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Transitions and New Realities Shake Up U.S. Manned Space Program

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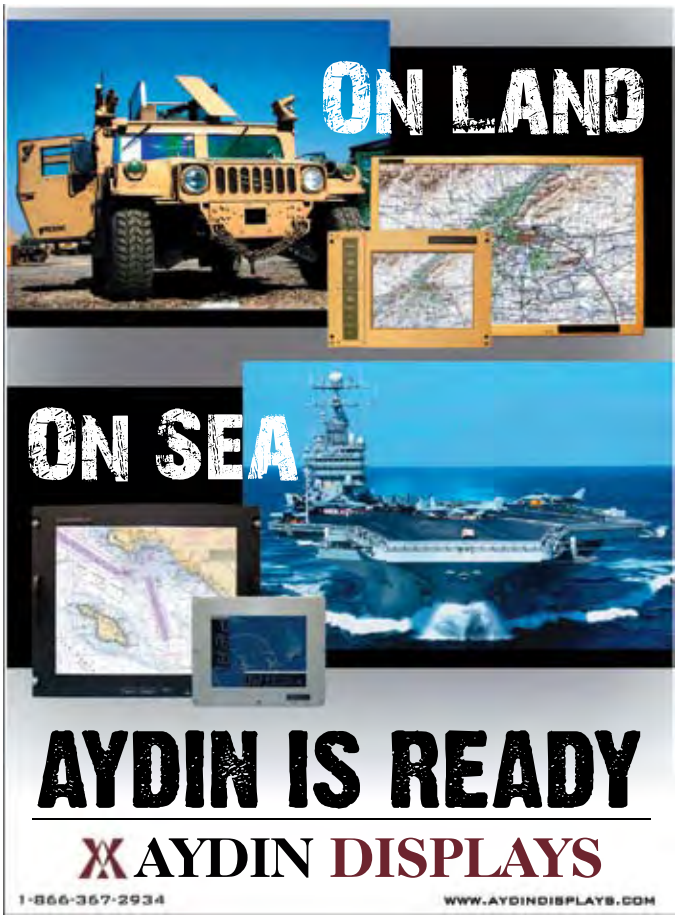
On The Cover: Space shuttle Atlantis lifts off from Launch Pad 39A at NASA's Kennedy Space Center in Florida on the STS-132 mission to the International Space Station on time at 2:20 p.m. EDT May 14, 2010. The mission marks the final flight of Atlantis and the first of the shuttles to be retired as the shuttle program moves toward its scheduled termination this year. *(NASA Photo)*



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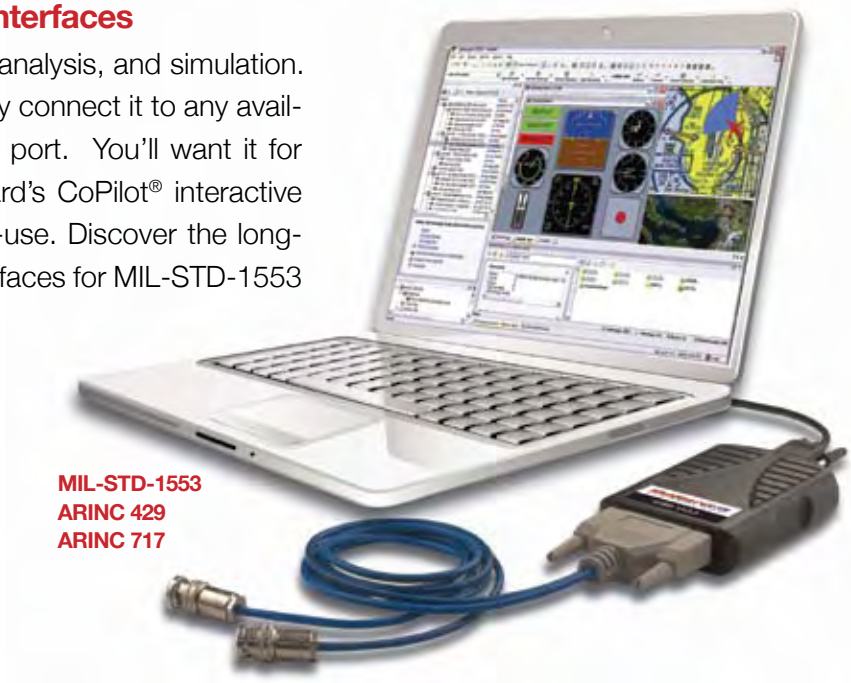

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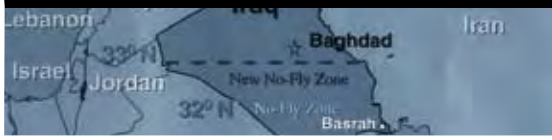

"…time for this nation to take a clearly leading role in space achievement…"

President John F. Kennedy, May 25, 1961

On April 15th, 2010 President Obama had a small meeting at Kennedy Space Center in Florida to present his views on space exploration in the 21st century. The meeting was intended to bring comfort to futurists and NASA KSC employees as the President announced that the Constellation program would be reworked/scrapped and that a new, smaller, less ambitious program will be envisioned by 2015. This means that—with the conclusion of the Shuttle program later this year—there will be no U.S. manned space effort for years after 2015, if ever.

When I was just starting high school President John F. Kennedy made two speeches that personally resonated with me. One was the "Ask not what your country can do for you, but what you can do for your country" speech. The other was when he made a special address to Congress and announced that the United States would have a man on the moon by the end of the decade. Kennedy really hit a chord with me. As an immigrant to the United States in the '50s, I realized how lucky I was to live here. The struggle to learn English and to fit in taught me that anything was possible if I just applied myself. I also felt that I probably owed this country something for allowing me to immigrate here.

There comes a time in high school when it's necessary to take a stab at what you want to be. For me, I thought if I could become an engineer, I might be able to work toward Kennedy's—and now my own—dream of participating in putting a man on the moon. I'm sure I wasn't alone because after college there were hundreds of thousands of people working the "dream." My first technical positions were with RCA - Astro Electronics Division in Hightstown, New Jersey. During my first year I was able to work on many commercial, defense and NASA projects—all personally very fulfilling. Although a portionof my engineering experience was interrupted by a short stint in the U.S. Army, I was able to see the moon landing, one of President Kennedy's dreams, fulfilled while stationed in Germany.

After returning to RCA, they presented me with the opportunity of working on the Ground Control Television Assembly. That was the color camera everyone saw on the Lunar Rover in the last few Apollo missions. I was working with the most cutting-edge technology on systems that exemplified what the country was. In a small way I was part of the dynamo that is the U.S. and felt in my own way part of Kennedy's directives to me as a citizen. Many may now consider these concepts a lot of hooey. And truth be told, even then I never expressed them openly for fear of being considered a geek. Before going back to college for my degree in business and moving on to the computer industry, I also had the privilege of working on the Viking Mars Landers—another great advancement for the U.S. and mankind.

A great disappointment for many of us in the early '70s was when the U.S. made the decision to terminate the last Apollo missions and convert them to more politically appropriate ventures: Apollo-Soyuz and Skylab. In spite of the shift in political emphasis, most people were convinced that before the 20th century was over mankind would land a man on Mars. Here we are in the 21st Century and we still have the same dream of being on Mars before the end of this century.

Throughout the history of the world people have been inspired by exploration, and not just great people, but also common people. They followed behind men like Columbus and Lewis and Clark. In my generation people were inspired to become educated and to participate in moving the great experiment that is the U.S. forward. Manned space exploration has now been shelved, and my participation has been reduced to occasionally reporting on it. But I still staunchly support Kennedy's other dream, "Ask not what your country can do for you, but what you can do for your country." In spite of the changes in the manned space program there is opportunity. We are exploring the new opportunities in space this month in a special article, "Transitions and New Realities Shake Up U.S. Manned Space Program." We've also put together for you a special Photo Essay offering a personal look at the last few Shuttle missions complete with many exclusive photos taken by myself and Warren Andrews at Kennedy Space Center. It can be viewed at *www.cotsjournalonline.com/nasa*.

Pete Yeatman, Publisher
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The Inside Track

Northrop Grumman to Upgrade Integrated Bridge Systems for Nimitz-Class Carriers

Northrop Grumman Corporation has been awarded a contract to provide Scalable Integrated Bridge Systems (SIBS) for five Nimitz-class (CVN) U.S. Navy Aircraft Carriers. The five SIBS shipsets were awarded to Northrop Grumman's Maritime Systems business unit under a U.S. Navy fixed-price contract. In conjunction with previously awarded shipsets by the U.S. Navy, this contract will complete bridge upgrades for the entire Nimitz class. The upgrades will provide enhanced situational awareness for safer navigation as well as increased commonality with systems and software used by other U.S. Navy ship classes for easier supportability.

The CVN SIBS include Northrop Grumman's Voyage Management System (VMS), which provides the "paperless navigation" technology to convert the fleet from hand plotting on paper nautical charts to automated navigation and piloting on computerized chart displays. VMS is the only system that is currently certified by the U.S. Navy to be compliant with the Navy's Electronic Chart Display and Information System (ECDIS-N) requirements for paperless navigation, as defined by the Chief of Naval Operations in OPNAVINST 9420.2. All U.S. Navy vessels certified for paperless navigation use VMS as their ECDIS-N software application, running on an ECDIS-N-certified Northrop Grumman equipment suite. The Nimitz-class carriers began construction in 1968 with the USS Nimitz (CVN 68). The tenth ship of the class, the USS George H. W. Bush (CVN 77) (Figure 1) was commissioned in January 2009.

Figure 1

The USS George H. W. Bush (CVN 77) will be among those Nimitz-class carriers to receive the Scalable Integrated Bridge Systems (SIBS) upgrade.

Northrop Grumman
Los Angeles, CA.
(310) 553-6262.
[www.northropgrumman.com].

Kontron Acquires AP Labs Group

Through its U.S. subsidiary, Kontron has acquired 100 percent of U.S. company AP Labs Group, which is based in San Diego, California. The group, which has two operating companies, specializes in system integration in the areas of defense and aerospace. Kontron anticipates that both new subsidiaries will make an annual revenue of $30 million. Kontron intends to integrate AP Labs with its North American headquarters, which is also based in San Diego. Kontron has access to cost-efficient, local production capacities as the result of the company AP Parpro., which also forms part of the group and is located in Mexico, close to Kontron's NA headquarters.

For Kontron, whose revenue share in the security application area had already grown to 16 percent in the last business year, the strategic acquisition brings advantages in many respects. AP Labs' system product line is complementary to its French subsidiary's board product range in the security segment. In 2008, Kontron acquired the former French company Thales Computers SA from Thales Group, boosting Kontron's play both in the defense/aerospace area and regionally in Europe. The U.S. Defense Department's official accreditation of AP Labs is expected to facilitate even better access for Kontron into the high-margin U.S. market.

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

General Dynamics Awarded U.S. Navy CALI Contract

General Dynamics has been selected by the U.S. Navy's Space and Naval Warfare Systems Command (SPAWAR) to compete for future orders under the Common Afloat Local Area Network Infrastructure (CALI) indefinite delivery/indefinite quantity (IDIQ) multiple award contracts. Under the CALI IDIQ contracts, contractors will provide ships and submarines with Common Computing Environment (CCE) Components, Integrated Logistics Support (ILS), Configuration Management (CM), Test and Evaluation (T&E), Quality Assurance (QA) and Installation Support. Specific requirements will be defined in individual orders.

Figure 2

The idea behind CANES is to consolidate and replace numerous legacy systems and deliver an open, common network to every ship, submarine and shore-based command and control center in the Navy.

As one of three awardees under the CALI initiative, General Dynamics (NYSE: GD) will lead an experienced

team in delivering secure, commercial-off-the-shelf (COTS) hardware, software and networking equipment. Each CALI contract has a total potential value of $502 million if all options are exercised. The CALI contract enables the delivery of equipment and systems to provide a bridge between currently deployed systems and the Navy's future Consolidated Afloat Networks and Enterprise Services (CANES) program (Figure 2). General Dynamics C4 Systems, in addition to leading the team, will provide secure naval communications, networking and computing infrastructure solutions.

General Dynamics C4 Systems
Scottsdale, AZ.
(480) 441-3033.
[www.gdc4s.com].

Lockheed Martin Adopts McObject Java Database for Defense R&D

Lockheed Martin will use McObject's all-Java Perst embedded database management system (DBMS) in a research and development application for the Medium Extended Air Defense Systems (MEADS) (Figure 3) project of the United States and NATO partners. Developers in the Lockheed Martin Space Systems Company chose the open source, object-oriented Perst database after a make-or-buy analysis found economic and time-to-market benefits in licensing a commercial off-the-shelf (COTS) high-performance DBMS rather than creating the technology in-house. Lockheed Martin has licensed Perst for commercial use from McObject, with initial integration planned in a trial software test component.

Figure 3
MEADS will incorporate the hit-to-kill PAC-3 Missile Segment Enhancement (MSE) Missile, along with 360-degree surveillance and fire control sensors, netted-distributed battle management and communication centers, and high-firepower launchers.

The MEADS mobile air and missile defense system will provide capabilities beyond any other current or planned air and missile defense system. It will incorporate the hit-to-kill PAC-3 Missile Segment Enhancement (MSE) Missile, along with 360-degree surveillance and fire control sensors, netted-distributed battle management and communication centers, and high-firepower launchers. MEADS will replace Patriot air defense technology in the United States and Germany, and Nike Hercules systems in Italy.

McObject
Issaquah, WA.
(425) 888-8505.
[www.mcobject.com].

Curtiss-Wright Acquires Hybricon

Curtiss-Wright announced that it has acquired Hybricon Corporation for $19 million in cash. Hybricon is a leading supplier of high-performance electronic packaging for the aerospace, defense and commercial markets, and provides electronic subsystem integration expertise. Hybricon, based in Ayer, MA, designs and manufactures custom and standards-based enclosures and electronic backplanes for defense and commercial applications. They are a leading supplier for the most popular embedded commercial-off-the-shelf (COTS) system architectures, including OpenVPX, VPX, VXS, VME64X, CompactPCI and MicroTCA. In 2009, Hybricon had sales of approximately $17 million, including an 85% concentration in the defense market. Hybricon will operate in Curtiss-Wright's Motion Control segment, within the Electronic Systems division.

Curtiss-Wright
Parsippany, NJ.
(973) 541-3700.
[www.curtisswright.com].

TCG to Provide Operator Simulation and Training Solution to U.S. Navy

The U.S. Navy has selected the Tactical Communications Group's (TCG) training software solution to provide realistic Link 16 training for operators at its Whidbey Island, Washington Naval Air Station. Whidbey Island is the premier naval aviation installation in the Pacific Northwest and home of all Navy tactical electronic attack squadrons flying the EA-6B Prowler and EA-18G Growler (Figure 4). The U.S. Navy's West Coast EA-6B/EA-18G training squadron awarded this new contract to TCG to fulfill a requirement to train pilots and ground operational personnel on tactical data link tactics, techniques and procedures, so pilots and operators can "train as they fight" using TCG's Ground Tactical Data Link System (GTS).

TCG's GTS solution will allow the Navy's EA-6B Prowler and EA-18G Growler operators at Whidbey Island—in the air and on the ground—to have connectivity and visibility into their Link 16-equipped aircraft operations, and provide these operators crucial training

on Link 16-supported missions. TCG's GTS solution is a complete, highly realistic tactical training and simulation system for terrestrial TDL networks.
Tactical Communications Group
Tewksbury, MA.
(978) 654-4800.
[www.g2tcg.com].

Figure 4

The Ground Tactical Data Link System will allow the Navy's EA-18G Growler operators to have connectivity and visibility into their Link 16-equipped aircraft operations.

Raytheon Links Networked Combat Systems for Army Exercise

Raytheon networked an array of combat systems during a U.S. Army experimental force exercise to evaluate existing and emerging capabilities for improved situational awareness and targeting efficiency. At the Army Expeditionary Warrior Experiment, Raytheon linked a number of combat sensors and weapons systems for improved lethality. The tactical network included a third-generation electro-optical Mast Mounted System, the Long Range Advanced Scout Surveillance System, an Improved Target Acquisition System and the Javelin Command Launch Unit (Figure 5).

Figure 5

The Javelin Command Launch Unit (CLU) is comprised of a launch tube connected to a targeting and control unit. The unit provides optical and IR sensors enabling the Javelin to fire day and night, under adverse weather conditions.

Networking these systems significantly reduced target acquisition and engagement timelines through slew-to-cue target handoffs and automated target reports. This increased situational awareness through transmission of streaming sensor video and imagery that supports targeting and battle damage assessments. While the Army is still analyzing field test data, emerging results indicate that Raytheon's lead technology integration and netted combat systems yielded positive performance.

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Special Feature

Transitions and New Realities Shake Up U.S. Manned Space Program

Even as our nation's manned space program as we've known it comes to end, new opportunities lie ahead. No longer tethered to an aging infrastructure, new aerospace developments ignite new paradigms and explore our universe from many different perspectives.

Pete Yeatman, Publisher

Here we are again at a crossroads of National manned space policy—the most significant since the transition from the Apollo/Saturn to the Space Shuttle. The Space Shuttle program is winding down and there is no clear successor in sight. That successor would have been the earlier proposed Constellation program. But that's now all but scrapped, and what's left of NASA's budget will likely be spread to industry partners and squandered over the next several years. Meanwhile the costly infrastructure that supported our manned space effort will be relegated to museum status. Is this the end, or a new beginning?

Many decry this abandonment of our manned space program as hurtful to everything from national pride to the abdication of our country's role as world leader in space exploration and scientific development. What we accomplished in this program was the unprecedented development of materials and systems, a discipline of safe and successful travel in space, knowledge of life in low-earth orbit and the ability to marshal wide-ranging resources to significant challenges. Figure 1 shows the transition from Saturn through Constellation.

Despite all those grand accomplishments, what we failed to do was create a compelling case for the continued manned exploration of space. We've instead become jaded by so many technological advances that we believe they will just continue without the effort of the highly trained engineers and scientists that have expertise in spacecraft technology (see sidebar "Did Success Trivialize Aerospace Achievements?"). Those individuals have been a part of the more than four decades of development on the United States' manned space program. When industry foots the cost of those engineers and scientists, it expects to make a return on their work. When NASA foots those costs it expects to achieve advancement for mankind.

The past century has seen a man on the moon, space ships sending back photographs of the surface of Mars and of the rings of Saturn and all manner of close-

A special Photo Essay with a personal look at the last few Shuttle missions complete with many exclusive photos can be viewed at: **www.cotsjournalonline.com/nasa**

up images of those and other planets. What's next? It looks as if, as a country, our efforts will now be focused on letting industry develop manned space efforts while continuing robotic exploration of the universe. China is moving rapidly toward getting men into space and to the moon. With all the different companies the U.S. has and their technical depth and resources, there should be opportunities in supplying China with technology and products to achieve their goals. But will we continue to supply China with our technology to allow it to dominate?

