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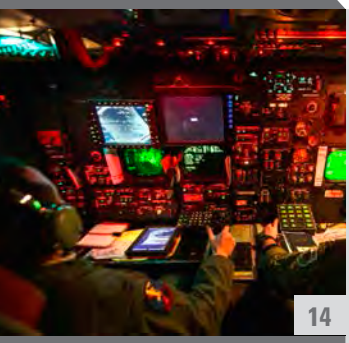

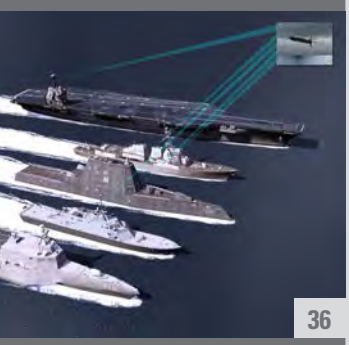

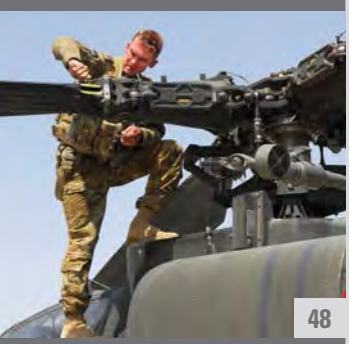

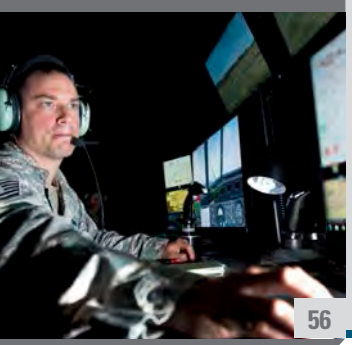

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ON THE COVER:

Top image: Testing of SEWIP is being performed on the USS Freedom littoral combat ship. Photo courtesy of Lockheed Martin.

Bottom image: Air Force Capts. Zachary Proano, left, and Andrew Parlsen conduct a training mission on a B-52H Stratofortress aircraft over Nevada. Proano, a radar navigator, and Parlsen, a navigator, are assigned to the 23rd Bomb Squadron. Photo courtesy of U.S. Air Force.

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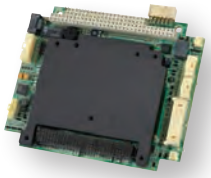

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MES Editorial/Production Staff

John McHale, Group Editorial Director
jmchale@opensystemsmedia.com

Lisa Daigle, Assistant Managing Editor
ldaigle@opensystemsmedia.com

Sally Cole, Senior Editor
scole@opensystemsmedia.com

Mariana Iriarte, Associate Editor
miriarte@opensystemsmedia.com

Steph Sweet, Creative Director
ssweet@opensystemsmedia.com

Konrad Witte, Senior Web Developer
kwitte@opensystemsmedia.com

Sales Group

Tom Varcie, Sales Manager
tvarcie@opensystemsmedia.com
(586) 415-6500

Rebecca Barker, Strategic Account Manager
rbarker@opensystemsmedia.com
(281) 724-8021

Eric Henry, Strategic Account Manager
ehenry@opensystemsmedia.com
(541) 760-5361

Twyla Sulesky, Strategic Account Manager
tsulesky@opensystemsmedia.com
(408) 779-0005

Kathleen Wackowski, Strategic Account Manager
kwackowski@opensystemsmedia.com
(978) 888-7367

Asia-Pacific Sales
Elvi Lee, Account Manager
elvi@aceforum.com.tw

Regional Sales Managers
Barbara Quinlan, Southwest
bquinlan@opensystemsmedia.com
(480) 236-8818

Denis Seger, Southern California
dseger@opensystemsmedia.com
(760) 518-5222

Sydele Starr, Northern California
sstarr@opensystemsmedia.com
(775) 299-4148

Europe Sales
James Rhoades-Brown
james.rhoadesbrown@husonmedia.com

Reprints and PDFs

Wyndell Hamilton, Wright's Media
whamilton@wrightsmedia.com, (281) 419-5725

OpenSystems Media Editorial/Creative Staff

John McHale, Group Editorial Director
Military Embedded Systems
PC/104 and Small Form Factors
PICMG Systems & Technology
VITA Technologies

Lisa Daigle, Assistant Managing Editor
Military Embedded Systems
PC/104 and Small Form Factors

Sally Cole, Senior Editor
Military Embedded Systems

Mariana Iriarte, Associate Editor
Military Embedded Systems
PC/104 and Small Form Factors

Jerry Gipper, Editorial Director
VITA Technologies
jgipper@opensystemsmedia.com

Curt Schwaderer, Editorial Director
Embedded Computing Design
cschwaderer@opensystemsmedia.com

Joe Pavlat, Editorial Director
PICMG Systems & Technology
jpavlat@opensystemsmedia.com

Joy Gilmore, E-cast Manager
jgilmore@opensystemsmedia.com

Rich Nass, Embedded Computing Brand Director
Embedded Computing Design
rnass@opensystemsmedia.com

Monique DeVoe, Managing Editor
Embedded Computing Design, DSP-FPGA.com
mdevoe@opensystemsmedia.com

Brandon Lewis, Assistant Managing Editor
PICMG Systems & Technology
Embedded Computing Design
Industrial Embedded Systems
blewis@opensystemsmedia.com

Jennifer Hesse, Managing Editor
VITA Technologies
jhesse@opensystemsmedia.com

Rory Dear, Technical Contributor
Embedded Computing Design
rdear@opensystemsmedia.com

Konrad Witte
Senior Web Developer

Steph Sweet, Creative Director

David Diomede, Creative Services Director

Joann Toth, Contributing Designer

Chris Rassiccia, Creative Projects

Corporate

www.opensystemsmedia.com

Patrick Hopper, Publisher
phopper@opensystemsmedia.com

Rosemary Kristoff, President
rkristoff@opensystemsmedia.com

John McHale, Executive Vice President
jmchale@opensystemsmedia.com

Rich Nass, Executive Vice President
rnass@opensystemsmedia.com

Wayne Kristoff, CTO

Emily Verhoeks, Financial Assistant

Headquarters – ARIZONA:
16626 E. Avenue of the Fountains, Ste. 201
Fountain Hills, AZ 85268
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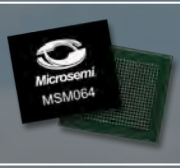

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Tech mergers and military electronics obsolescence

By John McHale, Editorial Director

Most industry folks I speak with agree that the current procurement climate is driving commonality and open architectures, which often means more investment in commercial off-the-shelf (COTS) technology. Another question: What about obsolescence? Have the Department of Defense and industry gotten any better at navigating obsolete components?

Unfortunately, the military no longer drives technology development. The military is a consumer of technology just like the rest of us and is also subject to the whims of commercial markets; it then passes these pressures to defense prime contractors and system integrators.

A perfect example dates back to 2008, when Apple Inc. bought PA Semi (Palo Alto Semiconductor), which made low-power 64-bit processors called PWRficient – high performance, low power, and loved by the military embedded computing community – but Apple only wanted the engineering talent, not the products. Defense electronics suppliers then had to scramble and relaunch product families with Intel and Freescale tech, but they still suffered losses as a result.

The point: Defense electronics suppliers get obsolescence. They have learned the hard way. As the conduit between commercial technology and military systems, they take that technology and enable it to work in mission-critical harsh military environments. They also convince their customers they have a plan for when these commercial components go end-of-life. However, not all of the customers have the volumes to survive long-term when they have to guess if military funding will be short-term, long-term, or happen at all. It can be like buying a lottery ticket.

They still have to guess when it comes to figuring out how much obsolescence the government is willing to pay for, says Dan Deisz, Director of Design Technology at aftermarket semiconductor supplier Rochester Electronics.

"The way the Department of Defense (DoD) goes about managing obsolescence could be improved. OEMs, when competing for a new contract, are required to keep costs low and flexibility high – planning for refreshes that may never get funded or for a contract that may not be won," he notes. "This forces them to do a derivation of what they've already done before, which hints toward using older and proven semiconductor products."

Today's semiconductor market is echoing that of 2008 with mergers and acquisitions making news, albeit in much less subtle ways than Apple's purchase of PA Semi.

"The problem is that the semiconductor industry is a bit like the [old] Pac-Man video game right now, with big companies gobbling up smaller ones," Deisz continues. "Examples include Intel buying Altera, Avago Technologies buying Broadcom, and NXP buying Freescale. The DoD needs a better macro plan for dealing with these changes, as many electronics systems use the PowerPC architecture or Altera FPGAs. One or more of these could be dead in a year or two and those without a plan for dealing with that will be in trouble. Yet I don't see any change in how the DoD partners with semiconductor companies to better manage these challenges. Altera raised their prices even before they were acquired to several companies this year. Xilinx is likely going to do the same because they can."

He poses the question I had, which was "How will the DoD manage that change? Is that the right space for the DoD?" The government represents less than one percent of total semiconductor spending. In other words, it does not drive semiconductor product designs or prices and is thus at the mercy of consumer-market trends.

Deisz says he has a solution. "One way to fix this would be to focus on total life cycle cost at the start," he says. "In other words, tell me the true cost to maintain the system for 30 years up front and put everything in place from a semiconductor perspective to make the same system for 30 years. The semiconductor content wouldn't be a heck of lot of money compared to what they are spending now. Then every single change to the system would need to be uniquely justified in annual budgets. This way, contractors would be duly incentivized to design for obsolescence; funded refreshes would then be locked in and paid up front. Right now, both the DoD and DoD OEMs are jointly incentivized to design in flexibility and the potential for change to try and capture future technology capabilities. When that future is unpredictably funded, unfunded refresh will drive obsolescence and counterfeit demand as it is today."

Admittedly, Deisz says, this would create more work for DoD personnel and OEMs, "but it could solve long-term obsolescence issues and at least bring full awareness to the costs up front. The way things are now, refresh cycles for many programs cost more than the platform itself. It could be better off up front if the DoD were to do mature technology ASIC designs instead of leading-edge FPGAs in several cases, and to lock it down for 20 years. They could add additional capabilities when necessary or design with more industry standard interfaces, but keep that core technology locked down."

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Metadata: When target video data is not enough

By Charlotte Adams

A GE Intelligent Platforms perspective on embedded military electronics trends

The pilot of a manned aircraft has the navigation equipment, the sensor inputs, and the smarts to know where the aircraft is and where the target is. The pilot can launch a missile against an enemy site or drop a bomb on a target and complete a mission with a relatively high degree of confidence. Multiple technologies augment the pilot's situational awareness and exert command-and-control authority. Supplemental data overlaid on cockpit displays is useful but not critical to completing the mission.

What if the pilot is thousands of miles away from the target, flying the airplane with a joystick and scanning the terrain and the threats on a video screen? In today's remote and virtualized combat scenarios, it is more difficult for fliers to understand the imagery they are seeing without metadata – that is, data about the data. The proliferation of unmanned air and ground vehicles is making the rapid encoding, compression, transmission, decoding, dissemination, and display of metadata every bit as important as the real-time streaming video.

In remotely flown missions, metadata can mean the difference between hitting the target and hitting something else. Sophisticated as today's sensors are, they could be misleading or downright dangerous without some indication of the imagery's larger context. At the other end of a thousand-mile loop, the decision maker looking at video of a suspected enemy vehicle moving down a road, for example, needs to know the vehicle's heading in relation to other objects of interest. The operator also may want to know information such as the geographical coordinates of the image, the local time at the site, and the identification number of the sensor host.

While the video is the fundamental data – the sine qua non of the mission – its inherent ambiguities make it, by itself, insufficient to act upon. Simultaneously processed metadata – and with metadata, the more, the better – is key to obtaining desired outcomes.

Metadata can be as simple as the audio files accompanying video files, closed-captioning for the hearing-impaired on a television, subtitles on foreign films, or time and date notations on emails. Metadata can also be as demanding as real-time directional and source cues for streaming video footage from unmanned platforms. It can indicate the GPS location, the time and date, the orientation of the camera on the platform, the host vehicle's altitude and airspeed, and much more. It can originate from within the video stream or from external sources, such as sensors, tracking devices, or other computers.

Processing challenges

Metadata has been used since the dawn of video and exists in a large number of video transmitting formats. The sheer variety of coding and decoding methods creates a challenge for metadata processing technology, however: How to capture and pass along all the formats from internal and external sources? Moreover, how to do this in both directions, both inserting and extracting metadata, with minimal latency while performing the primary task of video processing?

Figure 1 | The rugged ICS-8580 video compression XMC processes metadata as well as video.

Most metadata processing engines today are tied to specific formats, such as the KLV (Key-Length-Value) standard for metadata insertion and extraction, NATO's STANAG 4609, or Cursor on Target (CoT). (Efforts to unify around one format have not yet borne fruit.) Format-specific, hardware-based processing platforms add speed but don't necessarily guarantee performance over time. Retroactively adding new capabilities can lead to costly redesigns in mid-cycle. Most metadata processing is also unidirectional, inserting or extracting this information rather than performing both operations simultaneously.

The embedded logic necessary to capture metadata of any type or length is also more complex than the coding required to lock onto specific, fixed formats and ignore everything else.

An example of this approach to metadata processing is the GE Intelligent Platforms ICS-8580, a ruggedized XMC video streaming module newly updated with a firmware-based metadata processing engine that is format-agnostic, bidirectional, and has throughput rates as fast as 500 Kbytes/sec, with two to eight Mbits/sec throughput for 100x-compressed video data (Figure 1).

Given today's medley of coding/decoding algorithms, the best strategy may be to capture all types of metadata and let the military applications sort out which ones to translate and display. This approach allows future growth while insuring against costly refresh projects in midstream.

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Broadwell chip boosts GPU performance for COTS SBCs

By Aaron Frank
An industry perspective from Curtiss-Wright Defense Solutions

While Intel's new Broadwell processor was developed for broad commercial markets, it also offers big benefits to embedded defense applications. Tech-refresh programs that take advantage of this new 5th-generation Core i7 processor will see significant performance-per-watt improvements, while new designs can exploit an extremely fast multicore processor and powerful integrated graphics GPU combined in a single package.

Broadwell is a die shrink of the previous-generation Haswell architecture chip. Intel, following a "Tick-Tock" model, alternates its processor development by creating a new microarchitecture in one generation and then shrinking the die geometry in the following generation. This Tick-Tock cadence steps forward roughly every 18 months. For general-purpose processing, Broadwell delivers a modest 10 to 15 percent improvement over the previous generation Haswell, or a more significant 40 to 50 percent improvement over the 3rd-generation Ivy Bridge family. A much larger payoff is evident in the chip's graphics and floating point processing, driven by Broadwell's integrated Graphics Processing Unit (GPU).

GPUs are massively parallel compute engines designed for intense graphics and floating-point math operations. At a high level, they lend themselves to two broad classes of processing, both of which are critical for today's embedded defense applications: Rendering images for display and accelerated floating-point math operations for digital signal processing.

Broadwell's predecessors, Ivy Bridge and Haswell, featured integrated GPUs that delivered an impressive 141 and 320 GFLOPS, respectively. While Broadwell's final performance specifications are not yet public, its more powerful integrated GPU delivers a 40 to 60 percent GFLOP improvement over Haswell, and an even higher improvement over Ivy Bridge. This represents an enormous leap compared to what was available from a single piece of silicon just a few years ago, and is comparable to the best-in-class discrete GPU chips of just a few years ago. This new level of integrated GPU performance means that applications can drive multiple displays and/or accelerate DSP algorithms with the same piece of silicon that also manages general-purpose processing tasks. For many applications, this improved performance enables system designers to save a system slot or eliminate the use of a mezzanine graphics card. It also results in significant overall power reductions.

Broadwell features a 14-nm architecture, shrunk down from Ivy Bridge and Haswell's 22-nm process. This reduced transistor feature size typically results in decreased power consumption, so algorithms designed for previous generation Core i7 processors can run at lower power levels with Broadwell. However, to increase GPU capabilities, Intel has packed more functionality into Broadwell, resulting in an overall chip power dissipation nearly identical to that of the 22-nm chips. For military commercial off-the-shelf (COTS) designers, this leads to a significant new challenge in the area of thermal design. Since power is being dissipated across a much smaller piece of silicon, this heat concentration can present an extremely difficult cooling challenge. The technology that previously adequately cooled Ivy Bridge and Haswell devices in demanding aerospace and defense environments has shown to be insufficient for Broadwell chips. In response, new cooling technology has been developed that specifically addresses the challenges of Broadwell 14-nm chips. In addition, enhanced power-saving configurability options are now available that enable designers to turn off processing cores or lower clock speeds to save power based on their application's requirements. Using this approach, Broadwell-based SBCs can operate at as low as 16 W (typical) power, yet can also run at full power in the most challenging thermal environments.

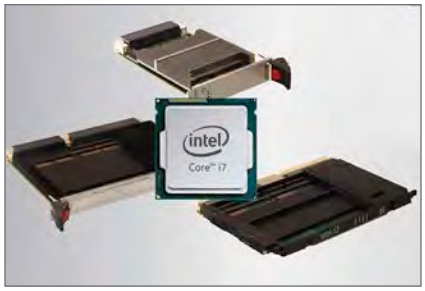

Figure 1 | The family of Broadwell-based SBCs includes 3U and 6U VPX designs as well as a 6U VME design.

Ideal for tech-refresh applications

Broadwell-based SBCs, ideal for technology-refresh applications, are well-suited to existing applications needing to run with less power in a smaller platform and in cases where enhancements to applications demand more than the original processor can handle.

Curtiss-Wright recently announced a new family of Broadwell-based SBCs (Figure 1). The family includes 3U and 6U VPX designs and a 6U VME design. An example of a Broadwell-based VPX SBC is the 3U OpenVPX VPX3-1259 module. This small board features a high-speed PCI Express Gen3 interface to the backplane. The new Broadwell SBC is 100 percent pin-compatible with previous-generation Ivy Bridge and Haswell SBCs.

Software support includes multiple versions of Linux (Fedora, Red Hat Enterprise Linux, Lynx Software's LynxOS, and Concurrent Red Hawk), Wind River VxWorks, and Microsoft Windows Embedded.

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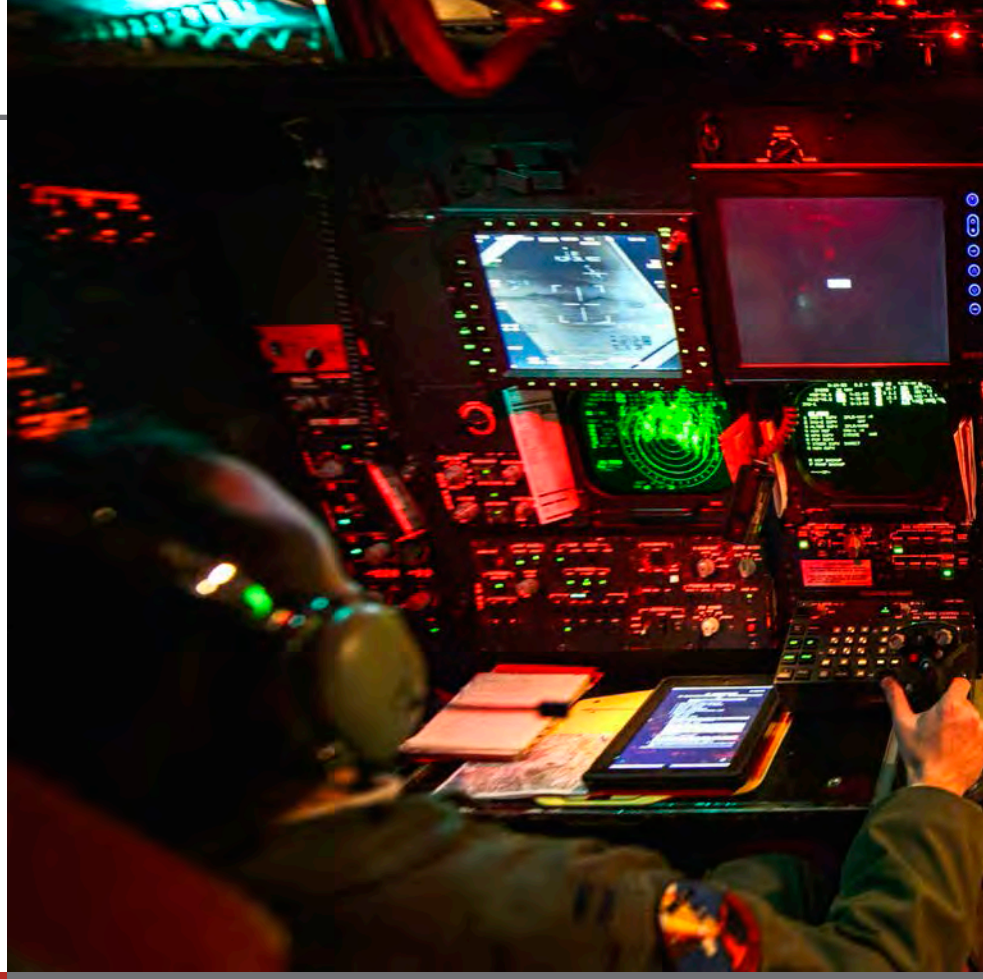
C4ISR funding a bright spot in military electronics market

By John McHale, Editorial Director

The President's Department of Defense (DoD) budget request for fiscal year 2016 saw an increase in overall funding over previous years that had seen reductions from sequestration and changing political priorities. The question is whether the current increase means more opportunities for electronics suppliers.



Air Force Capts. Zachary Proano, left, and Andrew Parlsen conduct a training mission on a B-52H Stratofortress aircraft over Nevada. Proano, a radar navigator, and Parlsen, a navigator, are assigned to the 23rd Bomb Squadron. Photo courtesy of U.S. Air Force.

The last few years have made it tough to forecast, as the U.S. military is not certain on concept of operations going forward; in other words, how it is going to fight the next war. Market analysts say that while concept of operations is still uncertain, the funding for electronics in application areas such as command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR), unmanned aircraft, and even space looks steady and may even grow over the next five years.

C4ISR

For all things C4ISR in the Fiscal Year (FY) 2016 budget request, the total is about $39.54 billion, which is a $3.21 billion increase over last year's request, says Brad Curran, Aerospace & Defense Industry Principal at industry analysts Frost & Sullivan. "The reason for the uptick is that we got a sharp procurement increase in ballistic missile defense (BMD) and unmanned vehicles. BMD is always a big item and work is being done on SLQ-32 upgrades to defend surface ships as the Russians and Chinese have good anti-ship missiles that are shore-based."

On the U.S. side, procurement is the largest category as big funding is moving from research, development, test, and evaluation (RDT&E) and operations and maintenance (O&M) to procurement, he continues. "They can't justify so much O&M due to the high operational tempo and are shifting to procurement to hurry up and buy stuff before it gets cut off. The FY 2016 request for the Air Force is $10.84 billion, the Army $10.08 billion, Joint Services $8.44 billion, and Navy/Marines $10.18 billion. Surveillance and reconnaissance is at $14.56 billion."

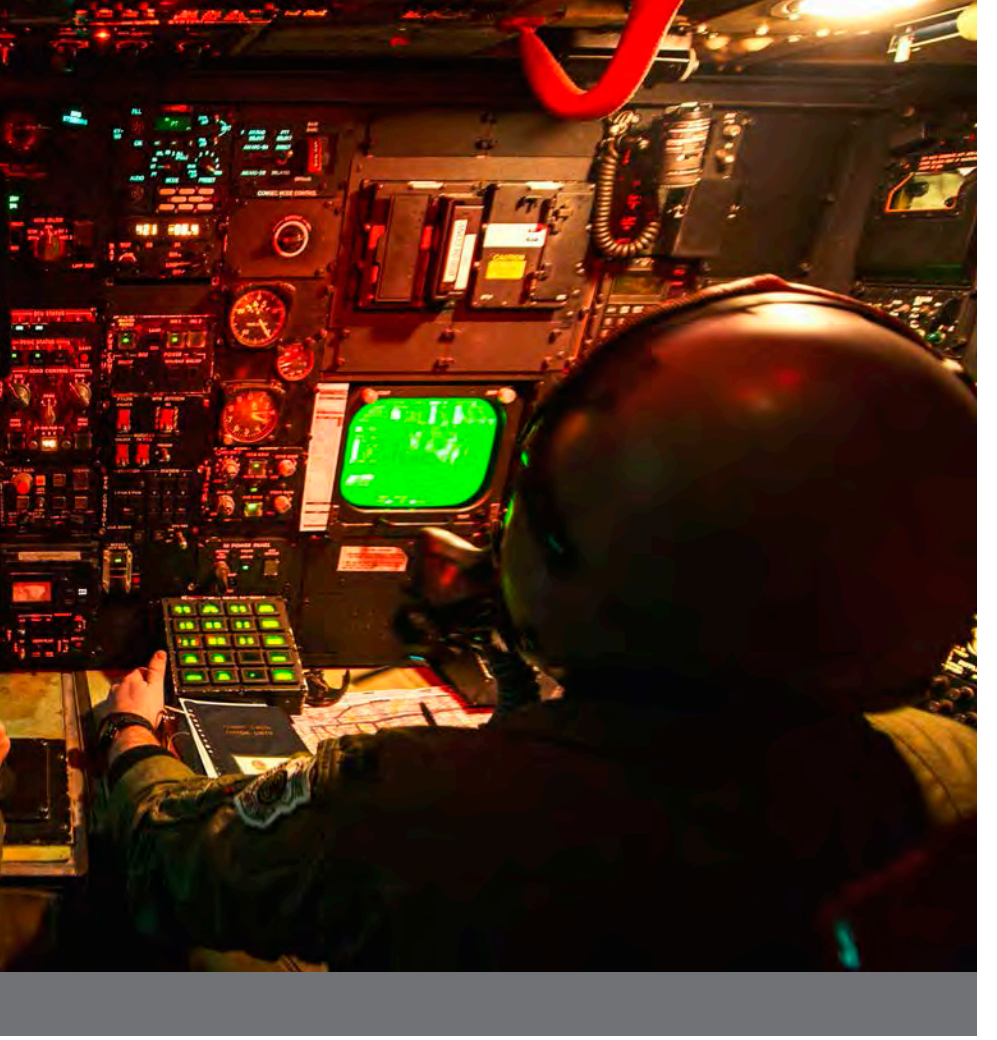
In 2014, $54.13 billion was spent on C4ISR with 352 companies getting contracts. Lockheed Martin is on top at $6.71 billion, Curran says. For new contract awards in 2014, 40.9 percent of contracts were with the top-ten primes.

"The 2014 market saw current contracts continuing, while at the same time there were a lot of new companies getting awards," Curran says. "The big top-ten primes are still really dominating things whether the awards are competitive or not competitive. In 2014, 39 percent of all noncompetitive contracts went to modified or existing contracts or sole-source selection. That's dollar-wise, but if you look at the numbers 65 percent of them were sole source. Yes, there are new companies, but still 65 percent of volume is not competitive and going into sole source. Basically what is going on is the big ten or the opposite side of the spectrum – small, set-aside companies are getting the contracts, which means the midtier companies get squeezed as there is not much value or volume."

Global C4ISR

"Basically, the story for global C4ISR is missile defense," Curran says. "It is really important, as is border security, which is a concern of Greece and Italy. Those concerned with missile defense are Saudi Arabia/UAE/Israel/Turkey, Japan/South Korea, Poland/Romania/Ukraine, and Finland/Sweden/Norway.

Global C4ISR in 2014 saw $106 billion spent, with a CAGR of 2.9 percent. Hot countries for C4ISR spending are Saudi Arabia and Japan, he says. "The last few years, Japan has been allowing more



defense contracts, enabling defense funding to increase. India is also a big importer, and Australia is a good market. On the downside are France, Italy, and the United Kingdom. Traditional big spenders are cutting budgets, while the U.S. is flat."

Global defense budgets stand at about $1.74 trillion total, with money targeting procurement and O&M-related spending at about $647 billion, Curran says. "Most money spent on defense budgets worldwide does not go toward technology procurement, but to buy weapons and ammo, pay bills, etc."

Radar and electronic warfare

Key ingredients to strong C4ISR are effective radar and electronic warfare (EW) systems. Both application areas are crucial to U.S. military initiatives worldwide as the world's superpower pulls back its ground footprint globally.

"For radar in 2014, the CAGR was 1.4 percent, which is basically flat compared to the previous year," Curran says. "There were 70 awards for $2.9 billion, with Lockheed Martin leading because they won the large Space Fence contract. In 2013 there were 79 radar contracts totaling $4.03 billion, with Raytheon leading again with 24 of the contracts for $2.09 billion. The drop happened because big programs such as JSTARS and Spy 1 – along with X-Band, which had more activity in 2013 – were completed. In 2013, Raytheon had a good chunk as they still had Spy 1, but going forward they will see more modest production.

"EW spending has not caught up with the acknowledgement that we need to upgrade sea-based EW," Curran continues. "The other side of this is anti-submarine warfare with sonar and similar technology, as the Russians are increasing their submarine production. The EW budget for the 2016 budget is about $2.35 billion with 52 programs. On the contract side, looking back at all radio frequency (RF) and EW countermeasure totals in 2014, the EW segment was $2.75 billion for 67 contracts, with the leading contracts being for the Next Generation Jammer and large aircraft infrared countermeasures. The leading company was Northrop Grumman."

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Analysts at Markets and Markets in Dublin, Ireland, see similar strength in the EW market, estimating the global EW market at about $17.72 billion in 2014 and registering a CAGR of 5.37 percent to reach $24.25 billion by 2020 in their report, "Electronic Warfare Market by category … Forecast & Analysis 2014-2020." Threats such as GPS-jamming stealth aircraft, and radio-controlled improvised explosive devices (RCIEDs) are driving EW system designs, according to a Markets and Markets release. Globally, Raytheon, Alliant Techsystems, BAE Systems, Rockwell Collins, IAI Elta, and L-3 Communications account for more than 40 percent of the total EW market share, the Markets and Markets analysts say.

Cyber

Cyberdefense is a critical part of every military system as DoD systems add complexity and rely increasingly on software and wireless networks.

"Cyber never stopped being hot and now there are actual line items regarding cyber-funding," Curran says. "However, most cyber you can't see in the budget because it is cooked into an enterprise-wide program. That said, security for computer networks in general within the DoD – such as healthcare and payroll – are upgrading hardware and software technology with enhanced cybersecurity and cloud-computing capability. Cloud computing is booming! It is really doing well; even bigger than cloud computing is the drive toward big data. The latter is mostly still happening, but remains on the intelligence community side for now.

"My estimate for overall networks – enterprise and tactical – is $13.66 billion with 142 awards and Northrop Grumman as the leader by far," he continues. "Total cyber within the FY 2016 budget I estimate at about $8 billion."

COTS and C4ISR

The push toward better cyber technology and radar and electronic warfare requires the adaption of commercial processing and software technology and open architectures.

"We see the market for open architectures and commercial off-the-shelf (COTS) technology in the military C4ISR market only accelerating as the operational and cost-utility advantages of using COTS are so obvious," Curran says. "As commercial networks and mobile devices accelerate like crazy, the DoD is looking to adapt this technology. The catch for them has always been security, but we may be seeing a paradigm shift in thinking now as they try to be smarter about what needs to be secured and – even more crucial – what does not. If we lose some stuff, the utility and cost of using commercial mobile technology will be worth it. They will maintain high-level security on the most important networks and data,

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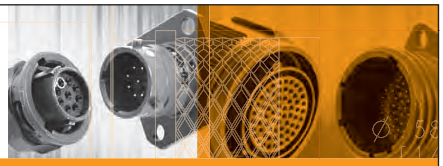

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saving money on protecting the more perishable data.

"Prior to this paradigm shift in thinking, tactical commanders would do whatever the NSA recommended, but now operational imperatives allow for more flexibility," Curran notes. "The CNCs and tactical commanders and service chiefs have more say now than they did in the past."

Avionics

Military avionics often is the steadier part of the global avionics market, compared to that of commercial aviation. Companies that have stakes in both areas often weather economic ups and downs much more easily than those with all their revenue tied to one market segment.

"If you look at pure-play defense companies they saw two years' worth of budgeted growth and are headed into perhaps a worse year this year," says Wayne Plucker, Aerospace & Defense Director at Frost & Sullivan. "For companies that play in both aerospace and defense, such as Boeing and Finmeccanica, they are seeing at best modest growth. Pure-play aerospace companies are seeing more growth.

"For avionics upgrades there is not a lot of what I'd call flight system avionics upgrades happening aside from some minor tweaks as most militaries around the globe are global air-traffic management (GATM)-capable," Plucker continues. "Where I do see growth is in mission avionics. While we are not replacing aircraft at the rate we used to, the C4ISR payloads these aircraft carry are getting funding as programs want mission-specific payloads for each platform. For mission avionics the leading companies are Northrop Grumman, Thales, and BAE Systems. A lot of the pure-play defense companies live in this space and really position themselves well, as opposed to the defense sides of Rockwell Collins and Honeywell, which focus more on flight avionics."

Unmanned aircraft

Analysts at the Teal Group say they expect the global unmanned aircraft systems (UAS) market to triple over the next decade in military, commercial, and consumer markets. They estimate that UAS production will rise from the current worldwide UAS production of $4 billion annually to about $14 billion, totaling $93 billion over the next ten years. Military UAS research spending would add another $30 billion over the same decade. About 72 percent of the global market will be military, 23 percent consumer, and five percent civil cumulatively for the decade, according to Teal analysts.

Global military UAS spending should be a total of between $11 billion and $12 billion by 2020, says Mike Blades, Senior Industry Analyst for Aerospace & Defense at Frost & Sullivan. "From a military perspective, the U.S. and Israel are far ahead of anyone else in UAS production. They are maintaining and upgrading what they have now, while also planning for funding of the Unmanned Carrier-Launched Airborne Surveillance and Strike (UCLASS) and the optionally-manned Long Range Strike Bomber (LRSB). Procurement is winding down for the MQ-1 and MQ-9. Down the road there will be an increase in spending for the optionally manned portion of the LRSB, however. If you look at the budget, it peaks out in 2017-2018, and maintains about a billion dollars a year in procurement afterward. (Figure 1 on following page.)

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"My assumption is that LRSB will be optionally manned," Blades continues. "So that said, in 2013 the total spent on UAS was $3.9 billion, in 2014 $3.5 billion, in 2015 $3.9 billion; in 2016 we will see $4.7 billion, in 2017 $5.4 billion, in 2018 $5.6 billion, and in 2020 $5.5 billion. The long-term increase is due to LRSB funding. If you take that out, the funding is more flat at $3.5 billion.

Ron Stearns, Research Director at Aerospace Analytics, has a similar outlook. "For the major programs of record, production runs are coming to a close between 2017 and 2020," he says. "Platforms such as the General Atomics MQ-9 will be running for a while and that will keep production moving in that regard. But absent on the DoD side are many new programs of record. It will be a sustainment market, by and large, through the forecast period. Total spend – if you look through 2014-2020 – in procurement and RDT&E will be constant, around $3 billion a year.

"If you look for growth in spending and programs of record, it is steady at $1.3 billion a year from 2016 onward, while UCLASS spending climbs from $400 million in 2016 to about $1 billion in 2020, as that system matures," Stearns continues. This does not count O&M spending. Six or seven years from now on the DoD side, the unmanned outlook will be similar to what we have now with regard to total spend.

UAS payloads

When unmanned aircraft first came on the scene, the buzz was about the aircraft themselves, but now it is all about the payloads they carry and how the payload sensors enable tactical advantages on the battlefield.

"From an overall sensor standpoint, procurement growth is in payload upgrades for full-motion video, data links, signal-processing technology, etc.," Blades says. "There is a lot of information coming down the datalinks and they need to be made more robust so they don't have to store so much on board." Increased onboard processing is also a key trend, he adds.

Figure 1 | The Navy Unmanned Carrier-Launched Airborne Surveillance and Strike (UCLASS) program is expected to get increased funding down the road in the DoD budget. Photo courtesy of Lockheed Martin.

"There is a demand for increased persistence and increased autonomy because you can reduce the number of personnel required," Blades explains. "Modularity is in demand, as is open-source architecture, which makes upgrades more simple to execute and cheaper because more companies will have the capability to compete – over proprietary programming which has been the historic paradigm. This trend is geared toward small aircraft. They want multi-intel sensors to do many things at once. There is also a push toward more miniaturized sensors, as the aircraft themselves get smaller. An example would be the Prox Dynamics PD-100 Black Hornet helicopter, which is smaller than most toy helicopters you fly around your home."

UAS payloads, such as electro-optic/infrared sensors (EO/IR), synthetic aperture radars (SARs), SIGINT, EW systems, and C4I systems, are forecast to double in value from $3.1 billion in FY 2015 to $6.4 billion in FY 2024, Teal analysts say. EO/IR remains the default sensor for the majority of UASs, but in recent years these have seen inconsistent funding and considerable uncertainty, they add.

New sensor markets will see significant increases as RF systems replace EO/IR capabilities, while next-generation UASs of all scales require much more sophisticated – and expensive – sensors. "Rapidly increasing capabilities for RF sensors will be funded, as potential conflicts shift from clear-skies Central Asia to the more restrictive geographies of Eastern Europe and the Pacific," says Dr. David Rockwell, author of the electronics portion of the Teal Group study.

"UASs will continue to provide the world's fastest-growing aerospace payload market, but not through continued growth of the usual suspects from the past decade. Instead, new sensor programs for current and future air vehicles will result in more unexpected growth spurts and losses."

Smaller UAS

Smaller UAS platforms are likely to increase as they offer more flexible solutions to ground units performing tactical reconnaissance.

"I see increased proliferation for smaller UAS in Special Operations for loitering munitions or lethal miniature aerial munition system (LMAMS) platforms such as Switchblade, Maveric, and Cutlass," Blades says. "LMAMS allows the infantryman to fire a weapon and not have it strike right away. If the target moves or hides the weapon can loiter (30-45 minutes) until the target is reacquired. Not only does it allow flexibility, it allows for surprise.

"There will also be an increase in manned/unmanned teaming (MUM-T). For example, on an Apache AH-64 that is away from the action, the copilot/gunner (CPG) in the front seat would control a UAS for surveillance, launching loiter munitions while the munitions are sending video back to the Apache. The example of launching LMAMS from a MUM-T UAS has not been tested yet, but I predict it will be relatively soon. Currently, the MUM-T setup would allow an AH-64 to direct an attack using an MQ-C or RQ-7 once that platform is armed with precision-guided munitions."

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Military space market

C4ISR and unmanned systems often get more funding and more press than space programs, but shifts in procurement thinking and the vulnerability of U.S. military satellites to attack is forcing U.S. military leaders to revisit how they deploy mission-critical space systems.

"Some of our major high-volume DoD space programs are coming to a place where they will be reconstellated or recompeted, from the SBIRS High program to GPS III to Advanced EHF/MILSATCOM," Stearns says. "All of those are looking different through the President's budget request for FY 2016. From a program of record perspective GPS III is moving toward a full recompete award in 2017 or 2018." (Figure 2.)

"The catch is these reconstellations will have to happen much more quickly than traditional space-program development cycles," Stearns says. "For one thing, it is unlikely the DoD will have the appetite for another decade-long award-to-build-to-launch process. The other pillar of change coming is the disaggregated space architecture.

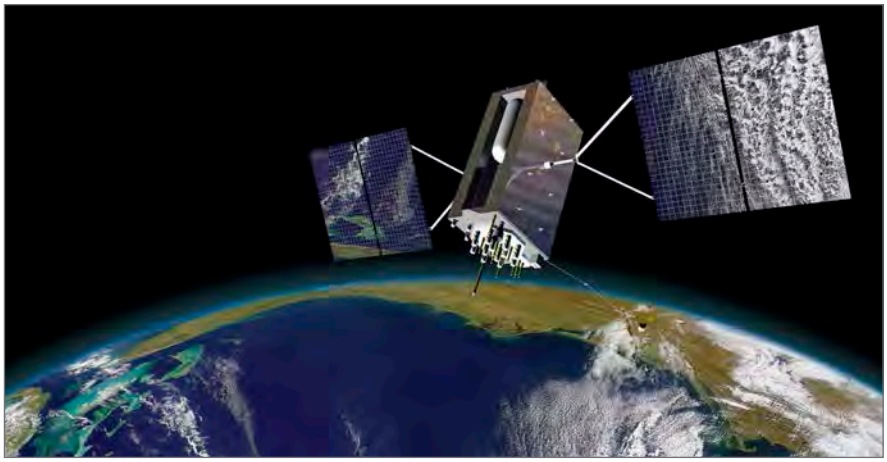

Figure 2 | From a program of record perspective GPS III is moving toward a full recompete award in 2017 or 2018. Photo courtesy of Lockheed Martin.

