-633-0770
www.gage-applied.com

CS12400 Digitizer

Gage's CS12400 PCI bus digitizer features 12-bit vertical resolution, 400 MS/s sampling, and high 200 MHz bandwidth. The fast sampling rate enables the capture of high-speed signals with ultra-high timing precision. The high resolution allows the capture of signals with a very high dynamic range. The CS12400 is available with up to 4 GB on-board memory and on-board FPGA options such as Peak Detection, Filtering, or Signal Averaging. Programming-free operation is provided with GageScope Windows-based oscilloscope software. Also available: SDKs for C/C#, LabVIEW, MATLAB, and other programming environments. The CS12400 is ideal for applications such as radar, lidar, signal intelligence, imaging, spectroscopy, wireless communications, ultrasonic NDT, and manufacturing test.

FEATURES:

- High resolution AND high speed in a digitizer: 12 bit, 400 MS/s sampling – ideal for military communications
- Up to 4 GB of on-board memory for acquisition of extremely long signals or multiple sequential signals
- FPGA Peak Detect option for detecting peaks in a set of digitized waveform data for data analysis & reduction
- FPGA Signal Averaging option for extracting small signals from a background of high-amplitude noise
- FPGA Finite Impulse Response Filtering option for removing unwanted signal features such as noise
- Includes GageScope programming-free oscilloscope software – optionally available C/C#, LabVIEW & MATLAB SDKs

For more information, contact: prodinfo@gage-applied.com **RSC# 30029 @ www.mil-embedded.com/rsc**

Interactive Circuits and Systems Ltd.

(A member of Radstone Embedded Computing)

296-300 Concord Road, Corporate Center, Suite 120 • Billerica, MA 01821
Tel: 613-749-9241 • Fax: 613-749-9461 • 800-267-9794 (USA Only)
www.ics-ltd.com

ICS SENSOR PROCESSING

ICS daqPC

ICS daqPC is a PC-based, real-time data acquisition and playback system that can be fully configured to offer a powerful sensor processing solution. Capable of accepting both ICS and third-party boards, the daqPC can be fully integrated for real-time applications that require acquisition, processing, and archiving of large volumes of analog input signal data.

The 600 MBps recording and playback solution requires two 19" rackmountable chassis with a total height of 7U (12.3") providing 2.8 TB of data storage capability. Additional storage is available by using an expansion chassis.

The daqPC can be used as an arbitrary waveform generation simulator and stimulator system as well as a cost-effective replacement for dedicated lab equipment.

FEATURES:

- Offers high-speed record/playback capability, storing up to 2.8 TB of digital data on array of hard drives
- Digital recording of sensor signals at over 600 MBps sustained rate
- Customized solutions to fit the users requirements. Compact and portable solutions available
- Available in rackmount or portable versions
- Built-in 1 Gb network interface
- NTFS file system for easy post processing of recorded data
- Integrated FPGA solutions for software radio applications can be easily integrated into the ICS daqPC

For more information, contact: sales@ics-ltd.com **RSC# 13844 @ www.mil-embedded.com/rsc**

Data acquisition MILITARY EMBEDDED SYSTEMS Resource Guide 2006

KineticSystems

900 North State Street • Lockport, IL 60441
Tel: 815-838-0005 • Fax: 815-838-4424
www.kscorp.com

KineticSystems

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 (6,560') 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.

A V15x VME-to-VXI adapter is 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, USB, etc.
- 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# 19087 @ www.mil-embedded.com/rsc**

Annapolis Micro Systems, Inc.
190 Admiral Cochrane Drive, Suite 130 • Annapolis, MD 21401
Tel: 410-841-2514 • Fax: 410-841-2518
www.annapmicro.com

Dual 1.5 GHz A/D Board

Annapolis Micro Systems 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 1.5 GHz A/D I/O card provides two channels of 1.5 GSps input (with 8-bit resolution) or one channel of 3.0 GSps input (with 8-bit resolution). The board has two Max108 8-bit ADCs, each one fed by its own pair of differential signals. The differential clock signals coming into the board can provide identical clocks to both A/Ds for dual 1.5 GSps channels or an inverted clock to one of the A/Ds to interleave the data for a single 3.0 GSps channel. Multiple I/O cards can be synched together via the Annapolis Clock Sync Distribution Board, as in the 24 GSps A/D Collection, Processing, and Distribution (CPD) system.

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 more 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, LD bus, I/O bus, and DACs. CoreFire users will have the usual CoreFire board support package.

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

FEATURES:

- Two MAX 108 8-bit A/D converters – two 1.5 GSps channels or one 3 GSps channel
- Two sets of differential input signals – one for each A/D
- Differential clock input – Synchronize or interleave the two data streams
- Up to 6 GBps I/O bandwidth to WILDSTAR II Pro motherboard I/O slot
- Xilinx Virtex-II Pro XC2V70 FPGA for user reprogrammable processing
- Heat sink on FPGA
- Host software: Win NT, 2000, XP, Linux, VxWorks, Solaris, MacOS, DECAlpha, and SGI
- Full CoreFire board support package for fast and easy application development
- VHDL model, including some source code
- Save time and effort and reduce risk with COTS boards and software
- Achieve world-class performance – WILD solutions outperform the competition
- Includes one-year hardware warranty, software updates, and customer support; training available

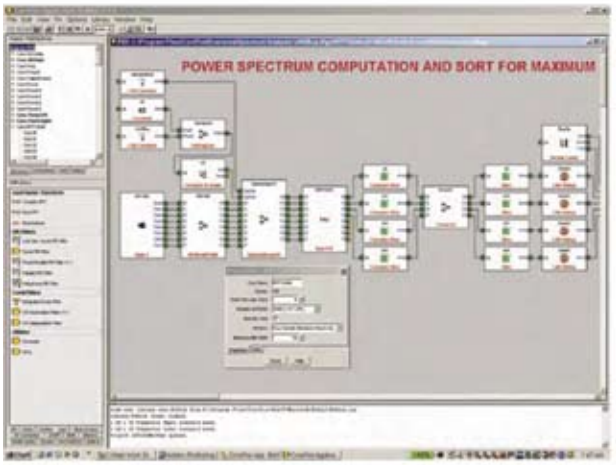
Annapolis Micro Systems, Inc.
190 Admiral Cochrane Drive, Suite 130 • Annapolis, MD 21401
Tel: 410-841-2514 • Fax: 410-841-2518
www.annapmicro.com

CoreFire FPGA Design Suite

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

Our extensive IP and board support libraries contain more than 800 proven, reusable high-performance cores, including FIR and CIC filters, a channelizer, and the world's fastest FFT. We support conversion between data types: bit, signed and unsigned integers, single precision floating point, integer and floating point complex, and arrays. A few of the newly added array cores include array composition and decomposition; slice, parallelize, serialize, repack, split, merge, reorder, rotate, and concatenate transformations; matrix math, sliding windows, and convolutions.

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



FEATURES:

- Data-flow-based – automatically generates intermodule control fabric
- Drag and drop graphical interface
- Work at high conceptual level – concentrate on solving algorithmic problems
- Hardware-in-the-loop debugging
- More than 800 modules incorporate years of application experience
- Reduce risk
- 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

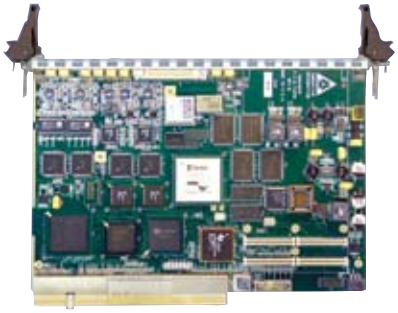
For more information, contact: wfinfo@annapmicro.com **RSC# 19250 @ www.mil-embedded.com/rsc**

Innovative Integration
2390-A Ward Avenue • Simi Valley, CA 93065
Tel: 805-578-4260 • Fax: 805-578-4225
www.innovative-dsp.com

Quixote

Quixote – A complete SDR platform on one powerful CompactPCI card

Combining 105 MHz 14-bit dual analog I/O, the C6416 DSP, a 6 million gate Virtex-II FPGA, and high-speed digital ports, Quixote merges the best of all worlds with unprecedented levels of integration. Quixote is the perfect platform for Software-Defined Radio, signal intelligence, advanced radar, electronic warfare, and high-speed physics. With upcoming support of PMC site and PICMG 2.17 StarFabric interconnects, Quixote is a powerful and compact design that redefines integration, performance, and flexibility. Complete software development suite and logic framework accelerate custom application development.



- 600 MHz TMS320C6416 DSP; 2-6M gate Virtex-II FPGA
- 32 MB SDRAM, 8 MB ZBT SBSRAM; 64/32-bit CompactPCI, 66 MHz, 5 V/3.3 V
- AD6645 and AD9764 converters
- Complex triggering modes with HW event logging
- PMC site with Jn4 to FPGA DIO
- PICMG 2.17 StarFabric compliant

For more information, contact: sales@innovative-dsp.com **RSC# 20448 @ www.mil-embedded.com/rsc**

Innovative Integration

2390-A Ward Avenue • Simi Valley, CA 93065
Tel: 805-578-4260 • Fax: 805-578-4225
www.innovative-dsp.com

Quadia

Quadia is a quad DSP, dual FPGA, dual PMC site, CompactPCI board with an advanced architecture that provides the best interprocessor connectivity and access to the finest external interfaces available today to deliver blazing performance and extreme flexibility for advanced signal capture and real-time processing applications. The board features four C6416 DSPs split in two independent clusters, each hosting a PMC site and one large FPGA for end-user code, a central FPGA routing interprocessor communication, end-user FPGA communication, external port serial I/O for PCI Express or other private link, global memory, and PCI interface.

FEATURES:

- 720 MHz TMS320C6416 DSP (x4)
- 64 MB SDRAM per processor
- Flexible internal/external communication mesh
- 64-bit/66 MHz CompactPCI
- Two PMC sites with Jn4 to FPGA
- External data port, up to 12 Gbps

For more information, contact: sales@innovative-dsp.com **RSC# 30029 @ www.mil-embedded.com/rsc**

DSP MILITARY EMBEDDED SYSTEMS Resource Guide 2006

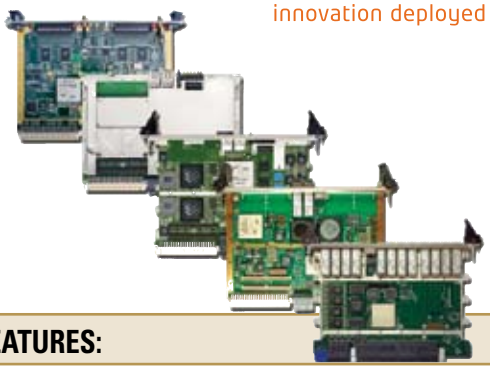
VMETRO Inc.

1880 S. Dairy Ashford, Suite 400 • Houston, TX 77077
Tel: 281-584-0728 • Fax: 281-584-9034
www.vmetro.com

Phoenix VXS System

Phoenix systems are built around high-performance processing, I/O, and multichannel Gbps serial communications with supporting software and firmware. They solve the next generation of performance computing requirements by combining the processing benefits of large FPGAs and PowerPC CPUs with a high-speed serial communications fabric. This configuration gives developers access to increased levels of processor density to produce smaller, lower-cost, and more effective solutions.

VMETRO's Phoenix VXS family includes FPGA/PowerPC processing, real-time switches, intelligent I/O controller with XMC/PMC sites, high-speed analog I/O, software/firmware communications support, backplanes, and enclosures. Phoenix solutions are suited for applications such as radar, ELINT, and EW.



FEATURES:

- High-performance data processing utilizing dual PowerPC and dual FPGA CPUs
- High-speed communications through a VXS fabric, multichannel data links, and raw or switch-packet protocols
- High-speed serial communication, zero-latency switch cards
- Intelligent PMC/XMC I/O controller, carrier, and recorder blade
- High-speed analog input cards
- TransComm FPGA Communications Toolbox for low-latency, efficient data communications

For more information, contact: info@vmetro.com **RSC# 30132 @ www.mil-embedded.com/rsc**

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ZEUS - PXA270 SBC

The ZEUS is an ultra-low-power, EPIC-size single board computer based on the Intel® 520 MHz PXA270 XScale® RISC processor. The PXA270 is an implementation of the ARM-compliant, Intel XScale microarchitecture combined with a comprehensive set of integrated peripherals, including a flat-panel graphics controller, multiple high-speed serial ports, USB controller, interrupt controller, and real-time clock.

The ZEUS board is ideal for cost-sensitive embedded communication solutions that require wireless connectivity for GPRS, iDEN, and 3G wireless services as well as local connectivity to multiple LANs and low-power wireless sensor networks (ZigBee) – all this with the ultra-low power consumption associated with SmartPhones and PDAs. The board has been designed to take advantage of the power saving modes of the PXA270 processor and other onboard peripherals to achieve less than 4W typical power consumption. The ZEUS also supports a very low power standby mode.

The ZEUS includes a flat-panel graphics controller with support for TFT, STN, and (TFT) LVDS displays. The onboard soldered SDRAM and resident flash, dual 10/100Base-Tx Ethernet ports, seven serial ports, and USB host controller make this ideal for an embedded communications controller. The board includes an AC97 audio/codec, SecureDigital socket (SDIO), CompactFlash interface (CF+), and a standard PC/104 bus, all in a small footprint industry standard (EPIC) form factor board expansion connector. The EPIC format is an industrial form factor measuring 165 mm x 115 mm.

The ZEUS is available with adapter modules for GPRS, iDEN, and CDMA wireless modems along with an adapter for IEEE802.15.4 low-power wireless networks. The ZEUS is supported with development kits for Windows CE 5.0 and embedded Linux.

For cost-sensitive, high-volume applications, Arcom offers the ZEUS-Lite – an alternative configuration based on the 412 MHz PXA270 fitted with 64 MB DRAM and 132 MB flash.

FEATURES:

- Processor: 520 MHz Intel PXA270 XScale
- Up to 128 MB of soldered SDRAM
- 64 MB of flash
- 256 KB of battery-backed SRAM
- Display controller: TFT/STN/LVDS flat-panel support up to 800 x 600 in 24-bit color
- Network: Dual 10/100Base-Tx Ethernet controller (Davicom DM9000A)
- USB: Dual USB host ports – v1.1 and USB v1.1 client port
- Serial ports: seven serial ports – three RS-232 (one RS-485), one RS-422/485 port for wireless modem, port for GPS and IEEE802.15.4/ZigBee
- Expansion: PC/104, SDIO, and CF+ (CompactFlash)
- I/O: Eight buffered digital inputs/eight buffered digital outputs (+5 V tolerant), CANbus and I2C
- PSU: Wide-input DC power supply (10-30 V)
- Industry standard EPIC form factor with easy-to-use connectors

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		CME46786HX650HR	CME47786HX650HR	CMX46786HX650HR	CMX47786HX650HR	CME36786HX1000HR	CME37786HX1000HR	CML36786HX1000HR	CML37786HX1000HR	CMG26686HX333HR	CMG27686HX333HR	CME26686HX333HR	CME27686HX333HR	CMV6486DX100HR	CMi6486DX100HR
Bus	AT Expansion Bus	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	PCI Universal Expansion Bus		✓		✓		✓		✓		✓	✓	✓		
	PC/104-*Plus* PCI Bus Masters		4		4		4		4		4		4		
	APIC (add'l PCI interrupts)	9	9	9	9										
CPU and BIOS	CPU Max Clock Rate (MHz)	650	650	650	650	1000	1000	1000	1000	333	333	333	333	100	100
	ACPI 2.0 Power Mgmt	✓	✓	✓	✓	✓	✓	✓	✓						
	Max Onboard DRAM (MB)	512	512	512	512	512	512	512	512	256	256	256	256	32	32
	RTD Enhanced Flash BIOS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Nonvolatile Configuration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Quick Boot Option Installed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Fail Safe Boot ROM (KB)	768	768	768	768	768	768	768	768	768	768	768	768	384	384
	USB Boot	✓	✓	✓	✓	✓	✓	✓	✓						
Peripherals	Watchdog Timer & RTC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	IDE and Floppy Controllers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
	SSD Sockets, 32 DIP	1	1	1	1	1	1	1	1	1	1	1	1	2	1
	Audio	✓	✓	✓	✓	✓	✓	✓	✓						
	TFT Panel TTL or LVDS			✓	✓			✓	✓	✓	✓	✓	✓		
	SVGA Interface	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
	AT Keyboard/Utility Port	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	PS/2 Mouse	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
	USB Mouse/Keyboard	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
I/O	RS-232/422/485 Ports	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	USB Ports	2	2	2	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		
	multiPort™(aDIO, ECP, FDC)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
SW	ROM-DOS Installed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DOS, Windows, Linux	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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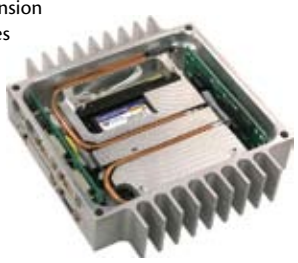

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		SDM6440HR	SDM6540HR	SDM7540HR	SDM8540HR	DM6420HR	DM6430HR	DM7520HR	DM7530HR	DM6620HR	DM6812HR	DM6856HR	DM6888HR	DM6956HR	DM7820HR
Bus	AT Expansion Bus	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	PCI Expansion Bus Master			✓	✓			✓	✓						✓
	McBSP™ Serial Ports		✓	✓	✓			✓	✓						
Analog Input	Single-Ended Inputs	16	16	16	16	16	16	16	16						
	Differential Inputs	8	8	8	8	8	8	8	8						
	Max Throughput (kHz)	500	1250	1250	1250	500	100	1250	100						
	Max Resolution (bits)	12	12	12	12	12	16	12	16						
	Input Ranges/Gains	3/4	3/7	3/7	3/7	3/4	1/4	3/6	1/4						
	Autonomous SmartCal™	✓	✓	✓	✓										
	Data Marker Inputs	3	3	3	3	3		3							
Conversions	Channel-Gain Table	8k	8k	8k	8k	8k	8k	8k	8k						
	Scan/Burst/Multi-Burst	✓	✓	✓	✓	✓	✓	✓	✓						
	A/D FIFO Buffer	8k	8k	8k	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	16	16	48	32	64	32	48
	Bit Programmable I/O	8	8	8	8	8	8	8	8	8	24				48
	Advanced Interrupts	2	2	2	2	2	2	2	2	2	2				2
	Input FIFO Buffer	8k	8k	8k	8k	8k	8k	8k	8k						2M
	Opto-Isolated Inputs											16	48	16	
	Opto-Isolated Outputs											16	16		
	User Timer/Counters	2	3	3	3	2	2	3	2	3	3				10
	External Trigger	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓
	Relay Outputs													16	
Analog Out	Analog Outputs	2	2	2	2	2	2	2	2	4					
	Max Throughput (kHz)	200	200	200	200	200	100	200	100	200					
	Resolution (bits)	12	12	12	12	12	16	12	16	12					
	Output Ranges	4	4	4	4	3	1	4	1	4					
	D/A FIFO Buffer		8k	8k	8k			8k		8k					

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SBC4685 Celeron EPIC Computer for GUI Applications

Based on an ultra-low voltage Celeron core, the SBC4685 from Micro/sys provides a powerful, multimedia controller in a 4.5" x 6.5" EPIC standard footprint. The color VGA interface supports resolutions of up to 1600 x 1200 and will connect directly to CRTs, TTL panels, single-channel LVDS panels, and dual-channel LVDS panels. Additionally, the AC97 audio interface allows output of sound from digital files or CDs or DVDs. This combination of video and audio interfaces allows the SBC4685 to easily implement systems ranging from kiosks to point-of-sale to industrial control panels.

In addition to the multimedia features, the new model also includes many different data communications channels. Two 100BASE-T Ethernet ports, four serial channels (three RS-232 and one RS-232/485), two USB host ports, and the first CAN™ bus interface on an EPIC-sized board, allow the SBC4685 to rapidly and reliably transfer data, whether it is audio files or machine control packets. The SBC4685 also has a full complement of AT-compatible I/O, including a dual floppy interface, a dual IDE controller for four IDE devices, a keyboard/mouse controller, and a parallel printer port.

With 256 MB of SDRAM, CompactFlash, and full AT-compatibility, high-performance control systems can be developed as single board solutions. In its stack-through version, the SBC4685 is ideal for plugging into a custom OEM I/O card. The SBC4685 can boot DOS, Windows 98, Linux, Windows CE, Windows XP, VxWorks, and other PC-compatible operating systems.

The SBC4685 is implemented with the Intel ultra-low voltage Celeron or low-power Pentium III, which offers speeds up to 700 MHz, on-chip cache, 64-bit DRAM access, and hardware floating point. If needed, I/O expansion can be added to the SBC4685 through PC/104 cards, or high-speed I/O expansion can be added with PC/104-*Plus* cards. The CompactFlash socket on the SBC4685 can be used as solid-state storage for operating systems and large applications. A free development kit is provided that includes cables, sample software, and full documentation.

FEATURES:

- Ready-to-run Celeron/Pentium III multimedia computer
- 400, 650, or 700 MHz
- Color flat-panel support; AC97 audio interface
- Quad serial ports
- Dual 10/100BASE-T Ethernet
- Dual USB
- CAN™ bus interface
- CompactFlash connector
- EPIC form factor
- PC/104 and PC/104-*Plus* expansion
- Boots DOS, Windows XP/CE, VxWorks, and Linux

For more information, contact: info@embeddedsys.com

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www.ces.ch

RIO4 8070/RIO4 8076

Applications

The RIO4 8070 and RIO4 8076 are designed for the most demanding applications, which combine high processing power with harsh environment conditions. Targets include UAVs, radars, and military aircraft. The RIO4 8070 shares the same PCB as the RIO4 8076, though the latter is the full conduction-cooled specification model.

Hardware specifications

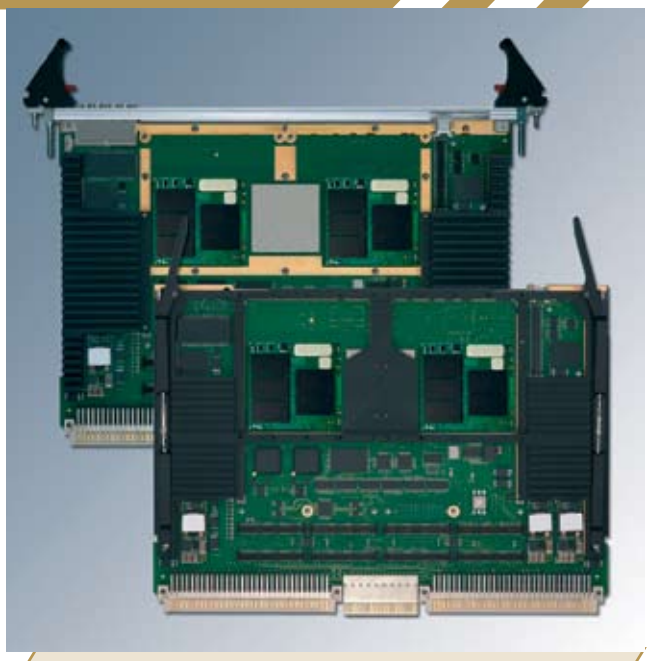
The RIO4 8070 and the RIO4 8076 are designed for ultimate high throughput acquisition combined with real-time data processing. Their computing elements use the latest PowerPC G4 processor, an FPGA, and a set of high-speed serial links handled by a unique CES multiport control logic incorporating user-controlled bandwidth. Each board hosts two PMC sites, which can be powered On/Off independently. Each board also hosts user-dedicated Virtex-II Pro FPGAs to handle user-specific applications. The boards are equipped with a full Secure Cells package for monitoring current, voltage, temperature, bus bandwidth, and so on, enabling reload, reconfiguration, and bypass decisions in real time.

Software specifications

CES, as a system company, designs in-house, both hardware and software elements comprising of a Board Support Package (BSP) and offers the package as a bundle, where all of the available hardware functions are supported by software. The RIO4 8070 and the RIO4 8076 are available with the general-purpose Linux tool kit, as well as CES extended BSPs for VxWorks and Integrity. CES AE 653 BSPs are also available. When equipped with two CPUs, the board can run two different operating systems (Linux on one CPU, and VxWorks on the other).

