Vehicle C4ISR Systems Focus on Network Technology

Signal Processing Designs Weigh FPGA vs. GPGPU Choices

PCI Express and Ethernet Meet Growing Bandwidth Appetites

Data Sheet: Small Non-standard Boards Roundup
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COTS (kots), n. 1. Commercial off-the-shelf. Terminology popularized in 1994 within U.S. DoD by SECDEF Wm. Perry’s “Perry Memo” that changed military industry purchasing and design guidelines, making Mil-Specs acceptable only by waiver. COTS is generally defined for technology, goods and services as: a) using commercial business practices and specifications, b) not developed under government funding, c) offered for sale to the general market, d) still must meet the program ORD. 2. Commercial business practices include the accepted practice of customer-paid minor modification to standard COTS products to meet the customer’s unique requirements.

—Ant. When applied to the procurement of electronics for the U.S. Military, COTS is a procurement philosophy and does not imply commercial, office environment or any other durability grade. E.g., rad-hard components designed and offered for sale to the general market are COTS if they were developed by the company and not under government funding.

On The Cover: Warfighter Information Network — Tactical (WIN-T) Increment 2 combined tactical radios, cyber-defense products, mission command capabilities and communications network systems all from General Dynamics C4 Systems and other mission command and control capabilities. These were all used for the U.S. Army’s Network Integration Evaluation (NIE) 15.1 last Fall. (Photo by General Dynamics C4 Systems).
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INTEGRATED COMBAT SYSTEMS (ICS)

Orbit Electronics Group’s Integrated Combat Systems (ICS) has announced the availability of two new 6U VME System Health Monitors, two 6U VPX System Health Monitors, and a Rear Transition Module (RTM) for each.

These six products join the over 135 standard and customized VME and VPX products shown on Orbit’s web portal at www.vmevpx.com. They are among the most advanced such components available today. All 6U System Health Monitors feature a unique, proprietary feature-rich GUI; Ethernet, USB and/or RS 232 interfaces; set-up; data logging; field upgradable firmware; and data password protection.

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Head in the Cloud

I trekked down to Atlanta earlier this month for this year’s AUVSI show—cleverly renamed Unmanned Systems 2015 this time around. Association for Unmanned Vehicle Systems International (AUVSI) never rolled off the tongue very well even in acronym form. The show has been an important one for COTS Journal over the past several years for the obvious reason that military unmanned systems including UAVs, UGVs and UUVs are by definition strongly tied to the technologies like embedded computing and networking on which they run.

With over 8,000 attendees at the show it’s clearly a growing market segment. One aspect that was most striking this year to me, and to many whom I talked to, was that this year’s growth was clearly dominated by commercial/civil unmanned platforms. That’s not to say that the military contingent wasn’t still strong—that side was growing too in terms of exhibitors and attendance. But the commercial side was clearly dominating. While I was slightly taken aback by that at first, it dawned on me that the surge in civil UAV technology is not necessarily a bad thing for the defense market. Just as Unmanned Systems is one of those few shows where technology supplier companies and defense primes exhibit side by side, it’s also that even more rare bird where defense and civilian applications and platforms are in display side-by-side.

When you think about it the commercial UAV industry has leveraged a lot of technical knowhow from the more well established defense UAV space. While the issues and constraints are different there’s a lot of overlap between the basics of the two. And there were a number of technologies displayed at this year’s show that have application on both the commercial and defense sides.

An interesting area of overlap between commercial and defense UAV technology needs is how to leverage Cloud technologies and services. The “Internet of Things” phenomenon has captured the commercial and consumer sectors by storm particularly in the past 18 months or so. For its part the military has long been interested in perfecting ways to move data captured from a multitude of sensors and collecting it on a virtualized network where it can be used from any remote location. But while the military calls that “Net-Centric” operations, it really overlaps quite directly to what an Internet of Things (IoT) implementation is. The term IoT itself may perhaps be a sticking point for the military.

At the Unmanned Systems show I had chance to sit down with my friend Chip Downing, Wind River’s senior aerospace and defense spokesman, to talk about how the military can adopt IoT and Cloud technologies. Is it truly possible to implement a military IoT system with network-enabled capability? One challenge is that right now each military force has its own infrastructure, both for connectivity and for the back office systems. But transitioning to a combat cloud infrastructure would offer huge operational advantages, with greater ability to export both data and assets in the field for joint operations. Once implemented, a “combat cloud” would allow information and control to move farther forward when appropriate, providing the operational flexibility to deal with a near peer targeting the national data systems.

There are other challenges. The sheer complexity and high cost of defense systems means these systems must remain in service for many years. Those long system lifespans creates operational challenges for enhancing their capability and attaching them to the combat cloud. For instance how do you share data between a stealth unmanned vehicle and a legacy F-16 aircraft, or between the unmanned vehicle and ground forces? The solution lies in making use of multi-core silicon and virtualization. The idea is that the performance and separation risks can be mitigated in silicon. By separating legacy and new environments on separate cores and networks its possible to allow diverse systems to connect without slowing one another down. Operating systems that enable such virtualization to happen seamlessly are a key part of that recipe.

At the end of the day, the defense industry may have to get over any reluctance to rubbing shoulders with concepts like IoT. Our industry can be satisfied in the knowledge that concepts like “Net-Centric Warfare” and “Net-Centric Operations” began more than a decade ago. But that doesn’t mean we can’t leverage the best of commercial and consumer technologies like advanced multi-core processing and Cloud-based visualization. And for those of us who have lived and breathed the COTS movement, that’s not such a foreign notion. Looking toward the next year of technology trends, I know that one place my head will be is in the Cloud.
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Lockheed Martin Tapped by Air Force for C-130 Training Solutions

Lockheed Martin has received contract awards from the U.S. Air Force valued at more than $80 million. Contracts include the delivery of the following training solutions: a C-130J Air Mobility Command (AMC) weapon systems trainer and C-130J AMC loadmaster part task trainer at Yokota Air Base in Yokota, Japan; a KC-130J weapons systems trainer, spares, support equipment and technical data; C-130 aircrew training system operations and maintenance services; and C-130J Training System Support Center services (Figure 1).

Under the C-130J Maintenance and Aircrew Training System (MATS) II contract, Lockheed Martin is delivering a number of aircrew and maintainer devices to support ground-based training, including high fidelity weapons systems trainers, part-task trainers and training aids. The company trained more than 15,000 students and delivered 17 major training devices, 12 training aids and more than 3300 aircrew courseware lessons under the legacy C-130J MATS program.

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TTTech to Provide ARINC 664 Technology for U.K. AW101 Merlin Helicopters

TTTech has been awarded a sub-contract by General Dynamics UK to provide ARINC 664 p7 end system cards for the Tactical Processor mission system equipment that will be installed onboard AgustaWestland’s AW101 Merlin Mk4/4a helicopters. The rugged end system cards increase the flexibility and functionality of General Dynamics UK’s mission system through the support of three traffic classes (Standard Ethernet, ARINC 664 p7 and Time-Triggered Ethernet SAE A56802), with three channels at 10/100/1000 Mbit/s. The end systems are available in various form factors (PMC, XMC, PCI, PCIe, CPCI). TTTech’s AFDX and TTEthernet end system cards and switches for safety-, mission- and time-critical systems support deterministic real-time data communication with defined Quality of Service (QoS) as well as bounded latency and jitter.

TTTech’s end system cards will be used in General Dynamics UK’s mission system equipment, which includes the Tactical Processor system and a secure data recorder to provide increased performance and capability onboard the helicopters. This sub-contract is awarded as part of the Merlin Life Sustainment Programme (MLSP), which was awarded to AgustaWestland by the UK Ministry of Defence in January 2014 to convert 25 AW101 Merlin helicopters for maritime operations.

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Mercury Systems Awarded Navy Contract for Advanced RF Tuners

Mercury Systems has announced that it has been awarded a $7.1 million indefinite quantity/ indefinite delivery (IDIQ) contract by the U.S. Naval Warfare Center, Crane Division (NSWC) to supply advanced radio frequency (RF) tuners, digital receivers and related equipment to be used as spares.
**INSIDE TRACK**

**TECHNOLOGY SPOTLIGHT**

Intel’s Xeon-D Processor will Ignite New HPEC Possibilities for Military Systems

Intel’s Xeon processor D product family, the company’s first Intel Xeon processor-based system-on-chip (SoC) is expected to bring server class processing even closer to the demanding HPEC needs of military embedded systems. Announced in March by Intel, over the past couple months a slew of embedded board vendors have announced or hinted at board-level solutions based on the Xeon-D. Built on Intel’s industry-leading 14nm process technology, the Intel Xeon processor D product family combines the performance and advanced intelligence of Intel Xeon processors with the size and power savings of an SoC.

The Intel Xeon processor D product family is the first Intel Xeon SoC, and Intel’s third generation of 64-bit SoC for microserver, storage, network and the Internet of Things (IoT). Products deliver up to 3.4x faster performance per node1 and up to 1.7x better performance per watt when compared to the Intel Atom processor C2750, part of Intel’s second-generation 64-bit SoC product family. Intel launched 4- and 8-core microserver optimized SoCs in March, with a more comprehensive portfolio of network, storage and IoT SoCs targeted for availability in the second half of this year.