"We are moving into an area where space is not the sole uncontested domain of the U.S.," Stearns notes. "Multiple countries have the ability to destroy satellites from ground-launched systems and the ability to perhaps dazzle and/or blind infrared sensors. We are moving into uncharted territory in this regard. In this environment, important space programs will need to be quickly reconstituted or gracefully degrade in the face of some kind of attack, whether kinetic, cyber, or otherwise. DoD is moving forward on this with analyses of alternatives. The question for industry is how to change programs of this velocity and size. It took a long time to get us to this place."

Small sats

"Small satellites are one alternative as they are less expensive and faster to deploy," Stearns says. "They are real and capable within the parameters of their expected life. They offer the counterbalance to traditional DoD thinking, as we have a threat to our freedom of action in space. We also have budget pressures and acquisition timelines not fit for a decade-long RFP-to-award-to-build-to-launch-to-capability process.

"I think there is a line where the DoD can look at how much capability and survivability they need to build into the space segment," he continues. "If we have ample satellite buses with modular payloads and a number of small commercial launchers that can be used to help reconstellate in weeks or even days, it could be one way to go. This type of commercial scenario is a real paradigm shift that will depend upon DoD's willingness to accept a higher level of risk within this area." **MES**

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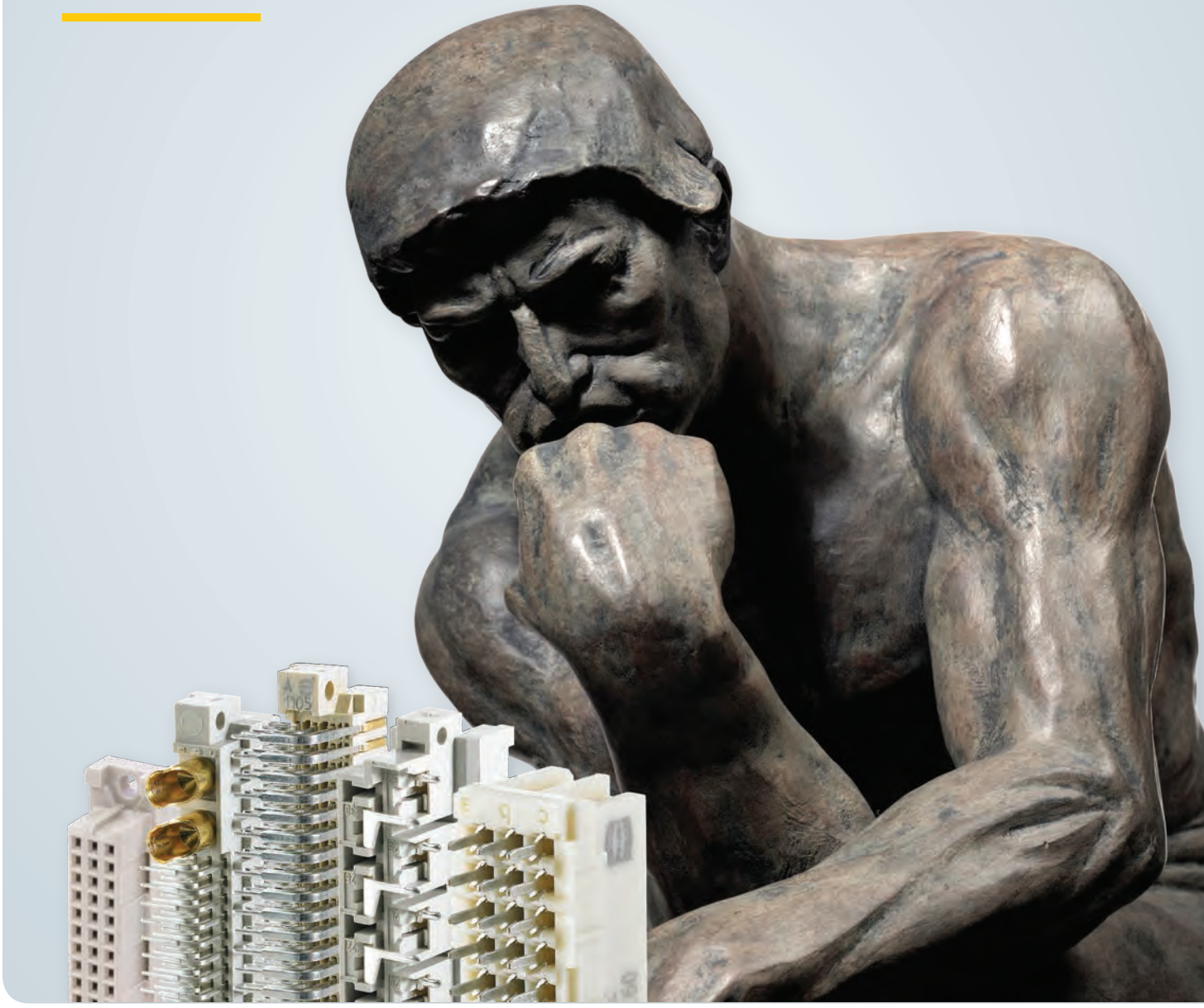

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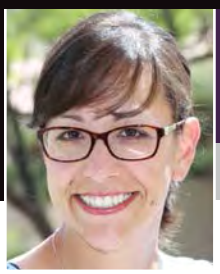

DEFENSE TECH WIRE

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By Mariana Iriarte, Associate Editor

NEWS

IFF AN/UPX-40 system installed into E-3 Sentry AWACS aircraft

The U.S. Air Force's Airborne Warning and Control System (AWACS) Next Generation Identification Friend or Foe (NGIFF) program office has completed the first installation of the AN/UPX-40 system on an operational AWACS aircraft at Tinker AFB in Oklahoma.

The $60 million IFF upgrade is part of an AWACS modernization effort known as Block 40/45, which will replace current 1970s-vintage mission computing and displays with an open system and up-to-date, commercial off-the-shelf (COTS) hardware and software.

The AWACS radar, coupled with the IFF interrogation system, was designed to gather information that can detect, identify, and track enemy and allied low-flying aircraft by eliminating ground clutter signals. The original Identification Friend or Foe (IFF) system retains legacy capabilities, but now includes Mode 5 Interrogation enhancements.

Figure 1 | AWACS photo courtesy of U.S. Air Force/Senior Airman Betty R. Chevalier.

DoD renews cybersecurity contract with Software Engineering Institute

The Software Engineering Institute (SEI), a Carnegie Mellon University center, will continue its contract with the U.S. Department of Defense (DoD) by continuing to progress and transition the DoD's secure software systems.

The five-year contract (with an option for an additional five years) has an estimated value of $1.73 billion. Under the terms, the SEI is positioned to develop technologies and practices through its own research; the contract also calls for application of technologies developed by outside organizations to solve engineering and cybersecurity challenges in fields including aerospace, transportation, banking and finance, energy, robotics, and industrial automation.

Sikorsky acquired by Lockheed Martin

Lockheed Martin officials say the company is now in a definitive agreement to buy Sikorsky Aircraft, known for producing military and commercial helicopters, for $9.0 billion. The price has been effectively dropped to about $7.1 billion, after taking into account tax benefits resulting from the transaction.

"I'm confident this acquisition will help us extend our core business into the growing areas of helicopter production and sustainment," says Marillyn Hewson, chairman, president, and CEO of Lockheed Martin. The acquisition is subject to customary conditions, including securing regulatory approvals, and officials expect it to close by the end of this year or early in 2016.

Company officials say they plan to place Sikorsky under the Lockheed Martin Mission Systems and Training (MST) business segment. MST and Sikorsky already partner on various programs, such as the VH-92 Presidential Helicopter, Combat Rescue Helicopter, and the Naval MH-60 Helicopter.

U.S. Marine Corps orders iRobot's unmanned ground vehicles

The U.S. Marine Corps System Command has ordered 75 Small Unmanned Ground Vehicle (SUGV) robot systems from iRobot Corp. The order's estimated value is $9.8 million.

The iRobot 310 SUGV provides situational awareness for infantry troops, combat engineers, and explosive-ordnance technicians, among other personnel. The man-portable SUGV robot can also be used for dismounted mobile operations. According to company officials, deliveries of the SUGV are to be completed by the second quarter in 2016.

Figure 2 | The iRobot SUGV performing dismounted mobile operations. Photo courtesy of iRobot.

Secure AEHF satellite communication network completes IOC phase

The Advanced Extremely High Frequency (AEHF) satellite network of the U.S. Air Force's Air Force Space Command has completed the initial operational capability (IOC) phase. It now provides secure military communications for national leaders and military commanders transmitting sensitive information in contested areas. The network serves the U.S., Canada, the Netherlands, and the U.K.

The completion of the IOC phase followed a six-month U.S. Air Force evaluation cycle during which AEHF was tested in simulated scenarios such as battlefield environments and cyberattacks. The system's high data-transfer rate can send images, video, and other data to compatible aircraft and naval vessels. It also has onboard signal processing and satellite-to-satellite crosslinks that insulate communications from vulnerability by eliminating the need for ground relay stations.

Lockheed Martin is under contract with the U.S. Air Force for six AEHF satellites; three are currently orbiting and the remaining three are in production at a Lockheed Martin facility in Sunnyvale, California.

Figure 3 | Protected communication capabilities via the AEHF satellite network. Photo courtesy of Lockheed Martin.

General Dynamics continues to modernize U.S. and Australian submarine tactical weapons systems

In a contract modification, General Dynamics will continue to modernize the AN/BYG-1 Weapons Controls Systems (WCS) Technology Insertion and Advanced Processing Build Software for the U.S. Navy and Royal Australian Navy submarines.

The software provides tactical, situational awareness for submarines by analyzing and tracking submarine and surface-ship contact information. It also includes the capability to target and employ torpedoes and missiles.

"Many of the system updates and capability improvements are the direct result of feedback from sailors and their commanders who work with the systems every day," says Carlo Zaffanella, vice president and general manager of Maritime and Strategic Systems for General Dynamics Mission Systems.

Navy RNP-RNAV flight management system aligned to FACE standard

U.S. Naval Air Systems Command (NAVAIR) and Rockwell Collins officials are working under a Cooperative Research and Development Agreement (CRADA) Required Navigation Performance-Area Navigation (RNP-RNAV) Flight Management System that will enable more software reuse in naval flight systems by being aligned to the Future Airborne Capability Environment (FACE) standard.

Rockwell Collins will demonstrate RNP-RNAV technologies aligned with the FACE standard this fall. This RNP-RNAV application uses commercial technologies that are operational on commercial and tactical aircrafts today.

The Rockwell Collins RNP-RNAV FMS solution currently enables multiple tactical aircraft types to safely interoperate within civil airspace, says Troy Brunk, Rockwell Collins vice president and general manager of Airborne Solutions. A version of the RNP-RNAV FMS aligned to the FACE standard will enable tactical aircraft that support a FACE operating environment to integrate advanced navigation performance standards and meet the current mandates, he adds.

BAE Systems upgrades M88 recovery vehicles to HERCULES configuration

BAE Systems has been selected to convert 36 M88A1 recovery vehicles to the M88A2 Heavy Equipment Recovery Combat Utility Lift Evacuation Systems (HERCULES) configuration in a contract with the U.S. Army with an estimated value of $110.4 million.

Due to the U.S. Army's Armored Brigade Combat Team (ABCT) vehicles increasing in weight, the M88 vehicle upgrades with the HERCULES configuration will help support soldiers on the field, recover the M1 Abrams tank, and aid the mine-resistant ambush protect (MRAP) variants in a combat environment.

Deliveries will begin January 2017 through October 2017, as work on this contract is expected to start immediately and take place at the company's facilities in York, Pennsylvania, and Aiken, South Carolina.

Figure 4 | M88 vehicle upgrades with the HERCULES configuration will support soldiers on the field. Photo courtesy of BAE Systems.

Additional Insitu RQ-21A Blackjack UAS ordered by NAVAIR

Insitu engineers are slated to build six RQ-21A Blackjack systems for the U.S. Navy and Marine Corps under the terms of their latest contract – the $78-million Small Tactical Unmanned Aircraft Systems (STUAS) Lot IV Low Rate Initial Production (LRIP) contract.

This agreement marks the most recent event in the STUAS program's march toward the Initial Operational Test and Evaluation (IOT&E) phase. Naval Air Systems Command (NAVAIR) officials awarded the STUAS Engineering Manufacturing Development contract to Insitu back in 2010 to begin development of the RQ-21A Blackjack, a variant of the company's Integrator unmanned system. The program reached "Milestone C," a significant juncture in the work, in 2013, and delivered the first LRIP system last year.

RQ-21A has a much larger payload mass, volume, and power than other small UAS platforms currently deployed by the Marines. The system has electro-optic and midwave infrared sensors along with a laser rangefinder and infrared marker. A portfolio of payload options has been created to provide immediate situational awareness for land and maritime missions.

Figure 5 | A RQ-21A Blackjack UAS launching off the flight deck of a Navy vessel. Photo courtesy of Insitu.

U.S. Army Multi-Mission Launcher receives Curtiss-Wright's electromechanical actuators

The Indirect Fire Protection Capability (IFPC) program will receive elevation and hatch control electromechanical actuators for use on the U.S. Army Multi-Mission Launcher (MML), under an initial contract with Curtiss-Wright Corp. The potential value is estimated to be $75 million over the lifespan of the program.

In the agreement with the U.S. Army, Curtiss-Wright will provide modified COTS solutions in line with the Army Aviation and Missile Research, Development, and Engineering Center (AMRDEC) requirement for open system architecture. The solutions will be based on Curtiss-Wright's Exlar electromechanical actuation technologies.

The MML is an air defense launcher built with open system architecture. Work will be performed at the Curtiss-Wright Sensors & Controls division facility in Chanhassen, Minnesota.

Virtual test bed in development for DARPA's Squad X Core technologies program

The DoD's Defense Advanced Research Projects Agency (DARPA) has selected Intific to develop a virtual test bed for the agency's Tactical Technology Office (TTO). The company will leverage its own background in commercial software to develop the virtual training environment that would adapt first-person gaming engines, add defense-specific scenarios, and connect technology generation systems.

The combination of game-based, virtual, and realistic training applications of the test bed would help model real military systems for adoption and engagement with military users at the squad-combat level. The initial phase will develop a prototype of a virtual test bed concept; if successful, subsequent optional phases will call for gamification features, increased capabilities, and scalability. The project has a potential value for Intific of an estimated $5 million over 33 months. The technologies developed by DARPA'S Squad X Core Technologies (SXCT) program will be evaluated by Intific's virtual-training environment.

Apache helicopters receive Lockheed Martin's upgraded targeting and piloting system

Engineers at Lockheed Martin Missiles and Fire Control are continuing their ongoing modernization of the U.S. Army's AH-64E Apache attack helicopter with the Modernized Day Sensor Assembly (M-DSA). The assembly is an upgrade to the Apache's targeting and Modernized Target Acquisition Designation Sight/Pilot Night Vision Sensor (M-TADS/PNVS).

Under the terms of the contract, Lockheed Martin will produce and deliver 786 M-LRFD (Modernized Laser Rangefinder Designator) kits, a targeting aid for the Apache helicopter.

Phase one of the M-DSA upgrades will modernize the Apache DaySensor Assembly that includes producing the M-LRFD kits. After that Lockheed Martin will transition into production M-DSA phase two upgrades. According to company officials, phase two upgrades enable pilots to have high-resolution on cockpit displays, which enable better coordination with ground troops.

Figure 6 | M-DSA is an upgrade to the Apache's targeting and Modernized Target Acquisition Designation Sight/Pilot Night Vision Sensor (M-TADS/PNVS). Photo courtesy of Lockheed Martin.

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F-35B Lightning II aircraft becomes operational, joins U.S. Marine Corps squadron

After a five-day Operational Readiness Inspection, the Marine Fighter Attack Squadron 121 (VMFA-121) based in Yuma, Arizona, has completed initial operational capability (IOC) on the U.S. Marine Corps' F-35B Lightning II aircraft.

"VMFA-121 has ten aircraft in the Block 2B configuration with the requisite performance envelope and weapons clearances, to include the training, sustainment capabilities, and infrastructure to deploy to an austere site or a ship. It is capable of conducting Close Air Support, Offensive and Defensive Counter Air, Air Interdiction, Assault Support Escort, and Armed Reconnaissance as part of a Marine Air Ground Task Force, or in support of the Joint Force," says Gen. Joseph Dunford, Commandant of the Marine Corps.

Gen. Dunford continued to say that the F-35B underwent seven weeks at sea conducting flight operations and also that prior to declaring IOC, the F-35B participated in large force exercises and executed an operational evaluation that included live-ordnance sorties.

Figure 7 | According to officials, the F-35B aircraft will eventually replace three legacy platforms: The AV-8B Harrier, the F/A-18 Hornet, and the EA-6B Prowler. Photo courtesy of U.S. Marine Corps/Lance Cpl. Remington Hall.

IT support services for Network Enterprise Center at Fort Bragg to continue

The U.S. Army has selected NCI, Inc. for a recompete contract consisting of a one-year base period and two optional one-year periods to provide information technology (IT) support services of the Network Enterprise Center (NEC) at Fort Bragg, North Carolina. The fixed price under NCI's ITES-2S contract is valued at approximately $14.9 million.

Under the contract, NCI will continue to support the NEC's Non-Secure Internet Protocol Router Network and Secure Internet Protocol Router Network. Services include end-to-end IT services, systems integration and testing, field support, information and network security, and network administration.

NCI will also provide planning and service delivery for the operations and maintenance support of the NEC's installation and remote site distributed telecommunication, computing, data, and network environments.

BAE Systems orders NAVICS IP-based integrated communications for British navy

BAE Systems has ordered an integrated communication system from Rohde & Schwarz to equip the British Royal Navy's Type 26 Global Combat Ship (T26 GCS).

The communication system, which would cover internal and external communications, is built around the Rohde & Schwarz NAVICS IP-based switching system that interconnects the distributed onboard voice terminals via a uniform IP network. The result of using a secure, ruggedized IT technology is a reduction in the number of voice terminals and the ability to use ATEX smartphones within security-critical environments, company officials say.

The VHF/UHF and HF transceivers from Rohde & Schwarz's M3SR family of radios will handle external communications. The radio equipment will provide TRANSEC and high-speed data transmission. RF filters and hopping EPM filters will help enable interference-free communication. At the same time, a common infrastructure named "shared network infrastructure" and "shared computing environment" will be set up for all onboard services.

Super Hornet and Growler fighter jets to get new avionics from Harris

Harris Corp. has won a two-year, $29 million full-rate production contract from the U.S. Navy to deliver avionics components to improve the targeting capabilities of flight crews on the U.S. and Australian F/A-18 E/F Super Hornet fighter aircraft and EA-18G Growler electronic attack fighter aircraft.

The newly ordered avionics are part of the Distributed Targeting System, which is designed to improve the aircrafts' networking capabilities, enhance targeting precision, and reduce the time from sensing to shooting.

The Super Hornet provides precision strike capability, while the EA-18G Growler – derived from the Super Hornet – is the U.S. Navy's newest and most advanced airborne electronic attack platform.

Figure 8 | EA-18 Growler preparing to make an arrested landing on the flight deck. Photo courtesy of U.S. Navy/MC3 Chris Cavagnaro.

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Defending DoD from cyberattacks, getting to the left of the boom

By John McHale, Group Editorial Director

INTERVIEW

In this Q&A with Deon Viergutz, Vice President of Cyber Solutions at Lockheed Martin Information Systems & Global Solutions in Fort Meade, Maryland, he discusses the most common cyberattacks against the military, the biggest threats going forward such as insider attacks, and how Lockheed Martin leverages its Cyber Kill Chain approach to defend against cyberattacks. Edited excerpts follow.

MIL-EMBEDDED: ***Please provide a brief description of your responsibility within Lockheed Martin and your group's role within the company.***

VIERGUTZ: I run the Cyber Solutions business under Lockheed Martin Information Systems and Global Solutions. We provide the full spectrum of cyber services and solutions from defensive to offensive capabilities for intelligence and defense customers. I am also responsible for the Lockheed Martin Cyber Center of Excellence in Fort Meade, which brings company employees together with defense and intelligence customers and industry under one roof to solve cyber challenges. Significant work is performed there as it is close to the future site of the U.S. Cyber Command's Joint Operations Center.

We provide cyber capabilities in business platforms and systems. Cyber is a growing part of Lockheed Martin and an area we have focused on for many years. We were doing cyber way before anyone ever called it cyber. We are making investments in education and in our workforce and how we run our business corporate wide and cyber is an integral part of that. [For information on cyber-related employment opportunities with Lockheed Martin go to www.lockheedmartin.com/us/what-we-do/information-technology/cybersecurity.html.]

MIL-EMBEDDED: ***What types of cyberdefense problems do your solutions solve? Please provide examples of current military cyberdefense programs/applications Lockheed Martin is involved in.***

VIERGUTZ: From a macro level we have been looking at cyber for 30-plus years and therefore everything we do and every program we administer there is a cybersecurity thread that runs through it. To put it into military terms there are traditionally four domains – sea, land, air, and space. Now we have a fifth domain, cyber, which runs all the way through the other four domains.

One example of where we are enabling cyberdefense throughout the four domains is in the DoD Cyber Crime Center (DC3), which is a program where we provide cyber capability and forensic support to the country's largest forensic laboratory work through cyber evidence in support of the customer. It includes digital and multimedia forensics examination, analysis, research, development, test and evaluation, information technology, and cyber analytical services.

Another program lies within the Defense Information Systems Agency (DISA) where we are managing the transformation of their Global Information Grid under the Global Systems Management Operations contract. We provide DISA with analysts, tools, and capability for this effort, which is helping defend the largest network in the world, the DoD Intranet. Lockheed Martin analysts and DoD personnel work in partnership.

We also earned the NSA Cyber Incident Response Assistance (CIRA) accreditation from the agency's Information Assurance Directorate (IAD) last year.

MIL-EMBEDDED: ***What is the Cyber Kill Chain?***

VIERGUTZ: The Cyber Kill Chain goes back to Lockheed Martin's approach to cybersecurity developed more than a decade ago where we needed to defend our own networks, which are large and global in scale. We developed a methodology that emphasizes intelligence analysis characteristics and prediction to ensure a rapid and agile response to ensure the reliability of our systems.

When it comes to catching cyber threats we look at it from an 80/20 perspective. In other words 80 percent are going to be caught by traditional products already out there that defend against

phishing and malware. The other 20 percent we define as advanced persistent threats, which are the most difficult to detect and can cause the most serious damage across various network sectors. This approach was a key part in developing the Cyber Kill Chain to defend our own networks.

The Cyber Kill Chain is comprised of seven phases of intrusion where the adversary is using a weapon against the network:

- Reconnaissance
- Weaponization
- Delivery
- Exploitation
- Installation
- Command and control
- Action on objectives

When an adversary is delivering cyber weapons against us we look across those seven steps and at what methods or tools we can use to protect against each one. We figure an adversary will have to be right seven times to be successful against our defenses.

The valuable thing about the Cyber Kill Chain is the return on investment in each of those phases. We look at what tools we used to stop a threat at phase two, evaluate their effectiveness and change them out if necessary. There is a return on investment at each step.

This methodology can go further. For example, if we stopped a threat at phase one we look at how much further it would have gone through the chain if we had not stopped it at the first step.

The chain was part of a strategic decision we made years ago to protect our own networks given the criticality of what is on those networks. We are now applying this same approach and its methodologies to the DoD, government agencies, and the industry. We have also gathered more than 12 years of threat data such as tactics, techniques, actor behavior, and how to work around those threats so we can – to use a military term – get left of the boom. In other words, to see the threat and prepare for it before it happens.

MIL-EMBEDDED: ***What are the most common cyberattacks U.S. military organizations face and how do you defeat or counter them?***

VIERGUTZ: From the 80/20 perspective mentioned above most attacks within the 80 percent range are phishing attacks, looking for weaknesses in networks. The threats range from state actors to individuals. This broad range requires networks to make sure they have good network hygiene whether they are government agencies or the industrial base.

The 20 percent are zero-day attacks and how you survive them comes down to how fast you patch the holes. They could be looking for IP, reconnaissance, or to inflict damage or harm and it is clear that the threats are getting more and more tenacious and continuous. They are not one and done. Unfortunately, there is no silver

bullet to stop them. You must assume the attacks will continue and will vary in terms of complexity and intent. To combat the advanced persistent threat you must be positioned for something unknown in the future. This is why the seven-part Cyber Kill Chain is effective. Adversaries have to be successful seven different times.

MIL-EMBEDDED: ***Are defense suppliers more or less likely to be victims of cyberattacks from terrorists or unfriendly nation-states when compared to DoD sites?***

VIERGUTZ: Like other defense prime contractors and suppliers we are providing products and services to the DoD and federal customers so our data is of interest to potential cyber adversaries. We focus on identifying these threats as we can't take action against those delivering the attack. However, we can report it to the appropriate authority, who will then determine the appropriate action. We do share the threat information that we gather.

MIL-EMBEDDED: ***What cyber threats keep you up at night? How can existing technology help prepare for such threats?***

VIERGUTZ: Two things. First is securing the supply chain. There are thousands of suppliers around the world feeding into military systems. This is something we are always thinking about and making sure we understand what more we can do as a prime contractor. We currently apply our Cyber Kill Chain approach to help ensure the security of our own supply chain and work with our suppliers to help them secure their own channels.

The second is defending against insider threats. This requires an overarching approach to protecting the infrastructure. Insider threats can be mitigated by good cyber hygiene among employees with effective password protection, etc. We've also implemented insider threat protection tools within infrastructures by leveraging our tool called LM WISDOM ITI. It a predictive analytics and big data technology tool that monitors and analyzes rapidly changing open source intelligence data such as social media and turns this data into actionable intelligence. Organizations can use LM WISDOM ITI to monitor behavior patterns among employees to see where a potential insider threat might be emerging.

"THERE ARE THOUSANDS OF SUPPLIERS AROUND THE WORLD FEEDING INTO MILITARY SYSTEMS. THIS IS SOMETHING WE ARE ALWAYS THINKING ABOUT AND MAKING SURE WE UNDERSTAND WHAT MORE WE CAN DO AS A PRIME CONTRACTOR. WE CURRENTLY APPLY OUR CYBER KILL CHAIN APPROACH TO HELP ENSURE THE SECURITY OF OUR OWN SUPPLY CHAIN AND WORK WITH OUR SUPPLIERS TO HELP THEM SECURE THEIR OWN CHANNELS."

MIL-EMBEDDED: ***Looking forward, what disruptive technology/innovation will be a game changer for cyberdefense? Predict the future.***

VIERGUTZ: The number one thing I'm focused on is developing a self-healing system for cyber defense. In other words a hardened system that assumes it is going to be attacked and can implement methods to not only stop an intrusion, but learn from it and "heal" from the damage.

The other game changer for cyberdefense will be the convergence of cyber with signals intelligence and electronic warfare. We will merge these three disciplines to enable advanced analysis and big data capabilities and enable persistent situational awareness in real time. This will help look across networks on a global scale and engage the health and wellness of those networks and how they are tied to the workforce operating those networks. **MES**

Deon Viergutz *currently serves as the Vice President of Cyber Solutions at Lockheed Martin Information Systems & Global Solutions, an organization that delivers full-spectrum, advanced cybertechnology and services for the U.S. government. Previously, he served as the Director of Operations and also led the Analytics & Data Acquisition Division within the Cyber Solutions line of business. His primary customers are located at Fort Meade with a focus on cybersecurity, information assurance, information technology, signals intelligence, mission management, cloud computing, and advanced analytics. Currently, Viergutz serves as the president of the Fort Meade Alliance, Fort Meade Alliance Foundation, and chair of the Fort Meade Alliance Executive Committee and Board of Directors. He also serves on the economic development and cyber-related boards of the Maryland Military Installation Council and the National Security Scholarship Program. He earned a Bachelor of Arts degree from the University of La Verne, California, and a Master of Business Administration from the University of Maryland, University College. He also served in the U.S. Army from 1989-1992.*

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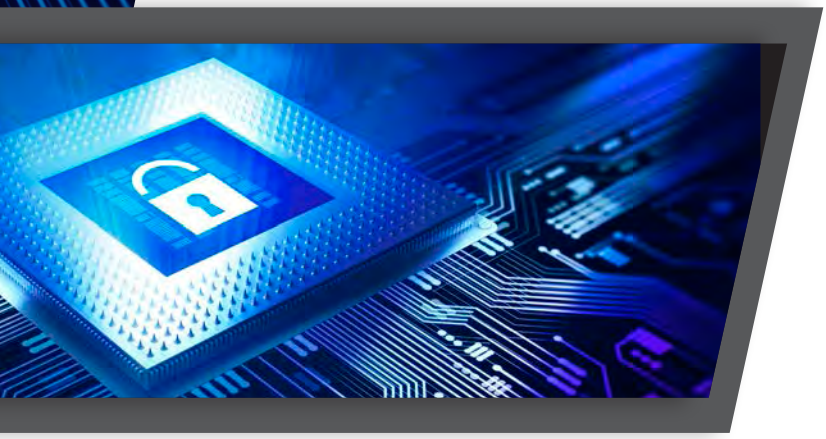

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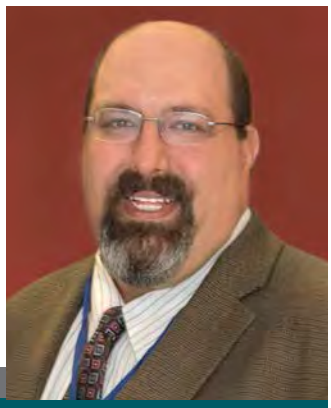
RF & microwave innovation drives military radar and electronic warfare applications

By John McHale, Group Editorial Director



INTERVIEW

In this Q & A with Bryan Goldstein, General Manager of the Aerospace and Defense business unit at Analog Devices, he discusses how innovations such as Gallium Nitride (GaN) technology is driving the radio frequency (RF) and microwave market and, in turn, radar and electronic warfare designs. He also comments on the evolution in defense procurement. Edited excerpts follow.

MIL-EMBEDDED: ***Please provide a brief description of your responsibility within Analog Devices and your group's role within the company.***

GOLDSTEIN: I am General Manager of the Aerospace and Defense business unit at Analog Devices. This year Analog Devices is celebrating its 50th anniversary. The business unit focuses on innovation at the chip level all the way through the system level for aerospace and defense system designers. We have a portfolio of advanced differentiated component and system level solutions focused on reduced size, weight, and power (SWaP) as well as development cost and time to market. At this division we specifically focus on radar, military communications, electronic surveillance/countermeasures, space, avionics for unmanned vehicles, commercial and military aircraft, and advanced munitions applications.

With the acquisition of Hittite Microwave, we have significantly expanded our RF & microwave portfolio such that we can now provide full RF, to bits and back, solutions to our customers. ADI can provide the complete signal chain for most aerospace and defense electronic applications and can provide standard and custom solutions at the component, module, and subsystems level.

MIL-EMBEDDED: ***What military applications are the best bets for RF and microwave suppliers?***

GOLDSTEIN: There are a number of areas that are very exciting right now within aerospace and defense. Phased array antenna applications are exciting due to their large semiconductor volume requirements. Although phased array technology has been around for many years and is used on many high-end military systems, the commercial availability of lower cost, simplified integrated solutions has enabled a whole new tier of customers and applications. Active collision avoidance systems on unmanned aerial vehicles (UAVs), next generation weather radars, and satellite and land-based communication systems all offer huge opportunities for RF & microwave devices and subsystems.

Electronic warfare – surveillance and countermeasure – systems also offer great potential, with significant activity in this market relying on high-performance next-generation devices to enable wide bandwidth capability. Solutions range from solid-state high power amplifiers and RF/microwave products to ultra-high-speed analog to digital converters (ADCs) and digital to analog converters (DACs).

MIL-EMBEDDED: ***As a designer of RF and microwave technology, what trends regarding military designs and applications in this niche did you see emerging at the International Microwave Symposium (IMS) held last spring?***

GOLDSTEIN: The increased focus on phased-array antenna, high-frequency transceivers, and direct-conversion receivers are all trends that were evident at IMS and are driving our customers' next-generation designs.

For example, in military communications there is a move to software definable radio (SDR) architectures that will reduce the number of different radio platforms currently used by the armed forces. New configurable architectures and devices, using silicon germanium (SiGe) and complementary metal-oxide semiconductor (CMOS) processes were on display and presented at the conference, which again continues to drive the goal to software definable systems. Higher integration in SDR applications also enables cognitive functionality, anti-jamming, and encryption.

We also continue to see a trend towards higher frequency analog-to-digital converters, simplifying receiver architectures, reducing size and complexity by reducing frequency down-conversion requirements while providing increased bandwidth.

In the areas of radar and electronic countermeasures, the increased development and acceptance of solid-state power amplifiers utilizing Gallium-Nitride (GaN) technology was also apparent throughout the show. This is a significant area of investment for ADI, as the improvements

that have been made in the efficiency, cost, and reliability of GaN devices and power combining methods are now starting to be actively implemented in military systems, replacing less reliable traveling wave tube amplifier technology.

MIL-EMBEDDED: ***RF and microwave technology fuels much of the radar and electronic warfare development in the military market, but the automotive radar market promises even larger growth. How is innovation in automotive radar driving military RF and microwave designs?***

GOLDSTEIN: The dynamic here is actually very interesting. Clearly much of the original radar work and phased array technologies were developed and targeted for defense applications. The automotive market is making use of this work, but is now driving towards lower cost, higher volume, and more highly integrated solutions. Analog Devices is heavily involved in developing these solutions. The aerospace and defense industry looks to leverage these advancements made in the commercial market whenever possible. For example, the advancements in automotive radar are now feeding back into lower-cost solutions in aircraft collision-avoidance systems and radar imaging applications, completing the innovation circle and supporting advanced development activities, which previously would have been cost-prohibitive due to the lower-volume nature of these defense application areas.

Going forward, we see this synergy continuing as the defense industry continues to drive applications requiring higher levels of performance, which we may use in commercial applications having the volume to support the development and manufacturing infrastructure costs.

MIL-EMBEDDED: ***Do you see growth for RF and microwave technology use in military applications with the announced increases in the Department of Defense (DoD) FY 2016 budget or will this market remain flat like other military niches?***

GOLDSTEIN: At first glance, the DoD FY16 budget and future initiatives show the defense industry growing, albeit at a moderate pace. Looking beyond the high-level budget numbers, the trends towards upgrading technical capabilities of existing electronics platforms in this area point to a larger than market average growth for RF and microwave. Furthermore, activities such as the Defense Innovation Initiative, which look to identify investments in innovations to sustain and advance the DoD's military dominance, also look promising for these technology areas. Similarly, Defense Advanced Research Projects Agency's (DARPA's) projected funding is also increasing and a number of their key initiatives will drive long-term growth in this area.

From a specific applications perspective, missile defense, advanced munitions, communications, satellite, and space programs – as well as electronic surveillance and countermeasure systems – were all identified as target areas for funding; all of these heavily rely on RF and microwave technology. Comparing our own activities and engagements

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with the defense primes, driven by the defense budget, the continued drive towards more systems using phased array technology, advanced communications, and high-efficiency solid-state power amplifiers indicates that the electronics content of these systems will grow significantly. Overall, it looks to be an exciting time for RF and microwave in the aerospace and defense arena.

MIL-EMBEDDED: ***Are you also seeing an increased demand for commercial-off-the-shelf (COTS) technology and commonality from your defense customers?***

GOLDSTEIN: There is a significant push within aerospace and defense toward open architectures to enable system reuse, thereby reducing system development time and cost and creating increased competition through second-sourcing. This is a divergence from past developments, which were based upon proprietary architectures that relied on sole-source development and provided limited competition. For example, recently the Navy Surface Electronic Warfare Improvement Program (SEWIP) Block III program demanded open architectures to enable subsystem competition to allow hardware reuse on other platforms. There will be many suppliers that will bid to be a part of this long-running program; that competition will provide long-term benefits to the Navy.

Leveraging open architectures and COTS hardware gives both system designers and component designers more options when it comes to transferring technologies between platforms. The commonality provides a clear roadmap for product development and clarifies definitions for new products, minimizing investment risk. The companies investing in new products have clear definition and know that their products will be needed for very long life cycles.

There is also a shift in procurement philosophy at the DoD as it now expects industry to invest in new technologies more strongly on its own rather than always waiting for government funding. In turn, the government is engaging more deeply with industry partners, sharing product roadmaps so that all can understand the long-term scenarios for sustainment and obsolescence management. Industry seems to be getting on board with this philosophy; as a result, there is a tighter relationship between the suppliers and the government customers. Moreover, the number of partners that the customers wish to support is reducing. This type of procurement atmosphere will put more pressure on smaller firms that can't afford to invest on their own and don't have the breadth of technologies to be a broad partner. Suppliers such as Analog Devices have an advantage because of their breadth of portfolio, capabilities, markets, and the scale of their technology investments. Serving many markets allows the investment in technologies to be shared across multiple businesses and creates sales volumes that will ultimately reduce total system cost and speed the release of new technology.

MIL-EMBEDDED: ***Looking forward, what disruptive technology or innovation will be a game-changer in the RF and microwave world? Predict the future.***

GOLDSTEIN: There are several areas of disruptive technologies that we are focused on at Analog Devices. We continue to improve the efficiency and reliability of GaN power amplifier technologies and develop power-combining techniques that have allowed us to demonstrate power levels up to 32 kW at X-band. These improvements will continue and we will move quickly to Ka-band frequencies and beyond.

Phased-array applications are pushing the developments of highly integrated SiGe core chips, which combine amplitude and phase control as well as digital and bias control onto a single silicon device. This technology has simplified the system and lowered the cost dramatically enough to finally create a viable high-volume market. High-frequency transceivers and high-speed converters will change the communications, radar, and electronics surveillance/countermeasures markets dramatically.

Software-defined functionality will create cognitive, programmable systems that can be configured for multiple applications that are secure and impossible to jam. Direct-conversion receivers and synthesizers will significantly simplify new architectures, while higher levels of integration at the chip, package, and subsystem levels will dramatically reduce the SWaP of future systems without negatively affecting system performance.

Lastly, there is an emerging offshoot from the traditional high-reliability space market that requires smaller, shorter mission life: low-cost satellites. These communication constellations are envisioned to have thousands of satellites. Such systems require a new breed of RF and microwave components, which will require some level of radiation tolerance, a small amount of incremental environmental screening, and a level of configuration control. **MES**

Bryan Goldstein, *General Manager of the Aerospace and Defense Business Unit of Analog Devices, Inc. (ADI), is responsible for all aspects of the business as well as product and advanced technology development for ADI's modules, subsystems, and high-reliability product domains. He has more than 25 years of experience in the aerospace and defense industry, with specific expertise in the design and manufacture of microwave modules and subsystems. Most recently, Mr. Goldstein served as Vice-President of the Modules, Subsystems and Space Business Unit of Hittite Microwave Corp. – prior to its acquisition by Analog Devices. Before joining Hittite, Goldstein worked at Arcom Wireless; Sanders, a Lockheed Martin Company; and the Raytheon Missile Systems Division. Over his career, he has worked on the Patriot Missile system, the Longbow Missile program, and other key defense platforms. Goldstein holds a B.S. in Electrical Engineering from Northeastern University and an M.S. in Electrical Engineering from the University of Massachusetts.*

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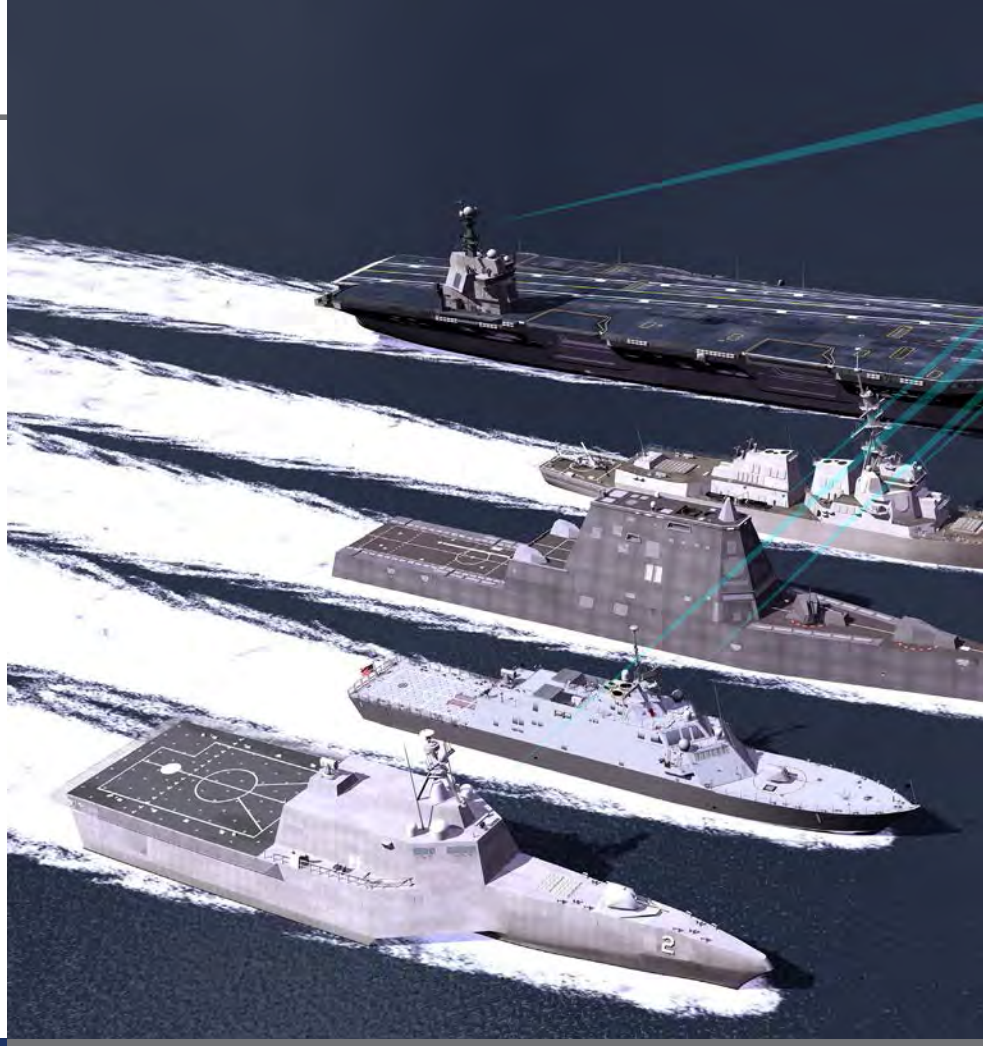
U.S. Navy's electronic warfare modernization effort centers on COTS

By Sally Cole, Senior Editor

"Block 2" of the U.S. Navy's Surface Electronic Warfare Improvement Program is the first commercial off-the-shelf (COTS) electronic warfare system to be built.