Related CES conduction-cooled modules

- PEB 6426 – PMC Extension Board
- MFCC 8449 – Multifunction Computing Core PrPMC
- GPIO 8436 – User-Programmable I/O PMC
- AFDX 8464 – AFDX® PMC
- MIL 5364 – MIL-STD 1553B PMC
- ARINC 8429 – ARINC 429 PMC
- CAN 8428 – CANBUS PMC
- DSIO 8300 – Discrete Interface
- ANIO 8301 – Analog Interface
- ACS 6060 - ARINC 600 Chassis
- ACS 6061 - ATR Chassis



FEATURES:

- Single or dual computing node
- Each node equipped with a PowerPC G4 at maximum available frequency, a tightly coupled FPGA and a set of high-speed links
- Two Gigabit Ethernet interfaces
- Two PMC sites
- Ultra-high-speed (200 MBytes/s) user data buffer with direct access to FPGAs and CPUs
- VME 64x 2eSST at 250 MBytes/s AND two separate PCI buses
- VXS or PCI interface on P0
- Onboard Virtex-II Pro FPGA for user-defined applications
- Onboard NAND Flash Memory with Fast File System
- Backplane real-time distribution logic
- Full Secure Cells real-time reconfiguration logic

For more information, contact: ces@ces.ch

RSC# 24232 @ www.mil-embedded.com/rsc

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Embedded PowerPCs

MEN Micro's family of PowerPC MPC5200-based compute engines come in a variety of standard, open-bus form factors. And the EM1N Embedded System Module (ESM) can be adapted to practically any open bus or custom application. The 384 MHz MPC5200 processor on the PP1 (PCI/104), EM1N (ESM), B13 (3U VME), and F12 (3U CompactPCI) delivers up to 760 MIPS of processing power. It also includes an FPU and TCU, and the BestComm/DMA I/O controller, which provides industrial I/O interfaces including two CAN ports, USB, Fast Ethernet, two RS-232 ports, and SPI. These boards are low power (850 mW for the MPC5200) and can operate over the entire industrial temperature range of -45 °C to +85 °C.

In addition to the capabilities of the MPC5200, MEN's small form factor compute engines offer extensive onboard memory and storage (SDRAM, Flash, FRAM) and a wide selection of standard I/O, including Fast Ethernet, RS-232 serial interfaces, USB, CAN ports, and others. Additionally, a high-capacity 144 K-gate FPGA can be configured to deliver custom functionality. MEN's small-form-factor compute engines are also compatible with MEN's SA adapters that can be used to implement the physical layer of many standard I/O ports.

The EM1N ESM is a small System-On-Module (SOM) that can be adapted to almost any form factor by way of an application-specific carrier card. When mounted on a 6U carrier card, for example, the carrier can also accommodate two more PMC cards or other types of mezzanine cards, such as PC•MIP cards or M-Modules.

FEATURES:

- High-performance processing from MPC5200 PowerPC (760 MIPS) with FPU and TCU, MMU, and DRAM controller
- Range of form factors includes: PCI/104, 3U VME, 3U CompactPCI, and Embedded System Module (ESM) adaptable to practically any form factor
- Ideal for embedded industrial applications: extended temperature range (-45 °C to +84 °C) and low power consumption
- Wide selection of I/O including CAN, USB, Fast Ethernet, serial communications (RS-232 and so on), SPI, and others
- Large FPGA for deployment of application-specific functionality or custom I/O
- Extensive onboard memory resources (SRAM, DRAM, FRAM, NAND Flash, and so on)
- Rugged operating characteristics: soldered memory for improved shock and vibration performance
- I/O flexibility with MEN's SA adapters, which provide the physical layer for many standard I/O interfaces
- EM1N on the ESM form factor (72 mm x 149 mm) can be used as a standalone compute engine or mounted on a carrier card
- Extensive software support including MENMON (MEN's BIOS for PowerPC processors) as well as BSPs for Linux, VxWorks, and QNX

For more information, contact: egodsey@menmicro.com **RSC# 30042 @ www.mil-embedded.com/rsc**

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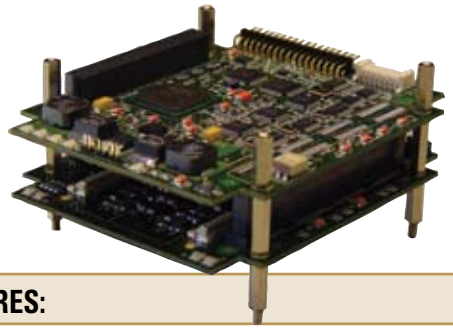
BenONE-PCI-104



The BenONE-PCI-104 FPGA computing card brings the processing power of FPGAs to the popular, compact PCI-104 form factor, providing a powerful platform for high-performance systems development and deployment in production environments. Using DIME-II expansion modules, the BenONE-PCI-104 supports Virtex-4, Virtex-II Pro, and Virtex-II FPGAs, complemented by a selection of memory and analog and digital I/O interfaces. The BenONE-PCI-104 FPGA computing card provides a powerful platform for embedded systems development and deployment in production environments. Combined with DIMEtalk for easy connectivity implementation and FUSE for host integration, the BenONE-PCI-104 offers a professional, compact, and standalone platform for embedded deployment applications.

FEATURES:

- PCI-104 form factor
- Single DIME-II module expansion slot
- Xilinx Virtex-4, Virtex-II Pro, and Virtex-II supported through DIME-II expansion modules
- 32-bit, 33 MHz PCI interface
- Digital I/O header
- Windows and Linux support (VxWorks on request); includes FUSE FPGA Computing Runtime Software

For more information, contact: contact@nallatech.com **RSC# 24182 @ www.mil-embedded.com/rsc**

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BenNUEY-PCI-X

The BenNUEY-PCI-X FPGA computing card provides a powerful platform for high-performance systems development and deployment in production environments across a variety of applications, including SIGnals INTelligence (SIGINT) and Software-Defined Radio (SDR). An onboard Virtex-4 FX FPGA provides the ideal balance of resources for processing and system management, while three DIME-II expansion slots allow users to optimize system resources to meet processing, memory, and I/O requirements. The BenNUEY-PCI-X can support multiple analog and digital I/O interfaces, memory types, and up to seven user FPGAs on a single PCI-X card. Applications requiring data storage benefit from 18 MB of DDR-II SRAM connected to the Virtex-4 FX user FPGA.

FEATURES:

- PCI-X form factor
- Three DIME-II module expansion slots with onboard Xilinx Virtex-4 FX user FPGA options of XC4VFX60 or XC4VFX100
- 64-bit, 133 MHz PCI-X interface
- 18 MB DDR-II SRAM
- Xilinx Virtex-4-II Pro/-II supported on DIME-II modules
- Windows and Linux support; includes FUSE FPGA Computing Runtime Software

For more information, contact: contact@nallatech.com **RSC# 24356 @ www.mil-embedded.com/rsc**

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BenDATA™-V4

For applications requiring the combined processing capability of very high-bandwidth, high-density external memories and the latest FPGA technology, the BenDATA-V4 is the ideal solution. Combining a Xilinx Virtex-4 SX or LX FPGA, 1 GB DDR2 SDRAM, and 16 MB of DDR-II SRAM, the module provides processing and memory expansion capability. The combination of high-density DDR2 SDRAM and rapid, random-access DDR-II SRAM offers maximum flexibility for application implementation.

This functionality is combined in a proven COTS solution, designed for ease of use, low-risk, and straightforward system integration/in-field deployment applications including SIGINT and C4ISR.

FEATURES:

- DIME-II expansion module
- Onboard Xilinx Virtex-4 user FPGA
- 1 GB DDR2 SDRAM – two independent banks
- 16 MB DDR-II SRAM – two independent banks and eight GBps total SRAM
- Multiple design-entry flows, industry-standard synthesis, and implementation tools supported
- FUSE system software and DIMEtalk design environment compatible

For more information, contact: contact@nallatech.com **RSC# 24342 @ www.mil-embedded.com/rsc**

FPGA/Reconfigurable computing MILITARY EMBEDDED SYSTEMS Resource Guide 2006

Nallatech
1010 Liberty Road, Suite 103 • Eldersburg, MD 21784
Tel: 410-552-3353 • Fax: 410-552-3354
www.nallatech.com

BenBLUE-Virtex 4

Designed for the most demanding processing applications, the BenBLUE™-V4 is the ideal solution when the highest processing density is required. The BenBLUE-V4 combines two Xilinx Virtex-4 LX FPGAs and 64 MB of DDR-II SRAM in eight independent banks, offering processing and memory expansion capability for Nallatech CompactPCI, VME, PCI, and PCI-104 COTS FPGA computing systems.

The high-bandwidth DDR-II SRAM enables developers to leverage the full processing capability of the onboard Virtex-4 FPGAs for maximum application performance.

This functionality is combined in a proven COTS solution, designed for ease of use, low-risk, and straightforward system integration/in-field deployment in applications including C4ISR and image processing.

FEATURES:

- Two onboard Xilinx Virtex-4 user FPGAs, with two Virtex-4 LX100 or LX160
- Up to 300k+ logic cells per module
- 64 MB DDR-II SRAM – eight independent banks; 16 GBps total DDR-II SRAM bandwidth
- Includes DDR-II SRAM FPGA IP core
- FUSE system software and DIMEtalk design environment compatible
- Multiple design-entry flows supported; also supports industry-standard synthesis and implementation tools

For more information, contact: contact@nallatech.com **RSC# 24344 @ www.mil-embedded.com/rsc**

VMETRO Inc.

1880 S. Dairy Ashford, Suite 400 • Houston, TX 77077
Tel: 281-584-0728 • Fax: 281-584-9034
www.vmetro.com

PMC-FPGA03/F PMC

The PMC-FPGA03 is a Xilinx XC2VP50 Virtex-II Pro-based FPGA PMC module, which interfaces directly to two banks of DDR SDRAM and three banks of QDR-II SRAM for high-performance, low-latency applications. Xilinx RocketIO channels are available at either the front panel or PMC connector as a build option. The PMC-FPGA03 communicates with a variety of Windows, VxWorks, and Linux host computers via an optimized 64-bit, 66 MHz PCI bus interface. The module is available in air-cooled and conduction-cooled variants. Fiber-optic options are also available. Example VHDL code blocks are provided to show how the PMC-FPGA03 resources can be used, along with utilities for configuring flash.

FEATURES:

- Xilinx XC2VP50 Virtex-II Pro FPGA
- Multi-Gbps serial I/O
- Modular I/O system supporting standards such as LVDS, Camera Link, and custom I/O
- Multiple banks of QDR-II SRAM and DDR SDRAM
- Rugged, conduction-cooled build variants

For more information, contact: info@vmetro.com **RSC# 21357 @ www.mil-embedded.com/rsc**

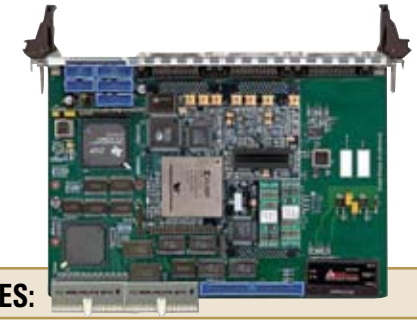
MILITARY EMBEDDED SYSTEMS Resource Guide 2006 FPGA/Reconfigurable computing

Innovative Integration

2390-A Ward Avenue • Simi Valley, CA 93065
Tel: 805-578-4260 • Fax: 805-578-4225
www.innovative-dsp.com

CompactConejo

CompactConejo is a performance-oriented DSP card for CompactPCI/PXI-based data acquisition, playback, and coprocessing with four analog I/O channels at up to 10 MSps input and up to 50 MSps output. It uses the acclaimed C6713 processor from Texas Instruments as the heart of data movement and processing functions. CompactConejo provides four simultaneous analog inputs, four analog outputs, a logic architecture that supports extremely flexible trigger mechanisms, a choice of timebase sources, and a valuable real-time event log. With Innovative Integration's multiboard support features, CompactConejo is a truly complete solution for a wide array of applications like radar, advanced medical imaging, physics research, video processing, semiconductor testing, transient capture, arbitrary waveform generation, industrial scanners, wireless development, precision instruments, and so on.



FEATURES:

- 150 MHz TMS320C6713 DSP (floating point); 32 MB SDRAM
- Four channels 10 MHz, 14-bit input
- Four channels 15 MHz, 2/30 or 1/50, 16-bit output
- 64/32-bit PCI, 33 MHz, 5 V/3.3 V, hot swappable
- Supports complex trigger modes with HW event logging
- Multiboard synchronization (PXI bus)

For more information, contact: sales@innovative-dsp.com **RSC# 18483 @ www.mil-embedded.com/rsc**

Active Silicon
17 Wilson Street, Suite 13 • Chelmsford, MA 01824
Tel: 978-244-0490 • Fax: 978-244-0491
www.activesilicon.com

LFG Series

Active Silicon develops frame grabbers and provides consultancy services for the design and integration of complete specialist vision systems. Our technology has been proven in applications throughout military, scientific research, medical imaging, remote visual monitoring and security markets.

The LFG range of low cost video frame grabbers captures from standard analogue video sources. The range starts with the entry level LFG, which will capture from one of 4 composite/monochrome sources or one S-Video. The range is topped of with the LFG4, which can simultaneously capture 4 from a total of 16 composite inputs or alternatively 4 S-Video inputs.

Our Software Developers Kit has been specifically designed for OEM integration and the API is common across all supported platforms.

FEATURES:

- Capture from PAL/NTSC/CCIR/RS170 video standards
- S-Video or composite/monochrome video sources plus audio capture
- Support for PCI, PC/104-*Plus*, CompactPCI, PMC, and PCI Express formats
- Trigger input and digital I/O lines
- Windows, Linux, DOS, VxWorks, QNX, and Mac OS X support
- 5V and 12V fused output

For more information, contact: info@activesilicon.com **RSC# 30144 @ www.mil-embedded.com/rsc**

Frame grabbers MILITARY EMBEDDED SYSTEMS Resource Guide 2006

Active Silicon
17 Wilson Street, Suite 13 • Chelmsford, MA 01824
Tel: 978-244-0490 • Fax: 978-244-0491
www.activesilicon.com

Phoenix Series

The Phoenix range of high-performance digital frame grabbers can capture from Camera Link and LVDS sources. The range is designed to interface to today's demanding cameras with support for multi-tap, high-bit depth and higher-speed pixel clock settings. The low-cost Camera Link range, the Phoenix D24CL, will support a single Base input, and our Phoenix D48CL boards will handle two simultaneous Base cameras or a single Medium camera.

Our Software Developers Kit has been specifically designed for OEM integration, and the API is common across all supported platforms. Phoenix application code can be easily ported between Windows, Linux, Mac OS X, QNX, VxWorks, and DOS platforms.

FEATURES:

- Capture from 36-bit LVDS digital or dual Base/single Medium Camera Link sources
- Wide range of Linescan and Areascan cameras supported
- Multiple form factor support: PCI, PCI Express, PC/104-*Plus*, CompactPCI, PMC
- Available for the high-speed 64-bit/66 MHz PCI bus and PCI Express standards
- Extensive Opto-isolated, TTL, and LVDS triggering and I/O lines
- Comprehensive Software Developers Kit

For more information, contact: info@activesilicon.com **RSC# 30145 @ www.mil-embedded.com/rsc**

Annapolis Micro Systems, Inc.
190 Admiral Cochrane Drive, Suite 130 • Annapolis, MD
Tel: 410-841-2514 • Fax: 410-841-2518
www.annapmicro.com

Universal 3 Gbit IO

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 Universal 3 Gb I/O 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 on the WILDSTAR II Pro main board. 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 channels per connector, with dedicated signal conditioners to ensure clean communication. It supports a wide variety of readily available cables, copper for short haul (about 1-5 m), or fiber for long haul (about 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.

The initial release of the Universal 3 Gb card will come with an easy-to-use rocket I/O protocol supporting up to 12 Gb full duplex per connector. Second quarter 2006 will see releases of up to 10 Gb full duplex InfiniBand per connector, up to 10 Gb 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 the 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.

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 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 per I/O card
- Four channels per connector
- One Xilinx Virtex-II Pro 70-5, -6, or -7
- Up to 2 GB DDR2 SDRAM in four banks or up to 1 GB DDR SDRAM in four banks
- Two power PC 405s in FPGA with onboard flash for program storage
- 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

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

Annapolis Micro Systems, Inc.
190 Admiral Cochrane Drive, Suite 130 • Annapolis, MD
Tel: 410-841-2514 • Fax: 410-841-2518
www.annapmicro.com

Dual 2.2 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 2.2 GSps DAC I/O card provides two 12-bit output streams at up to 2.2 GSps per stream. The 1.5 GSps version is available today, with the 2.2 GSps version coming out in Second Quarter 2006.

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. A 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 2.2 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 1 GB DDR SDRAM in four banks
- Supports three modes: NRZ, RF, and NZ
- 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

For more information, contact: jdonald@annapmicro.com **RSC# 30045 @ www.mil-embedded.com/rsc**

Hunter Technology Corporation

2921 Corvin Drive • Santa Clara, CA 95051
Tel: 408-245-5400 • Fax: 408-245-5503
www.hunterpcb.com

STABLCOR® Thermal Management Solutions

STABLCOR® Carbon Core Laminates provide unique and innovative solutions to today's thermal and reliability challenges. STABLCOR® enables tailoring of the expansion rate of the board to more closely match the assembled components. STABLCOR® technology can also assist in reducing component temperatures on the printed circuit board. Hunter Technology is a fully integrated Electronic Manufacturing Services Provider with Mil-Qualifications, J-Standard Certifications, and a Licensed Fabricator of STABLCOR® Thermal Management Solutions.

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:

- Reduce the operating temperature of your system with STABLCOR® Carbon Core Laminates from Hunter Technology
- Improve tin-lead and lead-free solder joint reliability by tailoring the CTE of your printed circuit boards
- Thermal conductivity 8.0-620.0 W/m*K, tensile modulus from 34-130.0 msi
- STABLCOR® offers a high-performance thermal solution at no weight premium
- Take your existing board and STABLCOR® it with Hunter Technology
- Call or e-mail for a free stack-up consultation; e-mail STABLCOR@hunterpcb.com or visit www.hunterpcb.com

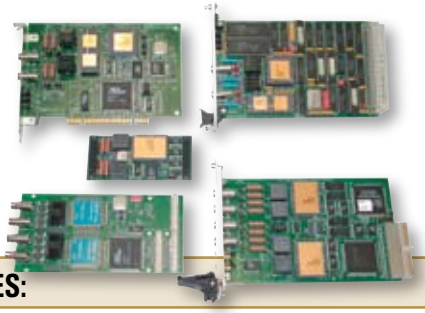
For more information, contact: stablcor@hunterpcb.com **RSC# 30056 @ www.mil-embedded.com/rsc**

Alphi Technology

6202 South Maple Avenue, #120 • Tempe, AZ 85283
Tel: 480-838-2428 • Fax: 480-838-4477
www.alphitech.com

MIL-1553 for CompactPCI-PCI-PMC-Industry Pack-VME

Alphi Technology has been offering MIL-STD-1553 solutions for 15 years. We have the largest portfolio of board level solutions in the industry. Alphi supports the CompactPCI bus, PCI, PMC, Industry Pack, and VMEbus architectures. We incorporate controllers from UTMC, such as the BCRTM and the SUMMIT, as well as DDC ACE and mini ACE. All products support Bus Controller, Remote Terminal, and Bus Monitor modes. All 1553 products have onboard transceivers and transformers and allow for external clocking. We support Linux, Windows, and VxWorks source packages. If you have specific design needs, contact our engineering department about our custom design and integration services.



FEATURES:

- 3U and 6U CompactPCI, one to four dual redundant channels, full BC/RT/M support, UTMC Summit, DDC ACE
- Single PMC module, one to two dual redundant channels, full BC/RT/M support, UTMC Summit, DDC ACE
- Half-size and full PCI bus, one to four dual redundant channels, full BC/RT/M support, UTMC Summit, UTMC, BCRTM, DDC ACE
- Industry Pack module, one dual redundant channel, full BC/RT/M support, UTMC Summit
- 3U and 6U VMEbus, one to four dual redundant channels, full BC/RT/M support, UTMC Summit, UTMC BCRTM, DDC ACE
- Software support includes VxWorks, Linux, LabView, Windows, "C" Libraries, and source packages

For more information, contact: engineering@alphitech.com **RSC# 21038 @ www.mil-embedded.com/rsc**

Condor Engineering
101 West Anapamu Street • Santa Barbara, CA 93101
Tel: 805-965-8000 • Fax: 805-963-9630
www.condoreng.com

QCP-1553 – MIL-STD-1553 cPCI Interface

Condor's QCP-1553 provides new levels of performance and flexibility for MIL-STD-1553A/B Notice II in a CompactPCI form factor. Available in commercial, ruggedized, and 3U conductively cooled versions with one, two, or four dual-redundant channels, the QCP-1553 includes advanced Application Programming Interface (API) software that reduces application development time. Standard features include selectable transformer or direct coupling, 1 MB of RAM per channel, 45-bit message time-tagging, triggers, extensive BC and RT link-list structures, error injection/detection, avionics-level discretes, automatic/manual RT Status Bit and Mode Code responses, along with advanced BC functionality. Variable output voltage is standard on multifunction boards. An IRIG-B signal Receiver/Generator is optionally available. With the highest speed encoder/decoder in the industry, the QCP-1553 Bus Monitor provides unparalleled error detection and 100 percent monitoring of fully loaded buses.

Multifunction interfaces

QCP-1553 multifunction interfaces are easily configured to operate with a simultaneous bus controller, 31 remote terminals, and bus monitor functionality.

Single-function interfaces

Single-function QCP-1553 interfaces have all the features and functionality of the multifunction versions, but only one major operational mode is enabled at a time. Each interface can emulate either a bus controller or 31 remote terminals or bus monitor.

Software

Condor provides our advanced 1553 API in source code, along with support for Windows XP, 2000, Me, NT, 98, 95, VxWorks, Integrity, Linux, Visual Basic, LabWindows/CVI, and other operating systems. To access 1553 functionality without software development, BusTools/1553, Condor's MIL-STD-1553 bus analyzer, LabVIEW, and LabVIEW Real-Time support are optionally available.

FEATURES:

- One, two, or four independent MIL-STD-1553 dual-redundant channels
- Simultaneous bus controller, 31 remote terminals, and bus monitor
- High-level API for Windows XP, 2000, Me, NT, 98, 95, VxWorks, Integrity, Linux, Visual Basic, and LabWindows/CVI included
- Optional LabVIEW and LabVIEW Real-Time support
- 66/33 MHz PCI bus operation and IRIG-B Rec (AM or DC/TTL) and/or Gen (DC) included
- Multifunction and single-function versions
- 45-bit, microsecond time-tagging and 1 MB RAM per channel
- I/O triggering and error injection/detection
- Selective real-time playback and multiple RT buffers
- RT map monitoring and full error detection
- 18 avionics-level discretes and universal voltage
- Programmable response time

BMC Communications Corp.

67 Bond Street • Westbury, NY 11590
Tel: 516-997-2100 x30 • Fax: 516-997-2129
www.bmccorp.com

PMC-Universal Avionic Protocol Converter

MIL-STD-1553/1760 ARINC 708/429/575/... RS-232

The Universal Avionics Digital Interface (UADI) is a plug-and-run device. The device uses a powerful 16-bit Flash RISC, low-power microcontroller. It supports a wide variety of communication protocols: MIL-STD-1553 dual redundant interface, ARINC 708/453, two transmit/receive ARINC channel protocols such as 429/575/571/572/581/582/615, and more, and two transmit/receive RS-232. It includes extensive C libraries, DLLs, Windows, and Linux drivers. A variety of software-programmable features includes error injection-detection, subaddress selection, major/minor cycle frame, long loop test, class A/B, and so forth. The unit is available in commercial or industrial grade, MIL-STD-810E, and EMI MIL-STD-416. Also available for PC/104, PCI, ComapctPCI, PMC, and VME platforms.

