INCLUDING DEFENSE TECH WIRE

# Military EMBEDDED SYSTEMS

September 2013
Volume 9 | Number 6

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# 2013 RESOURCE GUIDE

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*By Michael Flatley, Microsemi*

## Radar, unmanned aircraft are strongest defense markets

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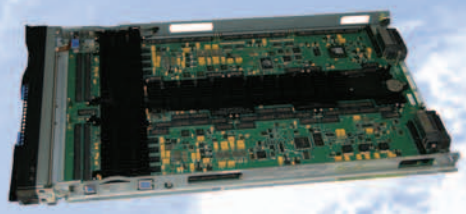

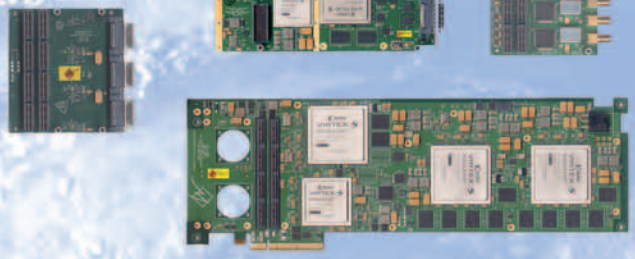

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**ON THE COVER:**

**Top photo:** The Lockheed Martin-built Freedom-class Littoral Combat Ship has a combat system that integrates radar, electro-optical infrared cameras, a gun fire control system, countermeasures, and anti-air missiles. Photo courtesy of Lockheed Martin

**Bottom photo:** Total radar contracts in 2012 were worth $4.26 billion. Pictured is the Lockheed Martin TPS-77 Long-Range Surveillance Radar. Photo courtesy of Lockheed Martin


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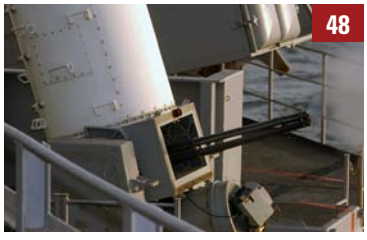


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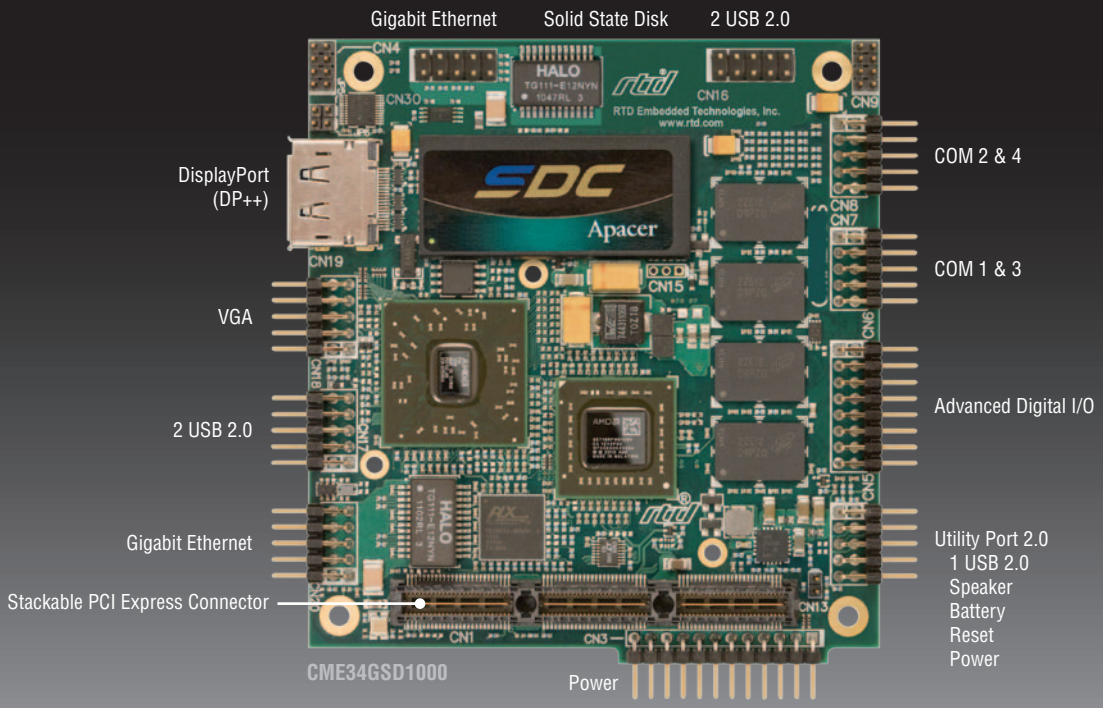


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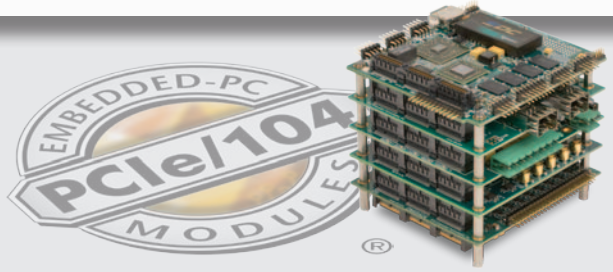


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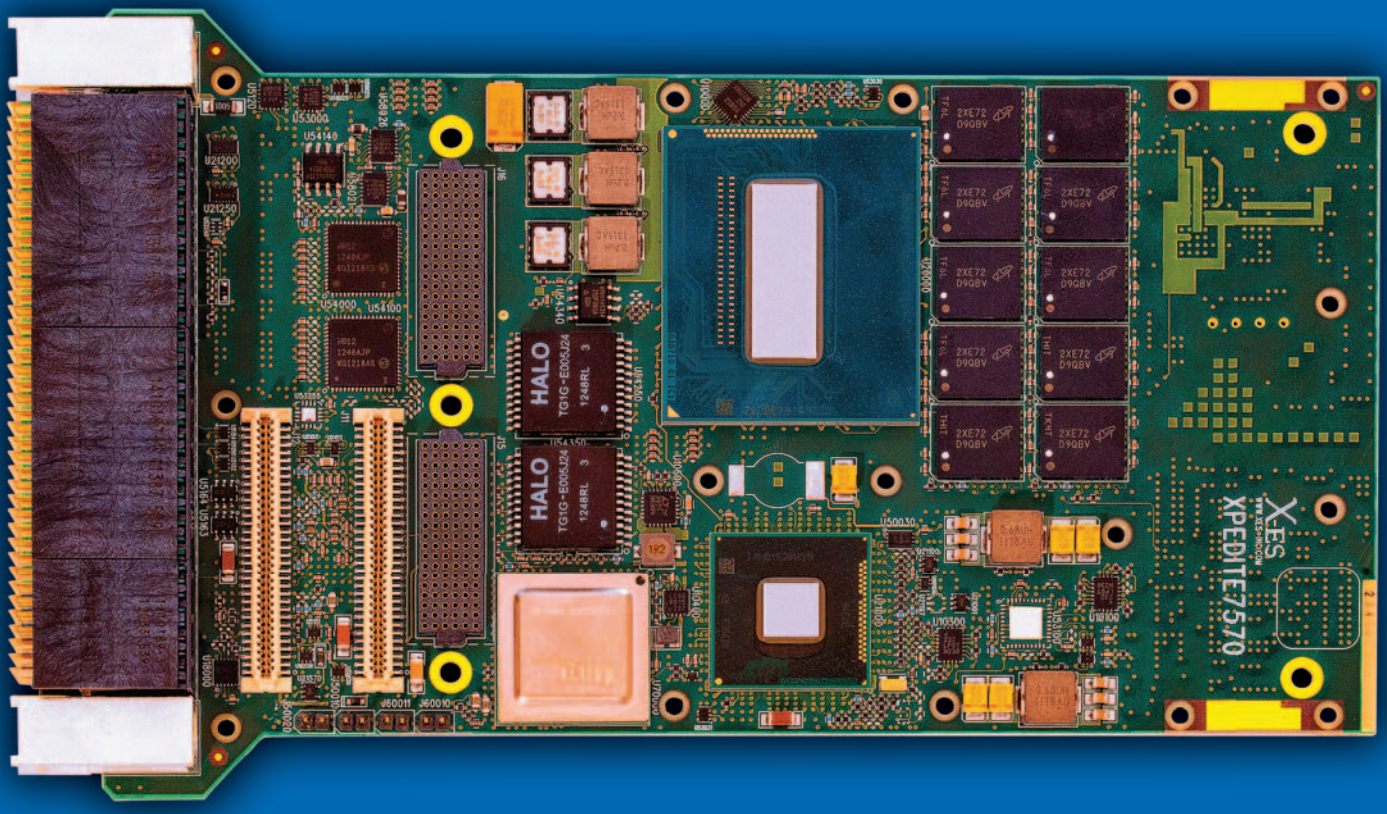


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# Payloads, throwable robots highlight decent Unmanned Systems trade show

*By John McHale, Editorial Director*

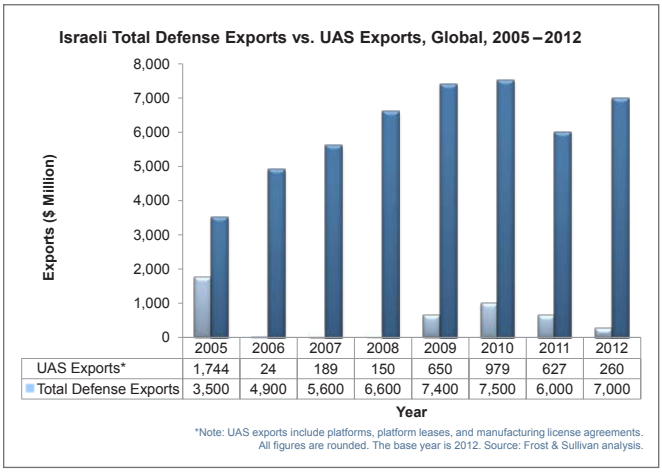
Above average is how I would rate this year's AUVSI Unmanned Systems show, which returned to Washington, DC, last month. With all the uncertainty surrounding future government spending on military technology, there was decent attendance and a good deal more optimism compared to other military events I've been to this year, such as the AUSA Winter Meeting in Fort Lauderdale, FL, which resembled a ghost town.

However, reviews among the exhibitors were mixed. Larger system integrators and primes found this year's event better than the 2012 show in Las Vegas, NV, mostly because in Washington, DC, they are closer to their customers. Others, such as suppliers of computing and navigation technologies for Intelligence, Surveillance, and Reconnaissance (ISR) payloads, thought their luck was better in Vegas in terms of leads. Yet, as is the case with most military events, one solid lead pays for the show, so even those who griped were looking to sign up again next year.

My favorites at the show this year included the iRobot 110 FirstLook small, throwable robot, and Dreamhammer's Ballista control software for controlling multiple Unmanned Aircraft Systems (UASs) and payloads from one console. The FirstLook only weighs 5.4 pounds and is 10 inches long, 9 inches wide, and 4 inches tall. No matter how it lands after a toss, it uprights itself in seconds. It can investigate hard-to-reach areas, such as tunnels, and provide video surveillance. iRobot engineers also looked into adding a small gun to it, but there are no firm plans to weaponize the robot at this time. In our July/August issue, we covered how Dreamhammer and Lockheed Martin collaborated on a NAVAIR demonstration where operators monitored and controlled multiple types of UASs and their ISR payloads.

Payloads are what this show has become about in recent years, whereas in its early days, it seemed more about the UAS airframes. Mike Blades, Senior Industry Analyst, Aerospace & Defense, with Frost & Sullivan, told me at the show that, "A common mantra in the airborne ISR world is 'every platform a sensor, and every sensor networked.' As troop strength is decreased and budgets reduced, military users are becoming more reliant on UAS payloads. As a result, UASs are often viewed simply as the platforms that deliver those payloads. DoD ISR requirements worldwide are driving the need for more capable sensors and more persistent platforms. Therefore, companies that can provide either the cheapest, most capable sensors, or the most reliable and persistent platforms, stand to benefit even in this time of constrained defense spending."

Blades also shared another fact that might surprise some – the U.S. is not the world leader in UAS exports. That honor belongs to Israel. "While Israel is the largest exporter, the U.S. still makes the most UASs by far," he says. "UAS exports have accounted for nearly 10 percent of the country's total defense export industry, and this is expected to increase. However, Israel does not have a built-in domestic market like the DoD in the U.S., so they are forced to market heavily internationally. From 2005 to 2012 Israel exported about $4.6 billion USD in unmanned aircraft while the U.S. did about $3 billion USD. Total defense exports will likely increase steadily, as Israeli companies form strategic partnerships and continue aggressive marketing campaigns with countries in growing UAS markets, such as Africa, APAC, and South America." Blades noted that his data does not include China, as Frost & Sullivan does not have access to aircraft spending data in China.




| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|
| UAS Exports* | 1,744 | 24 | 189 | 150 | 650 | 979 | 627 | 260 |
| Total Defense Exports | 3,500 | 4,900 | 5,600 | 6,600 | 7,400 | 7,500 | 6,000 | 7,000 |

**Figure 1** | This chart from Frost & Sullivan tracks Israeli Total Defense Exports versus UAS Exports, Global, 2005-2012.

For more on military technology market trends from Frost & Sullivan and other analysts, see the Military Market Analysis article on page 12. This month we also have a section on Rugged Computing – starting on page 32 – and Managing Obsolescence starting on page 44. This September issue is also our annual Resource Guide, so please be sure to take a look at the directory starting on page 57.

On another, more bittersweet note, September also marks the last issue for Managing Editor Sharon Hess. Sharon is leaving after eight years to explore another career path. She will be missed by all of us at OpenSystems Media and by those in the industry whom she worked closely with on contributed articles. Sharon has been a key member of our staff and a big part of our magazine's success, and my right hand since I took over the magazine in 2011. I have no doubt she will succeed and thrive in her next calling.

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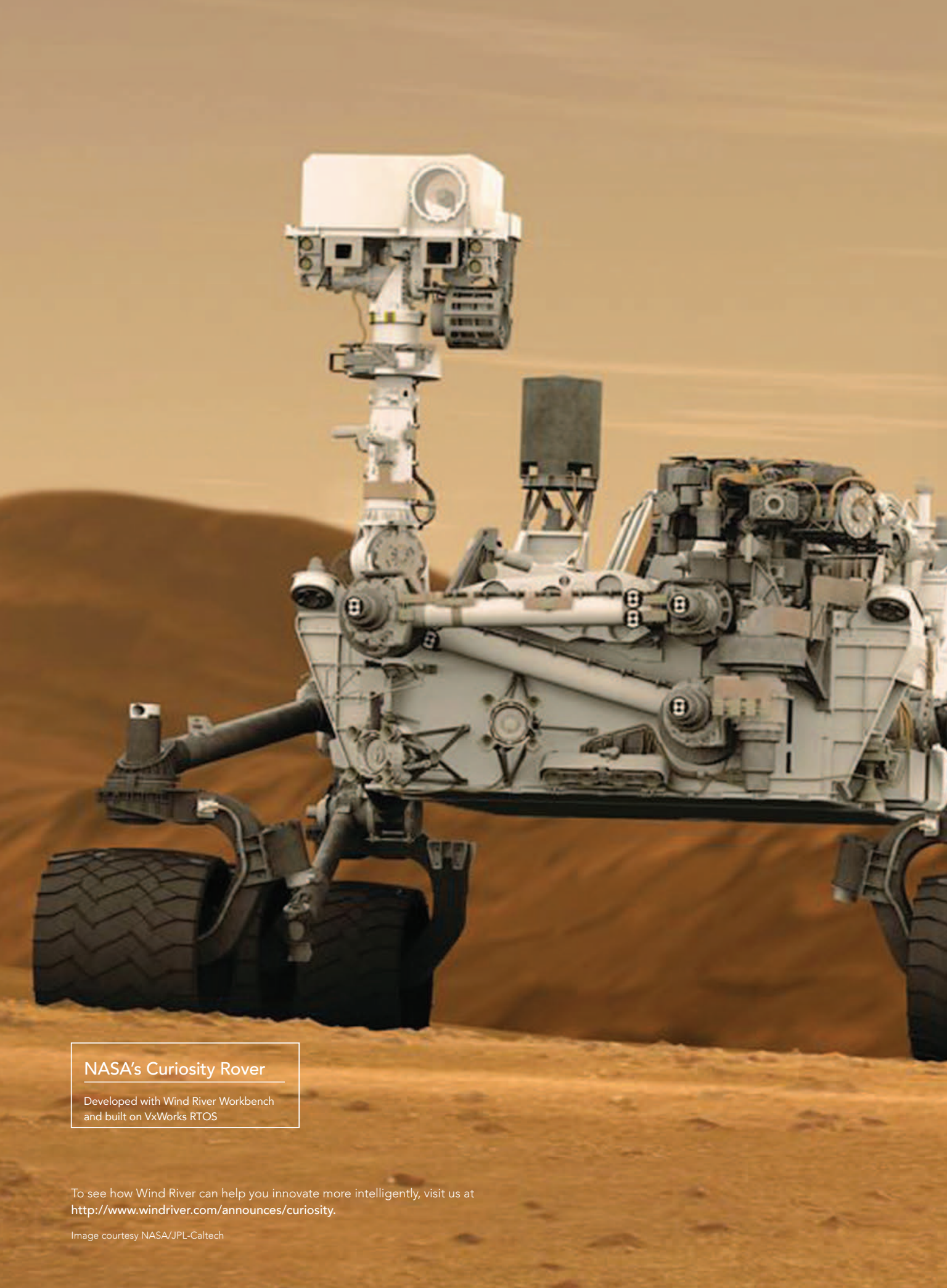

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Image courtesy NASA/JPL-Caltech

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# Radar, unmanned aircraft, best bets for defense electronics suppliers

By John McHale, Editorial Director

*Despite the doom and gloom associated with the U.S. Department of Defense (DoD) budget cuts, market analysts see silver linings for defense electronics suppliers in the radar and unmanned aircraft segments, as well as in avionics retrofits.*

Total radar contracts in 2012 were worth $4.26 billion. Pictured is the Lockheed Martin TPS-77 Long-Range Surveillance Radar. Photo courtesy of Lockheed Martin

"Strictly looking at the budget can be a gloomy experience as DoD leadership is faced with a great deal of uncertainty thanks to sequestration, the upcoming 2014 Quadrennial Defense Review, the draw down in Afghanistan, the debt ceiling debate, congressional elections, etc.," says Brad Curran, Industry Analyst at Frost & Sullivan (www.frost.com). "All of this makes it very hard for DoD leaders and industry to plan efficiently. We don't really have a strategy. The DoD 2014 budget request was $41.42 billion, down almost $5 billion from $46.1 billion in the 2013 request. I expect to see the 2015 request be even lower due to the political challenges, and stay flat for a couple years at around $40 billion."

On the other hand, there have been plenty of contracts let, more spending each month than was budgeted, and more market participants than ever, Curran continues. "In 2011 the top 10 prime contractors had about 60 percent of the prime contracts, but in 2012 they only took 41 percent of the prime contracts let. In 2011 there were 290 companies getting prime contracts, but in 2012 that leapt to 435. Now contracts are more spread out, involving more companies and reducing not only cost but risk as well."

"Of course, this is also an ideal market for COTS suppliers," says Michel Merluzeau, Managing Partner of G2 Global Solutions (www.g2globalsolutions.com). "It doesn't matter if it is only an 80 percent solution – who cares? Why spend 20 percent more for that extra 5 to 10 percent of capability if it might just turn into a "nice to have." If it has a significant operational impact, yes, but otherwise be smart about how you procure technology."

**ISR technology**

One area where COTS suppliers are thriving is in Intelligence, Surveillance, and Reconnaissance (ISR) applications. "The big contracts in 2012 in surveillance and reconnaissance were focused on radar, unmanned vehicles, Electro-Optical/Infrared (EO/IR), and night vision technology. Networking technology is also playing a role in this space," Curran says.

"Radar is a hot growth area for military technology," Curran notes. "Radar applications range from large missile defense systems to small radars that find incoming artillery and mortar rounds. On the Navy side there's been a lot of radar contracts for applications such as surface Ship Self-Defense Systems (SSDSs) to deter incoming anti-ship missiles from potential adversaries in the Western Pacific. In 2011 there were 79 radar contracts totaling $3.27 billion, with Raytheon as the leading producer. In 2012 the total contracts increased to 88, worth $4.26 billion, with Raytheon again as the leader.

"Night vision is also hot – everything from the traditional night vision goggles to weapon sights to cueing systems to helmet displays for helicopter pilots,"

**Figure 1** | F-35 Joint Strike Fighter (JSF) production is slated to be 120 aircraft between 2011 and 2017. Photo courtesy of Lockheed Martin

Curran says. "In 2011 there were 12 night vision contracts for about $2 billion with the average contract being about $173 million. The leading companies are Lockheed Martin, L-3, and FLIR Systems. In 2012 there were 12 night vision contracts totaling $2.08 billion led by EOIR Technologies. Yet, there will be a washout next year as Army and Marine Corps deployments are getting smaller, and therefore do not need larger volumes of night vision devices. However, these devices are lower cost and more sophisticated than earlier models, so going forward there will be more use for helicopter pilots and airborne and naval ISR platforms and weapon systems.

"Networking technology such as AT&T and Verizon cellular networks, COTS cloud technology, and commercial information assurance and cryptology solutions are playing a key role in intelligence programs," Curran continues. "There were 202 contract awards totaling $18.05 billion in 2012 for networking technology in military applications, and the leading company was Lockheed Martin."

**Aircraft and avionics**

New platforms such as the F-35 Joint Strike Fighter (JSF) (Figure 1) and the P-8, a replacement for the P-3 Maritime and Patrol aircraft, are getting a lot of funding, but maintaining older platforms like the P-3 through avionics upgrades will be the more common practice in the foreseeable future.

"I look for the F-35 JSF program to be stretched out a bit more than it already has been," says Wayne Plucker, Industry Manager at Frost & Sullivan. "It needs to head back to the woodshed for some more grow-up time. By extending the timeframe, we will see a slow stretch-out of the Air Force version. The Marines want their version now and most likely will get the first fully funded sets of buys for the F-35, but there is no official word on that yet. The F-35 production is slated to be 120 aircraft between 2011 and 2017. P-8 production is currently planned to be 34 aircraft during the same period. I think the P-8 has enough political support to continue unabated for some time. At the same time, the P-3 still has good legs as far as the program goes and will be around for a while. The P-8 will not replace it quickly, as the older platform fits certain strategic ISR needs.

"The F-35 and P-8 are the future, but upgrades and retrofits represent the best opportunities for avionics suppliers going forward," Plucker continues. "I show avionics modification spending for North American military aircraft avionics to be $24.12 billion between 2011 and 2017. I see the total military avionics market dropping slightly, principally as a reflection of fewer delivered airframes. In 2011 it was about a $13.5 billion market globally, and I look for it to be about $100 million less in 2017. It is a flat market overall, but with growth in the retrofit sector. Right now the market is being hit by last deliveries of individual models, and once that's done we will be in a truly retrofit world, which will change the value proposition a lot. I look at routine passive attack sensors, radar improvements, and glass cockpit upgrades in older aircraft to increase from 2015 onward."

Avionics retrofits over the next decade will be a steady market, Merluzeau says. "Training aircraft will get a good portion of this funding, as they will need new avionics displays and software so pilots can keep pace with the fifth-generation fighter technology on the F-22 and F-35 platforms. The vast majority of in-service training aircraft today were not designed to expose pilots to fifth-generation designs. Retrofitting these training aircraft will really enhance their display technology and, of course, result

in much higher MTBF. The lower cost of maintenance on training aircraft also enables them to last for at least another decade. These trainer upgrades do not represent massive dollar values, but should produce steady business that pays the bills.

"I also like the potential for F-16 AESA radar upgrades," Merluzeau continues. "These types of upgrades will enable these older assets to integrate in the future with the F-22 and F-35 and not just be passive assets that we can only use in a few instances. These upgrades bring these platforms closer to some of the capabilities of the fifth-generation fighters."

**Unmanned aircraft**

Opportunities also remain in the Unmanned Aircraft System (UAS) market. "I guess if I wanted to label the next 10 years, I'd call it the 'sustainment decade,'" says Ron Stearns, Research Director at G2 Solutions. "We are filling out our unmanned aircraft fleets from large to small, High Altitude Long Endurance (HALE) to Medium Altitude Long Endurance (MALE). We can have platforms for 10 to 15 years and upgrade the sensors, communications, and weapons systems to meet the standoff detection and ISR requirements and then focus on meantime between replacement for system elements such as communications, EO/IR, and others. There will be incremental upgrades to defense fleets, as some programs transition to programs of record such as K-MAX helicopter or the next iteration of MQ-9 Reaper or MQ-1 Predator replacements or when the Unmanned Carrier-Launched Surveillance and Strike (UCLASS) program is awarded.

"Funding for DoD programs of record, if you include money for the Long Range Strike program, which includes the Next-Gen Bomber – that may or may not have an unmanned component – the dollar amount will be much higher," Stearns continues. "Essentially you're going from $4.4 billion in spending on procurement and RDT&E, but not operations and maintenance, in 2013 to about $5.9 billion by 2018 when you include the Long Range Strike Bomber. If you take that out, it's $4.2 billion in 2013 and $3 billion by 2018. Things like the K-MAX rotary wing aircraft and the Air Force X-37B Unmanned Space Vehicle (USV) are not in there, as they are not programs of record yet and might not be released anyway."

In 2011 the total DoD funding of unmanned aircraft was $4.5 billion, Stearns says. "The decrease was anticipated as production numbers fell. It is a flat market and if flat is the new up, then there is sustainability from a DoD perspective. If you bend metal and make airplanes, it is going to be a tough road; but if you make command and control technology, flight controls, communication technology, and sensors, and the business model continues to open up, it could be a time of opportunity for you. The need for ISR is not going away. Even as CENTCOM winds down, ISR missions will be needed in AFRICOM and USPACOM after that."

**Fixed-wing UASs**

"What I hear and what I'm taking from the 2014 budget request is that there are a number of enhancements of the MQ-9 Reaper fleet happening in conjunction with fielding," Stearns says. "They are still building 401 of them with 65 to be built after 2018. Only 12 will be built in fiscal 2014. There are upgrades and enhancements that will continue to be performed, such as Lynx Synthetic Aperture Radar (SAR) upgrades, communication enhancements, anti-icing, etc.

"The Navy will also put forth a request for a proposal to award sole source construction of the UCLASS platform," Stearns continues. "They will roll in lessons learned in technology from the X-47B UCAS D naval demonstrator. UCLASS is the big prize as a program of record, as it is estimated to be worth $3.8 billion as an acquisition piece with some RDT&E rolled in. In regard to other fixed-wing platforms, the DoD is still fielding Gray Eagles, but not many beyond fiscal year 2015.

"In the small UAS category, Aerovironment is having success, but when looking at its RQ-11 Raven with regard to procurement quantities for Army programs, we can see that at some point RQ-11 will be filled out," Stearns continues. "There were plans for procuring in excess of 12,000 in total, and the new ones will have a data link with a gimbal on the Raven instead of a fixed side looking camera. However, since the Raven is a platoon-level asset, their addressable market is bound to erode as the U.S. shrinks the Army's size."

**Rotary wing**

"In rotary-wing applications, the MQ-8B Fire Scout will eventually be replaced by the next variant, the MQ-8C, which is based on a Bell 407 helicopter frame. As I understand it, the government will transition the C variant into the program of record. As of the fiscal 2014 request, the Navy will procure 202 of the B variant and 28 or 36 of the C variant, which came from a rapid fielding request. Those numbers will transition as MQ-8B and C. How many they will build of a mixed fleet could change," Stearns says.

**Vetronics**

"The military vetronics [vehicle electronics] market has turned out to be a bit stagnant as the retrenchment of the American military in ground vehicles drives the marketplace," Frost's Plucker says. "The Army is planning to reduce tank rebuild to minimum sustainment levels. The Army is effectively done building new ground vehicle platforms. The Ground Combat Vehicle (GCV) and Joint Light Tactical Vehicle (JLTV) programs are likely to be delayed or stretched out. There will be necessary spending on refits for returning vehicles, but that will not have the market pickup that it once was estimated to have. Last fall, the value of the vetronics market was at about $900.3 million. There was a small increase in vetronics funding, but it was less than initially estimated, as reduced spending was mandated within DoD. The principal growth will be in the RDT&E budget, not in procurement." **MES**

# 4G Core i7 boards: Best of both worlds

*By Charlotte Adams*

*A GE Intelligent Platforms perspective on embedded military electronics trends*

For High-Performance Embedded Computing (HPEC) applications with very tight space constraints, OpenVPX is the logical technology choice and 3U is the logical form factor. High-speed serial links like PCI Express and Gigabit Ethernet also make sense. But what about the processor?

It's usually a good idea to choose the latest and greatest. An obvious candidate is Intel's quad-core, fourth-generation (4G) Core i7 processor introduced in June. The new "Haswell" technology promises greater throughput and higher speed than its predecessor. It has approximately twice the performance per watt – a plus for embedded tasks – 30 percent better graphics capability, and double the data width for integer operations, compared with Intel's third-generation technology. But what's really new is its deep and enhanced parallel processing capability. 4G is a CPU and a General Purpose Graphics Processing Unit (GPGPU) combined.

**What does it buy?**

But what does it buy you in a 3U board? The new technology is thought to run sequential operations 20 percent faster than Intel's third-generation processor. So traditional command and control applications like weapon launch – where the data sets are small but latency requirements are strict – would run faster on the new boards.

More importantly, however, the 4G Core i7 features a graphics processing engine with some 40 execution units, or cores – more than twice the count of Intel's third-generation chip. The most obvious advantage to be gained from the improved graphics unit is improved displays. The wider integer pipeline can also improve image processing, which is often performed in an integer format. And users might be able to forgo a separate graphics processor, making room for other assets.

**Figure 1** | The GE Intelligent Platforms SBC326 is a 3U OpenVPX single board computer that features the latest generation of Intel's Core i7 technology.

**Multiply parallel**

The 4G technology can enable qualitative as well as quantitative advances for CPU boards. The execution units can be orchestrated to perform many identical operations simultaneously across a data set. Such a procedure is common in signal processing applications, where raw input from a camera needs to be converted to some engineering unit. The new chip also supports the latest release of OpenCL.

A second area of parallelization in the 4G processor is that each of the four cores has two execution threads. So each core could perform two parallel operations if the process lends itself to multithreading. Memory bandwidth for the 4G version is 25.6 GBps, up from 21.3 for the 3G processor. This means faster thread execution, while applications using the new Fuse Multiply Add (FMA) instructions – which provide two operations per clock cycle – will run faster.

A third area of parallelization involves the 4G Core i7's vector engine, known as Advanced Vector eXtensions (AVX), which adds a 256-bit integer instruction set, twice the data width of the 3G chip. Like a GPGPU, AVX performs Single Instruction Multiple Data (SIMD) parallel operations on a data set, and the wider data width of the 4G chip can double performance in some operations. But unlike a GPGPU, the vector engine involves much less latency at the outset. (The GPGPU's initial latency is balanced out over a large data set.) For smaller data sets, AVX would have the edge over dedicated parallel processors. By allowing multiple operations to be executed simultaneously, the vector pipeline also would be an asset for signal processing. While the 3G device was a highly competent signal processing engine, the move from 128-bit to 256-bit makes its 4G equivalent more compelling.

**Door opener?**

The 4G's technology could open doors to applications previously beyond the scope of SBCs. It can execute not only traditional CPU work but also sensor applications like sonar and signals intelligence on the same board without the price, power/heat, and real estate penalties involved with specialized processors. An example of an SBC implementing the new Core i7 is the GE Intelligent Platforms SBC326 (Figure 1), a single-slot, 3U OpenVPX board with an XMC site for signal processing adjuncts like high-speed analog-to-digital converters or FPGAs.

**More bang for the buck**

There are limits to how much processing and graphics capability can be squeezed onto a small SBC, and how much data can be run on and off the board. But the rapid evolution of processors – such as Intel's Haswell with integrated CPU and GPU – gives customers a lot of bang for the buck.

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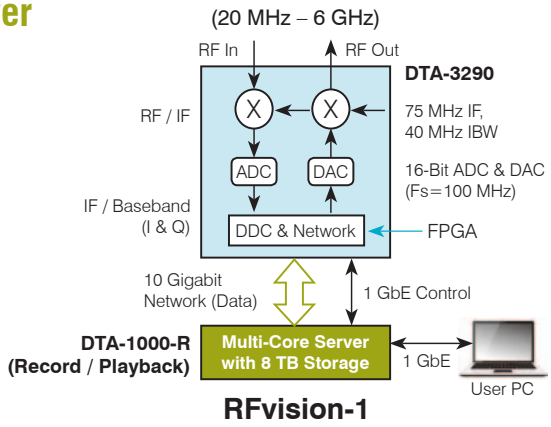


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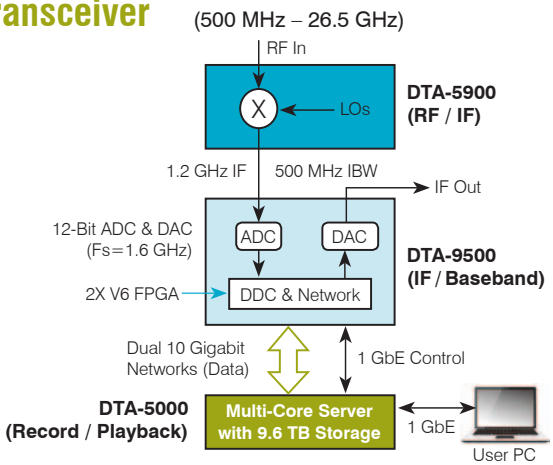


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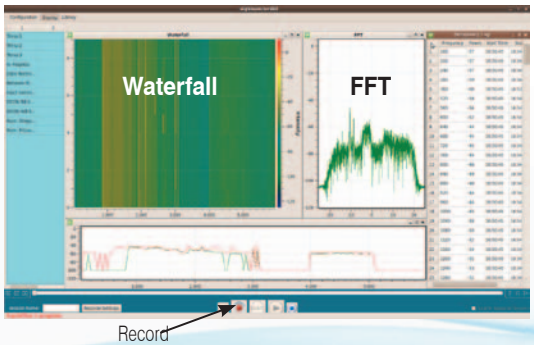


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# COTS data recorders with FIPS 140-2 encryption provide secure lockdown

*By Paul Davis*

*An industry perspective from Curtiss-Wright Controls Defense Solutions*

In deployed defense and aerospace applications, Data Recorders (DRs) are used to capture critical data. DRs are often deployed in harsh military environments, on platforms such as fixed-wing aircraft, helicopters, and armored vehicles that require a high level of system ruggedization. The recorded data, which may be captured from sensors or subsystems located on the platform, is extremely valuable; its value is related to the cost of individual missions for that type of aircraft or vehicle and the length of flight or mission time. In addition to its economic value, the data is often sensitive and must be protected from unauthorized access both during and after the mission. Types of DRs include mission recorders, built into aircraft or mobile vehicles, and instrumentation recorders that are used to capture data on test vehicles or subsystems. One effective method for handling the recorded data is via removable storage units that enable the data to be transported safely onto and off the platform. While Type 1 encrypted storage may be required for data classified up to Top Secret (TS), Type 3 encrypted storage can be used for Sensitive But Unclassified (SBU) data. The following focuses on capturing and storing SBU data.

**Encryption protects mission data**

After valuable mission data is recorded, it must be protected appropriately, which can involve the use of encryption. The decision regarding which level of encryption is needed is the responsibility of the program's Designated Approving Authority (DAA). The DAA must trade off costs, schedule, risks, and operational constraints to approve and select a specific encryption approach. For SBU data, the National Institute of Standards and Technology (NIST) established the Cryptographic Module Validation Program (CMVP) in 1995. NIST and the Communications Security Establishment Canada (CSEC) worked together on CMVP, which validated cryptographic modules to Federal Information Processing Standards (FIPS) 140-1 Security Requirements for Cryptographic Modules, and other FIPS cryptography-based standards. Released on May 25, 2001, the FIPS 140-2, Security Requirements for Cryptographic Modules, supersedes FIPS 140-1. The FIPS 140-2 encryption standard offers an internationally recognized approach that can be pursued by COTS storage subsystems vendors. Modules validated as conforming to FIPS 140-1 and FIPS 140-2 are accepted by the federal agencies of the United States and Canada for the protection of sensitive information.

To test their modules, developers of cryptographic modules use independent, accredited Cryptographic and Security Testing (CST) laboratories. The CST laboratories use the Derived Test Requirements (DTR), Implementation Guidance (IG), and applicable CMVP programmatic guidance to test cryptographic modules against the applicable standards. NIST's Computer Security Division (CSD) and CSEC jointly serve as the validation authorities for the program, validating the test results and issuing certificates.

The basic steps involved for a COTS storage company to become validated under FIPS 140-2 include:

1. The COTS company hires a FIPS consultant in order to avoid costly design mistakes and schedule slips.
2. The COTS company and consultant work in concert to architect the hardware and firmware designs.
3. The COTS company and consultant determine which part of the product is to be validated. This means defining the "encryption envelope."
4. The COTS company develops the storage product under company-paid IRAD.
5. The COTS company hires a NIST-accredited testing lab.
6. The COTS company sends the product to the testing lab.
7. The COTS company makes changes as discovered by the testing lab.
8. The COTS company locks down the exact configuration.
9. The testing lab submits a report directly to NIST.
10. The COTS company and the testing lab respond to any concerns from NIST and wait until the report is accepted and the validation certificate is issued.

The process for development and FIPS validation of a storage product is both costly and time consuming. Steps 1 through 9 might take up to 2 years to accomplish depending on the product complexity. Step 10 can take up to a year just for awaiting the actual certificate.