The U.S. Navy's Surface Electronic Warfare Improvement Program (SEWIP) will leverage open architectures as it replaces the legacy AN/SLQ-32(V) electronic warfare system through a series of block upgrades. Photo courtesy of Lockheed Martin.

The U.S. Navy's Surface Electronic Warfare Improvement Program (SEWIP) is a series of evolutionary development "block" upgrades for Raytheon's (Waltham, Massachusetts; www.raytheon.com) legacy AN/SLQ-32(V) electronic warfare system, designed to provide incremental capability enhancements to enable its ships to continue to outpace threats.

Introduced in the late 1970s, the original AN/SLQ-32 electronic warfare system's mission was to provide early detection, signal analysis, threat warning, and protection from anti-ship missiles. The integrated shipboard combat system is equipped with a full suite of electronic warfare capabilities that can be managed and controlled manually from a console either semi-manually or automatically by the host combat management system, according to the Navy.

In 2013, 258 electronic warfare systems, in seven variants, were deployed worldwide. The current SEWIP upgrade effort features four blocks – with a significant focus on obsolescence mitigation – for these electronic warfare systems.

The evolving electronic warfare threats the Navy is facing now involve such aspects as wider frequency bands, low power signals, frequency diversity, complex emitters, electromagnetic capability/electromagnetic interference, and flight profiles.

SEWIP Block 1

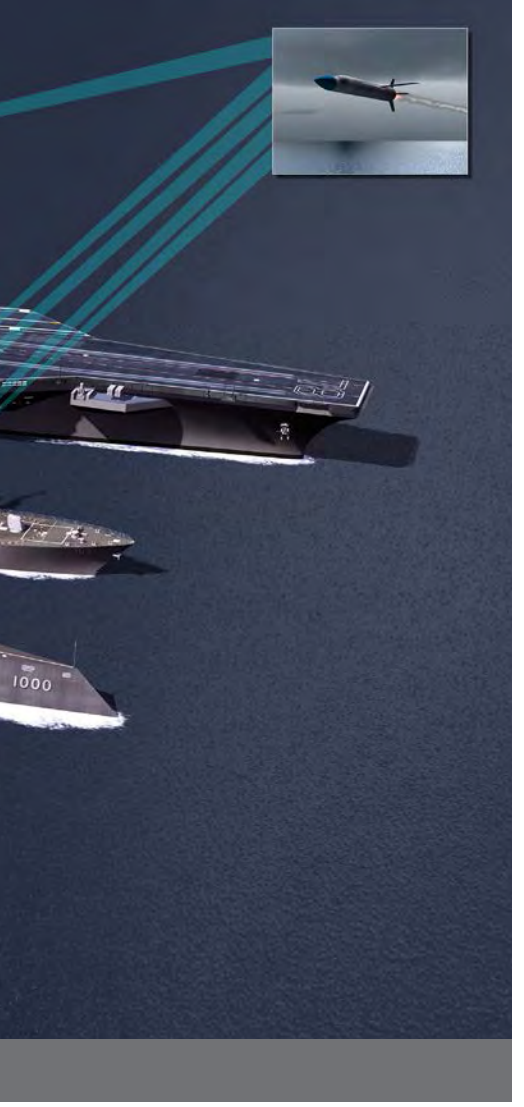
Block 1 focused on enhancing electronic warfare capabilities of existing and new ship combat systems to improve anti-ship missile defense together with countertargeting and countersurveillance capabilities. Obsolescence mitigation was addressed for Block 1 by incorporating electronic surveillance enhancements and improved control and display.

SEWIP Block 2

Block 2 upgrades are currently underway and are designed to provide enhanced electronic support capability by upgrading the electronic support antenna and receiver, as well creating an open combat system interface for the AN/SLQ-32.

The Navy awarded Lockheed Martin (Bethesda, Maryland; www.lockheedmartin.com) a $154 million contract to upgrade the fleet's electronic warfare defenses against evolving threats.

Under this Block 2 contract, Lockheed Martin is providing additional systems to upgrade the AN/SLQ-32 systems on U.S. aircraft carriers, cruisers, destroyers, and other warships with key capabilities to determine whether or not the electronic sensors of potential foes are tracking the ship.



"THE EVOLVING ELECTRONIC WARFARE THREATS THE NAVY IS FACING NOW INVOLVE SUCH ASPECTS AS WIDER FREQUENCY BANDS, LOW POWER SIGNALS, FREQUENCY DIVERSITY, COMPLEX EMITTERS, ELECTROMAGNETIC CAPABILITY/ELECTROMAGNETIC INTERFERENCE, AND FLIGHT PROFILES."

As another part of this deal, Mercury Systems Inc. (Chelmsford, Massachusetts; www.mrcy.com) was awarded a $7.1 million contract by the U.S. Naval Warfare Center's Crane Division to supply advanced radio frequency tuners, digital receivers, and related equipment to Lockheed Martin to be used as spares during the installation of the AN/SLQ-32(V)6 electronic countermeasures system on U.S. Navy and Coast Guard ships.

"The Navy's electronic warfare focus is on electromagnetic dominance," says Joe Ottaviano, Electronic Warfare program director for Lockheed Martin Mission Systems and Training.

In other words, it's necessary to be able to detect threats working in signals ranging from low-frequency RF to those within the visible light and infrared parts of the spectrum. "This is a push not only by the Navy but also the entire Department of Defense. Technology is enabling threats to become more

complex, so the systems that deal with threats are also increasingly complex," Ottaviano notes.

Responding to threats with a hardware change is no longer considered acceptable, for example. "Threats need to be dealt with through on-the-fly system upgrades rather than waiting for a new hardware piece to become available," Ottaviano explains. "So we're seeing a shift toward DC-to-daylight systems to outpace threats."

Electronic warfare is a much different type of challenge than radar, because while a radar knows when a signal was sent, what sent it, what it looks like, its intent, and roughly when it will return and what it will look like, typical electronic warfare systems – whether RF-based or based on visual electro-optics – can't determine any of these properties. "But the purpose of electronic warfare is to determine a signal's intent quickly to assess whether or not it's a threat to ongoing operations," points out Ottaviano.

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Block 2 creates open, reprogrammable architecture

In terms of Lockheed Martin's involvement in the Navy's SEWIP Block 2, the goal is to help keep pace with expanding threats – bandwidths becoming wider – by upgrading the antenna, receiver, and processing systems. This capability began with Block 1. "Block 2 is the first step toward creating an open architecture with a reprogrammable on-the-fly-type electronic warfare system for the Surface Naval platforms," Ottaviano says. "The blocks of SEWIP all build off each other – each one brings more capability," he says.

Block 2, in particular, zeroes in on detection. It encompasses an open "agnostic sensor" combat-management system interface, which is the first of its kind to be deployed on Navy ships because it simply publishes data anyone can pick up. This makes it unnecessary to "redo" interfaces, according to Ottaviano.

The main achievement of Block 2 was the creation of an open architecture with open signal processing. "We've moved away from custom processing, which was common in many military systems during the '80s, '90s, and 2000s," Ottaviano says. "Now, the government and industry are embracing open architectures. The programmability it enables allows us to deal with threats – whether it's an FPGA or signals intelligence work. So we're seeing a shift from custom processors to off-the-shelf processors, which gives us the next level of flexibility to literally be able to reprogram on-the-fly in real time during engagement."

Block 2 brings processing capability improvements

Processing capabilities are improving and enabling operations in real time that weren't possible three years ago.

"Now, we can reprogram the front end of a system in real time, and we're seeing the ability to inject RF into FPGAs directly," Ottaviano explains. "This is an exciting

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capability that opens up all kinds of new options. The amount of processing power we can bring to bear continues to improve, and the tools are finally catching up. As the tools improve, we're able to better manage its development." This is a huge step forward, because everyone jumped into open architectures before the tools were really ready.

There's also "a big effort going into general-purpose (GP) computation on GPUs, which are even more programmable and open in some ways than FPGAs," he adds. "It now takes mere seconds to upgrade a system, as opposed to 30 seconds."

Biggest Block 2 challenges

The front-end analog-to-digital conversion market was the biggest challenge, according to Ottaviano.

"As threats widened, it became the focal point. We keep moving the 'choke point' of the system closer to the front end," he explains. "Ultimately, the front-end analog-to-digital conversion is the next thing we're working to conquer."

Why? It's the "limiting factor to how open the front end can be, how wide the system can be at any one given point in time," Ottaviano says. "So we're working toward widening bandwidths,

EW pod in a single unit

Lockheed Martin engineers are testing and developing an electronic warfare (EW) pod that they say is a self-contained electronic warfare package, comprising an entire suite of EW capabilities in one unit.

Testing of the pod is being performed in Lockheed Martin's advanced anechoic chamber.

"Our electronic warfare solution offers the capability to understand the electromagnetic battlespace through passive detection capabilities for advanced threats, advanced countermeasures, and a framework to easily integrate future upgrades," says Brigitte Aungier, Electronic Warfare business development manager for Lockheed Martin.

Figure 1 | Testing of SEWIP is being done on the USS Freedom littoral combat ship. Photo courtesy of Lockheed Martin.

while maintaining the signal quality that everyone needs. Until recently, the challenge was that the commercial market drove the analog-to-digital devices."

Overcoming obsolescence concerns with Block 2

As you can imagine, obsolescence of parts and components is a major concern during these types of upgrades. "It's the beautiful double-edged sword of COTS," notes Ottaviano. "A typical refresh cycle can be as short as 12 months, so shifting to COTS does present a challenge. While we've experienced obsolete parts, we haven't missed a beat."

Lockheed Martin saw the COTS challenges coming and has worked to manage it because of the savings COTS can bring. "But there's a lot of downstream work to manage obsolescence, in terms of needing tighter integration with your supply base," Ottaviano says.

Significantly, Block 2 is the first COTS electronic warfare system to be built. "It was a growing pain when we first started moving electronic warfare into COTS four to five years ago," he admits. "But it's a uniquely COTS system with key ingredients to hold it together."

While COTS components may not exactly be known for being as reliable as custom ones, SEWIP is "performing very well out at sea in a harsh environment, proving that Blocks 1 and 2 can indeed be achieved using COTS components," Ottaviano points out. One of the key requirements was a "processing board with 25-year reliability to ensure operation within uncooled environments," he says. "This makes it crucial to work with suppliers who deliver high-reliability parts; you can't deliver a fragile system."

Testing SEWIP

The U.S. Navy is testing out a version of the Surface Electronic Warfare Improvement Project (SEWIP) on its littoral combat ship USS Freedom (Figure 1).

The electronic warfare system enables USS Freedom and other naval ships to detect, classify, and prevent electromagnetic interference to thwart hostile forces from jamming the ship's ability to use radar, communications, or weapons.

Lockheed Martin scaled the SEWIP – within eight months – to operate on both the Freedom and Independence class littoral combat ships to improve their defensive capabilities by enabling the ships to detect targets not seen by other sensors.

Blocks 3 and 4

Block 3 involves electronic-attack capability improvements and, as you'd suspect, is mostly classified. Earlier this year, Northrop Grumman (Falls Church, Virginia; www.northropgrumman.com) was awarded a $267 million contract by the Navy to develop and manufacture the next-generation surface electronic warfare system.

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The goal of Block 3 is to enhance Raytheon's AN/SLQ-32 electronic warfare attack system through a series of upgrades that add new technologies and capabilities for early detection, signal analysis, threat warning, and protection from anti-ship missiles (Figure 2).

It will feature "active and passive arrays" to perform electronic warfare and communications functions with continuous 360-degree coverage, according to Northrop Grumman. The solution is designed to interface with the ship's combat management system, while multimission technology provides "unprecedented situational awareness" to effectively detect, track, and engage threats in high-clutter environments.

Block 4 is a future upgrade that will roll in an electro-optic or infrared approach to the spectrum, because threats are expanding to encompass more of the spectrum.

"Blocks 3 and 4 will both build upon Block 2 capabilities to provide more sensor data to that type of interface," Ottaviano says. "Once these are fully rocked out, they'll continue to be future-proofed against all of the threats that are emerging now, including the RF and infrared spectrum. This requires a solid understanding of the RF and signal environment and how to work within it better than your adversaries."

Figure 2 | Lockheed Martin and Raytheon experts demonstrated an early Block 3 version of SEWIP during the multinational Rim of the Pacific (RIMPAC) maritime exercise near Hawaii in 2012. Photo courtesy of Lockheed Martin.

Say, for example, that a new threat comes online; the sensors are easily upgraded. "The only thing you'd need to do is a simple software update, perhaps, and most of it is dealt with through quick parameter changes, so it's software-defined and done in real time," he adds. "The system sees new threats and figures out how to deal with them." Perhaps best of all, it can be reprogrammed on the fly to help keep the fleet or planes out of harm's way. **MES**

Next phase of U.S. Navy CANES program completed by Northrop Grumman

Northrop Grumman Corp. engineers have completed the U.S. Navy's Consolidated Afloat Networks and Enterprise Services (CANES) program's design, development, and limited-deployment phase.

CANES, a programmatic and technical consolidation of five older shipboard network programs, enables a modern, common computing environment across the U.S. fleet to modernize command and control, communications, computers, and intelligence (C4I); update cybersecurity; and streamline logistics.

Company officials say they accomplished the task by maximizing commonality in hardware and software. It leveraged its Modular Open Systems Approach-Competitive process to maintain continuous competition and gain the life cycle benefits of open systems architecture and commercial off-the-shelf (COTS) components and software.

"The Navy used one of our CANES configurations and applied it to a destroyer and a cruiser, demonstrating the flexibility of our design to reduce network variants by ship class," says Sam Abbate, Northrop Grumman Information Systems vice president and general manager, command and control division.

CANES will be installed on all platforms in the Navy's inventory objective, which includes ships, submarines, and land sites. CANES installations have already been made on several aircraft carriers and cruisers and on multiple destroyers. Installations continue on carriers, an amphibious assault ship, landing-dock ships, cruisers, and destroyers, according to a Northrop Grumman release. To date, Northrop Grumman deployed 37 shipsets for various ship classes.

Sidebar Figure | CANES units bound for installation aboard the aircraft carrier USS Ronald Reagan (CVN 76) are loaded and tested in the U.S. Navy Space and Warfare Command (SPAWAR) Network Integration and Engineering Facility prior to fleet delivery. (U.S. Navy photo by Rick Naystatt/Released.)

Base Material Technology – High Reliability Meets Low Loss

By Fred E. Hickman III – Senior Director of High Speed Digital Products, Isola

Radio Frequency (RF) and High Speed Digital (HSD) applications continue to push the envelope of electrical performance. Traditional PCB substrate solutions for these markets have historically been limited to ceramic-filled PTFE composites. These materials, while satisfying the electrical requirements, require complex and expensive processing that limits the number of fabricators able to manufacture such PCBs.

The gap between FR-4 and PTFE performance has been bridged by an entirely new range of substrate materials with low Dissipation Factors (Df), coupled with excellent thermal performance and processability. These products cost less than traditional composites and provide greater flexibility in the PCB design, as they can be used in HDI and hybrid builds.

Isola's Astra MT laminate and prepreg materials feature a Dielectric Constant (Dk) that is stable between 55°C and +125°C and a Df of 0.0017, making it an extremely cost-effective alternatives to PTFE and other commercial microwave laminate materials. Astra MT does not require the use of plasma cleaning, which is an offline and expensive PCB hole-wall preparation process. It also enables lower drilling costs as its unfilled system provides easier drilling and extends drill life.

The inherent mismatch between the Dk of conventional E-glass and the resin matrix can cause signal integrity issues. In differential pair circuitry, the Dk difference where signals may pass over resin-rich or glass-rich areas leads to signal speed differences resulting in skew and data errors. The use of square weave or spread glass and routing signals "off grid" to the glass weave have been able to partially mitigate this issue; however, there are new materials in the market that addresses the fundamental Dk mismatch. Isola's Chronon™ and GigaSync® laminates are homogenous materials with the resin and glass having the same Dk, thereby eliminating the root cause of the skew.

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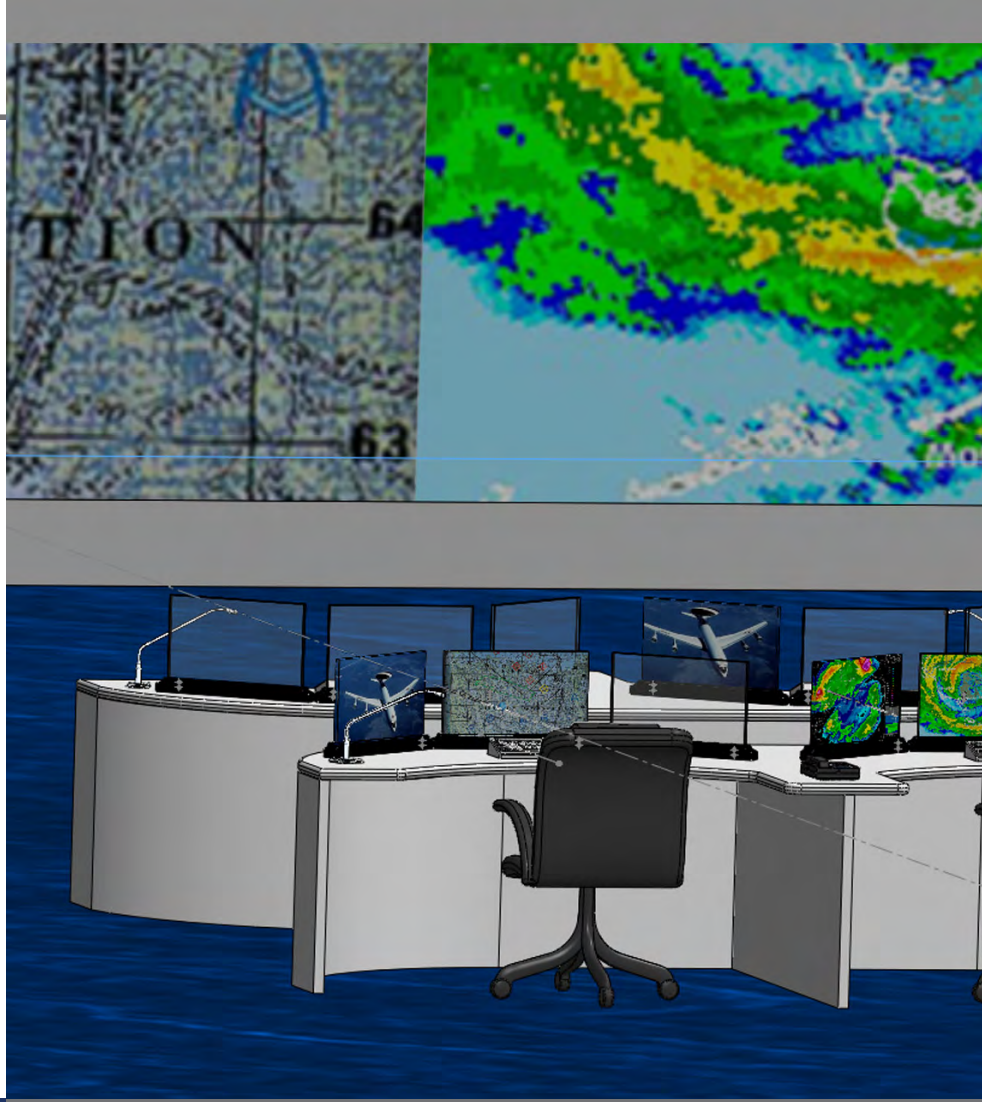
Key to military display technologies: System integration

By Tom Whinfrey

Increasing operator efficiency by encouraging collaboration and communication is a serious goal of military operations. New display technologies and trends can help create the next-generation military-operation consoles.



The vision of a video control-room wall, already a reality in some industrial applications, is coming soon to military operations centers. Diagram courtesy of IEE.

"What is possible" in technology seems to start in the imaginations of screenwriters and science fiction stories, and then moves sooner or later into reality. We've all watched movies such as Elysium or Minority Report and have seen the transparent computer screens and video walls with information being moved and tossed by swipe touch gestures. As consumers, we become aware of the newest technologies as they relate to making our lives easier or increasing our level of entertainment satisfaction, such as 4K televisions, heads-up displays (HUD) in our cars, and gaming platforms such as Xbox Kinect air-gesture technology.

Sometimes the trickle-down effect starts in the highest levels of military operation, such as the HUD in military aircraft. However, sometimes technology advances first mature in either the industrial or retail markets, achieving technological cost efficiencies before making their way into military operations.

Display innovation

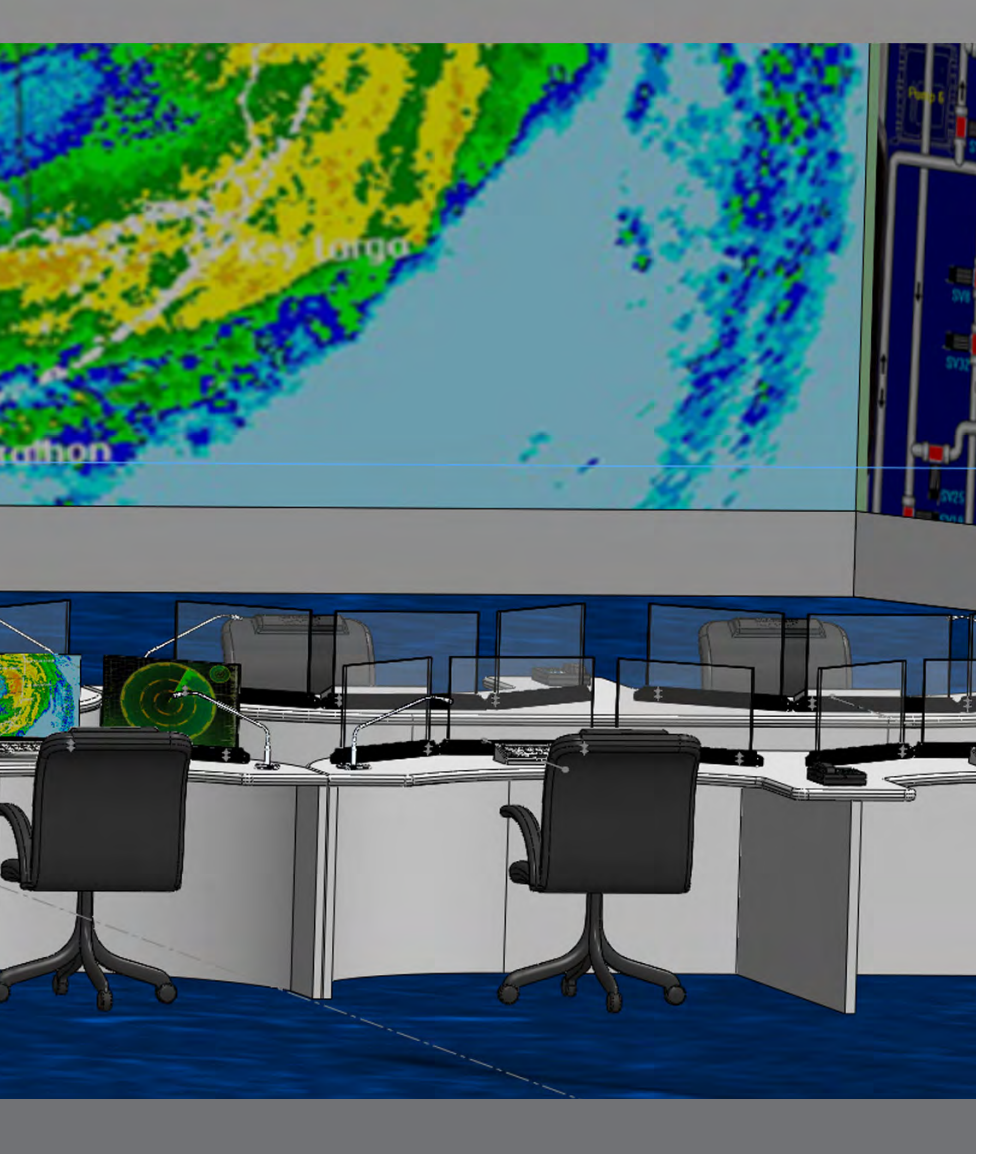
Monitoring industrial and consumer display technologies is a useful way to identify innovations that can effectively meet the needs of military customers, from cockpit to below deck. Some familiar technologies are now making their way into different levels of military operations.

Ultra-high resolution

A popular one is the Apple-termed "Retina Display," referring to ultra-high-resolution displays with 300 or more pixels per inch (PPI). In relatively recent history, maximum resolutions have progressed from FHD (1,920 by 1,080 resolution) to UHD (3,840 by 2,160), to 4k (4,096 by 2,160), 5K (5,120 by 2,880), and beyond. (See Figure 1.)

Today there are five-inch cellphone displays with 2,560 by 1,440 resolution, which is nearly 600 PPI. These super-high resolutions continue to develop in smaller and smaller packages as technology continuously enables higher PPI, which means more information can be displayed on smaller screen areas. Users can zoom in with much greater detail, which gives the user better accuracy in planning and execution.

Figure 1 | Used in shipboard and military environments, the 19-inch SXGA (1,280 by 1,024) rugged display is sealed against liquid penetration and can be used below-decks as well. Photo courtesy of IEE.



Transparent displays

Typically, this technology has been used in retail digital signage such as drink coolers with ad graphics on the display door, or in-store displays that literally box the physical advertised product. These boxes have been necessary to contain and redirect light out through the front of the transparent LCD to produce viewable video on the translucent surface. In the last six to eight months, this technology has taken a leap forward with freestanding transparent displays using OLED technology and innovative backlighting solutions, thereby eliminating the need to box, contain, and redirect the light. It's now possible to use these transparent displays as "windows," allowing people to see each other and interact on opposite sides of the display.

Touch technology

Projected capacitive (PCAP) touch screens, used on today's mobile devices, have set the bar for usability, with familiar multitouch gesturing. Not that long ago, the largest-size screen supported by PCAP was around 19 inches; however, this touch technology can now be seen in displays as large as 55 inches (and larger, very soon), opening the door to not only mobile apps, but also many other applications normally viewed on larger displays. Improvements are credited to advancements in coating technologies like indium tin oxide (ITO), along with additional points of connectivity on the touch panels.

In the past PCAP integration was held back in more industrial or mission-critical markets due to its lack of effectiveness when touched by operators with gloved hands. Today, more touch screens with PCAP products are able to function properly with increasingly thicker gloves. Quick sensitivity adjustments for "glove-mode operation,"

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higher speed controllers, and innovations like fingertip-stylus products for gloves are just a few things that are making PCAP touch a reality for military applications.

Software that detects air gestures have become popular through entertainment devices such as the Xbox Kinect, Nintendo Wii, and other gaming consoles. These devices are sensitive and fast enough to sense/detect motions. Software determines what motions are gestures and then acts appropriately when a predefined movement is captured as a defined gesture in the system.

Video formats

Large-scale video walls have necessitated the development of high-speed video trunks to display ultra-high resolution content (Display Port, DVI, HDMI). Higher resolutions mean more data to move to a display. Early versions of DVI and HDMI were capable of four to five Gbits/s, which was plenty fast to drive slightly higher than 60 Hz 1080p, but not nearly fast enough to handle new higher display resolutions, thus creating the need for faster connections.

Moving and storing increasingly larger amounts of video data has been a big contributor to the need for faster transports. All of the following are examples of high-speed serial interfaces currently being used:

- USB (1.1 to now 3.0) for external data
- HDMI (1.4 to 2) and Display Port (1.0 to 1.3) for video-to-display data
- Ethernet (10baseT to 1000baseT, and now 10GbaseT) for networking
- High-Speed Serial (copper or fiber): HD-SDI (SMPTE-292) and ARINC-818

Form factors

Ultra-narrow-bezel video walls continue to narrow image-to-image gaps, improving the seamless continuity of images across the LCD wall. When the image-to-image gap in tiled displays was around 12 mm, the information presentation lent itself to errors in interpretations. Thus, it was risky to rely on video walls in mission-critical situations. Today's large-format displays have closed the image-to-image gap to 5.5 mm and are moving to even smaller gaps, around 3.5 mm. At the same time, displays sizes are becoming larger and – importantly – thinner, allowing deployment in situations where depth is critical. (See Figure 2.)

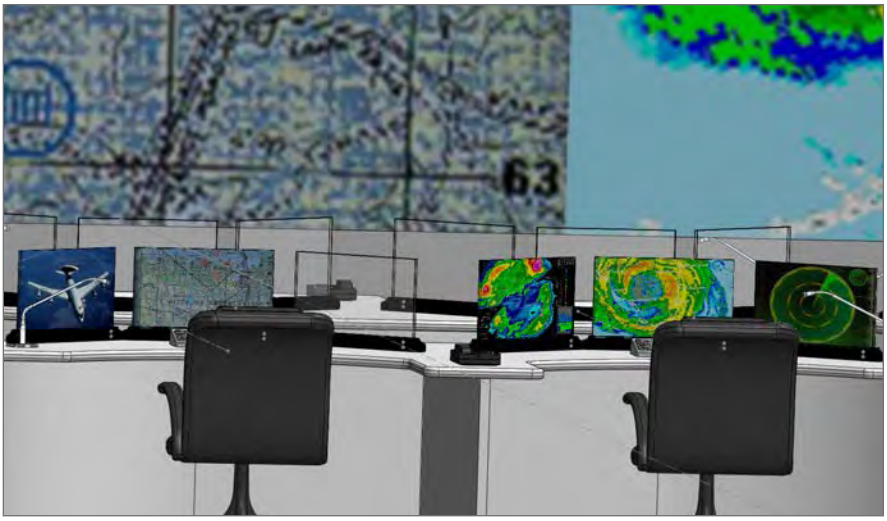

Figure 2 | This close-up of transparent displays and opposing banks of operator consoles was made possible by ultra-narrow monitors and robust networking technology. Diagram courtesy of IEE.

Usability defined

The definition of usability, as defined by ISO 9241-11, is "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use." In short, usability means making products and systems easier to use, while matching them more closely to user needs and requirements. In order to create the next generation of operator-display consoles, makers need to step back and look at the human interaction factors and address the points of effectiveness, efficiency, and satisfaction.

Effectiveness

Usability goes hand in hand with collaboration. Today's command-and control rooms still don't address one of the most obvious issues of encouraging collaboration among operators. That aspect is line-of-sight communications.

Displays are typically positioned upright in the visual path of the user, inhibiting direct eye contact with others. Many command rooms' designs have operators positioned against the walls in isolated silos of physical space. Operators have to turn and get up in order to communicate with other team members. Such a setup is inefficient and not conducive to communication.

With increased effectiveness and efficiency, users experience a greater level of satisfaction as their tasks become easier to execute; with this feeling of satisfaction, productivity levels increase. Decreased levels of frustration are more likely as the products support the task that the user actually needs to do.

Enabling efficiency in future military displays

Today's designs attempt to address ergonomic issues for operators with adjustable tabletops and correct viewing angles. However, the majority of console layouts are still focused on the individual operator's personal space and continue to promote a feeling of isolation. Effectivness and efficiency can be achieved by meeting the goal of providing the open physical environment for group collaboration, while also keeping the operator immersed in the tasks at hand.

"THE FUTURE DEMANDS THAT DISPLAY COMPANIES GET BEYOND MERELY THE DISPLAY AND BECOME TRUE SYSTEM INTEGRATORS."

Based on the endgame of increasing overall efficiency among colleagues and effectively sharing the workload by creating a more physically open workspace, a centralized control bridge would be an effective solution. In this configuration, operators are seated around this central area, next to and across from other operators. The display panel at each seat is transparent, enabling operators to drop their screen data and have an unobstructed line of vision to other team members. Information can be sent to the reverse side of the transparent display, enabling others on the opposite side to view it, or it can be sent directly over by various touch options.

The walls of the next-generation control room will hold ultra-narrow-bezel LCD video walls with 80- to 100-inch 4k or higher displays. Critical information such as moving weather maps, threat environments, surveillance data, warning data from systems sensors, and the like is in constant display, increasing situational awareness. From each operator's station, information can be pushed up to the video-wall display by a simple hand swipe or air gesture. These connected, high-resolution displays can present more information, and can also be organized and enlarged for detail.

The glue that holds all of these technologies together is advanced software and robust networking technology. The future demands that display companies get beyond merely the display and become true system integrators. The control-room vision described above is already a reality in some industrial network operations centers. Usability is reaching new heights; once these technologies are employed in military applications, it will be difficult to imagine how they operated without them. **MES**

Tom Whinfrey *is president and CEO of IEE, which makes enhanced displays for military and industrial markets. Prior to IEE, Tom served as president and CEO of Orion Defense Systems; he has also held senior-management positions at AiTech Space Systems and Northrop Aircraft. As an entrepreneur, Tom founded Orion Aviation, specializing in unmanned helicopters. You can reach Tom at twhinfrey@ieeinc.com.*

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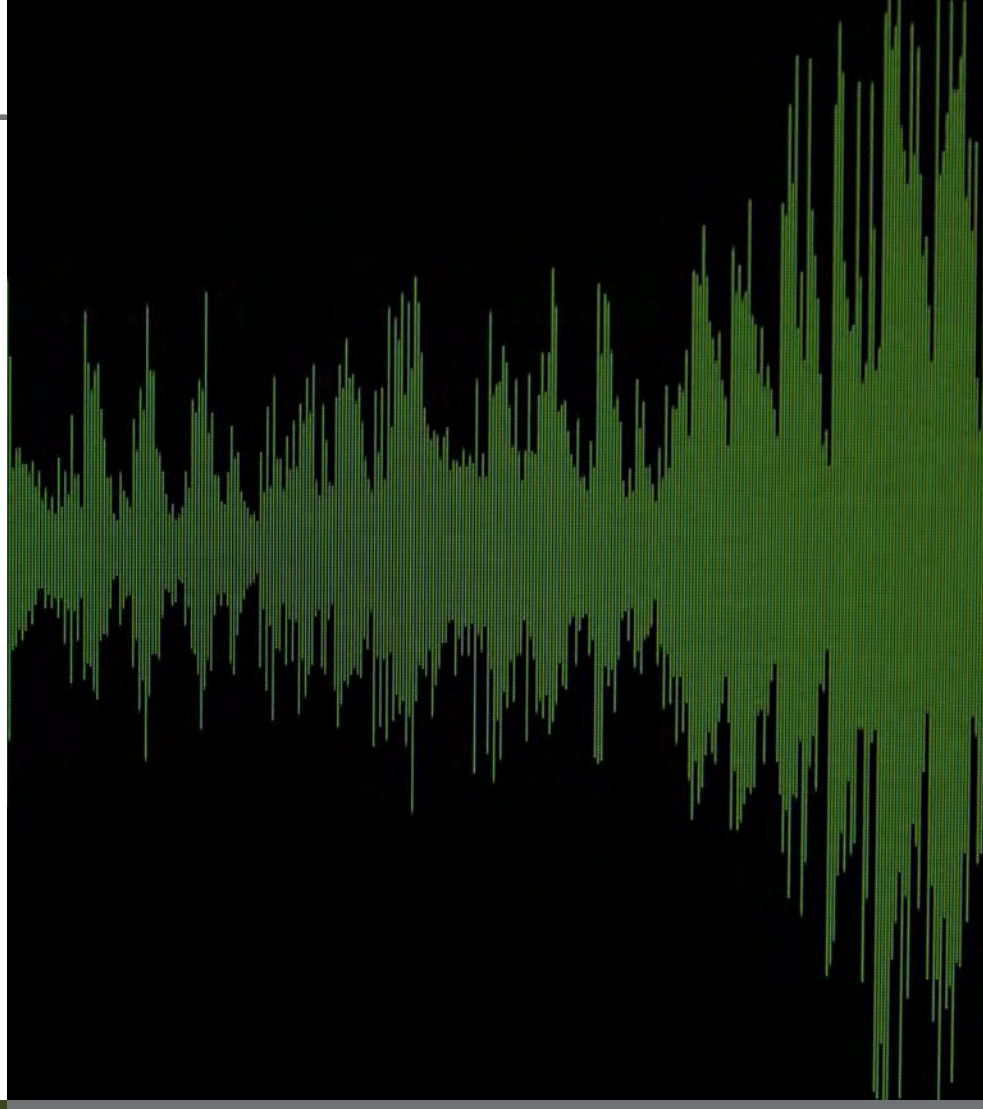
Test and measurement tackling demand for higher frequencies and wider bandwidth



By Mariana Iriarte, Associate Editor

Just as software-defined radios (SDRs), signals-intelligence systems, radars, and sonars are challenged by reduced size, weight, and power constraints, so are the test and measurement systems used to ensure their effectiveness.

Modern radio architectures for military applications are driving the demand for higher frequencies, digital modulation, and wider bandwidths. Couple that with the push toward reduced size, weight, and power (SWaP), and you are adding tons of complexity to designs.

Test and measurement solutions have been following the industry on this ride by continuing via open industry-standard modular architecture and expanding software-defined architectures that enable "mission-specific channel, capacity, and range needs," says Darren McCarthy, Marketing Manager for Rohde & Schwarz in Beaverton, Ore. "We have seen a steady increase in demand for high-performance products to support the different technology insertions. The test methodology incorporated to test individual radio waveforms is different than the efficient test methodology to test new software-defined radios. This creates a demand away from radio-specific testers to more general-purpose test and measurement equipment that is available as commercial off-the-shelf (COTS) to the broader radio industry."

Common test assets define a universal test platform

As military systems add complexity they must also add flexibility to enable commonality, which reduces training and maintenance costs and speeds up product development. In other words, users want a universal test system.

"Radio frequencies (RF) and microwave instruments need to be flexible – to be upgradeable by simply substituting or adding a new module; to make new measurements just by downloading a new software application. This approach also keeps a lid on the costs of documentation, training, spares, and maintenance. Additionally, industry standardization promotes competition, ultimately improving performance at a reduced cost," says Satish Dhanasekaran, General Manager, Mobile Broadband Operation, for Keysight Technologies in Santa Rosa, California.

"In both a development and manufacturing environment, for over a decade we have seen a continued effort from our customers to move from a radio-specific test architecture to a 'universal test platform' strategy," McCarthy says. "Rather than developing and using radio-specific test platforms for each radio waveform, customers that need to combine the multiple technologies into a single radio are designing the radios and test platforms for testability with common test assets."

Test assets range differently in each platform, "A software-defined radio can produce an unlimited number of radio waveforms. Let's say the three different radio formats are planned to be fielded by a UHF radio for one customer using the same SDR," he

continues. "Each radio format has a different modulation type, bandwidth, and frequency."

A good approach to the manufacturing process would be to use a Venn diagram, which according to McCarthy, is a good way to help customers understand the parameters needed during the process. Once that test platform is created, you can see the advantages of software-defined architecture that would fit in an atmosphere that changes to keep up with industry standards and new technologies. McCarthy's company offers the Rohde & Schwarz SMW200, a vector-signal generator, and the R&S FSW, a signal and spectrum analyzer, used for both commercial radio and military tactical development and testing. (Figure 1.)