FEATURES:

- **MIL-STD-1553 100 MHz and/or 1 MHz baud**
- 1553 modes: BC, RT, BM, BC-RT, RT-BM, and BC-BM
- 1553 multiple store buffers with 32-bit time-tag
- Two independent ARINC receive transmit channels
- Two independent RS-232 receive and transmit channels
- ARINC RS-232, baud rate 100 Hz to 1 MHz

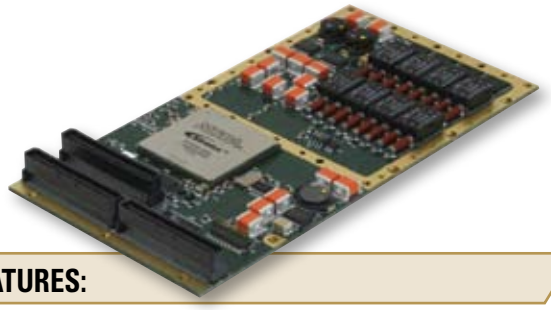
For more information, contact: uadi@bmccorp.com **RSC# 30180 @ www.mil-embedded.com/rsc**

MILITARY EMBEDDED SYSTEMS Resource Guide 2006 MIL-SPEC I/O (1553, ARINC-429, STANAG, etc.)

SBS Technologies, Inc.

7401 Snaproll N.E. • Albuquerque, NM
Tel: 505-875-0600 • Fax: 505-875-0400
www.sbs.com

1553-PMC3 – Conduction Cooled, 4-Channel MIL-STD-1553 PMC



1553-PMC3 is a flexible, conduction-cooled interface providing a single function, four channel, dual redundant MIL-STD-1553 interface to the PMC mezzanine.

This Advanced Single Function (ASF) architecture provides independent operation as a Bus Controller (BC), Remote Terminal (RT), or dual-function Bus Monitor (BM). The ASF-PMC-4T interface equips the PMC bus system with a complete 1553 interface. This includes 1553A/1553B selections, pointer-driven transmit and receive buffers, and extensive programmable event interrupts and triggers.

Based on a high-speed FPGA, the 1553-PMC3 includes multiple DMAs per message, built-in monitoring, and 48-bit, 1-µsec resolution time stamps.

FEATURES:

- One to four dual redundant 1553 channels featuring 100 percent independent operation as BC, 31 RTs, or BM
- BC features include programmable linked lists, dual conditional branching, and full error injection/detection
- RT features include programmable response time, linked buffers, full error injection/detection
- BM features include full error detection, double buffered monitoring, 1-µsec time stamp, and multiple DMAs per message
- Complimentary drivers for most operating systems
- Integrated avionics library, including source code

For more information, contact: info@sbs.com **RSC# 21057 @ www.mil-embedded.com/rsc**

SBS Technologies, Inc.
7401 Snaproll N.E. • Albuquerque, NM
Tel: 505-875-0600 • Fax: 505-875-0400
www.sbs.com

SBS – AFDX-1000

The AFDX-E1000 Series from SBS Technologies is an intelligent and flexible AFDX End System for commercial and rugged flight applications. It is based on COTS modules and consists of a 6U VME64 SBC with a PowerPC processor and one or two dual-port Ethernet PMCs for the AFDX network. The hardware independent AFDX software stack, compliant to ARINC 664 Part 7, is certifiable up to DO-178B Level A.

Two standard AFDX End Systems are available based on a 6U VME64 SBC with GHz PowerPC MPC7457 processor and 512 MB memory. Version 1 has a dual AFDX link and version 2 has two dual-port AFDX links. Both versions can be ordered as air- or as conduction-cooled designs. Other SBC configurations are available on request.

User advantages:

- Software loadable AFDX stack for rapid deployment and ease-of-maintenance case of deviation and/or evolution of aviation standards
- ARINC 664 aviation standard for upgradeability and investment protection
- COTS platform ensures technology and performance enhancements for the future
- One basic platform for commercial, rugged, and conduction-cooled applications, allowing the user to choose the optimal AFDX End System
- Inherent 1000BASE-T support lays out the path for higher speeds in future
- One single point of contact because SBS is able to design chassis as well as backplanes, power supplies, I/O wiring, and carry out environmental testing of complete systems

Software
The standard operating system for the AFDX-E1000 series is VxWorks 5.5.1. A Board Support Package and drivers are available from SBS Technologies. INTEGRITY is available upon request. Built-In Test (BIT) software will be available as an option.

FEATURES:

- Intelligent AFDX End System based on COTS hardware with software loadable stack
- Single or dual AFDX channels
- Ready for flight applications
- Compliant to aviation standards
- Fast AFDX stack update cycle
- Protocol change in software only
- Air- or conduction-cooled COTS solutions
- Built-in test software is optionally available
- AFDX software stack – ARINC 664 Part 7 compliant – Software loadable on target hardware – Designed to the guidelines of DO-178B lvlA
- Front Ethernet with air cooling, rear Ethernet with conduction cooling
  - Driver and stack- VxWorks 5.5.1- INTEGRITY on request
- Conduction cooled: Operating: -40°C to +85°C

For more information, contact: info@sbs.com **RSC# 30110 @ www.mil-embedded.com/rsc**

ACT/Technico

760 Veterans Circle • Warminster, PA 18974
Tel: 215-956-1200 • Fax: 215-956-1201
www.acttechnico.com

Ethernet 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 systems integration help mitigate the risk in your development time line. Whether managing joint operations in a theater of war or in a transportation logistics network, network-centric computing is the new paradigm in embedded systems providing the speed, scalability, reliability, and security necessary to get the job done.

ACT/Technico offers a full line of Ethernet switches and interface cards. Call or visit our website for all the details.

FEATURES:

- Up to 24 ports 10/100 (Fast) or 10/100/1000 (GbE)
- Solutions based on VMEbus, VITA 31.1, PICMG 2.16 (CompactPSB), and CompactPCI platforms
- Extended temperature and conduction-cooled versions for rugged environments
- Configurable, fully managed (Layer 3), wirespeed, and unmanaged versions
- Flexible management tools, such as user-defined, built-in tests
- LED and thermal sensor for easy network monitoring

For more information, contact: sales@acttechnico.com **RSC# 30038 @ www.mil-embedded.com/rsc**

MILITARY EMBEDDED SYSTEMS Resource Guide 2006 | Networking (Ethernet, SCSI, Fibre Channel, and enterprise)

DSS Networks, Inc.

23 Spectrum Pointe, Suite 202 • Lake Forest, CA 92630
Tel: 949-716-9051 • Fax: 949-716-9052
www.dssnetworks.com

Model 5468 Switch

The 5468 Switch is a compact, 8-port GbE switch on a highly integrated PMC mezzanine card form factor, featuring an innovative 4 + 2 + 2 switching design that is both unique and highly functional. It is designed to provide add-on GbE switching capabilities in a compact space. It has an integrated 8-port, Layer 2 device as the central switching function, a 2-port PCI-X MAC host interface, an onboard control FPGA, and transceivers for the interconnect. The eight ports are routed as follows: four ports to RJ-45s on the PMC bezel, two ports to the host via the Gigabit MAC's PCI/PCI-X bus interface, and the remaining two ports routed as 1 Gb SERDES to the I/O pins on the PMC JN4 connector.

FEATURES:

- Fourth-generation BCM5388 Layer 2 switch; Intel 82546 dual-port PCI-X MAC host interface
- 133/100/66 MHz, 32/64-bit PCI-X bus interface; PMC-Sierra PM8363 quad Gb SERDES transceiver
- Onboard FPGA for management, control, and routing functions; high-performance wire speed on all ports, 16 Gb total
- Up to 16M frames per second maximum switching rate; onboard firmware for configuration, management, and monitoring
- 1.5 Mb of onboard memory for packet buffering; extended Ethernet frame sizes to 9 kB; fully IEEE 802.3-compliant
- PCI Rev. 2.2 and PCI-X 1.0-compliant; VxWorks 5.5 and Linux 2.4.xx driver support; FCC certified (pending)

For more information, contact: sales@dssnetworks.com **RSC# 20480 @ www.mil-embedded.com/rsc**

Ampro
5215 Hellyer Avenue #110 • San Jose, CA 95138-1007
Tel: 408-360-0200 • Fax: 408-360-0222
www.ampro.com

Rugged SBCs

Ampro believes that ruggedness should be inherent in the design. 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). The LittleBoard™ 800 EBX SBC is a rugged, I/O-rich product and is one of the few Pentium M® SBCs that includes a PCI-to-ISA bridge chip for PC/104-*Plus* expansion. The CoreModule™ 800 PCI-104 SBC is a must-have for applications where performance and small size are the dominant requirements; it offers low-power Centrino® performance with advanced networking, high-performance graphics, and all of the PC-compatible component subsystems.

FEATURES:

- CoreModule 800: For rugged applications that need ultra-high performance in a compact module
  - PCI-104 compatible, ultra-low voltage Celeron® M processor, GbE
  - Two serial, two USB 2.0 ports, PCI-104 without wings
- LittleBoard 800: For compact, full-featured, rugged embedded applications requiring ultra-high performance
  - Offers a choice of high-performance, low-voltage Centrino® processors
  - Intel® Extreme Graphics (CRT and LVDS flat panel), Dual Ethernet 3/20/2006 – GbE and 10/100BASE-T

For more information, contact: info@ampro.com **RSC# 30036 @ www.mil-embedded.com/rsc**

PC/104 MILITARY EMBEDDED SYSTEMS Resource Guide 2006

DIGITAL-LOGIC AG
Nordstrasse 11/F – CH-4542• Luterbach, Switzerland
Tel: +41-32-681-58-00 • Fax: +41-32-681-58-01
www.digitallogic.com

MICROSPACE® MSM855

DIGITAL-LOGIC offers the PC/104-*Plus* CPU module MSM855 with Intel Celeron M or Pentium M processors. Designed for harsh environments, the MSM855 provides all interfaces for modern applications. CPU and RAM are protected against shock and vibration. With a typical power consumption as low as 12-25 W, extended temperature solutions of -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 MSM855 module is perfectly suited for embedded computing with high CPU and graphics performance in transportation, telecommunication, medical, aerospace, or automotive applications.

For Intel Core Duo processors, a compatible MSM945CX PCI/104 module with PCI Express is under development.

FEATURES:

- MICROSPACE MSM855 baseboard with exchangeable Computer-On-Module, smartModule SM855
- Intel Celeron M or Pentium M processor from 600 MHz up to 2.0 GHz
- Intel 855GME, ICH4, 512-1,024 MB DDR-RAM, Extreme Graphic, 64 MB, DirectX 9 compatible, CRT and DVO/LVDS
- MS, KB, FD, 2 x P-ATA, COM1, COM2, LPT1, 6 x USB V2.0, LAN Ethernet 100/10BASE-T, audio AC97 5.1
- Thermal concept, operating temperature -20 °C to +50 °C (optional -40 °C to +70 °C), EEPROM support, watchdog

For more information, contact: sales@digitallogic.com **RSC# 25064 @ www.mil-embedded.com/rsc**

Arcom Control Systems Inc.
7500 West 161st Street • Overland Park, KS 66085
Tel: 913-549-1000 • Fax: 913-549-1001
www.arcom.com

Think Embedded. Think Arcom.

APOLLO – EBX Intel Pentium M/Celeron M SBC

The APOLLO uses the Intel® Pentium® M processor to offer the best combination of high-performance computing features with the lowest power dissipation. This single board computer can be fitted with the Intel® Pentium® M or Intel® Celeron M processor with speed options from 600 MHz to 2.1 GHz. The combination of Enhanced Intel SpeedStep® Technology and the Intel 855GME/ICH4 chipset ensures that the board is ideal for compact systems with restricted ventilation and can be used to create extremely high-performance, fanless systems. All these features are incorporated onto an industry standard EBX board with standard connectors for many of the I/O connections.

The APOLLO includes a hot-swap CompactFlash (CF+) socket for use with memory and I/O cards (Wi-Fi, Bluetooth, modem, and memory cards). The single, PCI 2.2-compliant slot can be used to drive a three-slot PCI riser card for compact system integration.

The APOLLO is fitted with an ATMEL Trusted Platform Module (TPM) device for use in applications that require a high level of software security and tight control of application code execution.

The board also includes a tamper detect input, which operates with or without main power applied, and a simple LCD character display interface for systems without a traditional VGA display.

The APOLLO is ideally suited for low-power, high-density server racks, 1U and 2U systems with fanless passive cooling, and rugged, secure computing installations.

FEATURES:

- Intel Pentium M/Celeron M processor options from 600 MHz to 2.1 GHz
- Industry standard EBX format
- Up to 1 GB DDR DRAM
- Dual 10/100Base-Tx Ethernet ports or 10/100Base-Tx plus a 1000Base-T Gigabit Ethernet port
- IEEE-1394 FireWire port for high-performance video applications
- Four serial ports – (2x) RS-232, (1x) RS-232/IrDA, (1x) RS-232/422/485
- Six USB 2.0 ports
- Fanless operation – up to +65 °C
- Enhanced security features including tamper detect and support for trusted computing via a TPM device
- PCI and hot-swap CompactFlash (CF+) port expansion
- Display output for analog CRT and/or LVDS, supporting dual independent displays; also, expansion for DVI or secondary CRT
- Audio CODEC with six-channel surround sound support

For more information, contact: us-sales@arcom.com **RSC# 21061 @ www.mil-embedded.com/rsc**

Arcom Control Systems Inc.
7500 West 161st Street • Overland Park, KS 66085
Tel: 913-549-1000 • Fax: 913-549-1001
www.arcom.com

Think Embedded. Think Arcom.

VIPER – PC/104 PXA255 XScale Single Board Computer

The VIPER is an ultra low power, PC/104 compatible, single board computer based on the Intel® 400MHz PXA255 XScale® RISC processor. The PXA255 is an implementation of the ARM-compliant, Intel XScale microarchitecture combined with a comprehensive set of integrated peripherals, including a flat-panel graphics controller, DMA controller, interrupt controller, real-time clock, and multiple serial ports.

The VIPER board offers a long list of features making it ideal for power sensitive embedded communications and multimedia applications. The board has been designed to take advantage of the power saving modes of the PXA255 processor and other onboard peripherals to achieve an incredible 1.9 W typical power consumption. The VIPER also supports a very low power standby mode.

The VIPER board includes a TFT/STN flat-panel graphics controller, onboard soldered SDRAM and resident Flash, 10/100Base-Tx Ethernet, five serial ports, dual USB host controller, USB client, AC97 audio/codec, CompactFlash interface (CF+), and a standard PC/104 bus expansion connector. The PC/104 format is an industrial form factor measuring 3.8" x 3.6" (96 mm x 91 mm).

The VIPER is supported with development kits for the leading embedded operating systems including Windows CE 5.0, embedded Linux (and RT-Linux Pro from FSM Labs), and VxWorks 5.5. Arcom also provides support for RedBoot™, a utility based on the eCos RTOS, which serves as a simple boot manager and download tool for embedded Linux applications.

To speed up the process of system integration, you can purchase the VIPER ICE industrial compact enclosure (fitted with a 320 x 240 wide temperature TFT/touchscreen display) or the rugged CYCLOPS display terminal (fitted with a high brightness 640 x 480 TFT/touchscreen display).

FEATURES:

- 400 MHz Intel PXA255 XScale processor
- 64 MB DRAM
- 64 MB Intel StrataFlash
- 256 KB battery backed SRAM
- Direct TFT/STN display support with onboard bias supply
- 10/100Base-Tx Ethernet controller
- Five high-speed serial ports (4x) RS-232, (1x) RS-232/422/485
- Dual USB v1.1 host controller and/or USB device
- Industry standard PC/104 form factor
- Very low power operation – typically 1.9 W with sleep modes down to 200 mW
- Hot-swap CompactFlash (CF+) expansion port
- Support for Trusted Computing with ATMEL TPM module

For more information, contact: us-sales@arcom.com **RSC# 30196 @ www.mil-embedded.com/rsc**

Micro/sys
3730 Park Place • Montrose, CA
Tel: 818-244-4600 • Fax: 818-244-4246
www.embeddedsys.com

SBC1494ET 486/586 Computer with CompactFlash and Flat Panel

Based on a high-performance 486/586 core, the SBC1494ET from Micro/sys provides a powerful controller in a PC/104, 3.55" x 3.775" footprint that will operate from -40 °C to +85 °C. In addition to PC-compatible features, such as SVGA and dual serial ports, the new model also includes 100BASE-T Ethernet support. With up to 64 MB of SDRAM, CompactFlash, and full AT-compatibility, high-performance control systems can be developed as single board solutions. In its stack-through version, the SBC1494ET is ideal for plugging into a custom OEM I/O card. The SBC1494ET can boot DOS, Windows 98, Linux, Windows CE, VxWorks, and other PC-compatible operating systems.

The SBC1494ET is implemented with the STPC Atlas processor, which offers speeds up to 133 MHz, on-chip cache, 64-bit DRAM access, hardware floating point, digital I/O, and AT-compatible EIDE, interrupt, timer, and DMA controllers. The SBC1494ET includes COM1, COM2, SuperVGA, keyboard, and mouse. The SuperVGA includes hardware acceleration and drives CRT monitors and LVDS TFT flat-panel displays with resolutions to 1024 x 1024. 100 MHz Ethernet provides fast, reliable communications. If needed, I/O expansion can be added to the SBC1494ET through PC/104 cards.

The CompactFlash socket on the SBC1494ET can be used as solid-state storage for operating systems and large applications. Micro/sys installs a ready-to-run firmware system on the SBC1494ET at no cost. This firmware includes a complete industrial BIOS, board setup screens, and application download utilities, and can create a DOS-like execution environment immediately upon powerup. Borland or Microsoft C/C++ 16-bit .EXE files can be downloaded to the board upon receipt. Alternatively, the computer may be configured to boot 32-bit operating systems upon powerup. A development kit that includes cables, sample software, and full documentation is available.

FEATURES:

- Compact PC/104 footprint
- Ready-to-run 486/586 computer
- 120 or 133 MHz
- CRT and flat-panel output
- 64 MB SDRAM
- CompactFlash connector
- 10/100BASE-T Ethernet
- Two serial ports
- -40 °C to +85 °C operation
- PC/104 expansion
- DOS, Linux, Windows CE, VxWorks, PharLap ETS

For more information, contact: info@embeddedsys.com

Micro/sys
3730 Park Place • Montrose, CA
Tel: 818-244-4600 • Fax: 818-244-4246
www.embeddedsys.com

SBC1670 XScale Computer with LCD Panel Support

The SBC1670 from Micro/sys combines a flat-panel display interface with a fast, yet low-power ARM processor in a PC/104, 3.55" x 3.775" footprint that will operate from -40 °C to +85 °C. The CPU has multimedia capabilities, which include support for an 800 x 600 color flat-panel display, audio output, and debounced keypad input. These features enable implementation of sophisticated point-of-sale terminals or feature-rich industrial control panels with fewer peripheral boards required.

At the heart of the SBC1670 is the Intel PXA270 processor. This powerful processor is based off of the ARM5 core, which implements a super-pipelined RISC architecture and adds a number of integrated peripherals. The PXA270 can run at speeds up to 524 MHz and can dynamically change speed in response to changing performance or power consumption needs. On-chip cache, a watchdog timer, an SDRAM controller, a CompactFlash interface, and a USB host controller are also integrated on the same silicon.

In addition to its multimedia features, the SBC1670 also features five serial ports and a 10/100BASE-T Ethernet controller to handle a variety of communication needs. Four of the serial ports have RS-232 transceivers, while the remaining serial port is configured for RS-485 communication.

With 128 MB of SDRAM, and a 64 MB resident flash array, high-performance control or data communications systems with feature-rich operating systems can be developed as single board solutions. The SBC1670 can boot Linux, Windows CE, and VxWorks from its onboard flash. If more I/O is needed, the SBC1670 allows expansion through its CompactFlash socket, which supports storage devices and I/O devices such as Wi-Fi cards. Additionally, the SBC1670 has a 16-bit PC/104 bus interface, which allows access to numerous off-the-shelf boards such as modems, analog I/O, or digital I/O. In its stackthrough version, the SBC1670 is ideal for plugging into a custom OEM I/O card. A free development kit is provided.

FEATURES:

- Compact PC/104 footprint
- 520 MHz low-power ARM processor
- 800 x 600 color LCD Interface
- 10/100BASE-T Ethernet
- Five serial ports
- Debounced keypad interface
- 128 MB SDRAM, 64 MB Flash
- CompactFlash connector
- Extended temperature range available
- USB interface
- PC/104 expansion
- Linux, Windows CE, VxWorks, and RTOS support

For more information, contact: info@embeddedsys.com

Micro/sys
3730 Park Place • Montrose, CA
Tel: 818-244-4600 • Fax: 818-244-4246
www.embeddedsys.com

SBC1625 XScale PC/104 with Dual Ethernet

Based on a high-performance ARM core, the SBC1625 from Micro/sys provides a powerful, network-ready controller in a PC/104 (3.55" x 3.775") footprint that will operate from -40 °C to +85 °C. The CPU has dual network processing engines to drive the 10/100BASE-T Ethernet. This feature offloads networking tasks such as Ethernet filtering, which enables a high level of throughput, while consuming less than 3.8 W maximum at its full 533 MHz CPU clock speed. Applications ranging from industrial controllers to protocol converters to gateways can all be implemented on a single board.

In addition to its powerful networking features, the SBC1625 also features 24 digital I/O lines, eight read- able DIP switches, eight LEDs for application use, and four RS-232 serial ports. One of those serial ports can also be configured for RS-485 communication. With 128 MB of SDRAM and a 64 MB resident flash array, high-performance control or data communications systems with feature-rich operating systems can be developed as single board solutions. The SBC1625 can boot Linux, Windows CE, and VxWorks from its onboard flash. If more I/O is needed, the SBC1625 allows expansion through its CompactFlash socket, which supports storage devices and I/O devices such as Wi-Fi cards. Additionally, the SBC1625 has a 16-bit PC/104 bus interface, which enables access to numerous off-the-shelf boards, such as modems, analog I/O, or digital I/O. In its stackthrough version, the SBC1625 is ideal for plugging into a custom OEM I/O card.

The SBC1625 is implemented with the efficient Intel IXP425 XScale processor, which has a superpipelined RISC architecture. The IXP425 offers speeds from 266 MHz to 533 MHz, on-chip cache, a watchdog timer, 133 MHz SDRAM access, and a USB device controller. A free development kit is provided.

FEATURES:

- Compact PC/104 footprint
- Low-power ARM processor
- Dual 10/100BASE-T Ethernet
- 128 MB SDRAM, 64 MB flash
- CompactFlash connector
- Four serial ports
- 24 bits of digital I/O
- USB
- Watchdog timer
- Extended temperature range available
- PC/104 expansion
- Linux, Windows CE, VxWorks, and RTOS support

For more information, contact: info@embeddedsys.com

Robotrol Corporation

www.robotrolcorp.com
panderson@robotrolcorp.com

RPC628 Analog I/O

Analog inputs: Inputs have 12-bit resolution and can operate as 16 single-ended or eight differential inputs, each protected to ±32 V. Full-scale voltages from 25 mV to 10 V can be used. Four to 20 mA current loops are an option.

Analog outputs: Eight outputs with 12-bit resolution can be set to one of seven ranges. Four to 20 mA current loops are an option.

Digital I/O: 16 I/O can be individually programmed as inputs or outputs.

Programmable features: Data transfer width, interrupt, auto increment, continuous conversion, conversion interval, software reset.

Similar products are available in STD32 and ISA with 32 SE or 16 DI inputs and eight analog outputs.

FEATURES:

- 16 SE or eight DI inputs (Ranges: 25 mv-10 V, unipolar or bipolar); 250 kHz throughput; inputs protected to ±32 V
- Eight analog outputs (Ranges: 2.5 V, 5 V, 10 V, ±5 V, ±10 V, -5-0 V, -10-0 V)
- 16 digital I/O, bit-by-bit programmable as inputs or outputs
- Options: 4-20 mA current loops for both inputs and outputs, auto scan mode (scan all inputs with one command)
- Auto increment and continuous conversion modes; programmable conversion intervals from 4 microsecs to 64 millisecs
- Programmable features: Data transfer width, interrupt, auto increment, continuous conversion, conversion interval, software reset

For more information, contact: panderson@robotrolcorp.com **RSC# 21099 @ www.mil-embedded.com/rsc**

Interactive Circuits and Systems Ltd.