To protect SBU data, a lower-risk and less-costly approach is to utilize COTS products that have already been validated to FIPS 140-2. An example of a COTS data recorder with FIPS 140-2 validated storage is the Curtiss-Wright Vortex 3U FIPS Data Recorder, a rugged, open architecture COTS-based data recording system. Curtiss-Wright's 3U OpenVPX flash memory-based Vortex Storage Module (FSM) provides the FIPS 140-2 validated encryption. It is combined with an Intel-based single board computer running Linux and a recorder application. By including this FIPS recorder system in a rugged four-slot VPX chassis, the recorder memory is scalable from 1 TB to 6 TB. Utilizing such a data recorder system with FIPS 140-2 validated storage, SBU data-at-rest can be secured to a recognized standard with no schedule risk.

**Paul Davis**
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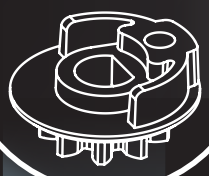

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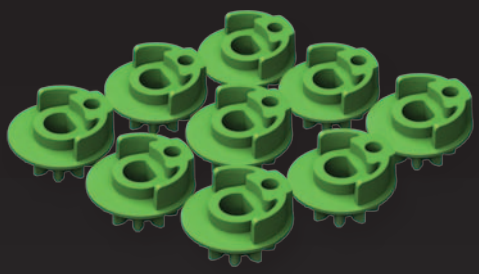

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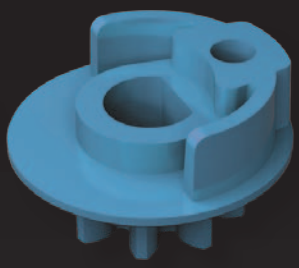

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# DEFENSE TECH WIRE

NEWS | TRENDS | DOD SPENDS | CONTRACTS | TECHNOLOGY UPDATES

*By Sharon Hess, Managing Editor*

NEWS

## U.S. to provide AH-64E helicopters to Indonesia

On a recent trip to Indonesia and other nations, U.S. Secretary of Defense Chuck Hagel announced the United States' $500 million sale of eight Apache AH-64E helicopters in addition to Longbow radars to Indonesia (Figure 1). While additional components of the sale such as the dates for the U.S. military-provided pilot training and delivery details are unknown, it is known that the U.S. military will help Indonesia develop relevant procedures, techniques, and tactics for the attack helicopters' usage within the security environment of Southeast Asia. The sale is part of the United States' commitment to growing its partners' defense capabilities while increasing military cooperation, according to a Pentagon senior defense official. The AH-64E "Guardian" features improved rotor blade technology and more powerful engines than its AH-64D "Longbow" predecessor.

**Figure 1** | U.S. Secretary of Defense Chuck Hagel recently announced the $500 million sale of eight Apache AH-64E helicopters as well as Longbow radars to Indonesia. U.S. Army photo by Capt. Jesse Paulsboe

## $1.3 billion contract mod enables DoD QRC

The Defense Microelectronics Activity recently issued a $1.3 billion (maximum) Advanced Technology Support Program III (ATSP3) contract modification to be spread over eight ATSP3 contracts previously awarded to: BAE Systems Information & Electronic Warfare Systems, Lockheed Martin Systems Integration, Northrop Grumman Systems Corp., General Dynamics Advanced Information Systems, Northrop Grumman Space & Missions Systems, Raytheon Technical Services Co., Honeywell Defense and Space Electronic Systems, and The Boeing Co. Phantom Works. The modification increases the ATSP3 contracts' cumulative value ceiling to slightly more than $6 billion. ATSP3 covers engineering services to develop applications and technology insertion solutions that solve issues of software or hardware deemed underperforming, unreliable, obsolete, or unmaintainable. The ATSP3's goal is to ready electronics to meet the DoD's Quick Reaction Capability (QRC) requirements. Work is anticipated for completion in December 2016 and occurs worldwide.

## Air Force Research Laboratory signs on CASE workers

The U.S. Air Force Research Laboratory recently awarded Compact Automatic Target Recognition (ATR) and Sustainable Environment (CASE) program contracts to Science Applications International Corp. (SAIC), Raytheon Co. Space and Airborne Systems, BAE Systems Information and Electronic Systems Integration, Inc., and KEYW Corp., with a cumulative IDIQ shared ceiling of $24.3 million. The goal of the CASE contracts is to condense the dimensionality of the database/template and to cut costs on multi- and single-phenomenology ATR, while preserving the target identification performance. Work under the contract will occur in McLean, VA; El Segundo, CA; Burlington, MA; and Severn, MD, respectively, by Aug. 2020.

## Navy BRITE Star contract beefs up ISR

The U.S. Navy and FLIR Systems Inc. recently penned a $136 million IDIQ contract covering BRITE Star I upgrades, data, depot repair actions, and cables plus BRITE Star Block II Systems, engineering services, provision item order, and class 1 engineering change proposal. BRITE Star Block II Systems, which work day or night, will be utilized in the Vertical Takeoff Unmanned Aerial Vehicle program as well as the UH-1 (Figure 2) program under the Naval Air Systems Command. The systems render ISR, in addition to identification, detection, and targeting capabilities for unmanned and manned platforms. Contract work is anticipated for completion in Wilsonville, OR, by August 2018. The contracting activity is the Naval Surface Warfare Center in Crane, IN.

**Figure 2** | FLIR Systems and the U.S. Navy recently signed a $136 million BRITE Star I/BRITE Star Block II IDIQ contract. Block II will be utilized in the UH-1 program. (Pictured: UH-1N) USMC photo by Sgt. Christopher Q. Stone

## VIDEO

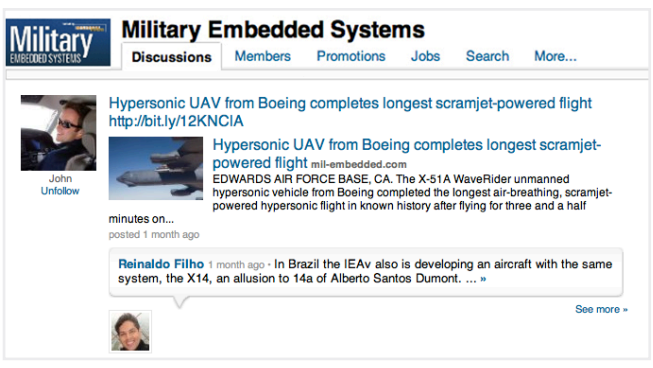
### Lockheed Martin JLTV demo rolls on

A recently released Lockheed Martin video shows the U.S. Marines Corps Base Quantico, VA demonstration of the company's incarnation of the Joint Light Tactical Vehicle (JLTV) for the U.S. armed forces earlier this year. Though this video shows LM's iteration, the other two companies vying for the all-or-nothing JLTV U.S. Army contract (Oshkosh Defense and AM General) also demo'd their versions of the JLTV in Quantico. The triad of JLTVs successfully ran over terrain laden with craggy steps, various-sized rocks, and power lines.

The JLTV is still headed for fiscal year 2015 purchase by the U.S. Army (49,000, including 5,500 for the USMC), despite sequestration, according to a media statement in June by Col. John Cavedo, Manager, Joint Program Office for JLTV. *Average* production expenses for each vehicle reportedly won't rise above $250,000; however, specialization for a specific mission such as combat buffering, command, or fording could alter a particular vehicle's price tag.

Watch the video: http://opsy.st/11YyHZ1

## SOCIAL MEDIA

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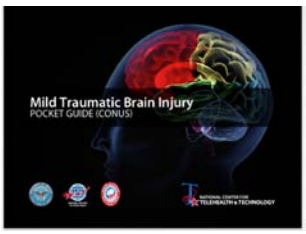
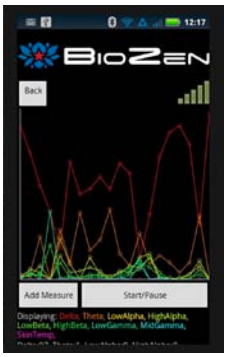
## MARKET PULSE

### $26 billion in mHealth app services by 2017

As the U.S. DoD's National Center for Telehealth & Technology (T2) continues to design healthcare-related apps for Service members, veterans, and their healthcare providers, mHealth (mobile health) app services are anticipated to climb to $26 billion worldwide by 2017, according to research2guidance's recent "Global Mobile Health Market Report 2013-2017."




Fifteen percent of mHealth apps are geared toward healthcare professionals. An example is T2's free, Android- and iOS-based mTBI Pocket Guide mobile app (pictured), affording a quick-reference repository of information to help healthcare providers offer improved levels of treatment to mild Traumatic Brain Injury patients.




Meanwhile, 42 percent of the 97,000 mHealth apps residing in larger app stores currently require payment for downloads. However, within the next five years, download app revenue will only constitute 9 percent of the mHealth market; instead, 84 percent of the mHealth app sector's income will result from associated products like sensors and mHealth-related services. T2's Android-based BioZen app (also pictured) plays into that trend, measuring a Service member's biofeedback via Electrocardiogram (ECG or EKG), Galvanic Skin Response (GSR), Electromyography (EMG), and Electroencephalogram (EEG) sensors that must be purchased separately.

Find out more: http://t2health.org/products/mobile-apps or www.research2guidance.com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# Multicore DSP enhances Synthetic Aperture Radar processing

By Dan Wang and Murtaza Ali

*Multicore DSPs allow power-efficient implementation of SAR processing tasks.*

U.S. Air Force photo by Senior Airman Andrew Lee

Synthetic Aperture Radar (SAR) utilizes the relative motion between the antenna and the target region to create an effect of a larger antenna than the actual physical size, thereby achieving high-resolution remote sensing. Different Commercial Off-the-Shelf (COTS) architectures have been applied to SAR systems to accomplish the signal processing tasks, such as the IBM cell-based platform, CPU, General Purpose Graphics Processing Unit (GPGPU), and FPGA. Considering both the intense computational efforts and the need to put these systems onboard during flight, the current challenge is to form a high-resolution image in real time with low power. To solve this problem, complex synthetic aperture processing can be implemented in low-power embedded processors like a multicore Digital Signal Processor (DSP).

**Basics of a SAR system**

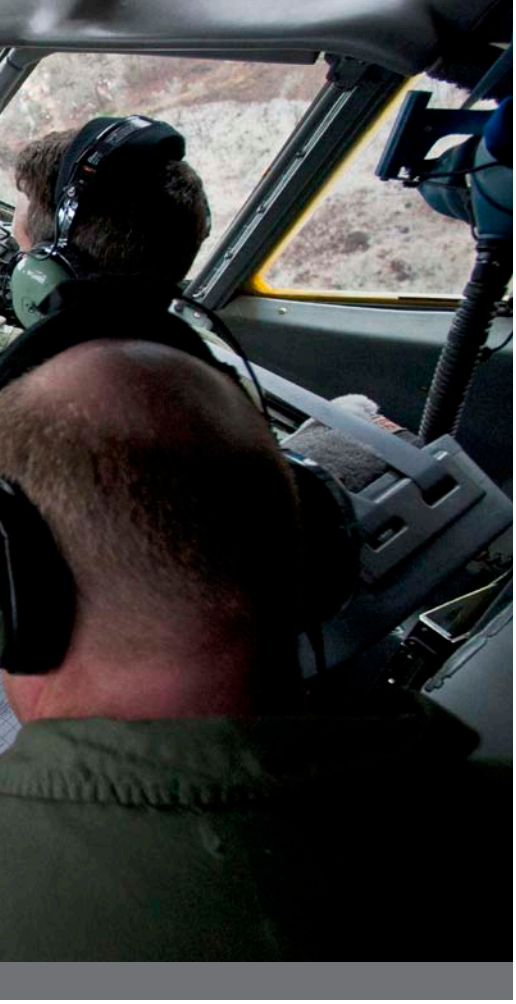
The complexity of SAR processing can be understood by studying the geometry of SAR signal acquisition. A SAR system gathers signals reflected from the targets at different positions at different times. The radar is usually carried by a spaceborne or airborne platform that moves with a certain speed along a desired track. The antenna transmits a short chirped waveform with a Pulse Repetition Frequency (PRF). The reflected echoes from the scene are collected, digitized, and stored by the antenna for later processing. The range direction is perpendicular to the azimuth direction, which is parallel to the flight track.

The original data collected from the radar is unfocused. To observe different targets in the scene area, the raw data passes through a chain of signal processing steps to achieve digital focusing. The first and most widely used method is the Range-Doppler (RD) algorithm. Other methods to focus the raw data on include the omega-K and the back-projection techniques. These techniques are much more computationally intensive compared to the RD method. The RD method features block processing efficiency and separability in two directions, so it is very suitable for parallel computing platforms. The following implementation is based on the RD algorithm.

**Working with a multicore DSP architecture**

Both the block processing and parallel nature of RD technique can be exploited using a multicore DSP. A typical multicore DSP can have several levels of parallelisms. First, the multiple (usually symmetric) cores can run multiple tasks at the same time. The cores can have multiple units that can run parallel instructions in the same cycle. Each unit within the architecture can also have Single Input Multiple Data (SIMD) instructions. The challenge is to map the computations efficiently to these different levels of parallelism to get the most power-efficient implementation.

In addition, these processor architectures also have memory hierarchy. This hierarchy consists of a set of internal private memories usually arranged in L1 and L2 configuration, internal shared memory, and DDR3-based external memory. Multicore DSPs usually offer additional configurability of these memory spaces, for example, the L1 and L2 memory can be configured as either cache or SRAM or as part cache/part SRAM. Efficient data movement across



this memory hierarchy is another important consideration for implementing complex computations like SAR processing. The Direct Memory Access (DMA) mechanism is often employed for this purpose.

**RD algorithm implementation**

An efficient DSP implementation of an RD algorithm requires that each of the sequential tasks in the overall processing chain is efficiently mapped to the DSP architecture. The main sequential tasks involved in the RD algorithm are: range compression, matrix transpose, Range Cell Migration Correction (RCMC), and azimuth compression.

*Range compression*

Range compression is to compress the received pulse along the range direction to concentrate the main energy into a narrower duration. After range compression, target points having the same slant range of closest approach are collapsed into a single trajectory. Compression is achieved with match filtering, which is implemented as complex multiplication in the frequency domain. Figure 1 shows the implementation flowchart for range compression involving FFT, multiplication, and IFFT. The raw data is originally stored in the external memory DDR3. Data patches are fetched into the local L2 memory via DMA. The reference function and the twiddle factors for FFT/IFFT are precomputed and stored in the shared memory.

Matrix transpose rearranges the range of compressed data so that it can be read and processed along the azimuth direction. The range compressed data stored in DDR3 are grouped into squared blocks to achieve higher DMA transfer efficiency. Block size is bounded by the available L2 memory space. Similar to the range compression, the ping-pong strategy is applied to improve the efficiency by overlapping the DMA operation and the data processing stage.

*RCMC and azimuth compression*

Range migration is caused by the range variations resulting from platform movement. Range migration correction adjusts distance at each radar position, so that the slant range appears to be constant. From the implementation perspective, the goal of RCMC is to rearrange the data in the memory to straighten the trajectory. After RCMC, azimuth compression can be conducted along each parallel azimuth line. Note that the migration for the whole family of targets with a same range distance is corrected simultaneously in this Range-Doppler domain method.

To implement RCMC, FFT along the azimuth direction needs to be carried out first. Therefore, we can treat RCMC as a part of azimuth compression. Similar to range compression, patch FFT strategy is applied to improve the DMA efficiency. The twiddle factors are precomputed and stored in the shared memory. After azimuth FFT, data in DDR3 are loaded to L2 as squared blocks. RCMC is implemented as a 16-set 8-tap filter. The interpolation coefficients are precalculated and stored in the shared memory. The fractional part of the migration amount determines the coefficient set, and the integer part decides the shift amount. Finally, the corrected data in the output buffered in L2 memory are transferred to DDR3. Figure 2 shows the

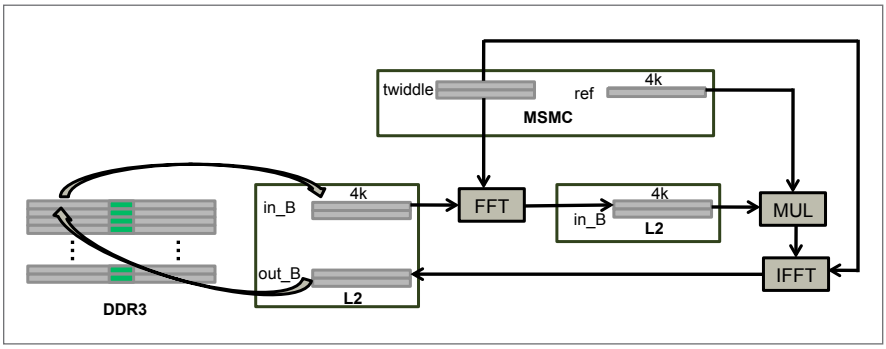



**Figure 1** | Data movement and computations are optimized for range compression.

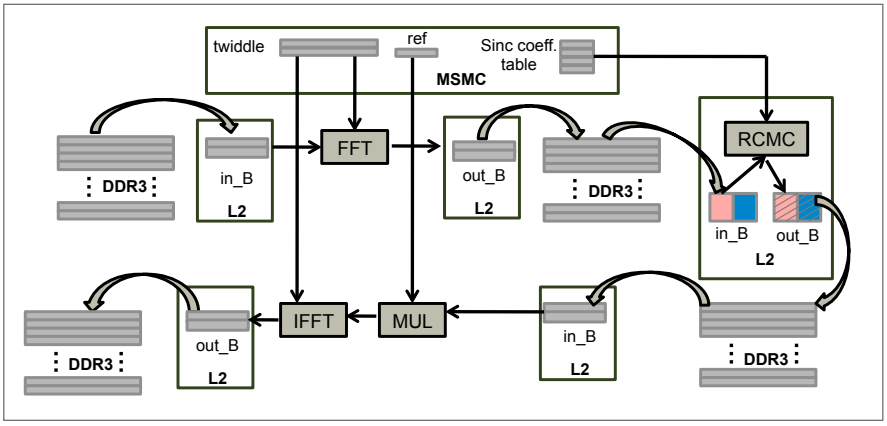



**Figure 2** | Data movement and computations are optimized for RCMC and azimuth compression.

detailed implementation of the RCMC and azimuth compression.

It is worth mentioning that the data to be read for interpolation at each correction are along the range direction. However, after matrix transpose, data are organized in the azimuth direction, so data used for interpolation are no longer continuously stored in the memory. This memory access discontinuity leads to additional cost during interpolation for RCMC.

Azimuth compression is the last step to generate a focused image. Each azimuth line collapses into a single point after compression. It is similar to range compression. The main difference is that the azimuth reference is range dependent. For simplicity, the current implementation assumes that the azimuth reference function is constant at all range cells.

**Assigning memory through multicore mapping**

As already noted, the RD technique is amenable to parallel implementation. A data parallel model is used in our implementation. Each core is simply assigned a different portion of data to process. At each stage, the data in the external memory are divided into eight portions. Each core retrieves the data according to the start point of the allocated location through DMA, and writes data to the assigned memory portion in DDR3 after local processing. The access to the DDR3 memory among multiple cores is scheduled by the DMA controller. The OpenMP runtime on the multicore DSP will run multiple threads (one thread per core) with their own allocated data portion.

**Illustrating application benchmark performance**

To provide some application benchmarks to illustrate the performance of the aforementioned design, we implemented it on a TMS320C6678 evaluation board available from Texas Instruments and profiled the execution time for each procedure in the RD algorithm. The applied image size is 4096 by 4096, which is very typical for a prototype SAR test. This results in 4096 FFTs and IFFTs in each transformation. The actual FFT size varies widely for different SAR applications. Very small FFT might be necessary for auto-focusing algorithms and very large FFT size might be needed in azimuth direction for full-resolution SAR image formation. In most cases, allowed FFT/IFFT size is limited because of the small local memory size. Therefore, one can divide the large image into patches and use smaller FFT sizes with overlap-save/add strategy for range/azimuth compression.

As expected, the time required for range compression and azimuth compression scales very well with the number of cores. With 8 cores, we obtained a speed-up factor of 7.9. On the other hand, the corner turning timing, RCMC, and azimuth FFT saturate at around 4 cores. This is because these steps are memory I/O bound, especially for matrix transpose.

The range compression and RCMC are the most computationally intensive steps. The sum of azimuth FFT and azimuth compression is similar to that of the range compression step. For the total execution time, it takes around 0.25 seconds to process the whole 4096 by 4096 image using 8 cores in parallel, with an acceleration factor of 6 relative to the single core case. Given that this processing is done with a 10 W device, this execution time makes the multicore DSP very competitive among other alternatives, such as GPGPU and CPU, as discussed earlier. Further, since the SAR processing is embarrassingly parallel, multiple devices can be employed to further improve the throughput.

**Making DSP SAR systems efficient, scalable**

Synthetic aperture radar systems require intense computational effort because of the large data size and complicated processing procedures. Considering the power efficiency and computational capability of new generations of multicore DSPs, designers can use such a platform as a candidate for SAR implementation. The computation tasks can be easily distributed to multiple cores and data processed in parallel. The scalability of SAR operations across multiple devices also bodes well for DSPs to provide embedded platforms suited to wide variations in SAR applications. The benchmarking results show that, with an image size of 4096 by 4096, the processing frame rate is 4 frames/second, achieving real-time performance with a 10 W multicore device. **MES**

> “ … Since the SAR processing is embarrassingly parallel, multiple devices can be employed to further improve the throughput. ”

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# Shipboard electronics leverage commercial technology

By Dan Taylor

*As technology and requirements evolve, the U.S. Navy is leveraging commercial technology and open architectures to keep shipboard electronics relevant in the 21st century. This also serves to enhance capability for the warfighter in new platforms such as the Littoral Combat Ship and in new systems such as the Air and Missile Defense Radar.*

The Lockheed Martin-built Freedom-class Littoral Combat Ship has a combat system that integrates radar, electro-optical infrared cameras, a gun fire control system, countermeasures, and anti-air missiles. Photo courtesy of Lockheed Martin.

These aren't your father's warships anymore. The information age has brought with it a marketplace of electronics, networking, and technology that is expanding at a breakneck pace, and the U.S. Navy is doing everything it can to keep up – and keep the young sailors deploying on their ships from becoming frustrated with outdated shipboard electronics.

It is no small task, and the quest to keep shipboard electronics both up-to-date and moving forward into the 21st century is a multifaceted effort. This ranges from introducing brand new systems that completely redefine how the Navy does things aboard its ships to figuring out how best to use systems that are already out there.

**New electronics, new platforms**

One of the newer classes of ships, the Lockheed Martin-built Freedom-class Littoral Combat Ship, illustrates just what kinds of new electronics are available for modern vessels. According to Lockheed, the ship boasts an Intelligent System Manager, which manages the ship's propulsion, electric plant, and other systems. The ship's combat system integrates radar, electro-optical infrared cameras, a gun fire control system, countermeasures, and anti-air missiles. It also features a system that uses lasers to monitor machinery health and detect contamination.

Other new vessels, like the Joint High-Speed Vessel and the CVN-78 aircraft carrier, also boast many new systems that were unavailable just a few years ago and allow sailors to utilize digital displays and more automated systems. However, getting the most out of shipboard electronics isn't just about the latest whiz-bang technology. It's also trying to figure out ways to use currently available technology in the most efficient manner, which is why the Navy is also looking to solutions in the commercial sector that could be adapted for military use.

**Leveraging commercial technology**

Experts at the Dahlgren Division of the Naval Surface Warfare Center in Virginia are currently working on such applications. "Basically, the stuff we're working on is looking at how to utilize commercial technologies and apply them to the shipboard environment, which is very different from a commercial workout," says Phil Irey, Lead Computer Scientist at the Dahlgren Division of the Naval Surface Warfare Center in Virginia. "There are similarities in that you have got to have properly cooled rooms to run these electronics in, but given the adverse conditions that you have at sea and in constrained spaces, a lot of times it's a lot more challenging."

There are also the issues of shock and vibration that most commercial electronics do not have to deal with, although electronics slated for the airborne environment can be more easily adapted to naval use. The challenge for the Navy is being flexible and

agile enough to keep pace with the processing capabilities that are constantly expanding in the commercial world, Irey says.

"We used to build all that stuff, custom electronics, back in the '70s into the '80s, but we found that we just couldn't keep pace," he says. "With the cost savings you got from the large audience who would buy those commercial products, you couldn't afford to build your own things." Networking and computing are two major areas where that applies, "because both of those are things that we traditionally do ourselves," he adds.

The Navy used to have dozens of parallel cables running from point to point between systems, which was not a very flexible system and very difficult to scale. Now the Navy is moving toward commercial Ethernet technologies, which provide high performance and are lightweight.

**Open architectures**

The Service's push toward open architectures – systems that are based on software and thus flexible and easier to upgrade than hardware-based systems – is helping create a more agile Navy, Irey says. The ability to interchange components because of the adherence to defined standards is a huge benefit to the Service, he adds.

"We have switches that we can easily change out … whereas in the past, we had to do a very complex replacement trying to find the exact copies of stuff that only we had created," Irey continues. "So it was very difficult to find spares. Now, we just upgrade with commercial equivalents of things."

There's still the challenge of making the electronics rugged enough to hold up in a maritime environment, but the Navy has figured out a few tricks in recent years. "When we adapted these electronics to the shipboard environment, we used to try to ruggedize the commercial components," Irey says. "What we've kind of moved to now is ruggedizing the enclosures and kind of putting the commercial equipment inside the ruggedized enclosures." That has the additional advantage of allowing the Navy to reuse the containers for other components, he adds.

**System consolidation**

The Navy also sees consolidating systems as an important step in improving the shipboard electronic environment, according to Isaac Porche, Associate Director for the Force Development and Technology program at RAND Corporation. "For ships in general, their issues are not so much the trends; it's the ability to refresh because of the nature of Information Technology (IT) – not including ship's radars and Aegis systems and really complex stuff," he says. "The biggest issue is how to get technology refresh rates. … Once you deploy on a ship, there are a lot of barriers to refreshing that tech. The Navy is aware and trying to do something about it."

Probably the most significant effort is the Consolidated Afloat Networks and Enterprise Services (CANES), which would take the numerous networking and enterprise systems aboard ships and consolidate them. The idea behind CANES is "let's not do a server for every application on the ship," Porche says. "If there's any trend, it's pushing toward consolidation and open architecture."

If you were to compare an old-model DDG-51 destroyer to the newly deployed Littoral Combat Ship, the difference between the electronics aboard the ships would be "night and day," he continues. "On the new ships, contractors can come in and put in an entire system. Older flights of Burkes will have tape drives. There's nothing consolidated. It has old operating systems. Anything in the last five years is drastically different from legacy classes."

**AMDR**

The Air and Missile Defense Radar (AMDR) – slated for Flight III DDG-51 Arleigh Burke-class destroyers – is one of the Navy's highest-profile overhauls of shipboard electronics to date (Figure 1).

**Figure 1** | Future versions of the DDG-51 Arleigh Burke class guided missile destroyers will use the Air and Missile Defense Radar to provide a simultaneous ballistic missile defense and air defense sensor capability. Pictured is the USS Michael Murphy, photo courtesy of U.S. Navy.

Captain Doug Small, AMDR Program Manager, says it will make the inner workings of the ship look a lot different from the Arleigh Burkes that premiered in the fleet decades ago.

Right now, the program is transitioning from the end of technology into engineering and manufacturing development with source selection underway. When all is said and done, AMDR, which is essentially a suite of two radars: S-band (SPY-1) and X-band (SPQ-9), will provide the Navy with a simultaneous ballistic missile defense and air defense sensor capability. Lockheed Martin, Northrop Grumman, and Raytheon are each leading a team competing for AMDR, which is expected to be awarded this year.

Small says it will be an active array that sits where the SPY-1 radar sits today on the ship, although it will be a bit bigger by about a foot on each side with about 14 feet of active aperture area. The software that controls the two radars will interface directly with the Aegis Weapon System currently aboard destroyers.

"The AMDR will be driven by the combat system," Small says. The Navy decided to bring on a new sensor system like AMDR because it was the "lowest-risk, quickest way to get this capability to the fleet to do the Ballistic Missile Defense (BMD) and air defense," he adds.

As far as the crew is concerned, AMDR represents the next generation of shipboard electronics in that maintenance will be much simpler and less dependent on regular monitoring. "It'll take fewer sailors," Small says. "[Training] is quite a bit reduced, and as far as on the operations side … it will be the same look and feel."

On the inside, things will look a bit different. All of the radio frequency components that transmit and receive, the power supplies, and everything else are mounted behind radiating elements, so the equipment on the deck is mostly computers, Small says.

On the other hand, while current SPY-1 radar setups have a lot of computers to drive the system, there also are racks of equipment in the radar rooms along with transmitting elements. Sailors won't have to deal with that with AMDR. "It's all up in the array," Small says. "That's the beauty of a modern active array radar – more than 30 times the radar capability" of older systems, but in a smaller footprint. The first ship to get AMDR is the second DDG-51 authorized in fiscal 2016, and the radar for that ship will arrive in 2019, he adds. However, new shipboard electronics technology has a drawback – outfitting it on older ships like first-flight DDG-51s is often cost-prohibitive, and AMDR is no different. "The ship impact would be considerable," Small says. "It's quite a different layout and footprint and all that sort of stuff. It would be a pretty invasive backfit on a ship." **MES**

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# Rugged military handheld designs inspired by consumer world

By John McHale, Editorial Director

*Cost pressures and consumer handheld technology increasingly drive rugged wearable computer designs for warfighter applications. Meanwhile, new ISR requirements for full motion video are pushing rugged display designers to innovate image enhancement technology.*


Black Diamond Advanced Technology's Modular Tactical System (MTS) is wearable electronics developed in part through feedback and lessons learned from SOCOM operators.

Rugged wearable computing designs are typically based on human factor feedback from the warfighter, as well as reduced Size, Weight, and Power (SWaP) requirements. However, in today's uncertain economic environment, there are also increased pressures on industry to reduce cost and fund their own product development.

"On the business side we continue to see pressures to reduce costs and wait times," says Steve Motter, Vice President of Business Development for IEE in Van Nuys, CA. "The government wants more off-the-shelf equipment and intends to spend less money on development. The consumer marketplace drives the tablet/wearable computer market. Military users want the same level of functionality that you get from modern iPhones and iPads with military-type performance. Many times in system development, guys will prototype by using Android on a consumer device, then port it over to a military-grade device and expect the same price point as the consumer product. This is a challenge, as developing security and encryption for these devices is complicated work."

"Today's Service member, more often than not, is a native of the digital world and has grown up with advanced technology," says James Poole, Director of Federal Sales, Panasonic System Communications Company of North America. "He or she is looking for a device to use on the battlefield that matches, if not exceeds, the capabilities of his or her personal devices used at home. The technology also offers connectivity, long battery life, portability, and ease-of-use to truly meet the needs of today's soldier. Panasonic offers the Toughpad FZ-G1 Windows 8 tablet, which was designed for mission-critical users. It has a sunlight-readable 10.1 IPS screen powered by a 3rd generation Intel Core i5 vPro processor. Panasonic engineers also have designed advanced heat-pipe assemblies that channel excess thermals away from sensitive internal components into their rugged tablets."

"There is a consistent Department of Defense (DoD) strategy to reduce risk and control costs and leverage investment dollars of industry," says Bill Guyan, Vice President at Network and Imaging Systems group in Melbourne, FL. "For our win on the Mounted Family of Computing Systems (m-FoCS), we had to show up with bit samples, which is not particularly new to DRS and is kind of the way we've been positioning ourselves. In this environment, you need to show the customer the product, not tell them about it."

"As defense spending continues to decrease globally, commands are looking for ways to do more with less," says Norman Lange, Director of Product Development at Black Diamond Advanced Technology in Tempe, AZ. "Military planners are looking not only for the best value for their limited acquisition monies, but are looking to reduce the government's burden to develop/mature technologies [that] can be applied to multiple requirements. Companies that create and deliver COTS

solutions at the system level (i.e., provide a total solution to the problem, not just provide a new widget) are well-positioned to weather this storm better."

**Wearable systems and the warfighter**

For wearable computer applications, most of the features and capabilities come out of feedback from the operators themselves. "Historically, we credit many Modular Tactical System (MTS) features and functions to good ideas, suggestions, and lessons learned from our early adopter customers within Special Operations Command (SOCOM) element commands," Lange says. "Most recently, we have been working closely with several end-customers to apply the multimission MTS solution to new mission sets including Remotely Piloted Vehicle (RPV), communications and networking, and Explosive Ordinance Disposal (EOD) missions." The MTS is a modular wearable electronics platform that is optimized for dismounted precision targeting, command and control, C4ISR, EOD, and other dismounted missions that require a computing function.

"The newest additions to our MTS ensemble provide the warfighter with more capabilities at the same weight, and in the case of the Radio Power Wedge, help reduce weight for extended dismounted missions," Lange says. "Our new dual-core Tactical Mission Controller (TMC) provides a 2x CPU performance increase, more than 4x graphics performance increase, and supports dual simultaneous displays. The newly improved Universal Tactical Display (UTD) multitouch enables two-finger gesture support (such as the familiar 'pinch to zoom' feature) for Windows 7 and newer operating systems."

The MTS supports a variety of Operating System (OS) choices, including Windows XP, Windows 7, Linux, Android, and soon Windows 8, Lange says. "To date, the vast majority of MTS users are constrained to a particular OS choice based upon the government software [that] they must utilize to execute their particular mission. Often within the DoD, there are very compelling reasons to continue using legacy operating system software (such as the high cost of requalifying application software and obtaining security certifications)."

Crystal Group, a longtime player in rugged servers and computers, is now entering the wearable computing market. Their new offering – the Wearable Computer System (Figure 1) – is an integrated ballistic and computer solution that is designed to meet communication, geospatial operation, and targeting in forward-deployed air support positions. It was designed to comply with the Ballistic Resistance of Body Armor NIJ Standard-010.0, Type III. Its computer, I/O hub, vest, GPS module, and display weigh less than 10 pounds, says Charles Tristani, Business Development Manager at Crystal Group in Hiawatha, IA. "The full vest, including batteries, weighs less than 32 pounds. The system's touch screen also works with cold weather gear, and the computer runs Linux and Windows."

The system came out of a U.S. Air Force requirement for a Joint Terminal Attack Computer System (JTACs), Tristani says. It will enable Special Forces operators behind enemy lines to perform such functions as designating targets for bombers to attack, he adds.

**Rugged displays**

Displays that can provide enhanced imagery in poor visibility environments for ISR applications constitute a significant trend in rugged computing displays. "Navy customers are looking for better visibility in extreme environments, such as underwater video for mine-hunting applications," says Bob Kopas, Vice President of Military Programs at Z Microsystems in San Diego, CA. The company's Intelligent Display Series flat-panel LCDs have a Real-Time Enhanced Video (RTEV) algorithm called Global Dehaze that can enhance images in these conditions, he adds.

"We use a fast FPGA built into the display controller in our Intelligent Display Series LCD panels to process image enhancement algorithms to multiple incoming video streams without adding any latency, so the data is viewed in real time," Kopas continues. "Basically the algorithm removes the detrimental effects of haze, smoke, fog, dust, mist, or other contaminants [that] may be interposed between a camera, for example, and the object or objects it is observing. The algorithm brings out the detail in images otherwise degraded by these poor visibility conditions or atmospheric interference."

**Figure 1** | The Wearable Computer System from Crystal Group weighs less than 10 pounds.

The military is also exploring gesturing for multitouch displays on handheld devices, Motter says. "For gesturing you essentially use gyros and accelerometers to determine the phone's position and then, based on the type of gesture, a particular function is initiated. In other words, you command the handheld device by motion, not just landscape orientation. For example, on some Motorola phones you can shake [them] and the camera will come on. We have not done anything in this realm yet, but are keeping an eye on it. The ARM processors we use have an interface built in, so putting in the solid-state device is easy." IEE offers a 10-inch TFT display that can be custom-tailored for harsh military environments.

"Another trend we are seeing in rugged displays is the move from 20-inch panel displays to 21-inch panels as the 20-inch ones are going end-of-life," Kopas says. "We are spending a lot of time in various programs fitting 21-inch displays into 20-inch form factors and testing for ruggedization."

Engineers at Digital Systems Engineering (DSE) in Scottsdale, AZ, are seeing more requests for rugged displays in the 6-inch to 17-inch form factor range from their military customers, says Ross Hudman, Account Executive at DSE. "Newer wide screen displays support a 16:9 aspect ratio.

"Regarding ruggedization, our displays are designed to be compliant with the commonly used MIL-STD 810F, EMI-461, MIL-STD-1275, MIL-STD-704, and

MIL-STD-3009," he continues. "These are very common standards that continue to dominate military environmental requirements." DSE's latest rugged display is the Programmable Tactical Awareness Controller (PTAC2) series for remote operation of military and avionics imaging systems (Figure 2). It enables on-display control of external equipment such as sensors, computers, masts, and turrets and/or internal display controls. The PTAC2 also has DSE's night vision technology.

**Rugged storage**

The demand for the rugged Solid-State Drives (SSDs) market is increasing steadily, says Wieslaw Wojtczak, CTO of Memkor in Phoenix, AZ. In the past, SSDs were very expensive, but the price has become more reasonable and their inherent reliability is making them very attractive to military customers, he adds. SSD flash storage is very complex technology, but has excellent resilience in hostile environments. Memkor offers the ORANGE Fast mSATA SSD, which has as much as 256 GB of storage in a 2-inch by 1.2-inch footprint. It also has optional hardware-enabled write protect and hardware/software-triggered data elimination.

**Figure 2** | The Programmable Tactical Awareness Controller (PTAC2) series from Digital Systems Engineering is used for remote operation of military and avionics imaging systems.

**m-FoCS**

DRS Network and Imaging Systems group won the m-FoCS contract, which is a modular family of computers and display systems for next-generation network computing technology on ground vehicles and weapons platforms. Under the contract, DRS engineers will provide platform-computing servers, dismountable tablets, docking stations, installation kits, interconnecting cables, and three sizes of sunlight-readable ruggedized touch-screen display units for more than 40 types of ground vehicles and weapons platforms. The three-year contract is valued at as much as $455 million.