The Xeon-D combines industry standard x86 cores with two ports of integrated 10 GbE Intel Ethernet and integrated I/Os (PCIe, USB, SATA and other general purpose I/Os) on a single package. It operates at a thermal design point near 20 watts and supports up to 128 Gbytes of addressable memory. It provides support or error-correcting code memory, combined with enhanced hardware-based Intel Virtualization Technology and Intel Advanced Encryption Standard-New Instructions (AES-NI).

**Navy Successfully Tests Two Surveillance Technologies Aboard Stiletto Ship**

The U.S. Navy has successfully tested Raytheon’s advanced intelligence, surveillance and reconnaissance (ISR) technologies aboard the experimental ship known as the M80 Stiletto, while the vessel was underway (Figure 3). The test took place during operations at Joint Expeditionary Base Little Creek-Fort Story, Virginia. The combined technology was created by combining two, proven Raytheon technologies: the Persistent Surveillance System Cross Domain Solution (PSS CDS) and Intersect Sentry. The successful test was conducted as part of the Stiletto Maritime Technology Demonstration Program.

PSS CDS receives critical data from multiple sensors and offers two-way sharing of information and commands across both classified and unclassified domains. Intersect Sentry is an automation and analysis tool that creates alerts from a variety of intelligence, sensor and reconnaissance data streams according to parameters defined by the user. During the Navy demonstration, Intersect Sentry automatically analyzed data streams and sent alerts to the PSS CDS for simultaneous display across various networks, creating a common operating picture for different users operating at multiple classification levels.

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**Figure 3**

The Navy successfully tested Raytheon’s advanced intelligence, surveillance and reconnaissance (ISR) technologies aboard the experimental ship known as the M80 Stiletto, while the vessel was underway.

**Figure 4**

The Xeon-D SoCs deliver up to 3.4x faster performance per node and up to 1.7x better performance per watt when compared to the Intel Atom processor C2750.
SPECIAL FEATURE

C4ISR Technologies for Military Vehicles
Today’s military views C4ISR as a capability that pervades all corners of the force, and that includes military vehicles. Onboard communications and control electronics are expected to multiply in sophistication for Current Force fighting vehicles. With budgets that shy away from new vehicle program starts, the focus is on tech upgrades of existing vehicles as the dominant activity in this space. The trend is definitely toward packing more and more electronics, networking and embedded computing onto military vehicles. And while traditional slot-card technologies still rule for tech refresh situations, more and more box-level systems are becoming the solution of choice. Meanwhile, open-standards like VICTORY are making it easier to de-couple C4ISR, communications and other mission types of functions from the basic control and power electronics of military vehicles.

In general DoD Budget plans for the upcoming fiscal year call for modernizing ground platforms and ongoing technology research and concept exploration that will benefit future Army and Marine Corps combat portfolios. The U.S. Army continues to modernize and upgrade select platforms including Stryker vehicles, Abrams Tanks, Bradley Fighting Vehicles, and Paladin 155mm Howitzers. And together the Army and Marines are planning to procure more of Joint Light Tactical Vehicles (JLTVs).

Networking Dominants
Vehicle-Based C4ISR Advances

With an emphasis on upgrading existing vehicle platforms instead of creating new ones, the military has made network technology a priority on vehicles. Standards like VICTORY and programs like WIN-T are making use of rugged computing solutions.

Jeff Child, Editor-in-Chief
Tech Upgrades Continue

For its part, the M1A2 Abrams remains the Army’s main battle tank with a series of upgrades over the years have included the System Enhancement Package (SEP) and the Tank Urban Survival Kit (TUSK) (Figure 1). Upcoming plans involving procuring numerous approved modifications to fielded M1A2 Abrams tanks, including the Ammunition Data Link (ADL) to enable firing of the Army’s new smart 120mm ammunition, and the Low Profile Commander’s Remote Operating Weapon Station (CROWS).

Outside the U.S. DoD, an interesting vehicle program in terms of technology is the British Army’s SCOUT Specialist Vehicle (SV). Earlier this year GE’s Intelligent Platforms announced that it received orders from General Dynamics UK valued at around $100 million to provide embedded computing subsystems that will be deployed onboard the SCOUT. The scalable, open architecture subsystems—which include Ethernet switches, gateway processors, data servers and video servers—will allow SCOUT SV platforms to be easily upgraded during their lifetime as new requirements and technologies emerge. In the system Ethernet switch connects all the networked elements of the vehicle together; the gateway processor provides all the processing capability for the software to run the platform; and the data and video servers allow the vehicle to store and distribute vehicle and scenario data and video around the platform and on into the wider connected battlefield.

VICTORY for Vehicle Networking

Among the major technology issues facing vehicle electronics in recent years has been the mish mash of system architectures and redundant functionality of interconnects aboard vehicles. That’s what gave birth a couple years ago to the VICTORY standard. The Vehicle Integration for C4ISR/EW Interoperability (VICTORY) initiative has as its main goal the reduction of SWAP-C on ground vehicles. VICTORY defines an approach for commonality through Gigabit Ethernet networking, standard connectors and well-defined electrical interfaces.

Today, the spec continues to evolve and now VICTORY is even a requirement on a number of acquisition programs. The initiative provides a framework for integrating electronic mission equipment including C4ISR and Electronic Warfare (EW) systems on ground platforms. The framework includes an architecture, a standard specification and reference designs. The architecture includes definitions of common terminology, systems, components and interfaces. The specification provides technical specifications for the systems, components and interfaces identified in the architecture.

Supporting the VICTORY initiative, a number of vendors have made compliance to the standard a part of recent product developers over the past 2 years. Among the more recent examples, Extreme Engineering included optional VICTORY Infrastructure Switch and Router support on its XChange3018 board, a 3U, conduction- or air-cooled, VPX 10 Gigabit Ethernet switch module. It provides four 10 Gbit Ethernet 10GBase-T or XAUI ports, six backplane 10/100/1000BASE-T Ethernet ports, and six backplane network 1000BASE-X Ethernet ports. Another example is North Atlantic Industries’ 64ARM1, a 6U VME ARM Cortex-A9-based, SBC that can be configured with up to six intelligent function modules and provides VICTORY interface services. VICTORY-compliant applications were also the focus of Themis Computer’s VITA 74 offerings including its SFF Rugged Gigabit Ethernet Switch and an i7 version of its SFF NanoPAK.

System-Level VICTORY Solution

Among the earliest with a VICTORY system solution was Curtiss-Wright with the introduction in September 2012 of its Digital Beachhead 16-port Gigabit Ethernet (GigE) Network Switch and high performance, power efficient Vehicle Management Computer. Digital Beachhead provides a Ground Vehicle “appliance” for modernizing ground vehicles to comply with the VICTORY standard. According to Curtiss Wright Digital Beachhead has generated significant interest in the Ground Vehicle community with multiple units acquired by and shipped to U.S. Army VICTORY test centers for evaluation.
Curtiss Wright’s most recent VICTORY-compatible product was introduced earlier this year—a single-slot module solution for integrating the essential networking elements needed to implement the VICTORY standard on legacy and future ground vehicles. The VPX3-671 VICTORY Ethernet Switch and SBC is a rugged 3U VPX module. It features a core subset of the advanced network switch and computing resources of the Digital Beachhead subsystem. The VPX3-671 provides a fully-featured 12-port managed Gigabit Ethernet (GbE) switch that is tested to be compliant with the VICTORY specification as an Infrastructure Switch. The boards 1.2 GHz Freescale Power Architecture QorIQ Dual-core P2020-based general purpose SBC is optional and is installed as a mezzanine daughtercard.

WIN-T Embraces Box-Level Computing

Development work continues on the Warfighter Information Network-Tactical (WIN-T), the Army’s high speed, high capability backbone communications network, linking Warfighters in the battlefield with the Global Information Grid. The network is intended to provide command, control, communications, computers, intelligence, surveillance and reconnaissance. The system is developed as a network for reliable, secure, and seamless video, data, imagery, and voice services for the Warfighters in theater to enable decisive combat actions.

The WIN-T program development consists of four increments. Increment 1 (Inc 1) provides “networking at the halt” by upgrading the Joint Network Node (JNN) satellite capability to access the Wideband Global Satellite (WGS). Increment 2 (Inc 2) provides networking on-the-move to the company level. The WIN-T Inc 2 introduces a mobile, ad-hoc, self configuring, self-healing network using satellite on-the-move capabilities, robust network management, and high-bandwidth radio systems to keep mobile forces. Increment 3 (Inc 3) provides Integrated Network Operations development. Increment 4 (Inc 4) provides protected satellite communications on-the-move.

Cost, Space and Heat Challenges

WIN-T is a program where rugged box-level embedded computing has caught on fast. The sheer level of compute density that WIN-T systems require would be hard to cool using slot card approaches like VME or VPX. With that in mind, the Army’s WIN-T program reportedly has leveraged General Micro Systems as exclusive supplier of multi-domain boxes in all six of the program’s ground vehicles. Four box systems per vehicle are supplied from GMS according to the company. Space, cost and particular heat dissipation were among the reasons why box-level systems were chosen over VPX or rackmount style approaches.