(A member of Radstone Embedded Computing)

296-300 Concord Road, Corporate Center, Suite 120 • Billerica, MA 01821
Tel: 613-749-9241, 800-267-9794 (USA Only) • Fax: 613-749-9461
www.ics-ltd.com

ICS-645D

The ICS-645D is a high-speed data acquisition system in a full-length PCI form factor. All channels feature adjustable gain and filtering, eliminating the need for auxiliary signal conditioning equipment.

Based on the Analog Devices AD9260 sigma delta ADC, the ICS-645D simultaneously samples up to 32 differential input signals at up to 5 MSps, with a maximum signal bandwidth of 1.25 MHz. The combination of high channel density and a high sample rate makes the ICS-645D ideal for applications such as high-frequency sonar (littoral and mine hunting applications), vibration analysis, and jet engine testing.

FEATURES:

- 32 ADC channels (Analog Devices AD9260): 16-bits @ 5 MSps, with a maximum signal bandwidth of 1.25 MHz
- 64-bit, 66 MHz PCI interface (PCI 2.2-compliant), 400 MBps FPDP II interface
- Differential inputs with onboard signal conditioning
- Simultaneous sampling across all channels, even in multicard systems
- Up to 16 MBps of onboard memory
- Windows, Linux device drivers with extensive application and technical support available

For more information, contact: sales@ics-ltd.com **RSC# 24346 @ www.mil-embedded.com/rsc**

Annapolis Micro Systems, Inc.
190 Admiral Cochrane Drive, Suite 130 • Annapolis, MD 21401
Tel: 410-841-2514 • Fax: 410-841-2518
www.annapmicro.com

WILDSTAR II Pro PCI

Annapolis Micro Systems is a world leader in high-performance COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, digital signal processing, FFTs, communications, software radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Our ninth-generation WILDSTAR II Pro for PCI uses Xilinx's newest Virtex-II Pro 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 or PCI-X slots, including dual 1.5 GHz A/D, single 1.5 GHz A/D, Quad Fibre Channel 2, Quad 105 MHz, Quad Gigabit Ethernet, WILDSTAR Data Port (WSDP), FPDP, and LVDS.

Our boards are on a large number of operating systems, including Win (NT, 2000, XP), Linux, DECAlpha, Solaris, IRIX, ALTIX, MacOS, and VxWorks. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models. We offer training, including customized application development and customer support. 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 is based on data flow and automatically generates distributed control fabric between cores. Our extensive IP and board support libraries contain more than 800 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 PCI, with its associated I/O cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time-to-deployment.

FEATURES:

- One to two Virtex-II Pro Xilinx FPGA processing elements – XC2VP70 or XC2VP100
- Up to 96 MB DDRII or QDRII SRAM
- Up to 256 MB DDR DRAM
- Programmable flash for each processing element to share FPGA images
- Works with PCI or PCI-X backplane
- High-speed DMA multichannel PCI controller
- Host software: Win NT, 2000, XP, Linux, Solaris, MacOS, DECAlpha, IRIX, and ALTIX
- Full CoreFire board support package for fast, easy application development
- VHDL model, including source code for hardware 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# 19243 @ www.mil-embedded.com/rsc**

Interactive Circuits and Systems Ltd.

(A member of Radstone Embedded Computing)

296-300 Concord Road, Corporate Center, Suite 120 • Billerica, MA 01821
Tel: 613-749-9241, 800-267-9794 (USA Only) • Fax: 613-749-9461
www.ics-ltd.com

ICS-8554 and ICS-8552

The ICS-8554 four-channel rugged IF receiver and the ICS-8552 two-channel rugged IF receiver are designed for Software-Defined Radio (SDR) applications in demanding environments. The products include two Graychip CG4016 DDC devices and a 3M gate Xilinx Virtex-II FPGA. The majority of FPGA resources are free for user-defined digital signal processing algorithms.

The ICS-8552 brings high performance to standalone, man-pack applications by including a high-stability (1 PPM) onboard TCXO in addition to two ADC/DDC/FPGA channels. The ICS-8554 trades the TCXO for two additional ADCs and is intended for higher channel count in vehicle mounted systems where a high-precision clock source is externally supplied.

FEATURES:

- Four ADC channels, 14-bits @ 105 MHz, and two ADC channels, 14-bits @ 105 MHz (ADS5424)
- Two Graychip 4016 DDC ASICS and 3 Mgate Xilinx Virtex-II FPGA
- ICS-8552 – 1 PPM Temperature Compensated Crystal Oscillator (TCXO) on board
- 2 MB of FIFO storage
- Pn4 user I/O supports LVTTL or LVDS signaling levels
- Windows, Linux, and VxWorks device drivers

For more information, contact: sales@ics-ltd.com **RSC# 30138 @ www.mil-embedded.com/rsc**

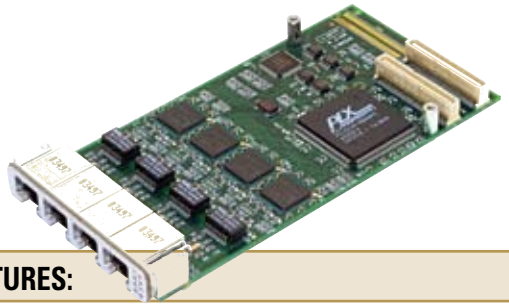
PMC MILITARY EMBEDDED SYSTEMS Resource Guide 2006

Technobox, Inc.

PMB 300, 4201 Church Road • Mount Laurel, NJ 08054
Tel: 609-267-8988 • Fax: 609-261-1011
www.technobox.com

4435

This Quad 10/100-TX Ethernet Adapter, which is built around Intel 82551ER Ethernet controllers, provides four Ethernet connections. The Quad's configuration options allow either front-panel connectiviy via RJ-45 connectors or rear I/O accessibility using a VITA 36 PIM module (for example, Technobox P/N 4516). The 82551ER Ethernet controllers feature an integrated MAC and PHY for operating at either 10 Mbps or 100 Mbps (full duplex). Each controller connects to the 32-bit, 66 MHz PCI bus through a PLX 6150B bridge and appears as an independent device on the bus. A dual-color LED (one for each port) provides indication of link mode/status and activity.



FEATURES:

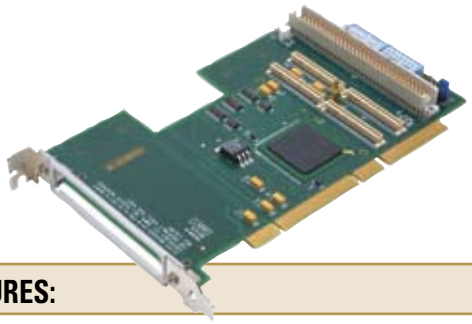
- Four 10/100-TX Ethernet ports, using Intel 82551ER Ethernet controllers
- Full-duplex operation at both 10 Mbps and 100 Mbps
- PLX 6150B PCI bridge (32/64-bit, 33/66 MHz)
- Front-panel I/O via RJ-45 interface
- Rear I/O access supported using PIM (for example, Technobox P/N 4516)
- Dual-color LEDs provide indication of link mode/status and activity

For more information, contact: info@technobox.com **RSC# 22639 @ www.mil-embedded.com/rsc**

Technobox, Inc.
PMB 300, 4201 Church Road • Mount Laurel, NJ 08054
Tel: 609-267-8988 • Fax: 609-261-1011
www.technobox.com

4352

This adapter features an Intel 31154 PCI-X to PCI-X bridge that permits delivery of PMC-derived applications in a standard PCI or PCI-X environment. Both PMC and PMC-X boards of any signaling level, clock frequency, and bus width are supported. The bridge assures signal integrity even with multiple adapters plugged into a single PCI bus segment. PCI and PCI-X rates are supported on both the primary and secondary PCI buses. Thirty-two-bit and 64-bit transactions are supported. LEDs indicate status of power and key PCI bus signals. A 4-pin power connector permits application of external power (+5 V and +12 V). An optional fan assembly (P/N 3675) is available.



FEATURES:

- Adapts PMC or PMC-X modules to PCI or PCI-X
- Intel 31154 bridge
- Supports PCI (33/66 MHz) and PCI-X (66/100/133 MHz)
- Rear I/O support
- LEDs for key PCI bus signals and power
- Accommodates external power

For more information, contact: info@technobox.com **RSC# 21145 @ www.mil-embedded.com/rsc**

MILITARY EMBEDDED SYSTEMS Resource Guide 2006 PMC

Technobox, Inc.
PMB 300, 4201 Church Road • Mount Laurel, NJ 08054
Tel: 609-267-8988 • Fax: 609-261-1011
www.technobox.com

4170

This PMC board, built around the Silicon Image 680, is designed to accept 2.5" ATA/IDE mass storage media, either a rotating hard disk drive or solid-state flash disk, using industry standard mounting. Media is normally installed by the end user.

FEATURES:

- Silicon Image 680 controller
- Accepts 2.5" ATA/IDE HD or solid-state disk
- Standard mounting
- Link activity LED
- Media optional

For more information, contact: info@technobox.com **RSC# 21141 @ www.mil-embedded.com/rsc**

Technobox, Inc.
PMB 300, 4201 Church Road • Mount Laurel, NJ 08054
Tel: 609-267-8988 • Fax: 609-261-1011
www.technobox.com

3923 FlexATX Processor PMC (PrPMC)

The 3923 is a FlexATX Processor PMC (PrPMC) carrier and development platform. This carrier board provides two PMC sites plus three PCI card slots (two 64-bit and one 32-bit). Using the 3923, a designer can work with a single PrPMC, dual PrPMCs, or a PrPMC and PMC for hardware and/or software development. All PCI slots are keyed for 3.3 V signaling. The PCI bus will run at 66 MHz, if all PCI cards assert 66 MHz enabled. At least one PMC site must be populated with a PrPMC running in Monarch mode. Site A's rear I/O is directed to connectors for a floppy disk and/or external IDE device. Each site has a fan to cool the mounted PrPMC or PMC.

FEATURES:

- FlexATX platform for PrPMC development and/or delivery
- Dual PMC sites enable various configurations with PrPMCs and PMCs
- Slots for three PCI cards (two 64-bit, one 32-bit), rear I/O access for external IDE or floppy drive
- Auxiliary cooling for PMC sites
- LED status for memory, configuration, I/O access, power, PCI interrupt, and bus mastering activity
- Site B rear I/O is directed to a DIN connector that emulates P2 of a VMEbus board

For more information, contact: info@technobox.com **RSC# 13761 @ www.mil-embedded.com/rsc**

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smartModule SM855

The smartModule SM855 is the smallest CPU module in its class at 117 mm x 70 mm x 15 mm, and supports Intel Pentium M processors and the Intel 855GME chipset.

In the development of new products, the SM855 reduces the design effort and the development costs, and can drastically reduce time to market. It is the ideal Computer-On-Module when application specific electronics and PC functionality are required in constrained space and extended environmental conditions. The genius cooling feature ensures perfect thermal connection.

Designed for low power consumption, the SM855 is the solution for mobile, medical, military, or automotive applications, where size, CPU, and graphic performance are important, along with high reliability and long-term availability.

FEATURES:

- smartModule SM855, mechanically protected against shock and vibration
- Intel Celeron M or Pentium M processor from 600 MHz up to 2.0 GHz
- Intel 855GME, ICH4, 512-1,024 MB DDR RAM, Extreme Graphic, 64 MB, DirectX 9 compatible, CRT, and DVO
- SM855Bus interface with PCI, LPC, 2 x P-ATA, 6 x USB V2.0, LAN Ethernet 10/100BASE-T, Audio AC97 5.1
- Thermal concept, operating temperature -20 °C to +50 °C (optional -40 °C to +70 °C), EEPROM support, watchdog
- Development kit for smartModule SM855 products, with documentation, schematics of MSEBX855-B, and tools

For more information, contact: sales@digitallogic.com **RSC# 25281 @ www.mil-embedded.com/rsc**

Kontron

14118 Stowe Drive • Poway, CA 92064-7147
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www.kontron.com

Kontron EB8347

The Kontron EB8347 is the latest RISC-based Computer-On-Module (COM) in the E Brain COM family. Based on Freescale's MPC8347 with an integral security engine, the EB8347 has dazzling features including an integrated DVI graphics port, TTL flat-panel interface, two GbE ports, two USB 2.0 ports, and 1008 MIPS at 533 MHz. For the first time, two functions can be integrated into an E Brain-based RISC system: sophisticated HMI and real-time controls. The EB8347 offers an excellent alternative to x86-based COMs, especially in harsh environments where the virtues of RISC shine through: excellent computing power, minimal power consumption, extremely robust mechanical design, long-term availability, extended temperature, and excellent software support (Linux, VxWorks).

FEATURES:

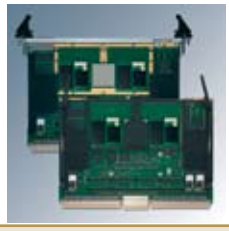
- Freescale MPC8347 processor at 533 MHz/256 MB DDR SDRAM (soldered)/64 MB flash/integral security engine
- Two GbE ports, four serial ports, AC97 audio interface, two USB 2.0 ports
- Graphics support: SM501 graphics chip with DVI-I + TTL flat-panel interface
- RTC, watchdog timer, I2C, SPI and JTAG, 24x GPIO, 3x PWMs; extended temperature option of -40 ˚C to +85 ˚C
- Expansion via 32-bit/66 MHz PCI interface and Low Pin Count (LPC) interface
- Software support: VxWorks 6.x BSP, embedded Linux with graphics support

For more information, contact: sales@us.kontron.com **RSC# 30046 @ www.mil-embedded.com/rsc**

Creative Electronic Systems

38 Avenue Eugène-Lance • Grand-Lancy 1/Geneva, Switzerland 1212
Tel: 41-22-884-51-00 • Fax: 41-22-794-74-30
www.ces.ch

RIO4 8070/RIO4 8076



Applications

The RIO4 8070 and RIO4 8076 are designed for the most demanding signal processing, such as ground, marine and airborne radar equipment, which combines extreme performance and capacity.

Hardware and Software

The computing elements use the latest PowerPC G4 processor, an FPGA and a set of high-speed serial links handled by a unique CES multiport control logic incorporating user-controlled bandwidth. Each processor includes one or two such computing elements. Radar algorithms are hosted in the FPGAs, which are tightly coupled with the CPUs and the interprocessor links. Data can enter / exit the system at 800 MBytes/s in non-blocking mode in parallel with the mathematical processing operation. These computing elements are available with the general purpose Linux toolkit, as well as with CES extended BSPs for VxWorks and Integrity.

FEATURES:

- Single or dual signal processing node
- Each node equipped with a PowerPC G4 at maximum available frequency, a tightly coupled FPGA and a set of high-speed links
- Ultra-high-speed (200 MBytes/s) user data buffer with direct access to FPGAs and CPUs
- Onboard NAND Flash Memory with Fast File System
- Full Secure Cells real-time reconfiguration logic

For more information, contact: ces@ces.ch **RSC# 24232 @ www.mil-embedded.com/rsc**

Barco

3059 Premiere Parkway • Duluth, GA 30097-4905
Tel: 678-475-8000 • Fax: 678-475-8100
www.barcodefense.com

FlexiVision III

FlexiVision III is a modular single-board solution for real-time video and graphics mixing, recording, image processing, and networked video distribution.

Featuring leading-edge technologies such as RapidI/O, GbE, JPEG2000, and an embedded operating system, FlexiVision III is ideally suited for demanding military surveillance and reconnaissance applications, battle space intelligence, and network-centric environments.

With a multitude of both analog and digital inputs and outputs, FlexiVision III offers a solution for today's most challenging visualization requirements and a growth capacity for any future demand.

FEATURES:

- Standalone, real-time video windowing up to 1920 x 1200 with zooming, scaling, positioning, and graphics overlay capability
- Onboard gigabit network interface for low-latency streaming of high-resolution graphics and video
- Video/graphics and audio recording on network storage at a user-selectable compression ratio including lossless encoding
- Programmable real-time video processing functions such as noise reduction, stabilization, image warping
- Network control and embedded webserver for easy configuration and system integration
- Available in PCI, VME, and conduction-cooled VME form factors

For more information, contact: sales.barcoview-a@barco.com **RSC# 20272 @ www.mil-embedded.com/rsc**

L-3 Communications Advanced Products & Design

10636 Scripps Summit Court • San Diego, CA 92131
Tel: 858-527-6100 • Fax: 858-527-0150
www.L-3Com.com/apd

Vigra – Video, Imaging

We're different. We work closely with you to create requirements-driven video and image processing solutions that meet your specific needs. From frame grabbers with graphics and dual monitor support to complex, real-time video/image processing to MPEG compression and decompression, our Vigra family of customizable, off-the-shelf board platforms can be tailored to meet the highest degree of functionality, performance, and reliability possible. Our Vigra products are based on programmable, scalable FPGAs, creating a flexible Custom Off-The-Shelf (COTS) technology to support video capture and display, as well as complex real-time image processing and high-resolution graphics. Vigra's architecture allows you to adapt and upgrade application-specific functions, without changing the hardware.

FEATURES:

- MPEG-2 compression/decompression
- High-resolution, programmable bandwidth video
- Onboard, real-time image processing
- VxWorks, Solaris, Windows
- FPGA-based
- PCI and PMC form factors

For more information, contact: apd-info@L-3Com.com **RSC# 19235 @ www.mil-embedded.com/rsc**

Annapolis Micro Systems, Inc.
190 Admiral Cochrane Drive, Suite 130 • Annapolis, MD 21401
Tel: 410-841-2514 • Fax: 410-841-2518
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, digital signal processing, FFTs, communications, software 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 VME64x slot, including dual 1.5 GHz A/D, single 1.5 GHz A/D, Quad Fibre Channel 2, Quad 105 MHz, Quad Gigabit Ethernet, WILDSTAR Data Port (WSDP), FPDP, and LVDS. We host our boards on a large number of operating systems, including Win (NT, 2000, XP), Linux, DEC Alpha, Solaris, IRIX, ALTIX, MacOS, and VxWorks.

We support our board products with a standardized set of drivers, APIs, and VHDL simulation models. We offer training, including customized application development and customer support. Develop your application very 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. CoreFire is based on data flow and automatically generates distributed control fabric between cores. Our extensive IP and board support libraries contain more than 800 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, calendar time-to-deployment, and dollars.

FEATURES:

- One to three Virtex-II Pro Xilinx FPGA processing elements – XC2VP70 or XC2VP100
- Up to 144 MB DDRII or QDRII SRAM
- Up to 384 MB DDR DRAM
- Programmable flash for each processing element to store FPGA images
- Works with VME64x backplane
- High-speed DMA multichannel PCI controller
- Host software: Win NT, 2000, XP, Linux, VxWorks, Solaris, MacOS, DECAlpha, and SGI
- Full CoreFire board support package for fast, easy application development
- VHDL model, including source code for hardware 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# 19242 @ www.mil-embedded.com/rsc**

BittWare, Inc.
31B South Main Street • Concord, NH 03301
Tel: 603-226-0404 • Fax: 603-226-6667
www.bittware.com

TS201 6U VME Board

The T2-6U-VME, T2V6, is a 6U VME board featuring eight ADSP-TS201 TigerSHARC DSPs from Analog Devices and is 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. It is available in both air-cooled and conduction-cooled versions. To take full advantage of the high-performance TigerSHARC, the T2V6 implements BittWare's ATLANTiS architecture, which combines robust TigerSHARC processing with a versatile FPGA to offer ultrahigh performance and unprecedented I/O bandwidth.

The board features eight ADSP-TS201 TigerSHARC DSPs from Analog Devices, arranged as two clusters of four. The four processors in each cluster are interconnected by a 64-bit, 83.3 MHz cluster bus. The ADSP-TS201 processor operates at up to 600 MHz, providing 3.6 GFLOPS of peak processing power. Because of its superscalar architecture, the ADSP-TS201 is also efficient at fixed-point processing, with each DSP supporting 14.4 BOPS of processing. Along with 24 Mb of on-chip RAM, each DSP also boasts four high-speed LVDS link ports running at up to 1 GBps each. Two link ports from each DSP create an interprocessor communications ring, and the remaining two link ports are routed to the ATLANTiS FPGAs, running at half-speed, 500 MBps each.

To facilitate off-board I/O and provide communications routing and processing, the T2V6 features a dual BittWare ATLANTiS architecture, which is implemented in the onboard FPGAs. All off-board I/O for the board, which includes external link ports and digital I/O blocks, is routed through the FPGAs, which can support a throughput of 5 GBps each. By tightly integrating the DSPs, PCI bridge, PMC interface, and I/O peripherals with the onboard FPGAs, ATLANTiS gives designers nearly infinite options for configuring and routing the I/O.

The T2V6 is part of BittWare's T2 board family, which features the ADSP-TS201 TigerSHARC DSP on a variety of platforms.

FEATURES:

- Two clusters of four ADSP-TS201 DSPs at up to 600 MHz – 3.6 GFLOPS of floating-point power per DSP, 14.4 BOPS of 16-bit processing per DSP
- ATLANTiS architecture featuring more than 10 GBps of external I/O throughput via onboard FPGA
- Two high-density FPGAs for interfacing and coprocessing
- One PMC site with PMC+ extension for BittWare's PMC+ I/O modules – rear-panel I/O options, front-panel I/O on air-cooled versions only
- Tundra Tsi148 PCI-X-VME bridge with 2eSST support
- 64-bit, 66 MHz PCI interface via BittWare's SharcFIN PCI-DSP bridge
- Up to 512 MB of onboard SDRAM
- 16 MB of flash memory for booting DSPs and FPGAs
- Two link ports per DSP dedicated for interprocessor communications
- 6U VME form factor
- Complete software support, including remote control and debug, support for multiple runtime and host OSs, and optimized function library

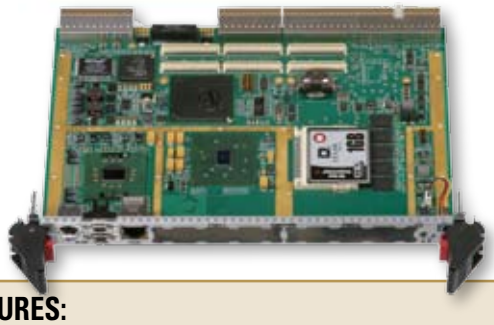
For more information, contact: info@bittware.com **RSC# 30048 @ www.mil-embedded.com/rsc**

Dynatem, Inc.
23263 Madero, Suite C • Mission Viejo, CA 92691
Tel: 800-543-3830 • Fax: 949-770-3481
www.dynatem.com

RPM

The RPM is a rugged, conduction-cooled VMEbus- and VME64-compatible platform based on the Intel low-power Pentium M, Dothan, processor. The RPM takes advantage of the Pentium M's low power consumption as a rugged SBC, and it is 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 855GME Graphics Memory Controller Hub (GMCH) and 6300ESB I/O Controller Hub (ICH) chipset supports PCI-X expansion, integrated VGA/DVO interface, USB 2.0, ATA/100, and Serial ATA (SATA).



FEATURES:

- 2 MB of L2 Advanced Transfer Cache
- Single-slot VMEbus operation with an onboard CompactFlash disk for bootable mass storage
- 400 MTps system bus; Ultra ATA 100/66/33 IDE protocol
- DDR-266 support with a memory bandwidth of 2.1 GBps
- Tundra Universe IID PCI-VMEbus interface provides 64-bit VMEbus transfer rates of more than 30 MBps
- One conduction-cooled PMC-X site with 64-bit, 66 MHz bandwidth is available onboard

For more information, contact: sales@dynatem.com **RSC# 20830 @ www.mil-embedded.com/rsc**

GE Fanuc Embedded Systems
12090 South Memorial Parkway • Huntsville, AL 35803
Tel: 800-GE Fanuc • Fax: 256-882-0859
www.gefanuc.com/embedded

Embedded Sustems

NEXUS™ Forte

The NEXUS Forte multiprocessor from GE Fanuc Embedded Systems features the latest Freescale PowerPCs in a shared memory multiprocessing architecture to achieve the highest performance for the most demanding signal, image, and data processing applications. The NEXUS Forte is the latest member of the NEXUS family of multiprocessor VME products and is based on the PowerPC 7447A/7448 processors.