The m-FoCS mounted family of computer systems came about from a request to consolidate mounted computing requirements for several programs, Guyan says. "The consolidation drives costs down and reduces the product sustainment expense. Having commonality and logistics across multiple programs enables dollars to be stretched further."

The m-FoCs is the follow-on to Force XXI Battle Command Brigade-and-Below (FBCB2) computers, which DRS has been supplying to the DoD for years. m-FoCS can run next-generation software

applications such as Joint Battle Command Platform (JBC-P), the Tactical Ground Reporting System (TIGR), and the Forward Observer System (FOS). The contract will support the Army PEO C3T and Project Manager Joint Battle Command Platform (PM JBC-P) at the Aberdeen Proving Ground, MD.

"The major difference between FBCB2 and m-FoCS is the difference between computing and networking," Guyan notes. "Although FBCB2 was a closed network, now there's increasing integration of all the systems and a weak link on any system provides weakness for the whole network." It is anticipated that the m-FoCS computer will run with a virtual machine architecture so that multiple applications can run simultaneously on it with different levels of security – unclassified, secret, and top secret all on the same box, at the same time, as there are different users in a vehicle with different security clearances, he adds. **MES**

## Rugged Computing Companies

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# Improving efficiency with COM baseboards

By Jonathan Miller

*Embedded computing in the military is trending toward wearable, handheld, and other small and lightweight systems, as well as experiencing increased downward pressure on cost. These systems require rethinking the internals in order to achieve their goals of size, weight, and cost. As a result, the traditional architectures of card cages and stackable systems, which are ideal for quick time to market but carry additional bulk and cost, are giving way to the lighter and more efficient COTS-based COM + baseboard approach. In addition to benefits in size and weight, COM + baseboard systems offer significantly longer lifetimes, fewer problems during technology refresh cycles, and equivalent ruggedness and reliability, making them ideal for long-lasting military programs.*

Tasked with the overarching goals of reliability and long-term availability, military electronics designers are understandably hesitant to adopt new technologies and methods that might prove unreliable in the long term or might disappear from the market altogether in a relatively short timeframe. The historic move to COTS was a recognition, however, that in order to achieve new performance and cost goals, the military would have to find a way to embrace faster-moving commercial technologies. After 20 years of experience with COTS, engineers are now far more ready and willing to incorporate new architectures into their product designs. This flexibility has allowed the introduction of new products with reduced size, weight, and cost for mobile and even wearable applications.

**Old versus new**

The mainstay hardware architecture for military electronics for the past two decades has been a combination of off-the-shelf boards (or customized versions of them) with dedicated functions, connected either with a backplane or a board-to-board stacking mechanism. This approach has allowed rapid prototyping, a high degree of configuration flexibility, and fast time to market, all significant benefits to any designer.

However, these boards also add a burden to the system in terms of size, cost, and weight. The backplane and/or stacking bus connectors exist solely because the system functionality has been spread across multiple boards. These board-to-board connection schemes require circuit boards, connectors, and bus driver circuitry, all of which drive these three important metrics in the wrong direction. In particular, as systems get smaller, PCB area as well as enclosure volume are at a premium, and any and all burdens on these limited resources must be carefully considered.

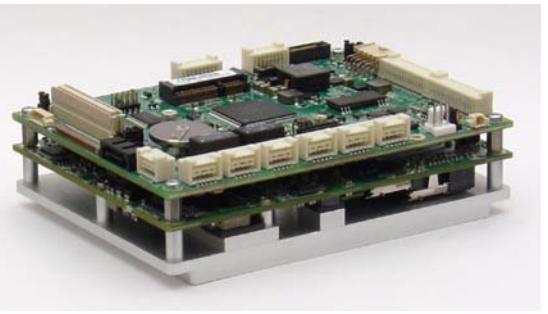
To alleviate these issues, the military is increasingly turning to a Computer-On-Module (COM) + Baseboard architecture. Instead of selecting one board for each function, this architecture requires just

two boards in total: One for the processor and one for everything else. Adopting this new format provides a slew of advantages to help military system designers achieve their goals.

**COM versus board set architectures**

In a COM-based solution, there is only one board interconnection between the two boards (for COM Express, this interconnection may consist of a pair of connectors) – see Figure 1. In most cases, the interconnection scheme has been specifically chosen for minimal impact on system size, weight, and cost, while retaining appropriate levels of reliability and ruggedness (Table 1). The result is greater efficiency in utilization of PCB area, smaller size, and significantly lower overall cost.

**Figure 1** | Conduction-cooled COM-based embedded system



**COM considerations**

A COM + Baseboard solution architecture brings other important advantages to the designer as well:

*Life-cycle extension*

Perhaps the most significant benefit is life-cycle extension. Military programs commonly have life expectancies of 20 years or more, whereas the typical embedded processor lifetime is only seven years. This means the typical military program can expect to encounter at least two redesign cycles during its lifetime. A common scenario with Single Board Computers (SBCs) is that when the becomes obsolete, the SBC designer has a difficult time finding an equivalent replacement. This is because no two SBCs are exactly alike, either in features or in connector type and placement. Typically the designer will engage in a series of unpleasant trade-offs among features, cost, and additional boards in order to obtain a suitable replacement to extend product life.

With a COM solution this problem simply disappears. All COMs of a given form factor offer essentially identical features. Therefore, changing to a new COM is a much simpler task. Product life can easily be extended another five or more years with minimal redesign effort.

*Performance upgrades*

The same reasoning applies when it comes time for a performance upgrade. The existing COM can be swapped out easily for a higher-performance one when additional processing power is needed to run new software applications, which is a common occurrence in long-life products.

*Time to market*

Another advantage of using COMs is that most vendors offer the newest processors in COM formats long before they offer the same processors in small form factor SBCs. Therefore, a COM can potentially offer a longer life cycle than an SBC with the same processor even before the technology refresh cycle kicks in. Case in point: At Embedded World 2013 in Nuremberg, Germany, the Intel booth had a display of no less than eight vendors showing their implementations of Intel's fourth generation "Haswell" Core i7 processor, all in COM Express Basic format. No standard form factor SBCs with this processor were on display. The processor had not yet even been released to the public at this time. This means that customers selecting Haswell in a COM Express form factor can enjoy the full seven years of expected lifetime, whereas waiting for an SBC might cut one to two years off that life expectancy.

| System architecture | Connector share of total component cost | Connector share of total available board area |
|---|---|---|
| Stackable system (4 boards) | 51% | 20% |
| COM + baseboard (2 boards) | 8% | 5% |
| Potential savings of COM over stackable | 43% component cost reduction | 15% PCB area reduction |

**Table 1** | Comparison of COM baseboard versus stackable I/O architecture in terms of size and cost – System configuration: Processor, DC/DC power supply, 8 multiprotocol serial ports, dual PCIe MiniCard sockets

*Physical system design*

Physical system design is another important consideration. Backplane systems typically severely restrict the overall size and shape of the system. In fact, most backplane architecture boards include front-panel slices with built-in I/O connectors, forcing the designer to use what the vendor has chosen, as well as impacting ruggedness and ingress protection. (The vast majority of such boards use commercial connectors, such as Dsub, rather than the rugged ones preferred for military applications, such as 38999.) With stackable architectures, the designer has much more freedom in designing the enclosure and selecting I/O connectors. However, cabling from the boards to the I/O panel can be a challenge, with board connections potentially on all four edges of the boards and no ready method to secure the cables internally. With a COM baseboard, the designer has total flexibility to choose what type of connectors to use and where to put them.

> "With a COM baseboard, the designer has total flexibility to choose what type of connectors to use and where to put them. In many cases, cabling can be eliminated by mounting user-accessible I/O connectors directly on the PCB."

In many cases, cabling can be eliminated by mounting user-accessible I/O connectors directly on the PCB. Benefits of this approach include reduced weight (eliminated cables), reduced assembly time, and increased ruggedness.

**Addressing COM concerns**

A common criticism of COM-based solutions is the expense of designing a custom baseboard. There are two answers to this complaint: First, the industry is starting to see off-the-shelf COM baseboards in the same size as the COMs themselves. These baseboards offer fast time to market as well as a convenient form factor for creating the total solution.

Secondly, although the cost of the baseboard project might be significant, amortizing it over the life of the project will usually result in a lower total unit cost than paying a vendor for an off-the-shelf

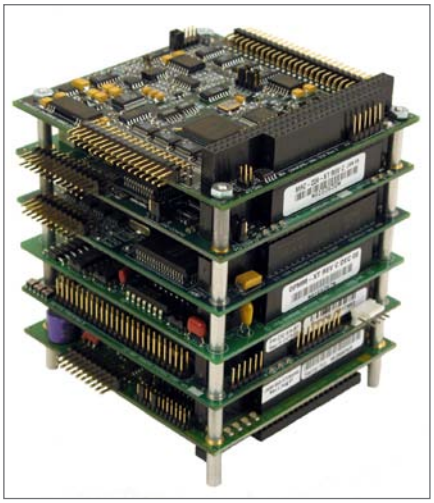
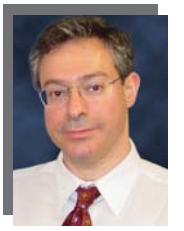


**Figure 2** | PC/104 stackable embedded system

SBC. For example, a $50,000 design project amortized over a 500 unit project lifetime is only $100 per unit, which is probably much less than the gross margin a vendor is charging over the production cost of the SBC alternative. Even with the cost of the baseboard rolled in, the overall cost of a COM-based solution is much lower than that of an off-the-shelf SBC + I/O module.

Another frequent question is the ruggedness of COM-based solutions, compared to the proven ruggedness of stackable architectures such as PC/104 (Figure 2), SUMIT, and EMX. Perhaps the most attention focuses on the fine-pitch gold fingers found on Qseven modules. Diamond has conducted shock and vibration tests according to MIL-STD-202G test criteria on the Qseven connector and found it to be sufficiently reliable to use in military vehicle applications. Part of the reason that Qseven survives this level of treatment is that it offers four mounting holes to help minimize relative movement between the module and the carrier board. COM Express vendors are starting to introduce substantially thicker PCBs (.093" versus the typical .062") that offer better resistance to flexing from vibration. In a nutshell, a COM-based solution can offer equivalent ruggedness to a stackable SBC.

All of these factors combine to provide a compelling argument for using COMs plus custom baseboards in military applications, especially where long life, size, weight, and cost are concerned. As discussed, designers can have full confidence that COM-based solutions will exhibit equivalent ruggedness to traditional SBC or backplane systems, and their extended life cycles plus easier technology refresh efforts provide additional appeal. **MES**



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# Next-gen data storage addresses military surveillance challenges

By Joel Leider

*Pluggable RAID solutions are widely used for military surveillance because they allow users to quickly unplug the data and transfer to a ground station for analysis. But the military asked for more storage capacity and faster data transfer in a smaller and lighter package. The latest generation of pluggable RAID canisters meets this challenge and is being used on a wide range of surveillance missions.*


U.S. Air Force photo

Military surveillance is performed daily with increasing sophistication to locate enemy combatants, vehicles and operations, and even individual explosives as well as identify and coordinate friendly assets. Cameras and sensors gather both visual and signals data of varying frequencies – and in continuously increasing resolution. The result is that very large quantities of data are recorded and analyzed in each mission. From a data storage perspective, the key challenge is recording data at high speed, storing it, and rapidly removing it from the plane, ship, or vehicle and transferring it to a ground station for analysis. In the past, the military used several different storage technologies to address this challenge, each of which had significant limitations. However, a new generation of pluggable RAID canisters designed especially for this application overcomes these limitations.

**Surveillance data storage comes of age**

Military surveillance aircraft such as the RC-135V/W Rivet Joint (see article lead-in photo) have played a crucial role in recent military conflicts such as those in Iraq and Afghanistan as well as a wide range of other missions. Military surveillance missions involve collecting images, signals, communications, and radar emissions. Surveillance planes are capable of recording and analyzing the complete electromagnetic spectrum over tens of thousands of square miles. They can transmit some information to ground stations but their data collection capabilities far exceed present-day wireless transmission speeds. So, in a typical surveillance mission, post-mission data storage devices with critical images and signals intelligence are removed and transferred to the ground station. Fresh canisters are immediately loaded into the aircraft so that the aircraft can be redeployed. The challenge for the military is that the volume of data collected during these missions is increasing at a geometric rate, making it more difficult than ever to store the data and easily and quickly transfer it to a ground station so that the plane can be redeployed.

The military has used a number of different solutions to address this challenge in the past. One approach is to mount disk drives in a rack-mount box. Then the drives, typically 24 per box, are each unplugged at the end of the mission, placed in a container, and carried to the ground station where they are plugged into a similar box for data retrieval. The weakness of this approach is the time required to unplug many drives, the difficulty of carrying the individual drives, and the potential for damage to a drive or connector.

A second approach involves the use of a small enclosure with four to six disk drives that can be unplugged from the plane and carried as a single unit to the ground station. The drawback in this case is that these boxes are typically heavy and awkward

to carry and the few drives do not come close to providing the data storage capacity needed for today's surveillance missions.

A third approach dispenses with the need to carry data storage devices by downloading the data through a cable from the ground station to the aircraft. Because of data transmission rate limitations it typically takes several hours to download the data. Military commanders are typically not willing to wait several hours for battlefield intelligence when mission success and warfighters' lives are at stake. This approach also ties up an expensive aircraft for several hours while the data is downloaded and runs the risk that the cable might be damaged by vehicles, water, or other conditions on the tarmac.

About a decade ago, the first data storage product designed specifically for military surveillance challenges appeared. It was a pluggable RAID solution designed to fit in about 4U (7") of standard 19" rack space and weighed nearly 100 lbs. A key advantage is that users were able to quickly unplug canisters with six hard drives containing up to 4.0 TB of data each and plug in a new set of canisters in a matter of a few minutes so the plane could be quickly turned around for its new mission. The RAID solution used 7200 RPM 3.5" SATA drives and provided two Fibre Channel ports per canister. It delivered a maximum data rate to and from the canister of about 200 MBps. The

**Figure 1** | Pluggable canisters are easy to insert and remove.

canisters were heavy and bulky, weighing about 20 lbs., but they were the best available at that time. This product became very popular in the military surveillance field; however, the company that produced it went out of business, leaving users in the lurch.

**A new generation of storage emerges**

The military asked for suppliers to step in and deliver a product with four times the data storage capacity, twice the data transfer rate, at half the size and half the weight – with higher reliability. Thus, a new generation of pluggable RAID data storage devices was born to address this challenge.

For reliability, SSDs are now popular in next-gen pluggable RAID solutions since SSDs are now more affordable, increase immunity to vibration, operate at higher altitudes, and run faster at lower power. The new generation of rugged disk arrays is constructed of lightweight, precision-milled aluminum that provides the strength needed without the weight of typical steel enclosures. The new generation of data storage devices also provides improvements in ensuring the integrity of the critical data. Each canister locks into place with self-locking handles that provide secure restraints for personnel safety during deployment with crash impact protection to 200G (Figure 1).

Military-grade connectors and cables in the disk array handle the everyday burden of insertion and removal. Sturdy guide pins align the canisters so that the connectors also align with precision to avoid damage. The canisters are mechanically keyed to avoid being inserted upside down. The disk array deploys 10 vertically mounted, compact, and lightweight 2.5" disks per canister. The smaller and lighter disk heads in 2.5" disks provide more protection from shock and vibration than traditional 3.5" disks. Vertical mounting reduces vulnerability to disk head crashes on the platter.

Next-gen pluggable RAID data storage devices, including the Winchester Systems RR2P dual canister disk array, are also, as mentioned, offering improved data storage capacity, data transfer rate, and size and weight (see Figure 2 on page 42).

Like the previous generation, next-gen RAID data storage comprises a purpose-built disk array designed specifically for the mobile storage requirements of military surveillance. Up to 40 TB of data can be stored in one pair of canisters. A high-performance RAID disk array controller delivers up to 2,200 MBps read speed and up to 2,000 MBps write speed. It supports four 8 Gb Fibre Channel ports to the host and 20 separate 6 Gb SAS drives that replace the old SATA drives with 1,000 times lower bit error rate. These disk arrays fit into just 2U (3.5") of standard 19" rack space and are only 22" deep. The canister is only 8" wide by 9" deep and only 3" high with a handle for easy insertion, removal, and carrying. Canisters removed from the disk array are easily labeled and moved to secure areas and are small enough to put into a physical safe. The canisters weigh about 10 lbs. each, and the rack loaded with two canisters weighs about 48 lbs., or 44 lbs. with SSDs.

**RAID delivers high capacity, speed, reliability**

As military surveillance continues to become of ever increasing importance with ever more data at ever higher speeds, the benefits of pluggable RAID become ever more apparent. Rugged, lightweight, and compact, the latest generation of disk arrays delivers the high capacity, high speed, and high reliability that make it ideal for new surveillance applications as well as the perfect replacement for earlier generations of equipment that are no longer available. **MES**

**Figure 2** | Next-gen pluggable RAID data storage devices, including the Winchester Systems RR2P dual canister disk array, enable recorded data to be removed and replaced with fresh canisters in less than two minutes.

*Joel Leider is Chief Executive Officer and Cofounder of Winchester Systems. For more than 32 years, Joel has successfully guided the company's sales, marketing, business-development, and business operations. Joel has served as Executive Director for the RR2P project, and previously he was Software Engineering Manager at Teradyne. Joel holds an MBA degree in Marketing & Finance from Boston University; an MS, Computer Science from Rensselaer Polytechnic Institute; and a BE, Electrical Engineering, from New York University.*

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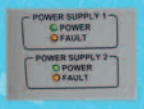


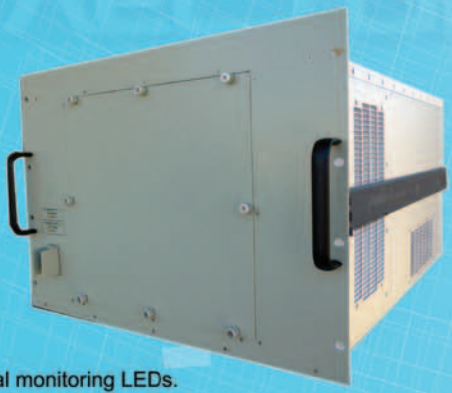

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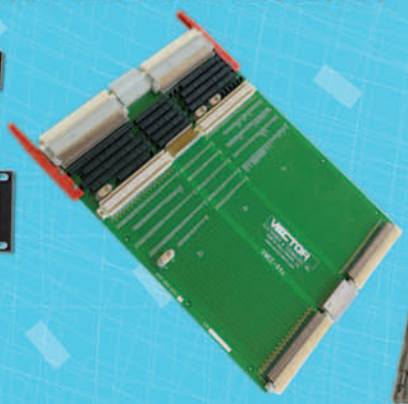

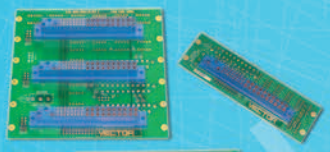

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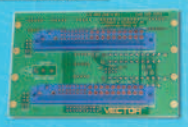

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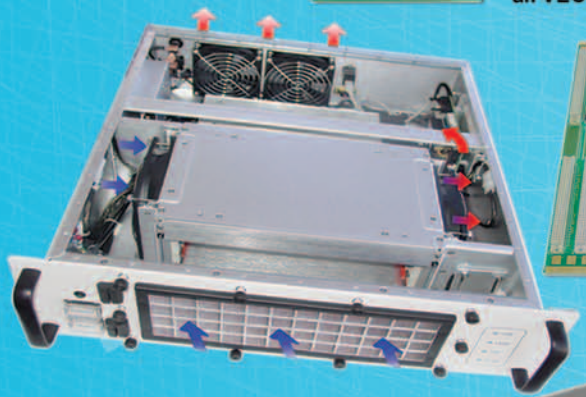

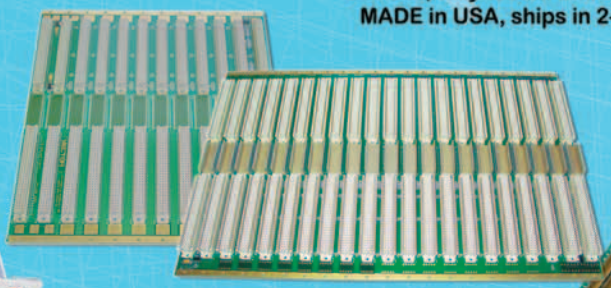

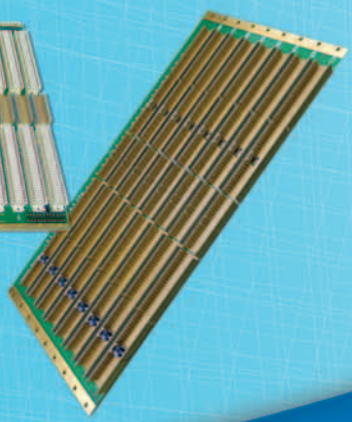

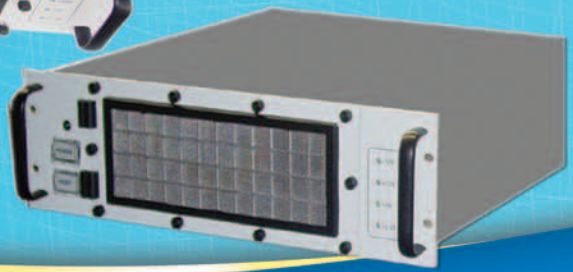

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# Managing obsolescence with PMC, XMC, and FMC mezzanine solutions

By RJ McLaren

*PMC, XMC, and FMC transition custom legacy system designs effectively and enable IP reusability for OEMs.*

U.S. Air Force photo by Staff Sgt. Kamaile O. Long

Managing obsolescence has long been a challenge for military designers. It can be a complex process to define long-term road maps for systems that might have originally been developed as full-custom solutions while at the same time managing costs and time to deployment, and continually increasing system performance in field deployments. These primary drivers for military designers and OEMs call for sophisticated product life-cycle planning to preserve the integrity of deployed systems, while establishing a tangible path forward that addresses changes that might be either anticipated or unexpected.

Preparation and predictability ensure the consistency and longevity of deployed solutions. When engineers of custom designs in particular struggle with these factors, other design considerations must come into play. The result is often a blend of traditional obsolescence mitigation efforts, such as extended commitment to availability of certain components, and evolution to standards-based options as a means of ensuring long-term system viability and performance. Mezzanine cards in three widely available standards – PCI Mezzanine Card (PMC) IEEE P1386.1, Switched Mezzanine Card (XMC) VITA 42, and FPGA Mezzanine Card (FMC) VITA 57 – are showing promise in managing obsolescence, effectively evolving custom solutions to a range of standards-based platforms.

**Diverse mezzanines enable evolution**

Mezzanines offer flexible and modular I/O options that can take the place of custom I/Os in an obsolescence management plan. PMC, XMC, and FMC (see sidebar on FMC) are the commercial form factors that dominate the market as standards-based components; as a result, carrier boards can readily accept mezzanines from a broad range of vendors and suppliers in a well-defined product ecosystem. Further, PMC, XMC, and FMC each support the primary mil/aero platforms (for example, VME, VPX, and CompactPCI) and are compatible with both 3U and 6U architectures.

This option functions in sharp contrast to previously customized designs where OEMs developed their own specialized I/Os and put them directly on a proprietary card design. When the chips or other components in these systems faced End-of-Life (EOL), manufacturers typically had to weigh the options of respinning the board with a new chipset versus executing an extended buy of components to manage the system into a longer product life cycle. Further, once an extended buy was committed, future changes might still warrant the need for additional product life-cycle management efforts. XMC, PMC, and FMC mezzanine solutions are proving valuable in delivering a standards-based alternative for transitioning such custom systems to standards-based solutions with well-defined and cost-efficient product road maps.

Packaging specialized I/O into modular mezzanine solutions serves to repurpose IP and define a significantly larger user base for what once were costly, fully custom designs. This not only answers the established COTS mandates, but increases competitive viability for OEMs seeking a broader range of military contracts.

By coupling mezzanine modules with carrier boards in platforms ranging from VME to CompactPCI to VPX, designers are poised to either jump their systems to small footprint blackbox solutions or more traditional 3U or 6U systems in the same platform.

**Mezzanines as rugged building blocks**

Within the standard platforms such as CompactPCI, VME, and VPX, carrier cards are consistently designed and available in the same 3U and 6U form factors. Each has a defined interconnect that plugs into the backplane, as well as a mezzanine connector and pinout that readily support the PMC mezzanine form factor. PMCs can be purchased in volume, and can be designed to function alongside the processor card or to exist on a separate carrier card – ultimately enabling reusability of the mezzanine on multiple bus architectures.

This concept can be illustrated by a traditional 6U VME deployment transitioning first to the use of a mezzanine card solution (PMC, XMC, or FMC) as a drop-in replacement to reduce program risk. The Kontron VM6250 makes available 2x PMC or XMC slots or an FMC slot for such cases (Figure 1).

This solution can deliver upgrade performance for a defined period of time and allow OEMs to effectively control planned performance steps within a system's deployment. The mezzanine solution can maintain system performance and minimize downtime, while giving system engineers time and prevalidated options for integration into a next-generation solution as the next step in its life cycle.

Most next-generation, high-speed, standards-based boards and systems will accept the same mezzanines, allowing OEMs to reuse them in many different applications by repackaging to meet the program's exact requirements. 3U/6U systems use backplanes to interconnect the processor, switch, and I/O (using mezzanines) specific boards.

**Mezzanines enable evolution**

Strenuous performance demands continue to translate to design challenges for military OEMs. As DoD budgets focus on both efficiency and performance, managing obsolescence is essential in meeting expectations. As system deployments extend years beyond original expectations, migrating custom designs to standards-based solutions is an increasingly important factor in managing obsolescence. Mezzanine options

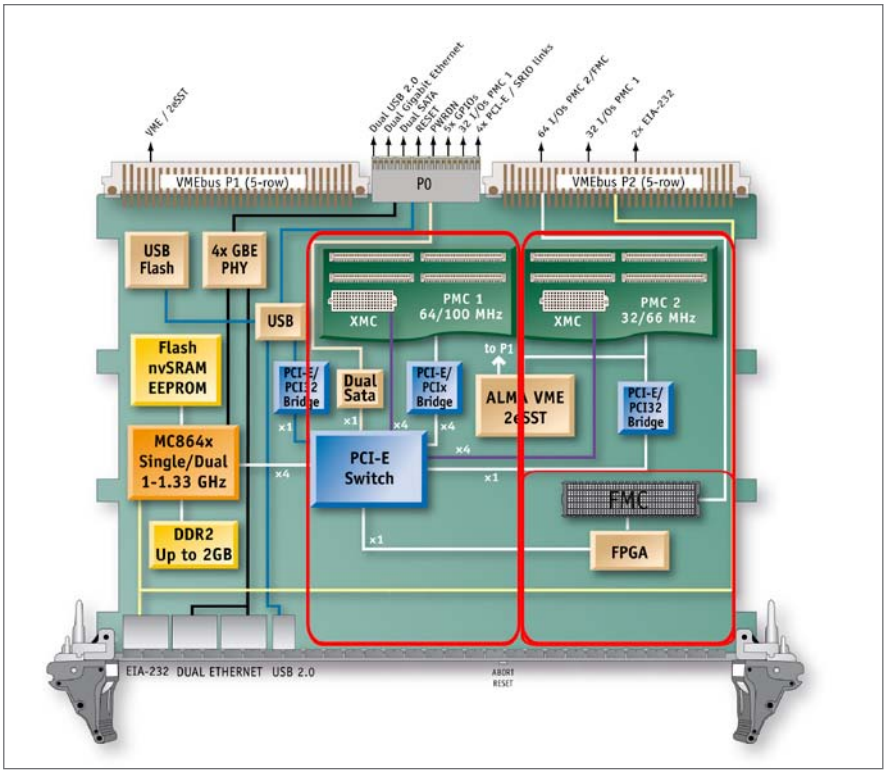


**Figure 1** | A traditional 6U VME deployment transitioning first to the use of a mezzanine card solution (PMC, XMC, or FMC) as a drop-in replacement to reduce program risk

## VITA 57 FMCs

The VITA 57 FMC standard provides an industry standard mezzanine form factor in support of a flexible, modular I/O interface to an FPGA located on a baseboard or carrier card such as Kontron's VX3830. It allows the I/O interface to be physically separated from the FPGA design, while maintaining a close coupling between a physical I/O interface and an FPGA through a single connector.

With VITA 57 FMC-based designs, OEMs can minimize latency for high data throughput in their COTS designs and still maintain flexible I/O configuration. The FMC optimizes the handling and formatting of data and is approximately half the size of a PMC, ideal for systems that are addressing improved Size, Weight, and Power (SWaP) as part of their product road map. Development costs are kept in check by integrating multiple functions into a single PCI Express-enabled FPGA, aiding system designers who want to retarget their designs without changing the PCIe interface implementation.

FMC is optimal for low-latency, high-bandwidth applications. For example, if a signal needs to be processed directly on the FPGA, a solution can be achieved in which one or more analog signals are digitized, then read directly and processed by the FPGA; data is then transmitted back out through the same FMC with a latency as low as a few nanoseconds. In this scenario, there is no need to route the signal through the bus architecture as it only moves in and out of the FPGA; any resulting delay is merely in the FPGA processing.This level of performance is ideal for electronic countermeasures where minimizing delays in the response time is absolutely critical.

In the past, this type of low-latency processing would have been achieved on a proprietary board and subject to component obsolescence. Also, if there is a system refresh benefit in using an FPGA for the application requirement, then the FMC approach is the most obvious mezzanine choice.

have proven their viability as flexible, modular, and cost-effective design choices for these programs (Table 1).

The mezzanine module has a long history and its implementation is a popular approach to reusing proven technology in many different systems. The PMC may be the longest existing standard discussed here and is well-proven within the industry, but it is limited to compatibility with legacy parallel bus architectures. The XMC standard is the next evolution to this robust mezzanine offering many options. XMC integrates seamlessly with VPX high-speed interconnects and will continue to grow in popularity as more vendors and products are added to the market. The latest mezzanine form factor, the FMC, offers the greatest flexibility and configuration options, but is more complicated because of FPGA core development. Its use will continue to grow, but will most likely be as a more customized path that can be tailored to customer application requirements.

| | PMC | XMC | FMC |
|---|---|---|---|
| Standard | IEEE 1386.1 | VITA 42 | VITA 57 |
| Adoption Date | 2001 | 2005 | 2008 |
| Size (mm) | 47 x 149 | 47 x 149 | 69 x 76.5 |
| Data Rates | 64-bit @ 66 MHz | Up to x16 Links | Up to 80 Diff Pairs |
| Protocols | Parallel Bus | PCIe, Serial RapidIO | FPGA Dependent |
| Ecosystem | High | Medium | Low |

**Table 1** | As system deployments extend years beyond original expectations, FMC, PMC, and XMC mazzanines have proven their viability when migrating custom designs to standards-based systems.

These mezzanines give system engineers a product-rich ecosystem that will provide the best solution to managing their products' obsolescence life cycles along with laying the foundation for future product expansion and flexibility for application requirements. **MES**

***RJ McLaren** is the Portfolio Manager for Military and Commercial Aerospace Products at Kontron America. He is responsible for product and business development for rugged systems along with Kontron's industry standard COMe, AMC, CompactPCI, VME, and VPX product lines in North America. Contact him at rj.mclaren@us.kontron.com.*

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# Four obsolescence management myths that kill defense programs

By Ethan Plotkin and Kaye Porter

*In the face of relentless budget cuts, defense programs face system life cycles lasting longer than originally anticipated. By the time a ship or plane is decommissioned, it has often been in use decades beyond its original life expectancy. When warfighter programs are affected by aging, unreliable products, or lack of funding for spare boards and system repairs, our troops aren't getting the support they need. In a climate of Performance-Based Logistics (PBL) programs, budget cuts, sequestration, COTS obsolescence, and increased counterfeit risks, proactive obsolescence management needs a refresh just as much as many defense systems do, but sometimes myths about obsolescence hold organizations back from taking a more proactive approach to obsolescence.*

We all know critical programs aren't abandoned because they're mature. Even in the face of forced obsolescence, counterfeit components, and ongoing supply disruptions, embedded systems need to last longer than the standard life cycle of the parts that go into them.

Until now, obsolescence has only offered a world of headaches:

- End-of-Life (EOL) notices negatively impact program sustainability.
- Last Time Buy (LTB) notices trigger expensive and risky overstocking.
- Counterfeit components threaten the supply chain.
- Component sourcing and reverse engineering risk critical downtime and drain resources.
- Forced obsolescence and redesign are risky and cost millions of dollars.

Long-term products find themselves in a gap between life-cycle management and legacy support. Without a clear process for proactively managing that gap, once-effective applications run the risk of becoming little more than paperweights. While programs may institute complex Product Life-cycle Management (PLM) systems and engage large engineering teams, it is common practice for DMSMS and logistics teams to target obsolescence reactively, leaving critical systems vulnerable to Last Time Buys and End-Of-Life events.

Common assumptions made about obsolescence management and sustainment seriously tax efforts to sustain warfighter programs. The assumptions we make about obsolescence put the systems our warfighters rely on at as much risk as the counterfeit components encountered in our efforts to sustain them. Because these assumptions undermine efforts to be proactive, our understanding of obsolescence management needs a refresh just as much as many of our defense systems do.

To maintain system reliability and mitigate hundreds of supply challenges, we need to understand and challenge the myths and assumptions that guide the decisions we make in attempting to secure and safeguard our critical legacy applications and programs. Legacy management then includes a larger picture

of total life-cycle sustainment planning, component qualification, and source qualification, and avoiding the need for unnecessary redesign and recertification of systems plagued by obsolescence.

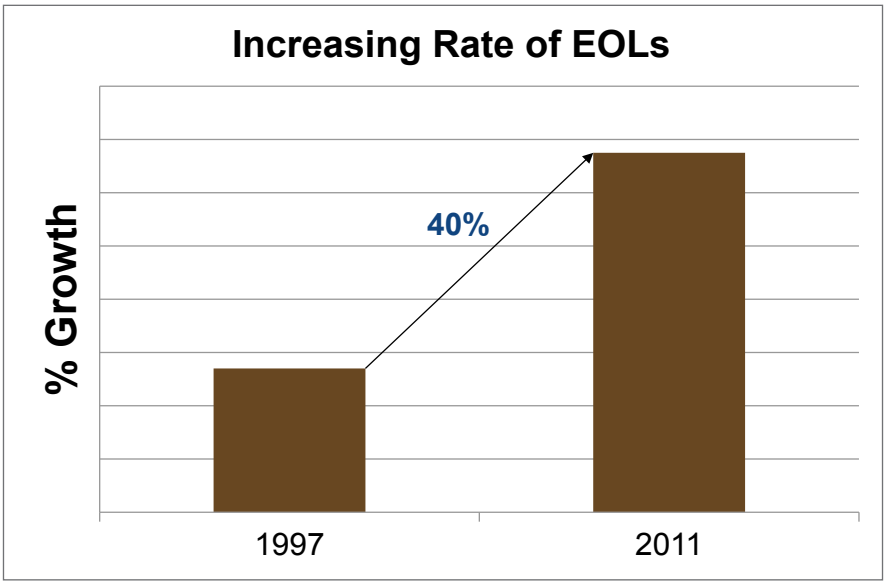



**Figure 1** | According to IHS, the embedded industry saw a 40 percent Compound Annual Growth Rate (CAGR) of EOLs and PCNs between 1997 and 2011.

## MYTH #1

**Obsolescence is a problem.**

Obsolescence is a problem if you think of it as something that can be avoided. However, obsolescence is actually a reality for the embedded industry and the dark side of relentless innovation. But even in the face of obsolescence, mature, mission-critical programs need to continue. The problem is not obsolescence, but how we try to manage obsolescence through the reactive approach of EOL.

According to IHS, between 1997 and 2011, component EOL and Product Change Notices (PCNs) have seen a Compound Annual Growth Rate (CAGR) of 40 percent (Figure 1), and during this time, COTS embedded board manufacturers were hit with the same supply chain disruptions and EOL issues as defense customers who were buying components directly. As a result, products that had been scheduled for a longer life cycle were being cut and the defense industry was heavily impacted by the reactive push for Last Time Buy orders in the face of EOL.

Effectively dealing with the reality of embedded obsolescence requires a paradigm shift from an industry "normal" of EOL cycles and forced technical upgrades – an approach that doesn't take into account ongoing legacy need. Instead, a proactive legacy management approach can acknowledge the inevitability that systems will be needed much longer than their parts' active life cycles. In practice, this means forecasting actual lifetime needs instead of constraining the forecast to available funding.

## MYTH #2

**If we have access to the components/IP, then every product could be supported indefinitely.**

According to the DMEA, the B-2 Bomber encountered more than 140 obsolete components and submodules could not be acquired for the B-2 Radar Warning Receiver (RWR). In addition to system age issues, design IP and support documentation for critical parts had been lost. Because of these types of situations, it makes sense the IP myth often goes hand-in-hand with the components myth: If the program has the IP they know what goes into the system, and if they have the parts they can build it.

But considering the numbers of programs and versions of programs that exist in the field, even getting the IP/components is not enough to ensure legacy sustainment. In 1994, part of the DoD's shift from custom to COTS was based on the rising costs and complications of organic (in-house) sustainment of all the custom IP in every single system. At the time, the hope was that if OEMs could be used to maintain the components and IP internally, that defense programs could leverage the inevitable upgrades, and the OEMs' internal sustainment teams and brain trust would keep the boards going.

Unfortunately, just like depots and DMSMS teams, it isn't realistic to believe that OEMs can support every version of a product that they have ever developed indefinitely. In the worst case scenario, sometimes the OEMs don't even exist long into a program's life cycle and the IP is then lost forever. Indeed, even in cases where OEMs are acquired by other companies, older and underperforming products often don't make the cut – meaning the IP and know-how are effectively lost forever.