The next DoD fiscal year budget request funds the upgrade of 31 WIN-T Inc 1 units to enhance interoperability with units fielded with WIN-T Inc 2 (Figure 3). It also supports procurement of 248 communications nodes (39 Tactical Communications Nodes, 167 Soldier Network Extensions, and 42 Points of Presence) for WIN-T Inc 2, and continues fielding and support for previously procured Low Rate Initial Production equipment. Funding is provided for Network Operations software (Build 4 & 5) and waveform development as part of WIN-T Inc 3. And finally, the request supports integration of 179 Modification kits for the AN/TRC-190 line-of-sight radio systems. The plan procures and fields Tactical NetOps Management Systems to 89 non-WIN-T units and 283 Battlefield Video-Teleconferencing Center III systems.

**Figure 3**
The next DoD fiscal year budget request funds the upgrade of 31 WIN-T Inc 1 units to enhance interoperability with units fielded with WIN-T Inc 2.
Applications such as radar, SIGINT, situational awareness, and sonar applications have specialized requirements for signal processing. The advancements of digitizers, FPGAs, processors, and GPGPUs across the signal processing chain have changed the dynamic for these applications. This transition in performance density puts serious pressure on SWaP-C requirements.

First, let’s take a look at the signal processing chain (Figure 1). In an application like radar signal processing, the antenna/RF interface goes to an A/D converter where there is a huge funnel of data that needs to be converted quickly. This mass amount of raw data typically goes to an FPGA which specializes in handling relatively simple operations on a lot of data. With that in mind, the ability to handle high bandwidth is critical at the front end of the chain. As you move along the signal chain, the data processing requirement decreases. While this is happening, the amount of information that needs to be processed with more complexity increases. This means that the beginning of the chain has high data processing which decreases across the chain while information content (and processing) starts small and increases.

The Start of the Chain

In the early phase of the signal chain high-end A/D converters are required along with powerful FPGA for processing. Today, these can be combined in a single, compact module. Figure 2a shows an AMC-based dual 4.0 Gsamples/s at 12-bit ADC with a Xilinx Virtex-7 FPGA. Even with an upper-mid level Virtex-7 FPGA chipset, it can provide 693K logic cells and 3600 DSP slices. Another option is to have the digitizer on the FMC per VITA 57 and the FPGA on the AMC FPGA Carrier. Figure 2b shows an example of this configuration.

Note that these modules are smaller than the typical Eurocard boards. The advances in digitizer and FPGA silicon, along with intelligent design techniques, allow high performance in these smaller, open-standard architecture modules. AMC modules are approx. 73.5 mm tall by 180 mm deep versus 3U Eurocard which is 133.35 mm x 160 mm deep—the pitch is typically the same. The end result is a large improvement in SWaP-C, often allowing more functionality within the processing chain—for instance storage, to be implemented in the same embedded computer instead of separate systems.

Kintex-7 FPGAs are also a popular version for solid performance at a lower price point. A common choice provides 406K logic cells and 1540 DSP slices, with low power consumption. The SoC approach of
ARM FPGAs like the Zynq-7000 is popular because of the efficiency of the chipset and ease in programmability as well as very low power consumption. Moving past the FPGA in the signal chain, the data funnel starts to narrow and the information funnel will start to expand.

GPPs and GPGPUs

In the middle part of the signal chain are the GPPs and GPGPUs that take the algorithms from the FPGA and do the complex processing for information extraction and do the heavy number crunching even within the system. Freescale and Intel processors are typically utilized here. With powerful processors that feature low power consumption, for example the Intel Haswell (like the Xeon E5-2680 v3) that provides up to 12 cores at 2.5 GHz (Turbo Frequency) at only 75W, you can provide a lot of processing even in conduction-cooled systems. With x4 or x8 PCIe Gen3 to the backplane, the signals can travel at 16 Gbps throughout the chassis. Or, the processor modules can have 40G or 10G Ethernet to the backplane.

The GPGPU is excellent in multi-sensor applications, preparing large amounts of graphical information for output in networked displays. It is an excellent matrix processing engine. Today’s commercial GPGPUs are tough to beat, often used in gaming. In the embedded market, by the time you develop a graphics board, there will usually be a new generation of GPU coming out. One solution to this issue is to utilize a PCIe Gen3 carrier. Any standard commercial PCIe cards can be plugged in, and you can upgrade regularly as needed with minimal hardware investment.

To allow the space for a PCIe card, an AMC card would need to be the “double module” size, which is approximately 150mm tall. You can have such a carrier route x4 or x8 PCIe Gen3 to the backplane. There are various PCIe Gen3 chassis platforms in the market to support these signals. Alternatively, if you are using the AMC form factor, there are also “single module” AMCs with powerful chipsets directly on the board. One example of such a module can provide 2560x1600 at 60 Hz resolution, 24 bpp for each of the 6 independent ports along with 1 Gbyte of GDDR5 memory in the compact module.

The End of the Chain

On the back end of the signal chain, a device for post-processing can prepare the information for multiple outputs. This may be a typical 2 to 4 core Freescale or Intel processor for simpler requirements. For large swaths of information with multiple outputs, a more powerful processor for functions such as intelligent networking, multimedia, video transcoding, etc, may be needed. Figure 3 shows a Tilera processor with seventy two 64-bit RISC cores. Its wire-
speed packet processing engine can deliver 240 million packets per second I/O. Also at the end of the chain are typically optional storage and networking boards.

Today, in one AMC you can have a 2 Terabyte solid state disk (SSD) with 12 Gbit/s transmission speeds across the backplane along with RAID striping, mirroring, and other RAID options. JBOD carriers in the AMC format can be utilized as well. These can hold up to 8 mSATA disks at 1 Terabyte each for a total of 8 Terabytes of storage in one AMC. In a modular open-standard backplane approach, the storage carriers can easily be swapped out for external analysis.

**Implementation Stage**

Naturally, there needs to be an infrastructure to support the modules in the signal processing chain. Not only do the small AMCs provide a more compact solution for SWAP-C, but so does creative design for the enclosures. Figure 4 shows a 1U rugged MicroTCA chassis designed to meet MIL-STD-810 and 901D for shock and vibration and MIL-STD-461 for EMI. By integrating the shelf manager, GPS/SyncE/IEEE 1588 for precision timing and time-stamping, PCIe Gen3 Switch and Base Channel Switches into one inside the chassis, there is space for 6 AMCs in a front-to-rear cooled configuration.

Putting together some of the modules discussed earlier, you can have 2 Virtex-7 FPGAs with dual 4.0 Gsamples/s ADC, 1 Virtex-7 FPGA with a dual 5.7 Gsamples/s DAC, a Core -7 or Xeon E5 v3 Intel Haswell processor, an 8 Terabyte storage JBOD module, and x8 PCIe Gen 3 RAID Host Bus Adapter for transmitting the storage data to an external network or device at 16 GB/s, all in a 1U rugged solution. This provides tremendous performance density for rackmount airborne, ground vehicle, or naval applications. Various chassis configurations in rugged or commercial versions can also be utilized per an application’s requirements. This includes ATRs, cube-shaped, vertical-mount, and horizontal-mount chassis platforms.

Cooling is an important issue in high-performance computing solutions. With a distributed computing approach across a high-speed, managed backplane, you can spread your hotter processors across the enclosure as opposed to single modules. This lightens the load on the power and cooling required per slot. Additionally, with lower power consumption chipsets, conduction-cooled systems can be utilized even for these high-performance modules. The MicroTCA specification allows standard MTCA.0 modules to be encased in clamshells and an ATR per MicroTCA.3 A half ATR can hold 6 AMC slots along with a power module slot and an MCH.

**Many Paths to Success**

There is not a single processing technology that is suited to handle the complete signal chain. GPPs, FPGAs and GPGPUs each have their own merits. A modular, open-standard architecture gives a design engineer the ability to mix-and-match modules according to their requirements.

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Airborne C4ISR Connectivity a Function of Platform and Mission

The design challenges of airborne C4ISR center around a balancing act. Increasing bandwidths, decreasing SWaP and achieving ruggedness together make for difficult connectivity problems to overcome.

Gregory Powers, Business Development Manager Aerospace, Defense and Marine, TE Connectivity

Although information has always been vital in military operations, today’s sophisticated electronic information gathering and processing gives unprecedented tactical and strategic insights at every level from global command to the individual warfighter. In uncertain times, security requires the enhanced ability to monitor events and respond appropriately and efficiently.

Airborne resources are critical to command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) activities to perform such functions as communications relays, signals intelligence, imaging, radar, and persistent surveillance. The C4ISR gear deployed in airborne applications is capable of complex signals processing—whether real-time surveillance imaging or radar tracking of multiple objects. Airborne C4ISR equipment is on the leading edge of sophistication and capabilities. While some low-end drones used in tactical situations are considered expendable, most airborne platforms are nonexpendable. Investments made in C4ISR equipment for these nonexpendable platforms are key to achieving long-term reliability and mission effectiveness.