The Forte is designed and tested to support commercial and rugged applications using the same functional design. This feature permits deployed application development using cost-effective commercial products while maintaining software compatibility with the rugged solution.

FEATURES:

- Factor build options for one, two, or four PPC 7447A or 7448 CPUs
- Two independent local PCI-X buses, 64-bit/133 MHz; two industry standard PMC sites (IEEE P1386-compliant)
- 1024 MB DDR266 SDRAM with ECC; 128 MB user and 16 MB boot flash
- Onboard GbE (10/100/1000BASE-T)
- Serial ports with front and rear access
- ANSI/VITA 31.1-compliant switched fabric interconnect; ANSI/VITA 47-compliant environmental performance

For more information, contact: sales.embeddedsystems@gefanuc.com **RSC# 29535 @ www.mil-embedded.com/rsc**

Interactive Circuits and Systems Ltd.

(A member of Radstone Embedded Computing)

296-300 Concord Road, Corporate Center, Suite 120 • Billerica, MA 01821
Tel: 613-749-9241, 800-267-9794 (USA Only) • Fax: 613-749-9461
www.ics-ltd.com

ICS-8145

Designed for high-frequency sonar and high-speed test and measurement applications, the ICS-8145 combines the best aspects of various ICS acoustic products. It includes signal conditioning for each analog input channel, consisting of programmable gain control (four ranges) and a fixed frequency anti-alias filter. The filters on the standard version of the product have cutoff frequencies of 1.25 MHz; as an option, the frequencies can be changed.

The ICS-8145 can be configured to accept up to 16 differential inputs, simultaneously sampled at frequencies of up to 2.5 MHz per channel. Two memory options are available: The standard version of the card provides 2 MB of synchronous SRAM, while the extended memory option provides 8 MB.

FEATURES:

- 16 ADC channels (Analog Devices AD9260): 16-bits @ 2.5 MSps
- Rear I/O features differential analog inputs and FPDP II output bus
- Onboard signal conditioning provides programmable gain, filtering
- Two input voltage ranges: 20 Vp-p and 2 Vp-p
- Two banks of onboard memory: 1 MB or 4 MB each (2 MB or 8 MB total)
- VxWorks device drivers available. For Linux availability, contact ICS

For more information, contact: sales@ics-ltd.com **RSC# 25177 @ www.mil-embedded.com/rsc**

VMEbus MILITARY EMBEDDED SYSTEMS Resource Guide 2006

THEMIS

47200 Bayside Parkway • Fremont, CA 94538
Tel: 510-252-0870 • Fax: 510-490-5529
www.themis.com/prod/hardware/tppc64.htm

Themis 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# 24541 @ www.mil-embedded.com/rsc**

THEMIS

47200 Bayside Parkway • Fremont, CA 94538
Tel: 510-252-0870 • Fax: 510-490-5529
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 a 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 perfor-

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# 24540 @ www.mil-embedded.com/rsc**

Interactive Circuits and Systems Ltd.

(A member of Radstone Embedded Computing)

296-300 Concord Road, Corporate Center, Suite 120 • Billerica, MA 01821
Tel: 613-749-9241, 800-267-9794 (USA Only) • Fax: 613-749-9461
www.ics-ltd.com

ICS-8550

Designed to bring more bandwidth and processing power to Software-Defined Radio (SDR) applications, the ICS-8550 XMC module features two analog inputs equipped with AD9430 210 MHz, 12-bit ADCs, and a Xilinx Virtex-4 XC4VFX60 FPGA. This card has been optimized for wide bandwidth front-end digital signal processing associated with digital receiver applications common to spectrum monitoring, signal intelligence, communications, and radar systems.

Five levels of ruggedization available from commercial air-cooled to conduction-cooled. Careful selection of components and thermal management techniques allows intensive DSP functionality to be maintained at sample rates up to 210 MHz.

FEATURES:

- Two ADC channels (Analog Devices AD9430): 12-bits @ 210 MHz
- Xilinx Virtex-4 FX60 FPGA
- High-speed serial I/O through XMC connector
- Companion to Radstone V4DSP
- VITA 43 XMC compliant high-speed serial links (eight lanes @ 2.5 GHz)
- Windows, Linux, and VxWorks device drivers with extensive application and technical support available

For more information, contact: sales@ics-ltd.com **RSC# 29769 @ www.mil-embedded.com/rsc**

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

Dual-Core Intel® Xeon® Processor LV 2.0

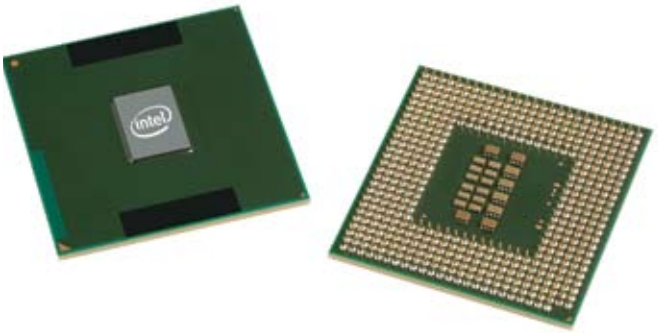
The Dual-Core Intel® Xeon® processor LV 2.0 GHz is a member of Intel's growing product line of multicore processors, delivering significantly greater performance-per-watt over previous single-core Intel® Xeon® processor-based platforms.[1] Two cores in one physical package support increased blade density, making it particularly attractive for AdvancedTCA* form factor designs, as well as CompactPCI*, COMM Express, and custom-bladed and rack-mounted designs. A high-performance 667 MHz Front-Side Bus (FSB) provides dual-processor support for demanding multithreaded and multitasking usage environments.

Based on Intel 65nm process technology, this processor combines the benefits of dual-core with dual-processor capabilities to provide four high-performance cores per platform. This dual-core/dual-processor capability provides ideal solutions for a wide range of low-power embedded, storage, and communications applications such as Storage Area Networks (SANs), Network Attached Storage (NAS), routers, Virtual Private Networks (VPN), ruggedized small form factor systems, intrusion detection systems, and telecommunications (wireless and wireline) servers. While incorporating advanced processor technology, this dual-core processor remains software-compatible with previous 32-bit Intel® Architecture processors.

The Dual-Core Intel Xeon processor LV 2.0 GHz is validated with the widely deployed Intel® E7520 chipset featuring high bandwidth for increased memory and I/O throughput, PCI Express*, and serial I/O technology. Enhanced 36-bit memory addressing supports up to 16 GB of DDR2 memory. Intel's comprehensive processor/chipset validation process enables fast deployment of next-generation platforms to help developers maximize competitive advantage while minimizing development risks.

[1]Benchmark tests demonstrate significant gain in performance and performance-per-watt, when comparing the Dual-Core Intel® Xeon® processor LV 2.0 GHz to previous single-core Intel® Xeon® processors. (See intel.com/design/intarch/prodbref/311375.htm)

*Other names and brands may be claimed as the property of others.



FEATURES:

- Two complete execution cores in one processor package support multithreaded applications and multitasking environments
- Dual-core processing efficiently delivers performance while balancing power requirements
- High-performance 667 MHz FSB provides dual processor support for demanding, high-performance, volume applications
- Supports up to four simultaneous threads on system
- Dynamically adjusts processor voltage and core frequency, decreasing average power consumption and average heat production
- Intel® Smart Cache Design allows two execution cores to share 2 MB of L2 cache, reducing FSB traffic and enhancing system responsiveness
- Intel® Advanced Thermal Manager supports digital temperature sensors and thermal monitors on each execution core
- Streaming SIMD Extensions 3 (SSE3) provides significant performance enhancement for multimedia applications
- Fully code compatible with existing Intel architecture-based 32-bit application software
- Enhanced 36-bit memory addressing supports up to 16 GB of DDR2 memory when paired with the Intel® E7520 chipset
- Embedded life-cycle support protects system investment by enabling extended product availability
- A strong ecosystem of hardware and software vendors (intel.com/go/ica) helps developers reduce costs and shorten time to market

ACT/Technico

760 Veterans Circle • Warminster, PA 18974
Tel: 215-956-1200 • Fax: 215-956-1201
www.acttechnico.com

PMC ShuttleStor

The PMC ShuttleStor is a hot-swap, removable PMC storage solution that enables quick and easy removal of vital data for safekeeping without requiring removal of the host board.

This solution consists of a shuttle and a receiving canister. The canister mounts to the host board, enabling easy insertion and removal of the storage shuttle through the host front panel. It is ideal for storage and OS updates as well as vehicle or system declassification.

FEATURES:

- Security: Quickly and easily remove vital data for safekeeping
- Flexibility: Simple and effective method of upgrading to newer drives
- Availability: Shortest Mean Time To Repair (MTTR) in the industry – with hot-swap capability

For more information, contact: sales@acttechnico.com **RSC# 30039 @ www.mil-embedded.com/rsc**

VMETRO Inc.

1880 S. Dairy Ashford, Suite 400 • Houston, TX 77077
Tel: 281-584-0728 • Fax: 281-584-9034
www.vmetro.com

Vortex Recorders

The Vortex family of real-time data recording, playback, and analysis systems for analog and digital applications offers sustained recording at rates up to 385 MBps. These high-speed recorders support both commercial and rugged environments utilizing Fibre Channel Storage Area Network (SAN) media in JBOD or RAID configurations from cost-effective commercial to rugged and solid-state storage.

Available as targeted recorders or open custom recorders, the Vortex family easily integrates into any VME, CompactPCI, or PC-based system. Vortex is the most powerful, flexible, scalable, yet easy-to-use recording capability available today. It is ideally suited for signal analysis environments such as ELINT, COMINT, SIGINT, SAR, MTI, and SDR, as well as medical scanners and industrial inspection systems.

FEATURES:

- Open architecture versions make custom I/O and feature enhancements easy
- Targeted ready-to-run versions for common I/O requirements
- Web browser Graphical User Interface (GUI) allows intuitive local or remote operation
- XML-RPC capability allows remote control from most any workstation
- Fibre Channel SAN offers an array of storage options
- SAN access kit allows high-speed direct access analysis from most any workstation

For more information, contact: info@vmetro.com **RSC# 30033 @ www.mil-embedded.com/rsc**

Adtron Corporation

4415 E. Cotton Center Blvd. • Phoenix, AZ 85040
Tel: 602-735-0300 • Fax: 602-735-0349
www.adtron.com

Diskpak™ S35H

The Adtron S35H Diskpak provides the same storage functions found in SCSI-1 and SCSI-2 fast and narrow hard disk drives. This product replaces out-of-production 3.5" SCSI hard disk drives. Using Adtron's proprietary SCSI host-to-IDE disk adapter with its controlled command set, combined with a standard 2.5" IDE disk drive, the S35H provides long-term availability and eliminates the need to requalify new SCSI models.

The Adtron S35H Diskpak delivers significant cost savings to the engineering, operations, and service departments by eliminating periodic disk qualifications, inventory costs, and field upgrades.

Factory configurable operating parameters include *destroking* to match system capacity requirements and disk power-down timing.

FEATURES:

- Narrow and wide, fast SCSI drive, 3.5" form factor
- Standard SCSI 50-pin and optional 68-pin connector and interface
- Storage capacity can be factory set to equal or lower capacity than the installed disk media
- 5 V-only operation eliminates the requirement for 12 V power supplies
- SCSI-1 and SCSI-2 fast and narrow Single Ended (SE) compatible
- High capacity, up to 80 GB in a standard 1" tall enclosure

For more information, contact: nasales@adtron.com **RSC# 30037 @ www.mil-embedded.com/rsc**

Magnetic HDD MILITARY EMBEDDED SYSTEMS Resource Guide 2006

Phoenix International

812 W. Southern Avenue • Orange, CA 92865
Tel: 800-203-4800 • Fax: 714-283-1169
www.phenxint.com

Ultra320 SCSI VME

The first plug-in VME storage module with 320 MBps speed, Phoenix's Ultra320 SCSI VME Module is available in a single-slot model (VL1-250-SC-DS-X) and a two-slot model (VL2-350-SC-DS-X), with capacity up to 600 GB.

The new VME Module joins Phoenix International's extensive line of rugged VME products, offers data transfer rates significantly higher than other products on the market. It also provides a superior VME storage module alternative for high-speed data acquisiton, high-definition imagery, telemetry recording, and data mirroring applications.

Phoenix's Ultra320 SCSI products offer the flexibility of LVD technology and include the most comprehensive set of performance features for VME products in the industry.

FEATURES:

- Transparency to any operating system
- LVD Ultra320 SCSI I/O
- Rugged packaging: shock, 60 G operating; vibration, 1 G operating
- 10,000 RPM spindle speed (optional 15 K)
- Sensi-term: automatic internal bus termination
- 1,400,000 hour MTBF

For more information, contact: amos3@phenxint.com **RSC# 30140 @ www.mil-embedded.com/rsc**

Adtron Corporation

4415 E. Cotton Center Blvd. • Phoenix, AZ 85040
Tel: 602-735-0300 • Fax: 602-735-0359
www.adtron.com

Bladepak™ SC6M

The Adtron SC6M Bladepak storage blade delivers self-contained RAID-1 functionality on a 6U CompactPCI, single-slot board appearing to the host CPU as a single-volume SCSI disk drive. Adtron SmartStorage™ framework mirrors two 2.5" IDE hard disk drives using Adtron ActiveRAID™ technology, provides failed drive hot swapping, and automatically initializes and rebuilds the replaced disk without stopping host access.

PICMG 2.9-compliant IPMI functionality on the Adtron SC6M Bladepak storage blade provides telecommunications and server computing platforms with health status monitoring. The Adtron IPMI communication channel provides storage system health information to the network controller through the local IPMI alarm card.

FEATURES:

- Adtron ActiveRAID feature with individual disk hot-swap capability provides RAID-1 functionality and operation
- Up to 80 GB hard disk storage
- An integrated IPMI controller communicates health and FRU status to the system network controller
- Single-slot design increases system integrity and simplifies NEBS qualification
- LVD or SE SCSI bus connection through J5 connects to a system controller or peripherals
- Onboard bootable SCSI host adapter using the 53C875 SCSI controller and 256 KB BIOS flash ROM

For more information, contact: nasales@adtron.com **RSC# 30035 @ www.mil-embedded.com/rsc**

MILITARY EMBEDDED SYSTEMS Resource Guide 2006 RAID

Phoenix International

812 W. Southern Avenue • Orange, CA 92865
Tel: 800-203-4800 • Fax: 714-283-1169
www.phenxint.com

PES16 SATA-II RAID

Phoenix's new 4 Gb Fibre Channel, 16-bay PES16 SATA-II RAID system is designed for users who require affordable high speed, high capacity, and reliability in storing and accessing data.

This 16-bay Storage Area Network (SAN)-ready RAID combines the performance and scalability of 4 Gb Fibre Channel host interfaces with the low-cost/high-capacity benefits of 3 Gbps Serial ATA drive technology. At 400 MBps, it doubles the maximum performance speed of direct attached SAN applications while maintaining backward compatibility with 1 Gb and 2 Gb systems. Its advanced design provides an enhanced, cableless, backplane-based, high-density 3U chassis, providing maximum storage capacity with the highest level of data availability.

FEATURES:

- Two 4 Gb fibre host channels, each with a transfer rate of up to 400 MBps
- Accommodates 16, 3 GBps SATA-II disk drives, backward compatible with SATA-I drives
- High fault tolerance with RAID 6 configurations
- Java-based GUI management software
- Highest capacity available in a 3U chassis, supporting up to 8 TB storage capacity
- SAN ready LUN filtering and multiple logical drive configurations

For more information, contact: amos3@phenxint.com **RSC# 30141 @ www.mil-embedded.com/rsc**

Adtron Corporation
4415 E. Cotton Center Blvd. • Phoenix, AZ
Tel: 602-735-0300 • Fax: 602-735-0349
www.adtron.com

ADTRON
Smart Storage, Smart People.™

Adtron Flashpaks

Adtron SmartStorage™ framework is the foundation for all of our flash disks in the Adtron Flashpak™ family. This family ranges from the entry-point IDE flash disk, I25F, to the high-performance and capacity SATA flash disks, A25FB and A35FB, and IDE flash disks, I25FB and I35FB. Starting with the application, Adtron evaluates the need for reliability, durability, and high availability. The more extreme the application, such as that found in defense and industrial systems, the more suited the application is for a Flashpak, and the less suited the application is for a traditional mechanical disk.

The Adtron Flashpak family offers 2.5" and 3.5" form factors to fit an array of applications that benefit from solid state technology, which provides the highest level of storage reliability.

In applications where shock, vibration, temperature extremes, or rapid temperature gradients are at issue, Adtron Flashpaks provide durability beyond rotating media. Today's embedded industrial and defense applications require not only high reliability and durability but also high capacities and fast performance. Adtron meets this challenge with advanced flash array processing capabilities. Sections of solid state memory are read and written transparently to the host, and managed by ArrayPro technology. The result is increased performance without using volatile front-end cache that could potentially lose data in the event of a power failure. Flashpak transfer rates represent true sustained read and write capabilities. The ArrayPro turbocharging features allow data storage tailoring to meet the most demanding performance requirements.

Designed for defense applications, Adtron EraSure™ technology meets the requirements set by various defense service branches and governing bodies. Three levels of data elimination, such as Clear, Sanitize, and Destroy, are available and may be customized for specific needs.

FEATURES:

- Patent-pending Adtron ArrayPro™ flash array processing for unmatched performance and capacity
- All solid state technology, no moving parts
- Cacheless design eliminates bottlenecks and speed limitations of legacy architectures based on cache
- SmartStorage framework enables fastest implementation of customized solutions and integration of new technologies
- 2.5" and 3.5" form factors
- MIL-STD-810F testing proves reliability and durability; other industry testing available
- EraSure technology compliant with NISPOM DoD 5220.22-M, NSA 130-2, U.S. Air Force AFSSI-5020, U.S. Army AR380-19, U.S. Navy NAVSO P-5239-26, IRIG 106-3
- Capacity ranges from 512 MB-128 GB in SATA, IDE, and SCSI interfaces
- Burst read and write performances of 100 MBps IDE and 150 MBps SATA
  - Sustained read 65 MBps IDE and SATA
  - Sustained write 55 MBps IDE and 60 MBps SATA
- Hot plug features allows users to remove and replace the SATA Flashpaks with power on, reducing planned and unplanned downtime
- C4ISR defense applications, avionics, video streaming, factory automation and robotics, ruggedized laptops, airborne mapping
- Backed by Adtron's warranty and exceptional customer support

For more information, contact: nasales@adtron.com **RSC# 30043 @ www.mil-embedded.com/rsc**

L-3 Communications Advanced Products & Design

10636 Scripps Summit Court • San Diego, CA 92131
Tel: 858-527-6100 • Fax: 858-527-0150
www.L-3Com.com/apd

Rapid Retargeting™

Rapid Retargeting redesign technology lets you escape the never-ending component obsolescence problems found in fielded military systems by providing a process to capture existing system functionality and re-express it in modern, modular component technology with the same form, fit, and function. The Rapid Retargeting process uses a collection of sophisticated analysis, simulation, and modeling tools to transform an existing electronic module from a fielded system into a new module with identical form, fit, and function. Retargeting extracts the functionality of the target hardware – captures it in the Hardware Description Language (HDL) software model. It is simulated, verified against the original hardware, and implemented in a new hardware design.

FEATURES:

- Lifetime solution to component obsolescence
- Form, fit, and functionally equivalent modules and components
- Improved system readiness and reliability
- Reusable software to reduce NRE – reduced ownership cost
- The model can be easily rehosted whenever new technology becomes available, making subsequent hardware modification and upgrades much easier; the result is an end to obsolescence for the lifetime of the system

For more information, contact: apd-info@L-3Com.com **RSC# 30146 @ www.mil-embedded.com/rsc**

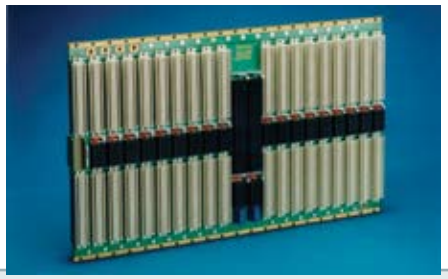
Hybricon Corporation

12 Willow Road • Ayer, MA 01432
Tel: 1-877-HYBRICON • Fax: 978-772-2963
www.hybricon.com

VXS Backplanes

Hybricon Corporation's new family of VXS switch-fabric backplanes are designed to meet the latest VITA standards, including VITA 41.1 InfiniBand, VITA 41.2 Serial RapidIO, VITA 41.3 Gigabit Ethernet, and VITA 41.4 PCI Express. These backplanes leverage Hybricon's signal integrity analysis and implementation experience to achieve the highest performance with the VMEbus tested to 320 Mbps per VITA 1.5 2eSST.

The boards are constructed in a 20-layer, low-noise stripline design with the outside layers incorporating a chassis ground EMI shield. The 21-slot VXS backplanes provide two VITA 41.x fabric slots and up to 18 VITA 41.x payload slots with 4x links to two switch slots.



FEATURES:

- Compliant to the latest VXS switch-fabric VITA standards
- High performance, low noise
- Twenty-layer construction ensures optimum signal performance
- InfiniBand, Serial RapidIO, GbE, and PCI Express versions available
- Stiffeners placed every two slots ensure board rigidity
- Custom configurations available

For more information, contact: info@hybricon.com **RSC# 21035 @ www.mil-embedded.com/rsc**

Omnetics Connector Corp.

7260 Commerce Circle E • Minneapolis, MN 55432
Tel: 763-572-0656 • Fax: 763-572-3925
www.omnetics.com

Omnetics Micro and Nano Miniature Connectors

Omnetics designs a full product line of centerlines from .025" to .050", including COTS and Bi-Lobe™, standard and custom single- and two-row connectors, along with circular and test configurations. Metal shells are available for added durability and more variety in mounting arrangements. Our Bi-Lobe connectors are compatible and intermatable with connectors built to MIL-32139 interface specifications.

These connectors feature the MIL-83513 Flex-Pin and are designed for use in mil/aerospace, avionics, and medical projects where high density and reliability are a must. Capabilities range from engineering, CAD, and prototyping, through high-volume production.

For more information, visit our website at www.Omnetics.com.