The proactive shift in these situations requires focusing on legacy sustainment – while the supply chain is secure, while managing the larger, strategic plan in parallel. This means working with extended support providers who specialize in assuming responsibility for OEMs' "long-tails" of lower-performing (but still critical) parts or investing in the organic capability to perform these functions indefinitely.

## MYTH #3

**Old products have no demand.**

What do the B-52, KC-130, the Phalanx, the USS Mount Whitney, and the THAAD Missile system all have in common? They are all tried-and-true defense programs that have had their life cycles extended far beyond their original anticipated need. They are also all mission-critical in the lives of soldiers and civilians, requiring they be functional and reliable each time they are in service.

It is the proven reliability of these programs that then increases the likelihood of life-cycle extensions, follow-on installations, or ongoing international sales – even in the face of short embedded COTS life cycles. While OEMs work hard with customers to provide drop-in replacements for mission-critical systems, things are rarely that straightforward, and there must be a solution for those programs that simply cannot afford the cost or risk of upgrading.

Even securing funding for an upgrade presents its own set of work and risk: Before deployment, each product still needs to be tested, certified, and verified to ensure that the product is not only going to work, but that it will mix in with the older versions of systems that are already in the field and continue to be compatible with the legacy software already being run by the program.

The fact is, older products have demand, and their demand is often robust and complicated to assess when coming from a place of obsolescence management through LTBs, redesign, and bridge buys. The proactive challenge is for everyone to acknowledge the value to everyone in creating a legacy sustainment plan for these products for as long as they are needed. In practice, this starts with insisting on knowing the answer to a single question: Are we confident in our approach to support our program until it is no longer needed?

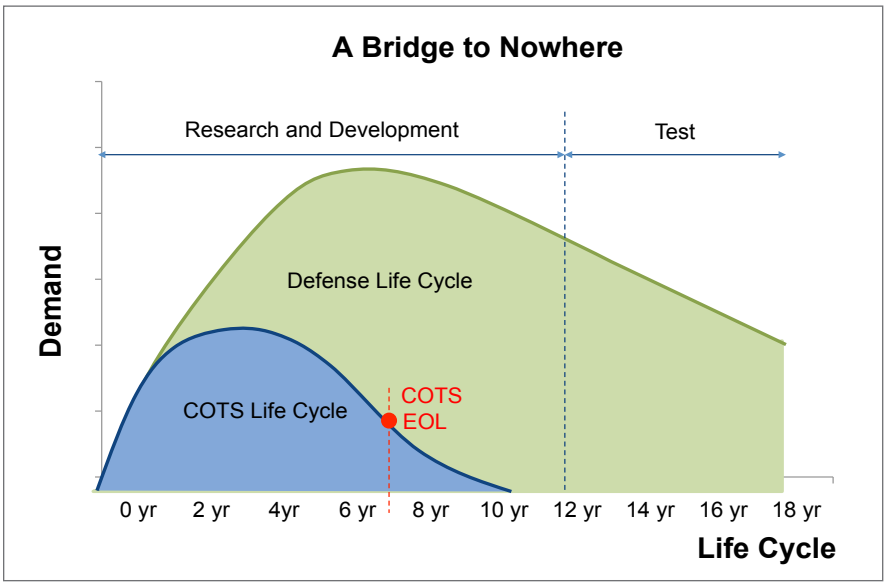



**Figure 2** | A Last Time Buy (LTB) brings a false sense of security, and doesn't account for follow-on sales or the logistics challenges of stocking and storing parts for the length of a program.

## MYTH #4

**Repeated LTBs are a good solution for EOL**

In the 1980s, before the uptake of COTS, defense programs caught criticism for maintaining large stocks of electronic components, even though these components were necessary to maintain the various custom embedded systems that these programs relied on. Today government contract cycles typically run anywhere from 2-5 years and face continuous scrutiny for unnecessary spending. Because of contract lengths, reduced funding, and defense-wide impacts like government sequestration, programs have become more cautious about how much stock they keep on hand, and money isn't as available to support the costs of increasing program life cycles.

This historic background is completely at odds with an LTB sustainment solution and experienced program managers know it (Figure 2). LTB is really only a solution for programs that need a bridge to help them along toward an upgrade. The LTB brings with it a false sense of security. It doesn't account for follow-on sales, loss of brain trust, and the logistics challenges of stocking and storing parts for the length of a program. Experienced program managers know they can't really fund the entire supply of what they need, and they don't have the freedom to hold large amounts of stock. The LTB solution then ends up being a situation of "buy what we have the money for, right now, and we will have to figure out the rest later." Otherwise, as Dr. Peter Sandborn, University of Maryland professor, points out, "... It is like being told you have 6 months to plan, fund, and buy all the shoes you need for the rest of your life."

Without having a strategic total lifecycle solution in place, many defense customers and primes go back to the OEM to plead the case for second or even third LTB opportunities. Because the OEM sustainment teams aren't set up specifically for legacy sustainment, they will often do everything they can to provide the additional builds. However, with decades left in the program, there is only so much an OEM can do before the costs are just too burdensome for both the customer and the OEM.

Supporting a program through its total life cycle then involves forecasting lifetime needs ... instead of constraining the forecast to available funding. Developing a predictable plan (and a fact-based budget) for every year remaining in a system's life is the only means program managers have to make a case for sensible program funding.

**What does it all mean?**

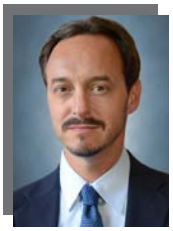
The defense industry has tried many tactics to address the challenges of supporting programs in the face of obsolescence. Whether the result of cultural issues of not being able to purchase "unnecessary stock," shortened contract cycles where funding only lasts the length of the contract, shortened product life cycles driven by the commercial COTS industry, or the increased risk of counterfeits on obsolete components, it is easy to understand why so many program managers feel like their ability to effectively "be proactive" is severely constrained. This belief ties back to the myth that obsolescence is a problem: Obsolescence is a reality that will one day happen. The problem arises when there is no plan for the eventuality that one day components will (with valid reasons) be EOL'd by their OEMs.

It is a fact: All the technology we use today will one day be replaced; that's innovation. Therefore, obsolescence is reality in the same way that gravity is a reality. And it makes about as much sense to blame obsolescence for causing

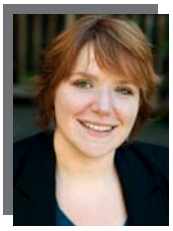
> … Obsolescence is reality in the same way that gravity is a reality. And it makes about as much sense to blame obsolescence for causing support problems as blaming gravity when a plane falls out of the sky.

support problems as blaming gravity when a plane falls out of the sky.

The supply chain is not set up to support legacy systems, but that doesn't mean obsolescence needs to result in a migraine. It is possible to have the relationships, processes, plans, engineering, and energy to keep the plane in the air … whether or not the original parts are now EOL. **MES**



***Ethan Plotkin,*** *CEO at GDCA, is a business transformation veteran with a dozen years of international and cross-industry management consulting experience. Since coming from Accenture to take over as CEO of GDCA in 2007, his focus has been on collaborating with OEMs of embedded and capital equipment to identify, measure, and address embedded computing obsolescence issues. He can be contacted at ethan.plotkin@gdca.com.*



***Kaye Porter*** *is Director of Marketing at GDCA. Her current focus is bringing collaboration and awareness to the embedded industry on the latest in anti-counterfeiting and long-term product support. She can be reached at kporter@gdca.com.*

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# Solve obsolescence problems before they start

By Michael Flatley

*The obsolescence of electronic components has long been a challenge in the defense market, where programs can run for decades, long product life is expected, and reliability is critical. Today, as military programs may be pushed out further and further because of funding issues, obsolescence management is more important than ever. The best way to combat obsolescence is through design-based techniques that minimize the problem at its genesis, rather than letting it become an ongoing issue that must be managed.*

U.S. Navy photo by Mass Communication Specialist 1st Class James Kimber

A key factor contributing to the obsolescence problem in military designs is that available electronic components are typically intended for commercial, industrial, and automotive use. Rarely are they specifically developed for defense applications. As a result, military system developers are left to design with commercial and industrial temperature-rated parts that are not necessarily designed, packaged, and screened for military high-reliability use.

The issue is often exacerbated in the digital world, driven by two major commercial forces. The first is generational technology change in the market (for example, consumers moving from desktops, to laptops, to tablets). This movement requires new semiconductors that are more powerful, yet draw less power, which means performance at temperature extremes is often sacrificed. The second force is die shrinks driven by semiconductor companies that are responding to cost pressures by designing and producing more bits per square area. Often, this results in decreased performance and reliability.

Neither of these two forces is good for companies designing products for multiyear life expectancies of military electronics. They hasten obsolescence in both the components' materials and the components' physical characteristics – each of which is critical in the design and development of products for the defense and aerospace industries. This obsolescence can have a dramatic impact on the long-term viability of aircraft, missile, C4ISR, and other systems that require long-term reliability and upgradability. Embedded electronics in applications such as missile, ordnance, and aircraft platforms continue to require increased processing and performance power without an increase in electronic component volume. Component obsolescence takes things in the wrong direction.

**Solving the problem**

Technology creators use a variety of obsolescence mitigation techniques. While production engineering-based techniques simply attempt to control an existing situation, design-based techniques are preferable because they can be used to minimize the initial problem. Companies that support defense

> “Embedded electronics in applications such as missile, ordnance, and aircraft platforms continue to require increased processing and performance power without an increase in electronic component volume. Component obsolescence takes things in the wrong direction.”

programs should have processes in place to deliver design-based obsolescence protection, preempting these issues and providing customers with products that have long life, known characteristics, and continued support. The process begins at product design, and then moves through the silicon characterization, manufacturing, and qualification phases as follows:

*Product design*

Because die availability over the life of the product is a primary concern, the component manufacturer's relationship with die suppliers is critical for combating obsolescence and designing for system longevity. Having access to roadmaps and closely monitoring suppliers provides insight to die shrinks and End-Of-Life (EOL) timetables. Die shrinks happen every two to three years with different families of die. Component designers consider which die will have the longest life, and further mitigate obsolescence by providing advanced notification of die EOL status, storing wafers or dies, storing work-in-process or finished goods, and making bridge buys. Additionally, ensuring there are upgrade paths for technology refresh or modernization allows product improvements without costly redesign. Other considerations include: material compatibility with PCB and silicon, relative costs, second-level reliability, and thermal management.

Internal Qualifications

| Test | Sample Size | Duration | Reference | Temp. Range |
|---|---|---|---|---|
| Precondition | All | | EIA/JESD22 Method A113 | |
| Bias Life Test | 15 | 1,000 hrs | EIA/JESD22 Method A108 | 125°C |
| Temp Cycle | 15 | 1,000 cycles | EIA/JESD22 Method A104-C | -55° to 125°C |
| 85/85 Bias | 15 | 1,000 hrs | EIA/JESD22 Method A101 | 85°C |
| Solder Ball Sheer | 22 (Minimum from three different devices) | | EIA/JESD22 Method B117 | |

Customer Qualifications

| Test | Sample Size | Duration | Reference | Temp. Range |
|---|---|---|---|---|
| HAST, 130°C 85RH | 25 | 100 hrs | | |
| HAST, 130°C 85RH | 25 | 200 hrs | | |

**Table 1** | Example of a qualification procedure for multiple SDR, DDR, DDR2, DDR3, and flash stack multichip packages.

*Silicon characterization*

To avoid obsolescence in military systems, the design team must ensure that the die will perform at extreme temperatures and conditions. Therefore, the silicon manufacturer's data is not assumed and parts have to be diligently characterized in sufficient quantities over a wide temperature range. Once the product design is finalized, prototypes are produced to get all the manufacturing processes to be high yielding. A second build will then be completed to ensure manufacturability. Qualification of products must first include preconditioning to simulate PCB assembly steps. This is followed by the following (see also Table 1):

1. 85C/85RH temperature humidity bias testing to evaluate the reliability of nonhermetically packaged silicon devices in humid environments: The severe conditions of temperature, humidity, and bias accelerate the penetration of moisture through the plastic encapsulation or along the interface between the external material and the metallic conductors passing through it. The parts are exposed to +85 °C temperature with 85 percent humidity for 1,000 hours. Interim electrical testing is performed at 168, 336, 672 hours and 1,000 hours. Parts are tested dynamically to ensure they meet specifications after experiencing this environmental testing.
2. Life test performed at conditions of high temperature and bias for 1,000 hours: This stress test will be used to accelerate infant mortality to prove product reliability. It is intended to identify design and manufacturing weaknesses in the part before it is released to production.
3. Temperature cycling is conducted to determine the resistance of silicon devices to alternate exposures of extremely high and low temperatures. Permanent changes in electrical characteristics and physical damage produced during temperature cycling may result, principally from mechanical stress caused by thermal expansion and contraction. Effects of temperature cycling include cracking and delamination of packages and internal structures, and changes in electrical characteristics resulting from mechanical damage. Parts will see extreme temps from -55 °C to +125 °C; the time at the temperature will be 10 minutes, and the parts reach the temperature in less than 15 minutes.

A number of other inspection techniques are used to evaluate product reliability as a defense against obsolescence. These techniques include X-ray inspection, C-SAM, in-situ thermal cycle analysis, coplanarity, and ball shear.

*Manufacturing and qualification*

Through proper planning, products can be introduced with an upgrade path to higher densities while also maintaining

form, fit, and function. Die shrinks or other die changes are handled internally to the product. Maintaining external footprint and performance then allows the system integrator to continue with manufacturing for years without expensive system redesigns. Throughout the system life cycle, working with a manufacturer that provides a single on-shore source for design, assembly, and test becomes even more important because of the complexities of redesign and retrofits. Ready access to all elements of the program – including customer interface, design, test, die, and interposer source and vendor management – can reduce risks and save a great deal of time and expense in mitigating obsolescence. The ability to manufacture single- or multi-die packages to match existing and backward-compatible packages or pinout requirements – while utilizing the most recent and advanced die stacking and semiconductor package technologies available – is essential (Figure 1).

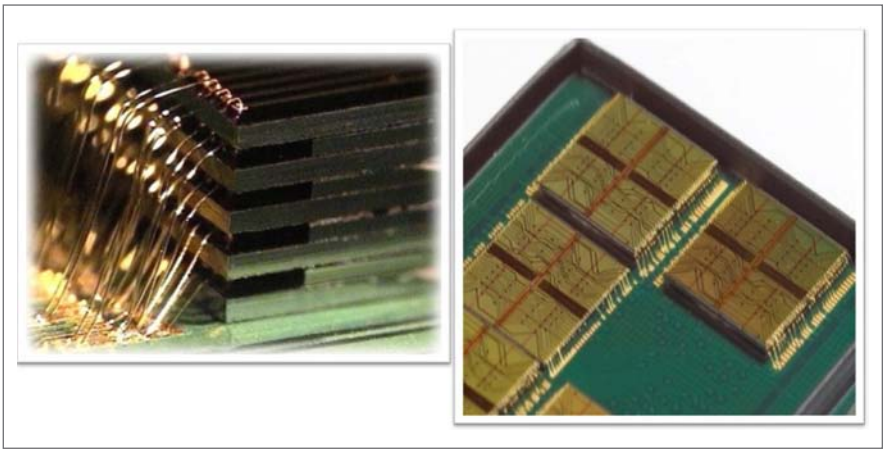
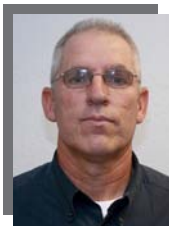


**Figure 1** | Example of two multichip packages incorporating advanced die stacking techniques.

**A more specialized approach**

Obsolescence is becoming an increasingly difficult challenge for military system designers, especially with the limited availability of components designed specifically for military, industrial, automotive, and other applications requiring high reliability across long product life cycles. Commercial component suppliers generally do not engage in obsolescence management or have the capability to meet defense requirements. Serving the defense market, therefore, requires a more specialized approach and the manufacturer's long-term commitment. The best way to combat obsolescence is at its root, during component design, with close attention to each step including silicon characterization, manufacturing, and qualification. **MES**



***Michael Flatley*** *has been with Microsemi since 2008 and serves as Manager of Product Applications, working closely with the company's engineering and sales teams to create new products in the military, aerospace, and information assurance technology markets. He has worked in the microelectronics industry for the past 15 years and has extensive experience working with distribution and manufacturers' representatives. Michael holds a Bachelor of Science in Materials Engineering and a Masters of Engineering in Quality and Reliability from Arizona State University. He can be contacted at mflatley@microsemi-phx.com.*

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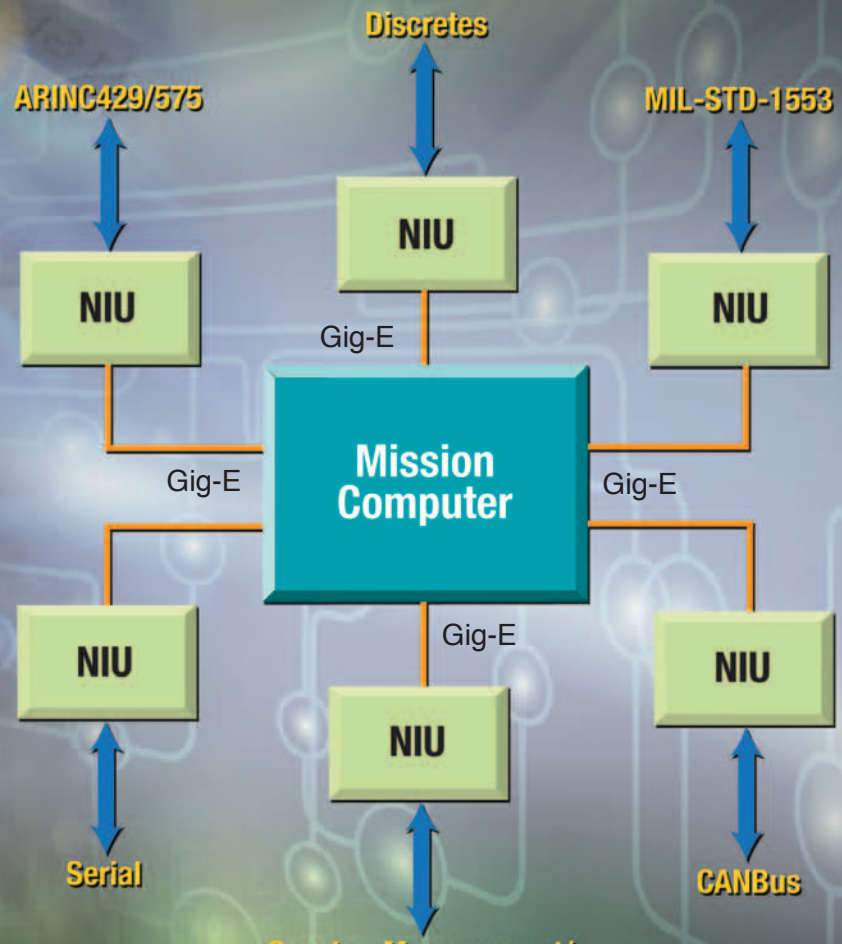


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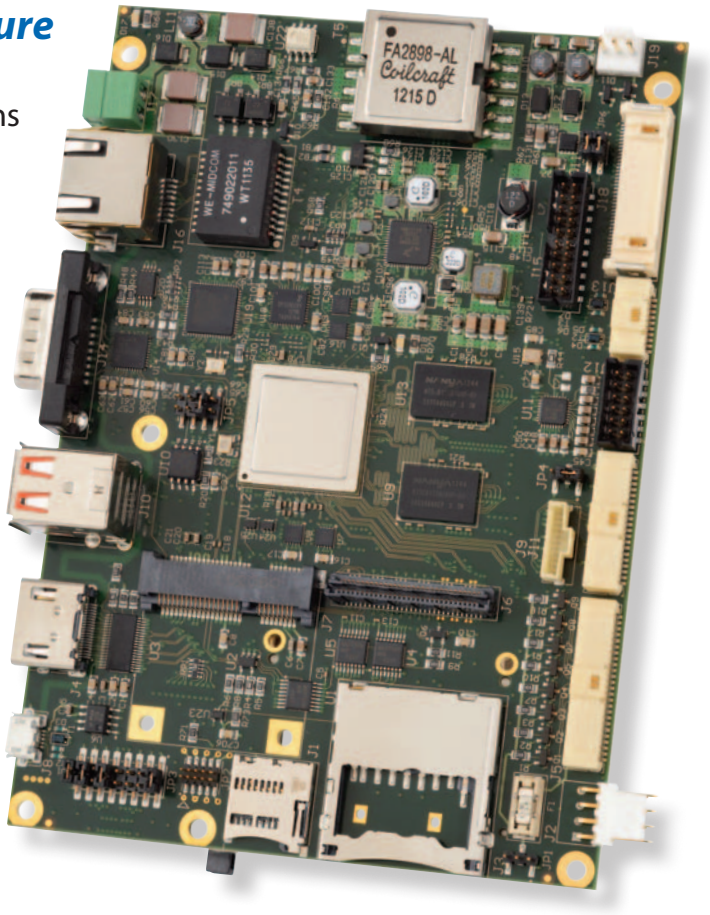


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- *Rugged, open architecture data/graphics processing module with Mercury POET/ FPGA implemented Gen 2 Serial RapidIO and 10Gigabit Ethernet data plane options*
- *Dual 4th Generation Intel® Core™ i7 processors with on-die GT2, GPUs and cache-coherent shared memory for demanding data/ graphics processing*
- *Open architecture, powerful and versatile*

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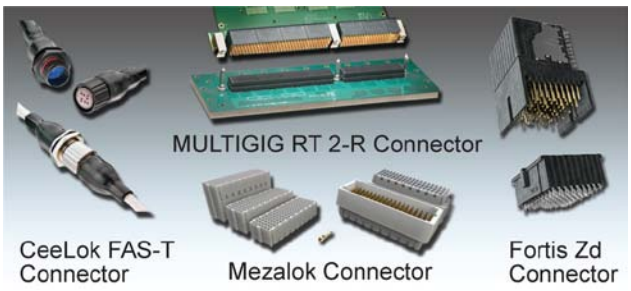


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Designed to perform in the most extreme environments, these compact, lightweight and high-speed interconnect solutions from TE Connectivity support increasing bandwidth requirements and withstand increasing shock and vibration conditions of emerging military, aerospace and marine applications.

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AVALON SCIENTIFIC

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**ASIU Protocol Converter**

The **Avalon Scientific ARINC-429** to Serial Interface Unit (ASIU) contains up to four ARINC-429 compatible transmitter and receiver pairs and up to four RS-232/422 channels. It can translate data between ARINC-429 and other communications buses. The protocol conversions are performed and formatted by the embedded CPU according to the customer's desired format.

The ARINC-429 interface includes a number of options including: Data Rate (12.5Kbps/100Kbps) and Parity (Normal/Disabled). There is a serial port for firmware uploads. Firmware upload can be easily accomplished at the customer site by uploading a hex file using a "Loader" software utility supplied by Avalon Scientific.

Optional interfaces include MIL-STD-1553, Synchro, and others.


## FEATURES

- Protocol Conversion between standard and custom interfaces
- Ruggedized, Qualified Unit
- MIL-Circular Connectors
- Mil-Std-704 28vDC Power Supply
- BIT Testing with Optional Discrete Output
- Optional Discrete I/O Port

**Avalon Scientific | 800-348-1765**

**Contact:** sales@avalonscientific.com

Microsemi

www.microsemi.com/igloo2-fpga

## IGLOO®2 FPGA


**Microsemi's IGLOO®2 FPGAs**, targeted at the cost-optimized FPGA market, integrate fourth generation flash-based FPGA fabric and high performance communications interfaces on a single chip. IGLOO2 devices offer best-in-class feature integration coupled with the lowest power, highest reliability and most advanced security in the industry. For cost-optimized FPGAs below 150K LEs, IGLOO2 provides a high level of I/O and SERDES integration – which is necessary for I/O expansion, bridging, system management and co-processing – allowing customers to use smaller devices for I/O expansion and bridging solutions. This, coupled with the need for only two power supplies and no external configuration devices, reduces overall system cost and board complexity.

In addition to many mainstream FPGA features, IGLOO2 is the only FPGA with hardened memory subsystem and only non-volatile and instant-on mainstream FPGA. The IGLOO2 FPGA family delivers the industry's lowest static power by providing 10 times lower static power than comparable FPGAs by utilizing a unique Flash*Freeze real-time power management mode. To protect valuable customer IP, the SEU-immune FPGA family includes state-of-the-art design security. Extended temperature ranges of up to 125C Tj are offered.

### FEATURES

The IGLOO2 family delivers best-in-class integration, power, reliability & security and mainstream FPGA features including:

- highest number of GPIOs for any given density node for 5G SERDES FPGAs;
- highest number of 5G transceivers density;
- highest number of PCI compliant 3.3V I/Os in the industry; and
- highest number of PCIe endpoints.

**Microsemi Corporation | 949-380-6100**

**Contact**: sales.support@microsemi.com





Microsemi

www.microsemi.com

## SmartFusion®2 SoC FPGAs


**Microsemi's SmartFusion®2** system-on-chip (SoC) field programmable gate array (FPGA) family features the only devices that address important fundamental requirements for advanced security, high reliability and low power in critical industrial, military, aviation, communications and medical applications. SmartFusion2 integrates inherently reliable flash-based FPGA fabric, a 166 megahertz (MHz) ARM® Cortex™-M3 processor, advanced security processing accelerators, DSP blocks, SRAM, eNVM and industry-required high-performance communication interfaces all on a single chip.

Microsemi's programmable logic solutions are used extensively in military, aviation and space applications due to their reliability and protection against Single Event Upset (SEU) occurrences, which can cause binary bits to change state and corrupt data and cause hardware malfunction. Industrial and medical safety markets are also requiring SEU protection as a vital requirement for their applications.

### FEATURES

- Highest reliability, most secure, lowest power FPGA
- Up to 150K LEs with 5Mbit SRAM and 4.5Mbit NVM
- SEU immune zero FIT flash FPGA configuration cells
- Hard 667 Mbps DDR2/3 controllers with SECDED
- Industry's lowest static power 10mW during operation on the 50K LUT device
- 1 mW standby power in Flash*Freeze real-time low power state

**Microsemi Corporation | 949-380-6100**

**Contact**: sales.support@microsemi.com

# Parvus

www.parvus.com

## DuraNET 30-2020

The **DuraNET 30-2020** is an ultra-rugged 19-port Cisco IOS-managed Layer 2 network switch integrating Cisco's ESS 2020 Embedded Services Switch technology with an isolated MIL-STD-1275/704 power supply in an IP67 (dust/water proof) sealed aluminum chassis with MIL-DTL-38999 connectors. Designed for Size, Weight and Power (SwaP) sensitive harsh military and civil environments (i.e. aircraft, vehicle, mining, industrial), the unit provides reliable local area network (LAN) switching capabilities with the ease of use, secure access, and manageability expected from Cisco-based technology. Two levels of Cisco IOS software (LAN Lite or LAN Base) are available to support access layer connectivity and needs for data, security, voice, and video traffic at the network edge for stationary or mobile network nodes.

### FEATURES

- Ruggedized Cisco ESS 2020 Managed Switch
- 19 Ports (2x GigE Uplinks, 17x Fast Ethernet)
- Cisco IOS Layer 2 LAN Base/LAN Lite Software
- Size, Weight & Power Optimized Subsystem
- Migration Path for Catalyst 2955T-12 Systems
- Designed to MIL-STD-810G, 461F, 1275D, 704F
- IP67 Protection, MIL-DTL-38999 Connectors

**Parvus Corporation | 800-483-3152**

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# SIE COMPUTING SOLUTIONS

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## 716 Series Conduction Cooled ATR Enclosures

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

### FEATURES

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

**SIE Computing Solutions, Inc. | 508-588-6110**

**Contact:** info@sie-cs.com
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## Communications Tech: Wireless

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Toyon Research Corporation

www.toyon.com/chilipepper.php

### Chilipepper FMC RF Front-End

**Chilipepper** is an FMC wireless transceiver module for use in development and rapid prototyping of software-defined radios. With a focus on translation to final product designs, Chilipepper uses a Lime Microsystems LMS6002 radio frequency integrated circuit (RFIC). This RFIC integrates data converters, synthesizers, and all up/down transceiver functions into a single IC. Toyon's Chilipepper provides a functional design by adding all necessary board and software support.

Two unique elements to Chilipepper are particularly useful for designers. The first is the inclusion of all power amplifier and switching logic such that you only need to connect a single antenna to be fully operational. Second, all calibration and configuration registeration is handled by an onboard microcontroller. You simply build a bitfile, load it onto the FPGA board, and you are ready to test your design.

### FEATURES

- Can be used with any FPGA board that hosts a FMC connector
- Onboard microcontroller can preconfigure operating mode
- Wideband receiving, TDD, and FDD
- Single antenna connector with PA/LNA/switching on board
- Integrated ADCs/DACs with simple parallel interface to FPGA
- Schematic provided, easing transition from prototype to production
- HDL Coder example designs written in MATLAB® found at github **https://github.com/Toyon/Chilipepper**

**Toyon Research Corp. | 805-968-6787**

**Contact**: embedded@toyon.com

## COTS Collection: Boards, Carriers, Mezzanines, ICs: AdvancedTCA (ATCA)

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EMERSON Network Power

www.Emerson.com/ATCA

### ATCA-7470

Emerson's **ATCA-7470** is a 40G ATCA® packet processing blade that enables the highest packet processing performance and security features. You can consolidate packet, application and control processing functions in a single blade architecture and benefit from lower development costs and the use of common tool suites. The ATCA-7470 is designed to exploit the full capabilities of the processors and chipset, with an optimized balance of processing, memory, I/O, data movement and interfaces. The optional crypto accelerator module enables you to offload en/decryption and compression tasks from the CPUs. Main memory and mass storage can be flexibly configured to provide a perfect fit to the needs of your application. Multiple available rear transition modules provide a flexible combination of storage and I/O, with options for high capacity redundant storage or up to 6x10G Ethernet interfaces.

### FEATURES

- Two 8-core Intel® Xeon® processors, E5-2648L, 1.8 GHz or E5-2658, 2.1 GHz
- Up to 128GB main memory
- Redundant 40G active/active (KR4) ATCA Fabric interfaces, both fabric interfaces can be run at full speed
- Backward compatible with previous 10G systems
- Optional hardware offload module for encryption and compression acceleration with two Intel® Communications Chipset 8920 devices
- Multiple 1 and 10Gbps network and storage I/O connectivity options

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## Centellis™ ATCA Platforms

Emerson has been supplying integrated, application-ready ATCA® systems under the Centellis™ name for over 10 years. Our unrivalled experience and expertise is why research reports that Emerson has the largest installed base of ATCA systems. Target applications include military communications, ship-based network data centers, command center equipment, server platforms for electronic warfare, surveillance and security infrastructure, data processing and logging. Emerson ATCA equipment mounted in shock-isolated racks was used by a US military contractor in afloat shock testing (better known as Class A barge testing). The US Navy has also run an operational ATCA system in a shock-isolated rack to simulate the effects of a barge test. The success of these tests clearly demonstrates the inherent ruggedness of ATCA equipment operating in battle ready operations.

### FEATURES

- 1, 10G and 40G systems with 2, 6 or 14 slots
- Best-in-class cooling, exceeding CP-TA B.4 thermal specification
- AC or DC power input options
- Up to 350 Watts/blade power distribution
- Designed for NEBS/ETSI or network data center

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www.lcr-inc.com

## 6U, 6 Slot Rugged AdvancedTCA Chassis

LCR Electronics announces a new family of high performance small form factor (SFF) rugged ATCA chassis designed specifically to meet the compute intensive requirements of mobile command and control applications. LCR's SFF chassis range in size from 6U 6 slots to 4U 3 slots, and are available in either AC or DC powered versions. LCR's rugged ATCA SFF chassis are designed to allow the use of readily available COTS ATCA blade products in military mission critical applications.

*Join the growing number of customers and programs that have LCR's integrated ATCA chassis deployed in the field for mission critical computing. To learn more about LCR and our ATCA products, go to www.lcr-inc.com and contact us by phone (800) 527-4362 or through military-sales@lcr-inc.com.*

### FEATURES

*All LCR SFF ATCA chassis have the following product features:*

- Full mesh backplane connectivity
- Single or dual shelf management and control
- Redundant cooling at 300W per slot
- AC or DC configuration for maximum flexibility
  - *AC features dual 1500W power supplies*
  - *DC features redundant 48VDC PEMs*
- Designed and built to comply with the applicable shock and vibration requirements of MIL-STD-810
- Complies with MIL-STD-461 EMI requirements

**LCR Electronics, Inc. | 800-527-4362**

**Contact**: sales@lcr-inc.com
**LinkedIn**: www.linkedin.com/company/lcr-electronics-inc

Annapolis Micro Systems

www.annapmicro.com

## Dual 4.0 GSps DAC

The **Annapolis Micro Systems Dual Channel 4.0 GSps D/A I/O Card** provides one or two 12-bit digital output streams at up to 4.0 GSps. The board has one or two MAX 19693 for 4.0 GSps, MAX 19692 for 2.3 GSps, or MAX 5859 for 1.5 GSps.

The Dual Channel DAC board has five SMA front connectors: two single-ended DAC outputs, a high-precision trigger input with Fs precision, and a universal single- or double-ended 50 ohm clock input. It has excellent gain flatness in the first 3 Nyquist Zones, ultra-low skew and jitter saw-based clock distributions, and main board PCLK sourcing capability.

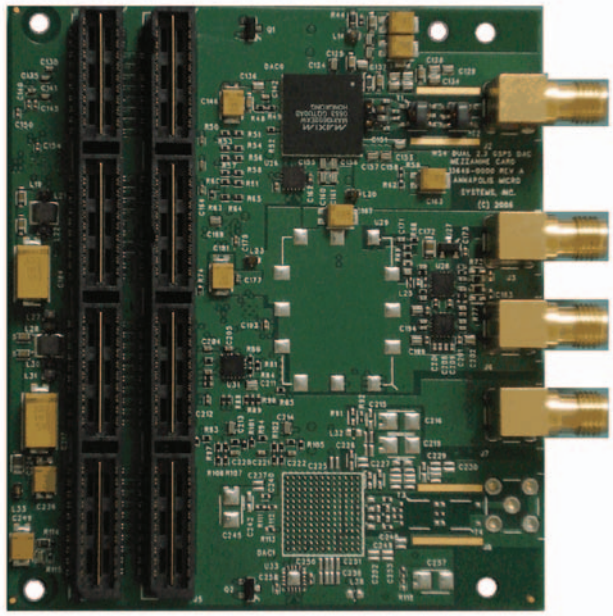
In concert with the WILDSTAR 4 or WILDSTAR 5 FPGA processing main boards, this mezzanine board supplies user-configurable real-time A to D conversion and digital output. Up to two A/D or D/A and up to two serial I/O cards can reside on each WILDSTAR 4 or WILDSTAR 5 VME/VXS or IBM Blade main board, or up to one A/D or D/A and up to one serial I/O card on each PCI-X or PCI Express main board.

Our boards run on many different operating systems. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models. VHDL source is provided for the interfaces to A/Ds, D/As, DRAM/SRAM, LAD bus, I/O bus, and PPC Flash. CoreFire™ users will have the usual CoreFire Board Support Package.

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

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

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



## FEATURES

- One or two 12-bit Analog to Digital Converters: MAX 19693 for 4.0 GSps, MAX 19692 for 2.3 GSps, or MAX 5859 for 1.5 GSps
- Five SMA front panel connectors: two single-ended DAC outputs, one high-precision trigger input with Fs precision
- One universal single- or double-ended 50 ohm clock input
- High-precision trigger input manufacturing options – 1.65 V LVPECL, 2.5 V LVPECL, 3.3 V LVPECL
- I/O card plugs onto WILDSTAR 4 or 5 VME/VXS/PCI-X/PCI Express/ IBM Blade main boards
- JTAG, ChipScope, and Serial Port access
- Full CoreFire Board Support Package for fast, easy application development
- VHDL model, including source code for board-level interfaces
- Proactive thermal management system
- Industrial temperature range
- Includes one-year hardware warranty, software updates, and customer support
- **Designed and manufactured in the USA**

**Annapolis Micro Systems, Inc. | 410-841-2514**

**Contact**: wfinfo@annapmicro.com

Annapolis Micro Systems

www.annapmicro.com

## Four Channel Clock Synchronization Board

The **Four Channel Clock Synchronization Board** distributes a common clock and synchronized control signal triggers to multiple cards in the system. This 6U VME64x/VXS board provides four high-speed, ultra-low jitter, ultra-low skew differential bulkhead mounted clock outputs, two ultra-low skew differential vertical SMA on-board clock outputs, and four ultra-low skew and clock synchronized single-ended bulkhead mounted control signal triggers.