Specifically, when a radio can produce unlimited number of waveforms, McCarthy says that "the production environment can be matured to focus on the test processes that actually focus on the variables expected to be found with tests rather than specific tests for each format. The modulation for one waveform might be 'worst-case' and be used as a proxy for other waveforms. It's the same with all other in-band and out-of-band radio tests. This matured method of test is similar to how the commercial technologies (cell phones) have been tested for years. A full conformance test for a cell phone to a wireless standard might take a week, while the confidence testing in a manufacturing environment to assure that phone will pass might only take a few seconds."

As the military moves away from more traditional standards of two-way radios to a network-based way of communications, the test and measurement industry follows right along. Technologies that are combined into a single radio design and a test platform is constructed with common assets; according to McCarthy, "it is safe to say that nearly 100 percent of top-tier radio manufacturers have moved in this direction or are in the process."

Figure 1 | Pictured is the R&S SMW200 and R&S FSW, a vector signal generator and signal and spectrum analyzer, respectively. Photo courtesy of Rohde & Schwarz.

GaN and PXI

Other technologies that drive RF test and measurement designs are PXI and gallium nitride (GaN), which also help enable cost-effective and efficient upgrades. "To address the simultaneous drivers of increase efficiency and improve spectral utilization, customers are driving designs for more efficient power architectures like envelope tracking with efficient new technology such as GaN," McCarthy says. GaN helps fill the needs of military customers that are asking for higher frequency and higher power.

For its part, PXI permits flexibility in the manufacturing processes. Keysight Technologies' M9451A PXIe Measurement Accelerator runs measurement FPGA algorithms, while in AXIe, the M8190A AWG has 5 GHz of bandwidth that provides testing on new radio

Marvin Test Solutions releases updates to its smart-weapon armament test systems

Engineers at Marvin Test Solutions released new variants of its MTS-916 Modular Target Simulators line, the MTS-916-6 and MTS-916-7. The MTS-916 replaces multiple obsolete target simulators for AGM-65 Maverick and AGM-114 Hellfire missile-guidance sections, as well as MAU-169 Paveway target-seeker kits.

The -6 variant enables the MTS-916 to be used to test AGM-65E/E2/L Laser Maverick seeker heads as well as AGM-114B/K/M/N/R versions of the popular Hellfire missile using the same I-level equipment, according to a company release. The -7 variant is designed to test laser-guided Paveway munitions, thus extending the flexibility and utility of the MTS-916 family.

"The latest versions of the MTS-916 family follow on the company's efforts to introduce more commonality and ease of use into armament test by enabling maintainers to have a common test solution for the AGM-65 and AGM-114 weapons systems, considerably simplifying logistics and sustainment costs for operators," says Major General Steve Sargeant, USAF (Ret.), and Chief Executive Officer of Marvin Test Solutions.

The MTS-916 is target simulator for optical, infrared, and laser-guided weapons such as the AGM-65 and AGM-65 Maverick missiles and guidance sections, MAU-169 Paveway kits, and AGM-114 missiles. Originally designed to replace the obsolete AN/DSM-129 (TV/CCD simulator) and the obsolete AN/DSM-787 (IR simulator), the MTS-916 is compatible with any Maverick tester using these legacy simulators such as the now obsolete AN/DSM-157 (GMTS) as well as the modern MTS-206, which is capable of testing Maverick and Hellfire missiles as well as LAU-117 and LAU-88 Launchers.

The MTS-916 family also supports the testing of MAU-169 Paveway kits (Laser), the AGM-65E/E2, L Maverick, and the AGM-114 Hellfire missile families. Laser variants of the MTS-916 employ a solid-state target design with no moving parts while the TV, CCD, and IR variants use a moving collimator architecture with precision movement control.

With the latest releases, the MTS-916 is now available in seven configurations:

- MTS-916-1 is used with TV and CCD Maverick seekers including the AGM-65A/B/H/K/J/Jx
- MTS-916-2 is used with IR Maverick seekers including the AGM-65D/F/F2/G/G2
- MTS-916-3 combines the capabilities of the MTS-916-1 and MTS-916-2
- MTS-916-4 is used with Laser Maverick seekers including the AGM-65E/E2/L
- MTS-916-5 is used with Laser Hellfire seekers including the AGM-114B/K/M/N/R
- MTS-916-6 combines the capabilities of the MTS-916-4 and MTS-916-5
- MTS-916-7 is used with Laser Paveway seekers including the MAU-169.

formats and signal threats, Dhanasekaran says. "RF and microwave instruments need to be flexible – to be upgradeable by simply substituting or adding a new module; to make new measurements just by downloading a new software application. This approach also keeps a lid on the costs of documentation, training, spares, and maintenance. Additionally, industry standardization promotes competition, ultimately improving performance at a reduced cost," he adds.

"In PXI, the M9381A Vector Signal Generator and M9391A Vector Signal Analyzer, as well as the fully configured EXM wireless device test set, provide as much as 160 MHz of RF modulation bandwidth. The M9290A CXA-m is a full-featured signal analyzer to 26 GHz with pre-amp and tracking generator in just four slots," Dhanasekaran says. (Figure 2.)

Another commercial technology driving designs is Voice over LTE (VoLTE), McCarthy notes. "It wasn't until just last year, in early 2014, that VoLTE devices and networks enabled voice traffic on the LTE network. Future releases of the LTE standard, Rel 12 and 13, will feature device-to-device communication, higher power devices, and the ability to form ad hoc networks. These functions are essential for tactical or battlefield LTE networks," says McCarthy.

Figure 2 | The M9381A Vector Signal Generator provides frequency coverage from 1 MHz to 3 GHz or 6 GHz. Photo courtesy of Keysight.

"We have also seen a push to incorporate commercial technologies from LTE radios to automotive radar, which can be safely addressed by COTS test equipment," says Keysight's Dhanasekaran. **MES**

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Teledyne LeCroy announces enterprise decoding for NVMe protocol analysis

Experts at Teledyne LeCroy in Santa Clara, California, extended the decoding and analysis capabilities on its PCI Express Summit protocol analyzer product family to support the new Trusted Computing Group (TCG) security and Precision Time Measurement (PTM) messaging features, utilized in Internet of Things (IoT) and PCIe SSD storage technologies.

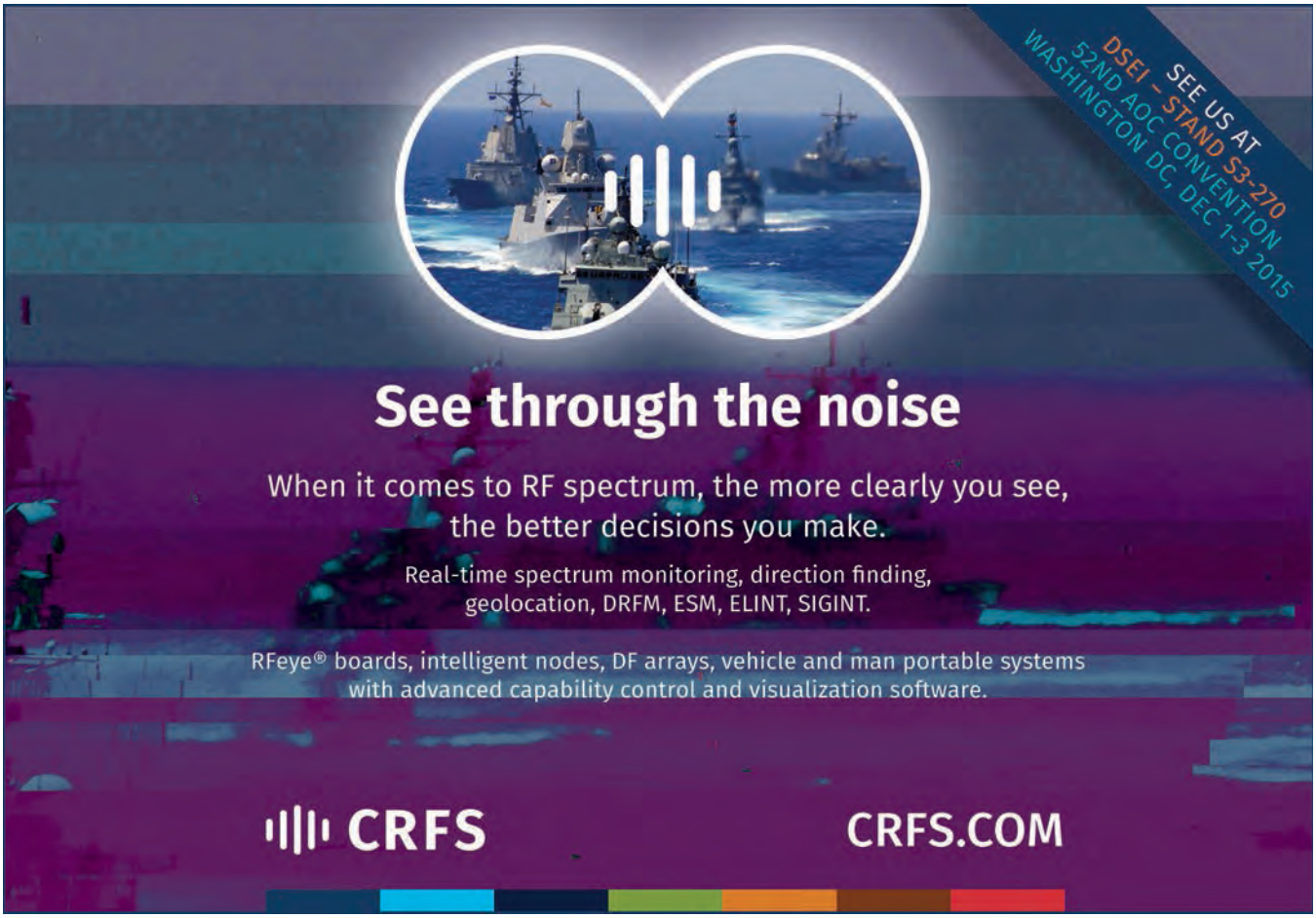
IoT-based products are requiring high security and low latency for efficient machine to machine (M2M) communication. The company's Summit protocol analyzers can determine if these and other features are correctly implemented, and when problems are identified the systems can help track the root cause of failure. These new features are now supported in Teledyne LeCroy's PCIe Protocol Suite 7.34.

The TCG is a not-for-profit organization that was formed in 2003 to define, develop, and promote security specifications for computers and networks, according to a Teledyne Lecroy release. Data protection for a broad range of devices is the primary purpose of these standards. Authentication, secured attribute-value storage, disk encryption/decryption, backup, time stamping, and event logging are some of the applications that are addressed through the TCG security specification.

Teledyne LeCroy protocol analysis supports the TCG specification; method calls such as invoking UID and method UID within a trusted command can be decoded and examined in context with the PCI Express bus infrastructure and new NVM Express storage interface protocol.

Precision Time Measurement (PTM), a supported feature in the PCI-SIG PCI Express 3.0 specification, defines a new protocol of timing measurement and synchronization messages for time-sensitive media and server applications such as industrial automation, instrumentation, geological sciences, telecomm synchronization and synchronized audio/video systems, among others. PTM enables systems that require high-precision timing the ability to monitor and track the time of transactions with sub-microsecond timing accuracy while accelerating server application performance.

Teledyne LeCroy's Summit protocol analyzers support the decoding of PTM message packets, enabling users to have a clear picture of PTM transactions on the PCI Express bus. PTM support has also been extended to the Summit Z3-16 exerciser, enabling users to emulate PTM functionality with the exerciser in either host or device mode, and to control PTM message-packet generation and error recovery. PCIe Protocol Suite 7.34 is available now.



Predictive analytics and the industrial IoT: Thinking about military adoption

By Todd Stiefler

The potential of the marriage of "big iron" and "big data" is not lost on the military; powerful analytics and constant connectivity will truly transform the way data is collected and decisions are made. Chief Warrant Officer 3 Shaun Steines – a maintenance test pilot in Company A, Task Force Attack, 1st Air Cavalry Brigade, currently attached to 10th Combat Aviation Brigade, 10th Mountain Division – performs a track and balance on Night Fury at Forward Operating Base Sharana. (U.S. Army photo/Sgt. Richard Wrigley, 1st ACB, 1st Cav. Division Public Affairs.)

The amount of attention being paid to the "Industrial Internet" or Internet of Things (IoT) has spiked dramatically over the past year or two. While some of this is clearly natural hype over a "new new thing," it is also true that the combination of brilliant machines, ubiquitous connectivity, and powerful analytics carries truly transformative potential. The question facing individuals and organizations across the world, including militaries, is: "How do we make the vision real?"

A recent report from global consulting firm McKinsey and Company said, "The ability to monitor and manage objects in the physical world electronically makes it possible to bring data-driven decision making to new realms of human activity – to optimize the performance of systems and processes, save time for people and businesses, and improve quality of life. From monitoring machines on the factory floor to tracking the progress of ships at sea, sensors can help companies get far more out of their physical assets – improving the performance of machines, extending their lives, and learning how they could be redesigned to do even more."

The potential of the marriage of "big iron" and "big data" has not been lost on the military, either, and it seems like there is a conference on the subject almost every week. It hasn't just been talk, either: Visionary leaders across the services are testing and implementing solutions that use digital information to drive better decisions and outcomes for operators of physical assets. However, for every decisionmaker willing to lean forward, there are many more skeptics who see the vision of the Industrial Internet as pie-in-the-sky; a pretty picture painted by consultants and academics that will never (and perhaps should never) come to pass.

Why the skepticism?

This skepticism is most likely born of three causes: First, the natural conservatism and risk-aversion of the military, which is a big bureaucracy with a mission in which it absolutely cannot fail; second would be past experience with condition-based maintenance (CBM) and other data-driven initiatives that generated uneven results. Another reason for skepticism about the IoT could be the daunting prospect of trying to move from the status quo to the space-age vision of autonomous-integrated-distributed everything that some well-meaning Industrial Internet enthusiasts have painted.

The benefits claimed by advocates of distributed sensing and data analytics seem diffuse, speculative, and far off in the future. The costs, conversely, are much more

tangible and much more present. Sensors cost money and so do the servers to store the data they generate, while analytics software and data scientists are expensive as well. Changing organizational behavior requires leadership time and effort. Then there's the unknown cyber-vulnerabilities opened up by connecting ground vehicles, aircraft, or ships to a network.

Each of these costs is real and all of these drivers of skepticism are rational and understandable. Overcoming resistance to the Industrial Internet in the Pentagon and out in the field will require a graduated approach that establishes incremental steps towards the end vision and concrete metrics for measuring value along the way. GE, for its part, calls this a "maturity model" and looks at it as a critical tool for organizations to use when asking if, how, when, and where they should begin their Industrial Internet journey.

The maturity model

That journey encompasses five basic stages of maturity: connect, monitor, analyze, predict, and optimize.

- **Connect:** Gather data from all machines using embedded computing capability (programmable logic controllers, industrial computers, and data historians) and store that data in a central repository so that it can be accessed and analyzed in subsequent steps.
- **Monitor:** Use time-series data from connected machines to visualize and understand the current performance of all assets and processes. See which systems and subsystems are performing nominally and which aren't. Enable aggregation of data at the asset level, unit level, and fleet level.
- **Analyze:** Determine the root cause of failures and poor performers based on historical and real-time data so as to understand relationships, correlations, and trends, and enable effective troubleshooting of problems.
- **Predict:** Utilize advanced predictive analytics to provide weeks or months of foresight into impending problems so issues can be averted in the first place, driving greater process consistency and asset uptime. Put actionable intelligence in the hands of frontline maintainers to drive readiness up and maintenance costs down.
- **Optimize:** Transform operations and maximize the performance potential of all assets and processes. Use the information learned from the data to make better decisions, change business processes, and even design better physical systems for the future.

Few organizations can be described monolithically as being at a certain point on the maturity spectrum. In most real-world cases, organizations are made up of subunits that may be at radically differing levels of maturity in terms of how they collect, process, and leverage data. By the same token, different types of equipment used by the same organization may be in completely different leagues when it comes to their Industrial Internet maturity.

So where is the military today? The answer, of course, is "it depends." The Army ground community, for example, is struggling with legacy assets that are sparsely instrumented and do not even allow, in many cases, for the assets to capture data. The first step for theses platforms and organizations is to think about getting fully connected and starting the process of monitoring their assets in real time. The good news is

that leaders in the government and among the ground-vehicle OEMs have recognized that they have gaps and are working to pilot new connected solutions at this very minute.

The Navy surface fleet, by contrast, made significant investments in instrumentation and connectivity in the early part of the last decade and now has a fairly robust system for connecting, monitoring, and analyzing the data from their ships. They are now in the process of exploring options for leveraging the data they already capture to get predictive using advanced analytics. (See Figure 1.)

Among the aircraft at any given Air Force base, there might be fifth-generation fighters managed "predictively" and older aircraft whose sensor data is dumped into a database and never reviewed again unless there's a major in-flight incident.

Uneven progress

The services have been making uneven progress, then, and some efforts to lean far forward have been met with bureaucratic resistance, technical challenges, or both. The good news, if it can be called that, is that the military is not that far behind the majority of commercial industry when it comes to using data. The McKinsey study referenced earlier found that, globally, less than one percent of industrial data is actually used in decisionmaking, and the vast majority of that is used for alarm and control purposes (i.e., "monitoring"). Certain parts of the military are already doing better than that.

The critical thing is that, for any organization, the steps in the model must each be taken in sequence, and must be completed before moving on to the next step. Assets that are not connected cannot be reliably monitored, just as operations cannot be optimized for a platform with no access to predictive analytics. No project or initiative that aims to go from disconnected assets to optimized operations in one fell swoop is going to succeed. That reality should be a relief to those who find the vision painted by Industrial Internet enthusiasts as daunting or unrealistic.

Moreover, it is not true that every organization should set the goal of getting to "optimize" for all of its assets. Each step in the maturity model carries incremental benefits and incremental costs. Whether the former outweigh the latter depends on how critical a given mechanical asset is to the organization's mission, how it underperforms or fails and how often, and how costly those deviations from ideal performance are to the organization from both a mission-effectiveness and a cost perspective.

Goals can vary even among assets within an organization or among systems on a platform. It is probably worth pushing for optimized performance of the gas turbines on an Arleigh Burke-class destroyer, for example, but it may be enough to simply monitor the status of the air-conditioning system.

As with any journey, the first step is figuring out where you are and where you want to go. GE helps its customers perform self-assessments using the Maturity Model all the time; it can then suggest Industrial Internet hardware and software solutions, from embedded computer systems to data historians to SmartSignal predictive analytics, to help customers realize their particular Industrial Internet vision. **MES**

Figure 1 | What phase is the U.S. military in today when it comes to Industrial Internet maturity? Every segment of the military is different. In this photo, Airman Tuan Hoang directs an MH-60S Sea Hawk helicopter attached to the Chargers of Helicopter Sea Combat Squadron (HSC) 14 during takeoff from the flight deck of the aircraft carrier USS John C. Stennis (CVN 74). (U.S. Navy photo/Mass Communication Specialist 3rd Class Christopher Frost.)

Todd Stiefler *leads the Military Analytics team at GE, where data scientists, engineers, and equipment experts help defense organizations increase readiness and decrease operations and support costs. Todd went to GE after a decade in Washington as a defense and foreign-policy advisor to three U.S. senators, including members of the Armed Services and Defense Appropriations Committees. Readers may follow him on Twitter at @ToddStiefler.*

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MANAGING OBSOLESCENCE

Software-induced hardware obsolescence: The big fix

By Andrew Coombes

Embedded systems in military applications – because of their long operational life and the changes to requirements experienced during use – are particularly prone to software aging, which can result in degradations in performance. This can, in turn, lead to expensive, unplanned hardware upgrades. One approach to avoid these upgrades is applying optimization to aged software.

Automating the measurement of military avionics software can minimize effort and let users measure possible improvements. A joint terminal attack control instructor assigned to the 6th Combat Training Squadron uses avionics software as he plays the role of a ground commander during a close air support training scenario Nellis AFB April 29, 2015. (U.S. Air Force photo/Senior Airman Joshua Kleinholz.)

Unlike other critical real-time embedded systems, military avionics systems have an operational life of decades, throughout which they are regularly refreshed with updates. These regular updates arise from planned changes and also from changes to operational requirements to meet evolving military demands.

The combination of changes (which cannot be predicted at the initial design) with upgrades that take place over many years inevitably lead to an increase on the demands placed by software on the underlying computing platform. This increase in demand can lead to decreased performance capability and intermittent failures due to timing overruns. One approach to avoiding this is frequent, expensive hardware upgrades.

An alternative approach relies upon automated detection of "timing optimization opportunities" within the legacy software. This timing optimization approach can also work in the legacy-software environment.

Software aging: myth or fact?

Initially, software aging might seem to be an oxymoron: Once the code is written, it doesn't physically degrade – unlike hardware, which is subject to random physical processes that cause components' performance to deteriorate over time.

Of course, the previous is based on the assumption that software doesn't change. In long-lived military systems, this is likely to be an untrue assumption: Operational requirements will change, and these changes will inevitably lead to software aging.

Software aging affects lengthy projects for four main reasons:

1. Over the course of very long projects, the rationale behind architectural design decisions will get lost in the mists of time.
2. As more decisions get made which are not in line with the original architecture, the original "shape" of the software gets lost.
3. Changing fashions in software development will pull the architecture in different directions.
4. Even with the best architecture, it is impossible to anticipate in advance all of the possible changes that might be required.

The net effect of such software aging is that software performance degrades over time.

Software-induced hardware obsolescence

Over the last forty years, a default assumption has been that electronics/computing performance inevitably improves over time. This "reality" leads to periodic hardware upgrades being built into long-running programs such as military systems, with the aim of taking advantage of performance improvements.

Working against these periodic performance improvements is the software aging problem: Increased capability requirements for little gain in functionality. Software-induced hardware obsolescence occurs when the software aging causes the need for extra hardware upgrades in addition to the planned upgrades.

Pushing back the ravages of time

The alternative to unplanned upgrades is to improve software performance, which comes about through careful optimization. In the case of real-time systems, this typically focuses on worst-case performance, or the longest time it takes software to execute a given function.

In an ideal world, optimizations can arise from taking an existing architecture and refactoring it to a more efficient structure in the light of new requirements. Given the inevitable degradation in the software architecture that comes about through software aging, the extensive redevelopment of an entire system that this would require is unlikely to be an acceptable option. Instead, optimization must be a more "opportunistic" activity – identifying improvements and applying them without a strong understanding of the underlying architecture.

Optimization follows three main steps:

- Determine contribution (identify where in the code base to focus optimization efforts).
- Optimize (identify alternatives to existing code).
- Rinse and repeat (measure the improvement, if any, and continue until the job is done).

Determine contribution

The single most important factor in deciding where to focus an optimization effort is understanding the contribution of each software component to the overall system performance.

"Contribution" here is used to mean the percentage of time spent executing a specific piece of code. It comes from two values: the longest execution time of the piece of code and the number of times it is executed.

Finding the contribution of a specific module relies on first finding the worst-case path through the code, then looking at the amount of time spent in each code sub-program on that path. (See Figure 1.)

As the graph shows, some code makes no contribution to the worst-case path, while some code makes a minor contribution; third, still other code makes a significant contribution. It is this last category that provides the best candidates for optimization.

Attempting to identify candidates for optimization through manual inspection of the code is not recommended, as it is effort-intensive and can lead to wasted optimization efforts; for example, by attempting to optimize code that falls into the "no-contribution" category. The best approach is to identify optimization candidates by measuring the execution time of the code.

Optimize, identify alternatives

Once optimization candidates have been identified, the next step is to optimize them. This activity, which is central to the overall process, relies upon the skill and experience of the engineering team.

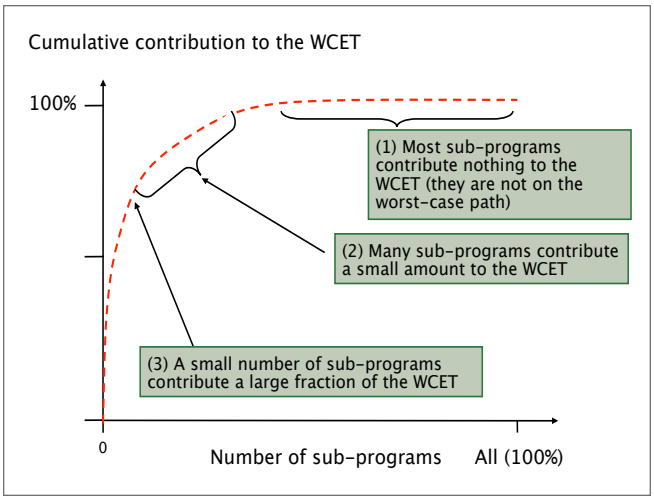

Figure 1 | Contribution to worst-case execution time (WCET) by sub-program.

A great source of optimizations comes from modules that are executed many times on the worst-case path. Each cycle that can be shaved off such code benefits from a multiplier effect on the overall path.

Rinse and repeat

Once optimizations have been made, it is necessary to measure execution times once more. This step will establish whether the system now meets its performance objectives.

If further improvements are still required at this stage, repeating the exercise of identifying optimization candidates may show up new places to focus optimization effort.

Two of the three steps described above require measuring the worst-case execution time of the code.

Typically, measuring execution times involves:

- Adding measurement points (also known as instrumentation) to the source code.
- Collecting measurements.
- Analyzing measurements.

For large systems, this quickly becomes a time-consuming activity. The effort required for all three of the above activities can be significantly reduced through tool support, which could be developed in-house, or via commercial tools, such as RapiTime.

Integrating such tool support into the build-test process means that the timing measurement can happen automatically during every build-test cycle. This gives designers the ability to see how the optimization activity progresses with every step, rather than waiting for the end of an optimization activity.

What about legacy systems?
Many of the systems that need to be optimized will fall into the category of "legacy systems": systems whose age means that there is restricted support for the computing platform both in terms of software tools and in the hardware to connect to them.

"A GREAT SOURCE OF OPTIMIZATIONS COMES FROM MODULES THAT ARE EXECUTED MANY TIMES ON THE WORST-CASE PATH. EACH CYCLE THAT CAN BE SHAVED OFF SUCH CODE BENEFITS FROM A MULTIPLIER EFFECT ON THE OVERALL PATH."

A key aspect of handling such systems is flexibility in the approach taken to timing analysis. For example, it may not be possible to use modern debugging interfaces or other specific hardware interfaces. The approach to making timing measurements must therefore be capable of adapting to the facilities that are available. At the same time, the impact of any instrumentation code must be minimized, as far as is possible, to avoid running out of resources (for example, memory or CPU capacity) during the measurement activity.

Military avionics system software unavoidably "ages," which can lead to expensive, unplanned hardware upgrades. The alternative is optimization of aged software, which can only realistically be performed through a program of measurement, optimization, and review.

Automating the measurement of software performance minimizes the effort involved, and also allows measurements to demonstrate incremental improvements to the software performance. **MES**

Dr. Andrew Coombes *leads the marketing department at Rapita Systems Ltd., a company specializing in tools for on-target verification of high-integrity embedded software. For the last twenty years he has been involved in the development and commercialization of software tools for embedded, real-time applications. He received his D.Phil. in Computer Science at the University of York in the U.K.*

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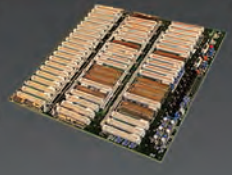

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Shrinking the air data system for UASs

The Micro Air Data System (μADS) 2.0 from Aeroprobe is a microprocessor-based embedded system that acquires and processes air flow data for unmanned aerial systems (UASs). The multihole air data probe and micro air data computer lets the user calculate the complete flow vector and calculate air data in real time. The μADS 2.0 will measure an aircraft's airspeed, angle of attack, and angle of sideslip, while the integrated GPS/INS unit produces real-time synched data. All data is then relayed to a flight controller or remote pilot in real time.

The tool – with a reporting rate of as fast as 100 Hz and low power usage of less than 2 W – is aimed at improving the operations of unmanned aircraft used in defense, commercial, or research applications.

Additional optional features can include an embedded deicing heater, dual sensors to increase the system's velocity and altitude range, and optional analog-to-digital channels for general-purpose data acquisition. The tool can be ordered as a quick-start kit for bench-top demonstration or in-lab use in both commercial off-the-shelf (COTS) and custom hardware versions.

Aeroprobe | www.aeroprobe.com | www.mil-embedded.com/p372989

Hi-rel embedded computer for extreme spots

The RE1112 compact embedded computer from Crystal Group is an all-aluminum-chassis unit intended for use in space-constrained deployments. The 10-inch by 8-inch computer weighs just eight pounds and can be ordered with various DIN railmount options.

The ruggedized RE1112 offers one or two 2.5-inch nonremovable solid-state drives (as large as 1 TB) and works on the i3 or i7 Intel core. To facilitate its use in rugged environments, the computer conforms to MIL-STD-810 operational temperature and MIL-STD-810 storage temperature requirements. Optional kits also allow the part to conform to IEC 6150-3 and IEE-1613 electromagnetic compatibility standards.

Because it is fanless, the convection-cooled computer is suitable for high-reliability operation where moving parts would be inappropriate. The computer uses a 120 W, 18 to 36 VDC power supply and is compatible with Linux, VMWare, and Windows software.

Crystal Group | www.crystalrugged.com | www.mil-embedded.com/p372990

Sensor fits in military guidance, navigation applications

The STIM300 from Sensonor is a small (35 cubic centimeters), tactical grade, low-weight inertial measurement unit (IMU) that can offer users another option to fiber-optic gyro systems. The non-GPS-aided IMU contains three MEMS gyros, three high-stability accelerometers, and three inclinometers. The IMU is aimed at use in stabilization, guidance, and navigation applications in the industrial, aerospace, and defense markets and can be used as part of inertial navigation systems in unmanned aerial vehicles (UAVs), autonomous underwater vehicles (AUVs), automatic guided vehicles (AGVs), unmanned ground vehicles (UGVs), and remotely operated vehicles (ROVs).

The ITAR-free STIM300 can also be employed in camera-turret stabilization or used in various handheld devices that require a small IMU to secure operations during GPS outage. The solid-state sensor is unreactive to magnetic fields, offers low gyro bias instability and noise, and runs off a single 5-V supply and communicates through a single RS422 interface.

Advanced users may configure their own output format, sampling rate, and filter settings by placing the sensor in "service mode," in which all the configuration parameters can be intermediately or permanently changed by overwriting the current settings in the flash memory.

Sensonor | www.sensonor.com | www.mil-embedded.com/p372991

High-speed video streaming for defense, robotics arenas

Designers wanting a CoaXPress acquisition platform for real-time video at high speeds can consider the PFC: Platform for CoaXPress acquisition, an FPGA-based platform that enables real-time processing of CoaXpress channels, from Techway. CoaXPress is a new transport protocol for high-speed video streaming that uses coaxial cables, up to 100 meters. The Techway product is an FMC CoaXPress interface card with a Kintex-7 FPGA card.

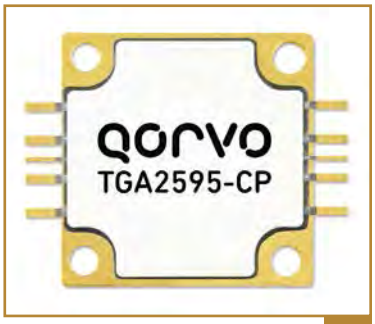
The platform handles as many as four CoaXPress links running at 6.25 Gbps, with each link able to be either host or device (configuration-specific). The PFC sports six opto-isolated inputs and six opto-isolated outputs and features five DIN 1.0/2.3 connectors available from the front panel.

Designers of vision solutions for defense, aerospace, and robotics applications can put image processing on the FPGA using the platform's software development kit, using standard FPGA development tools from Xilinx.

The platform tests at 1,600 Mb/s for DDR3/800 Mb/s for RLDRAM2, operates over the industrial range of temperatures (-40 °C to 70 °C), is PCIe Gen 2-compliant, and supports Power over CoaXPress (PoCXP).

Techway | www.techway.eu | www.mil-embedded.com/p372992

GaN power amps to boost satellite communications



A family of GaN power amplifiers from Qorvo is intended for use in military satellites and commercial very small aperture terminal (VSAT) ground stations. The Ku- and Ka-band power amps are fabricated using Qorvo's already-released QGaN15 process technology, for reliable operation.

The Ku-band TGA2239-CP is a 35-W, 28-V power amp that tests at 30 dB linear gain and 34 percent power-added efficiency. In Ka band, the TGA2594-HM gives the designer 4 W of saturated output power and 25 dB linear gain in a hermetic quad-flat no-lead (QFN) package; power efficiency for this amp stands at 25 percent.

The Ka-band TGA2595-CP, says the company, provides designers with 8 W of saturated output power and 21 dB of linear gain in a thermal-resistant Cu-base bolt-down package, with power-added efficiency at 22 percent.

Qorvo, Inc. was formed in early 2015 following the merger of RFMD and TriQuint.

Qorvo | www.qorvo.com | www.mil-embedded.com/p372993

Development suite for ARINC 818 installations

Great River Technology's suite of tools for ARINC 818 (avionics digital video bus protocol) projects enables designers to design and implement system-critical video and data transmission products into cockpit displays, avionics graphics generators, infrared cameras and sensors, and flight simulators.

One piece of the tool set is the graphics boards and DVI converters: The tool suite's various graphics generators can be used in the development, test, and function phase; while the full-motion ARINC 818 DVI converters convert live DVI video to ARINC 818 and back again. Another part is the video and protocol analyzer, which allows designers and users an overview at multiple levels: byte, FC frame, video line, and video frame.

The frame grabbers are preconfigured for link speeds between 1 Gbps and 4 Gbps, with a dedicated video port for viewing full-motion video without loading the bus. Additionally, an ARINC 818 transceiver IP core is available for designers who want accelerated development time and additional flexibility.

Great River also offers as part of the tool suite video record and playback systems, which are configurable for synchronized ARINC 818 video playout to a cockpit display or simulator; and a variety of switches, which offers designers control over switching and real-time switch-input monitoring.

Great River Technology | www.greatrivertech.com | www.mil-embedded.com/p372994

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ACCES I/O PRODUCTS, INC.

mPCIe-COM Family PCI Express Mini Cards

ACCES I/O Products is pleased to announce the release of a new family of mini PCI Express (mPCIe) multi-port serial communication cards. These small, low-priced, PCI Express Mini cards feature a selection of 4 or 2-ports of software selectable RS-232/422/485 asynchronous serial protocols on a port by port basis. These cards have been designed for use in harsh and rugged environments such as military and defense along with applications such as health and medical, point of sale systems, kiosk design, retail, hospitality, automation, gaming and more. The small size (just 50.95mm x30mm) allows for maximum performance in applications where space is a valuable resource.

Each RS-232 port is simultaneously capable of supporting data communication rates up to 921.6 kbps. RS-422/485 modes support data communication speeds up to 3 Mbps. The cards provide ±15kV ESD protection on all signal pins to protect against costly damage due to electrostatic discharge. Existing serial peripherals can connect directly to industry standard DB9M connectors on the optional breakout cable accessory kits.

The mPCIe-COM cards were designed using type 16C950 UARTs and use 128-byte transmit/receive FIFO buffers to decrease CPU loading and protect against lost data in multitasking systems. New systems can continue to interface with legacy serial peripherals, yet benefit from the use of the high performance PCI Express bus. The cards are fully software compatible with current PCI and PCI Express 16550 type UART applications and allow users to maintain backward compatibility.

FEATURES

- PCI Express Mini Card form-factor (mPCIe) type F1, with latching I/O connectors
- 4 or 2-port serial communication cards with optional DB9M connectivity
- Software selectable RS-232, RS-422, and RS-485 protocols, per port stored in EEPROM
- High performance 16C950 class UARTs with 128-byte FIFO for each TX and RX
- Port-by-port field selectable termination for RS-422/485 applications
- Industrial operating temperature (-40°C to +85°C) and RoHS standard
- Supports data communication rates up to 3Mbps simultaneously, (RS-232 up to 921.6 kbps)
- Custom baud rates easily configured
- ±15kV ESD protection on all signal pins
- CTS, RTS, 9-bit data mode, and RS-485 full-duplex (4 wire) fully supported
- RS-232 only and RS-422/485 versions available

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Embedded Hardware

ACCES I/O PRODUCTS, INC.

mPCIe-ICM Family PCI Express Mini Cards

The mPCIe-ICM Series isolated serial communication cards measure just 30 x 51 mm and feature a selection of 4 or 2 ports of isolated RS232 serial communications. 1.5kV isolation is provided port-to-computer and 500V isolation port-to-port on ALL signals at the I/O connectors. The mPCIe-ICM cards have been designed for use in harsh and rugged environments such as military and defense along with applications such as health and medical, point of sale systems, kiosk design, retail, hospitality, automation, and gaming.

The RS232 ports provided by the card are 100% compatible with every other industry-standard serial COM device, supporting TX, RX, RTS, and CTS. The card provides ±15kV ESD protection on all signal pins to protect against costly damage to sensitive electronic devices due to electrostatic discharge. In addition, they provide Tru-Iso™ port-to-port and port-to-PC isolation. The serial ports on the device are accessed using a low-profile, latching, 5-pin Hirose connector. Optional breakout cables are available, and bring each port connection to a panel-mountable DB9-M with an industry compatible RS232 pin-out.

The mPCIe-ICM cards were designed using type 16C950 UARTS and use 128-byte transmit/receive FIFO buffers to decrease CPU loading and protect against lost data in multitasking systems. New systems can continue to interface with legacy serial peripherals, yet benefit from the use of the high performance PCI Express bus. The cards are fully software compatible with current PCI 16550 type UART applications and allow for users to maintain backward compatibility.

FEATURES

- PCI Express Mini Card (mPCIe) type F1, with latching I/O connectors
- 4 or 2-port mPCIe RS232 serial communication cards
- Tru-Iso™ 1500V isolation port-to-computer and 500V isolation port-to-port on ALL signals
- High performance 16C950 class UARTs with 128-byte FIFO for each TX and RX
- Industrial operating temperature (-40°C to +85°C) and RoHS standard
- Supports data communication speeds up to 1 Mbps simultaneously
- Custom baud rates easily configured
- ±15kV ESD protection on all signal pins
- 9-bit data mode fully supported
- Supports CTS and RTS handshaking

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Application Areas:

- *Military and Aerospace – Rugged SFF*
- *Rugged Industrial Applications*
- *Communication Applications*
- *Mobile Routers and Other Network Appliances*
- *Railway Train Control*
- *Transportation*
- *Imaging Applications*

FEATURES & BENEFITS

- Modular Sidewall Design Supports Variable PC/104 Stack Heights (2 - 6 Cards) or Expanded 3.5" SBC Intelligent Systems
- High and Low IP (Ingress Protection) Systems Possible via High IP, Modular Chassis Design Coupled with Full Custom, Quick-Turn I/O Panels
- Broad Portfolio of PC/104 SBC Options Ranging from Low-Power Intel® Atom™ processors E3800 to High Performance 4th Generation Intel Core i7 processors
- Fully Supported by ADL Embedded Solutions' Team of Solidworks Engineers for Model and or Design Support
- Options for MIL-STD 810, MIL-STD 461, and MIL-STD 704/1275
- Designed for MIL-STD 810 Shock & Vibration

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ADLINK TECHNOLOGY INC. 20th ANNIVERSARY

VPX3001 Series Rugged 3U VPX Processor Blade

The VPX3001 Series is a 3U VPX processor blade featuring the 3rd Generation Intel® Core™ i7 processor with Mobile Intel® QM77 Express Chipset. The VPX3001 provides up to 8GB DDR3-1066/1333 dual channel ECC memory soldered onboard, one PCI Express x8 XMC.3 site with VITA 46.9 rear IO, and onboard soldered 32GB SLC SATA solid state drive. Rear I/O via P1 and P2 includes 2x 1000BASE-T or 2x 1000BASE-BX (BOM option), 1x SATA 6 Gb/s, 1x SATA 3 Gb/s, 2x USB 2.0, 6x GPIO, VGA, 1x RS-232, and 1x RS-232/422.

A VPX-R3001 Rear Transition Module is available to access rear I/O signals and a 9-slot 3U VPX Test Frame is available for users to validate VPX3001 functionality.

The VPX3001 Series is rugged conduction cooled with conformal coating, making it ideal for mission critical applications in radar; intelligence, surveillance and reconnaissance (ISR); and UAV/UGV platforms.