SWaP and Bandwidth

Airborne C4ISR platforms cover a wide range, from large P-8 Poseidon manned aircraft and BQ-4 Global Hawk UAVs to small UAVs like the compact 40-pound, pneumatically launched Scan Eagle. The size and mission of the platform impact the scope of the C4ISR payload and the designer’s choice in connectivity.

Manned aircraft have long patrolled the sky exercising a variety of sensors to exploit the electromagnetic spectrum. These platforms typically have all of the tools on board to gather and process information, allowing the flight crew to assess the results and potentially make mission-specific decisions. They typically would have proportional payloads and use a diverse collection of connectivity solutions, ranging from ARINC LRU connectors to fiber optic box-to-box harnesses. While powerfully equipped, manned platforms can be somewhat limited by the...
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- Power 4000W / 28Vdc
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- 1U rack mount (17” x 19.6”)
- Low weight — 25 lbs.
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human crew in terms of overall platform costs and flight time.

One of the biggest changes in airborne C4ISR is the emergence of UAVs (Figure 1). One requirement of UAVs is persistence—the ability to potentially loiter on station for tens of hours to perform surveillance and strike missions. Size, weight, and power (SWaP) are critical issues that affect component selection and platform’s payload and flight time. This evolved concept in system design has implications for the entire connectivity chain, inside the box and box-to-box.

As the sophistication and capabilities of C4ISR continue to evolve, engineers are paying greater attention to end-to-end connectivity to avoid performance bottlenecks and less than optimal SWaP. At the same time, the signal processing load is steadily increasing to keep pace with advanced imaging, targeting, and controls. These two factors – SWaP and high-performance computing needs – are leading designers to create systems with both higher bandwidth and lighter, smaller form factors.

Deluge of Input Sources

In their surveillance role, UAVs may carry multiple cameras and sensors to deal with a variety of frequencies, from visible light to infrared and thermal. In addition to the spectral challenges, an important issue is creating cameras that overcome low resolution and narrow fields of view. One solution is to use multiple cameras operating at multiple angles that can be stitched together into a single image.

The ARGUS imaging system, for example, can spot a six-inch object within a 39-square-mile radius from 20,000 feet in the air. The ARGUS system uses 368 five-megapixel cameras and can capture, process, and download one million terabytes a day. Combining images from multiple cameras and other signal processing needs require fast embedded computers and sophisticated software. Because of the enormous amount of data generated by the sensors, an additional system challenge is separating the wheat from the chaff via onboard processing so that only critical data is transmitted to satellites or ground stations. Even if the ARGUS system can process one million terabytes a day, the larger ISR infrastructure can’t handle such loads, even with hefty data compression.

Naturally, smaller, tactical UAVs with only one or two cameras do not require the same level of on-board processing; they can stream encrypted real-time images to the ground station for processing and analysis. While real-time encryption consumes some processing power, the load is comparatively light.

More Bandwidth

All of this processing load means more bandwidth, not only inside the box but in box-to-box interconnections. One goal in system design is to create a transparent infrastructure giving integrators the ability to achieve a location-independent architecture. Location independence allows subsystems to be placed at optimal locations throughout the UAV, perform local processing, and effectively use the entire UAV as a sensor platform.

Open architectures remain an important factor given their advantages of easier reconfiguration, ability to be upgraded, and the larger base of suppliers. Similarly, both in the overall network and in local data busses, industry-standard high-speed protocols, such as Ethernet, FireWire, or Fibre Channel, provide transparent physical layers for data transport.

SWaP, Speed, and Ruggedness

The most basic requirement of an airborne interconnection is a rugged reliability. Such expectations are met by a wide assortment of mil-spec and non-spec cables and connectors. MIL-DTL-38999 connectors, for example, offer a well-established form factor, feature a coupling mechanism that withstands vibration and shock, and are available in different materials and finishes to meet a range of environmental conditions. While MIL-DTL-38999 connectors are well defined, there is also a robust range of connectors using the same form factor but offering enhanced capabilities.

Such connectors offer higher contact densities, power and optical contacts, or alternative insert arrangements and materials. These connectivity solutions have been driven by the industry. In many instances, they are ruggedized COTS and have evolved faster than military specifications to meet changing needs. By adapting the tried and true in new and novel ways, connectors offer designers new capabilities with low risk. The CeeLok FAS-X connector from TE Connect (Figure 2), for example, supports 10G Ethernet in a connector using a 38999 shell. It has four inserts, making it capable of 40G Ethernet in a single size 25 interface.

For high-speed embedded computing applications, VPX is setting the pace inside the box. VPX systems are readily found everywhere—from armored vehicles to aircraft, and soon in outer space. VPX offers a rich ecosystem of well-established technologies for data, optical, RF, and power connectivity in a well-defined open architecture (Figure 3). VPX supports serial switch fabrics demonstrated beyond 10 Gbits/s. The VITA 46 VPX connector, which is the lightest
Meet the new HEP8225 HDEC Series® system host board. This new SHB builds on the goodness of PICMG® 1.3 SHBs by tripling the available PCI Express 3.0 links and device I/O to a system backplane. This "in-the-box" PCIe link expansion results in faster processor-to-card system throughput with lower data latencies. The HEP8225 SHB:

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available, gives designers the desired combination of high-speed performance, flexible options, and light weight.

**More Always Acceptable**

The deployment of airborne resources for C4ISR is sky-rocketing. With the breadth of connectivity technology available, lightweight, high-capacity solutions abound. Inside the box, embedded systems are trending toward 10 Gbit/s backplanes and connectors. Box-to-box applications increasingly require high data throughput, where high-bandwidth copper or lightweight fiber optic solutions are ideal. Advanced materials like composites and carbon nanotube-based connectivity are now being widely used by packaging engineers. All these tools add up to more flexibility and effectiveness. While platform and mission ultimately drive system design, accelerating connectivity technology continues to increase airborne capability.

*TE Connectivity*
*Berwyn, PA*
*(610) 893-9800*
*www.te.com*

---

**Figure 3**

VPX offers a rich ecosystem support high-speed data, RF, and optical connectivity.

---

**AIM Office Contacts:**

- **AIM USA LLC** - Trevose, PA
  salesusa@aim-online.com

- **AIM GmbH** - Freiburg
  sales@aim-online.com

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- Two independent 16-bit DUC channels
- Programmable bandwidth: 10 kHz - 100 MHz
- Programmable tuner: 1 - 1000 MHz

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Although there's little doubt that standard open-architecture board form factors continue to dominate in military systems, non-standard form factors free designers from the size and cost overheads associated with including a standard bus or interconnect architecture. Portable military gear, unmanned ground vehicles, smart munitions and small UAVs are just some of the systems that rely on such technologies (Figure 1).

But in very small systems, often the size and space of the board takes precedence over the need for standards. Instead the priority is on cramming as much functionality and compute density onto a single board solution. And because they tend to be literally single board solutions there's often no need to be compatible with multiple companion I/O boards. These non-standard boards seem to be targeting very different applications areas—areas where slot-card backplane or PC/104 stacks wouldn't be practical.

The range of new small embedded boards introduced over the last 12 months is exemplified by the example products shown in the “Small Non-Standard Boards Roundup” on the next four pages. This year’s crop of boards is based on processors with the lowest of power consumption, including Intel Atom E3800 series processors, AMD Embedded G-Series SoCs and ARM Cortex-A8 CPUs.

The Roundup shows that non-standard boards come in a variety of shapes and sizes. Some follow de facto industry standard sizes like 3.5 inches, while others take a twist on existing standards—such as ATX or PC/104—to produce a “one off” implementation that takes some of the benefits of a standard form factor. There are also some company-specific “standard” form factors that offer an innovative new approach.

Not all of the products in this year’s Roundup are “non-standard”. Included are several from emerging small standard form factors that we don’t cover as separate Roundup categories. Among these standards is the SMARC (“Smart Mobility ARCHitecture”) form factor. Managed by the Standardization Group for Embedded Technologies (SGET) group, SMARC is a versatile small form factor computer module definition targeting applications that require low power, low costs, and high performance. The module power envelope is typically under 6W. Two module sizes are defined: 82mm x 50mm and 82mm x 80mm. The module PCBs have 314 edge fingers that mate with a low profile 314 pin 0.5mm pitch right angle connector (the connector is sometimes identified as a 321 pin connector, but 7 pins are lost to the key).

Another more established standard called Qseven recent moved under the auspices of SGET. The Qseven concept is an off-the-shelf, multi-vendor, Computer-On-Module that integrates all the core components of a common PC and is mounted onto an application specific carrier board. Qseven modules have a standardized form factor of 70 mm x 70 mm and have specified pinouts based on the high speed MXM system connector that has a standardized pin-out regardless of the vendor.

Serving military applications with the most extreme size, weight and power (SWaP) constraints, small non-standard boards are offering an impressive increase in functionality.

Jeff Child, Editor-in-Chief

**Figure 1**

Smart munitions like the Small Diameter Bomb IIs is an example application suited to small non-standard embedded computer boards. Shown here, an F-15E fighter aircraft can carry seven groups of four SDB-IIs, for a total of 28 weapons.
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Small Non-Standard Boards Roundup

PCI Express 3.5-Inch SBC Sports SoC E3800 Atom

The ADLE3800HD from ADL Embedded Solutions is based on Intel’s first System-on-Chip (SoC) E3800 Atom product family which was built using Intel’s 22nm 3D Tri-gate process. It combines Intel’s 7th generation graphics engine and improved power management capabilities resulting in standby power measured in milliwatts with days of standby time. The board is ideal for rugged, extended temperature embedded systems with a thermal junction temperature (Tj) ranging from –40 to +85 degrees C.