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

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

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

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

## FEATURES

- Four Synchronized Differential Front Panel Clock Outputs up to 3 GHz with Typical Skew of 5 ps
- Ultra-low Clock Jitter and Phase Noise – 275 Fs with 1,280 MHz PLL and external 10 MHz Reference
- On-board PLLs Manufacturing Options provide Fixed Frequencies of 700 MHz to 3 GHz, Locked to Internal or External Reference
- On-board Low Frequency Oscillator provides Fixed Frequencies up to approximately 800 MHz
- Four Synchronized Trigger Outputs, always Synchronized with the Output Clock, with Typical Skew of 5 ps
- Jumper Selectable Trigger Output Levels of 3.3 V PECL, 2.5 V PECL, or 1.65 V PECL
- Source Trigger from Front Panel SMA, Pushbutton, or Optional P2 Serial Port
- Cascade boards to provide up to 16 sets of outputs
- Compatible with standard VME64x and VXS 6U backplanes
- Universal clock input supports wide range of signal options, including signal generator sine wave
- Differential clock input permits multiple standards including: LVDS, 3.3 V PECL, 2.5 V PECL, and 1.65 V PECL
- Clock and Trigger Outputs Compatible with all Annapolis Micro Systems, Inc. WILDSTAR™ 2 PRO I/O Cards and WILDSTAR™ 4/5 Mezzanine Cards

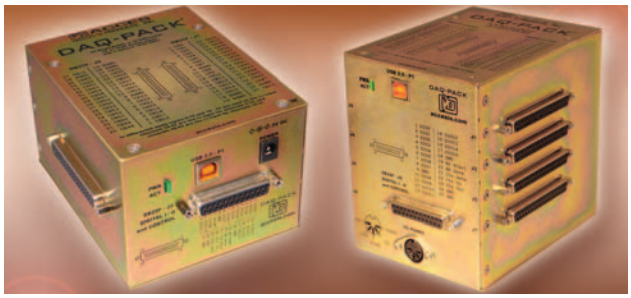
**Annapolis Micro Systems, Inc. | 410-841-2514**

**Contact**: wfinfo@annapmicro.com

ACCES I/O PRODUCTS, INC.

www.accesio.com

## Multifunction DAQ-PACK Series (Up to 128 Channels)



The DAQ-PACK Series is a highly integrated multifunction data acquisition and control system. The system offers an ideal solution for adding portable, easy-to-install high-speed analog and digital I/O capabilities to any PC or embedded system with a USB port. It performs signal conditioning such as RC filtering, current inputs, RTD measurement, bridge completion, thermocouple break detection, voltage dividers, small signal inputs, and sensor excitation voltage supply.

The small, compact, multifunction I/O DAQ-PACK Series units provide the user with everything needed to start acquiring, measuring, analyzing, and monitoring in a variety of applications. These data acquisition and control devices can be used in many current real-world applications such as precision measurement, analysis, monitoring, and control in countless embedded applications.

### FEATURES

- 32, 64, 96, or 128-channel single-ended or differential analog inputs
- High-speed USB 2.0 multifunction DAQ
- Sustained sampling speeds up to 500kHz
- 12 or 16-bit resolution A/D converter
- Flexible, software configured functionality
- 18 input ranges, 9 unipolar and 9 bipolar, per 8-channel programmable
- Wide range of flexible signal conditioning types
- Autocalibration and oversampling for real-time accurate data
- A/D starts via software, timer, or external trigger
- Two 16-bit analog outputs and 16 high-current digital I/O lines
- 16-bit programmable counter/timer

**ACCES I/O Products, Inc. | 858-550-9559**

**Contact:** contactus@accesio.com
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ALPHI TECHNOLOGY CORPORATION

www.alphitech.com

## Ultra-small footprint and lightweight 1553 Data Logger

The latest member of the ALPHI 1553 product line is a stand-alone, fully sealed, rugged, ultra-small and ultra-low-power Intel Atom™ based module. The system has an ultra-small footprint and is lightweight at only 6.4" x 3.5" x 2.9" and 3.5 lb., which includes an SBC and mass storage.

It supports up to four 500GB removable, sealed SSDs for up to 2TB total. It includes support for Network Attached Storage (NAS) Power by a dual redundant MIL-STD-1553 interface, programmable bus controller, remote terminal, or bus monitor modes, and supports MIL-STD1553A/B. It is controlled by a 1.6GHz Atom™ processor, 512KB of L2 Cache and up to 2GB of 533MHz DDR-2 SDRAM. The system I/O configuration is based on two non-switched x1 PCI Express lanes used on two Express Mini Cards slots.

The 1553 capabilities can be complemented by ARINC 429, FireWire, CANbus, GPS, GigE, A/D, D/A or any other functionality.

- Support for Windows® XP/XPE/7, Linux® and VxWorks®
- Available in extended temp -40°C to +85°C

This is a perfect solution for a wide array of 1553 communication applications such as: military mission computers, ground vehicles and many others.

### FEATURES

- Supports up to four removable, sealed, SSD Drives
- Each drive supports up to 500GB of storage for up to 2TB total
- Each SSD may be accessed via SATA or USB port when removed
- 1.6GHz Intel® Atom™ processor with 512KB of L2 Cache
- 2GB of 533MHz DDR-2 SDRAM
- Support for Network Attached Storage (NAS)
- PCI Express Mini Extension
- One Fast Ethernet port
- Line-In/Mic-In, and Line Out
- Eight buffered General Purpose I/O lines (Optional)
- DVI-D Video Port video ports or Headless operation
- Four USB 2.0 ports, one Serial port with RS-232/-422/-485 support
- Extensive Built-In-Test (BIT) and Extended BIT for diagnostics
- Full power management control for Sleep/Hibernate operation
- RTC with external/internal or no battery operation
- CPU temperature and voltage monitoring for safe operation
- Reset and power On/Off switch with suspend support

**ALPHI Technology Corporation | 480-838-2428**

**Contact:** sales@alphitech.com

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## FMC-250

The **FMC-250** is a high speed digitizing and signal generation FMC I/O module featuring two 250 MSPS A/D channels and two 250 MSPS D/A channels supported by sample clock and triggering features. The FMC-250 features two 16-bit 250 MSPS A/Ds, either AC or DC coupled, plus two 250 MSPS update rate DACs. The DAC can be used a single 500 MHz output channel. Analog I/O is either AC or DC coupled. Receiver IF frequencies of up to 125 MHz are supported. The sample clock is from either an ultra-low-jitter PLL or external input. Multiple cards can be synchronized for sampling. The FMC-250 power consumption is 6W for typical operation. The module may be conduction cooled using the VITA 20 standard and a heat spreading plate. Ruggedization levels for wide-temperature operation from -40 to +85C operation and 0.1 g2/Hz vibration.

*Download Data Sheets and Pricing NOW!*

### FEATURES

- Two A/D Inputs – 250 MSPS, 16-bit
- 250 MSPS, 16-bit option – AC or DC coupled
- Two D/A Outputs – 250 MSPS, 16-bit D/A
- 500 MSPS single channel mode – Sample clocks and timing and controls
- External clock/reference input – Programmable PLL
- 100 MHz, 0.5 ppm reference – Integrated with FMC triggers
- High Pin Count no SERDES – Compatible with 1.2 to 3.3V VADJ
- Power monitor & controls – 6W typical (AC-coupled inputs)
- Conduction Cooling per VITA 20 subset; environmental ratings for -40 to 85C – 9g RMS sine, 0.1g2/Hz random vibration
- Applications: Wireless Receiver & Transmitter, LTE, WiMAX Physical Layer, RADAR, Medical Imaging, High Speed Data Recording and Playback

**Innovative Integration | 805-578-4260**

**Contact:** sales@innovative-dsp.com



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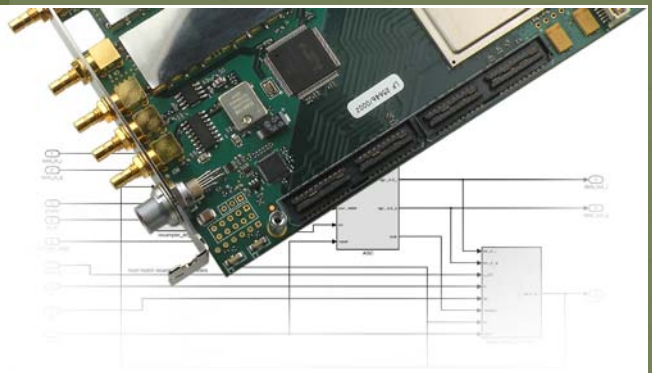
## Dual IF digitizer | 16-bit ADCs | Custom FPGA-based DSP designs



The **DRX16 dual IF digitizer with 16-bit ADCs** has two identical ports with independently programmable sample clocks. Included EDT firmware and software provide basic signal capture and spectral display. Custom FPGA-based DSP design, development, and integration services are available.

The board has a configurable Xilinx Virtex-6 LX FPGA and two identical ports for signals from 2 to 300 MHz. Each port has a sample clock that is independently programmable from 10 to 130 MHz.

Output is digitized by the ADCs and captured in the FPGA, which can perform DSP functions or route data to the main board. The main board provides DMA, as well as additional memory and programmable FPGA resources.

### FEATURES

- Mezzanine board (pairs with an EDT PCIe main board, which adds DMA, programmable FPGA resources, and memory)
- Digitizes two IF signals via two identical ports, each with its own independently programmable sample clock (10 to 130 MHz)
- FPGA: One programmable Xilinx Virtex-6 (XC6VLX240T)
- ADCs: Two 16-bit (one per port)
- Sample clock I/O: Programmable as input or output
- Time base: 10 MHz TCXO or reference input, available via reference output
- Time code: 1 pps or IRIG-B input
- DSP: Custom FPGA-based design + integration services available

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Annapolis Micro Systems

www.annapmicro.com

## 2.0 GSps 10-bit A/D

The **Annapolis Single Channel 2.0 GSps A/D I/O Card** provides one 2.0 GHz A/D input with a resolution of 10 bits. The board has one e2v AT84AS004 that is fed by an onboard analog input circuit, which converts the single-ended 50-ohm SMA input into differential signals for the ADC. There is a universal single-ended 50-ohm SMA clock input and a high-precision trigger input allowing multiple A/D I/O cards to be synchronized together. Synchronization of A/D I/O cards can be facilitated by the Annapolis 4 or 8 Channel Clock Distribution Boards.

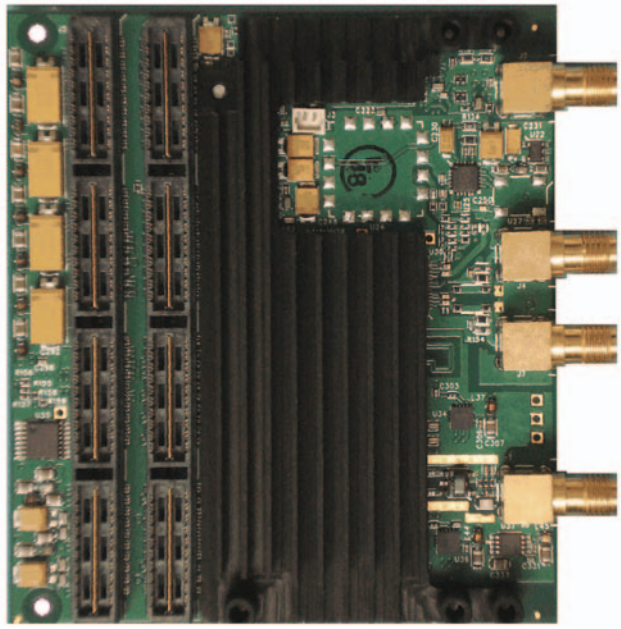
In concert with the WILDSTAR 4 or WILDSTAR 5 FPGA processing main boards, this mezzanine board supplies user-configurable real-time continuous sustained processing of the full data stream. Up to two A/D and up to two Serial I/O cards can reside on each WILDSTAR 4 or WILDSTAR 5 VME/VXS or IBM Blade main board, or up to one A/D and up to one Serial I/O card on each PCI-X or PCI Express main board.

Our boards run on many different operating systems. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models. VHDL source is provided for the interfaces to A/Ds, D/As, DRAM/SRAM, LAD bus, I/O bus, and PPC Flash. CoreFire™ users will have the usual CoreFire Board Support Package.

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

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

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



## FEATURES

- One e2v AT84AS004 (2.0 GHz, 10-bit) A/D
- Four SMA front panel connectors: one 50-ohm analog input, one single-ended 50-ohm clock input, or differential 1.65 V LVPECL clock input
- One high-precision trigger input with Fs precision; high-precision trigger input – 1.65 V LVPECL, 2.5 V LVPECL, 3.3 V LVPECL
- Analog input bandwidth is 100 KHz-3.0 GHz
- I/O card plugs onto WILDSTAR 4 or 5 VME/VXS/PCI-X/PCI Express/ IBM Blade main boards
- JTAG, ChipScope, and Serial Port access
- Full CoreFire Board Support Package for fast, easy application development
- VHDL model, including source code for board-level interfaces
- Proactive thermal management system
- Includes one-year hardware warranty, software updates, and customer support
- We offer training and exceptional special application development support, as well as more conventional customer support
- **Designed and manufactured in the USA**

**Annapolis Micro Systems, Inc. | 410-841-2514**

**Contact**: wfinfo@annapmicro.com

Annapolis Micro Systems

www.annapmicro.com

## WILDSTAR A5 for PCI Express

Supports up to Three 56G FDR InfiniBand, Three 40Gb Ethernet, or Twelve 10Gb Ethernet Connections.

WILDSTAR A5 for PCI Express uses Altera's newest Stratix V FPGAs for state-of-the-art performance. This is the first of a series of Altera Based FPGA Processing Boards from Annapolis.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. It accepts one or two I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OC 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

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

Our extensive IP and board support libraries contain more than 1,000 cores, including floating point and the world's fastest FFT. CoreFire uses a graphical user interface for design entry, supports hardware-in-the-loop debugging, and provides proven, reusable, high-performance IP modules. WILDSTAR A5 for PCI Express, with its associated I/O Cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.

## FEATURES

- Supports up to Three 56G FDR InfiniBand, Three 40Gb Ethernet, or Twelve 10Gb Ethernet Connections
- Up to Three Altera Stratix V FPGA Processing Elements – GSD4, GSD5, GSD6, GSD8, GXA3, GXA4, GXA5, GXA7, GXA9, GXAB
- Up to 4 GBytes DDR3 DRAM in 2 Memory Banks and Up to 192 MBytes QDRII + SRAM in 12 Memory Banks per WILDSTAR A5 for PCI Express Board
- Programmable FLASH for each FPGA to Store FPGA Images
- 16X PCI Express Bus Gen 1, Gen 2, or Gen 3 to Host PC through On Board PCIe Switch
- Supports PCI Express Standard External Power Connector
- Multi Channel High Speed DMA
- Full CoreFire Board Support Package for fast, easy application development
- VHDL model, including source code for hardware interfaces and ChipScope Access
- Available in both commercial and industrial temperature grades
- Proactive Thermal Management System – Board Level current measurement and FPGA temperature monitor, accessible through Host API
- Includes one year hardware warranty, software updates, and customer support
- Training available

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

Save time and effort and reduce risk with COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition.

**Annapolis Micro Systems, Inc. | 410-841-2514**

**Contact**: wfinfo@annapmicro.com

Annapolis Micro Systems

www.annapmicro.com

## WILDSTAR 5 for IBM Blade

Perfect Blend of Processors and Xilinx Virtex-5 FPGAs. Eleventh Annapolis Generation.

**Direct Seamless Connections** – No data reduction between: external sensors and FPGAs, FPGAs and processors over IB or 10 Gb Ethernet backplane, FPGAs and standard output modules.

**Ultimate Modularity** – From zero to six Virtex-5 processing FPGA/memory modules, and two Virtex-5 I/O FPGAs. Accepts one or two standard Annapolis WILDSTAR 4/5 I/O mezzanines: Quad 130 MSps through Quad 500 MSps A/D, 1.5 GSps through 2.2 GSps A/D, Quad 600 MSps DAC, InfiniBand, 10 Gb Ethernet, SFPDP.

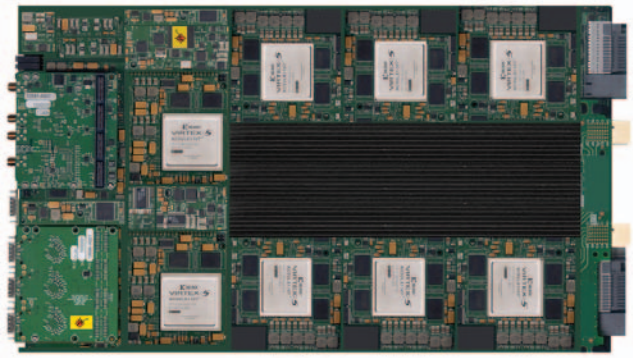
**Fully Integrated into the IBM Blade Management System** – Abundant power and cooling for maximum performance.

Annapolis Micro Systems, Inc. is a world leader in high-performance COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, Digital Signal Processing, FFTs, communications, software radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models.

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

WILDSTAR 5 for IBM Blade, with its associated I/O cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.

Achieve world-class performance; WILDSTAR solutions outperform the competition.



## FEATURES

- From two to eight Virtex-5 FPGA processing elements – LX110T, LX220T, LX330T, FX100T, FX130T, or FX200T; six are pluggable with power module and memory
- Up to 10.7 GB DDR2 DRAM per WILDSTAR 5 for IBM Blade Board
- 144 x 144 crossbar; 3.2 Gb per line; two external PPC 440s – 1 per each I/O FPGA
- Full CoreFire Board Support Package for fast, easy application development
- VHDL model, including source code for hardware interfaces and ChipScope access
- Available in both commercial and industrial temperature grades
- Proactive thermal management system – board-level current measurement and FPGA temperature monitor, accessible through host API
- Includes one-year hardware warranty, software updates, and customer support
- Blade management controller; USB, RS-485, Ethernet, KVM, 16 RIO, Switch to 1 GbE over backplane
- Save time and effort; reduce risk with COTS boards and software
- We offer training and exceptional special application development support, as well as more conventional support
- Famous for the high quality of our products and our unparalleled dedication to ensuring that the customer's applications succeed

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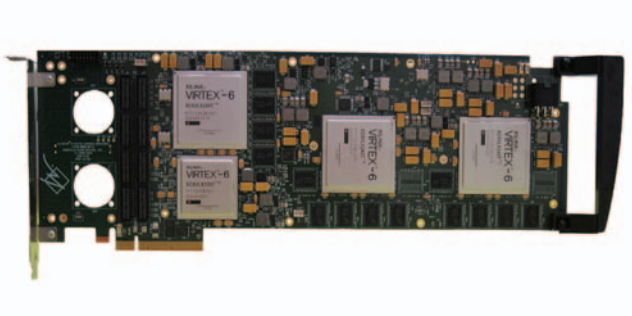
## WILDSTAR 6 PCIe



Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing-intensive applications. Our fifteenth-generation WILDSTAR 6 for PCI Express uses Xilinx's newest Virtex-6 FPGAs for state-of-the-art performance. It accepts one or two I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OC 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows, Linux, Solaris, IRIX, ALTIX, and VxWorks. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models.

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

Our extensive IP and board support libraries contain more than 1,000 cores, including floating point and the world's fastest FFT. CoreFire uses a graphical user interface for design entry, supports hardware-in-the-loop debugging, and also provides proven, reusable, high-performance IP modules. WILDSTAR 6 for PCI Express, with its associated I/O cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time-to-deployment.

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

Save time and effort and reduce risk with COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition.

## FEATURES

- Up to three Xilinx Virtex-6 FPGA I/O processing elements – LX240T, LX365T, LX550T, SX315T, or SX475T
- Up to 8 GBytes DDR2 DRAM or DDR3 DRAM in 14 memory banks per WILDSTAR 6 for PCI Express board or up to 480 MBytes DDRII+/QDRII DRAM in 15 memory banks
- Programmable FLASH for each FPGA to store FPGA images
- 8X PCI Express Bus Gen 1 or Gen 2
- Supports PCI Express standard external power connector
- High-speed DMA Multi-Channel PCI controller
- Full CoreFire Board Support Package for fast, easy application development
- VHDL model, including source code for hardware interfaces and ChipScope access
- Available in both commercial and industrial temperature grades
- Proactive Thermal Management System – Board Level current measurement and FPGA temperature monitor, accessible through Host API
- Includes one year hardware warranty, software updates, and customer support. Training available.

**Annapolis Micro Systems, Inc. | 410-841-2514**

**Contact**: wfinfo@annapmicro.com

## COTS Collection: Boards, Carriers, Mezzanines, ICs: FPGA

mil-embedded.com/p9914812

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a subsidiary of ISI
... real time solutions!

www.innovative-dsp.com/products.php?product=PEX6-COP

### PEX6-COP PCI Express Desktop/Server

The **PEX6-COP** is a flexible FPGA coprocessor card that integrates a Virtex-6 FPGA computing core with an industry-standard FMC I/O module on a half-length PCI Express desktop or server card.

The FPGA computing core features the Xilinx Virtex-6 FPGA family, in densities up to LX550 and SX475. An FMC site, conforming to VITA 57, provides configurable I/O for the PEX6-COP.

*Download data sheets & pricing Now!*


### FEATURES

- Desktop/Server Half-length FPGA coprocessor card
- FMC I/O site (VITA 57) with x10 5 Gbps MGT lanes, 80 LVDS pairs (LA, HA, HB full support)
- FPGA Computing Core
- Xilinx Virtex-6 SX315T, SX475T, LX240T or LX550T
- 2 Banks of 1GB DRAM (2GB total)
- 2 banks of 9MB QDRII+ SRAM (18MB total)
- 128MB DDR3 DRAM, 32Mb flash
- Dual sample clock input

**Innovative Integration | 805-578-4260**

**Contact:** sales@innovative-dsp.com

## COTS Collection: Boards, Carriers, Mezzanines, ICs: General purpose I/O

mil-embedded.com/p9912463

ACCES I/O PRODUCTS, INC.

http://acces.io

### USB-104-HUB – Rugged, Industrial Grade, 4-Port USB Hub

This small industrial/military grade hub features extended temperature operation (-40°C to 85°C), high retention USB connectors, and an industrial steel enclosure for shock and vibration mitigation. The OEM version (board only) is PC/104 sized and can easily be installed in new or existing PC/104-based systems as well. The USB-104-HUB now makes it easy to add additional USB-based I/O to your embedded system or to connect peripherals such as external hard drives, keyboards, GPS, wireless and more. Real-world markets include Industrial Automation, Embedded OEM, Laboratory, Kiosk, Transportation/Automotive, and Military/Government.

This versatile four port hub can be bus powered or self powered. You may choose from three power input connectors: DC power input jack, screw terminals, or 3.5" drive power connector (Berg). Mounting provisions include DIN rail, 3.5" front panel drive bay mounting, and various panel mounting plates.


### FEATURES

- Rugged, industrialized, four-port USB hub
- High-speed USB 2.0 device, USB 3.0 and 1.1 compatible
- Extended temperature operation (-40°C to +85°C)
- Data transfer rates up to 480 Mbps
- Supports bus-powered and self-powered modes
- Three power input connectors (power jack, screw terminals, or 3.5" drive Berg power connector)
- LED status indicators for power and overcurrent fault conditions for each downstream port
- USB/104 form factor for OEM embedded applications
- OEM version (board only) features PC/104 module size and mounting
- Includes micro-fit embedded USB header connectors in parallel with all standard USB connectors
- Industrial grade USB connectors feature high-retention design
- Small (4" x 4" x 1"), low profile, steel enclosure
- 3.5" front panel drive bay mounting provision

**ACCES I/O Products, Inc. | 858-550-9559**

**Contact:** contactus@accesio.com
**Follow us on Twitter @accesio**

SABTECH
Advanced Communication Systems

www.sabtech.com

## Sabtech Data Display Console (SDDC)

The **Sabtech Data Display Console (SDDC)** is a rugged, off-the-shelf, general-purpose computer. It be can be configured for any rugged computing application with expansion cards, mass storage devices, connectors, and a variety of operating systems including Windows, Linux and others.

It comes standard with a built-in 19" display, backlit 102-key keyboard with tactile feedback and a three-button HULA pointing device. The keyboard and pointing device are environmentally sealed and can be operated with gloves on. A DVD-RW and removable solid state hard drives are accessible behind the sealed access door.

**Ease of Maintenance** – The display and electronics chassis rolls out for maintenance. No periodic maintenance is required except for annual cleaning of the air filters, which are washable and reusable. The system is air-cooled with intake ports on the bottom and exhaust on the rear.

### FEATURES

- **Ready for Rugged Environment** – Tested and MIL-STD-810 and MIL-S-901D qualified* for shipboard use including shock, vibration, temperature, humidity, EMI, airborne and structure-borne noise, altitude and drip
- **Configurable and Upgradable**
- **Display** – Large, built-in 19" (diagonal) display for optimal viewing
- **I/O Options** – MIL-STD-1397C NTDS A/B/C/D/E/H, MIL-STD-1553B, ATDS, IRIG-B, dual copper Ethernet, dual fiber Ethernet, USB
- **Storage Options** – Dual removable solid state hard drives, DVD-RW, Blu-ray Rewriter
- **Other I/O & Storage Options** – Contact factory

* MIL-qualified SDDC configuration replaces obsolescent operator consoles in the Navy's shipboard Operational Readiness and Test System (ORTS)

**Sabtech | 714-692-3800**

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Rochester Electronics maintains the world's largest Factory Authorized Safety Stock™, offering active and mature semiconductor solutions ready for immediate shipment. Coupled with the most comprehensive support for aftermarket semiconductors in the world, all products are completely authorized and licensed by the original manufacturer, eliminating any chance of supply-chain issues or disruption due to counterfeit semiconductors. Through Extension-of-Life® programs, Rochester Electronics can sustain the supply of your critical semiconductor devices for the life of your system. Authorized by 60+ semiconductor manufacturers, Rochester Electronics is a complementary source for finished goods, die and the re-creation of unavailable devices.

### FEATURES

- Every device is 100% inspected both inbound and outbound
- Only Rochester Electronics provides complete device replication services, performance guarantee, and sustained, long-term source-of-supply programs
- Re-create devices even when original tooling no longer exists, the design archive is missing, or there is only one working device left
- All products are 100% guaranteed and factory traceable
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Sealevel designs and manufactures sync/async communications products, ruggedized computers, and custom MIL-STD adaptations of COTS products for mission critical applications.

Our knowledge of communications and I/O has been applied to PCI, PCI Express, PMC, PC/104 and many other form factors and interfaces – with success each and every time.

At Sealevel, meeting the needs and requirements of all types of customer applications is our passion. We have built, tweaked, modified, customized, and solved problems for customers for 27 years. *And, we do it right.*

**MIL-STD-1553 IP Cores**

MIL-STD-1553 IP Cores are the smart alternative to traditional 1553 ICs. This field-proven technology is software compatible with existing legacy 1553 applications, but at a fraction of the cost and board space.

- Suitable for any MIL-STD-1553 BC, RT or MT implementation
- Software compatible with existing legacy 1553 applications
- Available with simple local bus or 33/66 MHz PCI back-end interface
- Modular architecture allows flexible implementations
- Provided with full verification environment
- 3rd party RT validation tested

**USB to Synchronous Serial Adapter**

The ACC-188 synchronous serial radio adapter is interoperable among various tactical radio brands and models in use by the defense community.

- Interoperable, high-speed MIL-STD data solution for tactical radios
- Compatible with a wide range of radios
- Quick-disconnect option for easy radio interface
- Shielded to protect from RF interference
- Resistant to liquid, dust, and dirt
- Data rates to 76K bps

**Custom System Design**

Sealevel's engineers understand the advantages an optimized design can offer. From design specifications to project management to compliance and certification, our engineers work with your team to develop a product that perfectly meets your specifications.

- System level or board level design
- COM Express carrier board design
- Electrical, mechanical, software, and compliance expertise
- Complete manufacturing capabilities including SMT
- Extended temperature, vibration, and ESS screening

**Sealevel Systems, Inc. | 864-843-4343**

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GET Engineering

www.getntds.com

## Ethernet Data Conversion System (EDCS)

GET Engineering designed and currently manufactures an embedded **Ethernet Data Conversion System (EDCS)** for use in the Navy's CANES program.

The system allows the Navy to continue to use legacy equipment with new open architecture systems. The EDCS can be configured in many functional modes from a simple Legacy to Ethernet protocol convertor to a message traffic monitoring system, capturing specific data and converting it to either Legacy or Ethernet protocol.

The EDCS is available in several different form factors to meet the Navy's shipboard requirements.

### FEATURES

- Available in multiple form factors from single channel to 16 channel 4U Rack Mount
- Fully Integrated for use with the following message traffic, protocols and equipment:
  - OD19 * OD17 * NTDS * RS-422 + DCLS * TPX-42 * DDRT

**GET Engineering Corp. | 619-443-8295**

**Contact:** sales@getntds.com



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An Employee-Owned Company

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## -40° to +85°C PC/104 Single Board Computer with Dual Ethernet

The PCM-VDX-2 is a highly integrated PC/104-compatible Single Board Computer designed for space-limited and low-power applications. It is a full-featured SBC that includes a 1GHz Vortex86DX, 512KB DRAM, and 1MB battery-backed SRAM. I/O support includes two 10/100 Ethernet channels, four USB 2.0 ports and four serial ports. Its low power dissipation permits fanless operation over a temperature range from -40°C to +85°C. This board is well suited for rugged applications requiring a low power embedded PC.

The PCM-VDX-2 has x86 PC software compatibility, which assures a wide range of tools to aid in your application's program developments. It supports Linux, DOS and other x86 operating systems.

WinSystems provides technical phone support to assist customers with system integration of our SBCs and I/O modules in their designs.

### FEATURES

- Fanless 1GHz Vortex86DX processor
- Small size: 90mm x 96mm
- Two 10/100 Mbps Ethernet controllers
- Four USB 2.0 ports with overcurrent protection
- Four serial RS-232/422/485 channels with FIFOs
- 16 digital I/O lines with event sense
- LPT, PS/2 keyboard and mouse support
- CompactFlash and PATA supported
- MiniPCI and PC/104 expansion connectors
- -40°C to +85°C operating temperature

**WinSystems, Inc. | 817-274-7553**

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## Extended Temperature Intel® Atom™ PC/104-*Plus* SBC

WinSystems' PPM-C393, featuring high integration with PC/104-*Plus* expansion, provides a flexible and cost-effective solution for demanding embedded applications. This combination provides designers access to the low power performance of Intel Atom processors and to the thousands of PC/104, PC/104-*Plus*, and PCI-104 modules available worldwide.

It is well suited for new applications and for upgrading existing designs. The PPM-C393's extended temperature operation and low power open up applications for security, Mil/COTS, medical, transportation, data acquisition, and communications in a small, rugged, form factor proven in these industries.

It supports Linux, Windows®, and other x86-compatible real-time operating systems.

### FEATURES

- 1.66GHz N455 Intel® Atom™ CPU
- Runs Linux, Windows® and other x86 operating systems
- Up to 2GB of DDR3 SODIMM supported
- Simultaneous LVDS and CRT video
- Intel Gigabit Ethernet controller
- SATA (2.0) channel and CompactFlash supported
- Four serial COM ports (two RS-232, two RS-232/422/485)
- Eight USB 2.0 ports with polyfuse protection
- Watchdog timer adjustable from 1 sec. to 255 min.

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## PC/104 POE-PD Power Supply Module

The PCM-PS397-POE-1 is a PC/104 compatible Power over Ethernet Powered Device (POE-PD) DC/DC supply. Configured as either an endpoint or midspan device, it is designed to extract power from a conventional twisted pair CAT 5 Ethernet cable and conforms to the IEEE 802.3af and 802.3at POE standard with two stage class detection.

The PCM-PS397-POE-1 accepts positive or negative polarity power in the 42 – 57VDC range from the RJ45 Ethernet interface. It converts the power to three rails: +5VDC, +12VDC, and -12VDC. These three output power rails are available to the PC/104 and auxiliary output connectors. The PCM-PS397-POE-1 can alternatively take power from an auxiliary input power connector rather than from the Ethernet POE interface. The auxiliary input power range is from 16 - 60VDC.

The PS397 is available in two additional standard configurations and can be customized for OEM applications.

### FEATURES

- PC/104 POE Powered Device power supply
- POE input voltage: 42 – 57VDC
- Dual Polarity Power Sourcing Equipment (PSE) supported
- 802.3af/at compliant with support for Class 4 signature
- Auxiliary 16 – 60VDC input supported
- Isolated voltage outputs: +5VDC, +12VDC, and -12VDC
- Line and load regulation ±100mV for all outputs
- No minimum load required for regulation
- -40°C to +85°C fanless temperature operation

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## PC/104-*Plus* ATX-compatible DC/DC Power Supply Module

WinSystems' PPM-DC-ATX-P is a DC/DC power supply designed for PC/104, EPIC, and EBX Single Board Computers (SBCs) that support ATX power controls.

Well suited for harsh, rugged environments, it features a wide voltage input range from 10 to 50 volts. The module will operate from 12, 24, or 48 volt battery-operated or distributed DC power systems. It generates five regulated DC output voltages from one common DC input. The PPM-DC-ATX-P can also support software controlled shutdown and power monitoring for SBCs with advanced CPU chip-sets employing sleep modes and active power management.

WinSystems offers this module in three off-the-shelf configurations. All configurations will operate from -40° to +85°C without fans or heat sinks.

### FEATURES

- PC/104-*Plus* ATX DC/DC power supply
- Wide 10V to 50VDC input range
- Voltage outputs: +5V, +3.3V, +12V, -12V, and +5VSB
- Power On/Off, Power Good, and +5 VSB supported for power management and sleep modes
- Outputs have short circuit/overload protection
- -40° to +85°C fanless temperature operation
- Custom OEM configurations available
- Off-the-shelf product availability

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General Standards Corporation
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## The New 64 Channel Output Board

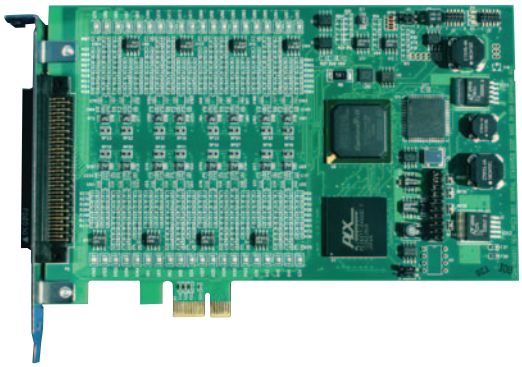
We now offer a 64 channel output board. Up until now it took four 16-channel boards. This one board places 16-bit, 64 channel, 500KSPS, PCI Express Analog Output, DAC per channel, right on one board, and allows you to manage your data in Real-Time Real-Fast.

This board was perfected at record industry speeds where every day counts. From custom board development within the shortest lead times, free software drivers, and loaner boards, to industry leading features second to none, General Standards always works to develop and provide what you need when you need it. If your application will experience environmental temperature fluctuations or power cycling, then the high reliability ordering option is recommended: High Reliability Processing, Ruggedization, Industrial Temp, Conformal Coating. Call about the availability of Conduction Cooled.

For alternate form factors, our designs allow the flexibility to change platforms, including: PCI, cPCI and PC/104-*Plus*, as well as PCI Express, PCI/104-Express, PMC, etc.

General Standards has a proven customer service track record – we never leave the problem with you, whether it's long-term availability or the support you need to be satisfied with our products. It's just good business to partner with us.

***Our products are always manufactured in the U.S.A.***



### FEATURES

**16-Bit, 500KSPS, PCI Express, DAC per channel**

- Precision 16-Bit simultaneously-clock analog outputs: R2R DAC per channel
- 256K-Sample output data FIFO buffer
- Autocalibration ensures high accuracy
- PCI Express operating at 2.5Gbps
- Free Loaner Boards
- Free Software Drivers
- Custom Board Development Available

**General Standards Corporation | 800-653-9970**

**Contact:** quotes@generalstandards.com
**http://www.generalstandards.com/support.php**

## COTS Collection: Boards, Carriers, Mezzanines, ICs: VITA 41 VXS

mil-embedded.com/p9914991

EMERSON Network Power

www.Emerson.com/EmbeddedComputing

### MVME8100

Emerson's **MVME8100** is a high performance 6U VME/VXS SBC featuring the Freescale QorIQ P5020 processor with up to 8GB DDR3-1333MHz ECC memory, 512K NVRAM, and 8GB eMMC NAND Flash. It offers expanded I/O and memory features with PCIe and SRIO fabric connectivity and multiple USB, Serial and Ethernet ports. The MVME8100 is offered in commercial and fully rugged variants for extreme environments with extended shock, vibration, temperatures and conduction cooling. It is designed for a range of high end industrial control such as SPE and photo lithography and C4ISR, including radar/sonar. It will provide technology insertion to prolong current programs while providing more computing performance and data throughput. Supported operating systems include Linux, Wind River VxWorks, and Green Hills INTEGRITY.

### FEATURES

- VME/VXS SBC with Freescale QorIQ P5020 1.8/2.0GHz
- Up to 8GB DDR3-1333MHz ECC Memory, 512KB NVRAM, embedded NAND Flash (8GB eMMC)
- 2 PMC/XMC sites
- Optional mounting kit to support 2.5" SATA SSD
- 2x4 PCIe or 2x4 SRIO connectivity to VXS backplane P0
- Up to 3 USB 2.0 ports, 5 Ethernet ports, 5 Serial ports, 4 GPIO
- Extended temperature and conduction cooled variants
- Conformal coating available

**Embedded Computing, Emerson Network Power**
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## COTS Collection: Boards, Carriers, Mezzanines, ICs: VITA 46 VPX

mil-embedded.com/p9913083

X-ES

xes-inc.com

### XPedite7570 4th Gen Intel Core i7 3U VPX

The **XPedite7570** is a high-performance, low-power, 3U VPX-REDI, single board computer based on the 4th generation Intel® Core™ i7 Haswell processor. With two PCI Express Fat Pipe P1 interconnects and four Gigabit Ethernet ports, the **XPedite7570** is ideal for the high-bandwidth data processing demands of today's military and avionics applications. Floating-point-intensive applications such as radar, image processing, and signals intelligence will benefit from the performance boost provided by the Intel Advanced Vector Extensions 2.0 (Intel AVX2).

The **XPedite7570** accommodates up to 16 GB of DDR3L-1600 ECC SDRAM in two channels to support memory-intensive applications. It hosts numerous I/O ports, including Gigabit Ethernet, USB, SATA, graphics, and RS-232/422/485 through the backplane connectors.