FEATURES

- Quad-core 3rd Generation Intel® Core™ i7 processor with QM77 Express chipset
- DDR3-1333 soldered ECC SDRAM
- Two PCIe x4 Gen2 data plane to P1 with NTB
- Two 1000BASE-T or two 1000BASE-BX to P1
- One XMC.3 PCIe x8 Gen2 with Rear IO to P2

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ADLINK
www.adlinktech.com/VPX/index.php

angela.torres@adlinktech.com
408-360-4360

ALPHI TECHNOLOGY CORPORATION

PCIe-Mini-ARINC429-4/8

The PCIe-Mini-ARINC429-4/8 PCIexpress Mini board supports up to 4 Arinc429 Tx and 8 Arinc429 Rx programmable via X 1 lane PCiexpress Mini bus.

It supports both High speed ARINC429 (100kbit/s) and low speed (12.5kbit/s with Programmable label recognition for 256 labels per channel.

Windows and Linux Drivers with SDK are provided.

FEATURES

- ARINC 429-based PCIe-Mini card ARINC controller
- Up to 4 transmitters and 8 receivers channels for ARINC controller
- Programmable label recognition for 256 labels per channel
- 32 x 32 Receive FIFOs and Priority-Label buffers
- Dependent data rates for Transmit and Receive
- Meets the ARINC 429 specifications for loading, level detection, timing, and protocol
- Software selected data rate of 12.5kbps or 100kbps with automatic slew rate adjustment
- Burst and continuous mode available
- Programmable word length selection, with the parity bit generated automatically
- Programmable Interrupt support ▪ Differential IRIG B Input

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Embedded Hardware

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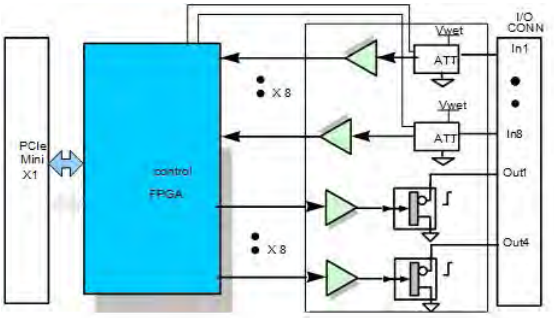
PCIe-Mini-AVIO-8

The PCIe-Mini-AVIO-8 is an avionic compliance discrete I/O card, it monitors or controls the on/off (high/low) status of up to 8 devices. 8 channels are used as an input and 8 Channels are output for the Low side of 500ma drivers.

Input channels can be configured with interrupts for a change of state or level detection of any bit on up to 8 channels. The TTL input threshold includes hysteresis for increasing noise immunity.

In order to ensure safe, reliable control under all conditions, output operation is "fail-safe." That is, the outputs are always off upon power-up and are automatically cleared following a software reset.



FEATURES

- 8-channel Selectable Sense Operation
- GND/Open or 28V/Open
- Programmable Thresholds and Hysteresis
- Discrete input thresholds are programmable in the range of 2V to 12V
- Sense inputs lightning protected to RTCA/DO1060G, Section 22 Level 3
- Airbus ABD0100H compliance
- 8 Low-Side 500 mA Drivers
- 1.2 Ohm On Resistance typical
- Max Power Dissipation Automatically Limited by Fault Protection
- Diode Clamps for Discharging Inductive Loads

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Amphenol Pcd

µCom-10Gb+ Series

µCom-10Gb+ Series *(pronounced, Microcom)* is a new connector from Amphenol Pcd that addresses one of the latest trends in the industry: ***miniaturization*** and ***high speed***. Able to withstand ***harsh environments***, µCom-10Gb+, designed with four data pairs insulated throughout the entire connector, achieves performance that exceeds10Gb/s Ethernet following IEEE 802.3an-2006 specifications for 10GBASE-T. It is a Cat6A connector that meets the TIA568C.2 and ISO/IEC11801 standard – attaining ***maximum performance in speed*** and providing ***minimal cross-talk*** between cables. The product is ***IP68*** rated and meets ***MIL-DTL-38999 series III environmental standards***. µCom-10Gb+ is also small and rugged – having a max external shell diameter of only 15 mm and a rating of 2,000 mating cycles. µCom-10Gb+ Series is one of the smallest, fastest, and most rugged interconnect solutions in the market today – and is an ideal solution for the ***Defense*** (C4ISR, Battlefield Communications, Shipboard), ***Com-Air*** (In-Flight Entertainment, Avionics, Communications), and ***Rail Mass Transit*** markets (Passenger Information & Communication Systems).

FEATURES

- Four pairs totally insulated throughout the connector
  - minimum cross-talk between the four pairs
- Patent-pending special interfacial shapes
  - minimum perturbation at the interface of each pair
- Thread & Push-pull coupling mechanisms
  - 2,000 mating cycles & high vibration resistance
- Machined brass shells w/multiple plating options (RoHS compliant)
  - shell-to-shell continuity and 500h salt spray resistance
- Machined & Gold-Plated Solder and Crimp contacts
  - design & performance according to the inner contact of M39029/77-429#16 & M39029/76-425#16 38999 contact
- Solder contact: max AWG24 ▪ Crimp contact: AWG 24 to 26
- IP68 sealing mated and unmated for receptacles
- 1500 Vrms Dielectric Withstanding Voltage
- Temperature range: - 55°C / + 125°C

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Apacer

Access the best

SFD25A

Designed in SATA 6.0 Gbps interface, SFD25A is able to deliver exceptional read/write speed, making it the ideal companion for heavy-loading industrial or server operations. In regard of reliability, the drive comes with various implementations including powerful hardware ECC engine, power saving modes, wear leveling, flash block management, TRIM, built-in S.M.A.R.T. (Self-Monitoring, Analysis, and Reporting Technology) technology and intelligent power failure recovery function to safeguard data and enhance product stability. It also employs the guaranteed wide-temp chip, which means it can run stably under industry-level extended-temperature (-40°C ~ 85°C) environment.

FEATURES

- Global Wear-leveling and Block Management
- Built-in ATA Secure Erase
- S.M.A.R.T. Functions
- Intelligent Power Failure Recovery
- TRIM Command Support
- DEVSLP Support (Optional)
- 9.5mm, 7mm, 5mm Housing (Optional)
- Nano Coating (Optional)
- Complies with MIL-STD-810F

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ssdsales@apacerus.com

Annapolis Micro Systems

Wild40 Seven Slot OpenVPX 3U Chassis

The Wild40 Seven Slot OpenVPX 3U Chassis is an OpenVPX-compatible chassis capable of accepting up to six 3U tall by 160mm OpenVPX Payload Front Plug-in Modules (FPMs) and one 3U tall by 160mm OpenVPX Switch FPM and up to seven 3U tall by 80mm Rear Transition Modules (RTMs). Plug-in Module slot spacing is 1 VITA 48.1.

This chassis is equipped with a very high performance backplane which is capable of Serial I/O signaling at rates up to 10Gbps on the Data and Expansion Planes. The Data Plane of the backplane is connected to adjacent slots with one Fat Pipe connection. The Expansion Plane is a 3 slot star with two Fat Pipes connecting slots.

The Wild40 Seven Slot OpenVPX 3U Chassis includes a Chassis Monitoring system which displays DC voltages, slot temperatures and fan Revolutions Per Minute (RPMs) on the front panel of the chassis and can be used to set fan speed. The Chassis Monitor can be accessed and controlled remotely via the Serial or Ethernet interfaces.

The card cage is recessed from the front of the chassis so that cabling can be used between Plug-in Modules and be contained within the frame of the chassis.

FEATURES

- 6U High with Front Mounted OpenVPX Card Cage
- 7 Slot OpenVPX 40Gb+ Mesh Backplane with RTM Support
- 1534 Watt Power Supply
- Radial clocking for AUXCLK and REFCLK with chassis input SMAs
- Payload Profile: SLT3-PAY-2F1F2U-14.2.1 and SLT3-PAY-2F4F2U-14.2.11
- Switch Profile: SLT3-SWH-2F24U-14.4.3 or SLT3-SWH-2F4T16U-14.4.11

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.

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www.annapmicro.com

wfinfo@annapmicro.com
410-841-2514

Annapolis Micro Systems

WILDSTAR 7 for OpenVPX 3U

The WILDSTAR 7 for OpenVPX 3U contains one VX690T or VX980T Virtex 7 FPGA per board with up to 2 GB of DDR3 DRAM for 12.8 GB/s of DRAM bandwidth and up to 32 MB of QDRII+ SRAM for 8 GB/s of SRAM bandwidth. It has up to 1 million logic cells and 1.6 million multiplier bits per board.

These FPGA boards include a Xilinx Virtex 7 FPGA with 64 High Speed Serial connections performing up to 13.1 Gbps. There are two 36-bit QDRII+ SRAM interfaces clocked up to 500 MHz and two 32-bit DDR3 DRAM ports clocked at up to 800 MHz.

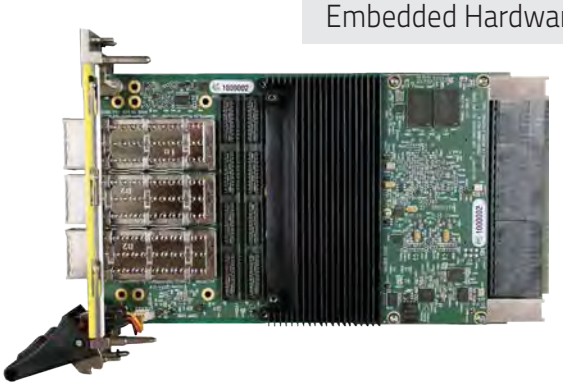
With included High Speed Serial (HSS) FPGA cores (including 40GBASE-KR), there is up to 10 GB/s of bandwidth on the VPX data plane which can go directly to other VPX cards or to a switch, depending on backplane topology. In addition, there is up to 20 GB/s of bandwidth on the VPX Expansion Place. When using 40GBASE-KR, there is the added reliability of Forward Error Correction (FEC) to achieve a much lower Bit Error Rate (BER).

If IO is required, Annapolis offers extraordinary density, bandwidth and analog conversion choices. Each 3U card has 1 mezzanine IO sites which can support up to 2 WILDSTAR Mezzanine cards as well as a QSFP+ option (on WS7 and WS A5 board) that allows for 3 QSFP+ transceivers per slot. These options can be mix and matched to meet customer needs. Some configurations utilize a second slot (for example the QSFP+ option and WILDSTAR Mezzanine card used in a single IO Site).

WILDSTAR A5 and V7 FPGA boards are hot swappable allowing for more system reliability. This feature is unique to Annapolis and was developed because our experience with OpenVPX systems has shown it invaluable so a whole chassis does not need to be shutdown to remove a single board.

Annapolis OpenVPX FPGA cards include an on-board dual core 1.2 GHz PowerPC with direct FPGA 4x PCIe connection which can be used by customers for application requirements. It is also used to query board health like FPGA temperature and power. It is connected to the OpenVPX control plane via 1GbE.

There are also plenty of user backplane signals available on the Annapolis 6U Rear Transition Module (RTM) such as LVDS, FPGA HSS, IRIG, Ethernet and clocking. RTM HSS is also capable of 10Gbps signalling and supports multiple channels of 40GbE.



FEATURES

- **General Features**
  - One Xilinx Virtex 7 VX690T or VX980T FPGA
  - Up to 2 GB of DDR3 DRAM for 12.8 GB/s of DRAM bandwidth
  - Up to 32 MB of QDRII+ SRAM for 8 GB/s of SRAM bandwidth
- **Backplane I/O**
  - 24x High Speed Serial IO lanes to VPX Backplane (P1/P2) for 30 GB/s of Full Duplex Bandwidth
  - Two PCIe Gen3 8x Connections to VPX Backplane (P1)
  - Eight LVDS lines to P2
  - Backplane Protocol Agnostic connections support 10/40Gb Ethernet, SDR/DDR/QDR Infiniband, AnnapMicro protocol and user designed protocols
  - External clock and IRIG-B Support via Backplane
  - Radial Backplane Clock Support for OpenVPX backplane signals AUXCLK and REFCLK
    - Allows points-to-point, very high quality backplane connections to payload cards
    - Allows 10MHz clock and trigger from backplane to synchronize and clock compatible ADC/DAC mezzanine cards without front panel connections needed
    - Allows 1000s of analog channels across many backplanes/chassis to be synchronized via backplane
- **Front Panel I/O**
  - Accepts Standard Annapolis WILDSTAR Mezzanine Cards, including a wide variety of WILDSTAR ADC and DAC Mezzanine Cards
  - Three optional built-in Front Panel QSFP+ Transceivers running at up to 52.4 Gbps each for 39 GB/s of Full Duplex Bandwidth
  - Simultaneous QSFP and Mezzanine Card use
  - QSFP+ Protocol Agnostic connections support 10/40Gb Ethernet, SDR/DDR/QDR Infiniband, AnnapMicro protocol and user-designed protocols
- **Dual Core Processor APM86290**
  - Host Software: Linux API and Device Drivers
  - Each core runs up to 1.2 GHz
  - 2 GB of DDR3 DRAM
  - 4 GB SATA SSD and 16MB NOR Boot Flash
  - 4x PCIe Gen2 connection to Virtex 7 FPGA
- **Application Development**
  - Full CoreFire Next™ Board Support Package for Fast and Easy Application Development
  - 10/40Gb Ethernet and AnnapMicro Protocol Cores Included
  - Open VHDL Model including Source Code for Hardware Interfaces
  - Open VHDL IP Package for Communication Interfaces
  - Chipscope Access through RTM
- **System Management**
  - System Management using Intelligent Platform Management Interface (IPMI)
  - Diagnostic monitoring and configuration
  - Current, Voltage and Temperature Monitoring Sensors
  - Hot Swappable (exclusive to WILDSTAR OpenVPX EcoSystem)
- **Mechanical and Environmental**
  - 3U OpenVPX (VITA 65) Compliant, 1" VITA 48.1 spacing
  - Supports OpenVPX payload profile: MOD3-PAY-2F4F2U-16.2.10-n
  - Integrated Heat Sink and Board Stiffener
  - Available in Extended Temperature Grades
  - Air Cooled with Conduction Cooled path
  - RTM available for additional I/O

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Annapolis Micro Systems, Inc.
www.annapmicro.com

wfinfo@annapmicro.com
410-841-2514

Annapolis Micro Systems

WILDSTAR 7 for OpenVPX 6U

WILDSTAR 7 for OpenVPX 3U boards have up to three Xilinx Virtex 7 FPGAs per board with VX690T or VX980T FPGAs, up to 8 GB of DDR3 DRAM for 51.2 GB/s of DRAM bandwidth and up to 128 MB of QDRII+ SRAM for 64 GB/s of SRAM bandwidth. Up to 2.9 million logic cells and 4.9 million multiplier bits per board.

The three Xilinx Virtex 7 FPGAs contain 64 High Speed Serial connections performing up to 13.1 Gbps. On each Compute Processing Element (CPE) FPGA there is four 72-bit QDRII+ SRAM interfaces clocked up to 500 MHz. The IO Processing Element (IOPE) FPGA has a choice of QDRII+ SRAM or DDR3 DRAM. The DRAM option has four 32-bit DDR3 DRAM ports clocked at up to 800 MHz while the SRAM option has two 72-bit QDRII+ SRAM interfaces clocked up to 500 MHz.

With included High Speed Serial (HSS) FPGA cores (including 40GBASE-KR), there is up 20 GB/s of bandwidth on the VPX data plane which can go directly to other VPX cards or to a switch, depending on backplane topology. In addition, there is 16 GB/s of PCI Express Gen 3 bandwidth on the VPX Expansion Plane with an 8x Gen3 connection to each FPGA through a non-blocking PCIe switch. When using 40GBASE-KR, there is the added reliability of Forward Error Correction (FEC) to achieve a much lower Bit Error Rate (BER).

If IO is required, Annapolis offers extraordinary density, bandwidth and analog conversion choices. Each 6U card has two mezzanine IO sites which can support up to four WILDSTAR Mezzanine cards as well as a QSFP+ option (on WS7 and WS A5 board) that allows for six QSFP+ transceivers per slot. These options can be mix and matched to meet customer needs. Some configurations utilize a second slot (for example the QSFP+ option and WILDSTAR Mezzanine card used in a single IO Site).

WILDSTAR A5 and V7 FPGA boards are hot swappable allowing for more system reliability. This feature is unique to Annapolis and was developed because our experience with OpenVPX systems has shown it invaluable so a whole chassis does not need to be shutdown to remove a single board.

Annapolis OpenVPX FPGA cards include an on-board dual core 1.2 GHz PowerPC. This also has a connection to PCIe infrastructure (which includes FPGAs) and can be used by customers for application requirements. It is also used query board health like FPGA temperature and power. It is connected to the OpenVPX control plane via 1GbE.

There are also plenty of user backplane signals available on the Annapolis 6U Rear Transition Module (RTM) such as LVDS, FPGA HSS, IRIG, Ethernet and clocking. RTM HSS is also capable of 10Gbps signalling and supports multiple channels of 40GbE.

FEATURES

- **One, Two or Three XILINX VIRTEX 7 FPGAS**
  - VX690T or VX980T
  - Up to 8 GB of DDR3 DRAM for 51.2 GB/s of DRAM bandwidth
  - Up to 128 MB of QDRII+ SRAM for 64 GB/s of SRAM bandwidth
  - PCIe Gen3 8x from each FPGA to on-board PCIe switch
- **Backplane I/O**
  - 16x High Speed Serial IO lanes to VPX Data Plane (P1) for 20 GB/s of Full Duplex Bandwidth
  - Up to 16x High Speed Serial FPGA connections to P5
  - 8x High Speed Serial IO lanes to P4
  - Two PCIe Gen3 8x Connections to VPX Expansion Plane (P2)
  - 32 LVDS and 8 Single Ended lines to P3
  - Backplane Protocol Agnostic connections support 10/40Gb Ethernet, SDR/DDR/QDR Infiniband, AnnapMicro protocol and user designed protocols
- **Front Panel I/O**
  - Accepts Standard Annapolis WILDSTAR Mezzanine Cards, including a wide variety of WILDSTAR ADC and DAC Mezzanine Cards
  - Three or six optional built-in Front Panel QSFP+ Transceivers running at up to 52.4 Gbps each for 39 GB/s of Full Duplex Bandwidth
  - 1 Gb Ethernet RJ45 connector for Remote Host Access
  - External clock and IRIG-B Support via Front Panel SMA
  - QSFP+ Protocol Agnostic connections support 10/40Gb Ethernet, SDR/DDR/QDR Infiniband, AnnapMicro protocol and user-designed protocols
- **Dual Core Processor APM86290**
  - Host Software: Linux API and Device Drivers
  - Each core runs up to 1.2 GHz
  - 2 GB of DDR3 DRAM
  - 4GB SATA SSD and 16MB NOR Boot Flash
  - 4x PCIe Gen2 connection to on-board PCIe Switch
- **Application Development**
  - Full CoreFire NextTM Board Support Package for Fast and Easy Application Development
  - 10/40Gb Ethernet and AnnapMicro Protocol Cores Included
  - Open VHDL Model including Source Code for Hardware Interfaces
  - Open VHDL IP Package for Communication Interfaces
  - Chipscope Access through RTM
- **System Management**
  - System Management using Intelligent Platform Management Interface (IPMI)
  - Diagnostic monitoring and configuration
  - Current, Voltage and Temperature Monitoring Sensors
  - Hot Swappable (exclusive to WILDSTAR OpenVPX EcoSystem)
- **Mechanical and Environmental**
  - 6U OpenVPX (VITA 65) Compliant, 1" VITA 48.1 spacing
  - Supports OpenVPX payload profile:MOD6-PAY-4F1Q2U2T-12.2.1-n
  - Integrated Heat Sink and Board Stiffener
  - Available in Extended Temperature Grades
  - Air Cooled with Conduction Cooled path
  - RTM available for additional I/O

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Annapolis Micro Systems, Inc.
www.annapmicro.com

wfinfo@annapmicro.com
410-841-2514

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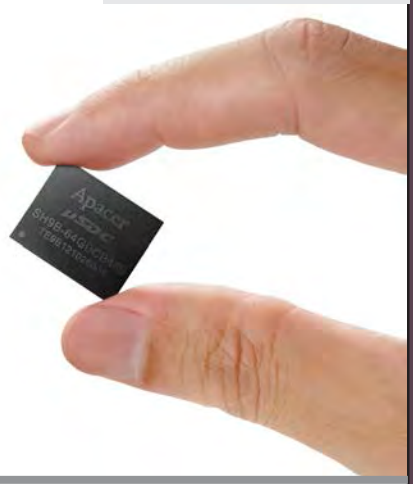

µSDC

Apacer's ultra-small 16x20mm SSD-µSDC complies with JEDEC MO-276 specification. It performs at a maximum sequential read/write speed of 515/165 MB/sec. Using the ball grid array (BGA) technology, it integrates key components such as a controller, flash and DRAM in a single chip. Its features such as wide temperature (-40°C ~ +85°C) and surface-mount technology (SMT) provide stable storage installation even at a high altitude.

FEATURES

- Tiny size with outstanding performance
- Compliant with MO-276 standard (16x20x1.4mm)
- SoC (System on Chip)/SiP (System in Chip) technology
- Built-in S.M.A.R.T. functions
- TRIM command support
- DEVSLP Support

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Embedded Hardware

ARTESYN™
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ATCA® Blades

In addition to integrated, application-ready systems, Artesyn offers a rich selection of payload blades featuring various processor architectures to suit the dense computing and integrated network needs of military and aerospace applications.

ATCA technology embodies MOSA into system platforms by optimizing joint combat system performance and total cost of ownership (TCO) over the entire program life cycle. Its rich multi-vendor ecosystem ensures that the architecture is extensible and enables key technology refreshes into production programs over time, without the need for a full system upgrade.

ATCA has a strong history of deployment in military & aerospace applications that require dense computing processor blades communicating over a 10G/40G integrated network.

FEATURES

- Designed and tested for challenging environments
- Tested and verified in Artesyn's Centellis® series systems to simplify configuration and integration
- Wide range of processor architecture options including Intel® XEON®, Cavium OCTEON, and DSPs from TI or Octasic
- Long life embedded processors support long life military programs

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Artesyn Embedded Technologies
www.artesyn.com/computing

computingsales@artesyn.com
linkedin.com/company/artesyn
+1 (888) 412-7832
twitter.com/artesynembedded

ARTESYN™
EMBEDDED TECHNOLOGIES

Centellis® ATCA® Systems

AdvancedTCA is a COTS open standard bladed architecture that meets the requirements for Modular Open Systems Approach (MOSA) in a rugged, compact and power-efficient package.

ATCA has a strong history of deployment in military & aerospace applications including shipboard communications and data center consolidation, naval tactical combat systems refresh, airborne reconnaissance, theater command centers, mobile TOCs, ground and airborne battle management systems, net-centric converged solutions for voice, video, and data, and C4ISR. All these programs require dense computing processor blades communicating over a 10G/40G integrated network.

Artesyn has the largest installed base of ATCA systems and blades and a long history of providing computing solutions to prime contractors and system integrators. Our ATCA systems in shock-isolated racks have operated flawlessly under afloat shock testing (Class A barge testing) and hour-long vibration testing with shock events increasing in intensity to the maximum -15G.

FEATURES

- Application-ready configurations shorten time-to-market
- Strong ecosystem of off-the-shelf or custom blades allows the platform to be easily configured for a range of applications & upgraded as new technologies become available
- Power & cooling up to 600 Watts per blade slot accommodates today's technology with headroom for higher powered processors in the future
- Integrated redundant switching of up to 40G to all slots in the backplane
- Long life embedded processors and switching architectures support long life military programs

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Artesyn Embedded Technologies
www.artesyn.com/computing

computingsales@artesyn.com
linkedin.com/company/artesyn
+1 (888) 412-7832
twitter.com/artesynembedded

Embedded Hardware

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MVME250x Series

Artesyn's MVME250x 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, nonvolatile 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 MVME250x 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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Artesyn Embedded Technologies
www.artesyn.com/computing

computingsales@artesyn.com
linkedin.com/company/artesyn
+1 (888) 412-7832
twitter.com/artesynembedded

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MVME 8100

Artesyn'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

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www.artesyn.com/computing

computingsales@artesyn.com
linkedin.com/company/artesyn
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LUMINEQ®
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Military displays

Looking at the specifications of our displays, it is obvious why very demanding applications are our core business. We deliver to projects where demands exceed the capabilities of most commercial displays available today. We take pride in delivering rugged tools for crystal clear visual communication, regardless of the conditions. For example, our displays exhibit instant-ON down to -60 °C, with no motion blur. We also tackle humidity, vibration and pressure fluctuations.

Lumineq in military applications – We have been serving military display projects for the past 20 years. Since being introduced to the stringent requirements of military applications, Lumineq displays have been used on land, at sea and in the air.

Broad product range – The Lumineq portfolio of displays consists of several product lines. Sizes range from 3.1" (diagonal) to 10.4". Display resolutions start at 160 × 80 (columns × rows) and reach VGA 640 × 480. In addition, customers can chose from many options in order to tune their display. These include conformal coating, locking connectors, extended temperature range, dimming, anti-glare film, wide input voltage and different mounting options.

Transparent displays you can really see through – Lumineq Displays has launched a line of transparent displays based on the same technology as our non-transparent products. These displays offer unbeaten see-through capabilities (transparency >80%) for optical peripherals, such as scopes and range finders. The complete self-emitting display structure is only 1.5 µm thick (excluding glass).

FEATURES

- **Wide temperature range**
  Lumineq displays have a wide operating range, e.g. from -25 to +65 °C. Special designs can achieve -60 to +105 °C.
- **Rugged design**
  Lumineq displays consist of an emissive glass panel, pixel drive electronics and power supply, all built into a compact and lightweight, but rugged, package. Lumineq displays have excellent shock resistance.
- **Image quality**
  Lumineq displays exhibit high contrast and excellent readability. Image quality is virtually unchanged over the entire temperature range, with instant pixel response and no motion blur even at the extreme colds.
- **Long-term availability**
  To make products available for a longer time, Lumineq establishes lifetime programs that make it easy for customers to focus on their products. We can help build a stellar product and keep it in production longer.

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COBHAM

GEN 6 Single Board Computer

The GEN 6 LEON 3FT Single Board Computer (SBC) is Cobham Semiconductor Solutions' (formerly Aeroflex) Flight Ready TRL-6 based, off the shelf system designed for LEO, GEO, and Planetary command and control applications. The board is designed with a flexible core architecture to balance power and performance needs. The system is capable of up to 95 Dhrystone MIPS with a132MHz System Clock. The GEN 6 SBC is equipped with 64MB of EDAC protected SRAM and 32MB of EDAC protected Non-Volatile Memory. There are 3 physical interface types on the SBC: cPCI, SpaceWire and a test and development interface. The cPCI interface connectors support 32 bit 33MHz PCI bus as well as 1553B, SPI, and CAN. The 1553B, SPI and CAN interfaces are implemented via unused signals of the J2 cPCI connector. The test and development interface is a 37 pin MDM connector that supports access to the LEON 3FT Debug Support Unit (DSU), Ethernet, and processor reset via the Cobham supplied Interface Pod. The SBC comes with an additional Interface Pod to expand the capabilities and debug/software loading of the GEN 6 SBC.

FEATURES

- **General:** 3U cPCI Form Factor ▪ Flexible Architecture ▪ LEON 3FT Based
- **Radiation Performance:**
  - TID > 100 krad(Si) ▪ SEL Immunity: up to 86MeV cm2/mg
- **Memory:**
  - 64MB of EDAC SRAM Memory ▪ 32MB of EDAC Non-Volatile MRAM
- **Interfaces:** Two SpaceWire Ports operating at 132Mbs max
  - 32 bit 33MHz cPCI bus
  - Test port for Ethernet, Serial DSU, and UART interfaces
  - 1553B (UT700 version only) ▪ SPI (UT700 version only) ▪ CAN (All versions)
- **Environmental:** Acceptance Test Levels: -30°C to +70°C
  - Qualification Level: -35°C to +80°C
- **Power Requirements:**
  - Requires only the 3.3V supply from the cPCI backplane. 5V is not required.
- **Power Consumption:** UT700 Processor up to 132MHz and 7.3W Max
  - UT699 Processor up to 49.5MHz and 8.5W Max
  - UT699E Processor up to 66MHz and 6.6W Max

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Cobham Semiconductor Solutions
www.aeroflex.com/SBC

Teresa.farris@aeroflex.com
719-594-8035

Embedded Hardware

CONCURRENT TECHNOLOGIES

TR B1x/3sd-RCx

TR B1x/3sd-RCx is a 3U VPX-REDI processor board based on a 4-core Intel® Core™ processor with up to 16 Gbytes of DRAM giving it the capability to run high performance applications in a rugged environment. TR B1x/3sd-RCx features an XMC site for local expansion and a range of rear interfaces including SATA, Ethernet, serial and USB.

Concurrent Technologies has a range of commercial and rugged grade OpenVPX products which includes processor boards, switch fabric, mass storage and XMC carriers as well as development systems to assist with initial integration. Our Fabric Interconnect Networking Software (FIN-S) is supported to provide a variety of communication mechanisms.

FEATURES

- Rugged conduction cooled and Non-rugged air cooled variants
- Based on a 4-core; Intel® Core™ processor and up to 16GBytes ECC memory for high performance applications
- Configurable PCI Express® (PCIe) VITA 46.4 data plane fabric interface
- Configurable Gigabit Ethernet VITA 46.6 control plane fabric interface
- Optional Built-In Test (BIT) firmware and software, board-level security package, Trusted Platform Module (TPM), fabric configuration tool and support for Linux®, Windows®; and VxWorks

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Concurrent Technologies
www.gocct.com/products/vpx/3u/processor_boards.htm

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+44 (0)1206 752626 or +1 781-933-5900

Connect Tech Inc.
Embedded Computing Experts

COM Express® + GPU Embedded System

The **COM Express® + GPU Embedded System** from Connect Tech combines the latest generation x86 processors with high-end Graphics Processing Units (GPU) all into a ruggedized small form factor embedded system. Choose from the latest generation Intel® Core™ i7 or i5 x86 processors; and from either the AMD GPU (ideal for driving multiple displays) or the NVIDIA GPU (ideal for CUDA Coreprocessing applications) lineup.

This embedded system exposes all of the latest generation interconnect including: Gigabit Ethernet, USB 3.0 and 2.0, DisplayPort++, VGA, LVDS, SATA III, GPIO, I2C, mSATA, miniPCIe, PCIe/104 and SD Card Expansion. This embedded system uses all locking ruggedized positive latching connectors and eases the challenge of cooling multiple processors with the use of our Unified Thermal Extraction Baseplate which can be mounted directly into an enclosure or chassis for further thermal dissipation.

FEATURES

- Combines High-End GPUs with Latest Generation x86 Processors in a ruggedized small form factor
- GPUs can be targeted for 4 independent display outputs OR for a headless GPU processing system utilizing CUDA cores
- All thermal extraction points from COM Express and GPU are brought out to a single unified plane

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Connect Tech Inc.
www.connecttech.com/VXG006-OSM/

sales@connecttech.com
www.connecttech.com

519-836-1291 | 800-426-8979
twitter.com/connecttechinc

Embedded Hardware

Connect Tech Inc.
Embedded Computing Experts

GraphiteVPX/CPU

Connect Tech's **GraphiteVPX/CPU** is a VITA 65 compliant 3U single board computer based on the Intel® Atom™ E3845 (Bay Trail) Quad Core processor. It provides a wide array of IO available at the VPX backplane including up to five networking ports and can source power from one or multiple backplane supplies. The GraphiteVPX/CPU is a modular design allowing for other processor options to be used; should an alternative processor be required for your application contact sales@connecttech.com.

FEATURES

- 3U OpenVPX VITA65
- Intel® Atom™ E3845 (Bay Trail) Quad Core processor
- Two x4 PCIe Gen3 Ports, Three 10/100/1000 BASE-T ports, Two 1000 BASE-X ports, Two USB 3.0 (Super Speed) ports, Eight USB 2.0 (Hi-Speed) ports, Two SATA 2.0 Ports, One DisplayPort++ Interface, HD Audio Input/Output, Two RS-232 Ports, 8 GPIO.
- Supports 3U VPX profiles: MOD3 PAY 2F2T-16.2.5-2,3 and MOD3-PAY-2F2U-16.2.3-2,3
- Uses COM Express Type-10 Technology
- Start development today with the GraphiteVPX/CPU RTM

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Connect Tech Inc.
www.connecttech.com/VPG001CPU-OSM/

sales@connecttech.com
www.connecttech.com

519-836-1291 | 800-426-8979
twitter.com/connecttechinc

Connect Tech Inc.
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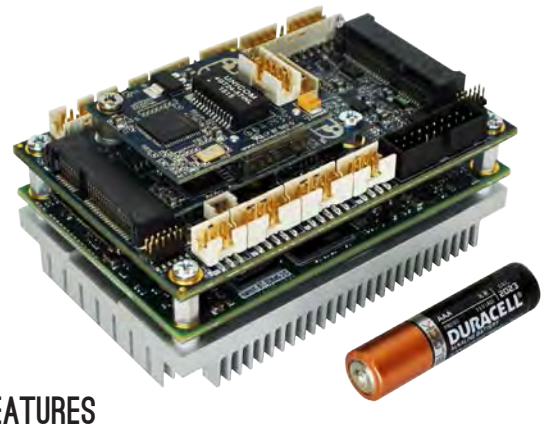
COM Express® Type 10 Mini Carrier Board



Connect Tech's latest addition to our growing COM Express Carrier Board line card, the **CCG020** is a Type 10 Carrier Board now with USB 3.0 support, 2 x half size Mini PCIe, 1 x mSATA, USB 2.0, dual Ethernet and more, extended temperature -40 to +85C. This device offers ultimate durability with high performance processing, while fitting the needs of a constrained Size, Weight, and Power (SWaP) environment.

The CCG020 supports the latest generation of low-powered CPUs from Intel and others, is module agnostic supporting a wide range of module vendors. It is 84mm x 55mm and weighs only 49 grams. It has two mini PCIe, mSATA, SATA, two GbE, six USB, LVDS, DisplayPort/HDMI/DVI/VGA, HD Audio, 2 x RS-232/422/485. Both sockets have PCIe and USB signaling and one socket can be configured as mSATA. It has one DisplayPort++ (DDI) interface and can also be used for HDMI, DVI, or VGA. The device has one LVDS interface (18-bit, 3 data pairs), two Gigabit (10/100/1000) Ethernet ports, one from COM Express, and one from the on-board Intel 82574 PHY/controller.

FEATURES

- Extremely small size, 84mm x 55mm
- All ruggedized latching connectors
- 2 x mini PCIe, mSATA, SATA, 2 x GBE, 2 x USB 3.0, 4 x USB 2.0, LVDS, DisplayPort/HDMI/DVI/VGA, HD Audio, 2 x RS-232/422/485
- Support for the latest generation of low powered CPU's
- Extended Temperature Range

mil-embedded.com/p372982

Connect Tech Inc.
www.connecttech.com/CCG020-OSM/

sales@connecttech.com
www.connecttech.com

519-836-1291 | 800-426-8979
twitter.com/connecttechinc

Embedded Hardware

Connect Tech Inc.
Embedded Computing Experts

Xtreme/GbE – Managed Carrier Ethernet Switch

Connect Tech's **Xtreme/GbE Managed Carrier Ethernet Switch** provides Carrier Grade Ethernet switching capabilities in an extremely small embedded form factor.

Excellent for high-end applications such as Mobile and Microwave backhaul, the Xtreme/GbE Managed Carrier Ethernet Switch is also a highly reliable way to communicate with 10/100/1000 devices in an embedded system. Powered by the latest generation Carrier Ethernet Switch engine the Vitesse 7428/7429. Its embedded 416 MHz MIPS 32-bit CPU, 1Gb DDR2 external memory and DMA-based frame extraction and insertion support timing over packet, Ethernet OAM, and performance monitoring.

FEATURES

- 8, 12 or NEW! 24 Port 10/100/1000 Mbps Switch
- Conduction cooled or Air cooled options
- Web GUI or CLI Management
- Carrier Grade Ethernet Switching
- With RJ-45 or Rugged Locking connectors
- Small Form Factor, 4.550" x 4.393"
- Extended Temperature Range -40°C to +85°C

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Connect Tech Inc.
www.connecttech.com/XDGseries-OSM/

sales@connecttech.com
www.connecttech.com

519-836-1291 | 800-426-8979
twitter.com/connecttechinc

CRYSTAL™

RE0814

With an all-aluminum compact chassis footprint, the RE0814 provides a small package with big capabilities. The unit was optimized for remote applications requiring powerful processing on a tight power budget. This unit is designed for dirty, dusty, dangerous environments.

Using our expertise in industrial and DoD electronics development, we have set the industry's expectations in rugged computing performance. Designed for and proven in the harshest environments, the RE0814 boasts the highest up-time reliability in the industry. Whether mission critical or vital to your business, the RE0814 will exceed your expectations.

FEATURES

- Compact aluminum construction - 11"x16.5" footprint
- Unit weighs 9.20 lbs.
- No moving parts; fanless, natural convection design
- Extended temperature range: -40°C to +85°C
- Power efficient Intel Core i3, or Core i7 options
- Up to four (4) SSD hard drives
- Billet construction from milled and strain hardened 6061T651 structural aircraft aluminum
- Panel or rack mounting options

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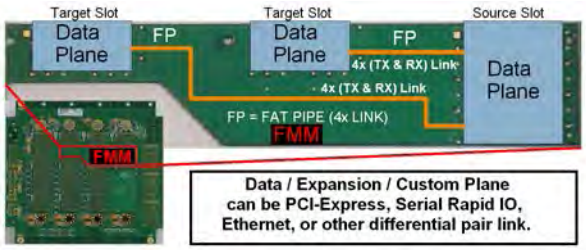
Crystal Group, Inc.
www.crystalrugged.com/products/embedded.aspx

rfq@crystalrugged.com
www.linkedin.com/company/crystal-group
800-378-1636
twitter.com/CrystalGroup

Dawn VME Products®



Fabric Mapping Modules

Dawn OpenVPX backplane **Fabric Mapping Modules** simplify topology customization. Dawn VME Products FABRIC MAPPING MODULES automate optimization of OpenVPX backplane topologies. Newly patented FMM micro-overlays quickly customize off-the-shelf OpenVPX backplanes to mission requirements.

Fabric Mapping Modules allow designers to work with flexible configurations of high speed links. Off-the-shelf backplanes can be quickly customized to mission requirements without the time and expense required for new backplane designs, a critical advantage when schedules are compressed by late system changes. Dawn engineers have successfully used Fabric Mapping Modules to solve many OpenVPX application problems in the design phase.

Fabric Mapping Modules provide a natural migratory development environment for moving from the lab to the field with high speed OpenVPX backplanes.

FEATURES

- Off-the-shelf backplanes can be quickly customized to mission requirements
- Optimize the communication topology between slots within a system's backplane
- Customize inter-slot communications to meet unique system requirements
- Improve signal integrity between system cards beyond requirements of PCI Express, Serial Rapid I/O and 10Gbit (XAUI) Ethernet standards
- Directly connect PCI Express or SerialRapid I/O to multiple cards or cards and switches
- Link SATA from a CPU card to a Solid State Drive (SSD) carrier
- Enable XMC cards to talk to other XMC cards or other I/O like PCI Express links
- Facilitate rear backplane I/O connections and low profile connector interface systems when normal transition modules do not fit the system application envelope

mil-embedded.com/p372452

Dawn VME Products
www.dawnvme.com

sales@dawnvme.com
800-258-DAWN (3296) ▪ 510-657-4444

Dawn VME Products®

PSC-6265

VITA 62 compliant 6U power supply for conduction cooled systems.

Dawn's VITA 62 compliant 6U **PSC-6265** can operate continuously in diverse environments over a wide range of temperatures at high power levels. The standard model is conduction to wedge lock cooled with an operating temperature range of -40C to +85C and a non-operating range of -55C to +105C.

The PSC-6265 operates continuously at a power level of 580 watts. For systems that require higher power levels, up to three supplies may be operated in parallel.

Fault monitoring and control circuits protect the system from over-voltage, over-current, and over-temperature conditions.

Power supply operational or fault status is displayed using colored LED's on front panel.

FEATURES

- Continuous 580W output over temperature range of -40C to +85C
- True 6 Channel supply provides full Open VPX support
- Secondary Side Wedge lock conduction cooled
- 6U, 1 inch pitch form factor
- Compatible with Dawn's HLD-6262 Holdup Module
- Fault monitoring and control
- Output over-voltage, over-current, and over-temperature shutdown protection
- Current/Load share compatible with up to 3 PSC-6265 units
- Standard INHIBIT*, ENABLE*, FAIL* and SYSRESET* control signals
- VBAT for support of VPX memory backup power bus
- Front I/O panel includes LED status indicator, and VBAT battery access
- VITA 48.2 Compliant Inject/Eject levers for easy installation

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Dawn VME Products
www.dawnvme.com

sales@dawnvme.com
800-258-DAWN (3296) ▪ 510-657-4444

Embedded Hardware

DDC®
Connectivity Power Control

Your Solution Provider for ... Connectivity, Power and Control

DDC is the world leader in the design and manufacture of high-reliability data networking, power control, and motion control solutions for aerospace, defense, and industrial applications. For more than 50 years, DDC has continuously advanced the state of high-reliability Connectivity, Power, and Control technology with innovations that optimize efficiency, reliability, and performance. DDC offers both standard and custom solutions that minimize size, weight and power consumption, while accelerating your time-to-market.