- Intel E3800 Series SoC Processors; DC/Quad.
- Up to 8 Gbytes of DDR3L-1333; 1.35V SoDIMM204 Socket.
- Power dissipation 8W to 10W.
- 2x SATA links, 3x 10/100/1000 Mbit Ethernet LANs, 2x RJ45, 1x Pin Connector.
- 8x USB 2.0 Total: 4x USB Connectors.
- 1x PCIxe x1 lane via 2x40pin Connector.
- 4.0- x 5.8-inch, 3.5-inch SBC Format.

SMARC Module Boasts Intel Atom Processor E3800 Series System-on-Chip

Adlink Technology offers its SMARC form factor computer-on-module, the LEC-BTS, running a single, dual, or quad core Intel Atom processor E3800 series system-on-chip from 1.46 to 1.91 GHz. The ADLINK LEC-BTS is a building block for the Intel IoT Platform framework with Wind River and McAfee software integration. Paired with ADLINK’s device-to-cloud platform SEMA Cloud that enables remote monitoring control and management, the LEC-BTS is ideal for developing IoT devices with a secure connection to the cloud.

- Single, dual or quad-core Intel Atom Processor E3800 Series System-on-Chip.
- Up to 4 Gbytes of DDR3L at 1066/1333 MHz (non-ECC).
- HDMI and LVDS
- Gbit Ethernet, camera interface.
- 1x SATA 3 Gbits/s, 1x USB 3.0, 3x USB 2.0, max. 12x GPIO.
- Extreme rugged operating temperature of –40 to +85 degrees C.

Core i7 Mini-ITX Board Features PCI-E x16 Slot

The AMBIH61T3 from Acrosser Technology is an industrial Mini-ITX motherboard powered by an Intel H61 chipset supporting 3rd/2nd Generation Intel Core i7/i5/i3 processors. Built with eight USB ports/headers and ten serial ports/headers, the card is equipped with a PCI-E x16 slot. The cost-effective Mini-ITX platform AMBIH61T3 makes mini-computing more usable.

- Intel LGA1155 Socket supports Intel Pentium/ 2nd Core i3 / 3rd Generation Core i3/5/7 CPU.
- With Cooler Module (W90 x L90 x H50 mm).
- Two DIMM slots support DDR3 1333/1066 SDRAM up to 1Gb bytes.
- 2 x VGA, 2 x GbE, 10 x COM, 8 x USB2.0.
- 1 x PCI-E x16, 1 x Mini PCIe.

Acrosser USA
Cypress, CA
(714) 903-1760
www.acrosser.com

PCI Express 3.5-Inch SBC Sports SoC E3800 Atom

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- Intel E3800 Series SoC Processors; DC/Quad.
- Up to 8 Gbytes of DDR3L-1333; 1.35V SoDIMM204 Socket.
- Power dissipation 8W to 10W.
- 2x SATA links, 3x 10/100/1000 Mbit Ethernet LANs, 2x RJ45, 1x Pin Connector.
- 8x USB 2.0 Total: 4x USB Connectors.
- 1x PCIxe x1 lane via 2x40pin Connector.
- 4.0- x 5.8-inch, 3.5-inch SBC Format.

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

COTS Journal | May 2015
Rich Mix of I/O Provided on Fanless Atom 3.5-Inch SBC

The MIO-5271 Compact 3.5-inch SBC is part of a series of boards from Advantech are specially developed for the 9 to 40 Watts chipset platform segment. From the PCB, material selection and power design, this particular 3.5-inch SBC line was created to support wide-temperature designs. With built-in iManager on chip it also supports boot-up in critical conditions, and an automatic system recovery device during voltage dips.

- Intel Celeron J1900 and Atom E3825.
- DDR3L-1066/1333MHz SODIMM up to 8 Gbytes.
- DirectX11, OpenGL3.2, OpenCL1.2, multi-display: VGA+LVDS/eDP+ HDMI/DP.
- 2 Intel i210 GbE ports, rich I/O: 4COM, SATA, USB 3.0, SMBus/I2C, GPIO full-size Mini PCIe with SIM holder, full-size mSATA or SD card.
- Supports iManager, SUSIAccess and Embedded Software APIs.

Advantech
Irvine, CA
(949) 789-7178
www.advantech.com

Qseven Module Provides Intel Atom E3805 for Headless Systems

The Conga-QA3/i-E3805-2G eMMC4 from Congatec is part of its Qseven product series and the first “headless” Computer-on-Module. Based on the new Intel Atom processor E3805 (1M Cache, 1.33 GHz, 3W TDP), the Congatec Qseven Headless module is a particularly cost effective and energy efficient solution for deeply embedded systems that require no graphics output. A space-saving single-chip processor and low power consumption make this an ideal solution for fanless designs in connected device applications.

- Qseven module with Intel Atom E3805 dual core processor without graphics.
- 1.33GHz, 1 Mbyte L2 cache, 2 Gbyte 1066MT/s DDR3L onboard single channel memory.
- 4 Gbyte eMMC onboard flash.
- Industrial grade temperature range from -40 to 85 degrees C.
- DDR3L-1066/1333MHz SODIMM up to 8 Gbytes.

Congatec
San Diego, CA
(858) 457-2600
www.congatec.com

COM-Based Core i7 SBCs Feature EMX I/O Expansion

The rugged Vega EMX Basic SBC family from Diamond Systems includes interchangeable COM Express COMs for scalability and long product life, high feature density in a compact size, integrated high-quality data acquisition, expandable I/O, conduction cooled thermal solution. Vega SBCs support stackable I/O expansion with EMX I/O modules as well as a dual use PCIe MiniCard/ mSATA socket for additional I/O expansion.

- Integrates 5 PC/104 modules in a single board using EMX Basic form factor.
- Up to 2.1GHz Intel Core i7 3612QE.
- Up to 16 Gbytes of 1.3MHz DDR3 memory via SO-DIMM.
- 2 Gbit Ethernet ports, 4 USB 2.0 ports; 4 RS-232/422/485 ports, 1 SATA port for hard drive.
- Dual channel LVDS LCD; VGA CRT display.
- Professional quality data acquisition circuit.
- -40 to +85 degrees C operating temperature.

Diamond Systems
Mountain View, CA
(800) 367-2104
www.diamondsystems.com
**SMARC SBC Supports Most of its I/O Like a Computer-on-Module**

Powered by the TI ARM Cortex-A8 AM335X high-performance processor, the SBC-SMART-MEN from Embedian is a sandwich-style SBC that supports 18-bit and 24-bit LVDS displays as well as two fast Ethernet ports with single 5V power input design and total power consumption is less than 2W. The SBC features a variety of I/O interfaces and expansion ports. The low-power fanless system also features built-in DDR3 512 Mbyte memory and 4 Gbyte flash capability. All are featured in 3-5 inch form factor.

- TI Sitara AM335X at 600 MHz, 800 MHz or 1 GHz.
- 512 Mbytes of DDR3 main memory.
- 4 Gbytes eMMC flash.
- 6 x RS232s, 3 x USB Host 2.0
- SDHC/SDIO
- 10/100Mbps Ethernet x 2, 18-bit and 24-bit LVDS, CANbus, I2C x 2, Stereo Audio, GPIO.
- Power typical 2W.

---

**SMARC Board Serves Up Intel Quark Processor**

Kontron’s latest ultra-low-power SMARC sXQU cards feature the Intel Quark X1000 series processor. Thanks to the Intel Quark 32-Bit-x86 system architecture, the Computer-on-Module is even smaller and more energy-saving than the predecessor version with an Atom processor. The SMARC-sXQU was developed specifically for applications in which lower energy consumption and smaller product dimensions take precedence over higher performance.

- SMARC - Smart Mobile Architecture with dimensions 82mm x 50mm.
- Intel Quark X1000, X1010 or X1021.
- Up to 1 Gbytes DDR3L memory.
- 2x 10/100 Mbit Ethernet, 2x PCIe x1, 1x USB 2.0 Client, 2x USB 2.0 Host, 1x RX/TX (Ser0), 1x UART (Ser1).
- Operates directly from single level Lithium Ion cells or fixed 3.3V or 5V power supplies.
- 0 to 60 degrees C operating temperature.

---

**Board Provides 1.2 GHz Freescale i.MX6 Processor and Camera Interface**

NanoRISC from MSC Technologies is a module concept combining the latest low power RISC controllers and embedded interfaces on a small form factor COM. The NanoRISC form factor has been created for applications requiring a small form factor and lowest power consumption. With NanoRISC, modules are plugged onto an application-specific baseboard.