### FEATURES

- Supports 4th generation Intel® Core™ i7 processors
- 3U VPX (VITA 46) module
- OpenVPX™ standards based
- Ruggedized Enhanced Design Implementation (REDI) per VITA 48
- Conduction or air cooling
- Up to 16 GB of DDR3L-1600 ECC SDRAM in two channels
- Up to 32 GB of NAND flash
- PMC/XMC interface
- Two PCI Express Gen3-capable Fat Pipe P1 fabric interconnects
- Four Gigabit Ethernet and four SATA ports
- Two HDMI/DVI-D or dual-mode DisplayPort interfaces
- One XMC (P16) SATA port for storage mezzanine
- Intel® vPro™/AMT support
- Wind River VxWorks BSP, Linux BSP, Microsoft Windows drivers

**Extreme Engineering Solutions (X-ES) | 608-833-1155**

**Contact:** sales@xes-inc.com
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Annapolis Micro Systems

www.annapmicro.com

## WILD OpenVPX Four Slot Mesh Chassis

Annapolis enters the OpenVPX market with **WILDSTAR 6 Xilinx Virtex-6** and **WILDSTAR A5 Altera Stratix 5 FPGA Processing Boards**, an 8 TB per slot WILD Storage Solution, a WILD Switch, a Four Slot and a Twelve Slot Chassis.

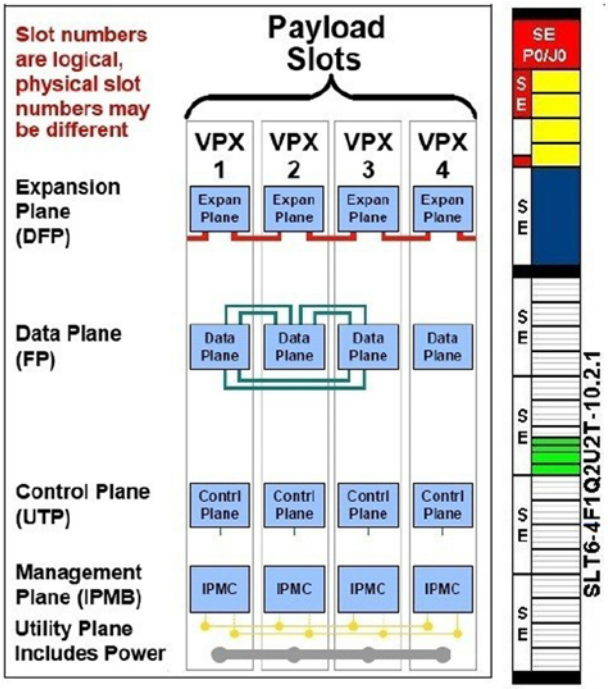
The **Four Slot Mesh Chassis** has a particularly powerful Backplane Configuration, as shown in the diagram.

The chassis could, for example, be filled with two of the 8 TB WILD Storage Cards, one WILDSTAR A5 Stratix V FPGA Processing Board, and a Single Board Computer.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Annapolis provides I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OS 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

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

Our extensive IP and board support libraries contain more than 1,000 cores, including floating point and the world's fastest FFT. CoreFire uses a graphical user interface for design entry, supports hardware-in-the-loop debugging, and provides proven, reusable, high-performance IP modules. WILDSTAR A5 for OpenVPX, with its associated I/O Cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.




## FEATURES

- 4U High 19" Rack Mount Chassis with Front Mounted Horizontal OpenVPX Card Cage with Four Slots
- 4 Slot OpenVPX High Speed Mesh Backplane with Rear Transition Module Support
- 10+GBps on Data Plane for 10GBase-KR Ethernet, 40GBase-KR4 Ethernet, 10GBase-KX4 XAUI or SDR, DDR and QDR 4x InfiniBand
- 8x PCIe Gen 1, 2 or 3 on Expansion Plane
- 1000Base-X on Control Plane
- Large Power Supply
- Chassis Management, including Voltage, Temperature and Fan Monitoring and Control and a Front of Chassis Display Panel
- High Performance Convection Cooling with Replaceable and Cleanable Fan Tray and Filter
- Front Panel Power Switch, System Rest Switch and Maskable Reset Switch, all with Safety Covers
- Electromagnetic Shielding
- Includes one year hardware warranty

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

Save time and effort and reduce risk with COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition.

**Annapolis Micro Systems, Inc. | 410-841-2514**

**Contact**: wfinfo@annapmicro.com

Annapolis Micro Systems

www.annapmicro.com

## WILD OpenVPX Storage Board

Annapolis leads the **OpenVPX** market with the 8 Terabyte per slot WILD Storage Solution with 4GBps Write and 8GBps Read Bandwidth. The **Storage Board** has a Hot Swappable Canister containing up to 16 Pluggable 1.8" SSD SATA 3.x Drives, with 2, 4 or 8 Terabytes per Board.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Annapolis provides I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OC 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

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

Our extensive IP and board support libraries contain more than 1,000 cores, including floating point and the world's fastest FFT. CoreFire uses a graphical user interface for design entry, supports hardware-in-the-loop debugging, and provides proven, reusable, high-performance IP modules. WILDSTAR A5 for OpenVPX, with its associated I/O Cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.

## FEATURES

- 4 GBps Write and 8 GBps Read Bandwidth
- Up to 40Gb Ethernet or QDR InfiniBand on each of Four Fat Pipes on P1 for a total of 20GBps on P1
- PCI Express 8x Gen 1, Gen 2 or Gen 3 on P2 and P5 of the OpenVPX Backplane
- 2, 4 or 8 Terabytes per OpenVPX Slot
- Hot Swappable Canister
- Up to 16 Pluggable 1.8" SSD SATA 3.x
- API for Command and Control of the Storage Process
- Includes one year hardware warranty

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## WILD OpenVPX Switch Board

Annapolis leads the OpenVPX market with the **WILD 6U OpenVPX** (VITA 65.0 Compliant) **Switch Board**, with up to 4 Tbps non-blocking switching capacity with up to 8 switch partitions.

Supports OpenVPX Switch Profiles: SLT6-SWH-20U19F-12.4.1: 20 Control Plane and 19 Data Plane Backplane Ports; SLT6-SWH 16U20F-12.4.2: 16 Control Plane and 20 Data Plane Backplane Ports; SLT6-SWH-24F-12.4.3: = 24 Data Plane Backplane Ports.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Annapolis provides I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OC 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

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## FEATURES

- 6U OpenVPX Board
- Up to 4Tbps Non-Blocking Switching Capacity with up to 8 Switch Partitions
- Multiprotocol Switch – SDR/DDR/QDR/FDR InfiniBand and 1/10/20/40 Gb Ethernet
- Each Backplane and Front Panel Port can be Configured for either InfiniBand or Ethernet
- Front Panel: Up to 8 QSFP+, Up to 2 SFP+, RJ45 Management Port, USB USART, LED Status
- Supports OpenVPX Switch Profiles
- InfiniBand and IP Routing
- Ethernet Gateways
- ChMc Management Plane Support
- Includes one year hardware warranty

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## WILD OpenVPX Twelve Plus 3 Slot Switched Chassis

Annapolis enters the OpenVPX market with WILDSTAR 6 Xilinx Virtex-6 and WILDSTAR A5 Altera Stratix 5 FPGA Processing Boards, an 8 TB per slot WILD Storage Solution, a WILD Switch, a Four Slot and a Twelve Plus Three Slot Chassis.

With Ten Payload Slots and Two Switch Slots, and an option for Three VME/VPX Slots, the **Twelve OpenVPX Plus 3 Chassis** has a particularly powerful Backplane Configuration, as shown in the diagram.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Annapolis provides I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OC 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

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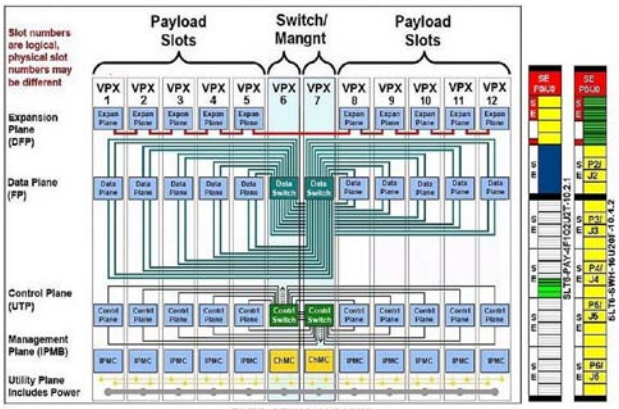


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## FEATURES

- 19" Rack Mount Chassis with Front Mounted OpenVPX Card Cage
- Primary Twelve Slot 6U OpenVPX High Speed Switched Backplane with Rear Transition Module Support
- 10+GBps on Data Plane for 10GBase-KR Ethernet, 40GBase-KR4 Ethernet, 10GBase-KX4 XAUI or SDR, DDR and QDR 4x InfiniBand
- 8x PCIe Gen 1, 2 or 3 on Expansion Plane
- 1000Base-X on Control Plane
- Secondary Three Slot VME/VPX Backplane for Power Only Payload Cards
- Very Large Power Supply
- Chassis Management, including Voltage, Temperature and Fan Monitoring and Control and a Front of Chassis Display Panel
- High Performance Convection Cooling with Replaceable and Cleanable Fan Tray and Filter
- Front Panel Power Switch, System Rest Switch and Maskable Reset Switch, all with Safety Covers
- Electromagnetic Shielding
- Includes one year hardware warranty

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**Contact**: wfinfo@annapmicro.com

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www.annapmicro.com

## WILDSTAR A5 for OpenVPX

Supports up to Twenty-four 14G InfiniBand, Six 40Gb Ethernet, or Twenty-four 10G Ethernet Connections.

**WILDSTAR A5 for OpenVPX** uses Altera's newest Stratix V FPGAs for state-of-the-art performance. This is one of a series of Altera Based FPGA Processing Boards from Annapolis.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. It accepts up to four I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OC 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

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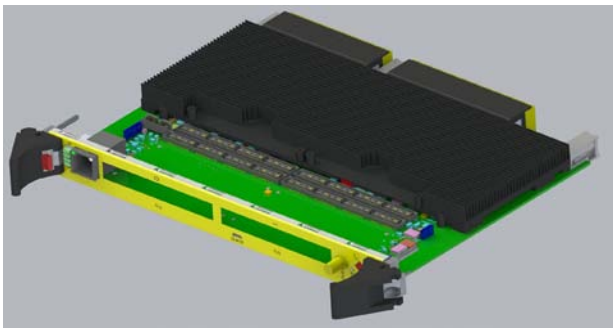

## FEATURES

- Supports up to Twenty-four 14G InfiniBand, Six 40Gb Ethernet, or Twenty-four 10G Ethernet Connections
- Up to Three Altera Stratix V FPGA Processing Elements – GSD4, GSD5, GSD6, GSD8, GXA3, GXA4, GXA5, GXA7, GXA9, GXAB
- Up to 8 GBytes DDR3 DRAM in 4 Memory Banks and Up to 80 MBytes QDRII + SRAM in 5 Memory Banks per WILDSTAR A5 for OpenVPX Board
- Programmable FLASH for each FPGA to Store FPGA Images
- APM86290 PowerPC on Board Host
- PCI Express Bus Gen 1, Gen 2, or Gen 3 to P2 Expansion Plane through On Board PCIe Switch
- Full CoreFire Board Support Package for fast, easy application development
- VHDL model, including source code for hardware interfaces and ChipScope Access
- Available in both commercial and industrial temperature grades
- Proactive Thermal Management System – Board Level current measurement and FPGA temperature monitor, accessible through Host API
- Includes one year hardware warranty, software updates, and customer support
- Training available

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www.annapmicro.com

## WILDSTAR 6 for OpenVPX

Annapolis Micro Systems is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Our 14th-generation WILDSTAR 6 for OpenVPX uses Xilinx's newest Virtex-6 FPGAs for state-of-the-art performance. It accepts one or two I/O mezzanine cards in one VPX slot or up to four in a double wide VPX slot, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (Rocket I/O, 10 Gb Ethernet, InfiniBand), and Tri XFP (OC 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows, Linux, Solaris, IRIX, ALTIX, and VxWorks. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models.

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## FEATURES

- Up to three Virtex-6 FPGA processing elements – XC6LX240T, XC6LX365T, XC6LX550T, XC6SX315, or XC6SX475
- Up to 7 GB DDR2 DRAM in 14 banks or up to 448 MB DDRII or QDRII SRAM
- OpenVPX backplane
- 80 x 80 crossbar connecting FPGAs and VPX backplane
- 1 GHz 460EX PowerPC onboard host
- 4X PCIe controller
- Programmable Flash to store FPGA images and for PCI controller
- Full CoreFire Board Support Package for fast, easy application development
- VHDL model, including source code for hardware interfaces and ChipScope Access
- Host software: Windows, Linux, VxWorks, etc.
- Available in both commercial and industrial temperature grades
- Proactive Thermal Management System – Board level current measurement and FPGA temperature monitor, accessible through host API
- Save time and effort and reduce risk with COTS boards and software; achieve world-class performance – WILD solutions outperform the competition
- Includes one-year hardware warranty, software updates, and customer support; training available

**Annapolis Micro Systems, Inc. | 410-841-2514**

**Contact**: wfinfo@annapmicro.com

CONCURRENT TECHNOLOGIES

www.gocct.com

## 3U VPX Processor Board – TR B12/msd

The TR B12/msd is a PC-compatible high performance 3U VPX processor board supporting the 4th generation Intel® Core™ processor and the Intel® QM87 PCH with up to 16 Gbytes of DDR3L-1600 ECC DRAM. The **TR B12/msd** features an optional XMC site and a range of I/O interfaces including four SATA600 channels, dual 1000Base-BX, serial and USB2.0/USB3.0 interfaces. The board provides a flexible PCI Express® (Gen 1, Gen 2 and Gen 3) backplane fabric interface for use in systems defined by OpenVPX (VITA 65). For rugged applications, a VPX-REDI Type 1 and VPX-REDI Type 2 conduction-cooled version is available. The board is suitable for a range of applications within the defense, aerospace, security and surveillance market sectors in particular.

**Optional front panel providing inclusive I/O:**

- 1 x USB3.0, 3 x RS232, 1 x Gigabit Ethernet, 1 x DisplayPort

**Optional XMC module interface (with front/rear I/O):**

- XMC module interface (2 x4 or 1 x8 PCI Express® Gen 2)
- Optional board security packages

**Optional Built-In Test (BIT) supports:**

- Power-on BIT, Initiated BIT, Continuous BIT
- Optional Rear Transition Modules
- Commercial and Ruggedized conduction-cooled VPX-REDI versions (RCx-Series)

**Complementary products include:**

- Switch Fabric boards
- XMC carriers
- Mass Storage Boards
- Development Systems
- Fabric Interconnect Networking Software (FIN-S)

## FEATURES

- 3U VPX (VITA 46.0) N-Series single board computer
- 4th generation Intel®Core™ processor
- Up to 16 Gbytes soldered DDR3L-1600 DRAM with ECC

**Configurable control plane fabric interface (VITA 46.6) supports:**

- 2 x SerDes (1000Base-BX) ports or
- 1 x SerDes plus 1 x Gigabit Ethernet ports or
- 2 x Gigabit Ethernet ports

**Configurable PCI Express® (PCIe) data plane fabric interface (VITA 46.4) supports:**

- 2 x 4 PCIe ports, 4 x2 PCIe ports or a 1 x8 PCIe port
- Support for Gen 1, Gen 2 and Gen 3
- Compatible with OpenVPX module profiles
- Single non-transparent port
- Compatible with the FR 331/x06 VPX Switch
- Up to 4 x SATA600 mass storage interfaces
- Support for onboard SATA Flash Drive Module
- Up to 4 x serial interfaces and up to 3 x USB interfaces
- IPMI (Intelligent Platform Management Interface)
- Watchdog and long duration timers
- Up to 3 x independent graphics interfaces
- Optional high definition stereo audio

**Concurrent Technologies, Inc. | 781-933-5900** **Contact**: info@gocct.com

## COTS Collection: Boards, Carriers, Mezzanines, ICs: VITA 65 OpenVPX

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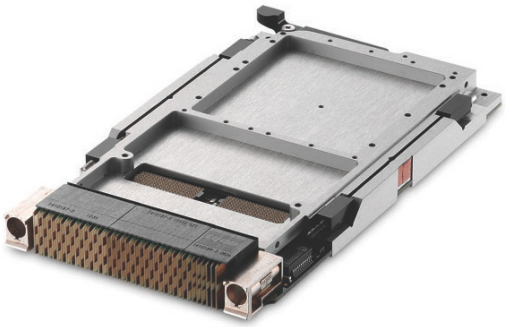
ADLINK TECHNOLOGY INC.

www.adlinktech.com

### VPX3000 Series Rugged 3U VPX Processor Blade



ADLINK has a rich history of innovating and delivering standards-based, rugged defense products. Starting with the introduction of its conduction cooled CompactPCI and Extreme Rugged™ board-level products in COM Express, PC/104 and EBX form factors, and now introducing our high performance VPX3000 Series.

The Rugged by Design VPX3000 3U VPX processor blade offers extensive I/O functionality along with a quad/dual-core 3rd generation Intel® Core™ processor. It is rugged, conduction cooled with conformal coating, and has been tested and certified to meet extended operating temperatures of -40°C to +85°C. A VPX-R300 Rear Transition Module is available to access rear I/O signals, and a tBP-VPX3000 Test Backplane supporting three payload slots is available for users to validate VPX3000 functionality.

#### FEATURES

- Quad/dual-core 3rd generation Intel® Core™ processor
- -40°C to +85°C operating temperature
- Conduction cooled with conformal coating
- Gigabit Ethernet, dual video display, audio inputs
- 2 Serial, USB 3.0, 4 GPIOs
- XMC expansion slot
- 8GB DDR3-1333, 16GB onboard flash
- Supports VITA 46, VPX-REDI 48, OpenVPX VITA 65
- Meets VITA 47-2005 environmental specifications

**ADLINK Technology | 408-360-0200**

**Contact**: info@adlinktech.com
**www.linkedin.com/company/adlink-technology**

## COTS Collection: Boards, Carriers, Mezzanines, ICs: VITA 65 OpenVPX

mil-embedded.com/p9914934

ORBIT POWER GROUP
Behlman Electronics

www.behlman.com

### VP*Xtra*™


In 2012, Behlman raised the power bar to 1000 watts, with **VP*Xtra*™** DC-to-DC COTS power supplies. These VITA 62-, OpenVPX-compliant switch mode units are rugged and highly reliable. They are built for mission-critical military airborne, shipboard, and mobile applications, as well as industrial power solutions.

Behlman pioneered a unique card edge cooling function – ***Xtra*-Cooling** Technology – that enables the dual output **VP*Xtra*™1000CD** to deliver up to 1000 Watts of clean, regulated 12 VDC power and 3.3 VDC auxiliary power with a typical efficiency of 90%, from wide-range 28 VDC input. The 12 VDC output can be paralleled for higher power and fail-safe redundancy.

The Behlman **VP*Xtra*™1000CM** Power Supply provides five outputs up to 600 watts in a 6U VPX compatible unit. It accepts wide-range 28 VDC input, IAW MIL-STD-704, and has high-power DC outputs of 12 VDC @ 40 A, 5 VDC @ 24 A and three auxiliary outputs of 3.3 VDC @ 15 A, -12VDC @ 2 A, and +12 VDC @ 1 A.

#### FEATURES

- OpenVPX, VITA 62 compliant
- Wide input range
- High DC-power output
- Conduction cooled at card edge via ***Xtra*-Cooling** Technology
- ***Xtra*-Reliable** Design
- ***Xtra*-Rugged** Construction

Both the **VP*Xtra*™1000CD** and **VP*Xtra*™1000CM** have no minimum load requirement, and have overvoltage and short circuit protection as well as overcurrent and thermal protection.

For applications with an AC input, a front-end **VP*Xtra*™1500S** 6U card will be available in 2013 Q4. This unit will convert single or 3-phase AC to 1000W DC, to power the **VP*Xtra*™1000CD** and **VP*Xtra*™1000CM**.

**Behlman Electronics**
**800 874-6727 • 631 435-0410 • FAX: 631 951-4341**

**Contact:** sales@behlman.com • **Twitter:** https://twitter.com/behlmanpower
**LinkedIn:** http://www.linkedin.com/behlman-electronics
**Facebook:** https://www.facebook.com/194171677268138

CREATIVE ELECTRONIC SYSTEMS

www.ces.ch

## RIOV-2440

The **RIOV-2440** features the QorIQ® T4240, the first Advanced Multiprocessing SoC from Freescale®, with 12 dual-threaded cores. The 24 virtual cores of the T4240, along with the associated AltiVec® technology SIMD engines and hardware accelerators, provide excellent performance for calculation-intensive applications. The integrated I/O peripherals and the data-path acceleration architecture (DPAA) guarantee the highest performance for I/O-intensive applications. The CoreNet™ fabric provides very efficient point-to-point interconnection between the multiple cores and peripherals, making the T4240 the ideal choice for applications requiring very high performance, both in I/O and calculation. The hardware-assisted virtualization support enables the safe and flexible partitioning of applications on the multiple cores.

The RIOV-2440 supports the T4240 processor with up to 12 GB of high-speed DDR3 memory in three separate banks, 2 GB of onboard Flash, and direct I/O connections to the backplane. The overhead of additional switches and bridges is eliminated, while flexibility is provided by the multiple processor I/O configuration options, including PCIe, SRIO, GbE, 10GbE and SATA II. It is compatible with most OpenVPX™ payload slot profiles.

### FEATURES

- **OpenVPX Profiles:** Slot profile: SLT3-PAY-1F2F2U-14.2.2, Payload module profile: MOD3-PAY-1F2F2U-16.2.2-n
- **Processor:** Freescale® QorIQ® T4240 (twelve dual-threaded cores) at 1.6 GHz, 2 MBytes internal L2 cache (per cluster) with ECC protection, triple 512 KBytes internal L3 cache with ECC protection
- **Memory:** triple 2/4 GBytes DDR3 SDRAM at 12 GBytes/s peak (per channel) with ECC protection, 2 GBytes Flash EPROM (NAND), 128 MBytes Flash EPROM (NOR), 256 KBytes NVRAM
- **Interconnect:** four PCIe x4 on VPX-P1/P2, two SRIO x4 on VPX-P1, twelve GbE on VPX-P1/P2 + one on front, three 10GbE on VPX-P1/P2, one SATA II on VPX-P2 + one on front, one USB 2.0 on front, one UART on VPX-P2 + one on front, one Aurora on VPX-P2
- **Advanced Board Management Controller:** for VITA 46.11 support, configuration management, event logging and other supporting tasks

**CES - Creative Electronic Systems | +41.22.884.51.00**

**Contact**: ces@ces.ch



kontron

www.kontron.com

## VX3324 and VX3327 – 3U VPX GPU/GPGPU

The versatile **Kontron 3U VPX GPU/GPGPU boards, VX3324 and VX3327**, offer high-end graphics capabilities provided by the latest graphics processing units from AMD Radeon™.

The Kontron VX3324 with AMD Radeon GPU E6460 is optimized for SWaP-C military and aerospace applications and supports the latest high-end graphics performance features such as DirectX 11 OpenGL 4.a0 and Shader model 5.0, providing an immersive 3D user experience.

The Kontron VX3327 is equipped with AMD Embedded Radeon E6760 GPU. With its 480 computing cores, Kontron's OpenVPX-compliant board delivers a parallel data processing performance of up to 576 GFLOPs. Equipped with this processing power, the Kontron VX3327 is optimized for compute-intense General Purpose Graphics Processing Unit (GPGPU) applications deployed in avionics and military technology requiring superior situational awareness.

### FEATURES

- Last GPU/GPGPU Graphics processing units from AMD Radeon™
- Modular design: MXM 3.0 mezzanine
- Three independent Displays: one VGA and two DP
- Air-cooled and Rugged Conduction-cooled Versions

**Kontron | 888-294-4558**

**Contact:** info@us.kontron.com

**https://twitter.com/#!/Kontron • www.facebook.com/kontron • www.youtube.com/KontronVideos**

## COTS Collection: Boards, Carriers, Mezzanines, ICs: VITA 65 OpenVPX

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EMERSON Network Power

www.Emerson.com/EmbeddedComputing

### iVPX7225

Emerson's 3U **iVPX7225** is a fully rugged SBC for extreme environments with extended shock, vibration, temperatures and conduction cooling. It is designed for a range of industrial, communication and military/aerospace applications.

This high compute density platform offers both high speed fabric connectivity with PCI Express and Gigabit Ethernet control plane connectivity with data transfer rates up to 5Gbps.

The iVPX7225 software support includes UEFI compliant BIOS with password protection and a wide range of operating systems including Wind River VxWorks 6.9 and Linux 3.x.

### FEATURES

- 3rd gen Intel® Core™ i7 2.5 GHz dual-core integrated processor
- Intel® QM77 platform controller hub (PCH)
- 8GB ECC DDR3L-1600 (soldered), designed for 16GB
- 1MByte F-RAM, 4GB USB NAND Flash
- PCI Express Fat Pipe data plane, 1000BASE-BX/KX control plane
- 3X SATA, 3X USB and 2X serial interfaces, 8X GPIO, VGA, DisplayPort
- Integrated 2D/3D graphics with digital and VGA output
- One XMC site
- Optional rear transition module
- Extended temperature and rugged variants
- Air and conduction cooled variants
- VITA 48 REDI two-level maintenance (2LM)

**Embedded Computing, Emerson Network Power**
**+1 800 759 1107 • +1 602 438 5720**

**EmbeddedComputingSales@Emerson.com**
**Facebook.com/EmersonEmbeddedComputing**
**@EmersonEmbComp**

## COTS Collection: Boards, Carriers, Mezzanines, ICs: VMEbus/VME64

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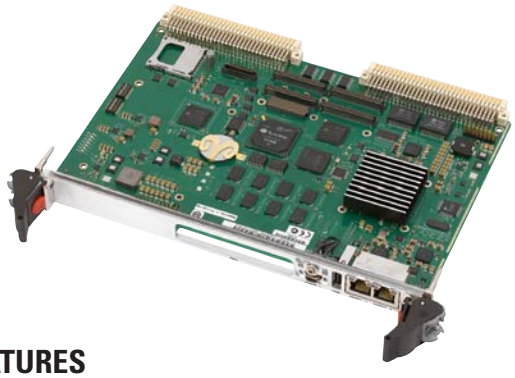
EMERSON Network Power

www.Emerson.com/EmbeddedComputing

### MVME2500

Emerson's **MVME2500** series makes a perfect migration path for older generation MVME3100, MVME4100, MVME5100 and MVME5110. On-board memory includes up to 2GB DDR3 memory and 512KB non-volatile MRAM. The MVME2502 variant has 8GB soldered eMMC solid state memory for additional rugged, non-volatile storage. Connectivity includes Gigabit Ethernet, USB 2, serial ports, SATA port and either one or two PMC/XMC sites with the MVME2500 and MVME2502 respectively. A hard drive mounting kit is available for Serial ATA or solid state hard drives. Extended temperature, rugged variants and conformal coating are available. The MVME2500 series is ideal for automation, medical, and military applications such as railway control, semiconductor processing, test and measurement, image processing, and radar/sonar.



### FEATURES

- VME SBC with Freescale QorIQ P2010 or P2020 processor
- Processor delivers an impressive performance-to-power ratio with single- or dual-core frequencies up to 1.2 GHz at less than 8W
- Up to 2GB DDR3 and 512KB non-volatile MRAM
- Connectivity includes Gigabit Ethernet, USB 2, serial, SATA
- Single PMC/XMC site on MVME2500 variant
- MVME2502 variant has 8GB soldered eMMC and two PMC/XMC sites
- Conformal coating available
- Optional rear transition module
- Optional hard drive mounting kit

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EMERSON Network Power

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## MVME4100

Emerson's **MVME4100** provides a high-performance, cost-effective continuation for currently deployed VME infrastructure. The Freescale e500 core coupled with the current operating systems allows for double precision floating point operations. In addition, the processor-enabled supplementary encryption engine can be leveraged to address new opportunities meeting the ever-growing demands for network privacy and data security. 2GB of DDR2 RAM is provided in SO-DIMM format. Innovative MRAM is included for truly non-volatile memory. Also included are 4GB of NAND flash, which can offer improved performance and life cycle over some rotating media. High speed 2eSST protocol and extensive I/O round out Emerson's MVME4100 to provide maximum performance and flexibility. Extended temperature and rugged variants support a wide range of operating and storage temperatures in addition to increased tolerances for shock.

### FEATURES

- VME SBC with Freescale MPC8548E with e500 processor core
- 2GB DDR2 ECC, 128MB NOR flash and 4GB NAND flash
- 512KB of MRAM non-volatile memory
- Four Gigabit Ethernet ports, five serial ports
- USB 2.0 controller for integrating cost-effective peripherals (commercial temperature only)
- 2eSST VMEbus protocol with 320MB/s transfer rate
- Board support packages for VxWorks and Linux
- Dual 33/66/100MHz PMC sites for expansion via industry standard modules with support for processor PMCs
- 8x PCI/PCI-X expansion connector for PMC/XMC expansion using Emerson XMCspan carrier
- MVME7216E direct-connect rear transition module (RTM) for I/O routing through rear of VMEbus chassis
- Extended temperature and rugged board variants available

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EMERSON Network Power

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## MVME7100

Emerson's **MVME7100**, featuring the SoC MPC864xD processor, offers a growth path for VMEbus customers with applications on the previous generation of VME, specifically the MPC74xx processors. OEMs of industrial, medical, and defense/aerospace VMEbus platforms can add performance and features for competitive advantage while still protecting the fundamental investment in VMEbus and related technologies. Customers can keep their VMEbus infrastructure (chassis, backplanes, and other VMEbus and PMC boards) while improving performance and extending the life cycle. Also, the extended life cycle of Emerson computing products helps reduce churns in development and support efforts resulting from frequent product changes. Extended temperature variants support a wide range of operating and storage temperatures in addition to increased tolerances for shock.

### FEATURES

- Freescale MPC864xD with dual Power Architecture e600 cores
- Up to 2GB ECC DDR2, 128MB NOR, and 4 or 8GB NAND flash
- 2eSST VMEbus protocol with 320MB/s transfer rate
- Four Gigabit Ethernet ports
- USB 2.0 controller for integrating cost-effective peripherals (commercial temperature only)
- Dual 33/66/100MHz PMC-X sites for expansion via industry standard modules with support for processor PMCs
- 8x PCI Express expansion connector for PMC-X and XMC expansion using Emerson XMCspan
- MVME7216E direct-connect rear transition module (RTM) for I/O routing through rear of a VMEbus chassis
- Extended temperature and rugged board variants available
- Board support packages for VxWorks, LynxOS, and Linux

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## Mass Storage: Data recorder (system)

mil-embedded.com/p9914814

Innovative Integration
a subsidiary of ISI
... real time solutions!

www.innovative-dsp.com/products.php?product=Andale

### Andale Luggable


**Andale** (pronounced on' duh lay) is a powerful data logging system that directly controls an NTFS disk subsystem to support gap-free storage or playback of analog or digital signals acquired using the Innovative X-series XMC modules. The included logging software moves data in real-time between the analog or digital I/O peripherals on any Innovative XMC module to/from dedicated SATA drives with minimal intervention from application software or Windows.

Dedicated PCI Express SATA3 RAID controllers interface to conventional hard/SSD drives supporting data flow rates up to 2600 MB/s, sustained.

*Download Data Sheets & Pricing Now!*

### FEATURES

- Turnkey, High-Speed Data Acquisition + Storage
- Runs Windows7/i7 CPU in ATX enclosure with integrated cooling
- Up to 48 TB Hard Disk Array
- Expandable storage via external JBOD
- 2600 MB/s sustained performance from analog or digital I/O module to standard NTFS disk files
- Supports all Innovative X3, X5 &X6 I/O module features including triggering and timing features
- Wideband (500 MHz) logging/playback
- Autonomous or Network-controlled operation via named pipe

**Innovative Integration | 805-578-4260**

**Contact**: sales@innovative-dsp.com

## Mass Storage: Data recorder (system)

mil-embedded.com/p9915144

PENTEK
Setting the Standard for Digital Signal Processing

www.pentek.com/go/mes2786rg

### RTX 2786

The Talon® RTX 2786 is a turnkey, RF/IF signal recorder designed to operate under extreme environmental conditions. Housed in a ½ ATR chassis, the RTX 2786 leverages Pentek's 3U VPX SDR modules to provide a rugged recording system with up to four 16-bit, 200 MHz A/D converters with built-in digital downconversion capabilities.

The RTX2786 can record and play back analog signals with bandwidths ranging from a few kHz up to 80 MHz, either as baseband signals or as IF signals with center frequencies tunable across a 700 MHz range. Optionally, the RTX 2786 provides one 800 MHz, 16-bit D/A converter with a digital upconverter for signal playback or waveform generation.

The RTX 2786 uses conduction cooling to draw heat from the system components, allowing it to operate in reduced air environments. It includes 1.92 TB of solid-state data storage, which allows it to operate with no degradation under conditions of extreme shock and vibration. The system is hermetically sealed.

### FEATURES

- ½ ATR 3U VPX chassis
- Designed to MIL-STD-704F, 810F and 461F
- Windows® 7 Professional workstation with high-performance Intel® Core™ i7 processor
- 200 MHz 16-bit A/Ds for recording up to four channels
- 800 MHz 16-bit D/A for playback up to one channel
- Real-time sustained recording rates of up to 500 MB/sec
- 1.92 TB of storage to NTFS RAID disk array
- RAID levels of 0 ,1, 5 and 6
- SystemFlow® GUI with signal viewer analysis tool, which includes a virtual oscilloscope and spectrum analyzer
- C-callable API for integration of recorder into application
- File headers include time stamping and recording parameters

**Pentek | 201-818-5900**

**Contact**: info@pentek.com

www.ToughSSD.com

## Proteus 2 and Galatea 2

**TCS Space & Component Technology** specializes in the best performing, highest quality ruggedized solid state drives for the most demanding environments. With a 100% focus on the military, aerospace and industrial markets, TCS can customize the performance and functionality of the drive to meet each customer application. All TCS SSDs are built in the USA at AS9100 or QML certified facilities to ensure high reliability.

**Proteus 2** provides high performance and maximized capacity in an industry standard 2.5" form factor. The ruggedness, quality and performance that military and industrial customers have come to expect from TCS is now available with even higher performance and capacity. Proteus 2 SSDs support the SATA revision 3.0 interface standard at up to 6.0Gb/s. Proteus 2 SSDs take full advantage of this improvement and deliver sustained reads up to 550MB/s and sustained writes up to 500MB/s. A robust interface is ensured by integrated hardware support for on-the-fly, per sector error detection and correction. The resulting Bit Error Rate is less than one in $10^{14}$.

**Galatea 2** also provides high performance in an industry standard 2.5" form factor. Galatea 2 goes further, improving encryption to AES-256 and adding user key management and TCG Opal compliance for complete data security protection. Secure erase functionality features seven different agency-approved enhanced erase methods. Erasure can be initiated by either software command or hardware signal. Galatea 2 SSDs support the SATA revision 3.0 interface standard at up to 6.0Gb/s.


## FEATURES

- Rugged Solid State Drives for the Military, Aerospace and Industrial Markets
- Milled Aluminum alloy case and rigid printed circuit board mounted by 8 screws for high levels of shock and vibration resistance verified by Mil-STD-810 testing
- Underfilled BGA controller, memory buffer and NAND flash
- Available in Industrial temperature SLC NAND flash for high data retention and write endurance over a wide temperature range
- Also available in Industrial grade MLC Flash providing you with a trade-off between cost and reliability
- 500 MB/s sustained bandwidth
- Capacities: 64 GB / 128 GB / 256 GB / 512 GB capacity (SLC)
- Capacities: 128 GB / 256 GB / 512 GB / 1 TB capacity (MLC & eMLC)
- Available in Standard and Military Secure Erase versions
- Additional options available (conformal coat, extended burn-in, gel fill)

**Additional Galatea 2 Features:**

- Power holdup
- AES-256 Encryption
- TCG Opal compliance

**TeleCommunication Systems, Inc. | 800-307-9488**

**Contact:** sctsales@telecomsys.com
**Twitter:** twitter.com/TeleComSys

## Mass Storage: Solid State Disk (SSD)

mil-embedded.com/p9912949

Apacer

Access the best

http://us.apacer.com

### SATA 3 Series

SATA interfaced SSDs have been the reliable partners for industrial and embedded computing systems in data cache, storage and system boot. Performance and I/O efficiency play extremely critical roles in industrial and embedded operations. Millions of daily data are processed and the host systems require storage media with even faster performance. Apacer has launched SATA III interfaced SSD series to break the performance bottleneck.


### FEATURES

- SATA 3 (6Gb/s) interface
- Global wear-leveling and block management
- Built-in ATA secure erase and S.M.A.R.T. functions
- TRIM command Support

**Apacer Memory America, Inc. | 408-518-8699**

**Contact:** ssdsales@apacerus.com

## Mass Storage: Solid State Disk (SSD)

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ELMA

Your Solution Partner

www.elma.com

### VPXStor – 3U and 6U VPX Storage Solutions

Elma offers the most complete line of storage modules in the embedded computing industry. Form factors include 3U VPX, PMC and XMC modules, 3U and 6U cPCI (PICMG), 6U VME (VITA). Environmental capabilities address commercial and rugged applications with SLC and MLC solid state and rotating drives and surface mount NAND flash. Choose from features including network attached RAID, front panel removability, high capacity conduction cooled mezzanine storage, secure erasure and write protection.

Elma's extensive line of 3U and 6U VPX storage cards supports the high capacity and high data rates necessary in today's emerging system designs. Build single or multi-slot array systems in air and conduction cooled configurations. Choose from SATA or PCIe interface solutions and protect your data with an Elma RAID controller card. Available in fixed or removable configurations, with optional write-protection and/or secure erasure.

