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Technical Article

Payload and Mission Computing Requirements

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Payload and Mission Requirements

High Performance Rugged Computing Solutions that Meet or Exceed the Payload Computing Requirements

Processing, I/O, and Storage—A mobile payload computer must possess advanced high performance embedded computing characteristics, flexible networking capabilities, and industry standard I/O without exceeding the available size, weight, and power (SWaP), and cooling. All storage and system functions must be capable of supporting DoD IA requirements. And all of this must be delivered in a ruggedized, standards-based platform with a low power design that doesn't limit payload computing performance.

Thwarting improvised explosive devices (IEDs) with ground penetrating radar is a challenge for today's small form factor payload computing solutions. In military vehicles, the processing performance required for IED detection as part of an electronic warfare solution will increase ten-fold. To be effective, ground mobile payload computer design requires a mature, rugged, highly reliable, standards-based computing architecture that meets DoD Information Assurance (IA) and intense application performance requirements.

In a ground vehicle, the Ground Mobile Payload Computers are the processing engines for the network of sensors and applications that make up IED detection. A payload computer must process enough sensor data in near real-time to enable counter measures to protect the warfighters.

As vehicle speeds increase beyond 15 to 20 mph, single compute engine capabilities fall short. System advancements in coupling Intel® and GPGPU processing architectures are required to meet the increase in vehicle speeds. A payload computer must support faster networking speeds to fully network the sub-system and support system scaling and failover. In addition, payload computers must be rugged, requiring MIL-STD-810G for a shock and vibration profile following method 514.6.

Balanced SWaP2C2—A ground mobile payload computer is often integrated in a vehicle later in the design cycle and constrained by available space. The choice of a ground mobile payload computer is driven by a balance between its size, weight, and power, performance, cooling, and cost (SWaP2C2), and sophisticated power management that reduces onboard power consumption is a necessity. Ground payload computing solutions should be cost-effective, built on industry standards, and successfully balance the SWaP2C2 equation.

Products for Mobile Mission Computers, Ranging from Single Board Computers (SBCs) through to Complete Embedded Systems

In today's armored fighting vehicle, the integration of vehicle electronic sub-systems for command, control, communications, computers, intelligence, surveillance, reconnaissance (C4ISR) and electronic warfare (EW) components, as well as power generation and distribution, are referred to as vetronics. The multiple sub-systems that support the ground mission are integrated and controlled using a Ground Mobile Mission Computer. Ground mobile mission computer design requires a mature, rugged, highly reliable, standards-based computing architecture that meets DoD Information Assurance (IA) requirements.

As the singular command and control display computer in a ground vehicle, the ground mobile mission computer is the network and application integration point. A mission computer embeds display controls for all vehicle processing, covering vetronics such as C4ISR and EW payloads, diagnostics, and power management. A mission computer must support multiple display interfaces, as well as Gigabit Ethernet and CAN bus, to fully network the sub-systems and support system scaling and failover. The mission computer must be rugged—MIL-STD-810G of a shock and vibration profile following method 514.6—yet present the lowest possible power and cooling profile. It must also scale to support myriad displays and control applications and offer connectivity that complies with DoD IA requirements.

I/O and Processing—A ground mobile mission computer must possess I/O flexibility, networking capabilities, and the right level of processing without taxing the available size, weight, and power (SWaP), and cooling available for the task. Driven by the need for specialized I/O to integrate between vectronic functions, a good mission computer must be flexible and configurable to match the ground mobile platform demand. To support flexible mission planning and configuration, removable storage and USB ports are a must. All system functions must be delivered in a ruggedized, standards-based platform with a low power, convection cooled design.

ADLINK in Defense

Sophisticated and diverse technology demands are the hallmarks of modern military systems, featuring endurance, efficiency and connectivity as proven force multipliers across the spectrum of global military operations. ADLINK Technology is a strategic asset to prime contractors and technology integrators competing in this arena – supporting agile acquisition initiatives, and addressing military design challenges fueled by dramatic increases in sensor data volume and processing requirements as well as ongoing mandates for greater integration in manned and unmanned systems. Capitalizing on a rugged design pedigree spanning more than 25 years of military design advancements and leadership, ADLINK's Extreme Rugged products meet the rigors of military deployments with high-tech ready levels providing optimal Size, Weight, Power and Cost (SWaP-C), high bandwidth and proven rugged performance in open architecture COTS-based solutions.