- Freescale i.MX6 Cortex A9, 1/2/4 core(s) CPU clocked up to 1.2GHz.
- Up to 4 Gbytes of DDR3 SDRAM soldered.
- Up to 4 Gbytes of SLC NAND soldered or up to 64 Gbytes of eMMC Flash soldered.
- 10/100/1000 Base-T Ethernet interface.
- USB 2.0 Host; USB 2.0 OTG Host/Client High Speed.
- HDMI/DVI, LVDS, RGB up to 1080; Dual independent display support; Video decoder and scaler.
- CAN 2.0B, 3x UART, 2x SPI, 2x I²C, I²S Audio Interface.
- Camera Interface ITU656 / CSI.

---

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Taipei, Taiwan  
+ 886 2 2722 3291  
www.embedian.com

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

*MSC Technologies*  
San Bruno, CA  
(650) 616-4068  
www.mscembedded.com
ARM-Cortex-A8 Module Features Land Grid Array Form Factor

TQ-Systems’ TQMa335xL Minimodule is the TQMa335x variant without connector and is directly soldered with the baseboard. The basis for this is an ARM Cortex-A8 core with up to 1 GHz. The LGA module has been developed especially for the use in high volume projects. The module is best suited for visualization and control applications with real time demands. A large number of interfaces and module functions are implemented in the CPU due to the high level of interface and function integration.

- TI AM335x ARM Cortex-A8 module on LGA (Land Grid Array).
- Compact dimensions 38 x 38mm² and low installation height 5 mm.
- 2 x CAN 2.0 interfaces, 2x Gbit Ethernet, USB host/USB-OTG controller and up to 6 UARTs.
- Other functional units can be connected via SDIO, SPI, I2C and McASP.
- Up to eight 12 bit ADCs.
- 3D graphics support a resolution of up to WXGA (1366x768).
- Up to 512 Mbytes of DDR3L and up to 16 Gbytes of eMMC.

TQ-Systems
Seefeld, Germany
+49 8153 9308-0
www.tq-group.com

3.5-inch SBC Boasts AMD Series-G SoC, 4K Resolution and Graphics Flexibility

The MB-80910 from WIN Enterprises, is a 3.5-inch SBC featuring the AMD Embedded G-Series SoC (System on Chip) with integrated chipset and 4K display capability. The device provides flexibility in graphics implementation through its support of HDML, VGA, and LVDS. The AMD G-Series processors are designed to provide up to 60 percent better computing performance than the previous generation of the same AMD series. Configurable thermal design power is a feature that can limit power to just 5W at the processor level.

- 2nd Generation onboard AMD Embedded G-Series SoC.
- Up to DDR-1866, maximum 8GB storage.
- 4K resolution display via HDMI.
- HDMI/VGA and LVDS.
- SATA, 2 x Mini-PCIe sockets/
- 6 x USB, 4 x COM, 1 x Gbit Ethernet, HD audio.
- DC input from 8Vto 32V.

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

Quadcore Intel Atom E3800 SBC Provides -40° to +85°C Operation

The SBC35-CC405 series SBC from WinSystems features the latest generation Intel Atom E3800 family of processors in an industry standard 3.5-inch SBC format COM Express carrier. The Intel Atom E3800 family delivers numerous enhancements over previous-generation Intel Atom processors including improvements in computational performance, energy efficiency, power management, virtualization and security, while maintaining a low thermal design power range of 5W to 10W.

- Intel Quad-Core Processor (Bay Trail) Atom E3845 at 1.91 GHz.
- Intel Gen7 Graphics and HD Audio, Up to 2 independent displays, VGA, LVDS, and DisplayPort.
- Up to 8 Gbytes of DDR3L SDRAM.
- Two MiniPCIe, IO60 (SPI, I2C, PWM and UART), Four USB ports (1xUSB 3.0 and 3xUSB 2.0).
- Fanless -40 to +85 degrees C operational temperature.

WinSystems
Arlington, TX
(817) 274-7553
www.winsystems.com
Air-Cooled 6U VME Board Sports 4th Gen Core i5/i7 CPU

The XVME-6410 from Acromag is a high performance 6U VME SBC based on the 4th Generation Intel Core i7 or i5 processor and utilizes the Intel 8-Series PCH chipset for extensive I/O support. Intel 4th Generation processors deliver significant performance advancements such as enhanced microarchitecture, integrated graphics, and expanded memory performance with up to 16 Gbytes of high-bandwidth DDR3L memory and ECC memory controllers. Rugged design suits harsh environments.

- 4th Gen Intel quad Core i7 CPU for high performance (47W) or dual Core i5 CPU for low power (25W).
- Intel 8-Series QM87 PCH chipset.
- Up to 16 Gbytes of high-speed DDR3L memory.
- Front panel I/O includes dual USB 2.0 ports, VGA, dual Gbit Ethernet and RS-232 port.
- Backplane I/O includes dual Gbit Ethernet, dual SATA ports, dual USB ports, DVI-D, RS-232/422/485 and VGA.

Acromag

Phone: (248) 295-0310
Web: www.acromag.com

68G5 — 3U OpenVPX I/O & Comms Board

The rugged 68G5 is a 3U OpenVPX Multi-function I/O and Communication Board that can be configured with up to three intelligent function modules. Built on NAI’s Custom-On-Standard Architecture™ (COSA™), the 68G5 is ideally suited for rugged military, industrial, and commercial applications. The low-power/high-performance board delivers off-the-shelf solutions that accelerate deployment of SWaP-optimized systems.

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- Commercial and rugged models
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North Atlantic Industries, Inc.
Phone: (631) 567-1100
Web: www.naii.com

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COTS Journal | May 2015
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THE SWISS RUGGED COMPUTERS COMPANY HAS A NEW LOOK!

We design and manufacture rugged embedded computers engineered to meet the most demanding performance requirements with optimal Size, Weight and Power (SWaP) considerations.
Pentek has announced a new recorder for its family of Talon RF/IF signal recording and playback systems: the Model RTR 2726A rugged portable recorder, suitable for wideband signal recording and playback in signal intelligence and RF testing applications. The RTR 2726A implements a new packaging scheme that boasts a smaller, lighter chassis. Enhanced capability permits up to eight recording and playback channels configurable with the right combination for a specific mission or application. An optional DC power supply enables use in ground or airborne vehicles without inverters.

At the heart of the RTR 2726A are Pentek Cobalt Series Virtex-6 software radio boards featuring A/D and D/A converters, DDCs (Digital Downconverters), DUCs (Digital Upconverters) and complementary FPGA IP cores. This architecture allows the system engineer to take full advantage of the latest technology in a turnkey system. The RTR 2726A features a portable, lightweight housing measuring only 16.0- x 6.9- x 13.0-inches, weighing just less than 30 pounds. This extremely rugged workstation is reinforced with shock absorbing rubber corners and an impact-resistant protective glass for its high resolution 17 inch LCD monitor.

The hot-swappable Solid State Drive (SSD) array is available in 1.9- to 15.3-Terabyte configurations and supports RAID levels 0, 1, 5, or 6. The SSDs are meticulously qualified by Pentek for optimum use in rugged and portable applications. The hot swappable solid-state drives exhibit high immunity to shock and vibration for full operation in ground vehicles, ships and aircraft. The increased storage capacity doubles the possible recording time over previous models. Available I/O includes VGA video, six USB 2.0 ports, two USB 3.0 ports and dual Gigabit Ethernet connections. Customers can select the recording I/O performance that best matches their recording system requirements. The Talon RTR 2726A starts at $49,995.

Pentek, Upper Saddle River, NJ (201) 818-5900. www.pentek.com

Bidirectional DC-DC Converter is Designed for Energy Storage Systems

TDK has announced the introduction of the TDK-Lambda 2500W EZA2500-32048 bidirectional DC-DC converter. This power supply can automatically, and continuously, change conversion direction from “grid side” 320Vdc nominal to “battery side” 48Vdc nominal. The EZA2500’s output voltage and current can be programmed or monitored using the RS-485 communications port. Several converters can be paralleled to provide additional power by programming the units into droop-mode current share via the RS-485 interface. A variety of signals and alarms are also accessible including under or overvoltage alerts or remote on-off. The converters can operate at full power in ambient temperatures ranging from -10 to +40 degrees C.

TDK-Lambda Americas
San Diego, CA
(619) 628 2885
www.us.tdk-lambda.com/lp

DC-50 GHz Wideband Amplifier Provides up to +23dBm of Saturated Power

M/A-COM Technology Solutions has introduced the MAAM-011109-DIE, a wideband amplifier boasting an operating frequency range of DC-50 GHz. The MAAM-01109-DIE provides customers with 50 Ohms matching and typical return losses better than 15 dB. This user friendly amplifier is a high-performance, low noise solution for customers seeking a very wideband, fully matched amplifier solution. Features of the MAAM-01109-DIE include gate bias adjust to change current setting for power or temperature, gain trim control that allows 15 dB of gain control (0 to -1 V) and a temperature-compensated power detector that provides a DC voltage in relation to the output power.

MACOM
Lowell, MA
(978) 656-2500
www.macom.com
Diamond Systems has unveiled the Epsilon-24000 family of Gbit Ethernet switches. These rugged, managed Layer 2+ Ethernet switch modules offer up to 24 10/100/1000 Mbps copper twisted pair ports plus two small form factor pluggable (SFP) sockets in the compact PC/104 form factor measuring 4.5 x 3.8 inches (96 x 116 mm).