### FEATURES

- COTS 3U & 6U VPX mass storage modules
- Secure erasure and write-protection options
- Dual storage in a single 3U slot; quad in 6U
- Front removable CFast and SATA drives
- Direct and networked attached configurations; RAID arrays
- Rugged modules in air and conduction cooled versions
- Meets most MIL standards

**Elma Electronic Inc. | 510-656-3400**

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Microsemi

www.microsemi.com/solid-state-drives/solid-state-drives

## SECURRE-Stor™ Self-encrypting Solid State Drive

When sensitive applications require maximum data storage security, Microsemi's **SECURRE-Stor™ SATA SSD** provides essential protection and reliability. With AES-256 encryption, authentication and other security features, data remains secure for banking, medical, industrial, smart grid and other critical applications.

Microsemi's design provides superior data integrity and endurance by focusing on error correction and wear leveling, eliminating drive corruption and protecting data from catastrophic failures.

SECURRE-Stor is ideal for applications where HDDs need to be physically destroyed to prevent loss of data. The Data key can be erased in less than 30ms, followed by a full hardware erase in less than 10 seconds. This leaves data forensically unrecoverable without physically destroying the drive.

All design and manufacturing for SECURRE Stor is performed in the U.S.


### GENERAL FEATURES

- Capacity: Up to ½ TB
- Commands: ATA–7, ATA–8
- Form factor: 2.5"
- Power: 5V +/- 10%
- Host interface: SATA at 1.5 Gb/s or 3 Gb/s
- Sequential reads and writes: 100 and 200 MB/s

### SECURITY FEATURES

- Key management
- 256 bit Pass-Phrase authentication
- Hardware authentication
- AES encryption with a 256-bit key
- Purge technology destroys key in less than 100 ms
- Full drive erase in less than 10 seconds

**Microsemi Corporation | 949-380-6100**

**Contact**: sales.support@microsemi.com



Microsemi

www.microsemi.com/solid-state-drives/solid-state-drives

## TRRUST-Stor™ Solid State Drive

***A New Level of SSD Security, Designed for Defense***

With encryption, unparalleled ruggedization and blazing fast erase, **Microsemi's TRRUST-Stor™** is the first and only solid state drive designed from the ground up for applications where data protection is crucial. The environmentally ruggedized, high reliability TRRUST-Stor is the industry's first SSD capable of withstanding zero-failure testing at vibration levels up to 42Grms, making it ideal for the most severe application environments. TRRUST-Stor delivers security, reliability and performance unmatched by current commercial SSD offerings for mission critical applications such as vetronics, UAVs, surveillance, data recorders, digital map storage, avionics, GPS/communications systems and ruggedized field computers.

***Why trust your data to anything less?***


### FEATURES

- Up to 512 GB densities
- Hardware-implemented AES-256 encryption
- Tamper resistant features available
- EOL management
- TRRUST-Purge™ renders data irrecoverable in milliseconds
- Full drive erase in less than 10 seconds
- Hardware- and software-based authentication
- Low power operation
- MTBF greater than 2,000,000 hours
- Military and government agency sanitization protocols
- Built-In-Self-Test (BIST)
- Power interruption protection

**Microsemi Corporation | 949-380-6100**

**Contact**: sales.support@microsemi.com

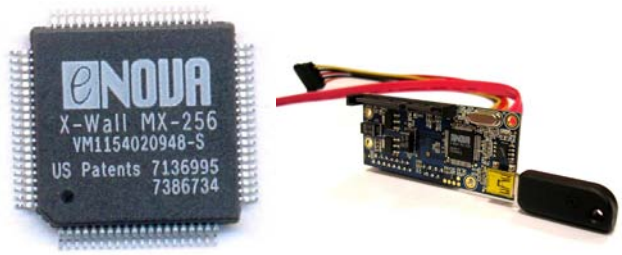
## Mass Storage: Solid State Disk (SSD)

mil-embedded.com/p9914569

ENOVA TECHNOLOGY CORPORATION

www.enovatech.net

### *X-Wall MX* – SATA-to-SATA FIPS 140-2 certified real-time crypto module




Enova announced its **X-Wall MX**, a SATA-to-SATA real-time crypto module, capable of encrypting ***any*** SATA disk or solid-state drive in its entirety in real-time at a sustained data throughput of over 120 MB/sec.

The **X-Wall MX** sits between the host SATA and the device SATA storage drive, encrypting the entire SATA drive with AES ECB and/or CBC 256-bit strength. With full FIPS 140-2 level 3 validation for physical security, the **X-Wall MX** meets the growing security needs of government agencies and enterprises today. The **X-Wall MX** is OS independent and complements all authentication mechanisms, including Government CAC/PIV. Contact us at Enova Technology to request an MX development board and/or **X-Wall MX-256C** (AES CBC 256-bit) engineering samples.

### FEATURES

- **FIPS 140-2 certified with certificates** #1471 and #1472
- **Generic host and device SATA interface** – equipped with standard SATA interfaces operating on any SATA 1.0a/2.0/3.0 disk drive/SSD at a sustained 120MB/sec throughput
- **SATA 6Gbps *X-Wall MX*** is on its way for upgrading
- **Low Power Consumption** – advanced semiconductor technology that offers lower power consumption for power sensitive applications
- **Drive repurposing made easy** – simply yank the key to avoid expensive drive erasing procedures as the encrypted content will be illegible
- **Keys Rotation** – allows the drive to be encrypted with either the first or the second Key interchangeably without taking the physical drive offline
- **Key management** is versatile and supports authentication through CAC/PIV, TPM, PIN, biometrics, Single Sign On and USB type tokens

**Enova Technology Corporation | US +1 510 825 7900**
Taiwan +886 3 577 2767

**Contact:** info@enovatech.com • Robert Wann: rwann@enovatech.com

## Mass Storage: Solid State Disk (SSD)

mil-embedded.com/p9915446

PHOENIX INTERNATIONAL

www.phenxint.com

### RPC24 Rugged RAID Storage Array

Phoenix International's **RPC24** is a high performance Fibre/SAS/iSCSI Host, SAS/SATA 3 Solid State/Hard Disk Drive RAID sub-system that delivers a level of operational environmental capability not previously available in COTS Data Storage Systems.

The RPC24 features two 12 drive removable magazines housed in a rugged 2U panel height chassis providing 8Gb FC, 6Gb SAS or 10GigE iSCSI host interfaces to high performance 6/12Gb SAS and/or SATA HDDs or SSDs.

Incorporating aluminium and steel in its rugged construction, the RPC24 weighs only 51 lbs with a full complement of 24 SSDs, is less than 20" deep and has been tested and certified to military specifications MIL-STD-810G and MIL-STD-461E.

### FEATURES

- Single or Dual Active Redundant RAID Controllers
- MIL-STD-810G and 461E Certified
- Two each 12 Drive (24 drives total) Removable Magazines
- Solid State or Hard Disk Drives
- Magazines are Enclosed and Electrically Isolated
- Sustained Read/Write Data Rates to 5000MB/sec
- Battery Free Cache Backup
- Operational Altitude to 45,000 ft
- Operational Temperature -20 to 70 C
- 40 to 440Hz, 90/240 VAC Input Operation
- Management GUI and Failover Software
- Self Encrypting Drive Support
- **Made in USA**

**Phoenix International | 714-283-4800**

**Contact:** info@phenxint.com

## **Mass Storage:** Solid State Disk (SSD)

mil-embedded.com/p9915286

PHOENIX INTERNATIONAL

www.phenxint.com

### VP1-250X VPX Solid State Data Storage Module

The **VP1-250X** Serial Attached SCSI (SAS)/Serial ATA (SATA) based VPX blade delivers high capacity, high performance data storage for military, aerospace and industrial applications requiring rugged, secure and durable mass data storage.

The VP1-250X is a 3U VPX storage module and is available in air cooled and conduction cooled configurations. It integrates MLC, eMLC and SLC NAND SSDs and can be direct connected as a SAS/SATA Drive or via the PCIe interface. When used with supporting media, the VP1-250X supports the purge input to destroy media or the Zeroize that will erase the media.

The Phoenix VP1-250X's outstanding performance and versatility are enabled by Phoenix International's state-of-the-art technology, which provides high transfer and I/O rates, endurance and data integrity.

### FEATURES

- Conduction, REDI Conduction or Air Cooled
- Supports SATA, SAS and PCI Express interfaces
- Up to 80,000 Feet Operational Altitude
- Operational Temperature from -40° to +85° C
- Can be Configured to work from Fat Pipe A or B from the VPX bus
- Integrated SLC, eMLC or MLC NAND SSDs
- Meets Military and IRIG 106-07 Declassification Standards
- Optional AES 256 Encryption
- Advanced NAND Flash Management for Enhanced Reliability and Durability
- **Made in USA**

**Phoenix International | 714-283-4800**

**Contact:** info@phenxint.com

## **Obsolescence/DMSMS:** End-of-life/Aftermarket supplier

mil-embedded.com/p9914933

Artisan® Technology Group

www.artisantg.com

### Extending the life cycle of legacy and critical systems

Artisan Technology Group provides solutions for legacy COTS platforms, extending the life cycle of critical in-service Automated Test Stations and Equipment (ATS/ATE) with end-of-life hardware support, procurement of obsolesced equipment, and sustainment of reserve equipment for spares and replacement parts to maximize availability of your application.

Artisan Test & Measurement, Artisan Embedded, Artisan PLC, Artisan Scientific, and Artisan Ecotech are divisions of Artisan Technology Group. EmbeddedLock is a service provided by Artisan Technology Group.

For more information visit our website at www.artisantg.com

### FEATURES

- Over 65,000 OEM COTS modules in stock
- We provide support to extend the lifetime of critical systems
- We acquire and source equipment for military and industrial platforms
- Our extensive inventory of certified used equipment is readily available and cost-effective
- We buy idle/retired/surplus equipment
- We are ITAR compliant and registered with the US Department of State DDTC
- Our EmbeddedLock program ensures a secure chain of custody for controlled assets

**Artisan Technology Group | 888-88-SOURCE**

**sales@artisantg.com**

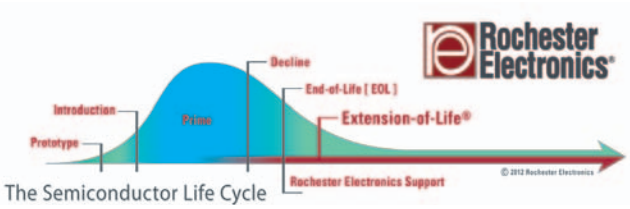
## Obsolescence/DMSMS: End-of-life/Aftermarket supplier

mil-embedded.com/p9915000

www.rocelec.com/

### Extension-of-Life® (ExOL) Manufacturing

Semiconductor end-of-life announcements don't have to abruptly change your engineering project development schedules. Through Extension-of-Life® programs, Rochester Electronics can sustain the supply of your critical semiconductor devices for the life of your system. Authorized by 60+ semiconductor manufacturers, Rochester Electronics is a complementary source for finished goods, die and the re-creation of unavailable devices.




### FEATURES

- Only Rochester Electronics provides complete device replication services, performance guarantee, and sustained, long-term source of supply programs
- Special Product Agreements (SPAs) are long-term supply programs tailored to reduce customers' end-of-life investments
- Partner with original semiconductor manufacturers and Rochester Electronics to proactively create a viable continuing supply program to alleviate problems associated with obsolescence
- Protect against semiconductor counterfeiting
- Re-create devices even when original tooling no longer exists, the design archive is missing, or there is only one working device left
- All products are 100% guaranteed and factory traceable

**Rochester Electronics | 978-462-9332**

**Contact:** sales@rocelec.com
**Facebook:** www.facebook.com/RochesterElectronicsLLC

## Packaging/Mechanical Chassis: 19" rack

mil-embedded.com/p9915462

HARTMANN ELECTRONIC
A Phoenix Mecano Company

www.hartmann-electronic.com

### 2U Rugged Slimbox

Hartmann Electronic is an established leader in the design and manufacturing of backplanes and electronic system platforms. With over 30 years of experience in high-speed backplane design and manufacturing, Hartmann offers an extensive range of standard backplanes and system platform products supporting architectures including VME/VME64x, VXS, VPX, CompactPCI/2.16, cPCI Serial, cPCI PlusIO and others.

As a new product Hartmann offers a 2U rugged Slim-box for applications in the military and railway market. The Slimbox is fully out of Aluminum and a very robust construction with 8mm thick sidewalls and 3mm thick Aluminum top and bottom cover.

### FEATURES

- 2U/84 HP wide, fully aluminum construction for a wide range of different kind of 6U backplanes (4 slots, slot pitch 4HP)
- With/without fan tray (with filter)
- Fan tray with LED indication for Voltage control and fan failure
- Mounting profile on front or rear side with Shelfmanager CML00
- VME/cPCI-Voltage measurement: 8 channels for 3.3V, 5V, 12V and -12V
- Temperature measurement: 1-wire-bus for up to 6 digital temperature sensors
- Fan Control: 6 Fans monitored, fan speed settable
- Ethernet connection IEEE 802.3 10BASE-T and IEEE 802.3u 100BASE-TX
- WWW Server integrated, full control via SNMP protocol

**Hartmann Electronic | 937-324-4422**

**Contact:** info@hartmann-electronic.com

mil-embedded.com/p9915465



HARTMANN ELECTRONIC
A Phoenix Mecano Company

www.hartmann-electronic.com

## ATR RUGGED SYSTEM

- The RUGGED MIL SYSTEM is based on ATR chassis
- Sizes: ½, ¾, 1, 1½ – ATR
- Option for air cooled over conduction cooled solution in order to increase power consumption
- Full turnkey integration including switches, SBCs and FPGA modules
- Uploading operation system and real time applications
- Qualification tests & reports
- Pluggable or fixed power supply solutions
- This System combines the strength and resistance with the usability and flexibility of a standard system, in a very compact design.

## FEATURES

› ARINC 404 Standard
› Low weight, ideal for applications where the weight is critical
› MIL 38999 type power connector
› 3U/6U VPX, CPCI, VME or VXS backplanes available
› VITA 62 3U Power Supply
› Excellent cooling from 6 high performance fans (12 V DC) or fanless solution

**Hartmann Electronic | 937-324-4422**

**Contact:** info@hartmann-electronic.com



mil-embedded.com/p9914931

MicroMax
Computer Intelligence

www.micromax.com

## Rugged M-Max 810-Family ATR Chassis to House PC/104 Boards

**MicroMax's** fully ruggedized **ATR** aluminum chassis is designed for fanless operation. It uses natural convection and conduction cooling in accordance with MIL-STD-810 standards. The **810-Family** chassis comes in a variety of sizes accommodating up to **12 PC/104 boards**. By using COTS components, the **M-Max 810 Family** chassis supports configuring to comply with a wide variety of airborne, marine and ground vehicle applications. **MicroMax** can easily modify the basic enclosure to meet custom requirements for the front/back panels, connectors, mounting hardware, and more.

The patent pending design for affixing PC/104 boards allows dissipating up to **60W** of power. This enables **MicroMax** to provide a complete **Quad Core Intel i7 CPU** based system that can operate at temperatures up to +60°C while providing full dust and humidity protection.

## FEATURES

› Rugged construction and **sealed case** for tough environments
› 1/2, 3/4 Standard, Tall, Short, Long **ATR-type** chassis
› Holds up to **12 PC/104 boards**
› Allows integrating **additional PCI/PCI Express** boards
› **Fanless MicroMax** patented technology dissipates heat
› Allows dissipating up to **60W** of power (allowing up to **Quad Core Intel i7 CPU use**)
› **IP66** rated dust and moisture protection

***Tough Computers for Tough Challenges!***

**MicroMax Computer Intelligence | 212-968-1060**

**Contact**: info@micromax.com
**Facebook:** www.facebook.com/MicroMax.Team

## Packaging/Mechanical Chassis: Backplane

mil-embedded.com/p9910627

SIE COMPUTING SOLUTIONS

www.sie-cs.com

### VPX/OpenVPX Series VITA 46/48/65 Backplanes

SIE Computing Solutions' VPX backplanes are designed to the latest VITA 46, 48 and 65 standards. SIE OpenVPX backplanes utilize the BKP3-CEN06-15.2.2-3 profile ratified by VITA 65, and are also available in custom configurations. The 5-slot full mesh 3U VPX and 6-slot 3U OpenVPX backplanes are designed for a wide array of VPX/OpenVPX applications. The highly configurable SIE backplane line offers maximum bandwidth in a compact size. The 3U VPX backplane provides greater I/O flexibility through I/O PLUS™, an innovative use of configurable I/O daughtercards that accommodates an array of VPX applications.


### FEATURES

- Designed for board-agnostic system design and integration
- Range of full mesh VPX and OpenVPX configurations and profiles
- 2 slots dedicated I/O daughtercards
- VITA 46, 48 and 65 compliant
- Over 200 Watts per slot
- 28 layer board
- RoHS compliant product features

**SIE Computing Solutions, Inc. | 508-588-6110**

**Contact:** info@sie-cs.com
**Twitter:** @SIE_CS
**LinkedIn:** www.linkedin.com/company/900478?trk=tyah

## Packaging/Mechanical Chassis: Electronic packaging

mil-embedded.com/p9915280

EMERSON Network Power

www.Emerson.com/EmbeddedComputing

### KR8-VPX-3-6-1

**KR8-VPX-3-6-1** is an Emerson enclosure designed for use with 3U convection cooled VPX blades. This chassis is primarily designed for development and lab duties as it can be desk or table mounted, has a convenient carrying handle, is powered from a standard AC supply, and has the ability to act as an open frame chassis with the removal of the side panels for board level debugging. In addition, KR8-VPX-3-6-1 is suitable for deployment as it meets Emerson's standard safety requirements and EMC and environmental requirements for ground benign based installations. The bottom half of the box includes the power and cooling elements with the top half containing slots for VPX boards and associated rear transmission modules (RTMs). KR8-VPX-3-6-1 is made of sturdy metal construction in an unobtrusive gray color with holes for ventilation. The front panel includes a power switch and indicator and the AC inlet connects to the rear panel.

### FEATURES

- 5 Slot desktop chassis for 3U VPX payloads
- Suitable for development, testing and deployment
- Supplied with AC power supply and cooling
- Removable side panels for module debugging
- Top mounted handle for ease of use

**Embedded Computing, Emerson Network Power**
**+1 800 759 1107 • +1 602 438 5720**

**EmbeddedComputingSales@Emerson.com**
**Facebook.com/EmersonEmbeddedComputing**
**@EmersonEmbComp**

VECTOR ELECTRONICS & TECHNOLOGY, INC.

www.vectorelect.com

## VECTORPAK™ "Slimline" CHASSIS – ITAR REGISTERED

19" rackmount, rugged aluminum construction with left to right airflow. Fans installed on left/right for maximum cooling of 6U x 160mm front cards and 6U x 80mm rear transition cards. 1U, 2U, 3U, 4U and 5U (2-10 backplane slots), IEEE 1101.1, .10 & .11 compliant.

**Plug-in, hot-swap power supplies or embedded ATX:**

- 200W plug-in power supply will provide 5V@25A; 3.3V@35A; +12V@8.0A and -12V@1.5A, AC/DC or DC/DC
- 250W high output plug-in power supply will provide 5V@40A; 3.3V@40A; +12V@5.5A and -12V@2.0A, AC/DC or DC/DC
- 300W embedded ATX-type power supply will provide 5V@30A; 3.3V@20A; +12V@16A and -12V@0.8A

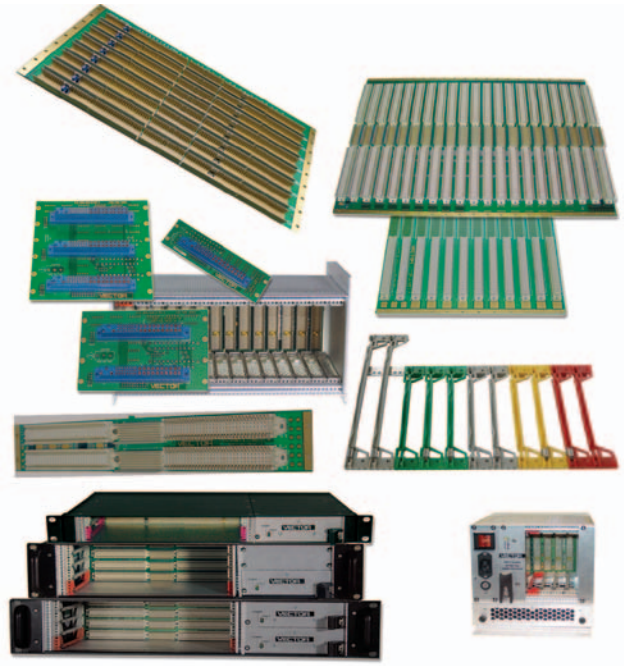
**Backplane options:**

- cPCI 64-bit/66MHz PICMG 2.0, Rev 3
- cPCI H110
- VME64x with EBG (Electronic Bus-Grant)

Our units are made at our U.S. facility, and we offer short lead times and custom configurations upon request.

*Many color options are available.*

Please call us at 1-800-423-5659 or e-mail us at inquire@vectorelect.com.



## FEATURES

- CompactPCI or VMEbus
- 1U, 2U, 3U, 4U and 5U 19" rackmount
- Push-pull fans for maximum airflow
- Dual-redundant hot-swappable power supplies
- Wide choice of factory colors

**Vector Electronics & Technology, Inc. | 800-423-5659** **Contact:** inquire@vectorelect.com

## Packaging/Mechanical Chassis: Rugged chassis

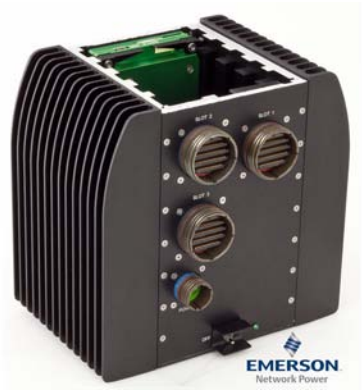
mil-embedded.com/p9915279

EMERSON Network Power

www.Emerson.com/EmbeddedComputing

### VPX3000

Emerson's **VPX3000** is a convection cooled, fanless enclosure that accepts up to three 3U conduction cooled VPX modules. It includes a configurable I/O Adapter Board (IAB) that is designed to mate with 3U conduction cooled VPX modules, including Emerson's iVPX7225 processor blade, itself based on the 3rd gen Intel Core mobile chipset. The IAB routes I/O from the payloads to the front of the enclosure and supports a range of I/O connectivity via suitable front panel connectors. VPX3000 includes a VITA 62 compliant power supply slot fitted with either an AC or DC power supply with a MIL-38999 power input connector. It has a full mesh backplane configuration for high bandwidth applications and includes integral solid state drive options for local application and data storage. Application areas include military, aerospace, commercial and other high performance embedded computing (HPEC) applications.




### FEATURES

- Convection cooled, fanless enclosure for 3U conduction cooled VPX modules
- 3 Slot VITA 65 compliant backplane with full mesh data plane 1000BaseX control plane
- Supports conduction cooled 3U VPX modules
- Natural convection cooled enclosure with cold plate
- Customizable Interface Adapter Board (IAB)
- Built in SATA SSD option
- DC or AC power option

**Embedded Computing, Emerson Network Power**
**+1 800 759 1107 • +1 602 438 5720**

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**@EmersonEmbComp**

## Packaging/Mechanical Chassis: Rugged chassis

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Innovative Integration
a subsidiary of ISI
... real time solutions!

www.innovative-dsp.com/products.php?product=ePC-K7

### ePC-K7

The **ePC-K7** is a user-customizable, turnkey embedded instrument that includes a full Windows/Linux PC and supports a wide assortment of ultimate-performance FMC modules. With its modular I/O, scalable performance, and easy to use PC architecture, the ePC-K7 reduces time-to-market while providing the performance you need.

- *Distributed data acquisition*
- *Uniquely customizable*
- *Remote or local operation*
- *Continuous data streaming*
- *Rugged – SSD boot drive support in a compact, rugged 8 x 11" footprint*
- *Download data sheets and pricing now!*


### FEATURES

- Combines an industry-standard COM Express CPU module with dual FMC I/O modules in a compact, stand-alone design
- Programmable Kintex-7 325/410 and Spartan-6 FPGAs
- Small form factor: 5" H x 8" W x 11" D
- Conduction cooled design: Fins or cold-plate
- Stand-alone operation: Able to operate headless, booting from SSD
- Windows, Linux OS support
- Dual VITA 57 FMC I/O module sites. Add anything from RF receivers to industrial control modules.

**Innovative Integration | 805-578-4260**

**Contact:** sales@innovative-dsp.com

# ELMA

Your Solution Partner

www.elma.com

## SFF-IP68 Fanless Computer

Elma's **SFF-IP68** is a compact, fanless, rugged computer for demanding environmental conditions. Designed to meet IP68 protection from continuous water immersion and dust penetration, it also offers high shock and vibration resistance. Standard & custom versions are available.

***For full configuration details, go to elma.com***

## FEATURES

- Intel® Atom based single board computer, conformal coated
  - Up to 2 GB DDR2 SDRAM, 4 GB NAND flash
  - I/O ports: 4 PCI Express, 6 x USB, 2 x SATA, 2 x RS-232, 2 x RS-422/485, COM
  - Two Gigabit Ethernet ports
  - Compact flash socket
  - VGA, LVDS interfaces
- Watertight, fanless box designed to protect to IP68/NEMA 6P
- Temperature range from -40°C to +85°C and 0°C to +70°C
- Conduction cooled
- Customized versions available. It ships off the shelf with the above features. Tailored configurations can be easily accommodated.

**Elma Electronic Inc. | 510-656-3400**

**Contact:** sales@elma.com
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**Twitter:** twitter.com/elma_electronic • **Pinterest:** http://pinterest.com/elmaelectronic

**Radar Technology:** Radar processing boards
mil-embedded.com/p9915499

# rakon

www.rakon.com

## Rakon's Digital Pulse Compression Sub-Systems (DPCSS)

**Rakon's Digital Pulse Compression Sub-System (DPCSS)** is the ideal solution when retrofitting or upgrading existing SAW based pulse compression radars.

Using powerful and scalable FPGA-based digital technology, the performance is close to theoretical limits; improving aircraft detection. This means a higher instantaneous dynamic range, higher accuracy angular measurements, higher flexibility, and repeatable performance from one device to the other as well as along the operating temperature range. It can also be form, fit and function compatible with existing SAW or digital units, making it easy and convenient to use in all military and civil radars.

Rakon's DPCSS has been successfully implemented in military and ATC radar upgrade projects and is fast becoming the leading solution to meet the growing demand in radar maintenance and life extension.

## FEATURES

- Digital technology for radar maintenance and life extension
- Military and civil SAW based pulse compression radars
- Low cost off-the-shelf expander and compressor unit
- Customized unit, form, fit and function compatible with existing units
- Improves overall system performance. High instantaneous dynamic range
- High flexibility (programmable parameters), reproducibility and stability

**Rakon | France: +33 4 97 97 97 32**

**Contact:** info@rakon.com
**Twitter:** rakonltd • **Facebook:** Rakon • **YouTube:** RakonLimited

## Rugged Computer Systems: Mission computer

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Embedded Solutions™

www.adl-usa.com

### ADLMES-8200 – Modular Enclosure System

**System Building Blocks:**

- Broad Portfolio of PC/104 SBC Options Ranging from Intel® Atom™ (Z510/Z530, D525 Pineview and N2600 Cedarview) to 2nd Generation Intel Core i7 Processors
- Leverage Vast PC/104 Ecosystem of Peripheral Possibilities for Quick System Design
- Power Supply Options (ADLPS35 and ADLPS104) Exist for Simple and High-Powered Systems
- Ruggedization and Extended Temperature Options (-40C to +85C) Available for all ADL Embedded Solutions Boards

**Potential Applications Include:**

- *Military and Defense • Communications Applications*
- *Mini-Routers and Other Network Appliances*
- *Railway Train Control • Rugged Industrial Applications*
- *Transportation • Imaging Applications ... and many more!*

### FEATURES

- Modular Sidewall Design Supports Variable PC/104 Stack Heights or Expanded 3.5" SBC Intelligent Systems
- Flexible Ribbed Chassis Design Allows for Conduction Cooling Through Base or Passive Conduction Cooling via Chassis Fins
- Capable of -40º to +85º C Conduction Cooling Configurations
- Standardized Modular Components Allow for High Availability and Short Lead-Times to Delivery of IP60 Systems
- Custom IP65 Systems and Cabling Design Services Available
- Designed for MIL-STD-461E Compliance
- *Fully Supported by ADL Embedded Solutions' Team of Solidworks Engineers for Modeling and/or Design Support*

**ADL Embedded Solutions Inc. | 858-490-0597**

**Contact:** sales@adl-usa.com

## Rugged Computer Systems: Mission computer

mil-embedded.com/p9911835

ADLINK TECHNOLOGY INC.

http://www.adlinktech.com

### HPERC-IBR – High Performance Extreme Rugged™ Computer System

**Sealed, Rugged COTS Computing Platform**

Built around the emerging SWaP and rugged form factor standard VITA75, HPERC's standards-based design provides a non-proprietary solution with ultimate cost/value ratio. The system's rugged capabilities are ideal for ground, air, and sea deployments. HPERC systems survive shock, resist corrosion and galvanic oxidation, and perform in the humid jungle, the heat of the desert, and the bitter cold of frozen mountain passes.

Inside the tiny footprint of HPERC™ lives the power of the Intel® 3rd generation Core i7 processor and optional GPGPU parallel processing engine. Dual removable Secure Erase RAID-0 SSDs provide screaming 12Gb/s throughput and security for deployment in hostile environments. Easy configuration and expansion allow for fast integration of custom rugged embedded applications. HPERC reserves connector pins for expansion interfaces. GPGPU sits on a 16-lane 3rd generation PCI Express interface. Uniquely keyed MIL-DTL-38999 connectors provide a wide array of fast I/O.

### FEATURES

- 3rd Generation Intel® Core™ processor
- Soldered DDR3L-1333 8GB – up to 16GB RAM
- Quad Gigabit Ethernet
- Ultra-fast 12GB/s solid-state RAID with Secure Erase
- 16-lane 3rd generation PCI Express to optional GPGPU
- Small SWaP2C2-efficient sealed enclosure
- Three digital DisplayPort/HDMI/DVI
- Simple expansion and configuration

**ADLINK Technology | 408-360-0200**

**Contact**: info@adlinktech.com
**www.linkedin.com/company/adlink-technology**

ALPHI TECHNOLOGY CORPORATION

www.alphitech.com

## XPC-1553-S

The latest member of the ALPHI 1553 product line is a stand-alone, fully sealed, rugged, ultra-small and ultra-low-power Intel Atom™-based module. The system is a fully submersible unit with an ultra-small footprint that is only 5.25" x 3.5" and includes an SBC and mass storage.

Dual-redundant MIL-STD-1553 Interface, programmable Bus Controller, Remote Terminal, or Bus Monitor modes, supports MIL-STD-1553A/B. Controlled by a 1.6GHz Atom™ processor, 512KB of L2 Cache and up to 2GB of 533MHz DDR-2 SDRAM. The system I/O configuration is based on two non-switched x1 PCI Express lanes used on two Express Mini Card slots.

The 1553 capabilities can be complimented by ARINC-429, FireWire, CANbus, GPS, GigE, A/D, D/A or any other functionality.
- Support for Windows® XP/XPE/7, Linux® and VxWorks®
- Available in extended temp -40°C to +85°C

This is a perfect solution for a wide array of 1553 communication applications such as: military mission computer, ground vehicle and many others.

### FEATURES

- Ultra-small 5.25" x 3.5" SBC that is a Fully Sealed Submersible unit with MIL-STD-810F Connector
  - 1.6GHz Atom™ processor with 512KB of L2 Cache
  - Up to 2GB of 533MHz DDR-2 SDRAM
  - High-performance graphics with 3D acceleration
  - 24-bit LVDS for direct connection to LCD displays
- Programmable 1553 mode: BC, RT and BM
  - Eight buffered General Purpose I/O lines
  - Support for one SSD
  - Support for Express Mini Cards
  - One Fast Ethernet port
  - Five USB 2.0 ports, one Serial port with RS 232/422 support
  - Onboard Power Supplies for single 5-12VDC input

**ALPHI Technology Corporation | 480-838-2428**

**Contact:** sales@alphitech.com



CRYSTAL™

www.crystalrugged.com/products/embedded.aspx

## RE0412 Carbon Fiber Embedded Computer


The RE0412 has been designed and developed to support airborne and ground mobile applications where significant processing power is required while still being lightweight and rugged.

The system is designed around a DC power solution with an Intel mini-ITX board form factor using an air-over-components cooling approach. The system can accept a single PCIe X4 card in a X16 slot and up to two hard drives and 16GB RAM. The RE0412 is exceptionally rugged, powerful, and lightweight.

### FEATURES

- Ultra-light carbon fiber chassis provides exceptional ruggedness
- Unit weighs up to 4.25 lbs.
- Extended temperature range -40C to +55C
- Intel mini-ITX motherboard, LGA1155 socket, Lan, 2XUSB 3.0, 2XUSB 2.0, DVI-I, eSATA, HDMI, Audio, PCIe(X4 in X16 slot) provides exceptional performance in small package
- Air cooled design limits weight
- Two (2) 204 pin DDR-3 SDRAM sockets support 1066 MHz and 1333 MHz SO-DIMMs of 2GB to 8GB size i.e. up to 16GB capacity non-ECC memory
- Intel H61 express chipset controller hub provides traffic management between memory, CPU, and I/O
- Integrated graphics support within processor incorporates latest graphics technology
- HDMI, DVI-I video options provide broad video support
- Supports one (1) or two (2) 2.5" SATA hard drives (weight based on single drive)
- One PCIe X4 electrical in a X16 slot via riser card supports LP expansion card
- Power LED, power switch, and circular connector provide easy access and operation

**Crystal Group, Inc. | 800-378-1636**

**Contact:** rfq@crystalrugged.com
http://twitter.com/CrystalGroup • www.linkedin.com/company/crystal-group
www.facebook.com/pages/Crystal-Group/

kontron

www.kontron.com

## Kontron Cobalt


**COBALT** is a highly scalable embedded computer system that is available with a wide selection of processor, storage, power and interface options. The small footprint and low power make it the ideal solution for applications requiring both performance and reduced SWAP (Size, Weight & Power).

The embedded module-based system enables designers to have full development flexibility allowing them to scale the computing performance based on specific application requirements from a very low power Intel® Atom™ processor-based implementation to a powerful Intel® Core™2 Duo processor system. The rugged embedded computer can be configured for either 28VDC (complying to MIL-STD-1275 or MIL-STD-704) or 115VAC input power to provide compatibility with full range of ground vehicle, UAV, airborne or shipboard requirements.

### FEATURES

- Reduced SWAP – Rugged Embedded Computer
- Small Form Factor (8.5" x 7.0" x 3.4")
- Intel Core i7 processor
- Dual or Five Gigabit Ethernet ports for network connectivity
- Delivered with Linux or Windows operating system

**Kontron | 888-294-4558**

**Contact:** info@us.kontron.com
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kontron

www.kontron.com

## Kontron StarVX

**Kontron StarVX High Performance Embedded Computer (HPEC)** system brings supercomputing data-center bandwidth and performance directly to the field. Offering 10x the bandwidth, Kontron StarVX ruggedizes mainstream technology to speed deployment of 3D reconstruction-based applications.

StarVX presents an optimal application-ready solution for radar and sonar systems that are expected to make a tremendous jump in a processing power and data I/O bandwidth. StarVX was designed to help developers dramatically streamline the process from design to field deployment of next-generation radar and sonar and imaging applications. Based only on mainstream IT technology (TCP/IP, PCIe, Intel® CPUs, Linux), and codeveloped with Intel and PLX, StarVX demonstrates the breakthrough technology that restores matched I/O and CPU performance ratios.

### FEATURES

- Prequalified HPEC Platform
- Compact 3U VPX Air and Conduction Cooled solutions
- Turnkey Linux parallel x86 systems
- Balanced I/O and CPU power
- Up to 4GB/s board to board with TCP/IP sockets

**Kontron | 888-294-4558**

**Contact:** info@us.kontron.com
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kontron

www.kontron.com

## Kontron ApexVX

**Kontron ApexVX** is a pre-validated computer system that can be easily modified and adapted to your application requirements. Based on Kontron COTS building blocks, it provides a cost-efficient, proven and technically stable solution to deploy your next generation systems. ApexVX modular design ensures fast customization features that allow the system to adapt to the specific requirements of multiple missions, helping secure ambitious deployment schedule.

The ApexVX is backed up by Kontron's long-term supply program, making it an ideal fit for long-term projects with 25+ years secured availability. **ApexVX is a true application-ready platform ideal for mission-critical applications in airborne systems, mobile military vehicles, precision-guided munitions, electronic warfare, UAVs and C4ISR.**

### FEATURES

» Multi-Mission Rugged Computer System
» Pre-qualified Solution based on COTS Building Blocks
» Flexible Design for Easy Customization
» 5-slot 3U VPX Computer System
» Conduction-cooled Structure

**Kontron | 888-294-4558**

**Contact:** info@us.kontron.com
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**Rugged Computer Systems:** Mission computer
mil-embedded.com/p9914924

MPL
High-Tech • Made in Switzerland

www.mpl.ch

## Rugged Embedded Computers up to 3rd Gen. i7 Core

The **PIP Family** is a powerful, highly integrated, robust and fanless rugged embedded Computer, based on Intel's Mobile Technology, all out of the Embedded2 Roadmap for longtime availability. The Systems represent a unique solution for today's demanding defense requirements and are available with basically unlimited options. They are designed to operate under extreme and normal conditions without the need of fans. The MPL solutions are designed and produced in Switzerland and come with a long-term availability guarantee.

Outstanding is the extreme low power consumption. The systems have a complete set of standard PC features as well as industrial features like wide DC input power, reverse polarity protection, etc. Additional GPS, WLAN, CAN, Sound, and UPS modules are available.