Rugged by Design

ADLINK's Rugged by Design process means all Extreme Rugged products are subjected to MIL-STD shock, vibration, and temperature testing during the product development process, not simply re-qualified after the fact. This purpose-built approach ensures performance, availability and reliability optimized for the rigors of mission-critical embedded environments.

Extensive voltage and temperature margin tests validate ADLINK's Extreme Rugged products during the development process, including full MIL-STD-810 shock and vibration testing. ADLINK's ISO- and TUV-certified development process features Highly Accelerated Life Testing (HALT), and all Extreme Rugged products are available with conformal coating.

ADLINK rugged hardware solution designs are validated to meet MIL-STD requirements during the development process, including:

- MIL-STD-461 is a DoD standard that defines the requirements for the control of electromagnetic interference characteristics of subsystems and equipment
- MIL-STD-810 is a DoD test method standard for environmental engineering considerations and laboratory tests

Thermal		Extreme Rugged Operating Temperature: -40°C to +85°C
Environmental	Immersion	ANSI/IEC 60529-2004 IP-67 Watertight (Ingress Protection)
	Humidity	95% at 60°C
	Shock	• MIL-STD-810G, Method 516.6, Procedure I - Functional Shock (40g shock) • MIL-STD-810G, Method 516.6, Procedure V - Crash Hazard Shock Test (75g shock)
	Vibration	• EN50155 • MIL-STD -810G- Table 514.6C-X Category 9 (Helicopter Vibration) • MIL-STD -810G- Table 514.6C-10 Category 11 (Rail Cargo Vibration) • MIL-STD -810G- Table 514.6D-9 Category 21 (Shipboard Vibration) • MIL-STD -810G- Table 514.6C-VI Category 4 (Composite-Wheeled Vehicle Vibration) • MIL-STD-810G, Method 514.6, Annex C, Category 7 - Vibration: Jet Aircraft
	EMI/EMC	• MIL-STD-461F ◦ CE101 Conducted Emissions, Power Leads, 30 Hz to 10 kHz ◦ CE102 Conducted Emissions, Power Leads, 10 kHz to 10 MHz ◦ CS115 Conducted Susceptibility, Bulk Cable Injection, Impulse Excitation ◦ RS101 Radiated Susceptibility, Magnetic Field, 30 Hz to 100 kHz ◦ RS103 Radiated Susceptibility, Electric Field, 2 MHz to 40 GHz ◦ CS101 Conducted Susceptibility, Power Leads, 30 Hz to 150 kHz ◦ RE101 Radiated Emissions, Magnetic Field, 30 Hz to 100 kHz
	Temperature	• MIL-STD -810G-510.5 Procedure II (High Temperature) • MIL-STD-810G, Method 501.5, Procedure II - High Temperature • MIL-STD-810G, Method 502.5, Procedure I and II - Low Temperature • MIL-STD-810G, Method 503.5, Procedure I - Thermal Shock
Altitude	Altitude	• 50,000 ft. • MIL-STD-810G, Method 500.5, Procedure II - Low Pressure Altitude

ADLINK's Extreme Rugged products address the full spectrum of military industrial supply principles, including design revision control, component referencing, and the longevity of supply so essential to military deployments. Further, ADLINK's Extreme Rugged products offer configurability and flexibility to meet the broadest range of military program requirements. Assuring rugged design while protecting development resources and time-to-market, ADLINK can expertly modify existing offerings or develop new solutions to defined specifications using our proven Rugged by Design methodologies and ISO quality assurance process.

Long-Term Military Design Success

Inherited from Ampro Computers, ADLINK's reputation is founded on the design and development of high performance embedded computing solutions for rugged deployment. Our mandate is to solve rugged design challenges, maintaining high responsiveness to military customer needs while enabling value, performance, flexibility and longevity for extended deployments. By offering in-house design with manufacturing — a service combination as valuable as it is rare in our industry — we maximize rugged design capabilities and capitalize on smart design principles that integrate both hardware and software to facilitate better performance, faster time-to-market and reduced risk and cost of ownership.