The new EPS-24000 family of switches operates standalone without any host computer interface. A microprocessor embedded directly into the switch manages all switch functions. The processor is accessed via an in-band web interface over one of the Ethernet ports or via an out-of-band command-line interface over an RS-232 serial port. The integrated web interface provides an intuitive GUI for configuring and managing all switch functionality. On-board memory holds dual application images, boot code, MAC addresses and other parameters, and can also be used for program execution. Epsilon-24000 comes with all the required firmware preconfigured, enabling immediate operation without any development effort.

Two models of the switch are available: The EPS-24016 (shown in photo above) includes 16 10/100/1000 copper ports, and the EPS-24026 (shown on photo 2) contains 24 10/100/1000 ports plus 2 SFP sockets. Both models use a conduction cooling heat spreader for efficient thermal dissipation and mounting to the system enclosure. A heat sink accessory is also available. Designed for use in rugged applications including industrial, on-vehicle and military environments, the Epsilon-24000 family operates over an extended temperature range of -40 degrees C to +85 degrees C. Single unit pricing starts at $880 for the 16-port model.
ATCA Blade and Switch Take Aim at Cloud Processing for Defense

Mercury Systems has announced next generation secure AdvancedTCA (ATCA) server-class compute modules. The first versions of Mercury’s secure ATCA processing building blocks include the Ensemble HDS8613 dual Intel Xeon server-class processor blade and the Ensemble SFM8104 40 Gb/s Ethernet/InfiniBand switch. The HDS8613 high density server (HDS) blade’s dual 12-core processors with Advanced Vector Extensions 2 (AVX2) and full Intel QuickPath Interconnect (QPI) are supported with up to 128 Gbytes of DDR4-2133 SDRAM to deliver a combined 1.38 Teraflops of general-purpose processing power. The blade supports multiple system integrity solutions and is equipped with an AMC mezzanine site for the broadest system integration versatility available.

The SFM8104 secure ATCA switch fabric module (SFM) supports either 40 Gbit/s Ethernet or InfiniBand and uses advanced signal routing techniques that enable switch fabric speeds unrestricted by bit error rates. Both the processor blade and switch fabric module are packaged in single-slot, 8U ATCA modules and share ruggedization and cooling enhancements inherited from their OpenVPX pedigree. Mercury’s secure ATCA Ensemble portfolio leverages the best commercial technology from the industrial base to support the U.S. Department of Defense’s Better Buying Power requirements for modular open system architectures, affordability and exportability.

Mercury Systems
Chelmsford, MA
(978) 967-1401
www.mrcy.com

Xeon-D-based OpenVPX Cards Combine Fast DDR4 Memory and PCIe Gen 3

Curtiss-Wright has announced that its Defense Solutions division has launched a new family of rugged DSP engine modules that is based on the Intel Xeon processor D (code-named “Broadwell-DE”) product family. The first members of the new CHAMP-XDx family, the 3U OpenVPX CHAMP-XD1 and 6U OpenVPX CHAMP-XD2, enable designers of High Performance Embedded Computing (HPEC) systems to take full advantage of the unmatched performance of today’s leading-edge Xeon processor D architecture. Xeon processor D is Intel’s first 3rd generation 64-bit SoC based on Xeon processor technology. These modules also feature XMC card expansion and a combination of 1 Gigabit and 10 Gigabit Ethernet (GbE) interfaces.

Both the CHAMP-XD1 and the CHAMP-XD2 will be available in a range of ruggedized configurations to deliver optimal performance in the harshest deployed environments, including air-cooled and conduction-cooled versions. In addition to its extremely fast DDR4 memory, and support for 1/10 GbE, the CHAMP-XD1 provides PCIe Gen 3 on the 3U Data Plane. The dual-processor CHAMP-XD2 brings the performance of two independent Xeon D processors to a single 6U chassis slot. It supports either 40 GbE or InfiniBand on the Data Plane in addition to its 1 GbE and 10 GbE interfaces.

Curtiss-Wright Defense Solutions, Ashburn, VA. (703) 779-7800. www.cwcdefense.com
BittWare has announced the availability of its first board based on Altera’s Arria 10 GT/GX FPGA—a low-profile PCIe board called the A10PL4. Integrating the 20nm process technology of the Arria 10 with a wide variety of features, the A10PL4 board supports a range of challenging applications such as network processing and security, compute and storage, instrumentation, and signals intelligence. The board offers flexible memory configurations supporting over 32 Gbytes of memory, sophisticated clocking and timing options, and two front-panel QSFP cages that support 100 Gbps (including 100 GigE) optical transceivers. A comprehensive Board Management Controller (BMC) with host software support for advanced system monitoring greatly simplifies platform management. The board will offer support for the Altera SDK for OpenCL.

Built on 20nm process technology, Arria 10 FPGAs boast higher densities, higher performance, and a more power-efficient FPGA fabric than previous generations; they also integrate a richer feature set of embedded peripherals, high-speed transceivers up to 28 Gbps, hard memory controllers, and protocol controllers. Arria 10 FPGAs are also the industry’s first FPGA to integrate hardened floating-point (IEEE 754-compliant) DSP blocks that deliver breakthrough floating-point performance of up to 1.5 Teraflops.

Other features of the A10PL4 include a PCIe x8 interface supporting Gen1, Gen2, or Gen3, USB 2.0 for programming, debug, or control and timestamping and synchronization support. Dual SMA is provided for reference clock/synchronization inputs. Also provided is a tunable high-accuracy TCXO and programmable clock synthesizer (Si5338). Complete software support is provided with Bittware’s BittWorks II Toolkit, an FPGA development kit for FPGA board support IP and integration.

BittWare
Concord, NH
(603) 226-0404
www.bittware.com

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AMC529

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- Xilinx Virtex-7 690T FPGA in FFG-1761 package
- Direct RF sampling clock via front panel

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Envision a new level of performance density!

North Atlantic Industries (NAI) has expanded its rugged systems product offering in 3U cPCI board form factors. Designed to support a multitude of mil-aero applications that require high-density I/O, communications, Ethernet switching and processing, NAI’s family of sensor interface units (SIU) use field-proven 3U cPCI or 6U VME boards with configurations ranging from one to five slots. By employing NAI’s scalable COSA architecture, customers can choose from more than 40 intelligent I/O, communication, and Ethernet switch functions, as well as SBC options. Select an enclosure and NAI will package it with the multi-function I/O and communication boards, intelligent function modules, SBC (if necessary), power supplies, and complete software libraries. This process allows new designs to be generated in days rather than months.

These systems are designed to operate reliably in rugged conditions and meet the following military standards: MIL-STD-810G, MIL-STD-461F, MIL-STD-1275 and MIL-STD-704A-F.

NAI’s configurable rugged systems product offering now consists of: NIU1A: a nano-sized unit with an integrated power supply and an intelligent I/O and communication function module; the SIU31 with 1 x 3U cPCI slots for installation of up to 3 intelligent I/O and communication function modules; the SIU33 with 3 x 3U cPCI slots for installation of up to 9 I/O and communication function modules; the SIU35 with 5 x 3U cPCI slots for installation of up to 15 I/O and communication function modules; and the SIU6 with 2 x 6U VME slots for installation of up to 12 I/O and communications function modules.

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

www.vadatech.com • info@vadatech.com • 702.896.3337
Why Should Researching SBCs Be More Difficult Than Car Shopping?

Today’s systems combine an array of very complex elements from multiple manufactures. To assist in these complex architectures, ISS has built a simple tool that will source products from an array of companies for a side by side comparison and provide purchase support.

INTELLIGENTSYSTEMSSSOURCE.COM is a purchasing tool for Design Engineers looking for custom and off-the-shelf SBCs and system modules.
Fanless Embedded System Boasts Quad Core Performance, Multiple I/Os

Advantech has announced the ARK-6322, a fanless, embedded, box PC with quad core processor, rich I/O ports, and flexible customization. It is powered by an Intel Celeron Quad Core J1900 2.0GHz SoC. The system supports full I/O ports including six serial ports, eight USB ports, dual LANs, one VGA, and one display port. The storage options include mSATA and a hard drive bay which is compatible with a 3.5 inch or 2.5 inch HDD. For the expansion capability, ARK-6322 provides two mini PCIe slots. It also reserves front panel space for iDoor modules, a series of mini PCIe cards with functional connectors such as isolated/non-isolated COM ports, CANBus, LAN, digital I/O and printer port in order to fulfill various custom requests.

Advantech, Irvine, CA. (949) 420-2500. www.advantech.com

Sound and Vibration Measurement System Offers 64-Channels

Data Translation has expanded its vibration module expertise to a standard 64-channel system. VIBbox is a fully complete portable system with 64 IEPE input channels, 8 stimulus D/A channels, 4 tachometer channels, and a plethora of digital I/O, counter/timer, and measure counter channels. Being a parallel measurement system, VIBbox features simultaneous measurement from all channels. IEPE inputs from sensors such as microphones, accelerometers, and other transducers that have a large dynamic range can be connected directly and executed at a very fast throughput of 105.4 kHz. Common applications include audio, acoustic, and vibration testing. VIBbox is available at $24,995.