DDC designs boards, hybrids, and multi-chip modules (MCM) to meet ruggedness and reliability levels for performance in demanding environments.

- **Rugged Solutions**
  - Flyable Boards for Conduction or Air-Cooled Applications
  - Extended Temperature Operation ▪ MIL-STD-810/VITA 47 Shock and Vibration
- **Life Cycle**
  - Uninterrupted Product Availability, Backwards Hardware and Software Compatibility, and Configuration Control

FEATURES

- **Connectivity**
  - Market Leader in High Reliability Data Bus Solutions
  - MIL-STD-1553/1760, ARINC 429, AFDX®/ARINC 664, ARINC 629, Fibre Channel, Ethernet, CANbus & Serial I/O
  - Optimized Modules, Boards & Components Maximize System Performance
- **Power**
  - Custom and Standard Power Supplies for Aerospace & Defense
  - Market Leader in Solid-State Power Controllers with over 800,000 nodes installed
  - When Off-the-Shelf Won't Do ... DDC Custom Motor Controllers and Drives. DDC has a Proven Track Record of Solving the Most Complex and Technically Challenging Motor Control Requirements
  - Market Leader for Transformer and Magnetic Solutions
- **Control**
  - Synchro/Resolver-to-Digital and LVDT Converters for Precision Motor & Actuator Positioning for Demanding Applications
  - Rugged & Reliable – Engineered for Dust, Fluid, Shock, Vibration, Extreme Temps (-55°C to +200°C)
  - Precision Performance – Accuracy (1 arc-min)

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Data Device Corporation
www.ddc-web.com

info@ddc-web.com
1-800-DDC-5757
www.linkedin.com/company/data-device-corporation
www.twitter.com/datadevicecorp

SBC347A 3U OpenVPX Single Board Computer

Rugged single board computer features enhanced connectivity for minimal disruption, advanced security capabilities.

Two channels of 10GBASE-T give GE's SBC347A rugged 3U OpenVPX single board computer (SBC) 10x the Ethernet capability of earlier models. This enables customers to benefit from substantially enhanced connectivity on the Control Plane without needing to undertake disruptive, expensive infrastructure changes.

Advanced security support empowers customers with formidable security capabilities such as anti-tamper and information assurance; while PCI Express® Gen3 technology provides the exceptional on-board and off-board bandwidth needed by today's sophisticated applications.

Based on 5th Gen Intel Core i7 technology, the SBC347A delivers greater CPU and 3D graphics performance when compared with previous-generation processors – yet maintains the same power envelope.

The SBC347A is designed for demanding applications in harsh, SWaP-constrained military environments such as manned- and unmanned vehicles, signal processing in ISR, sonar, radar, and command/control, as well as the most challenging applications in industry such as energy exploration and transportation.

FEATURES

- 5th Gen Intel® Core™ i7 quad core processor (6 MB shared cache)
- Two channels of soldered DDR3L SDRAM with ECC up to 16 GB
- Up to 32 GB NAND Flash
- Rear I/O:
  - 2x 10GBASE-T ports (also configurable as 2x 1000BASE-T)
  - 1x VGA port
  - 1x DVI port
  - 3x SATA 6 Gb/s ports
  - 2x COM ports
  - 4x USB 2.0 ports
  - Up to 8x GPIO
- Five levels of ruggedization (convection and conduction cooling variants)
- AXIS and Deployed Test software
- Microsoft® Windows, Open Linux® and VxWorks® support

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GE Intelligent Platforms
geembedded.com

'Contact Us' http://www.geautomation.com/contact-us
www.linkedin.com/grp/home?gid=5097734
1-800-322-3616
http://bit.ly/1MsJ7It

GPS SOURCE

GPS LIVE INSIDE

D3M

D3M replaces up to four AN/PSN-13A DAGRs as the source for PNT distribution in ground vehicle C4ISR architecture. It supports new or retrofit programs integrating radio or communications equipment. Port independence enables PNT clients that are connected to D3M to have full control over their respective ports, as if each client has its own DAGR. D3M functions as a secure GPS Hub or Router and can serve IS-GPS-153 PNT data simultaneously to as many as eight communications or weapon systems that require secure GPS information. Total platform integration costs are reduced by elimination of multiple GPS Antennas, DAGRs and/or GB-GRAM cards in a vehicle or rotorcraft. The D3, together with the Stryker LAV have been selected as the MGUE Lead Platform by the US Army.

FEATURES

- Convey M-Code protected PNT Data to Multiple IS-GPS-153 Clients
- M-Code Protected GPS Access
- Will Support M-Code Signal Applications
- J2-X Ports are Compatible with the J2 Port of DAGR
- Compatible with Anti-Jam Antennas

INTERFACE OPTIONS:

- Four IS-GPS-153 Data Ports
- J1 – DS-101/DS-102 Keyload
- J2 – Service and Programming
- J2-1 thru J2-4 – DAGR Compatible Interfaces
- J3 – Antenna Input
- J4 – 28 VDC Vehicle Power Input
- J5 – 6 Pin Key Fill

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GPS Source, Inc.
www.gpssource.com

defense@gpssource.com
http://linkd.in/1KuczNy
719-561-9520
@gpssourceinc

Innovative Integration
a subsidiary of Interconnect Systems, Inc.
... real time solutions!

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 – Put the ePC-K7 at the data source and reduce system errors and complexity. Optional GPS-synchronized timing, triggering and sample control is available for remote I/O. Limitless expansion via multiple nodes. Up to 4 HDD for data logging.

Uniquely customizable – Dual FMC I/O module sites – add anything from RF receivers to industrial control modules. User-programmable FPGA for I/O interfaces, triggering and timing control, USB ports.

Remote or Local Operation – Continuous data streaming up to 1000MB/s or 2 x Gb/s Ethernet. Optional, stand-alone, autonomous operation with GPS-synchronized sampling.

Rugged – SSD boot drive support in a compact, rugged 8x11" footprint that is ready for embedded operation.

8-36V DC-Only Operation – Perfect for portable or automotive data loggers or waveform generators.

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.
- I/O sites (VITA 42.3) deliver >3000MB/s to CPU memory
- Integrated timing and triggering support for IO includes GPS, IEEE1588 or IRIG-disciplined clock
- Supports Innovative and third-party FMC modules for private data channels, triggering and timing features
- USB3.0 x6, Gb Ethernet x2, SATA x4, DisplayPort, Touch Screen
- Up to 4 SSD or HDD (2.5 in) AC or DC operation

Download data sheets and pricing now!

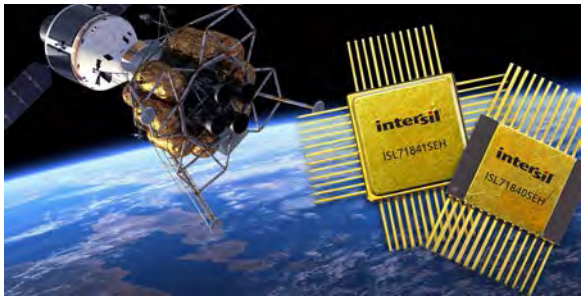
mil-embedded.com/p372943

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

sales@innovative-dsp.com
805-383-8994

intersil™

ISL71840/41SEH



Intersil's new ISL71840SEH and ISL71841SEH radiation hardened (rad hard) multiplexers offer best-in-class electrostatic discharge (ESD) protection, and the industry's highest signal chain accuracy and timing performance. The ISL71840SEH 30V 16-channel multiplexer is a drop-in replacement for Intersil's widely adopted HS9-1840ARH, which has been aboard nearly every satellite and space exploration mission, including NASA's recent Orion spacecraft flight test. For applications with form factor constraints, the new ISL71841SEH 30V 32-channel multiplexer offers high performance and 41% reduced board space compared with an ISL71840SEH two-chip solution.

The ISL71840SEH and ISL71841SEH deliver ultra-high performance in the most demanding environments by leveraging Intersil's proprietary silicon on insulator process, which provides single event latch-up (SEL) robustness in heavy ion environments. The enhanced 8kV ESD protection feature of these devices eliminates the need for costly external protection diodes on the input pins. And their reduced RON of 500 Ohms at +/-5V and propagation delays of less than 800ns increase the overall performance and accuracy of telemetry signals processed and multiplexed into an analog-to-digital converter (ADC) input.

FEATURES

- Delivers 8kV human body model (HBM) ESD protection
- Provides true rail-to-rail operation and features over-voltage protection with shutoff
- Cold sparing from ground +/-25V, analog over-voltage range from ground +/-35V
- Off switch leakage of 100nA, low RON of less than 500 Ohms reduces power consumption, improves signal integrity and total harmonic distortion
- Triple redundant decoders with fast response time of <5us drastically improves single event transient (SET) performance
- Improved off-isolation and crosstalk rejection ensures the output leaks to ground whenever multiplexer is disabled
- Adjustable logic threshold control with VREF pin
- High dose rate (50-300rad(Si)/s) radiation tolerance of 100krad(Si)
- Low dose rate (0.01rad(Si)/s) radiation tolerance of 50krad(Si)
- SEL/B immune up to 86MeV.cm^2/mg

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Intersil
www.intersil.com/products/isl71840seh

info@intersil.com

isola

Tachyon® 100G

Intended for very high-speed digital applications up to and beyond speeds of 100 Gbps, Isola's Tachyon® 100G laminate materials exhibit electrical properties that are very stable over a broad frequency and temperature range. Tachyon 100G materials have the same electrical properties as its predecessor, Tachyon; however, its Z-axis CTE (coefficient of thermal expansion) is more than 30% lower. This makes Tachyon 100G materials better suited for fabricating high-layer-count, 0.8-mm pitch line cards with heavy 2-oz copper inner layers.

Tachyon 100G products use spread glass and reduced-profile copper to mitigate skew and improve rise times, reduce jitter, and increase eye width and height. The material provides a nominal dielectric constant of 3.02 that is stable between -55°C and +125°C up to 40 GHz. It also has a low nominal dissipation factor of 0.0021.

Tachyon 100G materials are available in optimized laminate and prepreg forms in typical thicknesses and standard panel sizes for high-speed digital multilayer backplanes and daughter cards.

FEATURES

- Tg: 185°C (DSC)
- Td: 380°C (TGA @ 5% wt loss)
- Low CTE in the Z-axis – 2.5% (50-260°C)
- T260: >60 minutes
- T288: >60 minutes
- T300: >20 minutes
- RoHS Compliant
- Dk: 3.02
- Df: 0.0021
- Industry Approvals: UL 94 V-0, UL Qualified – 130 MOT, Non-ANSI, IPC-4103/17

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Isola
www.isola-group.com/products/tachyon-100g/

tachyon@isola-group.com
www.linkedin.com/company/isola-group
800-537-7656
twitter.com/IsolaGroup

Embedded Hardware

LCR™ EMBEDDED SYSTEMS, INC.
Chassis • Backplanes • Integrated Systems

LSF-02

The LSF-02 is a rugged environmentally sealed tactical computing and communications platform, ideal for vehicle and man-pack applications. The LSF-02 was designed to be easily customizable. The COM-Express based architecture provides flexibility to meet different performance and power envelopes. Support for 2 Mini-PCIe slots provides options for Mil-Std-1553, ARINC 429/575/717, CAN bus, WiFi or Cellular modems. The platform also has room for 2 additional add-in cards. Two optional Mil-Std 2590 batteries allows the platform to be unmounted and be used in man-pack applications.

- **Computing:**
  4th Generation Intel Core i7-4700E 2.4GHz, QM87 Express Chipset, 2 x 8GB DDR3L-1600 SO-DIMM dual channel
- **Storage:** Removable 2.5" SSD, Optional mSATA
- **I/O:** 2 GbE, 4 USB 2.0, VGA Display port, RS-232 or RS-422/485 (no handshaking signal)

FEATURES

- **Customizable Payload**
  2 mini-PCIe expansion slots, Space for 2 additional add-in cards
  6.9" x 6.9" 7" x 6.83"
- **Power**
  9-36VDC Input, Optional dual Mil-2590 Batteries
- **Physical**
  4.6"(H) x 9.5" (W) x 12.25" (L)
  Weight: <20 lbs
  Watertight to IP67
  Operational: -40C to 70C
  Shock: 30g/11ms per Mil-810F Method 516.5

mil-embedded.com/p372665

LCR Embedded Systems
www.lcrembeddedsystems.com

Sales@lcrembedded.com
1-800-747-5972

MPL
High-Tech • Made in Switzerland

Rugged Fanless Embedded Computers up to i7 Quad Core

The **PIP Family** is a powerful, highly integrated, robust, and fanless rugged embedded Computer solution. Selection of the parts are purely made on the subject for long-term availability (Embedded Roadmap). The systems can be expanded in a very modular way and represent a unique solution for today's demanding defense requirements, with basically unlimited options. The products are designed to operate under extreme and normal conditions without the need of fans. MPL solutions are designed and produced in Switzerland to meet MIL STD-810F as well as other standards.

The systems include features like wide DC input power, reverse polarity protection and more. Additional GPS, WLAN, CAN, Sound, and UPS modules are available.

FEATURES

- Wide CPU selection up to i7 Quad Core
- Soldered CPU and Chipset, and ECCRAM
- Up 5X Gigabit Ethernet, Up to 7 USB (3.0 & 2.0), Up to 4 serial ports (RS232/485)
- Internal & external PCIe expansion, Internal PMC, XMC, mPCIe, PCI-104 expansion
- Fanless operation
- Extreme low power consumption
- Availability 10+ years (repair 20+ years)
- Optional -40°C up to 85°C environment temperature, Optional Bonding & Coating

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MPL AG
www.mpl.ch

info@mpl.ch
+41 56 483 34 34

Embedded Hardware

North Atlantic Industries
Accelerate Your Time-to-Mission

3U cPCI ARM Cortex-A9 Single Board Computer – 75ARM1

NAI's 75ARM1 is a 3U cPCI ARM Cortex™-A9-based, Single Board Computer with three intelligent I/O and communication function module slots – and more than 40 different modules to choose from.

Ideally suited for rugged defense, industrial, and commercial applications, NAI's rugged SBCs offer more I/O intelligence in the smallest package with the highest processing power than anyone else in the industry.

Modules on the 75ARM1 have their own dedicated ARM processor, which frees up the main processor to be used by the application. This architecture is unique in the industry.

Architected for Versatility – NAI's Custom-on-Standard Architecture™ (COSA™) offers a choice of over 40 intelligent I/O, communication, and Ethernet switch functions, providing the highest packaging density and greatest flexibility of any 3U SBC in the industry. Pre-existing, fully-tested functions can be combined in an unlimited number of ways quickly and easily. Each I/O function has dedicated processing, unburdening the SBCs from unnecessary data management overhead.

The 75ARM1 includes BSP and SSK support for Wind River® Linux and VxWorks®, and for Xilinx® PetaLinux. In addition, SSKs are supplied with source code and board-specific library I/O APIs to facilitate system integration.

Eliminate man-months of integration with NAI's 75ARM1 single board computer.

FEATURES

- Compact 3U cPCI SBC with support for 3 independent, intelligent function modules
- 40+ modules to choose from
- Independent x1 SerDes interface to each function module slot
- COSA™ Architecture ▪ ARM Cortex™-A9 Dual Core 800 MHz Processor
- 512 MB DDR3L SDRAM ▪ Up to 32 GB SATAII NAND Flash (4 GB standard)
- < 5 W MB power dissipation
- System controller or peripheral option ▪ Front and/or rear I/O
- 2x 10/100/1000 Base-T Ethernet; 2 to rear, or 1 to rear and 1 to front I/O
- 1x RS232 to front or rear I/O ▪ I2C Bus to rear I/O
- Wind River® Linux and VxWorks®, and Xilinx® PetaLinux OS support
- Intelligent I/O library support available
- Continuous Background Built-in-Test (BIT)
- VICTORY Interface Services (contact factory)
- Commercial and rugged versions
- Operating temperature: 0°C to +70°C commercial, or -40°C to +85°C rugged

Made in the USA
Certified Small Business

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North Atlantic Industries, Inc.
http://www.naii.com/3U-cPCI-ARM-Cortex-A9-75ARM1/P275

lboccone@naii.com
631-567-1100

North Atlantic Industries
Accelerate Your Time-to-Mission

Nano Interface Unit – NIU1A

Configure with one I/O or communications function module and optional ARM1 processor – with over 40 different modules to choose from.

The rugged NIU1A low-power system consists of an integrated power supply, one function slot configured with an NAI intelligent I/O and communications function module, and an optional ARM Cortex-A9 processor. The NIU1A provides full-computer capability to add distributed network, sensor data interfaces to mission-critical computers without expensive chassis or backplane redesign – all in the industry's smallest package.

The small form factor NIU1A can be configured with any one, off-the-shelf, field-proven, multi-function I/O module. A wide selection of Intelligent I/O is available and includes motion simulation/measurement and communications functions such as: A/D, D/A, TTL, RTD; Discrete I/O; Differential Transceiver, Synchro/Resolver/LVDT/RVDT Measurement, Simulation and Excitation; Encoder; 2-channel, dual redundant BC/RT/MT MIL-STD-1553; high speed Sync/Async RS232/422/423/485; ARINC 429/575 and CANBus.

This approach provides a simple integration effort for dedicated I/O interface capability to existing or new applications targeting specific interface requirements and provides a complete I/O function subsystem.

FEATURES

- 1 intelligent function module
- 40+ modules to choose from ▪ Customer-configurable
- COSA™ Architecture
- Optional ARM Cortex™-A9 Dual Core 800MHz Processor
- 512 MB DDR3L SDRAM ▪ 4 GB SATA II NAND Flash (up to 32 BG option)
- 2x 10/100/1000 Base-T Ethernet ports
- Wind River® Linux and VxWorks®, and Xilinx® PetaLinux OS support (w/optional ARM processor)
- 2.5"H x 1.7"D x 6.8"L ▪ 1.1 lb (499 g)
- 3 mounting options
- < 15 W power dissipation ▪ +28 VDC input
- MIL-STD-461F, MIL-STD-810G, & MIL-STD-704A
- Continuous Background Built-in-Test (BIT)
- VICTORY Interface Services (contact factory)
- Commercial and rugged models
- Operating temperature: -40°C to +71°C

Made in the USA
Certified Small Business

mil-embedded.com/p372667

North Atlantic Industries, Inc.
http://www.naii.com/Nano-Interface-Unit-NIU1A/P278

lboccone@naii.com
631-567-1100

Embedded Hardware

Opal Kelly

XEM6310

The **XEM6310** was designed as a performance migration from the original XEM3010 introduced several years prior. Launched on the same form factor and footprint, it offers new customers a compact and capable FPGA integration platform with SuperSpeed USB 3.0 performance. It also offers existing customers of the XEM3010 and XEM6010 product lifecycle extension and a footprint-compatible migration to newer FPGA capability and a 900% increase in USB bandwidth.

Celebrating 10 years of USB FPGA connectivity, Opal Kelly's FrontPanel SDK fully supports the XEM6310 for real-world transfer rates in excess of 340 MiB/s. FrontPanel includes a multi-platform (Windows, Mac, Linux) API, binary firmware for the on-board Cypress FX3 microcontroller, and atomic HDL modules to integrate into your design.

FEATURES

- Xilinx Spartan-6 XC6SLX45 or XC6SLX150
- USB 3.0 interface with FrontPanel firmware binary included
- Real-world measured performance over 340 MiB/s
- 128 MiB DDR2
- Two 80-pin 0.8mm Samtec connectors
- Over 110 user I/O available
- Low-jitter 100 MHz clock oscillator
- 2x 16MiB serial flash
- Small form-factor: 75mm x 50mm x 15.9mm
- Fully supported by FrontPanel SDK C/C++, C#, Ruby, Python, Java, DLL

About Opal Kelly

Opal Kelly, founded in 2004, offers a range of powerful, off-the-shelf, USB 2.0, and USB 3.0 FPGA modules, including the easy-to-use Opal Kelly FrontPanel software interface and robust API. Opal Kelly products provide the essential device-to-computer interconnect for fast and efficient product prototyping, testing, development, and OEM integration. For more information, or to purchase Opal Kelly products, please visit ***www.opalkelly.com****.*

mil-embedded.com/p372328

Opal Kelly
www.opalkelly.com

sales@opalkelly.com
opal-kelly-incorporated
217-391-3724
@opalkelly

Embedded Hardware

Opal Kelly

XEM7350

The **XEM7350** is a perfect match for all three of the company's target markets: *Integration, Evaluation, and Acceleration.* System integrators can build fully-operational prototype and production designs with off-the-shelf FMC peripherals. Manufacturers of high-speed devices such as JESD-204B data acquisition chips can launch evaluation boards as FMC peripherals. The XEM7350 is an ideal platform for demonstrating these devices to customers with a capable, compact system, and custom evaluation software built on the well-supported FrontPanel SDK.

With ample logic resources, the Kintex-7 is also suited to signal processing and image processing for acceleration tasks when mated to image capture or data acquisition hardware.

Celebrating 10 years of USB FPGA connectivity, Opal Kelly's Front-Panel SDK fully supports the XEM7350 for real-world transfer rates in excess of 340 MiB/s. FrontPanel includes a multi-platform (Windows, Mac, Linux) API, binary firmware for the on-board Cypress FX3 microcontroller, and atomic HDL modules to integrate into your design.

FEATURES

- Xilinx Kintex-7 XC7K70T, XC7K160T, or XC7K410T
- USB 3.0 interface with FrontPanel firmware binary included
- Real-world measured performance over 340 MiB/s
- 512 MiB DDR3
- VITA 57.1 FMC-HPC connector
- Up to 170 user I/O
- 8 Gigabit Transceivers
- Low-jitter 200 MHz and 100 MHz clock oscillators
- 2x 16 MiB serial flash
- Integrated voltage, current, and temperature monitoring
- Small form-factor: 80mm x 70mm x 15.1mm
- Fully supported by FrontPanel SDK C/C++, C#, Ruby, Python, Java, DLL

mil-embedded.com/p372327

Opal Kelly
www.opalkelly.com
sales@opalkelly.com
opal-kelly-incorporated
217-391-3724
@opalkelly

Embedded Hardware

ORBIT POWER GROUP
Behlman Electronics

Behlman VPXtra™ 3U Open VPX VITA 62 Compliant Power Supply provides six outputs and 550 Watts of power.

The latest in the family of Behlman ***VPXtra***™ Power Supplies, the ***VPXtra***™ 500M 3U COTS DC-to-DC power unit is a rugged, highly reliable, conduction cooled, switch mode unit. It is VITA 62, Open VPX compliant, and delivers up to 550 Watts of DC power via six outputs. The 12V, 3.3V, and 5V main outputs can be paralleled for higher power. ***VPXtra***™ 500M can accept 18 to 36 VDC input, compliant with MIL-STD-704, and can supply a high-power DC output. It has no minimum load requirement and has overvoltage and short circuit protection, as well as over current and thermal protection. Designed and manufactured with ***Xtra-Cooling***™, ***Xtra-Reliable***™ Design and ***Xtra-Rugged***™ Construction, the Behlman ***VPXtra***™ 500M is your best choice for Open VPX system designs when 3U and VITA Compliance are essential.

Behlman Electronics is an ISO 9001:2008 company.

FEATURES

- Open VPX VITA 62 compliant, 3U VPX, 1.0" pitch single slot
- Wide input range: 18-36V with input transient protection
- Three high power DC outputs: +12V/25A, +5V/40A, +3.3V/12A
- Multiple auxiliary DC outputs: +3.3V Aux/1A, -12V Aux/0.375A, +12V Aux/0.375A
- Low noise & ripple
- Parallelable outputs (+12V/25A, +5V/40A, +3.3V/12A)
- Input-output isolation and excellent load regulation
- Overcurrent, Overvoltage, Over temperature protection
- Efficiency of 90% typical, with high power density
- Conduction cooled at card edge
- Conformal coating on PCB
- MIL-STD-461F, CE-102 compliance
- ENABLE*, INHIBIT* controls per VITA 62
- Output voltage FAIL* signal LED indication

mil-embedded.com/p372935

Behlman Electronics
www.behlman.com
sales@behlman.com
www.linkedin.com/company/behlman-electronics
+1 631 435-0410
twitter.com/behlmanpower

ORBIT ELECTRONICS GROUP
Orbit Instrument • Tulip •
Integrated Combat Systems

VME-VPX System Health Monitors

Stand-off and 6U System Health Monitors with RTMs:

VME and VPX 6U System Health Monitors from the Orbit Electronics Group are among the most advanced such components available today. A companion rear transition module is available for extended I/O.

The HMC-A has 20 analog sensors (4 onboard and 16 external), plus 8 digital sensors. Voltage monitoring accepts 8 inputs: +3.3 VDC, +5 VDC, +12 VDC, and -12 VDC, plus four user-defined positive voltages from 0 VDC to +28 VDC.

Also available in 3U form factor with highly customizable GUI.

VME-VPX Held to a Higher Standard.

FEATURES

- Unique, proprietary Graphical User Interface (GUI) that enables system designers to quickly and easily establish a broad range of operating parameters.
- Ethernet; USB and/or RS 232 interfaces; set-up; data logging; field upgradable firmware; and data password protection.
- Stand-alone form factor sizes are 80 x 120 mm and 51 x 51 mm (see complete specs at www.vmevpx.com).
- ICS is a Subsidiary of Orbit International (www.orbitintl.com) and a member of the Orbit Electronics Group.

mil-embedded.com/p372756

Integrated Combat Systems
www.vmevpx.com

info@vmevpx.com
+1 866 319-8085

Embedded Hardware

ORION TECHNOLOGIES

3U VPX 4th Generation Intel i7 Single Board Computer – VPX7664

Orion Technologies introduces its new small form-factor rugged computer. Drawing its processing power from a new **4th generation Intel Haswell processor**, our 3U VPX design makes it ideal for high performance small form factor applications.

Orion Technologies has taken advantage of the significant speed increase of PCIe 3.0 by offering **three PCIe 3.0 fatpipes**. Along with **two 10G Ethernet ports** (auto negotiate 10G/1G/100M) we offer one of the highest performance processors on the market. Our configurable "personality module" allows for maximum flexibility and configuration options. With I/O expansion and an XMC site this high performance processor is ideal for multiple applications.

We can couple this with one of our high speed backplanes which are capable of supporting PCIe 3.0 at full speed, making our solution one of the highest performance systems available in the market.

FEATURES

- Multi-Core 4th Generation Intel® Core™ i7
- Up to 16GB of soldered DDR3 SDRAM with ECC and Up to 64GB of on-board NAND Flash
- Trusted Platform Module
- One 8-lane PCIe 3.0 XMC slot (Vita 42.3)
- Three 4-lane PCIe v3.0 ports on VPX P1 (Vita 46.4)
- Two 10GbE Base-T ports (auto negotiate 10G/1G/100M)
- Anti-Tamper features available

mil-embedded.com/p372700

Orion Technologies
www.oriontechnologies.com

sales@oriontechnologies.com twitter.com/OrionEmbedded www.facebook.com/OrionTechnologies
www.linkedin.com/company/orion-technologies-llc 407-476-2120

PENTEK

5973-317 FlexorSet 8-Channel 250 MHz A/D with DDCs, Virtex-7 FPGA – 3U VPX

The FlexorSet Model 5973-317 is a 3U VPX carrier combined with Flexor Model 3316 8-Channel A/D FMC that contains Pentek's eight channel digital down converter (DDC) intellectual property (IP), which is ideally matched to the eight 250 MHz, 16-bit A/Ds on the FMC.

Each DDC has an independent 32-bit tuning frequency ranging from DC to the A/D sampling frequency. Each DDC can have its own unique decimation setting, supporting as many as eight different output bandwidths. Decimations can be programmed from 2 to 65,536 providing a wide range to satisfy virtually all applications.

Bundling for Seamless Integration

The Model 5973-317 FlexorSet comes pre-configured with a suite of built-in functions for data capture, synchronization, time tagging and formatting, all tailored and optimized for the FMC and carrier. This IP enables high performance capture and delivery of data to provide an ideal turn-key signal interface for radar, communications or general data acquisition applications, eliminating the integration effort typically left for the user when integrating the FMC and carrier.

Development Tools and Software Support

FlexorSet presents system integrators with an ideal development and deployment platform for custom IP. The Pentek GateFlow® FPGA design kit gives users access to the complete factory installed IP at the source level, allowing them to extend or even replace the built-in functions.

The Pentek GateXpress® PCIe configuration manager supports dynamic FPGA reconfiguration though software commands as part of the run-time application. This provides an efficient way to quickly reload the FPGA, which slashes development time during testing. For deployed environments, GateXpress enables reloading the FPGA without the need to reset the host system, ideal for applications that require dynamic access to multiple processing IP algorithms.

The Pentek ReadyFlow® Board Support Package is available for Windows and Linux operating systems. The ReadyFlow C-callable library contains a complete suite of initialization, control and status functions, as well as a rich set of precompiled, ready-to-run-examples, accelerate application development.

FlexorSet Environment Selections

FlexorSets are designed for air-cooled, conduction-cooled, and rugged operating environments.

FEATURES

- Supports Xilinx Virtex-7 VXT FPGA
- GateXpress supports dynamic FPGA reconfiguration across PCIe
- Eight 250 MHz 16-bit A/Ds
- Eight multiband DDCs
- 4 GB of DDR3 SDRAM
- Sample clock synchronization to an external system reference
- PCI Express (Gen. 1, 2 and 3) interface up to x8
- User-configurable gigabit serial interface
- Optional optical Interface for backplane gigabit serial interboard communication
- Optional LVDS connections to the Virtex-7 FPGA for custom I/O
- Compatible with several VITA standards including: VITA-46, VITA-48 AND VITA-66.4 and VITA-65 (OpenVPX™ System Specification)
- Ruggedized and conduction-cooled versions available
- Supports GateXpress® FPGA-PCIe Configuration Manager

mil-embedded.com/p373004

Pentek
http://www.pentek.com/go/mesdsp5973

sales@pentek.com
www.linkedin.com/company/pentek
201-818-5900
www.twitter.com/pentekinc

Embedded Hardware

OpenVPX System Platforms & Components Don't Need to be Costly

Is it possible to get high-quality OpenVPX system platforms, backplanes, and components for up to 30% less? Yes, and you owe it to yourself to compare Pixus to your existing suppliers. Contact Pixus today to learn more.

Leveraging Rittal's sleek European quality mechanical designs, Pixus is able to offer time-tested embedded computing system platforms that are built in one of the largest manufacturing centers for enclosures in the world. With Pixus' subsystem integration expertise, the result is the premier value in the industry for OpenVPX designs.

Pixus offers backplane designs and chassis platforms in OpenVPX, CompactPCI, AdvancedTCA, MicroTCA, and custom architectures. The company also provides a vast ecosystem of embedded components including ejector handles & panels, card guides, rails, subracks, and more.

In May 2011, Pixus Technologies became the sole authorized North and South American supplier of the electronic packaging products previously offered by Kaparel Corporation and Rittal.

FEATURES

- High quality German and North American designs
- Low-cost manufacturing at top enclosure center in the world, superior quality and consistency
- Customization expertise, lower volumes accepted
- Focus on superior service and on-time delivery
- ITAR-compliant, Mil/Aero expertise

mil-embedded.com/p372956

Pixus Technologies
www.pixustechnologies.com

info@pixustechnologies.com

Embedded Hardware

SigStream

The SigStream product family transforms a general purpose computer into a high speed signal acquisition and generation platform. A wide selection of sample rates and support for AC or DC coupled analog connections allow the product to address a broad range of applications (radar, communications, electo-optics).

The hardware incorporates a rich set of software programmable features that include selectable operating modes (continuous, snapshot, periodic), external or timed event triggers, timestamped data samples, and flexible data formatting. Each channel can stream raw samples or data packets defined by the VITA 49 specification. A unified code base allows application developers to transition between hardware options and across operating systems with a common API.

The SigStream product family is available in multiple form factors for seamless integration into an embedded chassis or traditional server/desktop environment. The conduction cooled XMC format can plug into any VITA compliant embedded host with no modification to the conduction frame.

FEATURES

- Available in XMC, CCXMC, and PCIe form factors
- Model 271 dual channel receiver (16-bit, 250 Msps ADC)
- Model 272 dual channel transceiver (16-bit, 310 Msps ADC/DAC)
- Model 276 single channel receiver (12-bit, 2.0 Gsps ADC)
- Model 277 quad channel receiver (16-bit, 250 Msps ADC)
- Model 278 octal channel receiver (16-bit, 125 Msps ADC)
- On-board fixed or programmable frequency synthesizer
- Support for external clock or 10 MHz reference
- Continuous, snapshot, and periodic operating modes
- Software selectable triggers (hardware, software, time of day)
- VITA 49 compliant data packet format with timestamps
- Multiple on-board temperature and current monitors
- PCI Express (PCIe) x8 Gen 2 host bus interface
- Windows, Linux, and VxWorks drivers and API

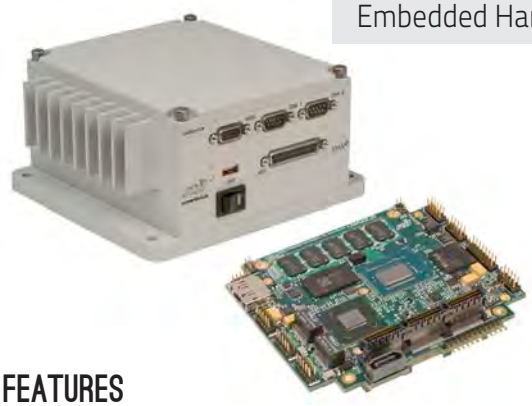
mil-embedded.com/p372975

Red Rapids
www.redrapids.com

sales@redrapids.com

972-671-9570

Embedded Hardware



Expandable Intel Core i7 Mission Computer

RTD's robust Intel Core i7 CPU offers high-performance for rugged applications in extended temperature environments. Choose from single-core, dual-core, and quad-core configurations. These fanless systems feature a synchronized power supply, an integrated 2.5-inch SATA carrier, and standard I/O including Gigabit Ethernet, USB, Serial, SVGA, DisplayPort, and programmable digital I/O. The CPU is designed with soldered SDRAM and solid-state flash storage for high shock and vibration situations.

The stackable PCIe/104 architecture allows system expandability for additional DAQ, I/O, storage, and network functionality. The Core i7 systems are compatible with RTD's complete line of data acquisition and peripheral modules. Tailored solutions include conformal coating, watertight enclosures with cylindrical MIL-SPEC connectors, and a variety of custom mounting, LED, and paint options.

FEATURES

- Modular, scalable Intel Core i7 mission computer
- Quad-core, dual-core, and single-core configurations
- 1.5 – 2.1 GHz Processors with up to 3.1 GHz Turbo Boost
- Dual-Channel DDR3 SDRAM (Surface-Mounted)
- 32GB surface-mounted industrial-grade SATA flash drive
- Ideal for extended temperature environments
- Optional stackable, modular chassis milled from solid T-6061 aluminum with standard PC or cylindrical connectors and user-defined pinouts
- Optional watertight configurations with EMI suppression and RF isolation
- Board-level and enclosure customizations available

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RTD Embedded Technologies, Inc.
www.rtd.com

sales@rtd.com
814-234-8087

Embedded Hardware

HiDAN HDC5915-5E2

RTD's HiDAN HDC5915-5 is a 5-port Fast Ethernet router system based on the Cisco 5915 ruggedized embedded router. This system enables the deployment of Cisco Mobile Ready Net capabilities in mobile, air, ground and unmanned applications. RTD's watertight, milled aluminum packaging with EMI shielding, locking cylindrical connectors, and LEDs create an ideal chassis for this advanced Cisco 5915 system.

This compact system pairs the proven ruggedness of RTD products and enclosure technology with the robust quality and performance of Cisco's 5915 Router. The HiDAN HDC5915-5 offers reliable operation in extreme temperatures and under high shock and vibration conditions.

FEATURES

- Integrated Cisco 5915 Embedded Services Router (ESR)
  - Cisco IOS Software
  - Highly secure data, voice, and video communication
  - 512 MB DRAM
  - 256 MB Flash Memory
- 5x Fast Ethernet Ports (10/100)
- LED indicators
- Serial programming port, isolated power input port
- MIL-C-38999 series III connectors
- Waterproof enclosure
- Tongue and groove O-ring for environmental sealing and EMI suppression
- Aluminum Alloy – 6061, Temper-T6
- -40 to +85°C Operating Temperatures

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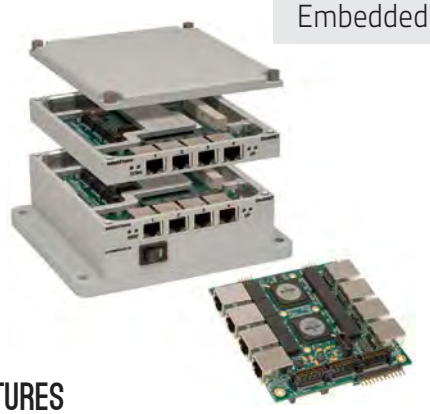
RTD Embedded Technologies, Inc.
www.rtd.com/router

sales@rtd.com
814-234-8087

Scalable GigE Switch Family



RTD's scalable Gigabit Ethernet Switch Family maximizes network connectivity and system flexibility to create IoT solutions in rugged -40° to +85°C environments.

Our 8-port host module can connect directly to the PCIe/104 bus, or it can be used as a standalone GigE switch. The total number of Ethernet ports can be increased using 8-port expansion modules. Configured with RTD's 88-watt synchronous power supply, a single system will support up to 56 total ports.

In board-level configurations, users can choose from RJ-45 jacks or 10-pin DIL connectors. RTD's rugged, enclosed packaging can be configured with RJ-45 jacks or 37-pin D-sub receptacles.

FEATURES

- Eight 1000/100/10 Mbps Ethernet ports per slice
- Boards/slices stack together to increase total GigE ports
- 10-pin DIL, 37-pin D-sub, or RJ-45 connectors
- BroadCom BCM53115 Unmanaged Gigabit Ethernet Switch
- Intel WG82574IT PCI Express Ethernet Controller for interface to optional host CPU
- Jumbo Frame Support (up to 9018 bytes)
- Auto MDI crossover
- Onboard LEDs
- Connectors for external LEDs
- Passive heat sinks included
- Available in stackable, rugged enclosures
- Fanless -40° to +85°C operating temperatures

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RTD Embedded Technologies, Inc.
www.rtd.com

sales@rtd.com
814-234-8087

Nebula High Reliability SATA Connectors

Smiths Connectors' Nebula SATA Connector addresses the market need for a high reliability connector solution which meets the mechanical footprint and electrical performance of the SATA 6.0 Gbps standard.

It is tested and proven up to 6 Gbps with the capability for compatibility at higher data rates.

Utilizing Hypertac hyperboloid contact technology, the Nebula Series leads the industry in ruggedness and performance in harsh environments. This ensures 360° of self-wiping contact and immunity to the effects of shock, vibration and fretting corrosion.

A drop in replacement for COTS SSD and HDD SATA Connectors, the Smiths Connectors' Nebula High Reliability SATA Series supports the function of all 22 pins and is offered in straddle mount, vertical and right angle PCB options.

FEATURES

- Utilizes Hypertac hyperboloid contact technology featuring a wire basket design with 360° contact, immunity to shock and vibration and 50% lower contact resistance than conventional contacts.
- Mating surface plated with 50 µin gold.
- Offers optional quarter-turn locking feature for PCB and cable connectors.
- Constructed with 100% NASA approved materials including LCP insulators and all gold plated contact surfaces.
- Exceeds the data rate requirements of SATA standard.
- Design optimized for high speed data rates, impedance matching and minimal losses.
- Provides superior signal integrity beyond 6 Gbps.
- Operating shock: 3,000+ G, 0.5 ms, 1/2 sine, 6 shocks per axis; 100+ G, 11 ms, 1/2 sine, 6 shocks per axis.
- Temperature range: -55° to 125°C
- Mating cycles: ≤ 5,000 with little to no performance degradation
- Vibration: 30 Grms MIL-STD-810F, method 514.5C-8

mil-embedded.com/p372957

Smiths Connectors
www.smithsconnectors.com

stephen.crabtree@smithsconnectors.com
Smiths Connectors
@smithsconnector

AYDINDISPLAYS
a sparton company

Model 8819 19" Multi-Application Rugged Display

Aydin Displays' Model 8819 display is designed for top performance in a variety of severe environments, including track & wheeled vehicles, fixed wing jets, propeller, helicopter, and all naval applications.