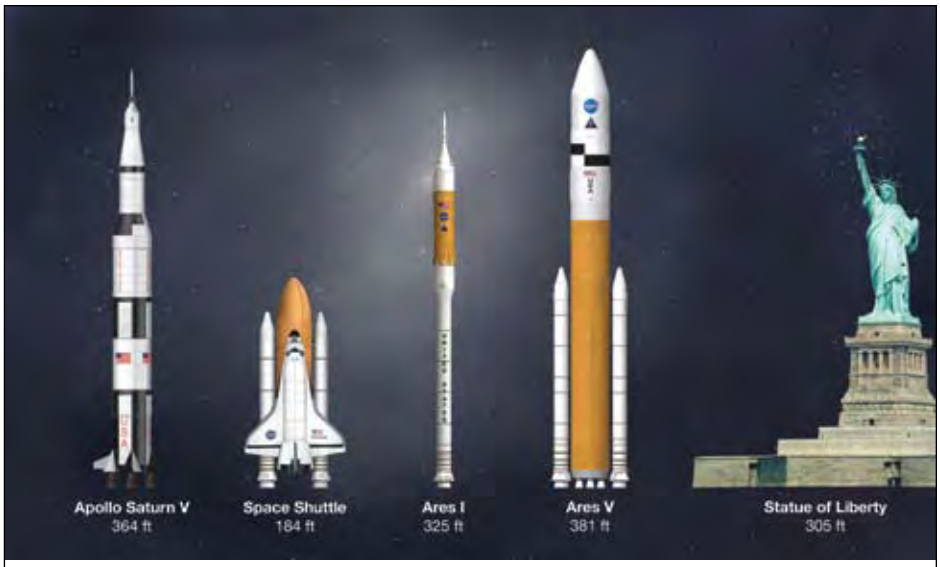


Figure 1

NASA's past, present and possible future launch vehicles shown side by side to scale.

Migration: Intentional or Not?

To get a true perspective on the many factors influencing the future of manned space flight technology, there are several points to consider. First off, technology has gradually migrated over the past 20 years from being primarily driven by

Did Success Trivialize Aerospace Achievements?

The advancements NASA has made over the past are indeed miraculous. While much of the technology has been evolutionary, there are certainly highpoints where true invention has made major differences in all of our lives. NASA Scientists alone account for some 1650 spin-off patents in the fields of computer technology, environment and agriculture, health and medicine, public safety, transportation, recreation and industrial productivity. Contrary to common belief, NASA did not invent Tang, Velcro, or Teflon. Whether it's the capability to insert stents into blood vessels leading to the heart; or new LED technology used to relieve pain in bone marrow transplant patients and eventually to combat the symptoms of bone atrophy, multiple sclerosis, diabetic complications, Parkinson's disease, and in a variety of ocular applications, NASA developments are pervasive. And developments in other areas are no less pervasive. While the diminution of the space program doesn't flag a halt to further NASA activities, it will undoubtedly crimp future developments.

But as important—or perhaps more—is the belief in some quarters that aerospace scientists—and engineers in general—have created such far-fetched expectations that virtually nothing they do in the way of new products and technology is greeted with more than a "Oh, that's nice." Development in semiconductors, software, packaging and integration are so numerous that they tend to leapfrog each other.

In semiconductors, for example, geometries are already down to the .45 micron level with no limit in sight. In his annual statement on being appointed president, Intel's President, Chairman and CEO Paul Otellini inferred that Moore's law wasn't going to go away on his watch. But even if a roadblock is on the horizon—with density and performance hitting a wall—along comes three-dimensional circuits (Figure 1) just in time to power 3D TV.

Are we so jaded with our iPhones, iPads and other toys that we've lost our capacity for enthusiasm—and therefore the adoration of the developers? As a kid, my "cell phone" had Campbell's Soup printed on the side and a string connecting it to the person I was talking to. When I was a little older, ham radio communication was the thing. A little rig with a 2E26 powering a six meter transmitter and homebrew converter could reach several miles. And, when conditions were right, it could carry to several hundred miles. At each step along the way the technology fascinated me. It still does. I hope, as a generation, my children and grandchildren do not lose that capacity for enthusiasm.

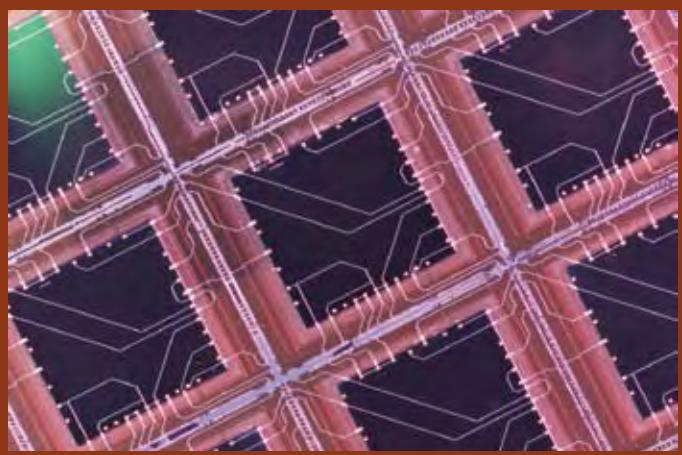


Figure 1 This close-up picture of a 3D IC from Ziptronix shows a set of memory die bonded to a logic wafer. The memory die are bonded face down to the logic wafer face up. The die is then thinned to about 10 microns.

FIGURE 2 One of RCA Astro Electronics Division's teams for the Apollo Ground Control Television Assembly (GCTA) project. *COTS Journal*'s own Pete Yeatman is second from the right. *(Photo by RCA-AED).*

government and the military to being driven by the commercial market. *COTS Journal* itself is witness to—and a result of—this transition. It became evident with the development of newer software and hardware products that the government and the military could no longer direct and develop all the technology it needed. It needed help from the commercial industry.

That migration became critically evident with (then) Secretary of Defense William Perry's mandate that the military use commercially available products and procedures rather than the old military process. While not all commercial-grade products can survive specialized missions, the effort has been to adapt commercial-grade products to special, severe environment applications. This has now become a multi-billion dollar industry.

Second, in spite of the dramatic benefits of spin-off technology from NASA, there is insufficient proof of the benefit (ROI) to pique the interest of the current government administration—nor does it provide a reason for support from the population. Our priorities are obviously in other areas, and thoughts of returning to the moon—not to mention voyaging to Mars—are very low on the list.

Third, after so many dramatic accomplishments, interest has waned in what might be considered another evolutionary development. The level of understanding of our universe today is so far over the heads of many individuals that the possible benefits of further exploration are in question.

Fourth, with the establishment of the International Space Station, a lot of the space efforts have been global. Russia, Japan, Australia and many European countries have all contributed to the effort and placed laboratories in space and plan to share the results of the on-going research. Has this diminished the role—and therefore the interest of the citizens—of the U.S. in scientific exploration?

Fifth, where there once was a strong military component to our space effort, there is notably less interest—due in part to international treaties. While our military will continue to develop and deploy satellites for observation, command and control and communications, it will have to wait until some crisis occurs before we again think of developing more space-based military hardware.

Finally, there is the question of affordability. Can the U.S. continue to fund a multi-billion dollar space effort while supporting record spending on endow-

Up in Smoke?

The U.S. space program has weathered a lot of problems since its inception—depending on when one considers its inception. From some way of thinking, it probably began in earnest with the "space race" when Russia first put a satellite into orbit. On October 4th, 1957, the launch of Sputnik (Figure 1) began what was thought to be the beginning of the "space age." Russia took an early lead in the space race putting people into orbit well before our Mercury project.

With determination of the administration and the creativity of its people, the U.S. soon took over and maintained leadership for several decades. The effort resulted in an unprecedented development of science and technology that has provided untold benefits in the fields of computer technology, environment and agriculture, health and medicine, public safety, transportation, recreation and industrial productivity.

Today we're left with what is viewed by many as the abdication of the U.S. from its active space program Will we once again leave leadership in space to the Russians? For 2010, NASA's budget is the smallest percentage of the Federal budget since 1960. And despite the rhetoric that has recently been heard, the budget is unlikely to fuel any future growth.

Our space programs have survived nine presidential administrations—but maybe can't survive a tenth. Is indeed all the infrastructure, momentum, intellectual property and enthusiasm that have been a hallmark of the space program going to go away? Is the plume of smoke pictured here (Figure 2) all we're going to have left of the most fantastic and successful technical program the world has ever known? Will the enthusiasm, education and interest of our school children and future generations dissipate like the smoke on the wind?

No, NASA isn't going away. But if we can judge by recent cuts in programs, it will be a shadow of what it once was. Most, if not all, of the paltry increase for 2010 will be spent on dismantling the infrastructure and trying to help the thousands that will be displaced with the downsizing of both the Kennedy Space Center and the Houston Space Center. According to NASA documents, year-to-year increases will be small with the increase from 2010 to 2011 a meager 1.5% and following years not topping 2.5%. This is not the kind of budgeting new programs are made of.

Figures 1 & 2 On top (1) a replica of Sputnik 1, the first artificial satellite be put into outer space. Below (2), spectators view the plume of exhaust as the Space Shuttle Atlantis blasts off last month for its final mission. *(Photo below by Warren Andrews).*

ments and bailouts? There are those that are already saying that the U.S. is on an irreversible road to where Greece, Portugal, Spain, Italy and Ireland already are—a condition of no longer being able to service immense debt.

Hope for the Future

Despite the many hurdles ahead for manned space fight, there is hope for the future. But exactly where the hope will come from is not so clear. One hope is that space efforts will become increasingly commercialized and space travel will be financed by business. In that environment, are we ready for colonization of the moon? Of Mars? That might be a little premature yet. However, Virgin Air's CEO Sir Richard Branson is already accepting deposits for space trips in this decade. And, well-heeled people have already enjoyed the view from space aboard Russian spacecraft.

All that said, passenger travel will probably not support the costs of a complete fleet of spacecraft—nor the research that will have to be part of the effort. It will remain for industry to step in and fill some of the gaps. There are experimental efforts currently ongoing on the International Space Station to perform specialized manufacturing in the zero gravity of space. Areas such as crystal growth, cell replication and other critical operations are often possible in zero gravity that are not possible on Earth. Expect to see prominent drug company names emblazoned on space-manufacturing stations in the future. Perhaps we'll even see an Intel space station where special epitaxial growth will take place in the absence of gravity.

The benefits of weightlessness are still not understood. Perhaps in the not-too-distant future, spinal reconstruction, surgery and rehabilitation will be done in the absence of gravity—resulting in better results and faster recovery. And the list goes on. This author's brain is not agile enough to imagine all the ramifications—but the motivation will be there for any effort that will produce a market and a profit.

FIGURE 3 Apollo LEM blast off viewed from the Ground Control Television Assembly (GCTA). Confetti-like color effect occurred because the motion of the particles was faster than the color wheel. That caused what looks like red, blue and green pieces flying away from the LEM. *(NASA Photo).*

The Transitions Continue

The U.S. tale of space travel has been well chronicled over the years in books, on TV and in the movies. Often the focus has been on propulsion systems and vehicles with only a passing mention of the developments in computer science that actually made it all possible. I've had the benefit of spending a lot of my working career in the aerospace arena working after college with RCA-AED (Astro Electronics Division). I'm still not at liberty to even mention any classified programs I worked on—probably shouldn't have mentioned I worked on any. But I can say that the most notable public projects I worked on were the TIROS weather satellites, the Apollo Ground Control Television Assembly (GCTA) (Figure 2)—or "Gotcha" as we called it—and the Command Control Unit for the Viking Mars Landers. One of my greatest regrets is not taking advantage of an opportunity to go see an Apollo Saturn V launch. I can only

imagine what it was like. When we now go for a Shuttle launch, after it clears the tower you feel it on your chest when the pressure wave hits along with the loud roar from three miles away.

Those who have had the opportunity to visit the Kennedy Space Center and tour the exhibits can quickly see the rapid evolution—from early systems in the Mercury, Gemini and other vehicles using discrete transistors—and perhaps the occasional vacuum tube—to today's highly redundant computer systems using the latest IC technology. Today's most primitive PC has more computing power than was on any of the Apollo vehicles. If you ever have the opportunity to tour the Kennedy Space Center, I highly recommend it.

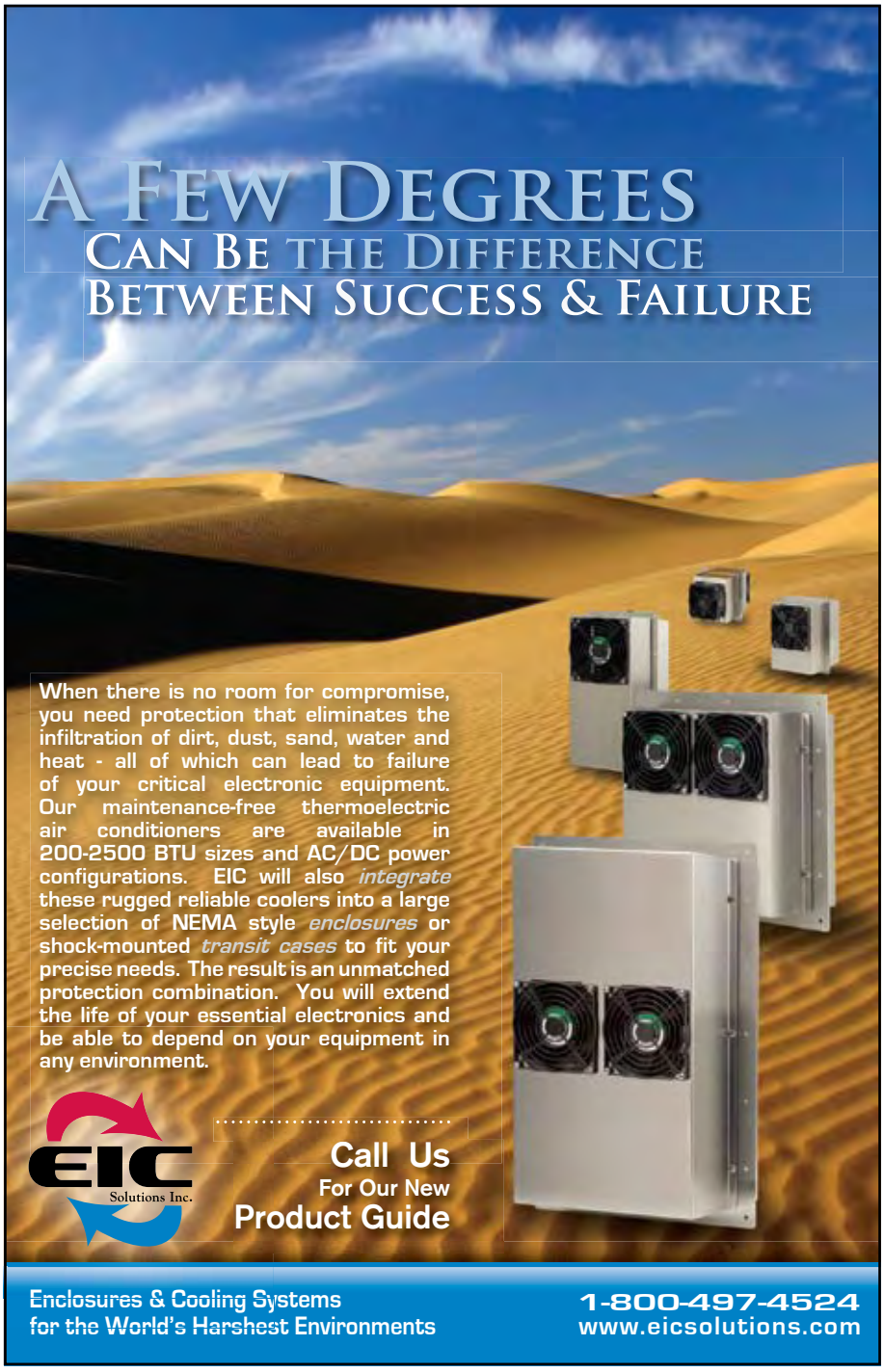
By today's standards the GCTA was like a Model T automobile, but it had to endure the violence of lift off, a vacuum, thermal extremes, a landing and bouncing around on the moon. On top of all that, it needed to get the heat out of the assembly into the vacuum, be as lightweight as possible and be handled by fighter pilots in welder's gloves. It used one small vidicon and a color wheel to allow for color images. That's what produced those confetti-like colors when it took images of the LEM's lift off from the moon (Figure 3). The motion of the particles was faster than the color wheel so you would see what looked like red, blue and green pieces flying away from the LEM. Today's iPhone has millions of times more electronics and capability than the GCTA had.

But, even the electronics going up in the next Shuttle STS-133 scheduled this September are woefully short of what is possible with newer and more efficient electronics. Developments in semiconductors alone continue to blaze paths to higher integration, more efficiency, better reliability and denser circuitry that boggle the mind. The next-generation spacecraft manned or unmanned will have to take advantage of these developments and, like the military, make room for technology insertion as newer and better technology is available.

Pros and Cons

Back a couple of dozen years ago there were many opponents of the Space Shuttle concept. Its limitations have been well documented. However, the Shuttle did yeoman's duty over the years. The program has had quite a run, from STS-1, the Columbia launch on April 12, 1981—traveling a little over a million miles in just over 54 hours—to the current STS-132, which took off May 15 this year. The record of achievement has been remarkable. And while the Shuttle program was confined to low-earth orbit—and recently serving as a mule for the ISS—the number and variety of scientific experiments it fostered was tremendous. Repairs like those to the Hubble Space Telescope could not have been made robotically. They could only have been performed by the Shuttle—not even a Russian Soyuz mission could have performed the repairs.

Like any newcomer, the Constellation program (that is no longer) was also criti-



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cized for a variety of reasons—and many of them make sense. The scraping of the program may turn out to be a blessing in disguise. While no one knows what will take its place, its replacement could turn out to be better thought out and more practical than the Constellation. Whatever it turns out to be, it's hoped that it will also captivate the imagination of the populace as it moves forward (see sidebar "Up in Smoke?").

For more technical details on the GCTA check out *http://history.nasa.gov/alsj/GCTA-Manual.pdf.*

The Editors and Publisher of *COTS Journal* put together a special Photo Essay offering a personal look at the last few Shuttle missions complete with many exclusive photos. It can be viewed at at *www.cotsjournalonline.com/nasa.*

Embedded Computers Help Find Water on Moon

Computing technology has come a long way since the days of the Apollo moon missions, and the COTS movement has been a part of that. Exemplifying that trend, NASA Ames Research Center engineers selected off-the-shelf products manufactured by RTD Embedded Technologies to use in connection with a specialized, light measuring instrument aboard the Lunar Crater Observation and Sensing Satellite (LCROSS). LCROSS—NASA's mission to search for water on the moon—was successfully launched on an Atlas V rocket from Cape Canaveral Air Force Station last summer along with its companion mission, the Lunar Reconnaissance Orbiter.

Figure 1 An IDAN embedded computing system was chosen to handle the power and data transfer for LCROSS's total luminance photometer (TLP).

LCROSS and its attached Centaur upper stage rocket separately collided with the moon last October. As planned, the Centaur impacted first, while the shepherding spacecraft followed close behind to observe the collision and analyze the debris plume before making its own lunar impact. Both plumes of debris were analyzed for the presence of water-ice and water-vapor. Data from LCROSS indicated that water exists in a permanently shadowed lunar crater. The science instrument payload aboard LCROSS consisted of five cameras, three spectrometers, a total luminance photometer (TLP) and a data-handling unit. RTD's IDAN system (Figure 1) provided power and data transfer for the TLP—the high-speed instrument that measured the flash created by the Centaur impact.

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Tech Recon

Military I/O: From 1553 to Switched Ethernet

Ethernet Ascends as 1553 Gets Boxed In

The venerable MIL-STD-1553 is seeing a smaller niche as military systems developers look to higher data rates. But box-level solutions are keeping all options open.

Jeff Child,
Editor-in-Chief

The great dilemma with military I/O technology is accommodating the needs of legacy interface schemes while meeting the performance needs of next-generation computing and electronic subsystems. Legacy I/O schemes such as MIL-STD-1553 and ARINC 429 still are considered good for pure control applications. The problem is they're not in the same bandwidth ballpark as today's modern interconnects. Several multipurpose communications protocols provide options to suit emerging needs. The battle continues between legacy military I/O schemes like 1553 and new approaches like using Ethernet as a fabric I/O interconnect. Together 1 Gbit and 10 Gbit Ethernet, Extended 1553 and Fibre Channel are all jockeying to satisfy these needs.