### FEATURES

› Wide CPU selection up to i7 Core
› Soldered CPU and chipset
› Soldered ECCRAM
› Up 5 x Gigabit Ethernet
› Up to 7 USB (3.0 & 2.0)
› Up to 4 serial ports (RS232/485)
› Internal & external PCIe expansion
› Internal PMC/XMC expansion
› Fanless operation
› Optional -40°C up to 85°C
› Long term availability (+7 years)
› Optional Bonding & Coating

**MPL AG | +41 56 483 34 34**

**Contact**: info@mpl.ch

**Rugged Computer Systems:** Mission computer

mil-embedded.com/p9914931

# Panasonic

us.panasonic.com/toughpad-fz-g1

## Toughpad FZ-G1

The **Panasonic Toughpad™ FZ-G1** is the only fully rugged Windows® 8 OS tablet that can deliver the maximum uptime and extreme durability required by the U.S. Military. With a MIL-STD-810G, 4ft. drop and all-weather IP65 dust and water-resistant design, the Toughpad FZ-G1 is built with highly mobile military applications in mind such as flight line maintenance, field command and control, and supply chain logistics. In addition, the daylight-readable HD display of the Toughpad FZ-G1 enables military personnel to view mission-critical information in virtually any lighting condition. Manufacturing tools that stand up to the extreme environments the U.S. Military faces every day is how we're engineering a better world.


## FEATURES

- Windows 8 Pro tablet (with optional Windows 7 downgrade)
- MIL-STD-810G and IP65-certified
- FIPS 140-2-compliant
- Fully sealed and integrated CAC reader available
- 10.1-inch, daylight-readable, HD display
- 3-year limited warranty, parts and labor

**Panasonic System Communications Company of North America | 888-322-3703**

**Contact:** defensesolutions@us.panasonic.com
**Twitter:** @PanaToughpad • **Facebook:** www.facebook.com/Toughpad

**Rugged Computer Systems:** Mission computer

mil-embedded.com/p9915145

# Parvus

www.parvus.com

## DuraCOR 80-40

The **DuraCOR 80-40** is a rugged Commercial-Off-the-Shelf (COTS) tactical mission computer subsystem based on the high performance Intel Core i7 Sandy Bridge processor with a high-speed, stackable PCI Express bus (PCIe/104) architecture for I/O card expansion. Optimally designed for Size, Weight, and Power (SWaP)-sensitive mobile, airborne, ground, manned or unmanned vehicle applications, the DuraCOR 80-40 combines powerful graphics and multi-core processing with ultra-reliable mechanical robustness and modular I/O expansion for extreme environmental and EMI performance per MIL-STD-810G (thermal, shock, vibration, dust, water, humidity) and MIL-STD-461F.


## FEATURES

- PCIe104 Expandable Core i7 Mission Computer
- Modular Rugged Chassis to Scale System I/O
- Dual Removable Solid State Media
- 28V DC MIL-1275/704 Power Supply
- IP67 Ingress Protected (Dustproof/Waterproof)
- MIL-810G Extreme Shock/Vibe/Thermal
- MIL-461F EMI/EMC Emissions & Susceptibility

**Parvus Corporation | 800-483-3152**

**Contact:** sales@parvus.com
**LinkedIn:** Parvus Corporation • **Facebook:** Facebook.com/parvusCorp

X-ES

xes-inc.com

## XPand5200 Sub-½ ATR for Four 3U Conduction-Cooled Modules

This natural convection-cooled or conduction-cooled, fully ruggedized chassis is designed to meet the rigorous standards of MIL-STD-810, while integrating the latest power-saving and performance-enhancing technology. In today's avionics and ruggedized environments the **XPand5200** sets a new standard for sub-½ ATR computing.

The **XPand5200** can be populated with up to four 3U VPX or cPCI modules with a 0.8 in. pitch. Utilizing natural convection cooling, the chassis has two high-power payload slots at up to 40 W each and two low-power payload slots at up to 10 W. The system can maintain 85°C board rail temperatures with up to 105 W total chassis power dissipation. The **XPand5200** maximizes power supply performance with an integrated MIL-STD-704 28 V DC power supply. It also provides internal EMI filtering and optional hold-up capacitors for a hold-up time of up to 100 ms at 70 W.

### FEATURES

- The sub-½ ATR natural convection-cooled or conduction-cooled chassis with a reduced height and length of 4.88 in. (W) x 5.65 in. (H) x 10.30 in. (L) weighs less than 12 lbs. fully loaded for demanding SWaP-constrained applications
- Four payload slots with a 0.8 in. pitch allow for improved space efficiency
- An integrated 28 V DC power supply provides MIL-STD-704 compliance, EMI filtering, and hold-up time of up to 100 ms at 70 W
- Configurable front panel I/O connectors easily support a wide range of I/O requirements

**Extreme Engineering Solutions (X-ES) | 608-833-1155**

**Contact:** sales@xes-inc.com
**twitter.com/XES_INC • facebook.com/XES.INC**



X-ES

xes-inc.com

## XPand6103 Compact Intel Core i7 Fanless Embedded Box

The **XPand6103** is a rugged and compact fanless embedded box PC utilizing the Intel Core i7 Processor. The XPand6103 provides a reliable and maintenance free, high performance computing platform ideally suited for environmentally challenging and space constrained situations. It was specifically designed for rugged yet processing intensive Industrial PC (IPC), vehicle, and rail transportation applications, and provides an optimal solution for demanding autonomous vehicle computing requirements.

The **XPand6103** supports the 3rd generation Intel Core i7 processor by integrating the XPedite7450 rugged COM Express module. The internal 64 GB Slim SATA SSD memory module combines the convenience of high capacity off-the-shelf storage with the reliability of solid state non-volatile memory.


### FEATURES

- 3rd generation Intel® Core™ i7 processor
- Fanless embedded box PC
- Compact and maintenance-free
- IP67-compliant
- Supports a wide voltage range for input power
- Rugged M12 I/O connectors
- Gigabit Ethernet, CAN Bus, DisplayPort++ video, USB 2.0, and RS-232/422 serial
- PCI Express Mini Card expansion slots
- Optional 10GBASE-T 10 Gigabit Ethernet
- -40°C to +70°C operating temperature
- Designed for rugged high performance Industrial PC (IPC) and transportation applications
- Ideal computing platform for autonomous vehicles

**Extreme Engineering Solutions (X-ES) | 608-833-1155**

**Contact:** sales@xes-inc.com
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PENTEK
*Setting the Standard for Digital Signal Processing*

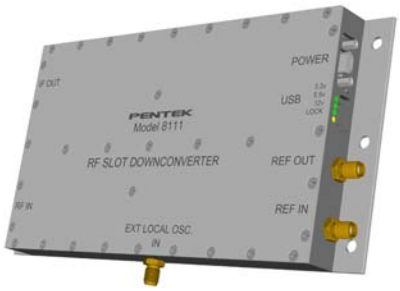
http://pentek.com/go/mes8111rg

## Bandit Analog RF Slot Receivers

The Bandit™ Model 8111 provides a series of high-performance, low-cost RF slot receiver modules. Packaged in a shielded enclosure, the modules offer programmable gain, high dynamic range and low noise figure. Input options cover specific frequency bands of the RF spectrum, and have IF output optimized for A/D converters. Seven different input-frequency band options are offered, each tunable across a 400 MHz band with an overlap of 100 MHz between adjacent bands. These options accommodate signals from 800 MHz to 3.000 GHz.

The 8111 is an ideal solution for receiving, amplifying, and down-converting antenna signals for satellite communications, radar, and signal intelligence systems.

More information at: http://pentek.com/go/mes8111rg.




## FEATURES

- Accepts RF signals from 800 MHz to 3.000 GHz
- Accepts RF input levels from -60 to -20 dBm
- 225 MHz IF output with 80 MHz output bandwidth
- Internal OCXO or external 10 MHz frequency reference
- Easy integration into RF systems
- Seven input-frequency range options
- Option – Frequency Band:
  - *001 – 800-1200 MHz*
  - *002 – 1100-1500 MHz*
  - *003 – 1400-1800 MHz*
  - *004 – 1700-2100 MHz*
  - *005 – 2000-2400 MHz*
  - *006 – 2300-2700 MHz*
  - *007 – 2600-3000 MHz*

**Pentek | 201-818-5900**

**Contact:** info@pentek.com

**Software/Middleware:** ADA/Static analysis tools

mil-embedded.com/p9915469

AdaCore
The GNAT Pro Company

www.adacore.com

## GNAT Pro 7.1


**GNAT Pro** is a robust and flexible Ada development environment, with complete support for all versions of the language standard including Ada 2012. It comprises a full Ada compiler, an Integrated Development Environment, a comprehensive toolsuite including a visual debugger, and a set of libraries and bindings. **GNAT Pro** offers a range of mixed language solutions supporting Ada, C, and C++ within a common environment.

**GNAT Pro** is available on the widest range of platforms of any Ada technology, with both native implementations and cross compilers to embedded targets. **GNAT Pro** is distributed with complete source code, and is backed by frontline support service from the product developers themselves – the world's largest and most experienced team of Ada experts.

### FEATURES

- Support for large-scale mission-critical systems
- Support for safety-critical and high-security applications
- Support for multi-language development
- GNAT Programming Studio and Eclipse-based GNATbench IDEs
- Support for major embedded platforms including VxWorks, ELinOS, PikeOS, LynxOS, and Bare board configurations (ARM, PPC, Leon)
- Excellent code quality

**AdaCore Technologies | 877-787-4628**

**Contact:** info@adacore.com

**Software/Middleware:** ADA/Static analysis tools

mil-embedded.com/p9915447

AdaCore
The GNAT Pro Company

www.adacore.com

## CodePeer 2.2


**CodePeer** is a source code analyzer that detects run-time and logic errors in Ada programs. Serving as an efficient and accurate code reviewer, **CodePeer** identifies constructs that are likely to lead to runtime errors such as buffer overflows, and it flags legal but suspect code typical of logic errors. Going well beyond the capabilities of typical static analysis tools, **CodePeer** also produces a detailed analysis of each subprogram, including pre- and post-conditions.

**CodePeer** finds errors by analyzing every possible input and path through the program. The tool can be employed early in the development cycle to identify defects when they are least costly to repair, and it can also be used retrospectively on existing code to help detect latent vulnerabilities.

### FEATURES

- Expedites code review and makes human review more productive
- Works on partially complete programs
- Analyzes programs for a wide range of flaws including use of uninitialized data, pointer misuse, buffer overflow, and numeric overflow
- Identifies not only where a failure could occur, but also where the faulty values originate
- Automatically generates both human-readable and machine-readable component specifications
- Exploits multi-core CPUs for efficiency and allows performance tuning

**AdaCore Technologies | 877-787-4628**

**Contact:** info@adacore.com

Annapolis Micro Systems

www.annapmicro.com

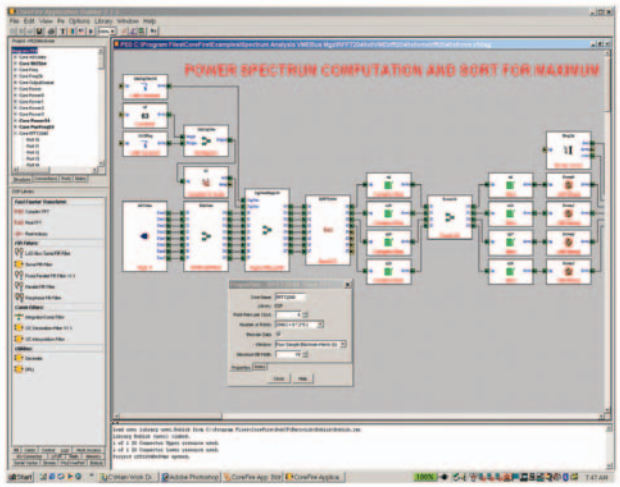
## CoreFire

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

Use CoreFire's graphical interface to drag and drop library elements onto the design window. Modify your input and output types, numbers of bits, and other core variables by changing module parameters with pull-down menus. The modules automatically provide correct timing and clock control. Insert debug modules to report actual hardware values for hardware-in-the-loop debugging. Hit the Build button to check for errors and as-built core sizes and to build an encrypted EDIF file. Use the Xilinx ISE tool to place and route each FPGA design. Modify and use the jar file or the C program created by the CoreFire Build to load your new file into your WILDSTAR and I/O card hardware. Use the CoreFire Debugger to view and modify register and memory contents in the FPGA and to step through the dataflow of your design running in the real physical hardware.

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

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




## FEATURES

- Dataflow-based – automatically generates intermodule control fabric
- Drag-and-drop graphical interface
- Work at high conceptual level – concentrate on solving algorithmic problems
- Hardware-in-the-loop debugging
- More than 1,000 modules incorporate years of application experience
- Reduce risk with COTS boards and software
- Save time to market
- Save development dollars
- Easily port completed applications to new technology chips and boards
- Training and custom application development available
- Achieve world-class performance; WILD solutions outperform the competition
- Annual node locked or networked license; includes customer support and updates

**Annapolis Micro Systems, Inc. | 410-841-2514** **Contact**: wfinfo@annapmicro.com

Mentor Graphics®

http://go.mentor.com/system-modeling

## SystemVision® Multi-Discipline Development Environment

Typical system design methods focus on creating architectural and signal flow diagrams – both of which ignore the physical effects of real hardware. If physical effects are not modeled, accurate system integration and analysis in a virtual environment is impossible. The **SystemVision Multi-Discipline Design Environment** is tuned for the fluent design and simulation of complex systems, giving engineers a modeling and analysis environment that simultaneously handles all aspects of system development. The SystemVision environment integrates simulation models from multiple design and engineering domains including mixed analog/digital circuits; thermal, mechanical and hydraulic systems; and continuous and sampled-data control systems.

Using SystemVision you can explore concepts, validate performance specifications, investigate architectural partitions, and integrate abstract or implementation-level electronics, sensors/actuators, controls, and embedded software, all in a single virtual environment. Utilizing the power of the IEEE standard VHDL-AMS modeling language, and supporting industry-standard SPICE modeling techniques, SystemVision offers reduced development time, simplified HW/SW integration, and reduced risk of late stage bugs that often jeopardize program success.

**SystemVision conneXion (SVX)** extends SystemVision's multi-discipline capabilities by connecting multiple domain-specific tools and processes together in a single simulation environment. SVX connects design partitions executed in SystemVision, MathWorks Simulink, National Instruments LabVIEW, SystemC, C/C++, Java, and AUTOSAR over a secure, managed signal channel. SV CAN Network SI is a specialized SystemVision package aimed at CAN network designers who need to analyze the CAN bus physical layer and ensure optimized, lowest cost, error-free network architectures.

The SystemVision design environment enables full verification of successive design stages: from the **Functional Stage**, where an executable specification is defined and tested; through the **Architectural Stage**, where functions are partitioned; to the **Implementation Stage**, where the final system HW/SW is integrated and tested as a virtual prototype. From conceptual design exploration through detailed implementation, SystemVision is a single design exploration and optimization environment supporting powerful verification and analysis capabilities for challenging multi-discipline designs.


## FEATURES

- Virtual environment for mechatronic system design and analysis
- Multi-language modeling support including VHDL-AMS, SPICE, and C/C++
- Intuitive modeling tools for automated model generation from device equations or datasheet curves
- Advanced analyses for robust design, including parametric sweep, sensitivity, worst-case, and Monte Carlo
- Advanced post-processing with full featured data measurements and waveform calculations
- Extensive library of domain-specific and general-purpose simulation tutorials
- Scripting automation for modifying designs, running simulations, and analyzing simulation data
- Integration with Mentor Graphics industry-leading PCB flows
- Collaborative simulation environment linking multiple tools and processes, including Simulink®, LabVIEW, C/C++, Java, and SystemC

***The SystemVision design environment:***

**Design:** Explore design concepts by creating and customizing system schematics using models that represent device behaviors at multiple abstraction levels. Migrate electrical partitions to circuit board implementation via a direct path to Mentor's PCB design flow.

**Verify:** Simulate the design and analyze results from the highest (behavioral) level of abstraction to the lowest (SPICE) level of circuit implementation. Account for real-world variability in components, the environment, and operating conditions.

**Integrate:** Unite the partitions of a multi-discipline system and their disparate engineering teams. Provides a virtual environment for early integrated verification and test of digital/analog hardware, software, control algorithms, sensors, actuators, and mechanical plant.

**Optimize:** Explore architectural alternatives and employ powerful parametric analysis capabilities to identify simple but effective parameter adjustments that can drive down cost and dial-in performance in the final design.

**Mentor Graphics Corporation | 800-547-3000**

**Contact:** sales_info@mentor.com
**Facebook:** www.facebook.com/IESF.Conference

LYNUXWORKS™

www.lynuxworks.com

LynxSECURE FROM LYNUXWORKS

LynxOS® 7.0

LynxOS®-178 FROM LYNUXWORKS

**LynxSecure • LynxOS 7.0 • LynxOS-178**

## RTOS and Secure Virtualization Software from LynuxWorks

### LynxSecure

LynxSecure provides one of the most flexible secure virtualization solutions for use in Intel® architecture based embedded and computer systems, including the new 4th generation Intel® Core™ i7 and Core™ i5 processors. LynxSecure is based on separation kernel technology and was designed from the ground up with security as a key design goal. Adding virtualization to the separation kernel allows for multiple different guest Operating Systems (OSs), both real-time and general purpose, to run in secure domains on a single embedded system. LynxSecure 5.2 is the latest version of this established product and adds a new feature that offers real-time detection of stealthy advanced persistent threats such as rootkits.

### LynxOS 7.0

LynxOS 7.0 is a deterministic, hard real-time operating system that provides POSIX-conformant APIs in a small-footprint embedded kernel. LynxOS provides symmetric multi-processing support to fully take advantage of multi-core/multi-threaded processors. LynxOS 7.0 contains new security functionality designed for M2M devices. LynxOS 7.0 supports the most popular reference targets in the Intel and PowerPC architectures, including the new 4th generation Intel® Core™ i7 and Core™ i5 processors.

### LynxOS-178

LynxOS-178 is a safety-critical COTS RTOS that fully satisfies the objectives of the FAA DO-178B level A specification and meets requirements for Integrated Modular Avionics developers. LynxOS-178 delivers the security and real-time responsiveness needed for safety-critical systems and provides a low-risk path to DO-178B certification for developers to meet the technical requirements in the production of software for airborne systems.

## FEATURES

### LynxSecure

- LynxSecure runs fully virtualized guest OSs such as Windows®, Solaris, Linux®, Android, and Chromium OS, requiring no changes to the guest OS
- LynxSecure offers the ability to run guest OSs that have Symmetric Multi-processing (SMP) capabilities
- Designed to maintain the highest levels of military security offering a MILS architectural approach

### LynxOS 7.0

- LynxOS 7.0 provides the ability for developers to embed military-grade security directly into their devices
- LynxOS contains networking support for long haul networks with TCP/IPV4, IPV6, 2G/3G/4G cellular and WiMax communication stacks. It also supports the short-haul networks common with M2M applications such as 802.11 WiFi, ZigBee wireless mesh and Bluetooth
- LynxOS is a true fully preemptive hard real-time OS with a POSIX application interface

### LynxOS-178

- LynxOS-178 provides full POSIX conformance, enabling developers to take advantage of the time-to-market and investment-protection benefits of open standards-based development
- Supported standards include ARINC 653 as well as support for the Future Airborne Capability Environment (FACE) standard currently under development
- LynxOS-178 is the only time- and space-partitioned RTOS that has been awarded the FAA Reusable Software Component (RSC) for DO-178B certifications

**LynuxWorks, Inc. | 800-255-5969**

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**Facebook**: www.facebook.com/pages/Lynuxworks-Inc/581719491847643

RIGHTWARE

www.rightware.com/benchmarking-software/

## Basemark ES 3.0

Rightware provides industry standard benchmarking software for professionals. These products enable you to objectively gauge the graphics and applications performance of your system.

Rightware's OpenGL ES 3.0 benchmark – **Basemark® ES 3.0** – is built to benchmark performance of OpenGL ES ES 3.0 graphics rendering.

Rightware also carries an extensive lineup of benchmarks for other APIs, such as OpenGL ES 1.1, OpenGL ES 2.0, and OpenCL. Benchmarks are available for various operating systems and platforms.


### FEATURES

- Instanced rendering. Allows rendering multiple instances of single mesh in one draw call
- Multiple simultaneous render targets
- Render target antialiasing
- Occlusion queries
- 3D Textures
- Improved shader uniform and varying counts
- Vertex shader texture read
- Primitive restart

**Rightware Inc. | 832-483-7093**

**Contact:** eric.zapalac@rightware.com
**LinkedIn:** www.linkedin.com/company/rightware

**Test and Measurement:** Analyzer/Meter/Scope mil-embedded.com/p9910616

Dawn VME Products®

www.dawnvme.com

## ITM-6973 Intelligent Test Module

Dawn's ITM-6973 represents a quantum leap ahead in features and capability. It makes possible complex tests, measurements, data logging and reporting all in a 3U size module. The full featured version of the DITM contains a powerful PIC microprocessor, 6 separate voltage independent microprocessor-controlled active loads (1 for each voltage rail), 6 separate current sensors (1 for each voltage rail), 6 separate precision voltage sensors (1 for each voltage rail), 7 ohm meters, 4 temperature sensors (located at 4 corners of the module), 6 separate power supply noise detectors (1 for each voltage rail), 2 accelerometers for measuring low and high levels of 3-axis shock and vibration – all coupled to a simple, easy-to-use, Windows-based Graphical User Interface (GUI).

The DITM may be used to test power supplies, power systems and chassis by providing an accurate, self-controlling and self-logging dynamic current load, voltage monitor and heat source to the system under test.

### FEATURES

- PIC microprocessor for testing, data logging, and control
- 6 microprocessor-controlled high current active loads
- 6-channel voltmeter measures to ±10mV accuracy
- 6-channel current meter with 200mA resolution
- 4 precision temperature sensors measure ± 1°C
- 6-channel noise meter measures P.S. pk-to-pk ripple
- 2 each 3-axis accelerometers measure shock/vibration
- 7-channel ohm meter measures isolation resistance
- Real-time clock provides absolute time stamp of events
- MS Windows-based GUI for viewing board, setting parameters and logging data

**Dawn VME Products | 510-657-4444**

**Contact**: sales@dawnvme.com

## Test and Measurement: PXI

mil-embedded.com/p9913158

Avionics Interface Technologies

www.aviftech.com/pxi-c429

### PXI-C429

***Four, Eight, 16, or 32 Channel***
***ARINC 429 Test & Simulation***
***PXI Module***

The PXI-C429 module is a member of AIT's family of ARINC 429 test and simulation modules. This module is a 3U PXI Hybrid Slot compatible instrument that is designed to enable monitoring, analysis, simulation, and testing of ARINC 429 data channels. The PXI-C429 module supports up to 32 fully programmable (as inputs or outputs) ARINC 429 channels. The PXI-C429 provides full error injection and detection capabilities.

### FEATURES

- Four, Eight, 16, or 32 Software Programmable Tx/Rx Channels
- Programmable High/Low Speed Operation
- All Tx/Rx Channels can operate concurrently
- PXI Interrupts, Star Trigger, and PXI Clock
- Full Error Injection & Detection
- Rate-oriented Label Transmission
- Label Selective Trigger for Capture/Filtering
- IRIG-B Time Code Encoder/Decoder
- Real-Time Recording & Post Analysis of Multiple Channels
- Application Interface supporting C/C++, C# and VB.NET Development
- Device Driver Support: Windows, Linux, VxWorks, and other operating systems
- High-level, intuitive LabVIEW Instrument Driver provided
- Flight Simulyzer GUI Analyzer Software

**Avionics Interface Technologies | 402-763-9644**

**Contact:** sales@aviftech.com
**www.aviftech.com**

## Test and Measurement: PXI

mil-embedded.com/p9913159

Avionics Interface Technologies

http://aviftech.com/pxi-c664

### PXI-C664

**ARINC 664 Part 7 Test & Simulation PXI Module**

AIT's PXI-C664 Test & Simulation module provides a PXI/cPCI interface capable of supporting the simulation of multiple ARINC 664 End Systems within a single slot. The module supports both the conventional 10/100 Mbit/s ARINC 664 Part 7 Ethernet interfaces as well as the next generation 1 Gbit/s Ethernet interface. The PXI-C664 utilizes two Small Form Factor Pluggable modules (SFPs) in order to provide the capabilities to support both traditional copper Ethernet interfaces as well as high speed optical physical connections.

### FEATURES

- Supports IEEE 802.3 10/100/1000 Mbit/s Full-Duplex Ethernet links
- Utilizes SFPs to support both copper and optical interfaces
- Standard 3U cPCI module
- Simulates multiple ARINC 664 End Systems, including VL traffic shaping and input VL redundancy management
- Standard Ethernet operations simultaneous to ARINC 664 operations
- Supports up to 128 Output VLs and 512 Input VLs
- Supports up to 1024 Sampling & Queuing output message ports and up to 4096 input Sampling & Queuing message ports
- Upper layer protocol handling (ARINC 653, UDP, IP) managed onboard
- Provides DMA for high data rate applications
- Time-stamping of all received messages with 8 nS resolution

**Avionics Interface Technologies | 402-763-9644**

**Contact:** sales@aviftech.com
**www.aviftech.com**

Avionics Interface Technologies

www.aviftech.com/pxi-c1553

## PXI-C1553

***One, Two, or Four Dual Redundant Interfaces***
***MIL-STD-1553A/B Test & Simulation***
***PXI 3U Module***

The PXI-C1553 module is a member of AIT's family of MIL-STD-1553A/B test and simulation modules. This module is a 3U PXI Hybrid Slot compatible instrument designed to support testing, simulations, monitoring, and analysis of MIL-STD-1553 A/B databuses. The PXI-C1553 module is capable of simultaneously simulating a MIL-STD-1553 Bus Controller (BC), up to 31 Remote Terminals (RT), and a Chronological Bus Monitor (BM) on each channel. Single, dual, and quad channel options are available. The PXI-C1553 provides full error injection and detection capabilities in support of AS4112/AS4111 testing.

### FEATURES

- Dual redundant, one, two, or four MIL-STD-1553 bus interfaces
- Concurrent Bus Controller, 31 Remote Terminals, & Bus Monitor operation
- Full error injection and detection
- Data capture filtering, 100% bus recording, and physical bus replay
- FPGA-based hardware architecture
- PXI trigger generation on 1553 bus events
- Initiate data simulaiton (BC) and data capture (BM) on PXI triggers
- Onboard time-tag clock synchronization to external IRIG or PXI system clock
- Variable output voltage signal and software selectable bus coupling modes
- Ten high voltage (up to 30V) programmable DIO lines
- Flight Simulyzer GUI Bus Analyzer Software

**Avionics Interface Technologies | 402-763-9644**

**Contact:** sales@aviftech.com
**www.aviftech.com**



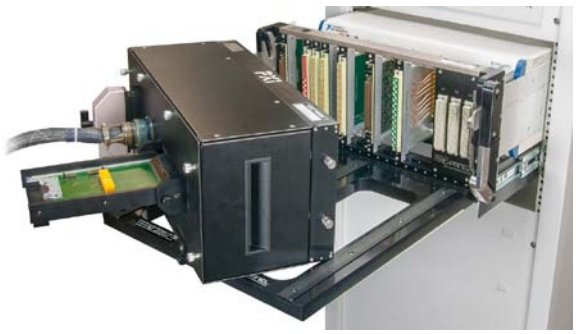
MAC-PANEL
*Interconnect Solutions & Services*

www.macpanel.com

## SCOUT Next Generation Mass Interconnect

SCOUT is an innovative pull-through mass interconnect solution specifically designed to deliver the full performance of the PXI platform. SCOUT enables system designers to limit/eliminate traditional cabling through the utilization of fully enclosed PCBs or fixed-wire Direct Access Kits. The result is increased performance with a far higher degree of stability and uptime.

SCOUT based systems are generally configured at a comparable initial price to cable based solutions, BUT the cost of integration and maintenance will ALWAYS be much lower. Furthermore, DAK modules meet COTS requirements, eliminating costly engineering and assembly time associated with custom cable assemblies – AND these costs savings will continue throughout the life of the system.



### FEATURES

- Improved Signal Quality – SCOUT DAKs mitigate capacitance, signal crosstalk and other attenuation issues that plague conventional cable based ATE by limiting/eliminating cabling.
- Simplified Integration – With SCOUT, complex PXI configurations can be integrated in a matter of hours where traditional cable based solutions can take days or weeks.
- Lower Cost of Test – SCOUT systems lower the cost of test by eliminating costly engineering and assembly time and simplifying integration, maintenance, calibration time.
- Future Proof – SCOUT modularity allows for simple future system upgrades. Removing and replacing instrumentation can be accomplished in a matter of minutes.

**MAC Panel Company | 336-861-3100**

**Contact:** sales@macpanel.com

## Unmanned Systems Technology: Connectors

mil-embedded.com/p9913086

Dawn VME Products®

www.dawnvme.com

### PSC-6236 UNIVERSAL AC INPUT VITA 62 3U POWER SUPPLY

Dawn PSC-6236 universal AC input VITA 62 compliant 3U power supply for air or conduction cooled OpenVPX systems. True 6 channel supply with up to 400 watts output. Mission critical wide temperature range at high power. Input 85 VAC to 264 VAC, 47 Hz to 400 Hz. Can be special ordered to support high current single channel applications. Embedded RuSH™ technology actively monitors voltage, current and temperature, and provides protective control.

The PSC-6236 offers current sharing with up to four power supplies in a system for outputs of 12V, 5V and 3.3V. The PSC-6236 is designed to be compliant with MIL-STD-461, MIL-STD-704F and MIL-STD-810F.

Dawn offers application-specific VITA 62 compliant power supply design, manufacturing and production through modifications to its PSC-6236 platform, and can incorporate requirements into a customized power management solution for prototyping and development.

### FEATURES

- Universal AC input VITA 62 3U 400W AC/DC power supply with full OpenVPX support.
- Air cooled, bulkhead conduction cooled and reverse side wedge lock conduction cooled models.
- AC input: Single phase 85 VAC to 264 VAC, 47 Hz to 400 Hz.
- DC output PO1: +12V/16.7A, PO2: +5V/40A, PO3: +3.3V/30A, +3.3V_Aux/4A, +12V_Aux/4A, -12V _Aux /3A.
- High power mission critical wide temperature range up to -40 °C to +85 °C at the thermal interface.
- Ruggedized – VITA 47 compliant.
- Microprocessor technology actively monitors voltage, current and temperature, and provides protective control.
- Overvoltage, overcurrent and overtemperature protection.
- I2C status and control user and IPMB interface.

**Dawn VME Products | 510-657-4444**

**Contact**: sales@dawnvme.com

## Unmanned Systems Technology: Encryption/Decryption

mil-embedded.com/p9914568

eNOVA TECHNOLOGY CORPORATION

www.enovatech.net

### *Enigma 2* – USB Hardware Crypto Module Securing Cloud Storage

The **Enova Enigma 2 HCM** is a USB hardware crypto module capable of encrypting selective files and folders of any computer detectable storage devices including boot drive, external drive such as USB or 1394, network attached drive and virtual drives such as Dropbox, Windows SkyDrive and Google's GoogleDrive. It deploys **Enova's X-Wall DX256** (AES ECB) and **X-Wall DX256C** (AES CBC) real-time USB-to-USB hardware crypto modules, which are NIST/CSE certified.

Unlike software encryption that relies on CPU and other system resources, the **Enigma 2 HCM** performs authentication and cryptographic operations on the chip level that completely eliminate security weakness found on all software encryption products. It encrypts existing data in place. The user gets to send the encrypted files/folders through the public network with confidentiality. Only the right recipient who has possessed the same key can successfully decrypt those received encrypted files and folders.


### FEATURES

- NIST/CSE certified AES ECB & CBC 256-bit hardware engines
- Supports 2-factor authentication
- Capable of encrypting selective files/folders of any OS detectable storage drives, including boot drive, external drive such as USB or 1394, network attached storage and virtual drives such as Dropbox, SkyDrive and GoogleDrive
- Capable of encrypting full disk, any number of connected USB storage devices
- Simple to use GUI of Windows and Macintosh; requires no software and/or driver download and installation
- Compliance to any USB 1.1/2.0/3.0 protocols

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## GPS/GNSS Constellation Simulators

Spectracom multi-channel, multi-frequency GSG Series GPS/GNSS Signal Simulators are ideal for development and manufacturing. Our simulators offer the most powerful, affordable, and easy-to-use GPS testing solution allowing you to simulate virtually any condition through built-in and user-defined scenarios. Now featuring expanded capabilities and a flexible, upgradeable design that allows you to select only the features you need for your specific application.

**BENEFITS:**

- *Test GPS from the convenience of your bench*
- *Simulate receiver movements without taking a step*
- *Have confidence knowing what happens, anytime, anywhere*
- *Save money, save time by testing more parameters more often*


## FEATURES

- Up to 64 channels and 4 frequencies simultaneously
- GPS, GLONASS, Galileo, BeiDou, upgradable to future constellations and signals
- L1, L2, L2C, L5, E1, E5, E6
- P-code, pseudo P(Y) in L1 and L2
- SBAS simulation: WAAS, EGNOS, GAGAN, MSAS
- White noise generation SNR testing
- GSG StudioView PC Software to build, edit and manage complex scenarios and trajectories
- Fully operational via front-panel, web-based remote control, or SCPI protocol
- Multiple interfaces for remote control: Ethernet, USB, GPIB
- Compact and lightweight (7 lbs./ 3 kgs.)
- Purchase only the signals you need – upgrade later

**Spectracom Corp. | 585-321-5800**

**Contact:** sales@spectracomcorp.com



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www.tinyurl.com/Geo-iNAV

## Rugged Inertial Navigation Systems

Inertial navigation systems (INS) integrate inertial motion units (IMU) that, as position sensors for mobile platforms, are greatly enhanced by GPS satellite signals.

Geo-iNav™ is an affordable, fully integrated GPS-aided INS offered in six configurations designed to meet a wide range of inertial navigation application requirements such as autonomous vehicles and airborne payloads. Configurations are available for both commercial and military applications (air/land/marine).

Applications include: UAV and UGV navigation and tracking; High-Dynamic aircraft navigation and tracking; Robotic control; Mapping; Gas and oil exploration; Agriculture; Transportation (safety and maintenance); Construction and structural management.

Geo-iNav™ is a trademark of Geodetics Incorporated.


## FEATURES

- Centimeter-Level position accuracy (dual-frequency RTK configuration)
- Precise Instantaneous Network (PIN) positioning based on Geodetics' Epoch-by-Epoch® technology
- Tight coupling with Geodetics' GKF Extended Kalman Filter
- Full post-processing capability using Geo-PostProcessing tools
- Support for tactical grade and low-cost MEMS IMUs
- Support for a variety of IMU interfaces including AMRAAM and SDLC
- Support for low, medium and high-dynamic platforms
- In-motion dynamic alignment
- Mil-Spec ruggedization
- Optional internal wireless data-link with TDMA capability
- Small footprint (without external IMU)
- Lightweight

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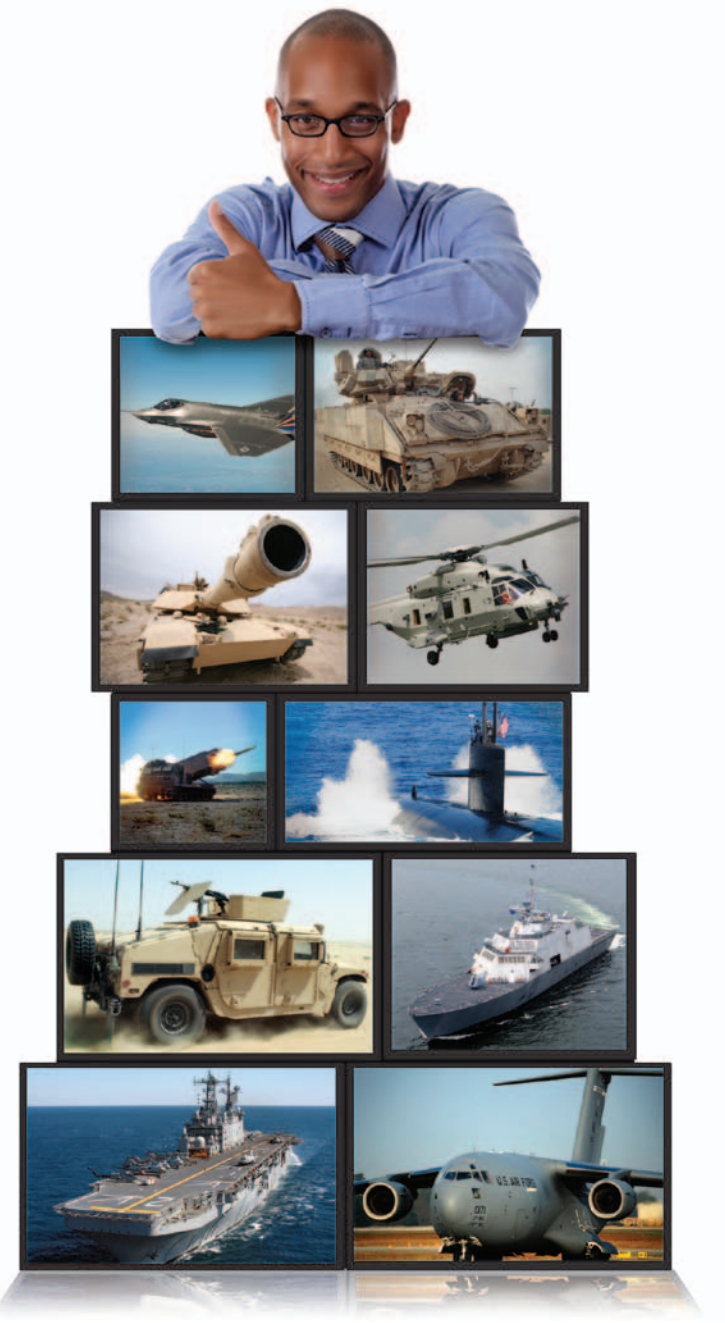

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