



+ A FORCE MULTIPLIER FOR AIRBORNE ISR - ZM3 MISSION COMPUTER

A universal requirement in virtually all rugged military computing applications is Size, Weight, and Power (SWaP) optimization. Whether the mission is airborne, shipboard or terrestrial the principal is the same: make it smaller, make it use less of the available resources, and make it contribute more to the overall system functionality. What constitutes optimal SWaP for a mission computer varies greatly depending on the target platform and application. In the case of airborne ISR, where the mission is often driven by the capabilities of the payload, there is a relentless drive for lighter, more compact and ever more capable rugged mission computers.

Most of today's ISR systems architectures share a lot of similarities and typically derive from a set of standard configurations. The only real differences from one platform to another typically revolve around the specific capabilities of the platform that the ISR system is installed on, such as the aircraft.

Generally, ISR aircraft consist of at least one or two operator stations, and in rare exceptions many more. Each of these stations is typically supported with a computer workstation and two or more displays. This operating position workstation usually has computer requirements

that are in line with modern, higher-end graphics workstations found in the commercial industry. These workstation requirements cannot typically be met with the traditional military style vehicle computer and typically fall into the "semi-rugged" type of computer workstation. They are usually comprised entirely or partially of commercial-off-the-shelf components that have had some level of minor modifications to increase their rugged-ability for the harsher environment for these unique applications. Because of these requirements and the fact that commercial form-factors are utilized to facilitate the commercial components, most computer designers in our domain opt for the standard rack mount style workstation. This allows for ease of implementation of standard motherboards and other add-ons, especially GPUs. Because of the growing emphasis on visual content, much of the workload in ISR applications has shifted to the GPU. In nearly all installations where ZMicro computers are used in an ISR system, a GPU is required.

In addition to the operator workstation, there are usually some additional support computers that are also required for the mission of the system. It is not uncommon for a single ISR platform to have at least 3 workstations each weighing around 25lbs. This may not seem like a lot, but

SMALLER. LIGHTER. FASTER.

The ZM3 Mission Computer packs in a 16-Core, Intel® Xeon D™ processor, three PCIe expansion slots, up to two removable storage drives and double-wide COTS high-end graphics cards making it the most compute dense, rugged computing solution on the market.



IDEAL FOR AIRBORNE ISR APPLICATIONS

Weighing less than 10 lbs., the ZM3 mission computer was designed specifically to minimize size, weight and power for airborne ISR applications.



COM EXPRESS TYPE 7 BASED SYSTEM ARCHITECTURE

The ZM3 utilizes the COM Express Type 7 architecture to create a versatile system that can be configured to fit application requirements. Com Express Type 7 supports up to four 10GbE interfaces and enables 32 PCI Express lanes to support NVMe storage and multiple lanes for PCIe expansion cards.



NVME BASED TRANZPAK 1 REMOVABLE STORAGE

Further reducing weight, the ZM3 can house up to two TranzPak 1 rugged storage drives (up to 4TB), which utilize the latest NVMe technology to provide storage read/write speeds up to 3x faster than SATA and only weigh 10oz. each.

each of these computers also requires mounting provisions in the aircraft, which adds additional weight and takes up space on what is typically a very small aircraft.

A GPU-CENTRIC APPROACH

In today's ISR space, Moore's Law seems to have shifted more towards GPUs rather than CPUs. Or rather, the focus of the implementation has shifted because, in reality, CPU technology is still making improvements in large strides, but in areas of chip and component density as opposed to speed. In other words, the chips are still fast and getting faster, but now they are many times smaller and sometimes even include nearly all of the subcomponents that used to be discrete pieces of a larger motherboard, on one single chip. This is known as the System-On-Chip (SOC) approach to computing. What used to be implemented 20 years ago on a 12-inch by 12-inch motherboard is now integrated on a half inch by half inch chip. This evolution, coupled with the rapid growth in capabilities of the GPU, has caused ZMicro to rethink the concept of an ISR mission computer and how it's designed.