With such a huge installed base, the MIL-STD-1553 bus continues to play a role in a wide variety of systems such as tanks, ships, missiles and satellites. The latest trend to emerge is rugged box-level solutions that include 1553 alongside several other interface technologies. And there's still a healthy cadre of vendors that continue to support 1553 with board-level products—whether stand-alone 1553 or included with other board or box-level functions. Among those vendors are AIM-USA, Aitech Defense Systems, Alpha Technology, Ballard Technology, Curtiss-Wright, Data Device Corp., Excalibur Systems, Extreme Engineering, GE, Kontron America and Themis Computers.

Figure 1

The MIL-STD-1553 interface is used by Northrop Grumman to upgrade its Integrated Avionics System (IAS) on the UH-1Y and AH-1Z (shown) helicopters. PMC-based cards are used by the avionics data bus interface, both 1553 and ARINC 429, which is the communications link to the aircraft.

Board-Level 1553

As old as 1553 is, board-level 1553 products continue to secure design wins. For example last fall, Northrop Grumman awarded GE Intelligent Platforms an order valued at approximately $1 million

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for quantities of GE's QPMC-1553 1553 PMCs and CEI-830 ARINC boards that will be used by Northrop Grumman to upgrade its Integrated Avionics System (IAS) that is at the heart of the UH-1Y and AH-1Z (Figure 1) helicopters.

Figure 2

Exemplifying the many form factors 1553 is designed onto, this line of cards includes PMC, PCI, cPCI and PC/104-Plus versions. These cards embed a 1553 core that provides Multi-RT capability to the feature set of 1553 functions.

The GE QPMC-1553 PMC and CEI-830 ARINC board are used by the avionics data bus interface, both 1553 and ARINC 429, which is the communications link to the aircraft. The QPM-1553 offers a very high level of performance and flexibility for MIL-STD-1553A/B in the PMC form factor. The CEI-830 ARINC board provides complete, integrated databus functionality for up to 32 channels of ARINC 429, ARINC 575 and selected 2-wire, 32-bit protocols. It supports maximum data throughput on all 32 channels while providing onboard message scheduling, label filtering, multiple buffering options, time-tagging and error detection with support for either 33 MHz or 66 MHz PCI/PMC interfaces.

1553 on Many Form Factors

Long-time specialist in MIL-STD-1553, Data Device Corporation (DDC) earlier this year rolled out a whole new line of rugged 1553/429 embedded and test cards (Figure 2) designed around its next-generation AceXtreme 1553 core, adding Multi-RT capability to DDC's

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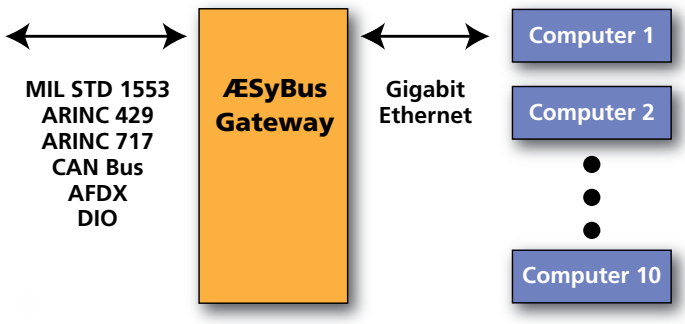

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field-proven and reliable data bus technology. The cards feature a common API that can be used for test cards, embedded cards and components to simplify application code development, shorten software development time and eliminate risk, while the unique I/O mix and high channel count of the hardware reduces space, power, weight and cost. The new line of cards includes PMC, PCI, cPCI and PC/104-Plus versions.

AceXtreme cards are designed to function in extreme environments, and a wide variety of form factors makes them an ideal choice for test/lab environments as well. AceXtreme cards are available in conduction-cooled or air-cooled versions, in the following form factors: PC/104-Plus, PCI-104, PMC, PCI and cPCI. The cards are ideal for systems with limited space yet high I/O requirements, featuring a wide combination and mix of MIL-STD-1553, ARINC 429, Digital Discrete I/O, Avionics Discrete I/O, RS-232/422/485 Serial I/O and IRIG-B input/output on a single rugged, space-saving card. Advanced features include IRIG-106 Chapter 10 onboard formatting, user-selectable BC disable/TX inhibit for safety-critical applications, and an onboard DMA engine for increased data throughput and low host CPU/PCI utilization.

Figure 3

This sub-½ ATR-sized conduction-cooled VPX-based rugged box system supports both 3U VPX and cPCI backplanes. It supports Gigabit Ethernet, graphics, RS-232/RS-422/RS-485, MIL-STD-1553, MIL-STD-188-114A, ARINC 429, discrete I/O, as well as custom conduction-cooled PMC/XMC I/O.

USB as a Test Interface

USB took some time to migrate into the embedded world, and longer still to be embraced as a military I/O interface. One example is Ballard Technology's portable USB 2.0 interfaces for MIL-STD-1553 and ARINC 429/717 protocols. These easy-to-use USB interfaces enable engineers and technicians to test, simulate and analyze avionics databuses using any available PC. The same device and software can be used in the lab and in the field. Typical applications include product and system development and integration, data loading, flightline maintenance and AOG support, and performance monitoring and analysis. These new USB devices make excellent replacements for plug-in cards, especially hard-to-get PCMCIA cards.

Several models are available with a variety of channel counts and capabilities for the most common aircraft databus protocols—MIL-STD-1553, ARINC 429 and ARINC 717. Units are available with up to 2 dual redundant MIL-STD-1553 channels, up to 16 ARINC 429

channels or up to 4 ARINC 717 channels. A multi-protocol version is also available with 12 ARINC 429 channels and 4 ARINC 717 channels. Weighing less than 5 ounces, these rugged little USB peripherals use the same powerful 5th generation technology as Ballard's PCI and PCI Express cards.

Ethernet Ties it All Together

One solution system designers have used to get the best of both worlds is to employ network-based solutions such as Ethernet for a sort of dual purpose. Ethernet is used on the one hand as a medium to connect specific high-bandwidth subsystems with each other. At the same time Ethernet is used as a back-end fabric that aggregates new, faster I/O technologies alongside slower legacy buses like 1553. This type of solution lends itself to more complete system- or box-level I/O solutions, some of which even embed processing.

For a variety of military programs, Ethernet switch boards have won a place as a critical building block. Looking for a faster solution than 1553, aircraft system integrators are looking for an easy way to implement Gbit Ethernet to handle high-bandwidth elements such as multifunction displays, moving maps and multiple full rate video feeds. Where once Ethernet was used only as a pure networking solution for command and control systems in the military, Ethernet is now gaining traction in numerous other military applications as an interconnect fabric in compute-intensive applications.

Ethernet on OpenVPX and More

Rugged Ethernet Switch products are available in many form factors, including VME, VXS and VPX. Switched Ethernet technology is finding its way into numerous programs. OpenVPX with its many defined profiles has Ethernet as one of its prominent options. For loosely coupled systems, Ethernet or PCI Express are expected to be the dominant OpenVPX fabric choice. This will appeal to military systems that are very communications- or networking-based—for example ad hoc networks with RF. Ethernet fits in well with the military's push toward an Everything-Over-Internet Protocol (EOIP) strategy leveraging the ubiquitous ecosystem of TCP/IP and Ethernet technologies.

Offering a VPX-based rugged box system, Extreme Engineering Solutions (X-ES) offers its XPand3200 system (Figure 3) that supports both 3U VPX and cPCI backplanes. Measuring 4.88 x 5.62 in x 8.75 inches, the unit is a sub-½ ATR-sized conduction-cooled, fully rugedized system designed to meet the rigorous standards of MIL-STD-810F. The system is aimed at avionics, UAVs, AUVs and vetronics requirements.

Depending on processing requirements, the XPand3200 can be populated with 3U modules from X-ES based on the Intel Core2 Duo processor, the Freescale dual-core MPC8572E PowerQUICC III processor, or the Freescale dual-core MPC8640D processor. The XPand3200 can then be configured to meet I/O re-

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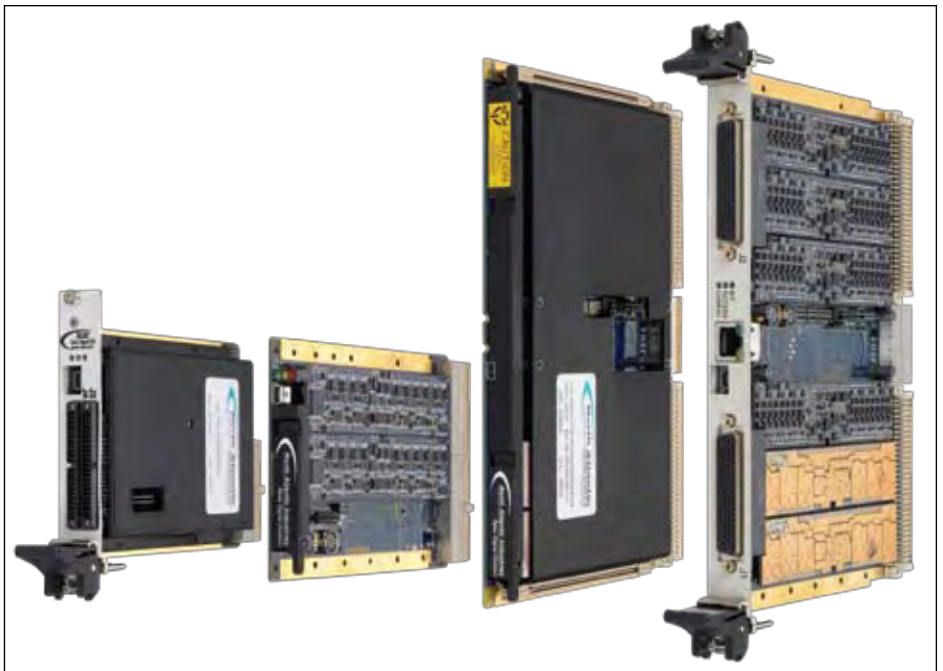

Figure 4

These VPX, VME, cPCI and PCI multifunction boards blend a variety of I/O technologies including ARINC429/575, CANBus, MIL-STD-1553, Synch/Asynch RS232/422/485, Discrete, TTL/CMOS and more.

quirements. The XPand3200 supports Gigabit Ethernet, graphics, RS-232/RS-422/RS-485, MIL-STD-1553, MIL-STD-188-114A, ARINC 429, discrete I/O, as well as custom conduction-cooled PMC/XMC I/O through the back panel D38999 circular connectors. An optional 32 Gbyte SATA SSD memory module provides the convenience of removable storage and the ruggedness of solid-state memory. An optional USB port provides system monitoring and maintenance capabilities.

I/O in Box-Level Systems

The emerging trend toward complete box-level systems has broadened to include some offerings that incorporate a variety of military-specific I/O. An example along those lines is Aitech Defense Systems' NightHawk RCU, an extreme rugged, compact Intel Atom-based, self-contained control unit that weighs only 4.5 pounds. This unit offers a slim profile and natural convection/radiation cooling that dissipates up to 22W at +55°C in stagnant (non-flowing) air, or at up to 71°C with an optional low pressure fan or baseplate.

Based on the low-power Intel Atom processor operating at 1.6 GHz, the new NightHawk provides up to 2 Gbytes of DDR2 SDRAM as well as between 4 and 8 Gbytes of SSD memory with an optional expansion up to 250 Gbytes for extended and remote data collection and storage applications. With a complete set of standard PC I/O interfaces, the NightHawk also provides two Gbit Ethernet ports, six USB 2.0 ports and four multi-function RS-232 serial ports, dual graphics/video ports, keyboard/mouse and stereo audio in/output ports as well as an I/O set specifically tailored for embedded military applications. Optional I/O includes MIL-STD-1553B, ARINC-429 and ARINC-708, CAN Bus, Wi-Fi and WAN ports as well as video capture and processing, discrete and analog I/O and an eight-port Gigabit Ethernet switch.

Multifunction Board Trend

Another important trend affecting military I/O is the emergence of multifunction board products. Semiconductor integration has enabled board-level products to cram multiple functions

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on a single card. Along just such lines, North Atlantic Industries (NAI) has made available ARINC429/575 support for its wide range of VPX, VME, cPCI and PCI Multifunction boards (Figure 4). Known as the A4, it joins an extensive list of functions that are currently available from NAI. The ARINC 429/575 A4 provides up to six programmable ARINC-429/575 channels. Each channel is software selectable for Transmit and/or Receive, High or Low Speed, and Odd or No Parity, supporting multiple ARINC429 and 575 channels simultaneously.

One major advantage of this multifunction approach is higher functional density, which reduces overall board count, thereby saving space and cost, reducing heat dissipation and increasing overall system reliability. Other available functions include A/D, D/A, Synchro/ Resolver/ LVDT/RVDT Simulation and Measurement, CANBus, MIL-STD-1553, Synch/Asynch RS232/422/485, Discrete, TTL/CMOS, Reference Generator, Differential Transceiver and Resistance Temperature Detectors (RTD). The ARINC429/575 function is supported on VPX, VME, cPCI and PCI Multifunction Boards with operating temperature ranges of -40° to +85°C and 0° to +70°C. ▮▮

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Expansion Bus	PC/104 ISA Bus			✓						✓	✓	✓	✓	✓	✓
	PCI-104 PCI Bus	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓
	PCIe/104 Express Bus	✓	✓												
CPU and BIOS	CPU Max Clock Rate (MHz)	1860	1200	1400	1400	1400	1400	1400	1400	650	650	650	650	500	500
	Intel SpeedStep Technology	✓	✓	✓	✓	✓	✓	✓	✓						
	ACPI Power Management	3.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	2.0	2.0
	Max Onboard DRAM (MB)	2GB	2GB	512	1GB	512	1GB	1GB	1GB	512	512	512	512	512	512
	RTD Enhanced Flash BIOS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Nonvolatile Configuration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	RTD Quick Boot	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	USB Legacy (Keyboard & Boot)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Peripherals	Watchdog Timer	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Solid State Hard Drive Disk Chip	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB
	Audio	HD	HD		✓	✓	✓	✓	✓		✓	✓	✓		
	Analog Video	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA
	Digital Video	LVDS	LVDS	LVDS	LVDS	LVDS	LVDS	LVDS	LVDS			TTL	LVDS	LVDS	
	PS2 Mouse/Keyboard/Utility Port	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	USB Mouse/Keyboard	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
I/O	RS-232/422/485 Ports	4	4	4	4	4	2	4	2	2	2	2	2	2	2
	SATA	2	2												
	USB 2.0	6	6	4	2	2	4	2	4	2	2	2	2	2	2
	Gigabit Ethernet	1	1												
	10/100Base-T Ethernet			1	1	1	1	1	1	1	1	1	1	2	1
	Parallel Port				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	aDIO (Advanced Digital I/O)	14	14	14	18	18	18	36	36	18	18	18	18	18	18
	aAIO (12-bit Advanced Analog I/O)	8	8												
	multiPort (aDIO, ECP, FDC)				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SW	ROM-DOS Installed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DOS, Windows, Linux	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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Bus		Active Bus	PCI	PCI	ISA	ISA	ISA	PCI	ISA	ISA	ISA	PCI	PCI	PCIe	PCI
		Passthrough Bus	ISA					ISA				ISA		PCI	ISA†
		DMA or PCI Bus Master	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓
		McBSP Serial Ports	✓	✓				✓							
ANALOG	Analog Input	Single-Ended Inputs	16	16	16	32	16	16							
		Differential Inputs	8	8	8	16	8	8							
		Max Throughput (KHz)	1250	1250	500		100	1250							
		Resolution (bits)	12	12	12	12	16	12							
		Input Ranges/Gains	3/7	3/7	3/4	3/4	1/4	3/6							
		Autonomous Calibration	✓	✓											
		Data Marker Inputs	3	3	3			3							
	Analog Out	Analog Outputs	2	2	2	4	2	2							
		Max Throughput (KHz)	200	200	200	200	100	200							
		Resolution (bits)	12	12	12	12	16	12							
		Output Ranges	4	4	3	3	1	4							
		D/A FIFO Buffer	8K	8K				8K							
	Advanced Features	Channel-Gain Table	1K	1K	1K	1K	1K	1K							
		Scan/Burst/Multi-Burst	✓	✓	✓	✓	✓	✓							
		A/D FIFO Buffer	8K	8K	8K	8K	8K	8K							
		Sample Counter	✓	✓	✓	✓	✓	✓							
		SyncBus	✓	✓				✓							
DIGITAL	Digital I/O	Total Digital I/O	16	16	16	16	16	16	48	18/9	64	48	48	48	48
		Bit Programmable I/O	8	8	8	8	8	8	24	6/0		48	48	48	✓†
		Input FIFO Buffer	8K	8K	8K	8K	8K	8K							
		Opto-Isolated Inputs									48				
		Opto-Isolated Outputs									16				
		User Timer/Counters	3	3	2	2	2	3	3	3		10	10	10	6
	Advanced Features	Advanced Interrupts	2	2	2	2	2	2	2			2	2	2	✓†
		Versatile Memory Buffer										4M	4M	4M	8MB
		External Trigger	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓†
		Incr. Encoders/PWMs								3/9		4/8	4/8	4/8	✓†

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System Development

Graphics/Video for Situational Awareness

Graphics and Video Advances Feed Situational Awareness Needs

Riding the wave of technology invented for gaming and consumer displays, the military is bringing full motion video, advanced graphics and high resolution to its situational awareness systems.

Jeff Child,
Editor-in-Chief

Leveraging cutting-edge graphics chips developed for the demanding gaming market, military graphics subsystems are now able to offer complex video and graphics functionality in highly integrated board-level solutions. Cockpit displays and simulation/training applications rank as two of the most demanding users of these advanced graphics technologies. But as the military migrates to a more network-centric mode of operations, situational awareness requirements are becoming ever more sophisticated—combining video, graphics, voice and text in real time.

An example of today's more sophisticated military display needs is Z Microsystems Intelligent Display Series (IDS) panels (Figure 1). Z Microsystems last month announced the first shipment of its ground control displays on a multi-million dollar contract to upgrade UAV ground stations. Acting as a subcontractor to a major supplier of UAS, Z Microsystems displays will be used by ground control station operators and analysts in the U.S. military to monitor live video feeds.

Figure 1

These display panels to be used in a UAV Ground Control upgrade will allow operators and analysts in the U.S. military to monitor live video feeds. The displays offer multiple PiP (Picture-in-Picture) windows and are designed to work in unison with the Any Image Anywhere (AIA) image enhancement system.

Z Microsystems' display panels are available with 17, 21 and 24-inch active display areas. The displays offer multiple PiP (Picture-in-Picture) windows and offer numerous mounting options. The ground control displays are designed to work in unison with the Any Image Anywhere (AIA) image enhancement system, which executes image enhancement algorithms in real time on live, full-motion video.

High Definition Meets Rackmount

Sophisticated graphics and video data are becoming the norm for military situational awareness systems. Addressing those and similar applications, Neuro Logic Systems recently announced what it's calling the world's largest ruggedized 2U rackmount HD-ready 24-inch LCD (Figure 2). Designed for installation in a standard 19-inch RETMA equipment rack or military transport case, it provides the largest high-resolution video display in the smallest storage space.