Data Translation
Marlboro, MA
(800) 525-8528
www.datatranslation.com

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**6U MicroTCA Cube Chassis Features Ultra-Quiet Operation**

In markets that require high-speed data generation and acquisition, performance is key. To make it easier to get a direct connection to the analog-to-digital-converter (ADC)/digital-to-analog-converter (DAC) and analog front end (AFE), Texas Instruments (TI) is changing the game with the highly integrated KeyStone-based 66AK2L06 System-on-Chip (SoC) solution. The 66AK2L06 SoC integrates the JESD204B interface standard, reducing the overall board footprint by up to 66 percent.

The 66AK2L06 SoC integration of a Digital Front End (DFE)/Digital Down Converter-Up Converter (DDUC) and a JESD204B interface delivers a reduction in system cost and power. The integration of TI’s industry leading DSPs and ARM Cortex processors, delivers two times the performance of current competing solutions on the market today with software programmability. The four TMS320C66x DSP cores, each delivering up to 1.2 GHz of signal processing, allow customers flexibility in programming via floating point. In order to perform complex control code processing, dual ARM Cortex-A15 MPCore processors deliver up to 1.2 GHz of processing power and enable real-time direct access to I/Os with low latency. TI’s 66AK2L06 is currently sampling. Full volume availability will be available in Q3 2015.

Texas Instruments
Dallas, TX
(972) 995-2011
www.ti.com

**6U MicroTCA Cube Chassis Features Ultra-Quiet Operation**

Vadatech has released a new 6U MicroTCA embedded computing system platform with quiet fan trays designed to operate at under 55 dBA, suitable for office use. The VT898 is a 6-slot cube chassis that is 10.5 inches tall by 10 inches wide by 10.5 inches deep. The “Whisper” chassis features redundant cooling in a push/pull front-to-rear airflow configuration. The elegant design includes a spring-loaded handle that is flush to the top of the chassis when it’s not in use and glide strips for smooth PSU and fan tray extraction.

The 6U Cube chassis platform includes a 40GbE-capable backplane, a 1000W AC power supply, Telco Alarm, and a JTAG Switch Module. The backplane has routing for FCLK, and TCLK A-D. Vadatech offers MicroTCA and other form factor chassis platforms in various styles including Cubes, Vertical Shelves, Horizontal Shelves, and Rugged ATRs. The company also provides a wide range of FPGA modules, A/D and D/A converters, storage modules, graphics cards, and more.

Vadatech
Henderson, NV
(702) 896-3337
www.vadatech.com
Thermal Profiling Solution Helps Optimize Test and Burn-In Socket Choices

Aries Electronics has announced the introduction of its thermal profiling solution for its test and burn-in socket line of products. This solution incorporates advanced thermal profiling software to develop an application/IC specific thermal analysis for each customer’s requirements. This software will analyze all of the necessary parameters within the socket/IC/test environment and determine the correct heat sink/fan/cooling combination necessary to optimize the test and burn-in application. New thermal profiles are initiated using an online fill-in .pdf form linked from all of Aries’ test and burn-in socket pages.

Aries Electronics
Bristol, PA
(215) 781-9956

Voltage Controlled Oscillator Delivers 3,000 MHz Operation

Crystek’s CVCO55CC-3000-3000 VCO (Voltage Controlled Oscillator) operates at 3000 MHz with a control voltage range of 0.5V~4.5V. This VCO features a typical phase noise of -110 dBc/Hz at 10 KHz offset and has excellent linearity. Output power is +7.0 dBm typ. Engineered and manufactured in the USA, the model CVCO55CC-3000-3000 is packaged in the industry-standard 0.5-in. x 0.5-in. SMD package. Input voltage is 8.0V, with a typ. current consumption of 35 mA. Pulling and Pushing are minimized to 1.0 MHz and 0.2 MHz/V, respectively. Second harmonic suppression is -15 dBc typical.

Crystek
Ft. Myers, FL
(239) 561-3311
Crystal Group has introduced the RCS5515FW, Rugged 1U Firewall, designed for deployments in harsh environments. Protection of network assets begins with the ability to monitor users, applications, devices and threats to the network. Based on a Cisco ASA 5500-X firewall, the system delivers network visibility, threat and malware protection, and greater automation control to reduce cost and complexity. The RCS5515FW is ruggedized to meet extreme environmental standards. The firewall is engineered to MIL-STD-810 and MIL-STD-461, and is capable of having EMI, humidity, vibration and shock kits added. The unit is also compatible with Cisco firewalls.

Data Device Corp. has introduced its new Rugged Avionics Interface Computer. Ideal for both system upgrades and new systems, the system provides a flexible and scalable platform that supports a wide range of Ethernet, MIL-STD-1553, ARINC 429, ARINC 717, CANbus 2.0/ARINC 825, RS-232/422/485 and Avionics/Digital Discrete I/O data network communications. The system combines industry leading performance from Intel’s embedded computing architecture and the I/O flexibility of DDC’s High Density Multi-Protocol XMC module, to deliver unmatched avionics connectivity in a small form factor, deployable, rugged enclosure.

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COMING NEXT MONTH

Special Feature: 1553, Ethernet and Every Military I/O Tech in Between
Tried and true I/O schemes such as MIL-STD-1553 and ARINC 429 remain popular for pure control applications, but they’re bandwidth-limited by today’s standards. A slew of multipurpose communications protocols provide options to suit emerging needs, and Ethernet is a top contender among them. Articles in this section compare today’s crop of I/O schemes relevant to avionics and other military users.

Tech Recon Signal Chain: Video Processing Boards and Systems
Throughout 2015 our Tech Recon feature delivers a series of sections that follow a sequential path hitting all the key technologies that are part of a signal chain. The June Signal Chain section looks at how video processing technology has now moved front and center. This section explores the display, GPU, board and box system technologies that are all a part of the push toward building out a Net-Centric military.

System Development: Military Applications for AMC, MicroTCA and ATCA
MicroTCA and ATCA are seeing resurgence in military applications. Tied together by the well-established ecosystem of AMC modules, MicroTCA and ATCA offer cost-effective solutions for SWaP-constrained (MicroTCA) or performance-intensive (ATCA) military systems, particularly those with a comms or networking focus. Articles here look at the technology and product trends in these architectures.

Data Sheet: PC/104 and PC/104 Family Boards
PC/104 has become entrenched as a popular military form factor thanks to its compact size and inherent ruggedness. Sweetening the deal, a number of special enclosure techniques are used to outfit PC/104 for extremely harsh environments. This Data Sheet section updates readers on these trends, along with a look at the new PC/104 follow-ons: EPIC, PCI-104, PCI/104-Express and PCIe/104. Also provided is a product album of representative boards.
» Transforming the Landscape of Military Supercomputing «

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Potential total worth of an indefinite delivery, indefinite quantity contract received by BAE Systems involving an order for the initial production of 12 of its Tactical Signals Intelligence Payload (TSP) systems and engineering support services. TSP will allow warfighters to see the big picture with intel from a U.S. Army UAV known as the MQ-1C Gray Eagle. The system’s open, software-defined architecture means that its network of sensors is interoperable and can talk to each other. It can capture a 360-degree aerial field of view gives the ground commander a comprehensive picture.

Distance beyond which U.S. Army and Raytheon successfully fired two Excalibur Ib projectiles from a M109A2/A3 howitzer during recent tests. Using the M185 cannon and M119A2 propelling charge with Excalibur for the first time, both rounds guided precisely to their targets more than 20 kilometers away. The M109A2/A3 is an early variant of the M109-series howitzer operated by armed forces around the world. Based on the test results, those forces are now able to use the extended range precision capability provided by Excalibur Ib.

Revenue value that the worldwide military communications market will account by 2020 according to a new market research report available from ASDReports. Investments are ranging from the adoption of multi-band and multi-mode tactical radio systems, to the integration of ad hoc networking platforms in unmanned vehicles. The report called “Military Communications Market: 2015 – 2030 – Opportunities, Challenges, Strategies & Forecasts” presents an in-depth assessment of the military communications ecosystem including key trends and market drivers.

Approximate amount of wash down mixture used just for the hanger bay alone during testing of the aircraft carrier USS George Washington’s (CVN 73) fire suppression systems, also known as the countermeasure wash-down systems. Such tests are essential to damage control efforts aboard the ship. The Engineering, Weapons and Air departments aboard Nimitz-class carrier conducted testing of critical firefighting systems, May 11-12. The countermeasure wash-down system seawater and aqueous film forming foam (AFFF) to combat fires by smothering a flame’s oxygen supply.

Amount of thrust instantly produced by SpaceX’s Crew Dragon spacecraft when it simultaneously fired its eight SuperDraco engines and leapt off a specially built platform at Cape Canaveral Air Force Station’s Space Launch Complex 40 in Florida on May 6. The engines fired for about six seconds before achieve that level of thrust, lifting the spacecraft out over the Atlantic Ocean before jettisoning its trunk, as planned, and parachuting safely into the ocean. The successful test of the spacecraft’s launch escape capabilities proved its ability to carry astronauts to safety in the unlikely event of a life-threatening situation on the launch pad.
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