We asked ourselves, knowing that what customers really want is the latest GPU support, what would it take to support the GPU in the smallest form factor possible? We looked at the solution from a "GPU support first" angle rather than "computer support first." If you look at it in this way, you can then begin to imagine how we could envision alternate solutions to the traditional form factors. With a fresh canvas, we set out to give customers the smallest, lightest, most capable rugged mission computer possible that could support an NVIDIA GPU. The challenge was to fit all the capabilities of a rack mount server in a fraction of the size and weight. We would need to create a new form factor that would be suitable for space-constrained applications such as manned and unmanned airborne ISR. It would need versatile mounting options and a convenient shape so that system designers could utilize available space in a vastly more efficient manner. Ideally, it would enable versatile new configurations of onboard equipment with greater processing capability and lighter, more compact loads.

A LIGHTWEIGHT POWERHOUSE

Our solution is the ZM3 mission computer. The ZM3 is a small form factor mission computer housed in a new rugged design that's about the size of a shoebox and weighs about 9 pounds. It's a lightweight powerhouse that packs in a 16-Core Intel® Xeon D™ processor, three PCIe expansion slots, up to two removable storage drives and double-wide COTS high-end graphics cards making it one of the most compute dense, rugged computing solutions on the market. It features a unique design that is driven primarily by the need to fit an NVIDIA GPU accelerator into the smallest possible form factor. In designing the ZM3, we took advantage of what we believe to be one of the most important breakthroughs in military embedded computing: COM Express Type 7. COM Express Type 7 is a server-

on-module specification that is optimized for the demands of embedded edge servers. Using COM Express Type 7, we were able to take all the enterprise compute capability of our 30-pound rack mount system and fit it into a new compact form factor that is less than a third the weight. As a bonus, the new design has better airflow and runs cool to the touch and is quieter because it requires fewer fans. The fundamental innovation of the COM Express Type 7 is a new pinout that supports up to four 10GbE interfaces and additional PCI Express (PCIe) lanes. This now allows processors such as the Intel Xeon to be designed into COM Express modules and enables GPUs to be added via carrier boards. Because GPU capability is highly prized by customers doing airborne ISR, in the past, they have been forced to purchase rack mount computers in order to accommodate the large GPU cards. COM Express Type 7 opens up a world of higher performance embedded and small form factor military applications.

The COM Express Type 7 spec brings a number of advantages to the ZM3. It supports NVMe drives, which increase read/write speeds three to four times compared to SATA 3. The new spec also provides 10GbE LAN for rapid communication of video over the network. COM Express Type 7 enables a more flexible, scalable design because it provides up to 32 PCIe lanes that can be allocated as needed. For example, the ZM3 mission computer is configured to use 8 lanes for storage and the remaining 24 lanes for expansion cards, typically up to 16 graphics cards and 8 encoders. But other configurations are also possible. Boosting performance in small form factor systems has always been a challenge due to stringent space and power constraints. Additionally, it's difficult to keep up with the design churn associated with implementing new processor generations. COM Express solves this by essentially isolating the processor, chipset and memory from the rest of the design. This allows customers to dial-in the right amount of performance by bringing together the best mix of available computing modules.

VASTLY MORE SPACE-EFFICIENT

The ZM3 tackles the challenges of ISR applications by rethinking the focus of the workstation in such a way that the overall SWaP is drastically reduced. Instead of building a solution by first thinking of the motherboard and CPU required and then including the GPU as an add-on, it starts with a GPU-centric approach.

This new approach has the most significant impact on the overall weight of the system. When you are talking about multiples of these computers on each aircraft, the weight impacts start to multiply. Additionally, because of the weight savings directly related to having smaller, lighter computers, the support structure within the aircraft also gets smaller. The less weight you have to support, the lighter your structure can be. Finally, the smaller computers allow customers to design their mission systems packages to be much more compact to allow for added capabilities or increased operator comfort.

As you can see, depending on the implemented system's size and scope, having the ability to use a mission computer that's about a third the size and weight of a typical ISR workstation can translate to downstream effects that lead to even greater savings in weight and/or capabilities.

FLY SMARTER

In a nutshell, the ZM3 is unique because it's the smallest, lightest, most cost-effective rugged mission computer available that can support an NVIDIA GPU card. It provides the capabilities of a rack mount server in a fraction of the size and weight, making it ideal for space-constrained applications such as manned and unmanned airborne ISR. With versatile mounting options and a convenient shape, the ZM3 enables system designers to utilize available space in a vastly more efficient manner, opening up new possibilities for configurations with greater processing capability or lighter, more compact loads. ++



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