The RFTD-24-R display is fully operational in the rack or transit case,

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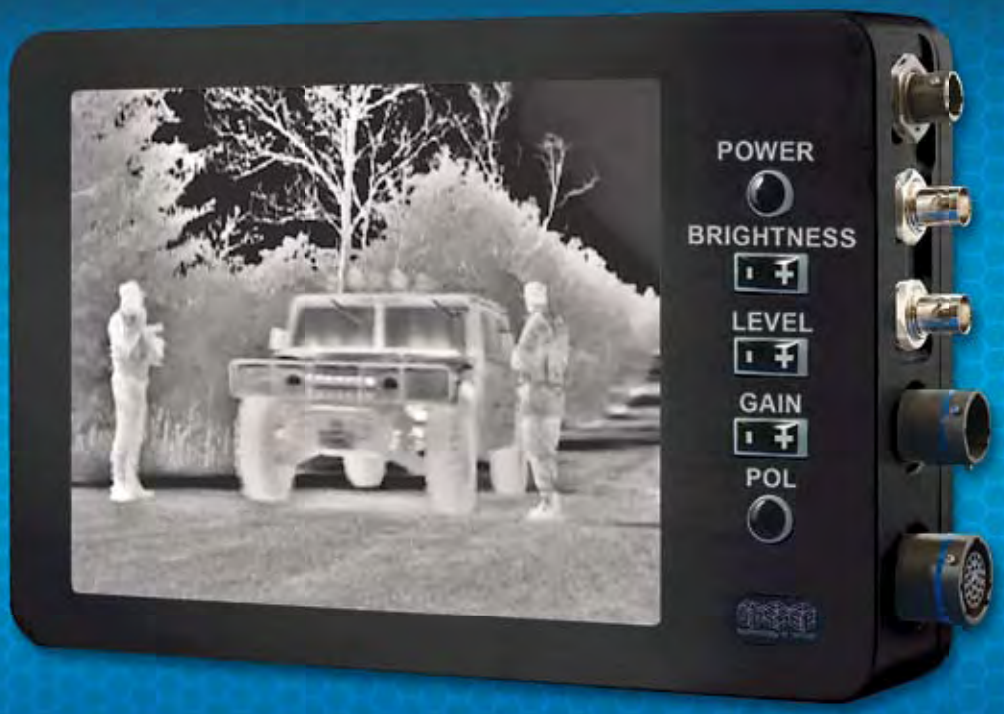

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Military ISR Info Overflow: Dealing with the Deluge

One of the core situational analysis challenges facing today's military is the inability to properly process that huge amount of ISR data that's coming in from multiple sources. That data in its raw form is comprised of massive amounts of signal and imagery data. The problem is that the intelligence processing and exploitation capability has been limited to highly trained analysts and applicable only after the threat occurred. That limits the ability of non-technical individuals to "connect the dots" and affect mission outcomes in real time.

By applying signal processing algorithms to this problem it's possible to detect potential threats as they surface. That can be done by doing end-to-end services including signals collection and presenting data as an automated multi-sensor fusion dashboard for non-technical operators, displaying user-friendly, actionable information across multiple assets as threats occur. This can be applied to deep domain expertise in signals intelligence (SIGINT), measurement and signature intelligence (MASINT) techniques, and to cyber security.

With those goals in mind, IvySys has leveraged its Real-Time Intelligence Analysis technology to create the Next-Generation Exploitation Optimization System (NEOS) (Figure 1). The core components of IvySys' NEOS are the Intelligence Processing Unit (IPU) and the Coherent Processing Engine (CPE). The IPU compresses vast amounts of data into channelized spectral information using advanced signal processing algorithms, whereas the CPE aggregates information from a number of IPUs, draws correlations (connects the dots) and presents intelligence in an actionable format.

Figure 1

NEOS compresses vast amounts of data into channelized spectral information using advanced signal processing algorithms. It aggregates information, draws correlations (connects the dots) and presents intelligence in an actionable format.

By applying its expertise in optimized signal processing algorithms, IvySys can adaptively detect anomalies in network traffic for real-time Network Intrusion Detection Systems (NIDS). The simplicity of the automated dashboard enables any user to identify a threat type, localize the threat and then be able to neutralize it, turning intelligence analysis from reactive to proactive.

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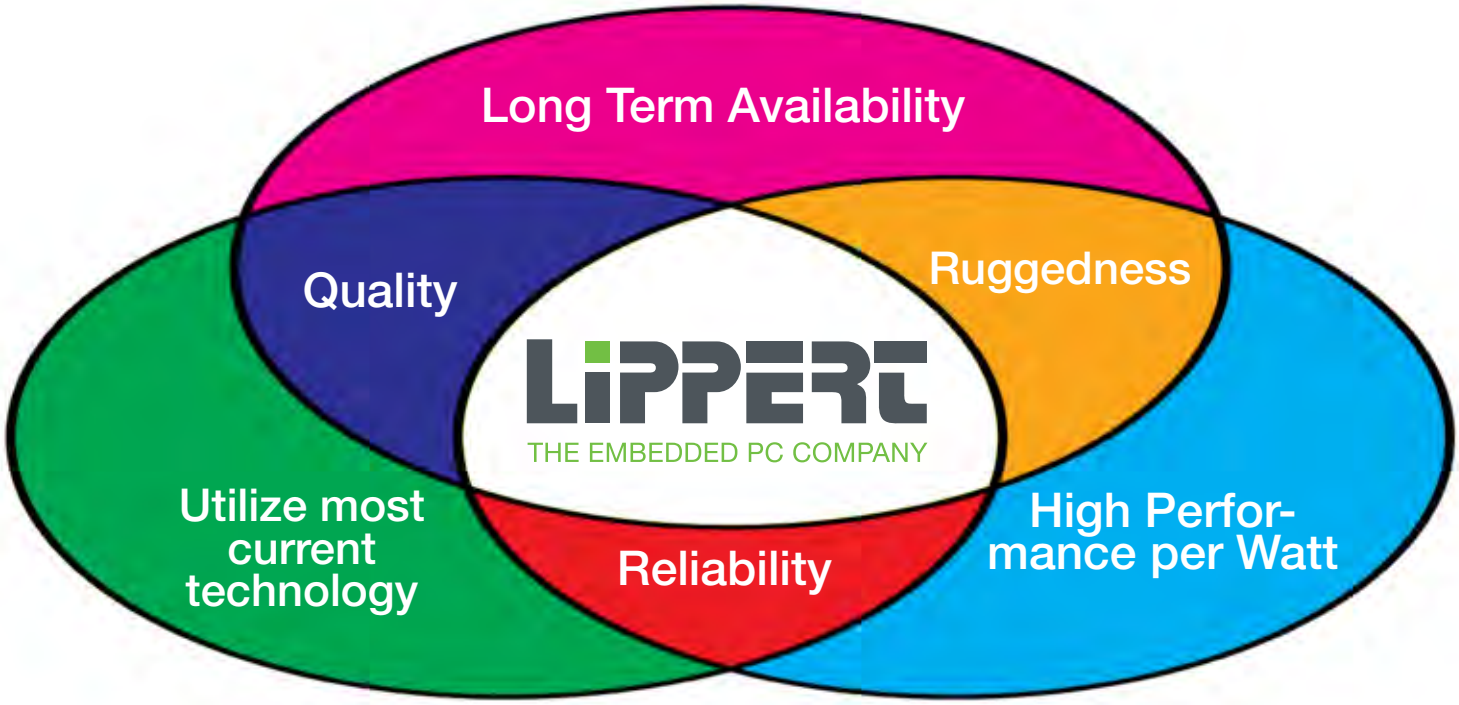

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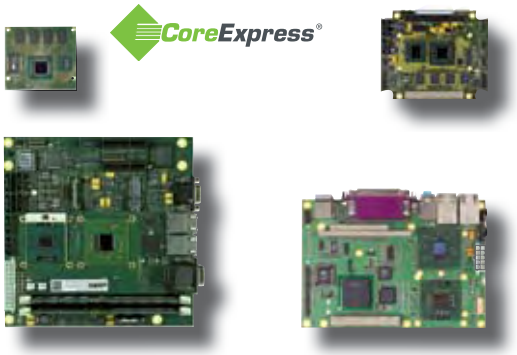

Model	Format	CPU, Clock	RAM (max)	Miscellaneous
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Cool XpressRunner-GS45	PCI/104-Express	Core™ 2 Duo	1 GB	LAN, SATA, USB
Cool RoadRunner-945-GSE	PC/104-Plus	Atom™ N270 1.6 GHz	2 GB soldered	LAN, 2 GB SSD, SATA
Cool RoadRunner-PM	PC/104-Plus	Pentium® M 0.6 ... 1.8 GHz	1 GB	LAN, USB
Cool RoadRunner-4	PCI-104	Pentium® M 0.6 ... 1.8 GHz	1 GB	LAN, USB
Hurricane-PM	EPIC	Pentium® M 0.6 ... 1.8 GHz	1 GB	LAN, USB, uDoC
Thunderbird	Mini-ITX	Pentium® M 0.6 ... 1.8 GHz	1 GB	LAN, MiniPCI
Thunderbird/MM	Mini-ITX	Pentium® M 0.6 ... 1.8 GHz	1 GB	LAN, USB, uDoC, Mini PCI, DVI, SPDIF, IEEEE1394
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and the modular display head can be easily removed and placed on a desktop stand for added convenience. All features and components are installed in an aluminum alloy housing designed to meet Military Specifications 461E, 167, 810 and 901D. Although originally designed for military use, the RFTD-24-R can be used in any harsh environment.

Big Screen Sophistication

At the Command and Control level, it has taken some pushing to get strategic military officers to part comfortably with their elaborate set of wall maps. Now that reliable, advanced wall-mounted displays have emerged, those old paper maps are finally being replaced with electronic displays across the board. An example along those lines, the U.S. Air Force's Advanced Displays and Intelligent Interfaces (ADII) program has developed the Interactive DataWall (IDW) to facilitate better information management and improve situational awareness in battlefield command and control environments. To achieve this capability, the ADII program's Interactive DataWall uses RGB Spectrum's SuperView multi-image display processors with three high-resolution video projectors tiled onto large screens.

The Interactive DataWall fosters collaboration and participation among decision makers. Each IDW uses three SuperView processors to create a tiled display of screens positioned to create a single continuous image. The SuperView

Figure 2

This ruggedized 2U rackmount HD-ready 24-inch LCD display is designed for installation in a standard 19-inch RETMA equipment rack or military transport case.

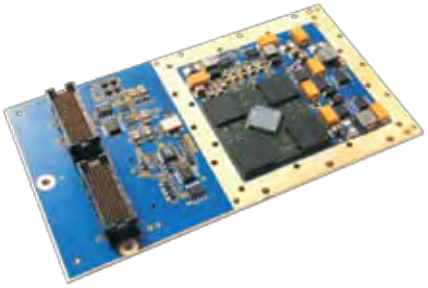
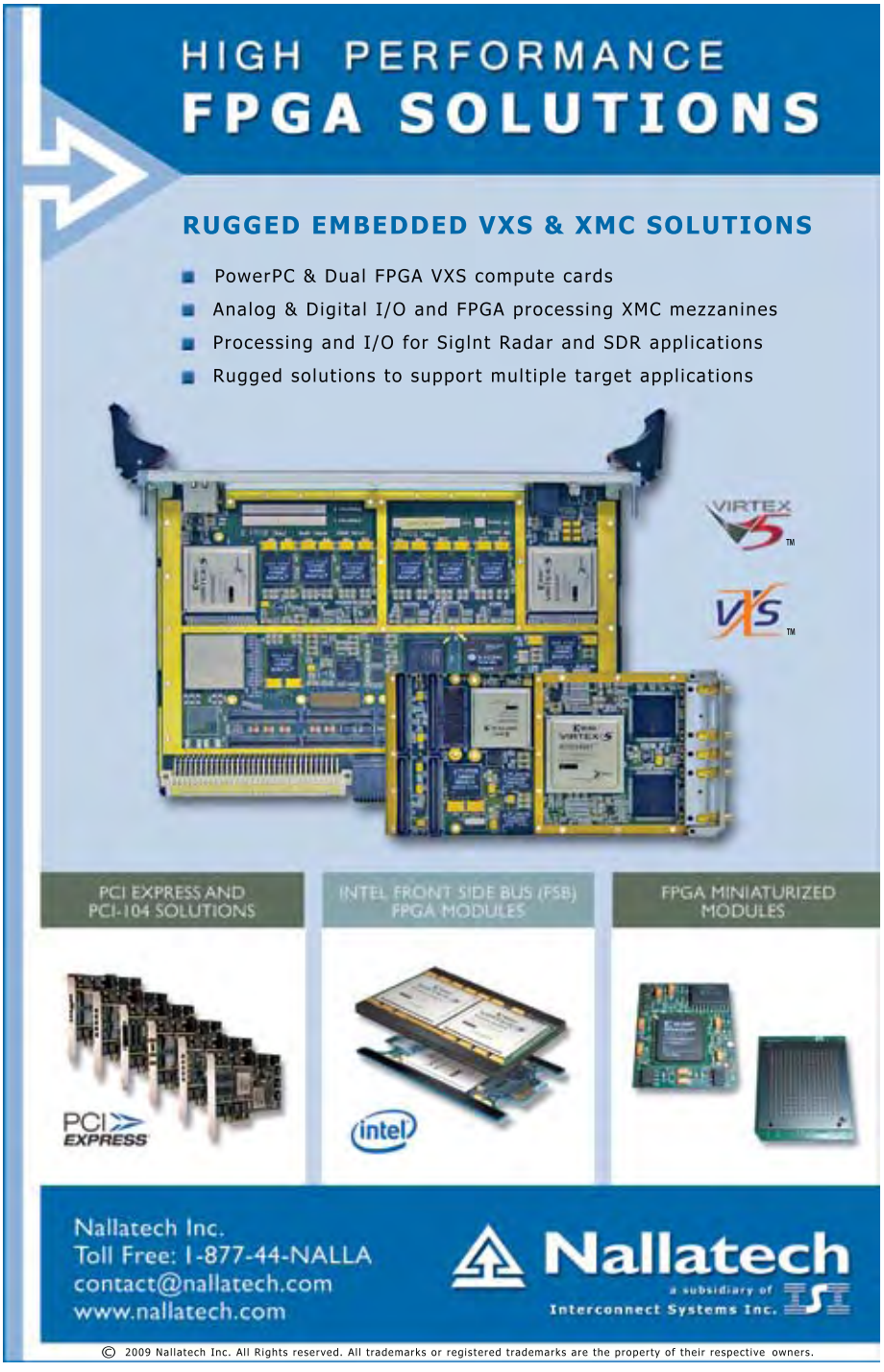


Figure 3

This XMC video graphics daughter card offers 2D and 3D rendering speeds that exceed that of previous-generation ATi Radeon units by more than 10 times. The board offers 28 standard combinations of dual independent display output.



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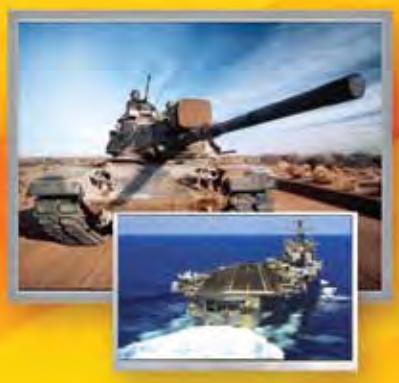

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Figure 4

Military simulation technology is leveraging the latest in full-motion graphics and video. Shown here, *COTS Journal*'s Jeff Child checks out a vehicle-mounted precision firing simulator at AUSA in Fort Lauderdale.

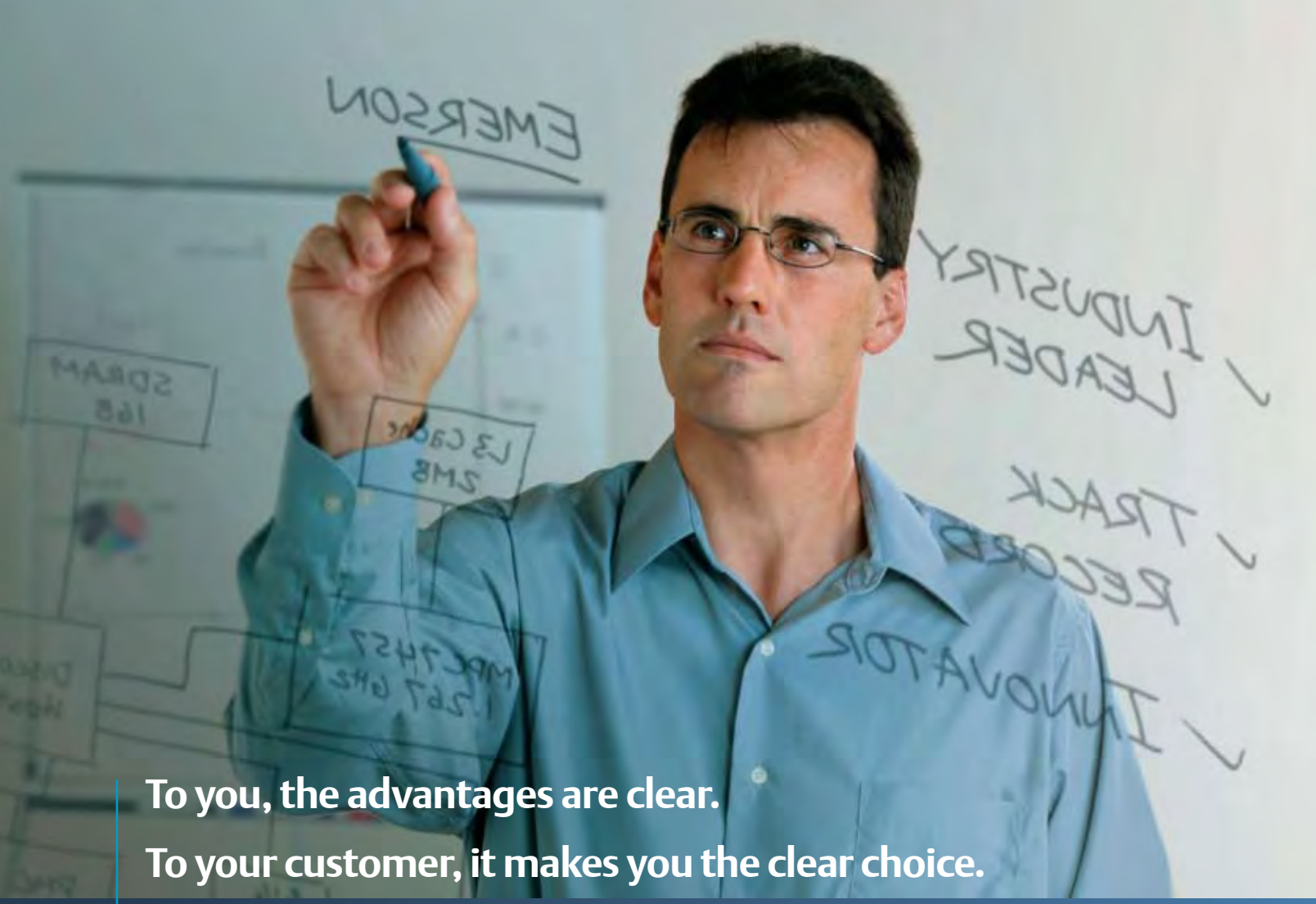
processor's advanced image processing performance provides high levels of detail and viewing clarity, especially useful for depicting intricate graphical maps and satellite imagery. The SuperView processor can display up to twelve real-time video and computer signals on a single high-resolution screen.

3D Enters the Game

Gone are the days when basic text displays were sufficient for military situational awareness needs. Full-motion video, advanced graphics and even 3D are now requirements. Wolf Military and Aerospace now offers three new, legacy XMC bus, video graphics daughter cards. The 2D and 3D rendering speed of these cards exceeds that of previous-generation ATi Radeon units by more than 10 times. Wolf's XMC-E4690 high-performance graphics cards (Figure 3) offer 28 standard combinations of dual independent display outputs: DVI, DP, HDMI, single and dual links, LVDS, TMDS, VGA, SCART, STANAG 3350-A;B or C, NTSC, RS170, RS343A, PAL and SECAM. And the XMC-E4690-XTCC-MV offers 28 combinations of dual channel video output, and dual independent video channel inputs.

Technologies like 3D and full-motion video are particularly pushing the envelope in military training and simulation systems. In an example, earlier this year GE Intelligent Platforms received an order for automatic video trackers from Link Simulation and Training of Arlington, Texas. The order is for a number of GE ADEPT74 real-time video tracker processing boards that will be employed as a major element of the U.S. Army's AVCATT (Aviation Combined Arms Tactical Trainer) AH-64D simulation and training system upgrade program.