FEATURES:

- Centerlines from .025" to .05"; COTS and Bi-Lobe
- Standard and custom single- or two-row connectors
- Metal shells for durability
- Bi-Lobe connectors compatible with MIL-32139 interface
- MIL-83513 Flex-Pin design
- Use for mil/aerospace, avionics, and medical applications

For more information, contact: sales@omnetics.com **RSC# 30147 @ www.mil-embedded.com/rsc**

ALPHI TECHNOLOGY CORPORATION

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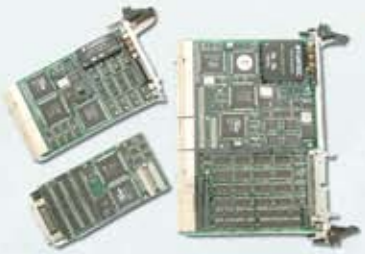

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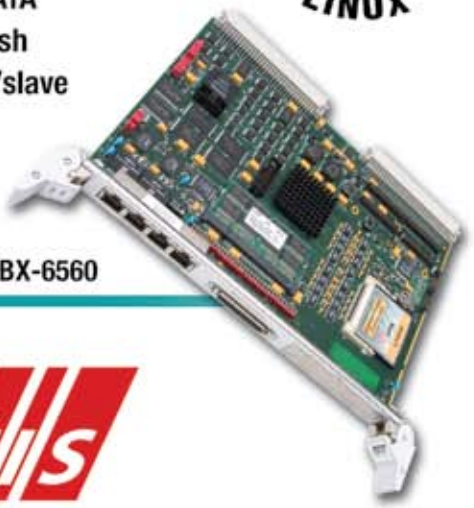

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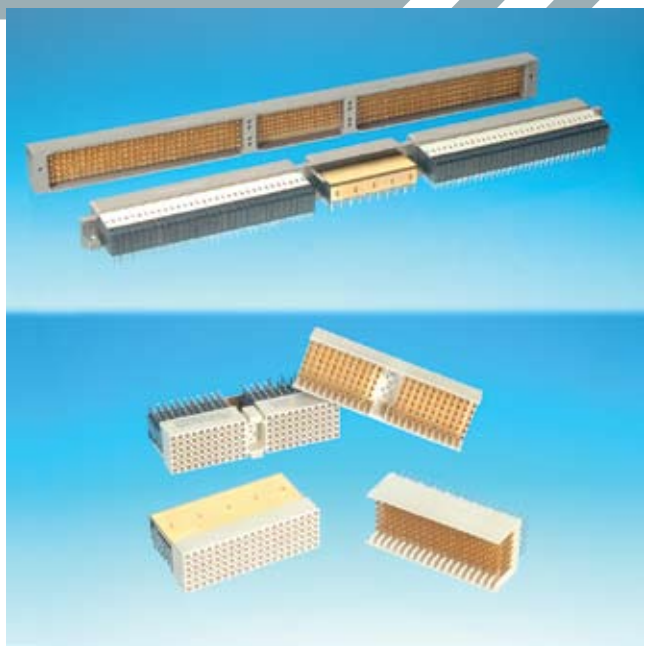
Hypertronics COTS



Robust 2 mm CompactPCI and ruggedized VME64x connectors overcome the challenges of harsh environments. The Hypertronics 2 mm connector system is based on the legendary Hypertac® contact, providing immunity to shock and vibration fretting. Tested to military standards, the Hypertronics 2 mm connector delivers high performance in a ruggedized CompactPCI format for mission-critical applications such as military land systems, shipboard, and aerospace. Configured on a 2 mm center-line with six rows, the Hypertronics 2 mm connector uses 0.4 mm Hypertac contacts that feature less than 8 milliohms of contact resistance and a current rating of 1.0 A. Hypertronics optimized contact lead traces provide superior performance in high-speed signal applications, and the connectors are compatible with standard reflow soldering processes.

The 2 mm connector is now available as a product family in both keyed and unkeyed configurations. Modular in design, the connector is variable in length and can be changed in increments of five contacts. Other benefits include: standard 2 mm footprint, keying to ensure correct mating, and a high-temperature LCP insulator that meets NASA outgassing requirements. The connectors are interchangeable with the board layout on COTS systems and are reverse gender to commercial 2 mm products. Adapters are also available to mate with COTS 2 mm connectors.

The Hypertronics ruggedized VME64x interconnect solution benefits from the same highly successful Hypertac contact technology as the 2 mm CompactPCI. Hypertac contact technology features a hyperboloid-shaped basket of individual spring wires that deliver the highest level of reliability. VME64x connectors are mechanically compliant with IEEE 1101.2-1992, supporting the premier embedded bus architecture. Aluminum frames provide ruggedness and conduction cooling, and keying features ensure proper mating.

Hypertronics offers both standard and customizable VME64x footprints. With the VME64x connectors, manufacturers with the most demanding applications are guaranteed a connector solution for situations in which the cost of failure is incalculable.

FEATURES:

- Immune to shock and vibration, which can cause fretting
- Standard 2 mm footprint
- Reverse gender to commercial 2 mm products
- Single shielding
- Variable in length and can be changed in increments of five contacts (one wafer) due to the modular wafer length
- Hypertronics optimized contact lead traces provide superior performance in high-speed signal applications
- Hypertac contacts with up to 100,000 mating cycles and low mating forces
- Mechanically compliant with IEEE 1101.2 -1992
- Keying feature guarantees proper mating
- Aluminum frames for ruggedness and conduction cooling
- COTS and custom applications
- Configure and download 3D connector models or 2D drawings for these products

For more information, contact: info@hypertronics.com **RSC# 30154 @ www.mil-embedded.com/rsc**

Carlo Gavazzi Computing Solutions

10 Mupac Drive • Brockton, MA 02301
Tel: 508-588-6110 • Fax: 508-588-0498
www.gavazzi-computing.com

714 ATR Chassis

The 714 Series is a line of ATR Chassis designed to meet the requirements of the ARINC 404A/MIL-STD-91403. During the design process of this chassis, thermal simulation was employed to optimize the size and location of the heat spreaders, which are responsible for conducting heat away from the chassis' power supply and board area. To bring these simulated results into the real world, these all-aluminum chassis utilize the dip brazing fabrication process, which completely seals the enclosure and aids in its natural convection to quickly conduct heat away from the boards and power supply. Up to 135 W can be expected from the power supply while the chassis is in a 50 ºC ambient environment. Custom backplane configurations are available.

FEATURES:

- Dimensions: 7.62" (H) x 12.52" (L) x 4.88" (W); 7.62" x 12.52" x 7.50"; 7.62" x 12.52" x 10.12"; 7.62" x 19.5" x 15.38"
- Operating temp.: -40 °C to +70 °C per MIL-STD-810E; designed for MIL-E-5400 for avionics equipment and Class B
- Input power: 28 Vdc per MIL-STD-704 and 115 AC 400 Hz (three-phase option)
- Vibration: 15-2,000 Hz at 0.1g /Hz (RMS~12g) per MIL-STD-810E method 514.4 Category 5; Shock: 20 *g* for 11 mS
- Weight (approx.): 1/2 size – 17 lbs, 3/4 size – 23 lbs, full size – 30 lbs, 1-1/2 size – 35 lbs
- Backplanes: Seven-slot – VME64, VME64X w/PO I/O, CompactPCI with/without H.110 5 V keys, left-justified system slot

For more information, contact: info@cg-cs.com **RSC# 21025 @ www.mil-embedded.com/rsc**

MILITARY EMBEDDED SYSTEMS Resource Guide 2006 Electronics packaging

Tracewell Systems Inc.

567 Enterprise Drive • Westerville, OH 43081
Tel: 800-848-4525 • Fax: 614-846-4450
www.tracewellsystems.com

T-Frame for VXS

Tracewell's T-Frame development platform is now available for high-speed serial VITA 41, VXS applications. This versatile system is a must for any hardware or software development. The hybrid eight-slot backplane includes four VXS payload slots, two VXS switch slots, and two conventional VME64x slots for added versatility.

The patented open design allows easy access to boards without using extender cards. Enhanced cooling supports boards up to 100 W. Power supplies provide 350 W or 700 W and can be plugged into either front or rear slots for improved access. Advanced monitoring displays output voltages, currents, and exhaust temperature.

FEATURES:

- Hybrid backplane supports both VME64x and VXS boards and is optimized for up to 3.125 Gbps per pair
- Dual-star design supports use of one or two switchboards, allowing testing of both payload ports
- High-pressure cooling supports up to 100 W per slot and provides separate cooling for boards and power supplies
- Voltage, current, and temperature monitoring with margin control for +5 V and +3.3 V outputs
- Plug-in power supplies support 350 W, N+1, or 700 W operation
- Other versions are also available for CompactPCI 2.0/2.16/2.20, VME64x, and VME

For more information, contact: sales@tracewell.com **RSC# 24222 @ www.mil-embedded.com/rsc**

AP Labs
10864 Thornmint Road • San Diego, CA 92127
Tel: 858-674-2850 • Fax: 858-674-2869
www.aplabs.com

AP Labs

FS-1280 Rackmount Enclosure

The AP Labs FS-1280 is a 9U ruggedized CompactPCI enclosure designed for 6U CompactPCI boards.

Highly serviceable and maintainable, this chassis provides easy access to front loading boards and utilizes a single 400 W plug-in style power supply. It has a removable peripheral carrier, and can accommodate up to four 5.75" removable drive carriers. The FS-1280 is designed to meet MIL-S-901D in an isolated rack, and MIL-STD-810 and MIL-STD-167 shock and vibration specifications for severe environments. Optionally, it can be upgraded to meet MIL-STD-108E for drip-proof requirements. Versatile and reliable, the AP Labs family of CompactPCI and VME enclosures are especially designed to meet the needs of embedded, development, testing, and military applications.

FEATURES:

- Front-load, rugged, hard-mount chassis single or dual 8-slot – 19" (W) x 15.75" (H) x 18" (D); weight 85 lbs
- 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 8-slot single backplane version
- Available with CompactPCI backplanes
- Front-to-rear airflow

For more information, contact: sales@aplabs.com **RSC# 30156 @ www.mil-embedded.com/rsc**

Rugged chassis MILITARY EMBEDDED SYSTEMS Resource Guide 2006

AP Labs
10864 Thornmint Road • San Diego, CA 92127
Tel: 858-674-2850 • Fax: 858-674-2869
www.aplabs.com

AP Labs

FS-1270 Rugged Rackmount Enclosure

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# 21094 @ www.mil-embedded.com/rsc**

Carlo Gavazzi Computing Solutions
10 Mupac Drive • Brockton, MA 02301
Tel: 508-588-6110 • Fax: 508-588-0498
www.gavazzi-computing.com

709 Rugged Chassis

The 709 Series of Rugged Chassis enclosures is designed to operate under a wide variety of environmental conditions. The rugged bolted enclosures meet MIL-167 for vibration and MIL-S-901 for shipboard shock, while the welded version meets MIL-STD-461 for emissions at the enclosure level along with MIL-810 shock and vibration. Red Black compartments for TEMPEST NSTISSAM operation are also available. This enclosure series also provides a wide variety of backplane options including CompactPCI, PICMG 2.16 fabric, along with VME, VME64x, VITA 41, and VITA 46 ranging from 10-20 slots. Both AC and DC input power is available for power supplies ranging from 250 to 1,200 watts. Optional system monitoring is available to monitor backplane voltage, intake/exhaust temperature, and fan speed.

FEATURES:

- Physical: 709 depth = 20.5" (520,7), height = 8U to 13U, width = 17" (431,8) w/o EIA ears
- System options: Redundant power supplies, hot-swap power supplies and backplanes, system and fan monitor
- Reliability: MTTR: PSU =.5 hrs, FAN = .25 hrs, B/P = 1 hr; MTBF: PSU = 100,000 hrs, FAN = 50,000 hrs, B/P = 1,000,000 hrs
- Environmental: Operating temperature of 0 °C to 50 °C, storage temperature of -20 °C to 85 °C, humidity-<95%, acoustical-<45dba typ nonconden
- Cooling: Triple 90 CFM fans, 12 Vdc brushless sealed ball bearing, current draw 500 mA/fan typ, 130 CFM available
- Structure: .125" (3175) 5052-H32 aluminum, clear chromate MIL-C-5541 CL3, outside surface, Fed. Std. 26307 Grey

For more information, contact: info@cg-cs.com **RSC# 30052 @ www.mil-embedded.com/rsc**

Geotest-Marvin Test Systems, Inc.
1770 Kettering • Irvine, CA 92614
Tel: 949-263-2222 • Fax: 949-263-1203
www.geotestinc.com

MTS-207 Ruggedized Field Test Set

The MTS-207 is a state-of-the-art portable PXI platform for field testing and data acquisition applications. Its architecture is based on the MTS-206 Maverick Field Test Set – the first PXI-based system to be qualified and certified by the United States Air Force for munitions testing. The MTS-207 combines the test capabilities of an I-Level test set in a compact, rugged, flight-line qualified enclosure.

The MTS-207 is ideal for use in harsh environmental conditions. Its modular 14-slot PXI chassis is secured via five shock absorbers to meet stringent shock and vibration requirements per MIL-STD-810. For added flexibility, the MTS-207 can be controlled by an optional integrated LCD display and touch screen.

FEATURES:

- Ultrarugged and portable PXI platform for field and flight-line applications
- Meets MIL-STD-810E requirements 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; Remote Control and Display Unit (RCDU)
- Optional heaters for extreme low-temperature operation and MIL-STD-461 compliance (EMI)

For more information, contact: sales@geotestinc.com **RSC# 21064 @ www.mil-embedded.com/rsc**

Tracewell Systems Inc.

567 Enterprise Drive • Westerville, OH 43081
Tel: 800-848-4525 • Fax: 614-846-4450
www.tracewellsystems.com

Tracewell Systems

S42 for VXS/VME64X

The S42 is an ultraperformance compute platform for rugged air and ground-mobile applications requiring small size and extreme low weight. At just 48 lbs with 4,500 W and 21-slots, the S42 incorporates "Light Rigid Core Enclosure Structure" using advanced laser weld manufacturing techniques to produce an exceptionally light and rigid platform capable of 30 Gs and MIL-STD-461 EMC. The MIL-STD-704 Tracewell-designed power system has up to five 900 W plugging power modules. Available VXS (VITA 41) backplane is optimized for speeds of 6.25+ Gbps. Cooling supports 200 W per slot at sea level at 50 °C; 85 °C at 10,000 feet. Ethernet-based monitoring manages low temperature startup to -40 °C and provides remote enable, plus power, cooling, and temperature status.

FEATURES:

- Rugged, ultra-low-weight platform is just 48 lbs using advanced, patent-pending LRCES technology
- Configurable 4,500 W power is MIL-STD-704 compatible and is available for DC and AC input requirements
- High-capacity cooling supports 200 W+/slot at sea level and 85 W+/slot at 10,000 feet
- EMI shielded per MIL-STD-461, shock and vibe per MIL-STD-810 and DO-160
- VXS (VITA 41) backplane option supports more than 6.25 Gbps; other backplane options for VME64X and CompactPCI
- Supports low-temperature startup down to -40 °C Ethernet-based power, cooling monitoring, and remote enable

For more information, contact: sales@tracewell.com **RSC# 25192 @ www.mil-embedded.com/rsc**

VPT, Inc.

11314 4th Avenue West, Suite 206 • Everett, WA 98204
Tel: 425-353-3010 • Fax: 425-353-4030
www.vpt-inc.com

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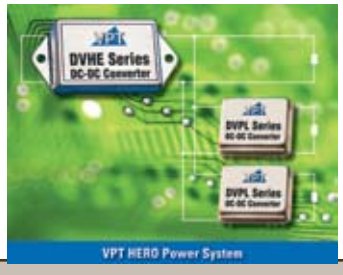

FEATURES:

- Power output of 1.5-200 W in single, dual, and triple output configurations
- 28 V and 270 V nominal inputs
- Small, lightweight, thick film hybrid converters in fully hermetic packaging plus potted COTS modules
- Radiation tolerant modules with available radiation hardening for space applications
- Full military temperature range of -55 °C to +125 °C; available compliance with MIL-PRF-38534 Classes H/K
- Three environmental screening grades to fit any high reliability application

For more information, contact: vptsales@vpt-inc.com **RSC# 30148 @ www.mil-embedded.com/rsc**

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www.tri-m.com

HPS3512

The HPS3512 is a high-power, high-performance, DC-to-DC converter that supplies +3.3/5/12 V outputs. The HPS3512 also includes a flash-based microcontroller that supplies advanced power management and an RS-232 serial port. The HPS3512 is designed for low-noise embedded computer systems, has a wide input range of 6-40 V (>6:1), and is ideal for battery or unregulated input applications. The HPS3512 is specifically designed for vehicular applications and has heavy-duty transient suppressors (up to 18000W1) that clamp the input voltage to safe levels while maintaining normal power supply operation.

The HPS3512 is a state-of-the-art, Mosfet-based design that provides outstanding line and load regulation with efficiencies up to 95 percent. Organic Semiconductor Capacitors (OSC-CON) and Polymerized Organic Semiconductor Capacitors (POSCAP) provide filtering that reduces ripple noise below 20 mV. The low-noise design makes the HPS3512 ideal for use aboard aircraft or military applications or wherever EMI or RFI must be minimized. Constant frequency architecture controllers provide excellent line and load transient response on the +5 Vdc and +12 Vdc outputs.

The HPS3512 has advanced power management functions that enable timed on/off control, notification of changes to main power, and secondary power status. For example, the HPS3512 can be programmed to power-off the outputs in 60 seconds and then turn on again 12 hours later.

The HPS3512 size is 3.55" x 3.775", which is the same size as the PC/104 standard, and has the same mounting holes pattern as the PC/104 standard. However, the HPS3512 does not include the PC/104 bus connectors. All generated voltages are provided to a removable header. A removable plug allows the HPS3512 to be easily installed. The RS-232 serial port is provided on a 2 x 5-row pin header.

FEATURES:

- Total power: 168 W with ATX interface
- +3.3/5/12 V outputs
- 6-40 V DC input range
- PC/104-size mounting holes
- Built-in temperature sensor
- RS-232 serial port
- Opto-coupled inputs

For more information, contact: info@tri-m.com **RSC# 30028 @ www.mil-embedded.com/rsc**

VPT, Inc.

11314 4th Avenue West, Suite 206 • Everett, WA 98204
Tel: 425-353-3010 • Fax: 425-353-4030
www.vpt-inc.com

Power Design

VPT offers fast, affordable design and assembly of your avionics, military, and space power systems. As a global leader in high reliability DC-DC power conversion, VPT combines experienced power system design with military quality standards in designing and delivering your custom power system.

VPT begins with a foundation of proven, off-the-shelf, hi-rel power modules and builds on them with additional technology using advanced design techniques. This approach enables VPT to design fast and cost effective solutions specifically suited to your power needs.

Power your critical mission today with custom power system design from VPT.

FEATURES:

- Power system design and assembly
- Expert, experienced designers
- Extensive portfolio of technical capabilities
- Exclusive focus on avionics, military, and space systems
- Proven, documented design process in class 100 K facilities
- Top flight quality system adhering to standards controlled by MIL-PRF-38534 and ISO 9001:2000

For more information, contact: vptsales@vpt-inc.com **RSC# 30157 @ www.mil-embedded.com/rsc**

Thales Computers

Av Berthelot - ZI Toulon • TOULON cedex 9, 83078 France
Tel: 33-4-98-16-33-95 • Fax: 33-4-98-16-34-01
www.thalescomputers.com

PowerMP6

PowerMP6 consists of multiple Pentium M boards in a 19" rack. Linux on Intel Pentium M processors supports software productivity and portability through an extensive set of open source and commercial tools and libraries. The level of performance is scalable by selecting the number of processors – up to eight boards in a 19" 10U rack.

Each processor has an independent GbE interface for application I/O purposes. An optional Fibre Channel loop or RapidIO interconnect switch fabric can be provided for high-speed communications with minimal CPU load (*zero copy* communications).

All processors are connected through a backplane GbE network. PowerMP6 is delivered ready-to-use with all software pre-installed.

FEATURES:

- Outstanding computing performance
- Enhanced software productivity
- Turnkey system with pre-installed software

For more information, contact: lto@thalescomputers.fr **RSC# 30139 @ www.mil-embedded.com/rsc**

Eurotech
Via Jacopo Linussio 1 • Amaro, Italy
Tel: 39-0433-485411 • Fax: 39-0433-485499
www.eurotech.com

Rugged DVR

Eurotech is one of the leading researchers in the field of high-performance embedded solutions and has been developing cutting-edge solutions since 1992.

Eurotech has recently developed the rugged Digital Video Recorder (DVR), a compact and low-power system for video capture applications. The system integrates all the functionality you would expect from a DVR. It has the ability to acquire and store up to eight channels of high-resolution video (PAL, NTSC, or SECAM) and store the information on the integrated data storage module. It also allows the user to transmit the data over long distances using the fully integrated wireless connections, which include GPRS, UMTS, WiFi 802.11.X, and Bluetooth.

Captured video data is stored into the integrated storage module as a compressed, high-quality file that can be accessed at a later date as required. From this point, the user has the option to analyze the data onboard or transmit it using the wireless connections. Files can be sent partially or as a complete block, whichever best suits the user's requirements. In any case, only a few kilobytes contain all the necessary information to rebuild the original images when received. The quantity can be dynamically adjusted depending on bandwidth availability or the required final image quality. In this way, the use of the broadcast bandwidth can be utilized flexibly to achieve optimal results, minimizing the loss of information and image corruption.

The DVR is also provided with a new integrated intelligence called *Guardian* that allows the user to monitor the operating parameters, such as temperature and internal voltages, and manage the command execution logic even if the system is in standby mode.

The system is designed for harsh environmental conditions and is EN50155-compliant. It can withstand high humidity and extreme temperatures ranging from -25 °C to +55 °C with 70 °C over-temperature for 10 minutes without fan assistance. The system is also resistant to shocks and vibrations.

Available configurations can include MPEG4 or JPEG-2000 compression, Gigabit and Fast Ethernet controllers, and USB 2.0 ports.

FEATURES:

- Advanced Audio/Video capture and compression functionalities; advanced autodiagnosis features
- Remote status monitoring with pre-alarm features; extended temperature range from -25 °C to +55 °C (70 °C over-temperature for 10 min.), fanless system
- Rugged chassis design; EN 50155, CE, and ECE Regulation 10.02 compliance; protection IP65
- Power consumption: 15 W (min), 29 W (max); weight: 1.5 kg (min), 3 kg (max) configuration dependent
- Isolated digital I/O; VGA analog video out; audio
- Solid state disk for OS and application software; hard disk for data storage (external, removable, or internal fixed); Wi-Fi
- Audio/Video acquisition and compression availability – Up to eight MPEG4 video encoder channels (NTSC, PAL, or SECAM) – Up to eight JPEG-2000 video encoder channels
- Up to eight frame grabber video IN – Processor availability: 5x86 133 MHz, Celeron 400 MHz
- Memory: 64 MB up to 256 MB SDRAM soldered onboard; solid state disk: Disk-On-Module
- Communication: Gigabit and Fast Ethernet controllers, USB 1.1, high-speed USB 2.0, GSM/GPRS (UMTS), 2.4 GHz high-speed wireless, serial ports
- Operating system support: WinXPE, WinCE, LINUX, QNX

For more information, contact: sales@eurotech.com **RSC# 30049 @ www.mil-embedded.com/rsc**

CePOINT Networks, LLC
1 W Otterson Street • Nashua, NH
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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, 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

Creative Electronic Systems
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www.ces.ch

CES Mission Computer Family

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

For example, the small form factor, five-slot ARINC 600 fits CES conduction-cooled VME or PMC boards to create virtually any mission computer version. The construction allows instant access to the complete payload with a less than five-minute exchange to all boards. This chassis has been designed to be part of the CES generic mission computer product line. In this context, it houses two COTS connectors on the backplane, PCI and VME, for parallel processing.

Typical boards used in these computers are:

- RIO3 8066/RIO4 8076 – VME Processor Boards
- RIOC 4070/RIOS 2476 – CompactPCI Processor Boards
- PEB 6426 – PMC Extension Board
- MFCC 8446/MFCC 8449 – Multifunction Computing Core PrPMCs
- GPIO 8406/GPIO 8436 – User-Programmable I/O PMCs
- AFDX 8464 – AFDX® PMC
- MIL-5364 – MIL-STD-1553B PMC
- ARINC 8429 – ARINC 429 PMC
- CAN 8428 – CANbus PMC
- DSIO 8300 – Discrete Interface
- ANIO 8301 – Analog Interface

FEATURES:

- Ruggedized air-cooled or conduction-cooled versions
- From one to five slots for 6U or 3U boards
- Hosts single or multiprocessor versions of the latest generation of CES real-time computers
- Any combination of AFDX, MIL-STD-1553B, ARINC 429, CANbus, discrete, or analog avionic interfaces
- Unique CES bandwidth control and data distribution logic
- Advanced system monitoring unit
- Complete software packages including BSPs, drivers, and APIs under LynxOS, VxWorks, and Integrity
- Complete certifiable packages for DO-178B up to Level A
- For full information, contact ces@ces.ch or 41-22-884-51-00

For more information, contact: ces@ces.ch **RSC# 30050 @ www.mil-embedded.com/rsc**

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www.inova-computers.de/icpesyscexp.php

ICPe-SYSC-EXP

Complete 3U and 4U *CompactPCI Express* systems and components make their debut for high-end rugged applications in industrial environments.