The 8819 is built to comply with the most stringent military requirements-RTCA DO-160D and MIL-STD-810G.

The 8819 is a totally sealed unit, and has no internal moving parts. Native resolution is 1280 x 1024, with a contrast ratio of 2000:1. Standard inputs include RGB and DVI-D, with options for NTSC, HDMI and HD-SDI inputs. A completely rugged design in a thickness depth of just 3 inches.

FEATURES

- Made In The USA
- Designed to MIL Standards
- Sealed Unit
- No Internal Moving Parts
- VESA or Rack Mounting

mil-embedded.com/p372998

Aydin Displays, A Sparton Company
www.aydindisplays.com

sales1@aydindisplays.com
linkedin.com/company/aydin-displays-inc.
610-404-5372
twitter.com/aydinrugged

Embedded Hardware

sparton
NAVIGATION AND EXPLORATION

AHRS-M1 – The Micro AHRS/IMU with AutoCal™

The AHRS-M1 is the first micro-sized, light weight, low power AHRS product with a revolutionary built-in auto-calibration mode. Utilizing a proprietary calibration algorithm that provides continuous, automatic calibration without the need to perform a traditional and complex "12-point" calibration, the AHRS-M1 learns on the fly, using the natural motion of the application platform to continuously calibrate magnetic properties. Ideal for SWaP-C improvements, the AHRS-M1 weighs only 1.4 grams in a very small form factor. With market-leading technology and state-of-art proprietary algorithms, the Sparton AHRS-M1 is the world's only micro-sized, programmable, and configurable AHRS.

TYPICAL APPLICATIONS

- Hand-held and mounted optical targeting systems
- Pan and tilt
- Antenna positioning
- Precision unmanned vehicle navigation
- Platform stabilization and orientation
- Accurate attitude, position, and orientation sensing

mil-embedded.com/p372999

Sparton Navigation & Exploration
www.spartonnavex.com

SpartonNavEx@sparton.com
800.824.0682

StratumSystems

SS-XPM-01

The SS-XPM-01 is a slave mezzanine XMC card which provides x1 lane PCI-Express interface with the host system. The card has on-board oscillator options (TCXO, OCXO and CSAC) which are kept synchronized to selectable references including GPS, IEEE-1588v2 PTP or external time code or pulse inputs. This card can also be used as an IEEE-1588v2 master clock when the high sensitivity 50 channel GPS receiver is used to synchronize the local oscillator.

Timing functions are derived from the on-board clock including programmable periodic pulse rate output, programmable start/stop output and a time-stamping input. The SS-XPM-01 also offers a selectable sine wave frequency output up to 1000MHz.

Power is provided through the GPS antenna connection for an active external GPS antenna.

The SS-XPM-01 software includes Linux Drivers and API's which come with a powerful set of library functions.

An SS-PCM-01 PCM mounted on PCIe carrier card version is also available.

Stratum Systems is a design and manufacturing company offering a range of advanced timing and synchronization products, test systems and FPGA IP cores for various embedded applications.

FEATURES

- High Sensitivity 50 channel GPS L1 C/A code receiver
- High Stability Low Noise 10MHz/1PPS output
- TCXO, OCXO and CSAC oscillator options
- Holdover up to 1us for 4 hours
- IEEE-1588v2 Master or Slave
- IRIG Time Code Inputs and Outputs
- Triggers Inputs and Event Outputs
- Secondary Programmable Sine Wave Output to 1000MHz
- USB Serial Port (UART), NMEA Protocol
- SS-XPM-01 XMC (75x149 mm)
- PCIe version available

mil-embedded.com/p372805

Stratum Systems, LLC.
www.stratum-systems.com/

info@stratum-systems.com

Embedded Hardware

THEMIS

RES-XR5 Servers

Designed to address diverse workloads and the growing needs of mission-critical applications in demanding deployments, Themis Computer announces RES-XR5 rack mounted servers with Intel® E5-2600 v3 processors and up to fourteen cores per processor. With a wide range of height, depth, I/O options, and expansion features. RES-XR5 rack-mounted servers provide unmatched configuration flexibility to meet current and future system requirements.

RES-XR5 rack-mounted servers feature expansion slots, extensive high-speed I/O, storage, and enhanced reliability options that provide users with configuration versatility and system expansion to meet current and future system requirements. Themis RES systems incorporate advanced thermal and mechanical design features that include dual-redundant, hot swappable AC and DC power supply options. The RES chassis design incorporates aluminum die cast front and rear panels, and strong, lightweight aluminum that improves system resistance to corrosion. Themis RES servers are an attractive solution for programs where Size, Weight, and Power (SWaP) are essential considerations. RES servers can be mounted in standard commercial racks or mobile, rugged transit cases.

FEATURES

- Up to two Intel® E5-2600 v3 processors/fourteen cores per socket
- Up to 512 GB DDR4 ECC
- Range of height, depth, and I/O configurations
- Superior resilience to shock, vibration, and temperature extremes
- Multiple expansion slots, high speed I/O, multiple storage options to meet current and future system requirements
- Dual redundant, hot-swappable power supplies
- Operating temperature: 0°C to +50°C
- MIL-STD-810G (Shock and Vibration)
- MIL-STD-461 (Quiet Operation) options available

mil-embedded.com/p372936

Themis Computer
www.themis.com/RES-XR5

sales@themis.com
www.linkedin.com/company/17952
510-252-0870
twitter.com/Themis_Computer

RUGGED TO THE CORE

TE Connectivity's (TE) Fortis Zd, Mezalok and MULTIGIG RT 2-R connectors provide extreme ruggedness and reliability in harsh environments.

Fortis Zd Connector

A modular, backplane connector system that provides a combination of robustness and signal integrity performance.

- 10 Gb/s
- Small form factor – shell size 8
- Field terminable
- 360° EMI protection

Fortis Zd

Mezalok Connector

A high-reliability XMC mezzanine connector that enables 5 GHz+ data rates coupled with a four-point redundant contact system based on the VITA 61 standard.

- Backwards compatible with XMC board footprint
- Available in 60, 114 and 320 positions
- Accommodates 10mm, 12mm, 15mm and 18mm stack heights
- Protected "stub-proof" socket contacts with superior signal integrity

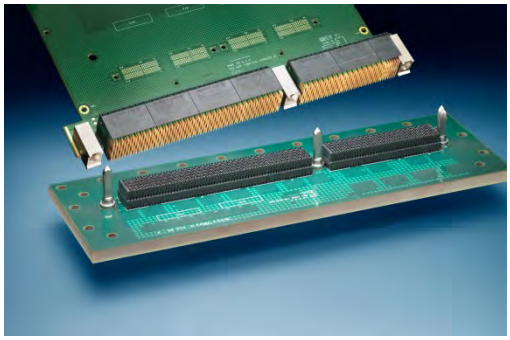
Mezalok

MULTIGIG RT 2-R Connector

These ruggedized rack and panel connectors feature an innovative quad-redundant contact design which helps reduce wear at the contact interface under extreme vibration levels.

- Rugged survivability
- High level shock and vibration – VITA 47 qualified
- Modular, lightweight system
- Robust "pinless" interface tested to 10,000 mating/ unmating cycles

MULTIGIG RT 2-R



mil-embedded.com/p372976

TE Connectivity - ADM
te.com/highspeed

tawilson@te.com
www.linkedin.com/company/te-connectivity
1-800-522-6752
twitter.com/teconnectivity

VECTOR ELECTRONICS & TECHNOLOGY, INC.

cPCI, PXI, VME, Custom Packaging Solutions

VME and VME64x, CompactPCI, or PXI chassis are available in many configurations from 1U to 12U, 2 to 21 slots, with many power options up to 1,200 watts. Dual hot-swap is available in AC or DC versions. We have in-house design, manufacturing capabilities, and in-process controls. All Vector chassis and backplanes are manufactured in the USA and are available with custom modifications and the shortest lead times in the industry.

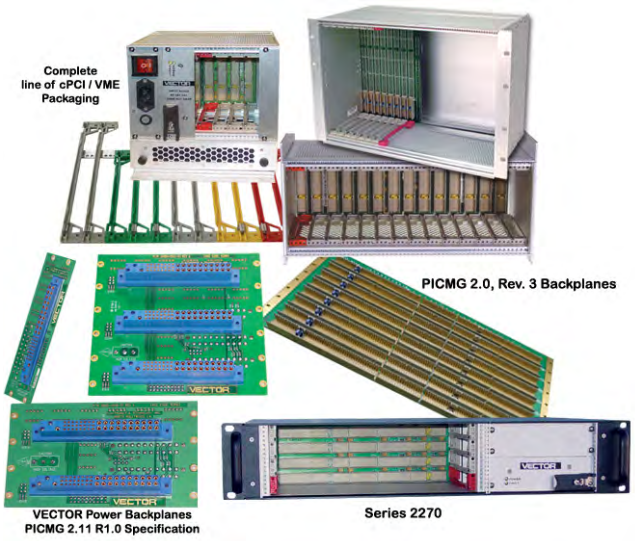
Series 2370 chassis offer the lowest profile per slot. Cards are inserted horizontally from the front, and 80mm rear I/O backplane slot configuration is also available. Chassis are available from 1U, 2 slots up to 7U, 12 slots for VME, CompactPCI, or PXI. All chassis are IEEE 1101.10/11 compliant with hot-swap, plug-in AC or DC power options.

Our Series 400 enclosures feature side-filtered air intake and rear exhaust for up to 21 vertical cards. Options include hot-swap, plug-in AC or DC power, and system voltage/temperature monitor. Embedded power supplies are available up to 1,200 watts.

Series 790 is MIL-STD-461D/E compliant and certified, economical, and lighter weight than most enclosures available today. It is available in 3U, 4U, and 5U models up to 7 horizontal slots.

All Vector chassis are available for custom modification in the shortest time frame. Many factory paint colors are available and can be specified with Federal Standard or RAL numbers.

For more detailed product information,
please visit **www.vectorelect.com**
or call
1-800-423-5659 and discuss your application
with a Vector representative.



FEATURES

- Made in the USA
- Most rack accessories ship from stock
- Modified 'standards' and customization are our specialty
- Card sizes from 3U x 160mm to 9U x 400mm
- System monitoring option (CMM)
- AC or DC power input
- Power options up to 1,200 watts

mil-embedded.com/p371649

Vector Electronics & Technology, Inc.
www.vectorelect.com
inquire@vectorelect.com
800-423-5659

VECTORNAV
Embedded Navigation Solutions

VN-300 Dual Antenna GPS/INS

The **VN-300** is the world's smallest and lightest high-performance Dual Antenna GPS-Aided Inertial Navigation System (GPS/INS). Incorporating the latest solid-state MEMS sensor technology, the VN-300 combines 3-axis accelerometers, gyros, magnetometers, a barometric pressure sensor, two GNSS receivers, as well as a low-power micro-processor into a rugged aluminum enclosure about the size of a matchbox.

Building on the architecture of the VN-100 IMU/AHRS and VN-200 GPS/INS, the VN-300 enables a wider range of applications through the incorporation of GPS compass techniques, which provide for accurate, GPS-based heading determination in static conditions. It is ideal for applications that require a highly accurate position, velocity and attitude solution under both static and dynamic operating conditions, especially in environments with unreliable magnetic heading.

FEATURES

- Built-in Extended Kalman Filter running at 400 Hz with IMU outputs up to 1 kHz
- Coupled position, velocity, & attitude estimates
- Operates as a "True INS Filter" that does not force any requirements on alignment of the sensor to the velocity direction of a platform or specify the orientation of the sensor for initial alignment
- Real-time gyro & accelerometer bias compensation
- Raw pseudorange, Doppler, & carrier phase outputs
- Dynamic accuracy better than 0.3° in heading, 0.1° in pitch & roll
- Static accuracy better than 0.3° in heading, 0.5° in pitch & roll
- Individually calibrated for bias, scale factor, misalignment, and temperature over full operating range (-40°C to +85°C)
- Compact surface mount and rugged packages (24x22x3 mm; 5 g / 45x44x11 mm; 30 g)

mil-embedded.com/p372977

VectorNav Technologies
www.vectornav.com

sales@vectornav.com
in VectorNav Technologies
512-772-3615

Embedded Hardware

VERSALOGIC
CORPORATION

PC/104 "Bay Trail" Single Board Computer

Bengal is a rugged new PCIe/104 Single Board Computer (SBC) based on Intel's highly acclaimed "Bay Trail" processor. It combines high performance, low power consumption, enhanced security, and small size.

Available in three performance levels; single, dual, and quad core. The quad core model delivers 2X the performance of a "Montevina" Core 2 Duo processor, with a 38% reduction in power consumption!

Bengal includes an extensive set of features including PCIe/104 expansion and a Trusted Platform Module (TPM) security chip. The Bengal's powerful feature set, combined with a low-power draw and compact PC/104 footprint, enables the next generation of intelligent medical, military, and industrial systems to be smaller, lighter, and more energy efficient.

With its high performance and low power consumption, Bengal is a natural fit for new product designs, and for migration or upgrade from older PC/104 products. It is an excellent upgrade for systems currently using Atom or Core 2 Duo processors.

The Bengal is backed by VersaLogic's 5-year warranty and product life extension programs that can continue delivery well past the year 2025.

FEATURES

High Reliability
- -40° to +85°C Operating Temperature
- No moving parts
- Latching connectors
- High shock and vibe

Product Highlights
- One, two, and four-core models
- 4th Generation Intel® Atom™ processor
- Trusted Platform Module (TPM)
- VGA and dual DisplayPort
- Mini PCIe/mSATA socket
- Two gigabit Ethernet ports
- USB 3.0 and five USB 2.0 ports
- Windows, Linux, VxWorks, etc.

mil-embedded.com/p372876

VersaLogic Corporation
www.VersaLogic.com/Bengal

sales@VersaLogic.com
in www.linkedin.com/company/versalogic-corporation
503-747-2261

VERSALOGIC CORPORATION

Ultra Small "Bay Trail" Embedded Computer

This next generation of VersaLogic Embedded Processing Unit (EPU) format combines processor, memory, video, and system I/O into an extremely compact full function embedded computer with a footprint the size of a credit card!

The **Hawk** was engineered to meet the military, avionic, and medical industries' evolving requirements for smaller, lighter, and more powerful embedded systems. Roughly the size of a credit card and less than one inch thick, it combines the new 4th generation Intel® Atom™ "Bay Trail" processor, with system interfaces, in a highly integrated format designed to withstand extreme temperature, impact, and vibration.

Hawk is available in single-, dual-, and quad-core models. The quad-core model delivers more than 5X the performance of previous generation products with an 18% reduction in power consumption! The single-core version provides over 2X the performance of the previous generation product, with a 25% reduction in power. The quad-core is ideal for UAV video applications where higher performance and light weight are important

The Hawk is backed by VersaLogic's 5-year warranty and product life extension programs that can continue delivery well past the year 2025.

FEATURES

SWaP

- Small size: 55 x 84 x 22 mm
- Low weight: 102 grams (< 4 oz.)
- Low power: Single core < 6W
- Low power: Quad core < 7W

Product Highlights

- Quad-, dual-, and single-core models
- 4th Generation Intel® Atom™ processor
- -40°C to +85°C operation; Wide input voltage (8V – 17V)
- Soldered-on RAM (up to 4 GB); Soldered-on eMMC Flash (up to 8 GB)
- Mini PCIe/mSATA expansion socket
- microSD flash socket
- Gigabit Ethernet
- Two serial/COM ports; Four USB 2.0 ports
- MIL-STD-202G Shock and Vibration; LVDS video output

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VersaLogic Corporation
www.VersaLogic.com/Hawk

sales@VersaLogic.com
503-747-2261
www.linkedin.com/company/versalogic-corporation

WinSystems®
The Embedded Systems Authority

PPM-C407 – Low Power PC/104 SBC with Long Term Availability

The PPM-C407 from WinSystems utilizes the E3800 family of Atom™ processors from Intel® to provide low power and performance in the versatile PC/104 form factor. Designed for harsh environments and reliability, it includes soldered RAM for added shock and vibration resistance with an operating temperature range from -40°C up to +85°C.

WinSystems is offering the PPM-C407 in multi-core options depending on the application requirements. The scalable performance allows you to choose between low power single-core and higher performance dual or quad-core solutions.

Linux, Windows, and other x86 operating systems can be booted from the CFAST, mSATA, or USB interfaces, providing flexible data storage options.

FEATURES

- Multi-Core Intel® Atom™ E3800 Processors
- Up to 2 GB Soldered Down DDR3 RAM
- Two Fully Independent Displays (VGA, DisplayPort & LVDS)
- 1 Gb Ethernet Controller
- Fanless -40° to +85°C operational temperature
- 4 Serial Ports and 4 USB 2.0 ports
- 24 Bidirectional GPIO with event sense
- Bus Expansion: MiniPCIe, PC/104 & PC/104-Plus
- Bootable SATA, CFAST, and mSATA

mil-embedded.com/p372685

WinSystems
www.winsystems.com

info@winsystems.com
817-274-7553
www.linkedin.com/company/winsystems-inc-
twitter.com/WinSystemsInc

Embedded Hardware

WinSystems®
The Embedded Systems Authority

PPM-N409 – Dual PC/104-*Plus* Ethernet with SFP Interface

The PPM-N409-2 PC/104-*Plus* Dual Ethernet module features Small Form Factor Pluggable (SFP) transceivers, controlled by dual Intel® I210 Ethernet Controllers, bringing the latest in technology to your legacy design. Both module housings are compatible with the large variety of SFP transceivers that range from optical single mode, optical dual mode, and GbE twisted pair copper.

The small form factor and negligible heat signature of the PPM-N409-2 makes it ideal for installation in confined spaces. Combined with its exceptional range of operational temperatures, low physical profile, and rugged design, the PPM-N409-2 can be deployed in even the most demanding environments.

Give your systems the advantage of compact design, low power consumption, and high precision time synchronization of the PPM-N409-2 Ethernet controller from WinSystems. Custom design options are available upon request.

FEATURES

- Intel® I210 Ethernet Controllers
- Two Fully Independent Ethernet Connections
- Small Form Factor Pluggable (SFFP) Interface
- Accepts the Wide Range of SFFP Ethernet Modules
- Fanless -40° to +85°C operational temperature
- PC/104-*Plus* Form Factor
- IEEE 1588 Precision Time Synchronization over Ethernet
- Robust Communication over Long Distances
- Supports Linux, Windows, and DOS Operating Systems

mil-embedded.com/p372686

WinSystems
www.winsystems.com

info@winsystems.com
www.linkedin.com/company/winsystems-inc-
817-274-7553
twitter.com/WinSystemsInc

Embedded Hardware

WinSystems®
The Embedded Systems Authority

SBC35-C398Q – Industrial ARM® SBC with Real-Time Linux

Designed for industrial applications and long-term availability, WinSystems' SBC35-C398Q SBC features a quad-core ARM® processor with options for expansion and customization. The combination of processing power and industrial I/O provides a flexible solution for a number of applications including security, industrial control, medical, transportation and MIL/COTS. This low-power design operates from -40° to +85°C without a fan or heatsink for improved reliability.

Kick-start development with our SD Cards, available preloaded with our newly released real-time Linux distribution or Android™. Our factory engineers offer technical support from pre-sales through production.

FEATURES

- Freescale® i.MX 6™ Quad-core ARM® Cortex™-A9 Processors
- Fanless -40° to +85°C operational temperature
- Powered by PoE or +10-50VDC Input
- 10/100/1000 Ethernet with IEEE-1588™
- USB 2.0 and USB On-The-Go Ports
- FlexCAN and RS-232/422/485 Serial Ports
- 24 GPIO tolerant up to 30VDC
- Mini-PCIe and IO60 (I2C, SPI, TTL, and PWM) expansion

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WinSystems
www.winsystems.com

info@winsystems.com
www.linkedin.com/company/winsystems-inc-
817-274-7553
twitter.com/WinSystemsInc

WinSystems®
The Embedded Systems Authority

SBC35-CC405 – Industrial Small Form Factor Computers

The SBC35-CC405 series of small form factor computers utilizes the Intel® Atom™ E3800 family of processors in a standard 3.5-inch SBC format. The COM Express based solution includes two Gigabit Ethernet controllers with IEEE 1588 time-stamping, two serial channels, USB 3.0, and +10 to +50V DC input.

Engineered for rugged applications, the low-profile thermal solution creates a sturdy base that protects the PCB assembly, provides convenient mounting, and enables fanless extended temperature operation.

Linux, Windows, and other x86 operating systems can be booted from the CFAST, mSATA, or USB interfaces, providing flexible data storage options. WinSystems provides driver for Linux and Windows 7/8, as well as pre-configured operating systems.

FEATURES

- Multi-Core Intel® Atom™ E3800 Processors
- Up to two independent displays (VGA, LVDS and DisplayPort)
- Two Ethernet Controllers with IEEE 1588 time stamping
- Two RS-232/422/485 Serial ports
- Bus Expansion (Two MiniPCIe and IO60)
- Four USB ports (1xUSB 3.0 and 3xUSB 2.0)
- Bootable SATA, CFAST, and mSATA
- Wide range 10 to 50V DC input
- Fanless -40° to +85°C operational temperature

mil-embedded.com/p372206

WinSystems
www.winsystems.com

info@winsystems.com
www.linkedin.com/company/winsystems-inc-
817-274-7553
twitter.com/WinSystemsInc

Embedded Hardware

X-ES
Extreme Engineering Solutions

XPand6903

The XPand6903 is a rugged, sealed, and compact fanless embedded box PC utilizing the Intel® Atom™ E3800 family of processors. It provides a reliable and maintenance-free, cost-effective, computing platform ideally suited for environmentally challenging and space-constrained situations. Specifically designed for Industrial PC (IPC), Human Machine Interface (HMI), industrial automation, and transportation applications, its sealed design makes it ideal for medical and food-safe environments where it will be exposed to chemicals and moisture.

The XPand6903 can be DIN rail mounted for easy installation into an industrial cabinet. It supports the Intel® Atom™ E3800 family processor, which offers up to four cores at 1.91 GHz. Internal SATA SSD memory modules combine the convenience of high-capacity off-the-shelf storage with the reliability of solid-state non-volatile memory. The standard configuration includes dual VGA video, two Gigabit Ethernet ports, four USB ports, and RS-232/422 ports. Internal expansion options allow a flexible array of additional I/O options, including WLAN, cellular, GPS, and CAN bus.

The XPand6903 supports a wide input voltage range from 12 to 28 volts. It can operate under demanding shock and vibration requirements, as well as the water-immersion requirements of IP67.

Out-of-the-box support for Microsoft Windows 7 or greater, as well as support for most modern Linux distributions, increases software flexibility. Wind River VxWorks and X-ES Enterprise Linux (XEL) Board Support Packages (BSPs) are also available. It supports coreboot bootloader, powered by Intel®'s Firmware Support Package (FSP), to enable ultra-fast boot times and drastically simplify system security.

FEATURES

- Supports Intel® Atom™ E3800 family processors (formerly Bay Trail-I)
- 4 GB of DDR3-1333 ECC SDRAM
- coreboot bootloader, powered by Intel®'s Firmware Support Package (FSP)
- Fanless, natural convection air cooling
- Extended shock and vibration tolerance
- Two Gigabit Ethernet ports ▪ Two serial ports ▪ Four USB 2.0 ports
- Storage via internal SATA-based storage modules
- MIL-STD-704 28 VDC input voltage support
- IP67-capable
- Wind River VxWorks BSP
- X-ES Enterprise Linux (XEL) BSP
- Microsoft Windows drivers

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Extreme Engineering Solutions (X-ES)
www.xes-inc.com/

sales@xes-inc.com
www.linkedin.com/company/extreme-engineering-solutions/
608-833-1155
twitter.com/xes_inc

Embedded Hardware

X-ES
Extreme Engineering Solutions

XPedite7670

The XPedite7670 is a high-performance, 3U VPX-REDI, single board computer based on the Xeon® D processor. The Intel® Xeon® D processor can provide up to eight Xeon®-class cores in a single, power-efficient System-on-Chip (SoC) package. It maximizes network performance with two 10 Gigabit Ethernet interfaces and four Gigabit Ethernet interfaces. The 10 Gigabit Ethernet interfaces can be configured as XAUI or 10GBASE-KX4. The four Gigabit Ethernet interfaces are configured as two 1000BASE-BX/KX (SerDes) ports and two 10/100/1000BASE-T ports.

Up to four lanes of Gen3 PCI Express are routed to the backplane P1 connector, supporting a single x4 PCIe interface. This interface also supports Non-Transparent Bridging, enabling direct communication with other Intel® processors, and there is no need for a separate switch module in the system, further reducing SWaP-C for the system integrator.

The XPedite7670 provides superior growth and expansion capabilities by including an XMC site with full 10 mm I/O envelope support, while maintaining a 0.8 in. VPX slot pitch. This gives system integrators a plethora of COTS options for additional I/O, storage, or processing.

The XPedite7670 accommodates up to 8 GB of DDR3-1600 ECC SDRAM in two channels to support memory-intensive applications. It hosts numerous I/O ports, including USB, SATA, and RS-232/422/485 through the backplane connectors.

Wind River VxWorks and X-ES Enterprise Linux Support Packages (XEL) are available. The XPedite7670 uses coreboot, powered by Intel®'s Firmware Support Package (FSP), to provide fast boot times and significantly simplify code traceability over legacy BIOS implementations.

FEATURES

- Supports Intel® Xeon® D processors (formerly Broadwell-DE)
- Up to eight Xeon®-class cores in a single, power-efficient SoC package
- 3U VPX (VITA 46) module
- Compatible with multiple VITA 65 OpenVPX™ slot profiles
- Ruggedized Enhanced Design Implementation (REDI) per VITA 48
- Conduction- or air-cooled
- Up to 8 GB of DDR3-1600 ECC SDRAM in two channels (available now)
- Up to 16 GB of DDR4-2133 ECC SDRAM in two channels (available in Q4 2015)
- Contact factory for larger densities of DDR4-2133 ECC SDRAM
- Up to 64 GB of NAND flash ▪ XMC interface
- One x4 PCI Express backplane fabric interconnect
- Two 10 Gigabit Ethernet ports and four Gigabit Ethernet ports
- Four SATA ports ▪ One XMC (P16) SATA port for storage mezzanine
- Coreboot firmware powered by Intel® FSP ▪ Wind River VxWorks BSP
- X-ES Enterprise Linux (XEL) BSP

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Extreme Engineering Solutions (X-ES)
www.xes-inc.com/

sales@xes-inc.com
www.linkedin.com/company/extreme-engineering-solutions/
608-833-1155
twitter.com/xes_inc

Embedded Software

NordiaSoft

SCARI Software Suite

NordiaSoft offers products and services for those who need to create state of the art software-defined platforms as used in the telecommunications, aerospace, radar, electronic warfare, robotics, and instrumentation domains.

The NordiaSoft SCARI Software Suite is a comprehensive Integrated Development Environment (IDE) specifically designed to minimize development risk, reduce development cycle and cost and improve overall quality of complex heterogeneous embedded systems.

Based on the international Software Communications Architecture (SCA) open standard, the SCARI Suite has undergone rigorous operational testing from its extensive use in industry, research organizations and academia worldwide. Its Core Framework has been fully tested with the official US Department of Defense certification tool and is now deployed in the battlefield in thousands of military radios.

Using a component based development approach, the SCARI Suite provides embedded system developers a high level of abstraction between the software and hardware platform, greatly simplifying their development cycle, promoting software reuse and facilitating system updates and upgrades.

The Suite is composed of Core Framework, providing the overall software management; SCA Architect, a Model-Driven Development (MDD) tool for application development; and the Radio Manager, the platform run-time monitoring tool.

FEATURES

- **SCARI GT:**
  - Run-time software framework compliant with international SCA open standard. Includes JTRS devices and services.
  - Available for wide selection of operating systems, processors, and ORB.
  - Fully tested by US DoD JTNC certification environment.
- **SCA Architect:**
  - Eclipse-based application development tool. Model-Driven Development (MDD) paradigm using Drag-and-Drop approach.
  - Abstracts all SCA programming specifics through automatic code generation.
  - Over 180 validation rules, ensuring compliancy of models. Includes plug-in to R-Check SCA.
- **Radio Manager:**
  - Platform run-time monitoring tool. Installs and controls applications for debugging and testing
  - Provides complete visualization capability for software deployment strategies. Provides functions to enable the development of personalized embedded platform controller.

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NordiaSoft
www.nordiasoft.com

info@nordiasoft.com
www.linkedin.com/company/nordiasoft
+1 819-307-0333
@nordiasoft

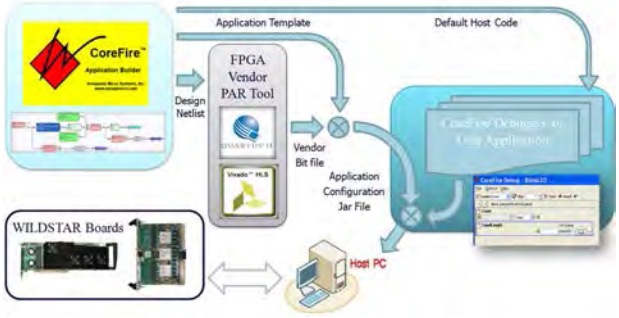
Annapolis Micro Systems

CoreFire Next Design Suite

The CoreFire Next Design Suite (compatible with all Annapolis Virtex™ 7 and Altera Stratix® V FPGA processor and I/O boards) is a dataflow-based development system that brings new levels of ease and speed to FPGA programming on Annapolis Micro Systems, Inc. high-performance motherboards, I/O cards, and mezzanine cards.

The CoreFire Next environment supplies user-made connections between ready-made programming modules, or cores, and manages multiple domain requirements automatically. CoreFire Next eliminates the need for hardware design languages: the user simply creates dataflow diagrams by dragging and dropping cores, or building blocks, from the libraries, and connecting their ports. Cores automatically work together to handle synchronization, manage clocks and other low level hardware signals, and guarantee correct control by design. CoreFire Next allows standard data types (see Data Types and Values) and supports data type propagation, where modifying a data type will automatically propagate through the rest of the CoreFire Next design. As a result, CoreFire Next allows the user to program and debug complex FPGA designs at a high level of proficiency.

CoreFire Next's drag-and-drop method of building designs allows for ease of use, which helps make the tool easy to learn. CoreFire Next presents the user with a simple way of visualizing designs, rather than extensive and confusing code. Because of this, the user does not have to be a skilled or experienced digital hardware designer. Designers of many different disciplines can use CoreFire Next to create applications.



FEATURES

- Build Designs for FPGAs on WILD™ Boards
- Works from High Level, Data Flow Concept of the Application
- Combines GUI Design Entry and Debug Tools with Tested, Optimized CoreFire Next™ IP Cores
- Drag and Drop High and Low Level Modules
- CoreFire Next™ Modules Incorporate Years of Application Development Experience – Highly Optimized and Tested
- CoreFire Next™ Tools and Modules are Intelligent
- Modules Automatically Handle Synchronization
- Manage Clocks and Other Low Level Hardware Signals
- Guarantee Correct Control by Design Modules "Know How" to Interact with Each Other
- Board Support Packages Incorporate Hardware Details of the Boards – Invisible to Users
- Single Precision Floating Point, Integer and Floating Point Complex Data Types and Array Types. Provides Java File
- Supports Conversion Between Data Types – Bit, Signed and Unsigned Integers Single Precision Floating Point, Integer and Floating Point Complex Data Types and Array Types
- Integrates with Matlab™ Simulation Flow
- Works with all Annapolis Virtex™ 7 and Altera Stratix® V FPGA processor and I/O boards

Benefits

- Save Time to Market
- Save Development Dollars
- Easy to Learn, Easy to Use
- Works with Proven COTS Boards
- Concentrate on Solving Your Problem
- Reuse Your Design
- Training Classes, Application Support

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Annapolis Micro Systems, Inc.
www.annapmicro.com

wfinfo@annapmicro.com
410-841-2514

LynxSecure ▪ LynxOS 7.0 ▪ LynxOS-178

RTOS and Secure Virtualization Software from Lynx Software Technologies

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 ARM and Intel 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

mil-embedded.com/p372827

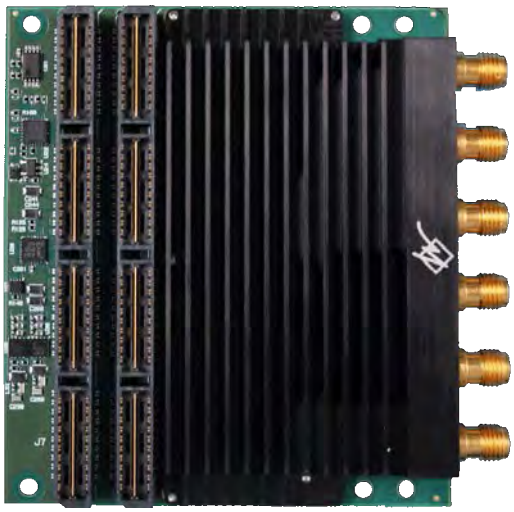
www.lynx.com

inside@lynx.com
linkedin.com/company/lynxsoftwaretechnologies
www.facebook.com/lynxsoftwaretechnologies
800-255-5969
@LynxSoftware

Annapolis Micro Systems

WILDSTAR G2 Dual 1.6/2.7/4.0GSps 12-Bit ADC Mezzanine Card

The WILDSTAR G2 Dual 1.6/2.7/4.0GSps 12-Bit ADC Mezzanine Card provides high fidelity and high speed analog-to-digital conversion along with a rugged design.



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

- Provides two channels of synchronized high bandwidth, high performance ADC channels.
- ADCs have built-in DDC/NCO/Decimation features which reduces FPGA resources
- Maximum Sample Rate up to: 1.6, 2.7 or 4.0GSps
- Minimum Sample Rate: 1.0GSps
- ADC Resolution: 12 bits
- Eight High-Speed JESD204B Serial Data Lanes per ADC
- Six 50Ω SMA Front Panel Connectors
  - Two Analog Inputs
  - High Precision Trigger Input
  - Differential Clock Input (can be driven single ended)
  - Optional PLL 10MHz Reference Input
- Software selectable Clock Source:
  - External clock provided on Clock Input SMAs
  - Optional Internal Fixed Frequency Ultra Low Phase Noise VCO/PLL with Software selectable 10MHz source:
    - Internal 10MHz source sourced by on board 10MHz source
    - External 10MHz source provided on Reference Input SMA
- Analog Input Options
  - Low Band (offers best dynamic performance in the First Nyquist Zone)
  - Mid Band (offers best dynamic performance in the Second Nyquist Zone)
  - High Band (offers widest bandwidth)
- High Precision Trigger Input Manufacturing Options:
  - 1.65V LVPECL
  - 2.5V LVPECL
  - 3.3V LVPECL
- Integrated Heatsink/Shield
- On-Board Temperature Sensors for ADCs

mil-embedded.com/p372968

Annapolis Micro Systems, Inc.
www.annapmicro.com

wfinfo@annapmicro.com
410-841-2514

Annapolis Micro Systems

WILDSTAR G2 2.5 GSps 10-Bit ADC & 12-Bit DAC Mezzanine Card

This ultra low latency 2.5 GSps ADC/DAC card is specifically designed for DRFM applications with 21ns latency from SMA to SMA.

The WILDSTAR G2 2.5 GSps 10-Bit ADC & 12-Bit DAC Mezzanine Card was designed from the ground up for latency sensitive DRFM applications. The Board Support Interface, which is available in VHDL or CoreFire Application Design Suite, was also designed from the beginning to be suited for DRFM applications. This interface provides a Digital Bypass Mode to achieve the lowest possible latency and a Fabric Space Mode to allow the user to do additional processing and manipulation of the ADC data before returning it out the DAC. The Fabric Space Mode adds only 21ns of latency. The Board Support Interface also includes a built-in Bypass Delay which can be controlled to be from 0 to 62 ADC sample clock periods. This allows the user to "walk" the latency out from the minimum Digital Bypass Mode latency to slightly beyond the Fabric Space Latency, providing for a smooth latency transition between the two modes.

The CoreFire Next Design Suite, Annapolis' FPGA Design Tool, allows the user to design a 21ns latency DRFM-optimized application in minutes.

The WILDSTAR G2 2.5 GSps 10-Bit ADC & 12-Bit DAC Mezzanine Card is shipped with a custom heatsink which enables proper cooling of the ADC. An on-board temperature monitor is also supplied which allows for real-time monitoring of the ADC's internal die temperature.

The WILDSTAR G2 2.5 GSps 10-Bit ADC & 12-Bit DAC Mezzanine Card provides high fidelity and high speed analog-to-digital conversion along with a rugged design.

FEATURES

› **General Features**
- Single Channel 10-bit ADC and 12-bit DAC running at up to 2.5GSps each
- Ultra Low latency from ADC SMA input to DAC SMA output
  - Digital Bypass Mode (SMA-to-SMA): < 21ns
  - Fabric Space Mode (SMA-to-SMA): < 42ns
- Digital Bypass Mode has built-in run-time adjustable delay providing additional delay from 0ns up to 124 Sclk periods
- Capability to have two ADC channels and two DAC channels in one 6U OpenVPX slot when plugged into WILDSTAR OpenVPX FPGA cards
- Support for WILDSTAR 7 (Xilinx Virtex™-7) and WILDSTAR A5 (Altera Stratix® V) PCIe and OpenVPX mainboards
- Firmware and Software Board Support Interface provided in CoreFire Next and VHDL source

› **ADC and DAC Performance**
- Sample Rate: 400 – 2500MSps
- ADC Resolution: 10 bits
- DAC Resolution: 12 bits

› **SMA I/O**
- One Analog Input
- One Analog Output
- One External PLL Reference Input
- One High Precision Trigger Input
- One Differential External Clock Input

› **Mechanical and Environmental**
- Integrated Heatsink and EMI/Crosstalk Shields
- Commercial and Industrial Temperatures Available
- Air Cooled with Conduction Cooled path

› **Clock Synchronization**
- Software-selectable external clock input or onboard PLL clock
- All ADCs and DACs across multiple mezzanine cards can be synchronized to the same sample using WILDSTAR Clock Distribution Boards
- Provides capability to configure 20+ ADC and DAC channels in one COTS Annapolis 19" OpenVPX Chassis

mil-embedded.com/p372969

Annapolis Micro Systems, Inc.
www.annapmicro.com

wfinfo@annapmicro.com
410-841-2514

Annapolis Micro Systems

WILD Data Storage Solution for 6U OpenVPX

When Storage capability is needed, Annapolis offers the highest density OpenVPX storage solutions on the market with up to 9.3 TB of capacity in a single 1" slot with up to 4.5 GB/s of write bandwidth. It also features a removable hot swappable canister with a connector rated for 10,000+ mating cycles. The WILD Data Storage Solution comes with standard images to support XAUI, 40GbE and AnnapMicro Protocol (Annapolis low FPGA utilization, full flow control protocol ideal for inter-FPGA communication).

The WILD Data Storage Solution is comprised of two pieces fitting in a single 1" OpenVPX slot, the "storage canister" which holds up to 12 1.8" SATA disks, and the "Storage Carrier" that plugs into the VPX backplane and holds the disk canister.

The Storage Carrier/Canister is specifically designed to support 10,000+ insertion cycles of the disk canister for frequent drive removal. Both the canister and the entire assembly (Storage Canister + Storage Carrier) are also hot swappable for minimum system down time and highest reliability. This OpenVPX compliant payload card supports 40Gb serial I/O on the VPX Data Plane on P1 to support four channels of 40GbE (proper backplane required for faster rates).

To ensure safe and reliable processing, WILD Data Storage Solution boards come equipped with a proactive thermal management system. Sensors across the board monitor power and temperature, with automatic shutdown capability to prevent excessive heat buildup. WILD Data Storage Solution boards are built with a rugged, durable design. Sensors can be accessed with a chassis manager (ChMC).

New heatsinks have been tested with great success on WILD Data Storage Solution boards. These larger heatsinks also act as stiffeners for the boards, making them sturdier.