The GE Intelligent Platforms ADEPT74 is a full-featured automatic video tracker and image processor. It was chosen for its flexibility, powerful process-



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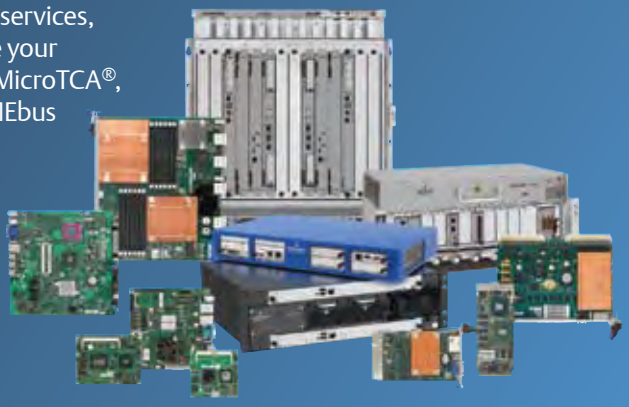

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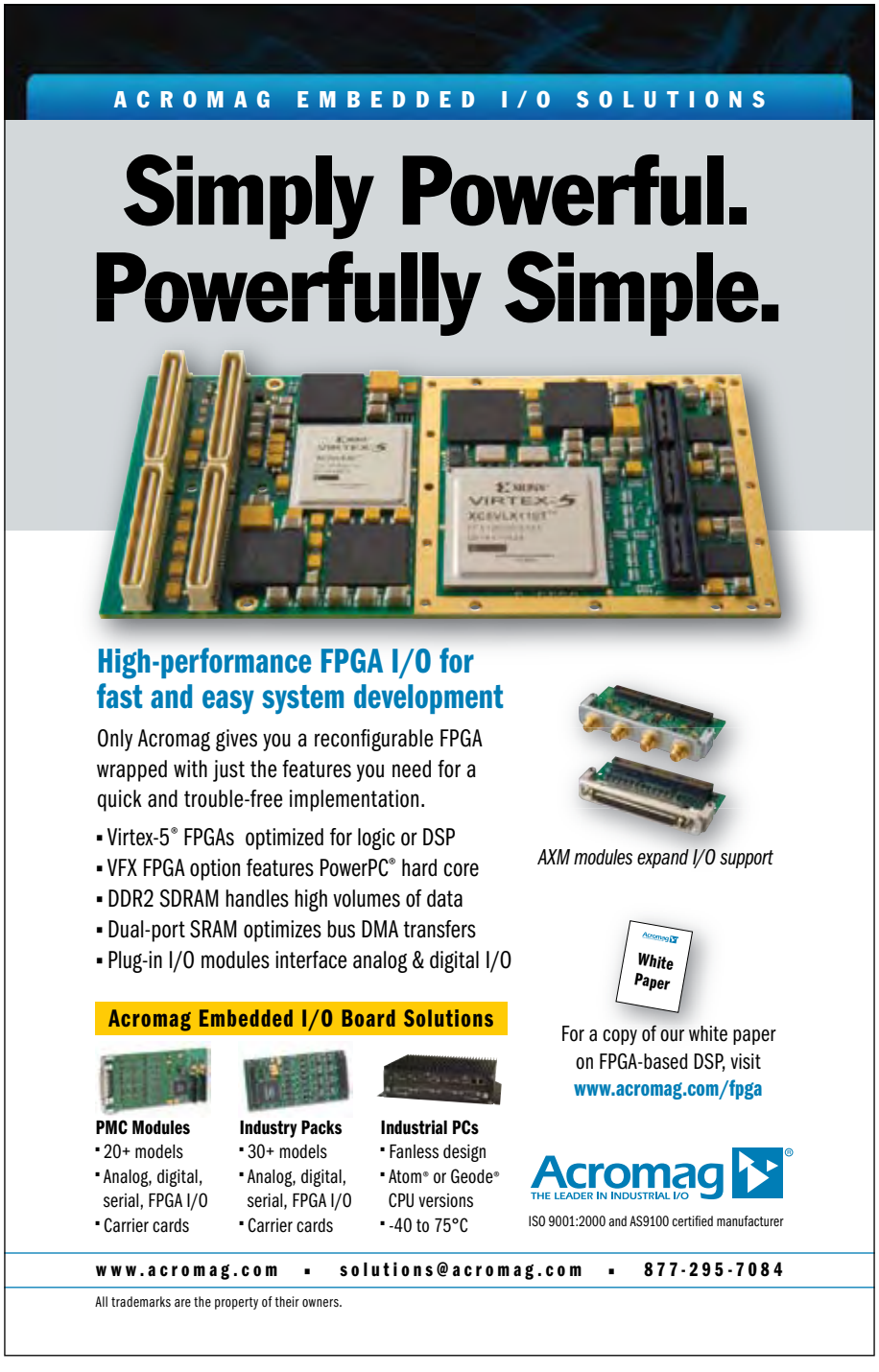
ing capability, and the facility to take the input of high-speed digital data directly from electro-optical sensors. A PMC site on the board allows the ADEPT74 greater flexibility for the provision of additional input video formats and image processing functionality. AVCATT is a mobile and reconfigurable virtual simulation system designed to support unit collective and combined arms training. Each AVCATT suite provides six manned modules, reconfigurable to any combination of attack, reconnaissance, lift and/or cargo helicopters. Platforms that can be simulated include AH-64A, AH-64D, OH-58D, UH-60A/L and CH-47D. AVCATT is employed to train both active and reserve component aircrews deploying in support of overseas contingency operations.



Realism Now Possible

The application of sophisticated graphics and video technology along with today's level of computing muscle is enabling new levels of realism in military simulators (Figure 4). Earlier this year Presagis announced that Lyra, along with other Presagis tools, was delivered as part of a Boeing-developed solution for the United States Air Force F-15C Eagle tactical fighter training program. In November 2009, Boeing fielded the four F-15C Visual Systems Trainers. Presagis Lyra and Lyra Sensors COTS Visual Runtime software were integrated into the training system to provide realistic out-the-window, infrared sensor and night vision goggle views for the fighter jet scenarios. The Presagis Technical Services team also supported the development of the simulator's Visual Database.

Depicting visual cues—exactly the way a pilot would see it if they were looking at the landscape through night vision goggles or from the cockpit—is critical to a positive training experience and success in the actual aircraft. With Presagis tools, Boeing can efficiently create the immersive and high-fidelity scenarios the Air Force needs to train their personnel. Presagis Lyra, a multichannel visualization system delivering 60 Hz image generation out of the box, provides out-the-window scenes with complex weather and environmental special effects. Lyra Sensors provides simulated views from the aircraft's infrared sensors as well as accurately replicating the pilot's night vision goggles system.

DisplayPort Moves to Embedded

DisplayPort, a relatively new digital display interface standard put forth by the Video Electronics Standards Association (VESA), defines a new royalty-free, digital audio/video interconnect intended to be used primarily between a computer and its display monitor, or a computer and a home theater system. DisplayPort is a competitor to the HDMI connector (with HDCP copy-protection), the de facto standard digi-

tal connection for high-definition consumer electronics devices. The military is more likely to embrace the royalty-free DisplayPort. Another competitor was Unified Display Interface, however, the founding companies abandoned UDI in favor of DisplayPort.

Kontron offers a 3U CompactPCI multicore board with the CP308-MEDIA extension card, which is one of the first embedded products to feature DisplayPort. With S/P-DIF-Out audio and the stereo audio ports for Line In, Line Out and Microphone, the processor board with the KCP308-MEDIA card from Kontron adds extensive multimedia capabilities to embedded computing. The CP308-MEDIA features the 45nm Intel Core 2 Duo processor running at up to 2.26 GHz, the most powerful embedded Intel GS45 Graphics and Memory Controller Hub, up to 8 Gbytes of energy-efficient DDR3 RAM, and the Intel I/O Controller Hub ICH9M. The CP308-MEDIA features two DisplayPort interfaces on the front for direct-drive, end-to-end communication between the board and different panels. Compared to DVI or LVDS, DisplayPort reduces cabling, connector footprint and minimizes the need for additional monitor electronics for panel control. The latching DisplayPort connector guarantees utmost mechanical stability. With conventional adapters, DisplayPort also connects to HDMI, DVI or VGA monitors. ▮▮

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

Kontron
Poway, CA.
(888) 294-4558.
[www.kontron.com].

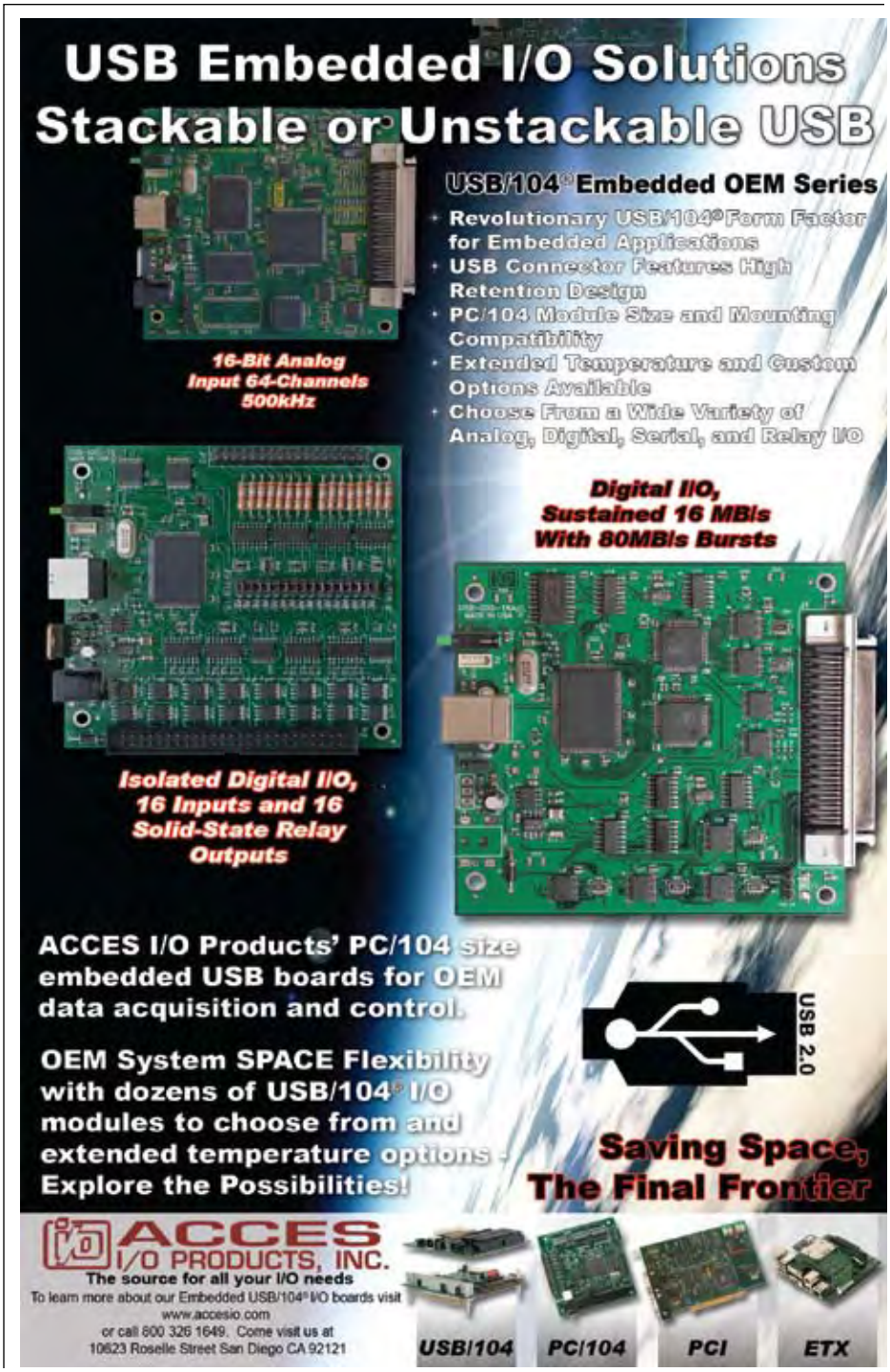
Neuro Logic Systems
Camarillo, CA.
(805) 389-5435.
[www.nlsdisplays.com].

Presagis
Montreal, Quebec
Canada.
(514) 341-3874.
[www.presagis.com].

RGB Spectrum
Alameda, CA.
(510) 814 7000.
[www.rgb.com].

Wolf Industrial Systems
Uxbridge, Ontario, Canada.
(800) 931-4114.
[www.wolf.ca].

Z Microsystems
San Diego, CA.
(858) 831-7000.
[www.zmicro.com].



Technology Focus

PC/104 and PC/104-Family Boards

PC/104 Camp Ropes in Multiple Interconnect Schemes

As PC/104 and its follow-on variants mature, a wealth of interconnection and interface compatibility—to PCI Express, USB, SUMIT and more—is strengthening its capabilities.

Jeff Child,
Editor-in-Chief

PC/104 and all of its follow-on variants continue to hold an established position in military embedded systems. Now, as PCI Express and USB make their way into the PC/104 universe, military system developers are no longer confined to ISA bus speed limitations. By leveraging the PC as its core foundation, PC/104—and its wider family of form factors including PC/104-Plus, PCI-104 and EPIC—has been able to leverage all facets of the PC infrastructure. The Consortium has detailed a consolidated and consistent stackable PCI Express roadmap, starting with the adoption of the PCI/104-Express and PCIe/104 specifications. The first one brought PCI and PCI Express buses together to form PCI/104-Express. For additional room on a module, the second one—PCIe/104—removes the PCI bus. This stackable PCI Express bus was incorporated across the Consortium's 104, EPIC and EBX form factors. A new high-speed surface mount connector was specially sponsored and designed for this application.

Military system designers gravitate to PC/104 because of its ultra-small 3.55-in. x 3.775-in. form factor. For example, the small size allows PC/104 CPUs, and even complete multiboard systems, to be placed in the nose cone of a missile or fit nicely inside a small UAV. The Scan Eagle UAV (Figure 1) for example has used a PC/104 SBC as part of its network control subsystems. Scan Eagle is a small GPS-guided UAV that can fly up to 15 hours and transmit real-time imagery directly to its home base.

The PC/104 camp has begun to embrace some of the work coming out of the Small Form Factor SIG. The SUMIT-ISM Specification documents the use of SFF-SIG's flexible SUMIT (Stackable Unified Module Interface Technology) interface on popular 90 x 96 mm stackable modules. The ISM Specification provides an explicit form-factor-only definition upon which the SUMIT-ISM Specification is built. Because the SUMIT Specification itself defines only a board-to-board interface (connectors and pin definition), the ISM Specification was needed to define the form factor while the SUMIT-ISM Specification defines how SUMIT is implemented on ISM modules. This enabled SUMIT-ISM modules to be created with legacy support for either the PC/104 ISA bus or the PCI-104 PCI bus by allowing the module to be rotated 180 degrees as necessary to fit the legacy type required while maintaining the SUMIT interface. Legacy bus support can be supplied by the CPU and maintained up the stack, or can be provided through a bridge module in the stack itself.

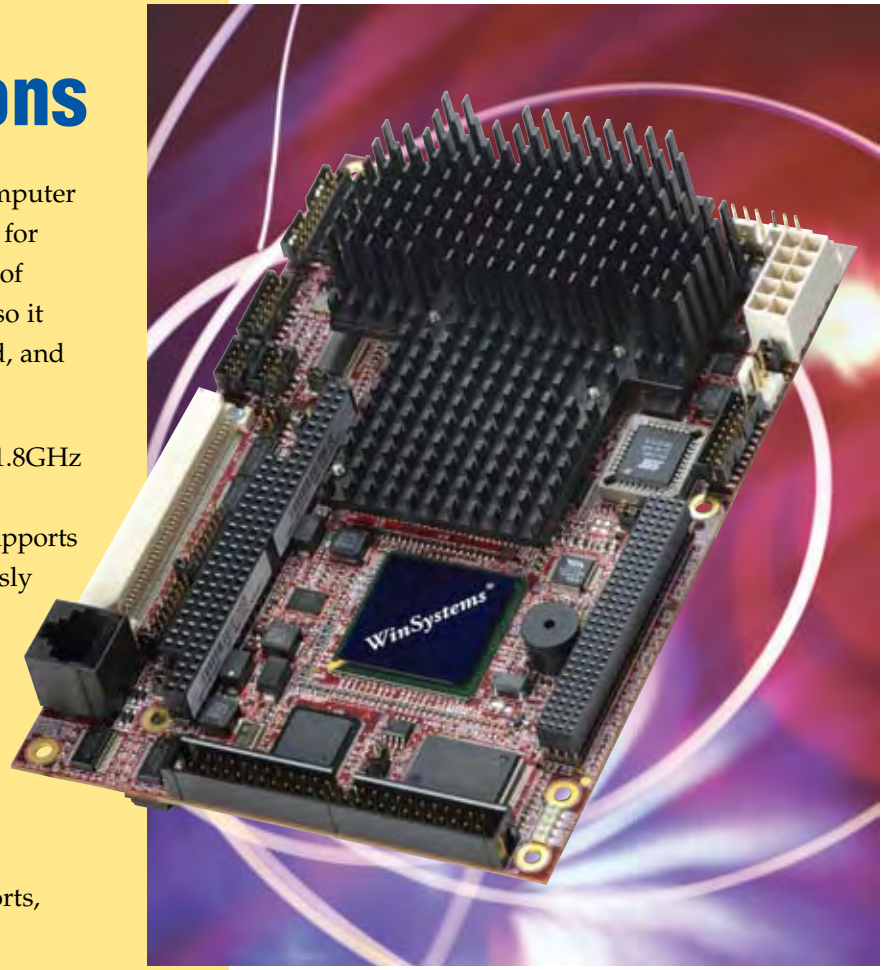
Figure 1

A Scan Eagle UAV launches from the Navy Surface Warfare Center (NSWC) Dahlgren test range. This small GPS-guided UAV can fly up to 15 hours and transmit real-time imagery.

The roundup on the following pages showcases some representative examples of PC/104, PC/104-Plus, PCI/104-Express and EPIC single board computer products. Many of these vendors offer both PC/104 and EPIC families of products. However, for the purposes of this product roundup, vendors were asked to include just one of their PC/104 or PC/104-related products. ■

A 1GHz Fanless Rugged SBC of *EPIC* Proportions

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



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

Technology Focus:

PC/104 and PC/104-Family Boards Roundup

Rugged EPIC SBC Features SUMIT Expansion

The SUMIT interconnect scheme provides an innovative way to aggregate a variety of I/O types onto a compact connector. Marrying that idea to the EPIC form factor, ADLINK announced the release of the latest rugged EPIC SBC, the ReadyBoard 850. The first of the ReadyBoard family to include the SUMIT expansion connector, the board supports both a single mezzanine card and multiple modules in a stack for optimal flexibility. The board is based on the Intel GM45/ICH9-M chipset

with the Intel Socket P processor socket, which supports a wide range of CPUs—from entry-level Intel Celeron M processors to the latest Intel Core2 Duo processors.

To satisfy the most extreme conditions, the ReadyBoard 850 has an operating temperature range of -20° to +70°C and meets MIL-STD-202 vibration up to 11.95 Grms and shock up to 15 Grms (peak-to-peak). The board has up to 4 Gbytes of 1066 MHz DDR3 RAM, two PCI Express x1 lanes. one PCI Express x4 lane, two Ethernet ports, two SATA ports and up to 8 USB ports. Both VGA and LVDS connectors are provided, along with two serial ports. Software support includes a full range of popular embedded and desktop operating systems including Linux (Ubuntu), VxWork 6.6, QNX 6.3, Windows Embedded CE 6.0 and Windows XP Embedded. The single unit list price of the ReadyBoard 850 starts in the $600s in quantity.