The **GoldNugget** is a 3U, 44 HP system complete with a 2 GHz, actively cooled Pentium M or conduction-cooled ULV Celeron M CPU board, five free 32-bit CompactPCI slots (of which three are "hybrid" and can be used for dedicated Express I/O boards), 100 W AC/DC PSU and translation board (CompactPCI Express to CompactPCI) with independent Gigabit Ethernet, provision for an onboard Serial ATA hard disk and/or rear I/O based SATA RAID solutions.

For high-end industrial applications, a full-size, 84HP, 4U **GoldRush** enclosure is available with provision for either an ATX power supply or standard Inova 100 W CompactPCI Express PSU. The **GoldRush** enclosure may be open (ventilation holes) to allow the free passage of air, or closed, but still benefit from the airflow supplied by the supervised underslung removable fan tray unit.

The newly developed **GoldMine** CompactPCI Express CPUs for use in these systems are based on the i915 chipset and address up to 2 GB of 533 MHz DDR2 RAM. These CPUs provide legacy I/O support, USB 2.0, Gigabit Ethernet, graphic translation (LVDS, SDVO), and Serial ATA or conventional EIDE mass storage interfacing. For true rugged deployment, application code and OS can be neatly accommodated in either µDOC Flash, conventional CompactFlash, or the latest 1.8" hard disk medium.

Integrated into the BIOS Flash is a µLinux kernel for total cost-of-ownership reduction (OS license), remote diagnostic and field servicing, rapid boot, and for robust applications where rotating parts cannot be tolerated.

An implementation of the Intelligent Platform Management Interface (IPMI) enables the boards to monitor, log, and control many of the CPU's functions for fast pre-boot diagnostics, OS self-repair, and life-time forecasting in harsh industrial environments.

Complete with the ULV Celeron M CPU, the **GoldNugget** system is available for rugged applications starting at $2,990 for OEM volume.

FEATURES:

- **First complete 3U/4U CompactPCI Express system**
  - 100 W CompactPCI Express 115 V/230 V AC/DC PSU
  - Optional ATX power supply
  - 6-slot CompactPCI Express backplane with legacy support
  - Translation board with Gigabit Ethernet and HD interface
  - Windows XP Embedded
  - MTBF > 200,000 hours
  - 0 °C to +60 °C operational temperature
  - Conforms to EN50155 (DC PSU)
- **1 GHz ULV Celeron M/ 2.0 GHz Pentium M CPU**
  - Intel 915GM chipset with DirectX 9 H/W support
  - Up to 2 GB 533 MHz DDR2 RAM
  - VGA/DVI/TFT supported video formats
  - Up to 2048 x 1536 pixel video resolution
  - Up to two independent Gigabit interfaces
  - Up to eight USB 2.0 interfaces
  - CPU extension with HD, COM, and PS-2 interfaces
  - Single-slot, inline Serial ATA interface
  - µDOC technology or CompactFlash
  - µController for system management
  - Intelligent rear I/O

  The conduction-cooled 1 GHz Celeron version is just 4HP wide and is suited to applications in harsh environments or extremes of temperature.

Quantum3D, Inc.
6330 San Ignacio Avenue • San Jose, CA
Tel: 407-737-8800 Ext. 100 • Fax: 408-361-9980
www.quantum3d.com

Thermite® COTS PC

The Quantum3D Thermite Tactical Visual Computer (TVC) is a multirole, real-time 2D/3D COTS PC specifically designed for wearable and vehicle-based graphics/video-intensive deployed C4ISR, mission planning and rehearsal, embedded training, UAV/UGV and weapon system control, 2D/3D/augmented reality-based field maintenance, and video surveillance applications in extended environments. By combining state-of-the-art embedded computing, mobile graphics, extended environment packaging, and conduction-cooling technologies with support for open-architecture operating systems, Thermite brings the power of PC-based workstations to the field.

For advanced visual computing applications, Thermite includes an Intel Pentium M embedded CPU with up to 2 GB of DDR system memory and an advanced discrete or integrated mobile graphics/video module with up to 128 MB DDR2 shared or dedicated frame buffer memory. It also includes support for dual, independent analog and digital outputs with 32-bit (RGBA) color and Z-buffering, stereo graphics sync, and analog resolution support up to 2048 x 1536. Thermite also supports simultaneous video-out in RS-170/A, NTSC, PAL, and S-Video formats and accelerated direct video-capture capabilities with color space conversion, scaling, and overlays for NTSC, PAL, S-Video, and RS-170/A formats for sensor and camera video capture and display applications such as sensor fusion. Through a rich suite of standard PC and government/military I/O options, Thermite provides essential connectivity for mission-critical battlefield and first responder applications.

For optimal power efficiency, Thermite features Quantum3D's advanced power saving technologies, which combine clock throttling with discrete power-down of portions of the system not in use, providing a longer operating envelope for field applications where extended battery life is essential. With comprehensive support for Windows and Linux operating systems, Thermite is ideal for enabling the rapid migration of C4ISR, vetronics, weapon systems control, UAV/UGV control, and other applications that require 100 percent PC compatibility.

FEATURES:

- Small (4.5" x 6.8" x 3"), light (2.5 lbs), ruggedized COTS PC, ideal for wearable and vehicle-based 2D/3D/video-intensive deployed applications
- 100 percent PC compatible: Intel Pentium M 1.0 or 1.4 GHz CPU and up to 2 GB system memory; Microsoft Windows XP, XP Embedded, BlueCat, and Redhat
- Sealed alloy enclosure with MIL-SPEC connectors, conduction cooling, power efficient design for long battery life/continuous use in hostile environments
- Advanced discrete or integrated mobile GPU/video module with up to 128 MB DDR2 shared or dedicated frame buffer memory
- Microsoft DX9 and OpenGL® 2.0 graphics API support
- Designed to meet MIL-STD-810F and MIL-STD-461E environmental requirements; available with a range of solid-state or shock resistant extended temperature rotating media drive options
- Vehicle DC power and hot-swappable battery support; compatible with BA5590 and BA2590 batteries and Li-Ion, Li-Polymer, and Li-Cobalt rechargeable smart batteries
- Accelerated real-time video capture capability for sensor and/or camera input with color space conversion, scaling, and overlays (S-Video, RS-170/A, NTSC, or PAL)
- Single or dual RGB QXGA and simultaneous NTSC, PAL, RS-170/A, or S-Video output configurations
- Comprehensive I/O capabilities: IEEE 802.3 Ethernet 10/100 Mbps, USB 2.0; IEEE 802.11X, IEEE 1394 Firewire, and a range of factory options
- Factory installed options include GPS, Secure Radio, MIL-STD-1553B, and GbE; consult factory for additional options

L-3 Communications Advanced Products & Design

10636 Scripps Summit Court • San Diego, CA 92131
Tel: 858-527-6100 • Fax: 858-527-0150
www.L-3Com.com/apd

Vigra Book

Vigra Book is a *ready to go* mobile video system that saves integrators the time and expense of researching, integrating, and testing different technologies to support video capture, processing, and display. It can be easily integrated into larger applications supporting the military's transformation into a lighter, more mobile and network-centric force. We've integrated our proven VigraWATCH video and image processing board into a powerful 64-bit Solaris/SPARC notebook, to create a system capable of real-time video capture, processing, MPEG-2 compression/decompression and display.

The SPARC notebook is a powerful tactical computer designed to support various military Sun SPARC-based platforms and applications. OEMs and integrators can add their own applications.

FEATURES:

- Real-time video and image processing
- Simultaneous MPEG-2 compression/decompression
- Capture and display; mobile SPARC/Solaris computer
- Live video in a graphics display
- OEMs and integrators can add their own applications, such as image communications and fire control, to Vigra Book to meet their customers' specific requirements

For more information, contact: apd-info@L-3Com.com RSC# 30202 @ www.mil-embedded.com/rsc

SBS Technologies, Inc.
7401 Snaproll N.E. • Albuquerque, NM
Tel: 505-875-0600 • Fax: 505-875-0400
www.sbs.com

ROC Vehicle CPU

The SBS Technologies Rugged Operation Computer (ROC) defines a new standard for deployable, compact vehicle computers.

The lightweight, ruggedized ROC vehicle computer is a powerful and compact computing system based on PCI Mezzanine Cards (PMCs). Weighing less than six pounds and displacing less than 100 cubic inches, the ROC measures 3.5" (H) x 4.2" (D) x 6.8" (W) and fits well into the tight spaces usually found in military vehicle applications.

ROC systems are designed to operate in extreme temperature, shock, and vibration environments. They include an integrated EMI filter and power supply with power sensing circuitry.

Featuring PowerPC or Intel Pentium processors and a wide range of I/O options, ROC systems are perfect for avionics or vehicle management applications where size and weight are critical.

SBS supports many embedded operating systems such as VxWorks, INTEGRITY, Microsoft Windows XP, and Linux.

Thanks to the capabilities of the latest Processor PMCs , ROC systems are very small but can still provide enough processing power to run the most demanding vehicular applications. Because they are COTS-based systems, they enable a great deal of I/O flexibility. The result is amazing power right in the palm of your hands.

Originally developed for airborne avionics, the ROC concept has expanded to include ground combat vehicle and personnel applications where rock-solid performance, reliability, flexibility, physical robustness, weight, power, and space are all critical considerations. Since program requirements are often diverse, we offer the ROC in multiple configurations to address that diversity. Each configuration addresses common requirements typically seen in flight and mission management, data acquisition processing and storage, situational awareness, and reconnaissance.

FEATURES:

- Lightweight (5.75 lbs) rugged computer fits in the palm of your hand
- Versatile system architecture based on standard PMC modules
- Designed for extended temperature, harsh vibration, shock, and EMI environments
- Pentium M configurations up to 1.1 GHz and PPC configurations to 450 MHz
- Up to five conduction-cooled PMC cards (excluding power supply)
- Optional solid-state flash disk up to 128 Gb
- Up to three system stackable, dual PMC carriers
- Inputs and outputs – Eight high-speed serial channels; digital and analog I/O
- Materials and finish – Conduction-cooled milled aluminum 6061-T651; black anodized external finish; chem film interior finish
- Hardware – Rugged LEMO push-pull connectors; airborne stacking (RC4) connectors for carrier interconnect; no internal wiring harness

SBS Technologies, Inc.
7401 Snaproll N.E. • Albuquerque, NM 87109
Tel: 505-875-0600 • Fax: 505-875-0400
www.sbs.com

SBS Rugged Systems – Designed to thrive in harsh environments

Ruggedized systems from SBS Technologies include advanced vehicle computers, rugged chassis, and rugged electronic boards and components for use in military and space systems. Our advanced computing platforms are designed to meet the challenges of extreme temperatures, shock, vibration, EMI, and G-forces.

SBS Rugged Systems provide robust, yet highly flexible COTS computing platforms suited for a wide variety of avionic, vetronic, and navtronic applications where complete reliability and immunity to extreme environmental conditions are required.

Featuring ruggedized computing platforms in VME and CompactPCI formats, SBS systems are available in dozens of standardized configurations. These systems include ruggedized chassis with integrated processor, I/O, and signal processing subsystems, as well as expansion slots and rugged power supplies.

SBS also provides custom integration to quickly create a custom design based on our extensive product portfolio. A custom design might involve minor adjustments to standard systems and boards, or it could include customized interfaces, platforms, and configurations. We also offer development support and advance prototypes.

SBS ruggedized systems are based upon VME and CompactPCI backplanes.

AVC-3000 Series
Our AVC-CPCI-3000 Series systems are based around one to three CompactPCI 3U form factor single board computers and I/O boards. They feature casings that are both strong and lightweight. At their core, a robust COTS power supply and ruggedized single board computer integrate with other CompactPCI modules to deliver reliable, cost-effective performance.

AVC-6000 Series
Our AVC-6000 Series systems are based upon VME and CompactPCI 6U form factor single board computers and I/O boards. They feature rugged casings that are both strong and lightweight and are based upon ruggedized single board computers and I/O boards.

FEATURES:

- AVC-CPCI-3000 Series Advanced Vehicle Computers are based upon CompactPCI 3U systems:
  - 3-14 CompactPCI 3U slots
  - 65-300 W rugged power supply
  - PPC or Intel-based SBC(s)
  - Flexible I/O options
- The AVC-CPCI-6001 Advanced Vehicle Computer is based upon a CompactPCI 6U system:
  - Eight CompactPCI 6U slots
  - 450 W rugged power supply
  - PowerPC-based SBC
  - Flexible I/O options
- AVC-VME-6000 Series Advanced Vehicle Computers are based upon VME 6U systems:
  - Five VME 6U slots
  - 150-300 W rugged power supply
  - PPC or Intel-based SBC(s)
  - Flexible I/O options

For more information, contact: info@sbs.com **RSC# 30153 @ www.mil-embedded.com/rsc**

ACP

4080 McGinnis Ferry Road, #801 • Alpharetta, GA 30005
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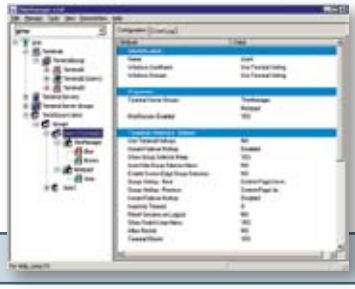
www.thinmanager.com

TermSecure



ACP's TermSecure radically advances Microsoft terminal server security. It completely insulates thin clients from the servers so only legitimate users are allowed on the system. Users must have proper authentication and be located at a valid thin client to even have access to the network.

Only TermSecure can offer this level of security because it controls terminal servers, thin client hardware, and Windows operating systems. The TermSecure user doesn't even know a Windows username and password.

TermSecure users log in by typing a TermSecure username and password or by using an RFID tag, card swipe, or USB key. Combine a hardware key with password and even if the user's key falls into the wrong hands, network security won't be compromised.

FEATURES:

- Drastically enhances security of Microsoft terminal server and thin clients
- Completely insulates users from the terminal server network until they are authenticated
- Allows manual login, automatic hardware validation and login, or combination of both
- Prohibits users from even knowing a Windows username and password
- Brings supervisor's terminal server desktop and sessions to any thin client when they log in
- Allows one thin client to control multiple sessions on multiple terminal servers

For more information, contact: dhancock@thinmanager.com **RSC# 30040 @ www.mil-embedded.com/rsc**

Ardence, Inc.

266 2nd Avenue • Waltham, MA 02451
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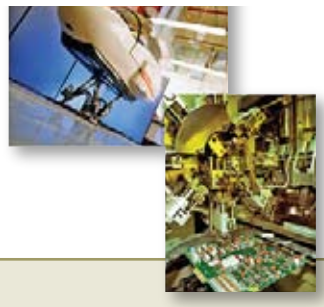
www.Ardence.com/Embedded/RTX.htm

Ardence RTX Kernel



By operating in kernel mode (Ring 0), RTX is the highest performing real-time extension for Windows XP Pro, XP Embedded, 2000, Server 2000, and Server 2003. It is the only solution to support multiprocessor, multicore, and mobile platforms. RTX reduces system costs and speeds time to market by leveraging Microsoft's comprehensive set of debugging tools.

RTX is proven in thousands of demanding applications providing enhanced performance, control, and scalability, combined with unmatched dependability for: industrial automation, military/aerospace, test and measurement, equipment, robotics, and many other industries.

For more information: Contact Jeff Abbott, 781-693-6278 or jabbott@ardence.com.

FEATURES:

- Intuitive development tool that easily integrates into standard Windows IDE
- Worst-case interrupt latencies in single-digit microseconds: Sustained interrupt rates of 30 kHz
- Complete IA32 support: Pentium, Pentium II, III, 4, Multicore, M, Xenon, and AMD CPUs
- Support for all standard Microsoft HALs, including ACPI-compliant PIC, uniprocessor and multiprocessor APIC
- Integrates with Microsoft Visual Studio Debugger
- WinSock-compliant TCP/IP stack: Independent of Windows

For more information, contact: info@ardence.com **RSC# 21082 @ www.mil-embedded.com/rsc**

Objective Interface Systems

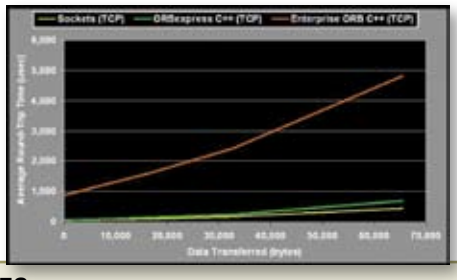
13873 Park Center Road, Suite 360 • Herndon, VA 20171
Tel: 703-295-6500 • Fax: 703-295-6501
www.ois.com

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 700 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, Inc.

266 2nd Avenue • Waltham, MA 02451
Tel: 781-693-6278 • Fax: 781-647-3999
www.Ardence.com/Embedded/ReadyOn.htm

Ardence ReadyOn

The enhanced end-user experience of instant-on/off functionality and secure, corruption-proof reliability in devices using Windows OS provides OEMs with clear advantages. ReadyOn-enabled devices bypass driver loads, OS boot, network configuration, and application loading time by accessing a preconfigured *environment* – bringing the device to full operability in seconds. Because the preconfigured environment is hardened, viruses cannot permanently install into a ReadyOn-enabled system. Any problem is fixed by simply powering off the device and turning it back on. ReadyOn has been deployed in 2,000,000 systems, with manufacturers such as NEC and Fujitsu, and is ideally suited for consumer electronics, medical devices, automation, portable systems, and testing.

FEATURES:

- Protects key partitions while leaving writeable partitions for saving data, including use with removable storage
- Robust, high-performance Windows instant-on and off: Boot time is virtually eliminated
- Microsoft Windows Support: Windows XP Pro, XP Embedded, Server 2003, including all current service packs
- Integrated appliance environment: OEM can implement multipurpose functionality on a single system
- *Ghosting* support: Simplifies manufacturing; speeds time to market
- Comprehensive GUI-based configuration and management: Intuitive interface results in reduced time to configure

For more information, contact: info@ardence.com **RSC# 16000 @ www.mil-embedded.com/rsc**

Synplicity, Inc.
600 W. California Avenue • Sunnyvale, CA
Tel: 408-215-6000 • Fax: 408-222-0268
www.synplicity.com

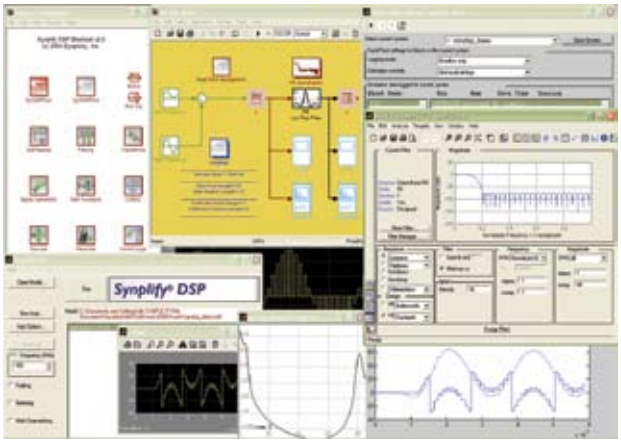
Synplicity®
Simply Better Results

Technology-Independent DSP Synthesis from Simulink® to FPGA

DSP designers are increasingly targeting FPGAs for implementation of their high-performance DSP designs. FPGAs can achieve an order of magnitude performance boost over standard DSP chips through efficient and parallel implementation of DSP functions. Until now, there has been no good way to get a design specified at the algorithm level from tools such as Simulink by The MathWorks, into high-quality RTL code.

Synplify® DSP software is a true DSP synthesis solution and the only one that performs high-level DSP optimizations from a Simulink specification. These special DSP optimizations allow designers to capture the behavior needed for their DSP algorithm without worrying about the specific implementation in hardware. The Synplify DSP solution automatically produces a highly optimized, technology-independent implementation of the design ready for RTL synthesis into your choice of FPGA device.

For more information about Synplicity's Synplify DSP solution, visit our website at http://www.synplicity.com/products/synplifydsp/index.html or e-mail info@synplicity.com.



FEATURES:

- Fully integrated fixed-point blockset of common DSP functions useful for many DSP applications such as Software-Defined Radio
- User-extensible DSP IP library for custom functions
- DSP synthesis toolbox for optimizing both performance and area (cost) using unique system-level retiming and folding technology
- Access to the full range of algorithm development and analysis tools within Simulink
- Waveform portability for quickly targeting your choice of FPGA hardware from a single Simulink design
- Floating-point to fixed-point conversion and analysis
- Synthesizable RTL code and test-bench automatically created from a Simulink specification

For more information, contact: info@synplicity.com **RSC# 21109 @ www.mil-embedded.com/rsc**

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Radiation Hardened (RadHard) and Radiation Tolerant FPGAs offer significant advantages for commercial and military applications such as satellites, space probes, guidance, and all types of military and high-reliability equipment. These types of applications must consider the effect of radiation on electronic components. Single Event Upsets (SEUs) can change the logic state of static memory elements – such as flip-flops, latches, and RAM – causing incorrect functionality in a device. Synplicity has built several features into its synthesis products to help create SEU-resistant, high-quality devices.

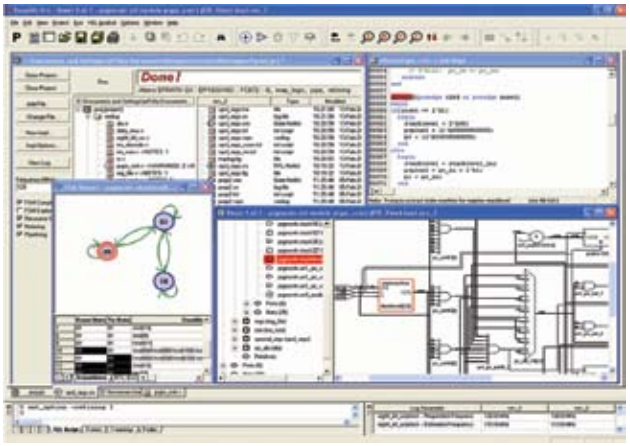
TMR for Actel devices – Synplicity's long-standing partnership with Actel has enabled support for the Triple Module Redundancy (TMR) method of managing SEUs. Combinatorial Cells (CC) with feedback are used instead of flip-flops or latches. TMR implements each register using three flip-flops, or latches, and a *vote* is performed to determine the register's state.

Safe-state machine encoding – This feature allows the designer to specify an encoding attribute that tells the tool to perform reliability analysis to determine all the states that could possibly be reached, then optimize away all states and transition logic that cannot be reached, producing a highly reliable implementation of the state machine.

Retiming – By selecting a switch, designers can tell the tool to automatically move registers inside combinatorial logic to balance timing delay and improve circuit performance by as much as 20 percent.

Support for formal verification tools – This feature allows the designer to prove functional correctness of the design using popular logical equivalency checking tools such as the Encounter Conformal product from Cadence and eCheck from Prover.

For more information about Synplicity's high-performance FPGA, DSP, structured/platform ASIC, cell-based ASIC, and prototyping solutions, visit www.synplicity.com/products.



FEATURES:

- Multipoint synthesis: Provides superior methodology for incremental design
- Interactive timing analysis: Enables point-to-point timing analysis without retiming
- Formal verification mode: Compatible with popular formal verification tools
- Proprietary BEST algorithms: Globally optimized designs in a fraction of the time required by traditional synthesis tools
- Lightning-fast compile times: Synthesizes even the largest design in minutes
- TMR and safe-state machines: Triple Module Redundancy and safe FSM for high-reliability applications
- SCOPE multilevel design constraints: Provides designer with complete control over the synthesis process
- Comprehensive language support: Supports Verilog, VHDL, and mixed language designs
- Automatic RAM inferencing: Bypasses tedious hand instantiation of RAM
- Third-party tool integration: Cross-probing with popular simulators and design entry tools
- FSM Explorer: Automatically finds and selects the best coding style option for the fastest performance
- Automatic retiming: Moves registers automatically within combinatorial logic to balance delay and improve performance

LynuxWorks, Inc.
855 Embedded Way • San Jose, CA
Tel: 800-255-5969 • Fax: 408-979-3920
www.lynuxworks.com

LynxSecure®

The LynxSecure separation kernel meets the needs for the highest level of embedded software security. LynxSecure uses the space and time partitioning features of LynxOS-178® safety-critical RTOS to provide the foundation for building highly secure systems utilizing Multiple Independent Levels of Security (MILS) architecture and is designed for certification to Common Criteria EAL-7 as well as DO-178B Level A. LynxSecure supports software reuse by enabling BlueCat® Linux and LynxOS-178 to run in user mode within LynxSecure partitions. LynxSecure provides a scalable solution ranging from embedded systems to workstations and servers that can be applied to applications in embedded avionics products, weapons systems, C4ISR data systems, as well as critical infrastructure control systems.