FEATURES

› **General Features**
- 9.3 TB of Storage Per Each 6U VITA 65 Compliant OpenVPX Slot
- Up to 4.5 GB/s Write and Up to 5 GB/s Read Bandwidth (write bandwidth determined by system environmentals)
- Scalable Depth and Bandwidth
- Hot Swappable Drive Canister with 10,000 Insertion Cycles & Hot Swappable Carrier (exclusive to WILDSTAR OpenVPX EcoSystem)

› **Backplane I/O**
- Up to 40Gb Ethernet on each of Four Fat Pipes on P1, for a total of 20GB/s on P1
- 1 Additional Fat Pipe on P4 providing QSFP+ connection via RTM
- 1Gb Ethernet Connection on P4

› **System Management**
- Client/Server Interface for WILDSTAR FPGA Boards and Linux and Windows-based CPU systems
- Extensive System and Drive Diagnostic Monitoring and Configuration over 1 Gb Ethernet via P1 and P4 Ethernet
- Standard Intelligent Platform Management Interface (IPMI) to Monitor Current, Voltage and Temperature
- Front Panel Status LEDs for all 12 SSDs and all Backplane Control and Data Plane Connections

› **Physical Features**
- 6U OpenVPX (VITA 65) Compliant, 1" VITA 48.1 spacing
- Supports OpenVPX Payload Profile: MOD6-PAY-4F1Q2U2T-12.2.1-n
- Integrated Heat Sink
- Air Cooled with Product Path to Conduction Cooling

mil-embedded.com/p372950

Annapolis Micro Systems, Inc.
www.annapmicro.com

wfinfo@annapmicro.com
410-841-2514

innodisk

Innodisk's flash storage and DRAM modules meet all of today's aerospace and defense application requirements

The aerospace and defense industries require the most rugged storage products that can handle environmental challenges, such as shock and vibration, and extreme temperatures. These products must also handle vital security challenges, such as protecting sensitive data and preventing data breaches. Also working with storage vendors that can provide long-term support and ensure the long-term availability of products is crucial.

As a result, it is important for manufacturers not only to use the right storage products for aerospace and defense applications but also to work with the right storage vendors.

InnoRobust® feature set

Innodisk's dedicated flash and DRAM products with our InnoRobust® feature set provide mission-critical performance for the aerospace and defense sectors. Our products are fully compliant with aerospace and defense standards, and are built with a wide array of features to ensure outstanding performance in extreme environments. With our InnoRobust feature set, we are able to guarantee that our storage and memory modules are fully protected against heat, dust, extreme cold and heat, shock, vibration, and other environmental stresses. In addition, we apply industry-leading data protection technologies to keep sensitive information secure. Our flash storage and DRAM modules are also backed by a dedicated engineering support team, and come with BOM control and flexible customization options.

This series of products are fully compliant with aerospace and defense standards as below:

- MIL-STD-810F/G Compliant
  Military-Grade System Design Standard
- MIL-I-46058C Compliant
  Silicone and Conformal Coating Standard

FEATURES

The InnoRobust feature set delivers all the operational robustness and ruggedness needed in defense industry environments:

› **Rugged Design**
Compliant with the United States Military Standard MIL-STD-810F/G. DRAM modules also extend the JEDEC SO-DIMM standard by 10 mm.

› **Conformal Coating**
Our flash and DRAM storage products are compliant with the MIL-I-46058C silicone conformal coating standard for protection against moisture, dust, and chemicals.

› **iData Guard (Available for flash only.)**
iData Guard is our patented Power Cycling data management system, which helps to ensure SSD data integrity after sudden power outages.

› **iCell Power Failure Management (Available for flash only.)**
Our iCell technology uses buffer management to store data in volatile DRAM, to prevent the loss of valuable data during sudden power failures.

› **Advanced Data Security (Available for flash only.)**
Our comprehensive data security suite for SSDs includes QEraser, SEraser, write protect, and self-destruct functions.

› **Physical Data Destruction (Available for flash only.)**
A self-destructing design initiated through high voltage being supplied to an SSD to destroy its controller IC and flash IC.

mil-embedded.com/p372953

Innodisk Corporation
www.innodisk.com

sales@innodisk.com
+886-2-7703-3000
in www.linkedin.com/company/innodisk-usa
Address: 5F., No. 237, Sec. 1, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan

PHOENIX INTERNATIONAL

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 (pictured) 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/FIPS 140-2 Encryptionn
- Advanced NAND Flash Management for Enhanced Reliability and Durability
- **Made in USA**

mil-embedded.com/p372974

Phoenix International
www.phenxint.com

info@phenxint.com

714-283-4800

Mass Storage

PHOENIX INTERNATIONAL

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 subsystem 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 up to eight 16Gb FC, 12Gb 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 over 6000MB/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
- AES 256/FIPS 140-2 Encryption
- **Made in USA**

mil-embedded.com/p372973

Phoenix International
www.phenxint.com

info@phenxint.com

714-283-4800

AdaCore

GNAT Pro

GNAT Pro is a robust and flexible Ada development environment based on the GNU GCC compiler technology. It provides:

- a full Ada compiler that implements Ada 83, Ada 95, Ada 2005, and Ada 2012;
- the GPS (GNAT Programming Studio) and GNATbench (Ada plugin for Eclipse) Integrated Development Environments;
- a comprehensive toolset including a visual debugger; and
- a set of libraries and bindings.

With GNAT Pro, users can develop pure Ada applications as well as Ada components in multi-language systems. GNAT Pro is distributed with complete source code, and is backed by frontline support service supplied by the product developers themselves – the world's largest and most experienced team of Ada experts.

GNAT Pro has been used by industry and government customers worldwide in professional, mission-critical software products ranging from small-footprint real-time embedded applications to large-scale information management systems. It is available on more platforms, both native and embedded, than any other Ada technology.

Benefits

GGNAT Pro meets the real requirements of the professional user:

Ada 2012 support: GNAT Pro is the first Ada environment to implement the latest versions of the language standard. With GNAT Pro, developers can exploit Ada 2005's features such as enhanced object-oriented programming support, additional APIs, and the Ravenscar Profile. GNAT Pro users can likewise take advantage of Ada 2012's many innovations including contract-based programming (pre/postconditions and type invariants), subtype predicates, conditional/case/parameterized/quantified expressions, and improved support for multiprocessors/multicores.

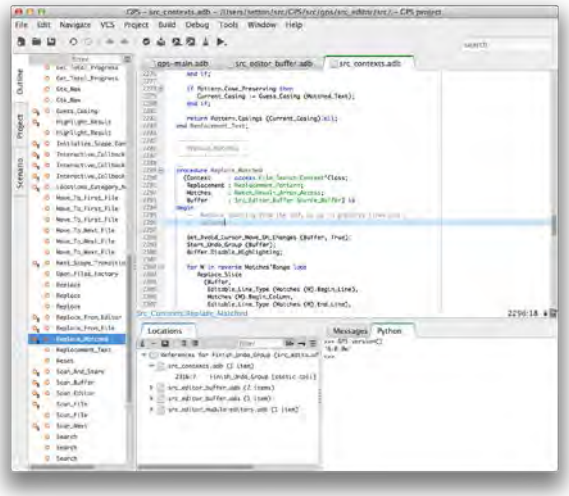
Multi-language development: Thanks to the open standards used by GCC, GNAT Pro eases the job of developing applications comprising Ada and other languages such as C, Fortran, and C++. The Ada interfacing facilities are fully implemented.

Support for safety-critical and high-security applications: Specialized GNAT Pro editions – GNAT Pro Safety-Critical and GNAT Pro High-Security – are respectively oriented towards applications that require certification against software safety standards such as DO-178B / DO-178C, and security standards such as the Common Criteria. These versions of GNAT Pro include several language profiles (including the Ravenscar tasking subset) whose run-time support libraries simplify the certification effort. For safety-critical applications a source-to-object code traceability analysis is available, which directly supports one of the Level A verification objectives in the DO-178 standards.

Excellent code quality: Efficient object code is achieved through a combination of Ada-specific and GCC back end optimizations; a supplemental tool reduces code size by removing unused subprograms from an executable. The run-time libraries have been tuned to provide high performance, with a special focus on efficient exception handling and tasking.

Ease of transitioning from other Ada compiler systems: GNAT Pro implements several attributes and pragmas that ease the porting of existing Ada 83 or Ada 95 code bases to GNAT, and the Project Manager facility allows developers to adopt the same file naming conventions and directory structure as were used in the previous system.

For more information, please visit: http://www.adacore.com/products



TECHNICAL FEATURES

- Full Ada implementation (Ada 2012, Ada 2005, Ada 95, and Ada 83), including all Specialized Needs Annexes
- GPS (GNAT Programming Studio), a powerful, extensible and tailorable Integrated Development Environment
- Visual debugging support, including a remote interface for debugging an embedded target
- Stack usage analysis tool (GNATstack)
- Compiler switch to help traceability of source to object code, for GNAT Pro Safety-Critical product (-fpreserve-control-flow)
- Coding standard verification tool (GNATcheck)
- Additional tools, including a heap usage monitor, a unit testing framework, a pretty printer, a program browser, an HTML generator, and a program metrics generator
- Libraries and bindings supplementing the standard Ada API, including packages for services such as operating system interfaces, text manipulation and pattern matching, data structures and algorithms, and I/O operations
- Detailed and understandable documentation, including the GNAT Pro User's Guide and GNAT Pro Reference Manual

Other GNAT Pro advantages:

- Source code inclusion, allowing developers to understand important implementation decisions.
- Quality assurance, based on a rigorous configuration management process and extensive test suites.
- Dependable support is intrinsic to all AdaCore products and is supplied by the GNAT Pro developers themselves. In essence, AdaCore serves as online consultants to customers' projects. Questions on all aspects of Ada and GNAT Pro are answered promptly, comprehensively, and accurately. Blocking issues receive immediate attention; if appropriate, a wavefront release with the relevant repair can be provided.
- AdaCore can also provide specialized engineering and/or training services based on specific customer requirements.

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AdaCore
www.adacore.com/products | www.adacore.com/customers

info@adacore.com @AdaCoreCompany

Embedded Computing *without* Compromise

COTS Lifecycle+™ Program

Aitech Defense Systems Inc. offers full support and a product availability guarantee for all boards and systems developed by the company for a minimum of 12 years from initial production date.

Unique in its long-term commitment to the industry, Aitech's three-phased COTS Lifecycle+™ program ensures that, in a time when component obsolescence is on the rise in many military COTS applications, customers will be able to rely on Aitech to obtain the needed component parts and support to keep systems running effectively well into the future.

Each of Aitech's standard products consists of the **three product lifecycles**, each with a guaranteed minimum support period of four years. The **active phase** is the initial product lifecycle, where both the product and Aitech support are available for all existing and new programs.

The **supported phase** extends this product availability and support for existing, program-specific designs for a minimum of another four years.

The **extended support phase**, available through an agreement tailored to each customer to provide specific services and support needs based on the application, adds another four years and brings the full COTS Lifecycle+™ program to a minimum 12 years of program support provided by Aitech.

The new COTS Lifecycle+™ program complements Aitech's carefully-honed technology insertion design philosophy of developing products that are easily upgradeable to newer technologies as they become available. Both help end users maximize their embedded computing investments.

The Aitech COTS Lifecycle+™ program was developed to ensure product availability for end users as well as to provide a base of stable COTS embedded computing components that allow systems and sub-systems to continue to function over an extended period of time, and at optimum performance.

FEATURES

COTS Lifecycle+™ Program Features:

- Product availability assurance and long-term program support
- Configuration management program options that meet your program's needs
- Extended product logistics, lifecycles and maintenance
- "4+4+4" or 12 years of product support – at a minimum

Our Approaches to Obsolescence Management:

- Data Package Management
- Component device and die banking
- Re-qualification testing
- Component radiation characterization and certification testing
- Legacy electronics parts re-design
- Manufacture of Form-Fit-Function LRUs (Line Replaceable Units)

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Aitech Defense Systems, Inc.
www.rugged.com
sales@rugged.com
https://www.linkedin.com/company/Aitech
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GET Engineering

Legacy Obsolescence Solutions

Obsolescence –

Systems or devices reached end of life or are no longer maintainable?

GET Engineering can provide a form, fit and function, cost effective replacement that will allow continued support of an already fielded program. We can provide legacy and short run solutions.

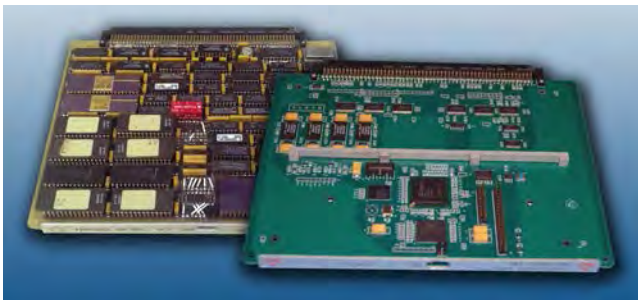
Transition –

Legacy systems or devices unable to integrate with new networks or processors?

GET Engineering can provide conversion devices that connect legacy protocols to Ethernet based networks.

Need to transition bulky costly copper cable plants to more cost effective secure fiber?

GET Engineering has solutions to provide an immediate cost effective result.



GET DIFFERENCE

- Custom Solutions
- In-House Engineering and Production
- Rapid Turnaround
- Live Product Line Support
- Free Lifetime Software Support
- Platform Independent Software

"What Can We (Re)Build For You?"

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GET Engineering Corp.
www.getntds.com

sales@getntds.com

619-443-8295

OpenSystems Media works with industry leaders to develop and publish content that educates our readers.

Choosing the right video interface for military vision systems: The cost, design, and performance benefits of GigE Vision for real-time imaging applications

By Pleora Technologies

Implementing the GigE Vision interface standard can help designers reduce the cost and complexity of military imaging systems, while also improving usability and increasing intelligence for end users. In this white paper, get a detailed review of video-connectivity approaches commonly used in military imaging systems, followed by an overview of the GigE Vision standard. The paper then outlines the design, cost, and performance benefits that can be achieved by using GigE Vision-compliant video interfaces in a vetronics retrofit upgrade project.

Link: http://mil-embedded.com/white-papers/white-vision-real-time-imaging-applications/

Check out our white papers.
http://whitepapers.opensystemsmedia.com/

Annapolis Micro Systems

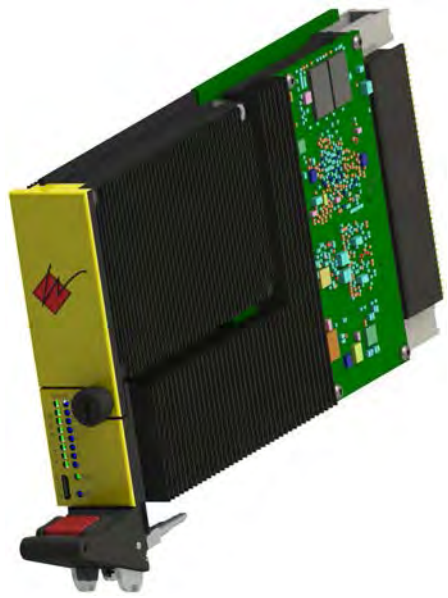
WILD Storage For OpenVPX 3U

WILD Storage for OpenVPX 3U is a revolutionary storage technology with very high memory, storage, and I/O bandwidth capacities. This allows for high-density and high-performance system designs.

The WILD Storage for OpenVPX 3U is comprised of two pieces fitting in a single 1" OpenVPX slot, the "storage canister" which holds up to 8 M.2 SATA disks, and the "Storage Carrier" that plugs into the VPX backplane and holds the disk canister. The Storage Carrier/Canister is specifically designed to support 10,000+ insertion cycles of the disk canister for frequent drive removal. Both the canister and the entire assembly (Storage Canister + Storage Carrier) are also hot swappable for minimum system down time and highest reliability. This OpenVPX compliant payload card supports up to 10Gbps serial I/O on the VPX backplane.

To ensure safe and reliable processing, WILD Storage for OpenVPX 3U boards come equipped with a proactive thermal management system. Sensors across the board monitor power and temperature, with automatic shutdown capability to prevent excessive heat buildup. WILD Storage for OpenVPX 3U boards are built with a rugged, durable design. Sensors can be accessed with a chassis manager (ChMC).

New heatsinks have been tested with great success on WILD Storage for OpenVPX 3U boards. These larger heatsinks also act as stiffeners for the boards, making them sturdier.



FEATURES

- 4 TB of Storage Per Each 3U VITA 65 Compliant OpenVPX Slot
- Up to 4 GB/s Write and 4 GB/s Read Bandwidth (write bandwidth determined by system environmentals)
- Scalable Depth and Bandwidth using multiple Storage Cards
- Hot Swappable Drive Canister with 10,000 Insertion Cycles & Hot Swappable Carrier (exclusive to WILDSTAR OpenVPX EcoSystem)
- Drive Canister only: 94mm x 61mm x 24mm

Backplane I/O

- Up to 40Gb Ethernet or QDR Infiniband on each of Four Backplane Fat Pipes for a total of 20GB/s
- 1Gb Ethernet Connection on P1
- 8x PCIe Gen 3 pass-thru connections

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.

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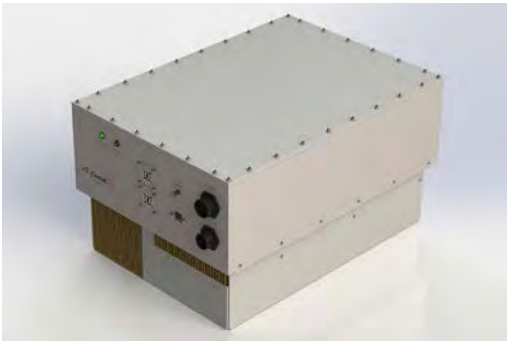
Annapolis Micro Systems, Inc.
www.annapmicro.com

wfinfo@annapmicro.com
410-841-2514

dB Control
a HEICO company
Reliability by Design®

dB-3840

The dB-3840 is a TWT Amplifier (TWTA) operating in the frequency range of 34.5 to 35.5 GHz providing 700 Watts minimum peak output power at a duty cycle of up to 10%. A wideband, periodic permanent magnet (PPM)-focused, conduction-cooled TWT is used for power amplification. The power supply topology uses proprietary low-noise, high-efficiency designs to operate the RF signal path. An embedded micro-controller provides the interface, control and protection functions and status indication for the TWT Amplifier. Standard interface protocol for remote operation is RS-485. Other protocols such as RS-232, RS-422, Ethernet, or custom interfaces are available as options. The TWT Amplifier is encased in an environmentally sealed package for outdoor and antenna pedestal mounted applications, and uses integral forced-air cooling for thermal management.



FEATURES

- Ka-Band TWTA
- 34.5 GHz to 35.5 GHz
- 700 Watts minimum peak output power
- 10% maximum duty
- Hub-Mount configuration
- Excellent reliability

Options

- Prime power input voltage
- Standard or custom interface protocols
- RF gain control

Applications

- Radars
- Test and measurement
- Antenna pattern and radar cross-section measurements
- Electronic warfare (EW) simulation

mil-embedded.com/p372633

dB Control
www.dBControl.com

marketing@dBControl.com

+1 (510) 656-2325

Unmanned Systems

IMPERX™

IMPERX Aviation Camera

IMPERX has developed an Aviation Camera that can be used for airborne and other demanding environmental applications. The Aviation Camera has passed the Minimum Operational Performance Standards (MOPS) which were prepared by RTCA, Inc. (Radio Technical Commission for Aeronautics) to ensure that the equipment is reliable to operate in actual aeronautic installations. This test procedure is referred to as the DO-160, "Environmental Conditions and Test Procedures for Airborne Equipment". IMPERX's Aviation Camera can operate in -55°C to +70°C, travel up to 60,000 ft. altitude and has a vibration and shock specification of 100g (20-200) HZ XYZ and 1000g. The Aviation Camera has an IP 69 rating, is hermetically sealed, and has a nitrogen purging system with valve regulated sealing. This camera is the best option for the most demanding environmental applications.

FEATURES

- DO-160 Tested
- High Definition Video Quality
- Operating Temperature: -55°C to +70°C
- IP 69 Rating
- Shock/Vibe: 100g (20-200) HZ XYZ/1000g
- Hermetically Sealed
- Nitrogen Purging System

mil-embedded.com/p372942

IMPERX, Inc.
www.imperx.com

sales@imperx.com
www.linkedin.com/company/imperx
+561-989-0006
twitter.com/IMPERXInc

LEMO

LEMO M Series

LEMO, a global leader in the design and manufacture of precision custom connection solutions offers the LEMO M Series, a lightweight aluminum connector series for military, aerospace, security and other harsh environment type applications. This connector series offers a new innovative design that is made out of lightweight, high-strength aluminum and is considered one of the lightest and most compact connectors of the LEMO range.

LEMO's high quality connectors can be found in a variety of challenging application environments including medical, industrial control, test and measurement, audio-video, military, aerospace, robotics, broadcast and telecommunications. LEMO also offers cable & wire as well as cable assembly services.

FEATURES

- Ratchet coupling mechanism
- 6 keying options
- Compact and lightweight
- Oil and fuel resistant
- 12 shell styles
- Temp. range -50°C to 200°C
- Shielded
- Crimp or print contacts
- High vibration resistance (gunfire test)
- High shock resistance
- Optional anti-vibration flange fixing
- Dark finish

mil-embedded.com/p372944

LEMO
www.lemo.com

info-us@lemo.com
www.linkedin.com/in/lemousa
1-800-444-5366
twitter.com/lemousa

SEALEVEL®

Relio R2 Sync Server

The Relio R2 Sync Server solid-state computer offers designers robust synchronous serial communications, small size, powerful processing, and long product life.

Perfect for radar, satellite, and other military applications, the R2 Sync Server's four synchronous ports are individually configurable for RS-232, RS-422, RS-485, RS-530, RS-530A or V.35. The system operates over a wide 0-50°C temperature range and is compliant to MIL-STD-810 specifications for shock and vibration.

Enclosure Front:
- 100-pin SCSI-style connector for synchronous serial ports
- ATX style push button power switch

Enclosure Rear:
- Two 10/100/1000BaseT RJ45 Gigabit Ethernet ports with status LEDs
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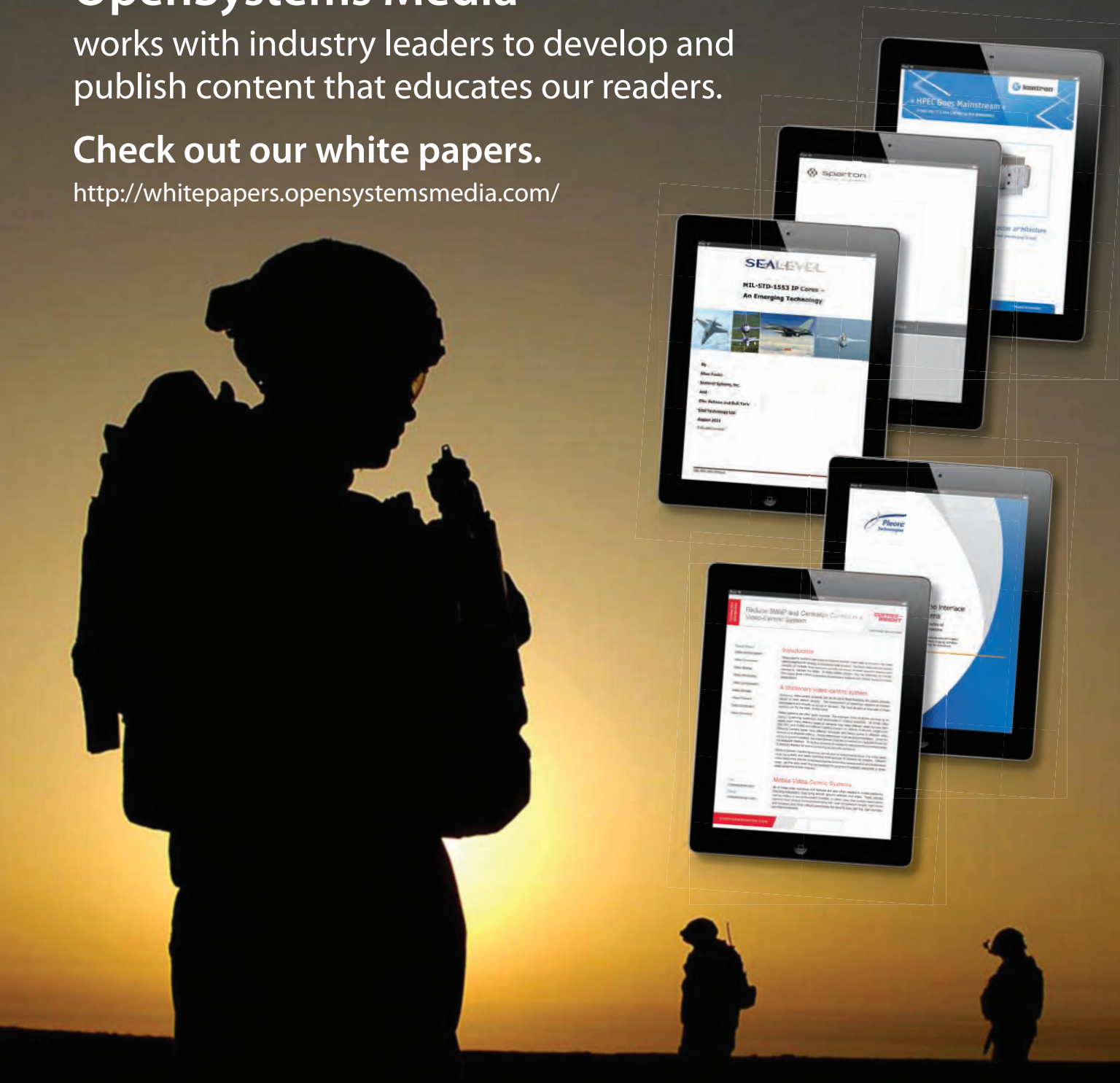

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On DARPA's cybersecurity radar: Algorithmic and side-channel attacks

By Sally Cole, Senior Editor

The U.S. Defense Advanced Research Projects Agency (DARPA) is working with university researchers to prepare now for next-gen cyberattacks in the form of "algorithmic complexity attacks," which are nearly impossible to detect with today's technology (and the kind most likely to be attempted by nation-states), as well as side-channel attacks, a.k.a. "spy-in-the-sandbox attacks."

While vulnerabilities based on flawed implementations of algorithms are already popular targets and have been for years, cyberattackers are expected to shift their attention to vulnerabilities found within the algorithms themselves.

So DARPA's Space/Time Analysis for Cybersecurity (STAC) program is working to develop new program-analysis techniques and tools to identify vulnerabilities related to space and time resource-usage behavior of algorithms, specifically ones associated with algorithmic complexity attacks and side-channel attacks. The STAC program's main goal is to enable analysts to detect these types of vulnerabilities at a scale and speed that can support searching for them within software that the U.S. government, military, and critical infrastructure all rely upon.

Attacks targeted by STAC

Software systems are vulnerable to algorithmic complexity attacks, which attackers can manipulate by crafting an input that forces the system to consume super-linear space or time processing it. This malicious act results in legitimate users being denied service or the system becoming disabled when it's forced to attempt computations that require large amounts of space or time.

Side-channel attacks, on the other hand, are stealthy indirect information flows that cause software systems to give up their secrets. Attackers can uncover secret information by measuring the behavior of running software, such as how long a program runs or how much memory it uses.

Academic input

STAC work includes efforts from the Universities of Maryland, Utah, California-Irvine, Yale, and Wisconsin-Madison.

The University of Maryland team was awarded a $3.4 million grant to develop automated software-analysis tools to detect anomalies associated with algorithmic complexity attacks and side-channel attacks.

"It turns out that these two problems are related," explains Michael Hicks, a professor of computer science affiliated with the University of Maryland Institute for Advanced Computer Science and the Maryland Cybersecurity Center. "Both depend on how inputs to the program can influence the program's subsequent behavior. So we want to develop analysis tools that, when handed a piece of software, can determine whether that particular software might be vulnerable to either of these problems."

A team of computer scientists at the University of Utah and University of California-Irvine won a $3 million grant from DARPA to create an analyzer to thwart algorithmic attacks targeting the set of rules or calculations that computers must follow to solve a problem.

"The military is looking ahead at what's coming in terms of cybersecurity and it looks like algorithmic attacks," says Matt Might, associate professor of computer science at the University of Utah. "Right now, the doors of the house are unlocked so there's no point getting a ladder and scaling up to an unlocked window on the roof. But once all the doors are locked on the ground level, attackers are going to start buying ladders."

Algorithmic attacks are a little unusual because they don't require conventional vulnerabilities. "These attacks are particularly devious because they exploit weaknesses in how resources like time and space are used in the algorithm," notes Suresh Venkatasubramanian, an associate professor of computer science at the University of Utah.

Creating these vulnerabilities is, however, an extremely costly, complex, and time-intensive process, which so far falls within the realm of state-sponsored hackers.

The team is currently developing software capable of performing audits of computer programs to detect algorithmic vulnerabilities or "hot spots" within the code. Their analyzer will perform a mathematical simulation of the software to predict what will happen in the event of an attack. "Think of it as 'spell check' for cybersecurity," says Might.

GrammaTech, Inc. (Ithaca, New York) engineers teamed up with Yale University researchers on STAC to develop technology to detect denial-of-service vulnerabilities based on the space and time complexities of code.

The company's approach is to detect these classes of vulnerabilities in Java bytecode without requiring access to program source code. To do this, they teamed up with the Yale experts, who are contributing recent breakthroughs in amortized resource-bound analysis, as well as University of Wisconsin-Madison researchers who are contributing seminal work in shape analysis, which will enable the combined technology to capture the dependence of resource use on linked data structures.

These three groups are a sample of the 10 currently receiving funding as part of DARPA's STAC initiative, which launched in April 2015 and will continue for four years.

E-CAST

Managing avionics safety certification for unmanned aircraft

Presented by dSPACE and RTI

For the U.S. military, unmanned aircraft platforms have been a force multiplier, a term often used to describe something that gives one side a game-changing tactical edge over the other side. Now, however, the Federal Aviation Administration (FAA) is opening the nation's airspace to unmanned aircraft systems (UASs); these systems must now comply with FAA safety standards for technology, such as DO-178 B and C for flight-critical software and DO-254 for hardware. In this e-cast, learn from industry experts as they discuss the challenges found in and solutions for managing avionics safety certification for UASs.

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BLOG

The fascinating world of containers – and why the military should care

By James Kirkland, Red Hat

Look up the word "embed" on Oxford Dictionaries and you'll find this definition: "… fix (an object) firmly and deeply in a surrounding mass." From that description, it certainly sounds like things that are embedded are not very flexible. And so it has traditionally been with embedded systems: solutions were "built to last" but, in many cases, weren't able to be easily changed or updated.

Such a strict approach doesn't work well with the U.S. military's drive for greater agility and flexibility. From the battlefield to the administrative front, the military needs to be able to make changes on the fly, develop new applications, and deploy across multiple hosts. How's a "fixed" embedded system able to keep up?

Welcome to the world of containers. While not considered a new technology (they have existed in UNIX derivatives since the early 1980s), containers have taken off lately due to specific advantages in meeting the application-delivery needs of today's defense environment. The fact that containers also offer the Department of Defense (DoD) the ability to hold down costs by maximizing existing resources and minimizing system requirements is a welcome added bonus.

Containers release efficiency

Let me explain: Unlike traditional technology stacks, or even popular virtualization environments, each container consists of just the application and its dependencies (libraries, binaries, etc.). By using existing Linux technologies like kernel namespaces, cgroups, SELinux, and others, containers run as isolated processes on the host operating system and are able to share the kernel with other containers. This can reduce both hardware and operating system costs.

Containers enable the same application to be quickly developed and shared across devices, virtual machines, and any cloud. They give developers the tools to efficiently and iteratively build integrated systems. Because developers are able to create applications and manage one set of software (not several), software can run more efficiently, the development deployment cycle can be faster, and overhead costs can be reduced. It's no wonder container technology is taking off.

How does this all come together in your embedded system? Just think: You can develop embedded software using the same development tools used for your datacenter or the cloud. You can manage updates easily and efficiently across all systems with the help of the underlying operating system to certify API and ABI stability and library compatibility. And you can rewrite, redesign, and relaunch existing applications.

With the help of robust test and certification processes for containers, the risk can be taken out of updates and you can be assured they will run across all devices, even embedded ones. For example, in a military application such as a weapon system, there may be several different components, requiring the isolation of different user interfaces and communications capabilities from the mechanical operations commands and reporting systems. With containers, development for each separate component would take place using individual containers launched across the appropriate hosts – all accomplished with the same set of software tools.

Using containers helps simplify development complexity while enabling efficient deployment. But containers can't go it alone.

Containers need Linux

While you are concentrating on customizing and developing containerized applications, the underlying Linux platform is hard at work enhancing performance and ensuring the security. Scalability of containerized applications is addressed through Kubernetes management, enabling deployment across a large cluster of container hosts.

The success of containerized applications is dependent upon the Linux operating system and its capabilities. Since containers depend on the kernel and operating system to function, defense agencies will want to consider implementing open source software that offers resource management, isolation, abstraction, and security, all of which are needed for container applications to truly be portable across container hosts.

Are containers right for you? To answer that, simply consider the workloads you're planning to run. Most federal IT users will find containers ideal for application packaging and delivery because of their low overhead and greater portability. Of course, there's also the added benefit of reduced maintenance concerns and greater flexibility – two important factors for today's increasingly virtualized military. Given these benefits, perhaps the question is not "Are containers right for you?" but instead "What are you waiting for?"

James Kirkland *is Chief Architect for Intelligent Systems at Red Hat.*

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OBITUARY

AdaCore's Robert Dewar passes away

By John McHale, Editorial Director

AdaCore lost its founder recently and the embedded software community lost one of its most eloquent experts with the passing of Dr. Robert Dewar, AdaCore President. Dr. Dewar succumbed to cancer on June 30, 2015. He was 70.

Robert was a pleasure to work with and frankly one of the best interviews in the business. He made complicated subjects easy to understand and never was guilty of spin, which we in the media appreciated most of all. He will be missed. Our whole team at OpenSystems Media sends its thoughts to his family and colleagues.

"Robert made a difference," said AdaCore CEO and cofounder Franco Gasperoni. "In Africa there is a saying that you die when you are forgotten. All of us at AdaCore will keep Robert's memory alive, and we will strive to continue the technical and business heritage that Robert has left us with."

Over the years I've interviewed Robert many times and also worked with him on conferences and online webcasts, most recently as part of the "COTS Confidential" roundtable on COTS software. In our Feb/March 2014 issue, he also spoke to safety certification for unmanned aircraft in an article titled "Safety certification concerns for UAVs in national airspace," and spoke on the same subject for a webcast last winter.

Dr. Dewar had a distinguished career as a Professor of Computer Science at New York University (NYU), and was key in the design and implementation of the Ada programming language, founding AdaCore, along with four colleagues, in 1994. He served as its CEO until 2012 and as its President until his death.

At AdaCore, Dr. Dewar was the principal architect of the GNAT compiler technology and guided AdaCore's strategic decisions that enabled the company to achieve and sustain steady growth and profitability.

Born in Oxford, England, he eventually moved to the U.S., where he attended the University of Chicago, receiving a BS in 1964 and a PhD in Chemistry in 1968. While a graduate student, he started working with computers to analyze x-ray crystallography and soon shifted careers, joining the Computer Science faculty at NYU in 1975, becoming a full professor in 1976, later serving as chair of the department.

Dr Dewar participated in the SETL project and became involved with Ada from the outset as he specialized in programming language design and implementatio. He was one of the architects of the Ada/Ed compiler at NYU, which was written in SETL and served as an operational definition of the Ada 83 language. He was actively involved with Ada throughout the language's history, as a member of the Ada Rapporteur Group that maintains the language standard.

"Robert was at the same time a brilliant computer scientist always ready to engage in intellectual debates over technical topics, and an open and friendly human being always ready to show kindness and support in personal or social matters," says AdaCore Managing Director and cofounder Cyrille Comar. "His intensity in technical debate was matched by his gentility in personal relationships, and I owe Robert a great debt in his helping me find and set a path toward my goals in life."

"Robert was a genius in software design, certainly one of the best of his generation," said Edmond Schonberg, AdaCore cofounder. "In addition, he was a tireless teacher and an exemplary stylist in all he wrote, and we learned immensely from his example, his lucid prose, and his elegant code. The best way to honor his memory will be for all of us at AdaCore to apply all he taught us about our craft, and about the core values that he stated so forcefully, and that animate all our work."

Outside of his professional life, Dr. Dewar was a superb baritone, a bassoon and recorder player, a conductor, and a member of the North American Heckelphone Society. He was also part of the Village Light Opera Group (VLOG) in New York, serving for 35 years in numerous capacities from producer and president to fly master and music director. He was a major benefactor and performed in a myriad of productions with the group. VLOG's Dewar Center for the Performing Arts is named in recognition of Robert and Karin Dewar's contributions.

"In the 40 years I was working with him in various capacities, Robert was always a source of great stories and wisdom in fields far beyond computing," said Richard Kenner, AdaCore cofounder. "He has taught all of us much in those fields as well as in computing, and those lessons will remain with us always."

Dr. Dewar is survived by two children, Jennifer and Keith Dewar, and two grandchildren. His wife Karin predeceased him in 2013.

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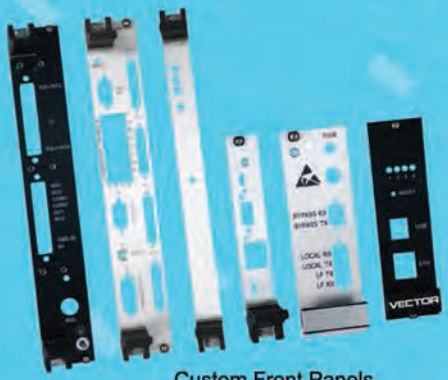

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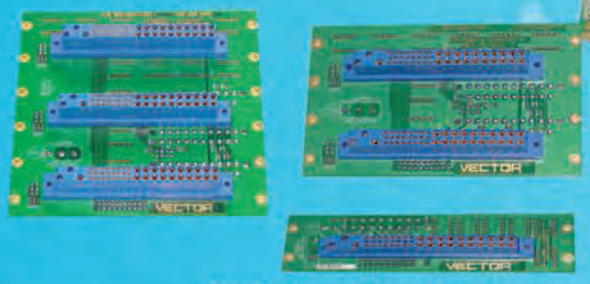

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CHARITY

Home Base Program

Each month in this section the editorial staff of *Military Embedded Systems* will highlight a different charity that benefits military veterans and their families. We are honored to cover the technology that protects those who protect us every day. To back that up, our parent company – OpenSystems Media – will make a donation to every charity we showcase on this page.

This month we're featuring the Home Base Program, a private-sector program dedicated to healing the "invisible wounds" of war for Iraq and Afghanistan veterans and their families. The Home Base clinical staff provides no-cost treatment each day for veterans living with post-traumatic stress, traumatic brain injury, depression, relationship challenges, military sexual trauma, substance abuse, and the stress and anxiety that result from wartime military service.

The Home Base program was started by Red Sox chairman Tom Werner: Following the baseball team's 2007 World Series win, Red Sox players and owners met with wounded veterans at Walter Reed Army Medical Center and learned of the medical challenges faced by many of the returning veterans. Following his visit, Werner made a commitment to partner with the Massachusetts General Hospital in Boston in order to address the signature "invisible wounds of war." Home Base opened the door to its clinic in 2009 and since then has provided clinical care, services, and support to more than 5,000 veterans and military family members from across all six New England states.

In 2015, Home Base will transition from a Boston-based regional program to what will be called the National Center of Excellence for the Invisible Wounds of War. The program will grow its existing clinical staff of doctors, psychologists, nurses, physical medicine, rehabilitation specialists, and licensed clinical social workers to double the size of its clinical program. The majority of the program's funding comes from individual, corporate, and foundational support.

For more information, visit www.runtohomebase.org.

E-CAST

Addressing hardware obsolescence for VxWorks 5.x-based systems

Presented by Wind River Systems

Hardware components are no longer available for many legacy systems running VxWorks 5.x. A schedule- and cost-friendly solution is needed that allows current systems to be updated and fielded without requiring a full development and internal certification process. In this webinar, John Bliss, A&D Solutions Architect, Wind River Customer Experience Group (CXG), discusses issues, scenarios, and solutions for reusing legacy applications on next-generation hardware.

Participants will learn how to extend a legacy system, further enhance a legacy system, and consolidate and multiple federated systems.

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WHITE PAPER

Solving DO-178C design challenges with SCADE model-based tools

By Pierre Vincent, Ansys

Verification efforts when developing safety-critical software often exceed 60 percent or more of the total cost of the project when addressing DO-178C level A applications. Various verification techniques have been proposed to streamline software verification while preserving the safety of the application, with model-based verification considered one of the most efficient. It includes several verification techniques such as model check, model simulation (including rapid prototyping), and model coverage. On the basis of these techniques, most of the verification activities can be carried out at model level, thereby identifying problems earlier in the development cycle.

This white paper details the process for verifying a model-based application developed with SCADE and highlights how SCADE Test, combined with LDRA Test Environment, can satisfy the DO-178C/DO-331 verification objectives cost efficiently.

Read the white paper: http://mil-embedded.com/white-papers/white-challenges-scade-model-based-tools/

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