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

PC/104-Plus Card Combines Atom and Rich I/O

The desire to reduce Size, Weight and Power (SwaP) has fueled a great deal of interest in the low-power Atom processor. Advantech offers an Intel Atom industrial-grade PC/104-Plus CPU board. The PCM-3362, with the latest Atom N450 processor, features a new super-low-power design that doesn't sacrifice performance. Rich I/O connectivity is provided with up to four USB 2.0 and three COM ports integrated into a standard 96 x 90 mm form factor. Even better, this PC/104-Plus CPU board supports dual display for LVDS and CRT. PCM-3362 is ideal for outdoor integration in military, transportation and diverse space-saving embedded applications. PCM-3362 delivers super low power consumption and extended

temperature support, ranging from -40°~85°C in a ruggedly built board that's highly resistant to vibration.

PCM-3362 incorporates an Intel Atom processor that produces a Thermal Design Power (TDP) rating of less than 5.5 watts—designed to enable space-efficient solutions with outstanding power saving features. The Graphics and Memory Controller Hub (GMCH) running at 1.66 GHz is designed on the same chip as the CPU—a first for Intel—and together with the Intel ICH8M chipset, the maximum power consumption comes in at a mere 12 watts. PCM-3362 has a 667 MHz Front Side Bus (FSB) and accepts up to 2 Gbytes of DDR2 667 SDRAM. PCM-3362 comes with exciting expandability.

Advantech
Irvine, CA.
(800) 866-6008.
[www.advantech.com].

SBC Melds Together Atom, ETX and PC/104-Plus

Roomier than PC/104, ETX has secured its own niche as a popular non-backplane form factor. And by adding PC/104-Plus expansion, developers get the best of both worlds. Along just those lines, Diamond Systems has launched Pluto, a compact, I/O-rich, board-level embedded computer based on an Intel Atom processor and featuring modular PC/104-

Plus expansion. PLT-N270-1G is the first in a series of Pluto models offering scalable CPU performance and power consumption. It integrates a low-power 1.6GHz Intel Atom processor along with up to 2 Gbytes of DDR2 SDRAM, and boasts a wide -20°C to +70°C operating temperature.

Pluto's advanced high-resolution display controller supports analog and LVDS-interfaced CRTs and LCDs and also provides a TV output option. Pluto's set of I/O interfaces also includes: two 10/100 Mbit/s Ethernet LAN ports, an IDE interface, two SATA interfaces, four USB 2.0 ports and four serial ports. Physically, Pluto is a low-profile board-set comprising an ETX CPU module mated with an ETX-sized (4.5 x 3.7-inch; 114 x 95mm) I/O baseboard. A PC/104-Plus socket on Pluto's top side makes it easy to tailor the system to an embedded application's precise requirements by plugging in suitable PC/104 (ISA), PCI/104 (PCI), or PC/104-Plus expansion modules. Shipping now, the Pluto PLT-N270-1G—based on a 1.6 GHz Intel Atom processor and equipped with 1 Gbyte SDRAM and a heat-spreader—is priced at $599 (quantity 1). An interface cable kit is available for $45.

Diamond Systems
Mountain View, CA.
(650) 810-2500.
[www.diamondsystems.com].

Rugged PC/104-Plus Card Sports Atom Processor

Rugged military applications, in-vehicle ones in particular, require a blend of extended temperature range and low power operation combined with high performance. With all that in mind, Eurotech has launched its ISIS XL, a rugged PC/104-Plus Board based on the Intel Atom processor Z5xx series platform. The ISIS XL offers high-performance, x86 compatibility in a fanless design that requires only a fraction of the power previously needed for comparable systems. A full range of onboard peripherals is provided including 8 x USB 2.0 ports, VGA, LVDS, HD-Audio, RS-232/422/485, Ethernet, GPIO and IDE. Expansion requirements are well covered by a combination of PC/104 (ISA), PC/104+ (PCI) and PCI Express Mini Card,

so interfacing to real-world I/O or the latest wireless technology is easy.

Requiring less than 5W of power and running at up to 1.3 GHz for the industrial-grade ISIS XL and up to 1.6 GHZ for the commercial-grade ISIS, both modules have all the functionality and connectivity previously associated with much larger and more power-hungry systems. The ISIS and ISIS XL come with up to 1 Gbyte of DDR2 RAM and 4 Gbytes of soldered-down flash for security and durability. Further solid-state flash expansion is available via an SDIO socket. The ISIS XL will be available in the second quarter of 2009.

Eurotech
Columbia, MD.
(301) 490.4007.
[www.eurotech.com].

Atom Processor and GPS Ride PCI/104-Express

A host of power-sensitive military applications—ranging from small UAVs and UGVs to handheld devices—are hungry for lower power embedded computing. Based on the latest Intel Atom processor, a PCI/104-Express board called the MSM200X/XL/XP from Kontron provides all standard PC interfaces required for such demanding applications, including Ethernet LAN, an

audio controller (HDA-AC97), four RS-232 interfaces, two SATA and one PATA interfaces. In addition, the PCI/104-Express bus (PCI + PCIe), PCIe Minicard and six USB interfaces are available as functional extensions.

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

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

StackableUSB Carrier Boards Support SUMIT 104 Spec

The SUMIT connector interface ranks as one of the most innovative approaches to maximizing small form factor board space. Micro/sys has added to the growing line of StackableUSB carrier and hub boards with the addition of a SUMIT version, enabling StackableUSB I/O modules to make plug-and-play connections to SUMIT CPU single board computers. The CRR-SUMIT and HUB-SUMIT attach to SUMIT-enabled 104 Form Factor (3.55 x 3.775 inch) SBCs providing OEM users four bays for the powerfully small StackableUSB I/O modules that come either USB, SPI or I2C enabled.

Micro/sys offers a root-port carrier and a hub version. The HUB-SUMIT expands a single

USB port from the SBC into four USB channels. Alternatively, the CRR-SUMIT allows an OEM to interface with up to four separate root USB ports from the SBC, assuming the SBC has that number of Client ports. Additionally, for users who are concerned about stacking I/O devices directly over the CPU (as the SUMIT standard requires), the CRR-SUMIT and HUB-SUMIT solve OEMs' space concerns for air circulation. The basic CRR-SUMIT starts at $125 in single quantity. The basic HUB-SUMIT starts at $150 in single quantity.

Micro/sys
Montrose, CA.
(818) 244-4600.
[www.embeddedsys.com].

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733 MHz Eden-Based EPIC Card Is Conduction-Cooled

In many defense and aerospace platforms, Size, Weight and Power (SWaP) are critical design considerations. Developed for applications that need all three, Octagon Systems offers the EPIC form factor XE-900 SBC, designed to operate in harsh, demanding environments. The XE-900 incorporates the 32-bit, low-power VIA Eden ESP CPU family. Three versions are available: the 400 MHz and 733 MHz versions operate at -40° to +85°C, and the 1 GHz version operates at -40° to +75°C. Memory includes 512 Kbytes of surface mount flash for BIOS, a SO-DIMM socket for up to 512 Mbytes of SDRAM, and 1024 bytes of user-available serial EEPROM. ATA-4 hard drive and CompactFlash interfaces support up to three drives: CD-ROM, hard drive, EIDE flash drives

and other EIDE devices. The board includes CRT and flat panel video, six RS-232/422/485 serial ports, two USB ports, 10/100 Base-T Ethernet, PC/104 and PC/104-Plus expansion and 24 lines of bit-programmable, digital I/O with 16 mA sink/source capability. It features ACPI 2.0 and PCI power management. The conduction-cooling system eliminates the need for a fan even at 1 GHz.

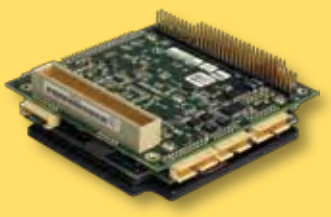
Companion XE-900 OS Embedder kits are available for Linux 2.6 and Windows XP. These kits combine hardware and software for instant-on operation. The single piece price is $795 for the 1 GHz version, $745 for the 733 MHz version, and $695 for the 400 MHz version. Volume discounts are available for all three.

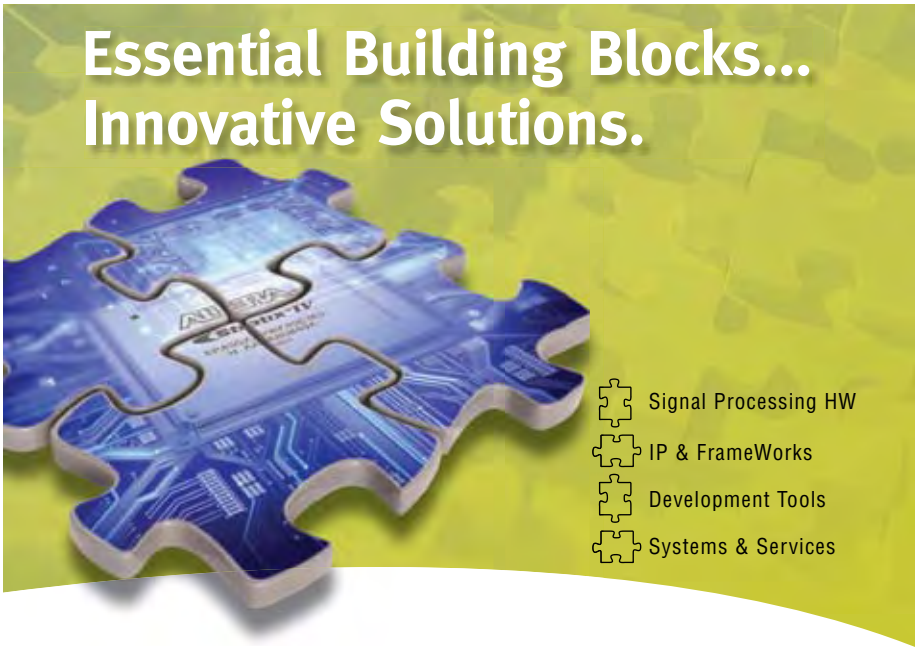
Octagon Systems
Westminster, CO.
(303) 430-1500.
[www.octagonsystems.com].

Pair of PC/104-Plus Boards Eyes Rugged Apps

Compute density has become the watchword in numerous military applications such as UAVs, vetronics and avionics systems. Feeding such needs, Parvus has unveiled its CPU-1472 and CPU-1474, two PC/104-Plus form factor SBCs featuring the low-power Intel Celeron M 1 GHz processor and Intel i855GME chipset. The CPU-1472/74 cards operate without any active cooling (fanless) over standard (0° to +60°C) and extended (-40° to +85°C) operating temperature ranges. Like other Parvus/Eurotech CPU modules, system DRAM is soldered on board to enhance shock/vibration resistance, and each card is individually thermally qualified to ensure high reliability. A structural heat spreader plate is integrated on top of each CPU module to dissipate heat from critical components.

The CPU-1474 features dual Local Area Network (LAN) controllers (Gigabit and Fast Ethernet) and four USB 2.0 ports, along with





Simplify FPGA Integration and Implementation with BittWare's ATLANTiS™ FrameWork

Implementing complex signal processing on FPGAs? No need to spend most of your design effort on infrastructure and integration. BittWare's ATLANTiS FrameWork provides a simpler, more efficient approach:

- Follows a software-like FPGA development methodology
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- Allows straight-forward integration of components
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Implemented in Altera® Stratix® family FPGAs

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standard PC peripherals and I/O interfaces, including dual serial ports, TFT/LVDS interfaces, AC97 audio interface, keyboard and mouse ports, and IDE controller. The CPU-1472 is similar but provides a total of eight USB 2.0 ports and a single 10/100 Ethernet controller. These x86 CPU modules are compatible with Linux, Windows XP Embedded and other popular operating systems. Hardware development kits (DTKs) and accessories are available, as well as professional services for systems engineering of rugged box-level solutions tailored to customer requirements.

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

1.86 GHz Core 2 Duo Climbs aboard PCI/104-Express

PCI/104-Express marries the legacy of the PCI/104 form factor to the realm of speedy switched fabrics. RTD Embedded Technologies does just that with its latest Core 2 Series of cpuModules with Intel Core 2 Duo Processor and 1 Gbyte of SDRAM. These boards are powered by the GS45 chip set from the "Montevina" platform. A dual-channel DDR2 memory interface ensures adequate memory bandwidth to keep up with both processor cores. An Intel Gen 5.0

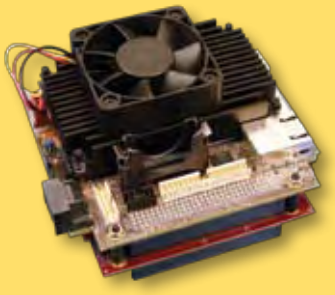
integrated graphics engine provides extensive rendering capabilities. Some of this CPU's I/O features include Gbit Ethernet, three SATA hard drive connections plus an onboard SATA Disk Chip, up to six USB 2.0 ports, up to four RS-232/422/485 serial port, analog SVGA and digital LVDS video ports.

These modules also support RTD's Advanced Digital I/O and Advanced Analog I/O (aAIO), which allows them to be used as single board solutions for some data acquisition and controller applications. The Core 2 Series cpuModules and controllers are available in PCI/104-Express and PCIe/104 form factors.

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

PC/104-Plus SBC Serves Up Core 2 Duo CPU

PC/104-Plus is an ideal platform for meeting today's need for higher compute density. Feeding those needs, VersaLogic offers the Leopard, an ultra-fast PC/104-Plus embedded computer. Leopard brings the power of a second-generation Intel Core2 Duo processor (SP9300) to a compact PC/104-Plus form factor. Leopard is designed for applications that require extreme CPU and video processing performance in a compact 4.2" x 3.8" (107 mm x 96 mm) package. The SP9300 Core 2 Duo CPU is combined with the GS45 Graphics Memory Controller Hub and ICH9M I/O



Controller Hub to form an extremely high-performance system. Leopard is qualified to MIL-STD-202G shock and vibration standards for use in harsh environments.

Available in full industrial (-40° to +85°C) and commercial (0° to +60°C) temperature versions, the Leopard can run at speeds of 2.26 GHz with typical mid-range power consumption of only 21W. Standard onboard I/O includes two Gigabit Ethernet ports, six USB 2.0 ports, five serial ports, dual SATA interface, LPT interface and HD audio. Leopard has an SO-DIMM socket for up to 4 Gbytes DDR3 RAM as well as several high-reliability flash storage options, including a latching MiniBlade socket and an eUSB interface. The GS45 chip supports both analog VGA and LVDS video interfaces for Extended Desktop, Clone and Twin video display modes, as well as 3D video acceleration. Leopard provides both PCI and ISA stackable expansion buses. An additional interface for SPX expansion modules provides add-on I/O for cost-effective, enhanced system scalability. Leopard is priced at round $2,050 in OEM quantities.

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

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Atom-Based SBC Supports SATA II and CompactFlash

An Intel Atom-based PC/104-Plus single board computer (SBC) is designed for space-limited military applications requiring fanless operation. The MB-73200 from Win Enterprises offers a choice of two onboard Ultra-Low-Power (ULV) Embedded Intel Atom Z5xx series processors. The CPUs provide either 1.1 GHz or 1.6 GHz of performance. As Intel embedded processors, these components enable

long life for OEM products. Support for both PC/104+ and PC/104 enables additional wired and wireless I/O, or other feature expansion. An optional high-definition audio card is offered. Two serial ports, four USB 2.0 ports are featured. The device provides two SATA II interfaces and one CompactFlash type I/II socket. Two Gbytes of memory are provided.

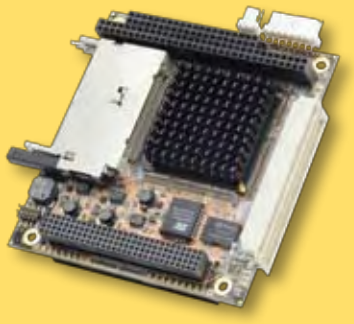
The Intel System Controller Hub US15W supports 2D, 3D and advanced 3D graphics, high-definition video decode and image processing. The chipset also enables support for Single Channel 24-bit LCD/LVDS. Dual simultaneous displays can be supported by MB-73200. CRT resolution of up to 2048 x 1536 is provided. Other features include ultra-low power consumption (5W), dual 10/100 Mbit/s PCI bus Ethernet, two SATA interfaces and one CompactFlash type I/II socket. OEM pricing begins at $242. Price includes CPU with memory and storage extra.

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

Complete PC/104-Plus SBC Offers Long Life Cycle

Obsolescence continues to vex military system designers. PC and consumer processor silicon goes end-of-line so fast it can make your head spin. WinSystems eases that burden with their PPM-LX800-G, a highly integrated, PC/104-Plus-compatible, 500 MHz Pentium-class SBC. This SBC is based on the low-power AMD LX 800 at 0.9W CPU, which has product availability through at least 2015. The board includes the CPU, video, Ethernet, USB, COM ports, EIDE controller, digital I/O, mouse, PC 97 audio and keyboard controllers, and measures only 3.6 x 3.8 inches (90 x 96 mm).

The PPM-LX800-G can be populated with up to 1 Gbyte of system DRAM plus onboard CompactFlash. A high-resolution video engine is on board that supports displays with resolutions up to 1920 x 1440 for a CRT



or up to 1600 x 1200 for a flat panel. An Intel 82551ER 10/100 controller supports Ethernet networking. Further I/O support includes two USB 2.0 ports (with in-rush and over-current protection), four independent full-duplex serial UARTs, 16-lines of TTL-compatible digital I/O and AC97 audio. The PPM-LX800-G contains the core logic to provide PC compatibility for the I/O and bus interface logic including the Ultra DMA100 controller for hard drives, keyboard/mouse controller, LPT interface, interrupt controller and real-time clock. The PPM-LX800-G is priced at $495.

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

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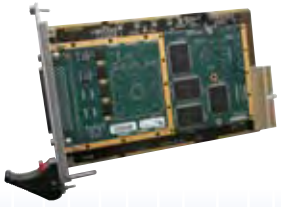

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Offering 160 digital I/O signals for specific application needs, the user-configurable GX3500 FPGA card employs the Altera Cyclone III FPGA, which can support clock rates up to 150 MHz and features over 55,000 logic elements and 2.34 Mb of memory. The GX3500 can also accept application-specific expansion boards providing additional flexibility for addressing custom applications.

Geotest
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SATA SSD Is Built for Harsh Environments

The military values solid-state drives (SSD) because they're inherently more rugged than rotating drives. But many harsh environment military applications require a whole extra level of ruggedness. Serving those needs, Delkin Devices has introduced their advanced generation of ruggedized SSDs, Iridium and Palladium. Using its patent pending Tekta infusion process, the drive and its contents are protected from extreme temperatures (-50° to 100°C), water intrusion, humidity, rain, shock, dust, impact, vibration, rust and more. Designed to deliver supreme performance in even the most extreme conditions, the drives obtain superior sustained speeds up to 260 Mbyte/s read and 210 Mbyte/s write. The Delkin SATA SSDs are currently available in capacities from 4 Gbytes to 128 Gbytes, in either 2.5- or 1.8-inch form factors.

All Delkin SATA SSDs adhere to a strictly controlled specification using only certified NAND flash to ensure no variation in performance or longevity. Control of each drive's performance is assured by a configurable part number and a locked down Bill of Materials. Only extended temperature components are used and drives are continually tested for enhanced shock and vibration performance. Advanced error detection, correction code, and static and dynamic wear leveling are used to prolong drive life and efficiency. These specialized drives are an ideal solution for applications where reliability and data integrity are required.

Delkin Devices, Poway CA. (858) 391-1234. [www.delkinoem.com].