FEATURES:

- MILS architecture conformance for building secure systems
- Optimal security and safety – the only operating system to support CC EAL-7 and DO-178B Level A
- Real time – time-space partitioned RTOS for superior determinism and performance
- Virtualization technology – supports multiple heterogeneous operating system environments on the same physical hardware
- Highly scalable – supports Symmetric MultiProcessing (SMP) and 64-bit addressing for high-end scalability
- Supports 100 percent binary compatibility for Linux or POSIX-based software application to migrate to a highly robust, secure environment

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

Ardence, Inc.
266 2nd Avenue • Waltham, MA 02451
Tel: 800-334-8649 • Fax: 781-647-3999
www.Ardence.com/Embedded/ETS.htm

Phar Lap ETS

The Phar Lap ETS Real-Time Operating System (RTOS) provides system designers with the most reliable, highest performing, and easy-to-deploy hard real-time development environment. Based on x86 architectures, ETS offers a comprehensive suite of tools that smoothly integrates into the well-known Microsoft Visual Studio IDE – minimizing development and debugging time.

With support for all standard BIOS implementations and the industry's smallest operational footprint, the Win32 API-compliant Phar Lap ETS RTOS enables developers to install, configure, and start developing within two to four hours. ETS has proven itself in thousands of demanding environments, such as multimedia streaming solutions, ocean vessel location systems, submicron scanning systems, and RFID products.

FEATURES:

- Real-time file system: High-speed media access with FAT16 and FAT32 support
- Fully Win32 compliant: No need to use code wrappers for API mapping
- Complete IA32 x86 support: 386, 486, Pentium I, II, III, 4, Multicore, M, Xenon, as well as AMD CPUs
- Smallest operational footprint: < 500 kB with I/O graphics and TCP/IP
- Support for all standard BIOS implementations: Support includes ACPI-compliant PIC and uniprocessor APIC
- Integrated WinSock-compliant real-time TCP/IP stack: Fully Windows independent

For more information, contact: info@ardence.com **RSC# 24196 @ www.mil-embedded.com/rsc**

LynuxWorks, Inc.
855 Embedded Way • San Jose, CA
Tel: 800-255-5969 • Fax: 408-979-3920
www.lynuxworks.com

LynxOS-178

LynxOS-178 is the first DO-178B and EUROCAE/ED-12B certifiable, POSIX-compatible, RTOS solution. The COTS package includes the most robust feature set of any DO-178B level A certifiable RTOS kernel available. LynxOS-178 serves as foundation software for numerous DO-178B-certified deployments, including multiple mil/aero systems certified to DO-178B, up to and including level A. LynxOS-178 provides previously certified software and artifacts in order to fully satisfy, right out of the box, the DO-178B level A requirement. LynxOS-178 is the first hard RTOS certifiable to DO-178B level A while offering the interoperability benefits of POSIX and support for the ARINC 653 APplication EXecutive (APEX). LynxOS-178 is the first and only operating system to receive FAA Reusable Software Component (RSC) Acceptance for safety-critical software.

FEATURES:

- Low risk – known DO-178B level A certifiable RTOS package at a known cost
- Reduced costs – eliminates many years of effort and significantly lowers overall cost of certification
- POSIX conformance – the only DO-178B certifiable RTOS available today for safety-critical systems with POSIX conformance
- Support for ARINC 653 – ensures application portability, software reuse, and interoperability between embedded systems
- Time and space partitioning for fault containment
- Secure multithread, multiprocess applications
- ARINC 653 space and time partitioning
- Full POSIX conformance

For more information, contact: inside@lnxw.com **RSC# 15839 @ www.mil-embedded.com/rsc**

ITCN
591 Congress Park Drive • Dayton, OH 45459
Tel: 937-439-9223 • Fax: 937-439-9173
www.itcninc.com

ST-201 VME Backplane & ST-101 1553 Data Bus Monitor/Analyzer

SystemTrace™ has been designed to provide global visibility into system operation by monitoring key *data flow* in multiple, dissimilar data streams incorporated in embedded systems. This monitoring is accomplished using Real-Time Non-Intrusive (RTNI) techniques so that the act of monitoring does not affect the system operation. The data files collected *synchronously* at the key dataflow points are *time-correlated* so that dependencies on actions among system elements can be observed.

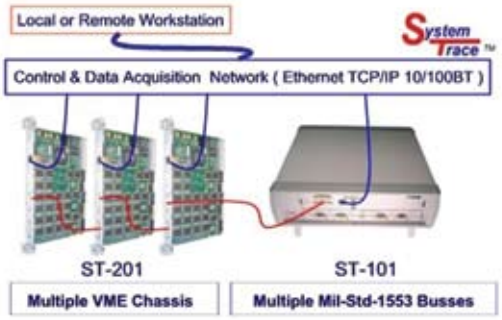
SystemTrace has a networked architecture that incorporates distributed monitor modules for VME backplanes, MIL-STD-1553 data busses and future additions. A feature is also included to time-correlate the software execution in the system's processing units to the data in the heterogeneous data streams.

These modules can be distributed throughout the embedded system and over different physical locations. SystemTrace can take the form of laboratory instruments or onboard monitors with man-machine interfaces supporting operational functions.

SystemTrace is:

- Scalable
- Distributed
- Synchronized
- Adaptable to different data media
- Able to simultaneously monitor multiple dissimilar data streams in real time
- Monitor and time-correlate software execution events with other system events monitored in separate data stream; uses a common Graphical User Interface (GUI) for setup, run-time presentations, and post-run analysis

The SystemTrace ST-201 VME Backplane Monitor/Analyzer is capable of monitoring and recording activity on all four VME backplane busses – Data Transfer Bus (DTB), Arbitration Bus, Interrupt Bus, and Utility Bus. This feature enables the analysis of data transfers between processors or any other device that participates in data transfers and VMEbus arbitration. VME protocol interactions can be analyzed by specifying operations on the Arbitration, Utility, and Interrupt Busses as *Events* for the module to monitor and record.



FEATURES:

- Simultaneous, real-time, nonintrusive monitoring of up to 32 unique nodes (any combination of VME and/or 1553)
- Richly featured Windows GUI for setup and analysis of 32 SystemTrace modules
- Long-term data acquisition and storage via SystemTrace host module
- Time-correlated data collection
- Up to 256 unique Events collected per session
- Local or remote setup and control via 10/100BASE-T TCP/IP
- Runtime data displays
- Eight cross-module triggers
- Complex triggers and filters (64 Level State Machine)
- Programmable and reusable data collection scenarios
- Open data interface
- Post-run analysis software

For more information contact: sales@itcninc.com **RSC# 21121 @ www.mil-embedded.com/rsc**

KineticSystems

900 North State Street • Lockport, IL 60441
Tel: 815-838-0005 • Fax: 815-838-4424
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 such as digital I/O, analog output, and high-speed digitizers are also available.

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-ch 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 & ATE
- High-speed Digitizers with up to 2 GS/s sampling, up to 16-bit resolution, and up to 2 GB on-board memory
- CP199: Rugged 14-slot, 3U/6U dual stack 800 Watt PXI system with high-pressure 220 CFM cooling

For more information, contact: mkt-info@kscorp.com **RSC# 30034 @ www.mil-embedded.com/rsc**

EADS North America Defense Test & Services

4 Goodyear • Irvine, CA 92618
Tel: 949-859-8999 • Fax: 949-859-7139
www.eads-nadefense.com

Engine Test System

Our integrated instrumentation suite provides diverse solutions that meet the demands of the engine test community. With the flexibility to test multiple engine types, our jet engine test system solution uses common hardware and test program sets for both land- and sea-based installations. This common platform is capable of testing the F414, F404, F110, F405, F402, and J52 jet engines as well as two auxiliary power units.

We have developed a universal engine throttle control system to meet a wide variety of jet, shaft, and propeller engine test requirements. Provided with a simple user interface, a menu-driven setup mode, and modular components, the throttle control system is flexible enough to meet intermediate and depot test requirements.

FEATURES:

- Complete COTS solution
- Open architecture allows flexibility
- Meets jet and shaft engine requirements
- Commercial TPS development environment
- Scalable configuration
- PC/Windows operating system

For more information, contact: info@eads-nadefense.com **RSC# 30047 @ www.mil-embedded.com/rsc**

By Sharon Schnakenburg

For further information, enter the product's RSC# at www.mil-embedded.com/rsc

AIR TRANSPORT RACK (ATR)

Hybricon Corp.
Website: www.hybricon.com
Model: 1 ATR Chassis **RSC No:** 30175

Chassis designed for applications using high-power, conduction-cooled boards • Top load 1 ATR short • Liquid-cooled card cage side walls • Cools up to 100 W per slot power dissipation • Brazed construction • VITA 41 VXS or VME64x backplanes with custom I/O • Meets ARINC 404A/MIL-STD-91403 • MIL-STD-704 power supplies • MIL-STD-461 EMI • Low pressure drop (under 1.5 psid) • Customizable I/O front bezel with Mil 38999 or other connectors • Custom configurations and system integration services available

CARRIER BOARD: OTHER

Hunt Engineering
Website: www.hunteng.co.uk
Model: HERON-BASE2 **RSC No:** 25330

A USB-based HERON module carrier for up to two modules • Two 3.3 V HERON module slots • High-speed (480 Mbps) USB 2.0 connection to a host PC • Can be used as a standalone board for embedded systems • Single 5 V power supply required – 20 W mains PSU included • FIFO connections between module slots and also between each module and USB • TI Code Composer supported for DSP modules via JTAG header and separate emulator board • Enables users of one or two HERON modules to connect their system to a PC via USB 2.0

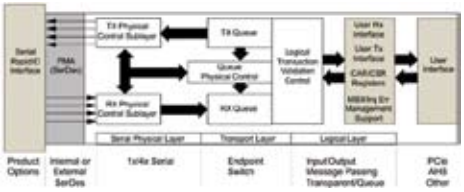
CHIPS & CORES: BUS INTERFACE

Integrated Electronic Solutions
Website: www.integratedelectronicsolutions.com
Model: IES5501 **RSC No:** 29594

A bus buffer integrated circuit • Dual, bi-directional, unity gain two-wire bus buffer • Compatible with I2C bus (standard and fast mode), SMBus (standard and high-power mode), and PMbus • Low input-output offset voltage • Threshold and offset parameters allow the connection of several devices in series • Low noise susceptibility • Enable pin allows bus segments to be disconnected • Wide range of bus voltages from 1.8 V to 15 V • No minimum bus capacitance requirement

CHIPS & CORES: IP

Mercury Computer Systems, Inc.
Website: www.mc.com
Model: Serial RapidIO IP **RSC No:** 30166



A highly flexible, high-performance core useful for embedded, communications, wireless, storage, and defense applications • Incorporates a logical, transport and physical layer, making it ideal for implementing endpoints or switches • Interoperability provides users with a fast time to market • Provides both RapidIO endpoint and switch applications • Simplifies the construction of add-on, third-party bus interfaces • Ideal for use in a variety of high-end embedded computing applications • Implements an advanced buffer management • Targets both FPGA and standard Cell technologies

DATA ACQUISITION

Acqiris
Website: www.acqiris.com
Model: SC240 **RSC No:** 25267

A dual- and single-channel 6U CompactPCI streamer analyzer featuring an Optical Data Link (ODL), a high-speed optical data transceiver system that provides data streaming at rates of up to 25 Gbps • Incorporates Acqiris' XLFidelity and JetSpeed ADC chipset technology • Designed for use with mass storage devices or subsequent post-processing engines • Ideal for data streaming requirements encountered in advanced signal processing applications such as EW, SIGINT, ELINT, and SAR, as well as in applications requiring scalable real-time data sampling and storage, including radio astronomy • Provides onboard high-performance data handling through an FPGA-based Data Processing Unit (DPU), a Virtex-II Pro 70 FPGA

Microstar Laboratories
Website: www.mstarlabs.com
Model: iDSC 1816 **RSC No:** 29915

A specialized data acquisition card for spectral analysis applications, including shock and vibration • Acquires signals through built-in analog and DSP anti-aliasing filters • Eight simultaneous channels of data acquisition • Onboard fourth-order analog anti-alias filters • Maximum aggregate analog sampling rate over eight channels: 1229 ksps • Maximum analog sampling rate per channel: 153.6 ksps • Linear phase response • Two external timing channels • 16-bit A/D converter resolution • Variable cutoff frequencies

DATACOM: ETHERNET

Concurrent Technologies, Inc.
Website: www.gocct.com
Model: CL PMC/GB3 2xGbEnet **RSC No:** 24982

PMC Gigabit Intel 82546GB Ethernet controller • Copper • Two 10BASE-T, 100BASE-TX, or 1000BASE-T Ethernet interfaces via dual RJ-45 connectors supporting various operating systems • Two RJ-45 front panel connectors • 33/66 MHz, 32/64-bit PCI interface • 3.3 V or 5 V PCI signaling supported • Compatible with VME, CompactPCI, Multibus II PMC host boards • Supports Windows NT, Windows 2000, Windows XP, Windows XP Embedded, Linux, QNX, and VxWorks • Power requirement is typically 5 W (5 V power source) • Single-width PMC format

For further information, enter the product's RSC# at www.mil-embedded.com/rsc

DSP RESOURCE BOARDS: VMEBUS

TEK Microsystems, Inc.
Website: www.tekmicro.com
Model: PowerRACE-3A **RSC No:** 29982

The latest member of the PowerRACE family of high-performance, fabric-enabled I/O processors equipped with FPGA coprocessors • FPGA processors: FPGA cores increase processing throughput, reduce board count and maximize overall performance • Dedicated CPU per PMC slot: Local 800 MHz processor available for I/O protocol processing, supports high throughput I/O without host processor overhead • Onboard RACE++ fabric easily supports any required system architecture with a single hardware model

ENCLOSURE + CARD RACK + POWER SUPPLY

Triple E
Website: www.tripleEase.com
Model: VXS/VME Enclosure RSC No 30109

A VXS enclosure that effectively handles increased data bandwidth transfer demands while maintaining backward compatibility with all VMEbus structures • Meets VITA 41.0-200x specs for VXS VMEbus switched serial standard • System backplane conforms to both VITA 41.0 Rev 1.10 VXS core spec and VITA 38 spec for system management • High-speed multi-gig RT-2 connector provides up to 6.4 Gbps switched serial traffic over P0 • Maintains compatibility with VME64X COTS boards that do not include a P0 connector • Patented guide deck accommodates twelve 6U X1, 6 mm x 160 mm boards, 10 payload slots, two switch card slots • 800 W power supply • Nominal input @ 115-240 Vac, operation input @ 90-264 Vac • Output rated +5 Vdc @ 120 A, 3.3 Vdc @ 40 A, +12 Vdc @ 12-20 pk, 12 Vdc @ 10A

GPS/PRECISION TIME CODE

WinSystems, Inc.
Website: www.winsystems.com
Model: PCM-GPS RSC No: 25323

A dual-function PC/104 module featuring a GPS receiver and cellular modem • Ideal for fixed and mobile embedded applications that require navigation, tracking, data logging, timing, and/or communications functions • GPS features: Lassen GPS receiver module provides position, velocity, and time data; TSIP, TAIP, and NEMA 0183 protocols; very low power requirement; supports pulse output for accurate time standard; external powered antenna connection via a standard SMA connector • Cellular wireless features: supports both GSM/GPRS and CDMA; socket support for Multitech wireless module; recognizes standard AT commands; alarm management, phone book management, and Short Message Services (SMS); Bluetooth support available soon • Programmable address and interrupt settings • +5 V only operation • Small size: 3.6" x 3.8" (90 mm x 96 mm) • Operating temperature: -40 °C to +85 °C

For further information, enter the product's RSC# at www.mil-embedded.com/rsc

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Military and Aerospace Group

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Crosshairs Editorial

By Chris A. Ciufo
Group Editorial Director

COTS: 10 years after
Well, sure…but what about the *next* 10 years?

1996: COTS kickoff

The theme of this year's *Military Embedded Systems* Resource Guide is "COTS: 10 years after." Dr. William Perry's famous "Perry Memo" was published in 1994, but it took about two more years of DoD and interservice arguing and hand wringing before the real weight of the memo sunk in: COTS wasn't going away.

Back then, the SECDEF wasn't changing his mind or policy. Commercial-Off-The-Shelf *was* going to be a mandate that the Services, primes, subs, and suppliers couldn't dodge with fancy cost-plus contracts or funded overruns. Still, some contractors did try to fudge their way through contracts with sly wording that allowed them to design something *COTS-like* from scratch under federal funding. All too often these programs found themselves stuck with obsolete *one-off* technology, waivers to an Operational Requirements Document (ORD), and no budget to fix an in-house design.

In fact, as our panel of COTS executives points out (page 34), the military is not going back to the pre-COTS days. Except for some highly specialized electronics applications such as space, high radiation, or unique military-specific sensors, the military just can't revert to the pre-COTS days. "No way," simply said one executive.

While an increasing number of companies such as QP Semiconductor actively build MIL-STD-883 devices, the order of the day is to use even more consumer-quality COTS components, hardware, and software in modern defense systems.

2006: Latest COTS trends

That brings us to the present. The U.S. military and its allies rely heavily on electronics, specifically *COTS electronics*, and the capabilities of future military systems and weaponry can be spotted simply by reviewing today's civilian and consumer electronics products and markets. What'll be in your living room or coat pocket in two or three years? You'll find that technology in mil programs 10 years from now.

At the recent Embedded Systems Conference in San Jose, California, I toured the aisles and met with vendors while keeping in mind what I call the DoD's *electronic battlefield doctrine* (see sidebar). After five days of dazzling displays, compelling demos, and some of the coolest embedded technology on the planet, here are some of my favorites and how they might apply to tomorrow's military programs. I'll be examining each of these in more quantitative detail in future *MES* issues.

Multicore processors: This is nothing new in military systems, but it's taking AMD's and Intel's desktop CPUs to wake up the software market. Without the code, having extra hardware is useless. Intel's Core Duo is the buzz in Apple's new desktops and notebooks, and the software development ecosystem is really only starting. Most C4ISR and simulation apps migrate from Windows and Linux platforms, so multicore personal computers will have a huge impact on next-gen command centers and deployed x86-based systems.

Software optimization, verification, and embedded databases: The number of vendors offering these capabilities is just too large to list here. (I stopped counting after about 20). Suffice it to say, as embedded systems get more complex *and distributed*, it's becoming increasingly important to get the code done right. (And I'm not referring to DO-178B or MILS safety-critical code.) Also, look for distributed and embedded databases as battlefield assets seek to share data. Of particular note: the recent RTI announcement marrying NDDS publish-subscribe to Oracle's Times Ten database.

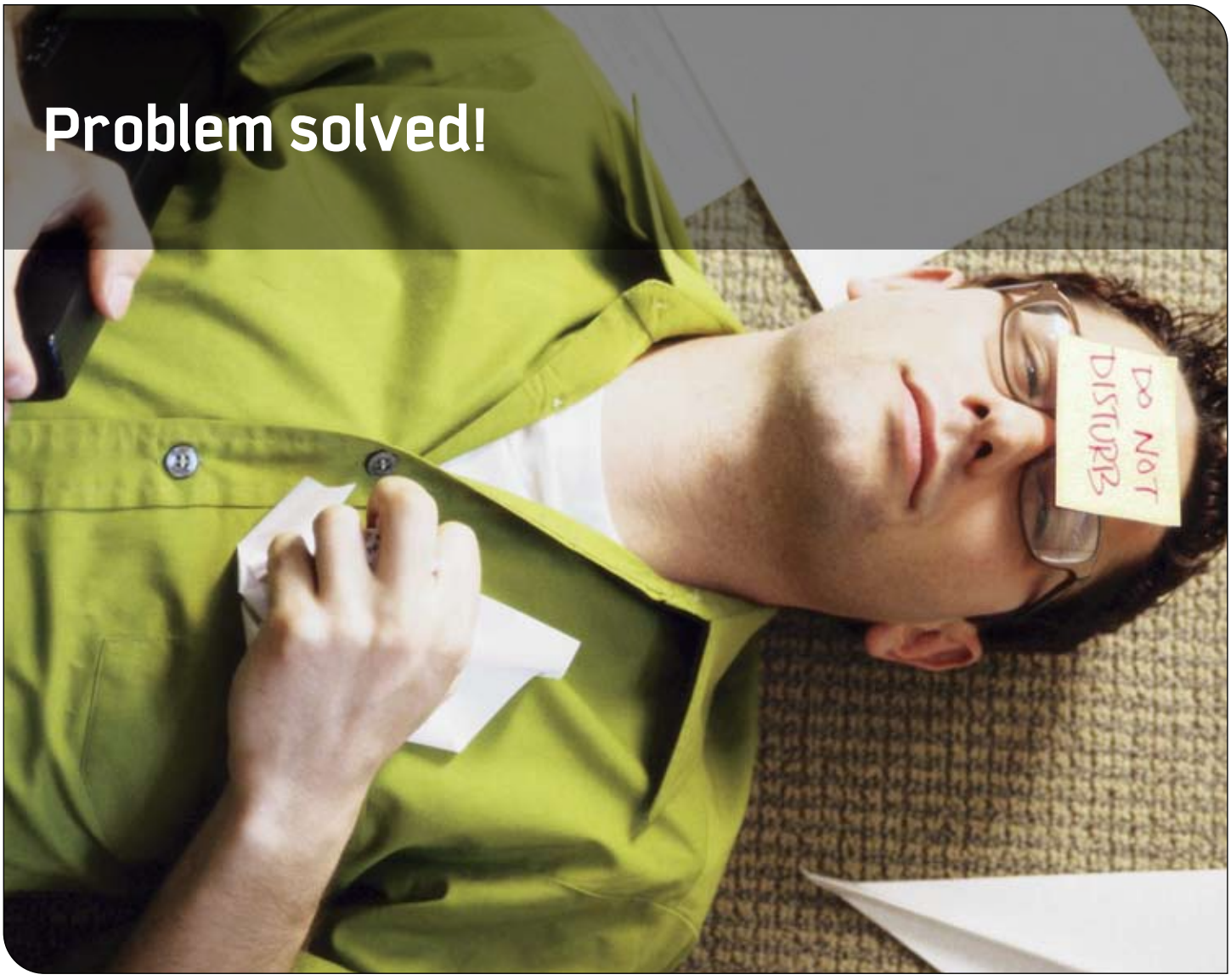
Graphics-capable processors: Only the highest-res systems need dedicated graphics controllers anymore. General purpose CPUs can directly drive LCDs with reasonable performance and 2D video, even for moving maps and symbology overlay. The upside is smaller and lower power systems with ever more situational awareness powered by CPUs such as VIA's new CX700.

PICMG's Advanced Mezzanine Card (AMC) and PC/104's EPIC: Look for these open standards-based hardware platforms to shoehorn their way into more deployed defense systems. AMC cards are robust enough for many rugged apps, and PICMG's MicroTCA cage/rack efforts may well offer an alternative to high-cost VME and CompactPCI systems.

I see three key tenets of DoD doctrine that will underlie all future programs. COTS electronics is the underlying enabler:

(Unofficial) Electronic battlefield doctrine

Force multipliers	Do more with less; bring overwhelming lethality to the enemy. A *unity of one* asset (such as a Marine) can deploy individually but bring multiple assets to bear in real time.
Network-centric warfare	Connect as many battlefield assets as possible for information sharing and improved success.
Minimize U.S. casualties	Rely on technology: This includes UAVs/UCAVs, standoff weapons, long distance C4ISR, and information warfare.



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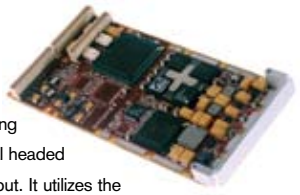

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