Committed Standards Leadership

ADLINK is vigorous in developing standards and then integrating them into market-leading products. Illustrated through ADLINK's comprehensive support of CompactPCI and VPX products, ADLINK has been innovating and delivering standards-based CompactPCI products for more than 15 years.

ADLINK supports COTS technology and open systems, offering flexible technologies and platforms. Deployable as system ingredients or ready-to-go systems that ensure optimal rugged performance, ADLINK products blend hardware and software elements into intelligent platforms that enable a tangible competitive edge in time-to-market.

Rugged Innovation, Value and Performance

ADLINK was founded to deliver innovation, value and competitive edge to our customers, capitalizing on our rugged design pedigree and culture of creativity to develop smarter embedded technologies and platforms. ADLINK is your complete supplier of Extreme Rugged products featuring military grade requirements.Our extensive lines of systems, platforms and products deliver optimized SWaP, thermal management and price/performance value in standards-based COTS and MOTS (modified COTS) solutions.

Innovative Embedded Products and Capabilities

ADLINK's Extreme Rugged computing platforms have been deployed across the broad spectrum of demanding military environments, supporting applications such as missile command and control, in-vehicle tactical displays for communications systems and portable weapon terminals optimized for mobile deployment. Extreme Rugged solutions are highly versatile and ideal for force protection applications such as counter-sniper systems and image processing applications enabling image stabilization for naval and sub-sea missions.

ADLINK's rugged products and platforms also offer a wide range of internal and external I/O, storage and networking options, including internal PCIe (Gen 3) data buses, multiple display technologies (HDMI, VGA, LVDS), GPIO, multiple SATA interfaces and USB and Gigabit Ethernet ports. ADLINK's world-class technical support ensures convenient accessibility to our team of highly skilled customer hardware and software support engineers. Our support team is expertly trained and knowledgeable in the applications and concerns of our military customers.

ADLINK Rugged Platforms

3U Conduction Cooled VPX Blades: VPX3010

- Intel® Xeon® Processor D-1500 SoC up to 12 cores
- DDR4-2133 soldered ECC SDRAM up to 16GB
- One 10GBASE-KX4, up to three 1G Ethernet ports
- Up to PCIe x16 Gen3 interface supporting non-transparent bridge
- One XMC expansion slot, PCIe x8 Gen3 with Rear I/O to P2

6U Air/Conduction Cooled VPX Blad es: VPX6000

- Dual quad-core Intel® Core™ i7 processor
- Dual channel DDR3L ECC soldered memory, 16GB per CPU
- Supports PCIe non-transparent bridge (NTB) and 10GbE
- Storage upgrade via mezzanine card with scalable onboard SSD option
- Remote management with Intel® AMT

VPX Graphics Cards & Modules

- NVIDIA GeForce GT 745M GPU with "Kepler" architecture
- CUDA Compute Capability 3.0 for parallel computation and graphics processing
- High-resolution, high-performance platform for rugged video I/O and GPGPU applications

COTS Computer: HPERC-IBR series

- MIL-STD-38999 connectors
- VITA 75 coldplate mounting or passive cooling
- Intel® Core™ i7 dual core Processor
- Soldered DDR3L 8GB RAM, up to 16GB RAM
- Available GPGPU on 16-lane 3rd Generation PCI Express
- Extreme Rugged™ operating temperature: -40°C to +85°C

6U CompactPCI Processor Blades: cPCI-6940

- 14nm Intel® Xeon® Processor D-1500 family SoC processor with up to 16-cores
- 16GB DDR4-2133 ECC soldered memory & optional 32GB DDR4-2133 ECC socket type memory, up to 48GB
- Integrated AMD Radeon™ E8860 GPU onboard supporting DirectX 11.1, Open GL 4.2, Open CL 1.2
- PCIe x16 Gen2 to J4 UHM connector for rear expansiono

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