3U Industrial Servers Offer Preconfigured Solutions

The Trenton TCS3500 and TCS3501 industrial servers are now available for deployment in computing applications requiring fast delivery as well as system performance, stability and flexibility. Trenton configures, integrates and validates these system solutions ahead of time with long-life processors, motherboards and storage options. The TCS3500 and TCS3501 enable faster system deployments in defense and government applications. The TCS3500 has a single processor ATX motherboard with multicore Intel Core i3-540. Option card slots are provided for PCI Express and PCI. The TCS3501 has a dual processor EATX motherboard with quad-core Intel Xeon E5504. Option card slots support x16 PCI Express 2.0 and PCI. Storage is provided via a front access hot swap HDD and internal drives. Trenton's standard systems have undergone rigorous electrical, mechanical and thermal testing to ensure maximum performance and reliability in demanding environments.

Trenton Systems, Gainesville, GA. (770) 287-3100.
[www.TrentonTechnology.com].

EMI Filter Targets Distributed Power Systems

Military system designers were not first in line to embrace distributed power approaches. But now there's no choice given the voltage and power levels of today's chips. VPT has introduced a new EMI (electromagnetic interference) filter module for distributed power systems. The new VPTc10-28 EMI filter satisfies strict reliability requirements for commercial avionics and military systems in the U.S. and Europe. The VPTc10-28 Series EMI filter and transient suppressor combines two modules in one space-saving package. This module reduces the reflected noise of DC-DC converters while simultaneously protecting a power system from inrush current damage and reverse polarity conditions. These new EMI filters feature up to 10 amps of output current and up to 150W of output power. They meet conducted susceptibility requirements of DEF STAN 59-411 Part 3 Issue 1 for Land Applications, MIL-STD-461C, CS01 and CS02, and MIL-STD-461D/E/F when used with VPT Series DC-DC Converters. The new modules are priced beginning at $248 each in OEM quantities.

VPT, Everett, WA. (425) 353-3010. [www.vpt-inc.com].

XMC Video Graphics Card Offers Two Video Inputs

The concept of using graphics processors for general computing tasks is catching on fast in the military. Tech Source offers the Condor 2100x XMC video graphics card with two video inputs and outputs. As a member of the Condor 2000 family of products, it is based on the ATI Radeon E4690 GPU from AMD and provides a robust solution for embedded applications that require high-performance graphics, video processing and/or GPGPU computing.

The Condor 2100x has two video outputs and two live video inputs (TV, HD, RGB, DVI). The multiple input streams are displayed on either output in independent overlays and can be positioned or sized (zoom or shrink) under software control. All I/O is through the rear Pn4 connector. The product is available in convection- and conduction-cooled formats and for both benign and rugged environments. Operating System support includes Windows, Linux and other real-time operating systems such as VxWorks and Integrity. The product offers the high-performance GPGPU computing capability of the ATI Radeon series GPU with 320 shader processors. In addition, it offers hardware acceleration of H.264 and VC-1 HD video as well as MPEG-2, enabling multiple HD video streams and freeing the CPU for other tasks.

Tech Source, Altamonte Springs, FL. (407) 262-7100. [www.techsource.com].

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Tool Supports Debugging and Profiling of Android Platforms

The small, handheld segment of military system design continues to rank among the most dynamic. Lauterbach announces TRACE32 support for debugging and profiling of the Android platform. Device drivers, native libraries and several native applications can be debugged at the same time. For CPUs with real-time trace capability, it is possible to run comprehensive run-time profiling analysis on native applications up to function and source line level, and for Dalvik applications up to thread level. TRACE32 In-Circuit Debuggers access the "target" development board via the processor JTAG connector. Using this hardware approach to gain full control over the CPU, TRACE32 can be used to access peripherals, debug boot code and exception routines, and also has complete system visibility at any given moment. If the CPU supports external tracing using trace ports such as ARM's ETM, then TRACE32 can record the program flow in real time.

Lauterbach, Höhenkirchen-Siegertsbrunn, Germany. +49 8102 9876-0. [www.lauterbach.com].

Rugged Sensor Interface Supports Remote Data Acquisition

The multifunction I/O trend has been particularly useful for military applications, where reduced system size is such a priority. North Atlantic Industries (NAI) has announced the release of the SIU6 Sensor Interface Unit, a rugged, packaged, turn-key Embedded I/O system for remote data acquisition and distribution for large platform monitoring and control system applications. This high functional density system features COTS Multifunction I/O Boards with an integrated rugged Power Supply, enclosed in a compact, conduction-cooled enclosure. The rugged chassis is designed to operate in harsh environments such as extreme temperature, EMI, shock and vibration. A fully integrated backplane and front panel architecture eliminates the need for custom internal cabling or wiring.

Taking advantage of NAI's high density Multifunction I/O and Power Supply products, the SIU6 allows for a wide selection of different I/O and communications functions such as A/D, D/A, TTL, RTD, Discrete I/O, Synchro/Resolver-to-Digital and LVDT, Digital-to-Synchro/Resolver and DLV, BC/RT/MT MIL-STD-1553, high-speed Sync/Async RS232/422/485, ARINC 429 and CANBus. Additionally, the user can select a Processor module that allows processing of the raw data available from the I/O functions. This approach increases package density, saves enclosure slots and reduces power consumption. The SIU6 is ideally suited for military and Aerospace applications, such as engine monitoring, weapons targeting, guidance, navigation and command & control. The SIU6 provides control and monitoring of the overall enclosure and/or system health, including temperature monitoring, multiple power sources with switch-over, complex power control schemes and status reporting to system processors.

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

Boundary Scan Fixture Targets AMC and ATCA

As the military warms to the relatively new ATCA and AMC form factors, the ecosystem for those architectures is expanding. Goepel Electronic has announced the launch of CION Fixture /AMC, a new interface test fixture based on the popular CION Fixture family. The new low-cost fixture is compatible with standard Advanced Mezzanine Cards (AMC) for ATCA systems (Advanced Telecommunication Computing Architecture) and comes with a preset AMC slot, in which the card is inserted and connected to a TAP (Test Access Port) at the same time. The integrated IEEE 1149.1 and IEEE1149.6 test channels allow a structural test of all high-speed and low-speed signal pins.

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

Rugged Industrial Server Offers Complete System Solution

Crystal Group has announced the newest addition to the Crystal Group server family, the IS100- Rugged Industrial Server. The IS100 1U Server is the first product in Crystal's new Rugged Industrial Server line. The IS100 will be replacing Crystal's current Industrial line, while complementing their existing Rugged RS line. The IS line will target customers that are looking for something less rugged than the RS line, but will still offer superior performance and reliability.

This industrial server offers extended capabilities with a shock/vibe rating designed to 1.5 GRMS, in combined wheeled vehicle and aircraft profiles, and a operational temperature range of 0° up to 50°C (32° to 122°F). The IS100 is available with the Intel 5500 series, socket 1366 LGA architecture and features embedded dual, quad and hexa core CPU technology. Expansion choices in this short depth (20 inches) industrial server include one full-height, 3/4 length slot, meaning greater adaptability. An option of two 2.5" or 3.5" drives, or four 2.5" drives and a slimline CD/DVD are available. These drives are removable and hot swappable.

Crystal Group, Hiawatha, IA. (319) 378-1636. [www.crystalrugged.com].

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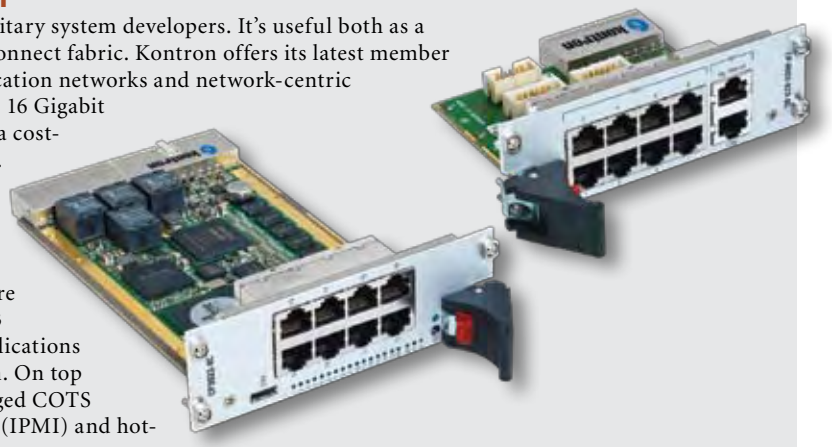
Gigabit Ethernet Switch Rides 3U CompactPCI

Ethernet is now firmly entrenched in the mindshare of military system developers. It's useful both as a networking technology and as a high-speed data plane interconnect fabric. Kontron offers its latest member of the 3U CompactPCI product family for IPv4/v6 communication networks and network-centric applications: the Gigabit Ethernet Switch CP3923. With up to 16 Gigabit Ethernet ports, the Kontron CP3923 fully managed switch is a cost-effective, high-performance solution for harsh environments.



The Kontron Gigabit Ethernet Switch CP3923 is a fully managed Layer 2/3 Gigabit Ethernet (GbE) switch offering IPv4 routing and optional IPv6 routing as well as full management capabilities. It supports powerful CLI, Telnet, Web and SNMP management interfaces to configure the entire set of protocols and parameters including Layer 2 and Layer 3 (IPv4/v6) protocols, Multicasting, QoS and Security. For applications requiring higher bandwidth, it also supports link aggregation. On top of that, the Kontron CP3923 maximizes the reliability of rugged COTS applications by supporting Intelligent Platform Management (IPMI) and hot-swap capabilities.

The base configuration (CP3923-8C) supports eight GbE ports via RJ45 and eight GbE ports via rear I/O to ensure highest connectivity capabilities and broadband flexibility. Two additional versions directly target transportation and mobile applications, providing four (CP3923-4M) or eight (CP3923-8M) Fast Ethernet ports via M12-D connectors. All versions support eight GbE via rear I/O. To have access to the 8x GbE ports routed to the rear, a special Rear Transition Module is available. Designed to meet the highest reliability and ruggedization requirements of harsh environments, the new Kontron CP3923 is compliant with the EN 50155 railway standard and offers an extended operating temperature range (E2) of -40° to +85°C. Additionally, the use of soldered components ensures resistance against the typical effects of shock and vibration. For even harsher environments a rugged conduction-cooled version is planned.

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

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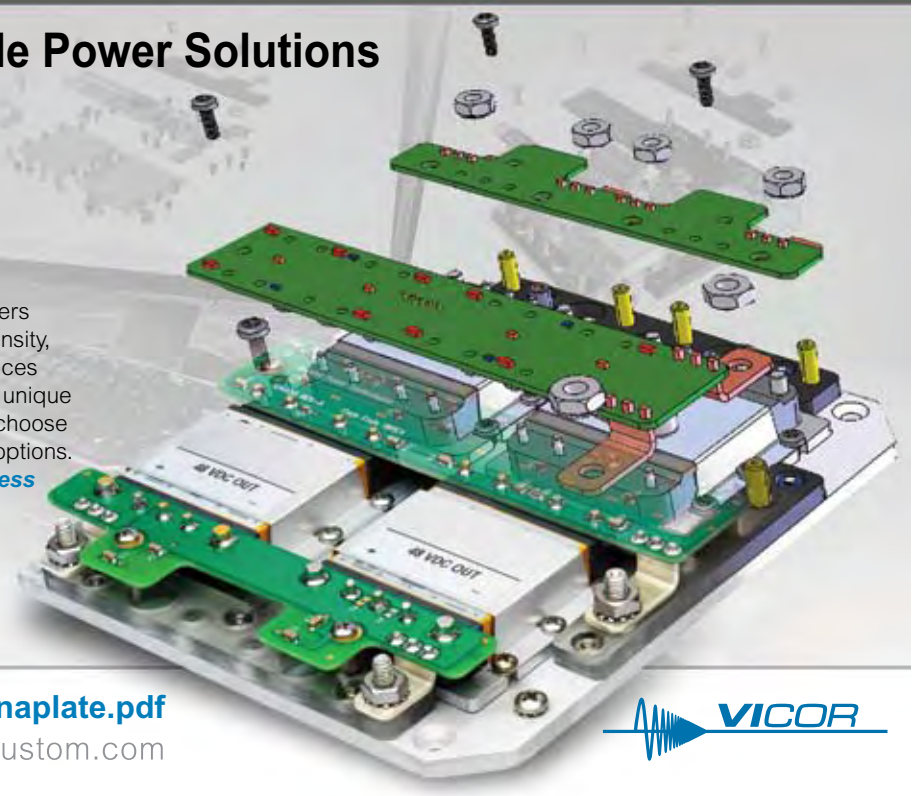

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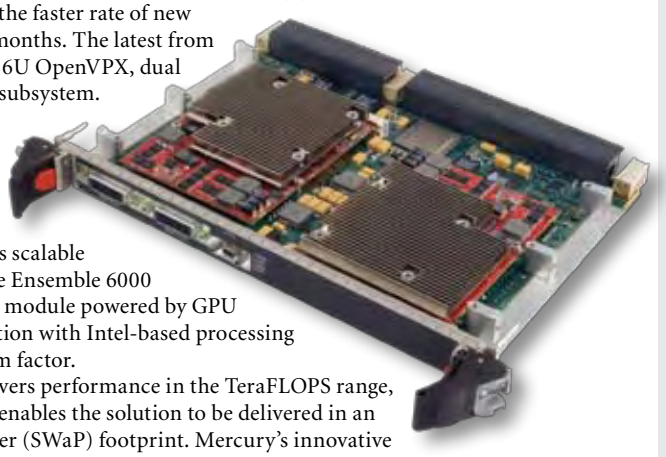
6U OpenVPX Board Provides GPU-Based Rugged Solution

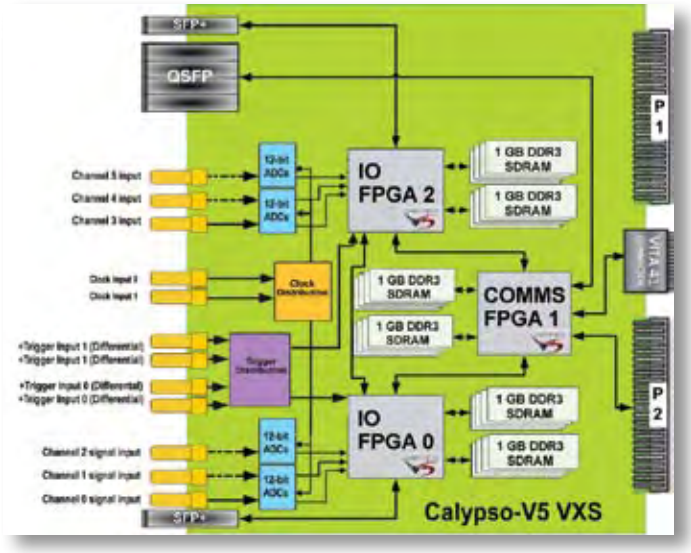


OpenVPX has seen probably the faster rate of new product roll outs in the last 12 months. The latest from Mercury is a high-performance 6U OpenVPX, dual GPU-based conduction-cooled subsystem. This subsystem is currently deployed in an embedded rugged defense surveillance platform, performing processing, exploitation and dissemination (PED). Mercury's scalable ISR subsystem is powered by the Ensemble 6000 Series GSC6200—an OpenVPX module powered by GPU technology working in conjunction with Intel-based processing in a conduction-cooled, 6U form factor.

The subsystem currently delivers performance in the TeraFLOPS range, and the incorporation of GPUs enables the solution to be delivered in an optimized size, weight and power (SWaP) footprint. Mercury's innovative packaging technology on the GSC6200 leverages the easy-to-upgrade MxM GPU form factor, which enables customers to rapidly upgrade and deploy the latest and fastest GPUs from ATI or NVIDIA, resulting in even higher performance.

Mercury Computer Systems, Chelmsford, MA. (978) 967-1401. [www.mc.com].

12-bit ADC Has Two or Six Channels with up to 3.2 GS/s per Channel



A new 12-bit ADC supports either two 12-bit analog-to-digital converter (ADC) channels at 3.2 GSPS (Gigasamples per second) or six channels at 1.6 GSPS. The Calypso-V5 from Tekmicro is compatible with legacy VME systems as well as newer ANSI/VITA 41 VXS-based systems and combines high-density FPGA processing with the ultimate in ultra wide band ADC signal acquisition. Calypso-V5 is based on the latest National Semiconductor ADC device, which supports either a pair of channels in non-interleaved mode or a single channel using 2:1 interleaved sampling. Calypso-V5 contains four ADC devices, supporting a total of either six channels plus trigger at 1.6 GSPS or two channels plus trigger at 3.2 GSPS.

In all modes, the converters provide 12-bit resolution and open analog bandwidth exceeding 2 GHz. This allows Calypso-V5 to be used as a 3.2 GSPS converter for 1st Nyquist applications or as a high-density multichannel building block for lower bandwidth applications using either 1st or 2nd Nyquist sampling. Calypso-V5 also includes sample-accurate trigger synchronization in all modes, allowing coherent processing of multiple input channels both within a single card and across multiple cards. This allows applications of up to 108 channels to be supported within a single chassis. The Calypso-V5 contains four separate ADC devices, with each pair of devices assigned to its own front-end FPGA for signal processing. In the QuiXilica-V5 family, the front-end FPGA is typically a Xilinx Virtex-5 SX95T-2 device. Future QuiXilica products later in 2010 will offer higher density Virtex-6 FPGA options including LX240T, SX315T and SX475T devices. The two front-end FPGAs are supplemented with a "back-end" FPGA, which can be used for additional processing or for backplane or front panel communications. In the QuiXilica-V5 family, the back-end FPGA can be configured with a range of Xilinx Virtex-5 FPGA options, from the standard LX110T-2 up to a LX330T, FX200T, or SX240T, depending on application requirements.

Tekmicro, Chelmsford, MA. (978) 244-9200. [www.tekmicro.com].

3U cPCI Card Serves Up FPGA and Atom CPU

FPGAs are now powerful enough to be used alongside general-purpose CPUs as coprocessors. MEN Micro offers a 3U CompactPCI SBC that combines low-power Intel Atom XL processors with an onboard FPGA for user-defined functions, the first SBC available to offer this capability. Depending on the application, the board can be equipped with various 45nm-based Intel Atom XL processors, which offer a maximum power dissipation of 7W at a speed of up to 1.6 GHz. The board's specially designed heat sink enables operation across an extended -40° to +85°C (-40° to +185°F) temperature range.

The onboard FPGA also allows for customer-specific interfaces, such as serial interfaces, CAN bus, binary I/O, protocol converters or touch controllers to suit a user's specific application. The F11S can accommodate up to three SA-Adapters for additional I/O. The memory configuration contributes to the board's flexibility with the incorporation of up to 2 Gbytes of soldered DDR2 SDRAM, 2 Mbytes of non-volatile SRAM, a CompactFlash card and a microSD card slot in addition to the 512 Kbyte of L2 cache integrated in the processor. Pricing for the F11S starts at $1,443.

MEN Micro, Ambler, PA.
(215) 542-9575.
[www.menmicro.com].

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Type II Compact COM Express Has Dual Core CPU

A new (95 mm x 95 mm) Type II Compact COM Express is based on Intel Atom processor N450 (single core), D410 (single core) and D510 (dual core). Called the PCOM-B215VG from American Portwell Technology, the board features Intel 82801HM I/O controller, up to 4 Gbyte DDR2 SDRAM, onboard 4 Gbyte NAND flash upgradable to 8 Gbyte, one Gigabit Ethernet, dual independent display via VGA and LVDS, eight USB ports, wide input voltage support (8V to 18V) and support for EIDE and SATA. Expansion capability includes five PCI-E x1 lanes that can be configured as one PCI-E x4 and four PCI-E x1, four PCI, LPC interface and a high-definition audio interface.

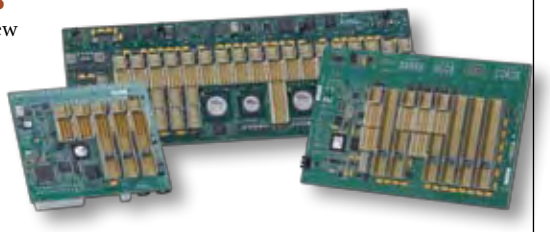
American Portwell, Fremont, CA.
(877) 278-8899. [www.portwell.com].

Power over Ethernet Compact Vision System

A new compact vision system is based on the Intel Core2 Duo P8400 processor. The EOS-1000 from Adlink Technology provides four independent Power over Ethernet (PoE) ports with data transfer rates up to 4.0 Gbits/s and combines high computing power and multi-camera imaging—suitable for applications such as 3D vision robotic guidance. It has undergone harsh vibration and shock testing during its design to ensure durability up to 5G. Long-life embedded components were selected and system monitoring components were incorporated to monitor CPU temperature, fan speed and system responsiveness to further provide a very robust and reliable platform. The EOS-1000 is currently available for a list price of $1,635.

ADLINK Technology, San Jose, CA (408) 495-5557.
[www.adlinktech.com].

PXI/CompactPCI Backplanes for Embedded Test and Control OEMs



More than 10 new 3U and 6U PXI/CompactPCI backplanes offer from 4 to 18 slots and work with PXI, PXI Express, CompactPCI and CompactPCI Express modules. Engineers can design custom installations and enclosures around the backplanes while integrating more than 1,500 existing PXI modules—from data acquisition to FPGA-based I/O modules, to high-end instruments such as signal generators and RF signal analyzers, as well as a variety of bus interface modules including serial, MIL-STD-1553, IEEE 1588, Profibus and DeviceNet. With the new backplanes from National Instruments, they also can use the NI LabVIEW graphical system design platform to design, prototype and deploy all aspects of their system, increasing productivity and reducing time-to-market.

National Instruments, Austin, TX. (512) 794-0100. [www.ni.com].

Module Links MIL-STD-1553 to Gigabit Ethernet

The conflict between the needs of net-centric communication and the current situation where the vast majority of basic military equipment interconnects via MIL-STD-1553 can be easily resolved with the use of "Network Bridges" to these legacy data buses. Such a "Bridge" is now available from the German company MBS Electronic Systems, which offers autonomous connectivity between MIL-STD-1553 and Full Duplex Gigabit Ethernet. This FPGA-based Standalone Module is one of a family of Gigabit Ethernet interface modules, referred to as ÆSyBus modules, which provide a low latency connection to a range of military and aerospace data buses using UDP/IP protocol. The open source nature of this solution, combining Ethernet and UDP/IP protocol, allows these devices to be easily accessed by any networked computer and operating system without the need of any additional drivers or software infrastructure. Furthermore, these devices can be accessed simultaneously by up to 10 separate computers, which can individually log on to the Module, configure and control its resources and automatically receive status and data messages, periodically or as needed.

The MIL-STD-1553 ÆSyBus Module can be configured to operate as a Bus Controller, Remote Terminal or passive monitor. In all cases, terminal/bus status is collected with receive data for automatic transfer to the applications in accordance with the configured requirements of the user. A configurable hardware scheduler is also provided for accurate scheduling commands when operating as a Bus Controller. The Modules are available in a robust conduction-cooled enclosure, with build options to meet various environmental conditions, or as interface cards that slot into a VME I/O-type enclosure.

MBS Electronic Systems, Starnberg, Germany. +0049-8151 918047.
[www.mbs-electronics.com].

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Touch Solution Enables High-Res Screens, Unlimited Touch

A new set of touch screen solutions now supports large touch screens up to 15 inches. The maXTouch technology from Atmel is targeted to enable exciting new applications and user interactions on one screen. The chip technology, combined with proprietary algorithms, will offer higher performance and faster response times to provide a better user experience. The larger screen solution is an enhancement of existing maXTouch products that provide configurability to exceed today's user interface requirements. Advanced touch screen functionality includes unlimited touches and rejection of unintended touches; stretch/pinch and rotate gestures; stylus support; handwriting and shape recognition, including face detection.

Atmel, San Jose, CA. (408) 441-0311. [www.atmel.com].

Atom Processor Featured in Fanless Box Computer

A fanless box computer for embedded applications supports the new generation of Intel Atom processors that includes the dual-core Intel Atom processor D510 and single-core Intel Atom processors N450 and D410. The PL-80190 from Win Enterprises can be used in a variety of embedded market segments such as print imaging, digital signage, retail and transaction solutions, thin clients, digital security, residential gateways, plus commercial and industrial control. This family of processors offers scalability to OEMs wishing to go to market with an entire product line. The rugged chassis features an integral heat sink on its top side to aid cooling.

Key features include Intel Atom N450, D410 or D510 processors (all are 1.66 GHz) and fanless operation along with advanced low power consumption. The unit supports dual 10/100/1000 Ethernet LAN interfaces, two SATA interface, mounting kit for 2.5" HDD and full-featured I/O. In addition, there is one VGA connector, one RS-232, four USB 2.0 ports along with a high-definition audio interface. In addition, it supports one Mini PCI and one CompactFlash. Linux (Fedora, MontaVista, SUSE), Microsoft Windows Embedded, Microsoft Windows XP and Microsoft Windows CE 6.0 are supported. The version with the Intel Atom D510 dual-core processor begins selling for $405 in OEM quantities.

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

8051-Based ASP Family with Integrated Programmable Logic

The 8-bit 8051 microcontroller is still a popular solution for very small low-power military devices. The last trend toward application services platforms (ASPs) adds new flexibility to the equation. The latest example is the PSoC3 architecture from Cypress Semiconductor. It enables the integration of digital peripherals including PWMs, Timers, Counters, UARTs, glue logic and state machines. Additionally, the CY8C32xxx Programmable Digital PSoC 3 family offers customizable digital functions and interfaces lowering overall system power by migrating traditional CPU functions to programmable digital logic. Samples of the four PSoC 3 families are available today, with full production expected in the third quarter of 2010. Package options include 100-pin TQFPs, 48- and 68-pin QFNs and 48-pin SSOPs.

Cypress Semiconductor, San Jose, CA. (408) 943-2600. [www.cypress.com].

6.5-Inch and 15-Inch Touch Screen Panel PCs for HMI Apps

Two new fanless touch screen panel PCs feature durability with IP65-compliant LED backlit panels that can withstand temperatures of -200° to 600°C. Device interactivity is assured with touch panel navigation, an integrated two megapixel autofocus IP camera, microphone and speakers. The 6.5-inch VIPRO VP7806 and 15-inch VIPRO VP7815 Via VIPRO series from Via Technologies are placed for next-generation panel applications that include hospital patient terminals, home and building automation and advanced multimedia-rich security ecosystems.

Both Via VIPRO VP7806 and VIPRO VP7815 are based on the Via ART 3000 embedded box PC, adding a high-quality touch screen display to one of the industry's most flexible and complete embedded box systems. This uniquely modular design strategy offers customers faster time-to-market and design cycles compared to traditional panel PC designs. The Via ART 3000 combines a 1.3 GHz 64-bit Via Nano processor with the Via VX800 media system processor, providing DX9 integrated graphics, crystal clear HD audio, Gigabit networking, four COM ports and four USB ports. Both the Via VIPRO VP7806 and VP7815 support one external VGA port plus a 24-bit LVDS signal through DB-26 connector. Via VIPRO products use high-quality 700 cd/m2 luminous backlit LED displays that are fully IP65 compliant against water and dust, providing 800 horizontal and 700 vertical viewing angles.

Via Technologies, Fremont, CA. (510) 693-3300. [www.via.com.tw].

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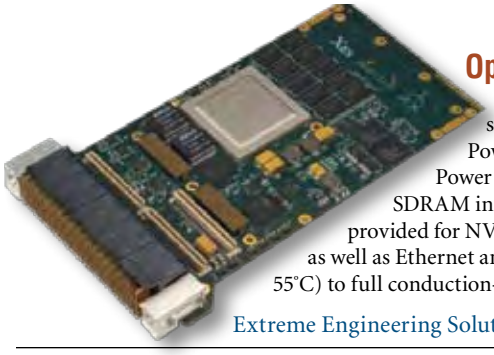
FeaturePak Embedded I/O Comes to SUMIT-ISM Stacks

A new adapter board allows the use of FeaturePak I/O expansion modules in systems that provide SUMIT-ISM expansion stack locations. The FeaturePak socket on the SUMIT/FP Adapter consumes a single PCI Express x1 lane from the SUMIT-A bus connector on the SUMIT-ISM module. The adapter provides a pair of 50-pin I/O header connectors for convenient access to all FeaturePak I/O. In addition, it includes pass-through connectors for the SUMIT-ISM stack's SUMIT-B bus and PC/104 (ISA) bus. An extended operation temperature range of -40° to +85°C is supported.

The FeaturePak specification defines tiny, application-oriented personality modules—three-fifths the size of a credit card—that snap into low-cost, low-profile, reliable sockets on single board computers (SBCs), computer-on-module (COM) baseboards and full-custom electronic circuit boards. FeaturePak modules interface to the host system via a single low-cost, high-density, 230-pin connector, which carries PCI Express, USB, I2C and several other host-interface signals, plus up to 100 points of application I/O per module. Additionally, the modules can easily be integrated into embedded designs along with Qseven, COM Express, Mobile-ITX, SUMIT, PCI/104-Express, EBX and EPIC. Small quantities of the SUMIT/FP Adapter are available in 60 days, priced at $190.

Diamond Systems, Mountain View, CA. (650) 810-2500. [www.diamondsystems.com].



OpenVPX Module Sports Eight-Core P4080 Processor

Extreme Engineering Solutions has announced the XPedite5470, a high-performance 3U OpenVPX single board computer with Freescale QorIQ P4080 processor. XPedite5470 provides a new level of Power Architecture computing power with features including a Freescale P4080 processor with eight Power Architecture e500 cores at up to 1.5 GHz. Memory on board includes 8 Gbyte DDR3-1333 ECC SDRAM in two channels and 256 Mbytes of NOR and 16 Gbytes of NAND flash. Hardware write-protection is provided for NVRAM. The card provides Serial RapidIO, x4 PCI Express and SerDes Gigabit Ethernet interconnects as well as Ethernet and serial ports. All of X-ES's P4080 products are engineered to scale from air-cooled commercial (0° to 55°C) to full conduction-cooled (-40° to +85°C) with appropriate shock and vibration testing.

Extreme Engineering Solutions, Middleton, WI. (608) 833-1155. [www.xes-inc.com].

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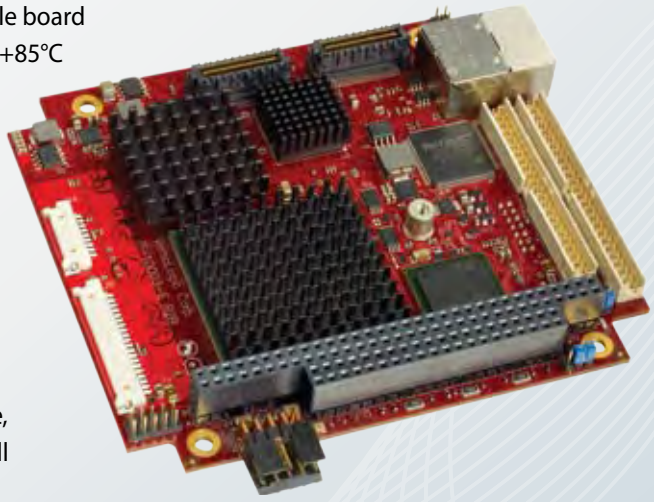

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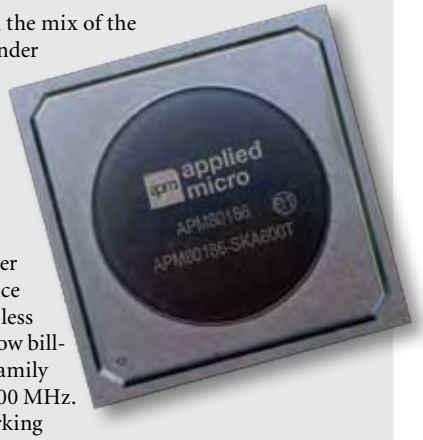
32 Gbyte CompactFlash Card Does 45 Mbyte/s Sustained Reads

Swissbit's popular family of Industrial Type 1 CompactFlash (CF) cards has just added a new member. The C-320 offers the highest density and performance of all Swissbit CF storage cards. A capacity of 32 Gbytes and data transfer rates of 35 Mbytes/s for sustained write and 45 Mbytes/s for sustained read makes the C-320 perfect to satisfy the most demanding non-volatile, high-reliability applications. Like all Swissbit industrial flash products, the C-320 CF card series use Single-Level Cell (SLC) flash technology, which provides a minimum of ten times (10x) the program/erase endurance over Multi-Level Cell (MLC) flash components. Intelligent wear-leveling ensures that all dynamic and static data is balanced evenly across the entire flash memory card. This approach to wear leveling will guarantee that maximum write endurance is achieved for every Swissbit C-320 CompactFlash flash card.

Swissbit, Bronschofen, Switzerland. +41 71 913 03 03. [www.swissbit.com].

Energy-Efficient Processor Family Targets 1-Watt Video-Enabled Devices



Small electronic devices are in the mix of the most advanced military devices under development. A product family of energy-efficient embedded processors provides a small form factor for Power Architecture-based performance. Each of the System-on-Chip (SoC) devices in the APM8018x family from Applied Micro is designed to deliver server-class processing performance in embedded systems that require less than 1W of operating power and low bill-of-material cost. The APM8018x family supports CPU frequencies up to 800 MHz. High-speed inter-chip and networking connectivity is key to the SoC's delivery of high performance at low power dissipation, and each family member is enabled with a number of high-speed interfaces such as PCIe, SATA, GigE, SDIO, TDM and USB 2.0. Pricing is under $10 for 10,000-unit quantities.

AppliedMicro, Sunnyvale, CA. (408) 542-8600. [www.appliedmicro.com].

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Special Feature: Pre-Integrated Subsystems In parallel with the trend toward rugged box-level systems is another trend toward "pre-integrated subsystems." These are defined as a set of embedded computing and I/O boards put together and delivered as a working system to provide a certain function, but intended to be used in a military customer's larger system. This section explores the forces driving this trend and the types of military applications that are the first to exploit it.

Tech Recon: RoHS: Mitigating Problems in the Lead-Free Electronics Era The military market may be exempt from the restriction of hazardous substances (RoHS) initiative, but that doesn't mean makers of board-level products, for example, are off the hook. Most embedded computer companies craft board designs targeted for both military and non-military markets. Even companies purely in the military market can't escape RoHS's effects, because for some categories of components lead-free versions are the only game in town. This section examines the test and analysis problems brought on by RoHS and the methods for mitigating those problems.

System Development: Real-Time and Safety-Critical Software Challenges Efforts are moving forward to solidify specs for real-time and safety-critical Java. Meanwhile the Ada language offers unique features and an installed base that remains formidable. This section compares the tradeoffs between Java and Ada and how both are attempting to meet real-time and safety-critical needs.

Tech Focus: VXS, VPX and VME SBCs VME has earned an enduring role as the most popular embedded computer form factor for defense applications. Next-generation, fabric-based flavors of VME are coming together in the form of specs such as VXS (VITA 41) and VPX (VITA 46). This section updates readers on the progress of those implementations and displays a sampling of the current crop of VME, VXS and VPX single board computer (SBC) products.

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Editorial

Jeff Child, Editor-in-Chief

Information Overload and Ducks

If you look at the role of military embedded computing systems today, the analogy of a duck coasting along the water comes to mind. The movement of a duck across a pond looks smooth and simple, but just underneath the surface its feet are furiously paddling away. In a similar way, embedded computers run the control and user interface tasks that hide the complexity from the end user. The trend has crept up on the electronics industry gradually, but the main theme of system design today is for more and more functionality to be implemented as software running on an embedded computer. There's still—and will always be—a shell of real world analog interfaces that those subsystems connect to—sensors, actuators, motor controllers and so on—but the idea of a computer as the primary "traffic" manager and user interface engine has become firmly entrenched.

For the Navy the trend seems to be toward reducing crew size by automating tasks that have traditionally required specialists. For the other military branches, it's more about taking the vast amount of incoming Intelligence, Surveillance and Reconnaissance (ISR), and organizing and presenting it in ways that don't have to be interpreted manually by experts in signals analysis. The goal of an end-to-end network-centric military means providing information that any level of warfighter can access and act on.

Situation awareness systems are specifically hard pressed to deal with these issues. This avalanche of ISR data that's coming in from multiple sources is actually causing a serious challenge for situational analysis systems. In its raw form, that data is made up of massive amounts of signal and imagery data. Problem is, the intelligence processing and exploitation capability has been limited to highly trained analysts and applicable only after the threat occurred. That limits the ability of non-technical individuals to "connect the dots" and affect mission outcomes in real time.

The good news for our embedded computing industry is that the solution to handling this "information overflow" is more and more powerful embedded computing. But the other leg of the solution is more advanced applications that process and sort the data for the warfighter so he can use it in real time. Companies like IvySys are doing some specific work addressing those needs. By applying signal processing algorithms to the problem it's possible to detect potential threats as they surface. The company says this can be applied to deep domain expertise in signals intelligence (SIGINT), measurement and signature intelligence (MASINT) techniques, and to cyber security.

This trend of hiding system complexity also seeps down the food chain into the development of complex processing systems. Today we have almost an excess of computing muscle available, while the ability to properly exploit that increased compute-power is facing the classic "law of diminishing returns." That could drive a shift to new ways of thinking when it comes to architecting systems. Such shifts have happened before of course. At one time general-purpose processors (GPPs) carried the full burden of processing tasks in military embedded computing. Then came Digital Signal Processors (DSPs) to act in a role as adjunct accelerators, leaving GPPs to handle system management types of tasks. Then more recently FPGAs, as they have become denser and more sophisticated, now offer on-chip DSP functionality that rivals stand-alone DSPs. Moreover, FPGAs can provide the benefit of application-specific—or rather, waveform-specific—logic implemented on chip.

Now, the latest concept is the idea of putting high-performance graphics processors to work on general-purpose processing tasks. Graphics processing units, or GPUs, are programmable floating-point graphics-rendering engines primarily used in personal computers, workstations and gaming consoles. Because of architectural advancements in GPUs in recent years, these devices provide unprecedented performance. And their "performance per watt" fits nicely into the military's increasing requirement for reducing system Size, Weight and Power (SWaP).

Implementations of this idea of "GPUs as general-purpose processing engines" also falls nicely into the theme of doing more while keeping the complexity at bay—complexity to the system developer in this case. Along those lines, graphics chip vendor NVIDA developed a parallel computing architecture called CUDA (an acronym for Compute Unified Device Architecture) that addresses a key weakness of FPGA parallel processing systems: the complexity of programming them. CUDA is the computing engine in NVIDIA graphics processing units (GPUs) that is accessible to software developers through industry standard programming languages.

CUDA lets programmers use conventional computing languages to access the massively parallel processing capabilities of the GPU. Aside from serving applications in radar, signals intelligence and video surveillance and interpretation, GPUs based on the CUDA architecture have potential in other application areas including target tracking, image stabilization and SAR (synthetic aperture radar) simulation. Sensor processing and software defined radio are also well suited for this kind of processing. Board-level products have emerged specifically for GPGPU computing in a number of form factors including OpenVPX.

The bottom line is military electronic systems—across all branches, manned and unmanned, large and small—continue to head in the direction of increasing compute-power as programs require ever more functionality, autonomy and intelligence. And that's all good for our segment of the industry because it drives demand for faster embedded computing and other more sophisticated electronic subsystems of every kind. The systems engineers' job will be to apply that gear in implementations that run smoothly—as smooth as that duck looks on the surface of the water. ▮▮

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