



# VMEbus Systems

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## New Cooling Developments:

Groundbreaking PCB composite

Thermal analysis software

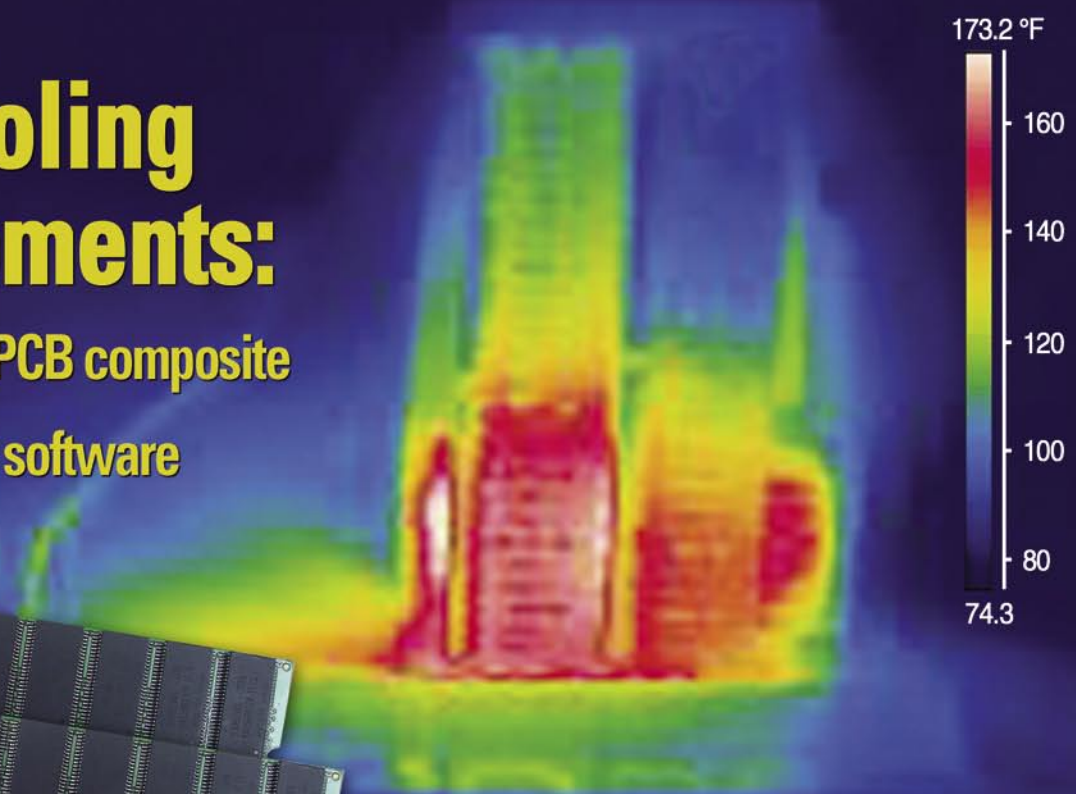


APPLICATION FEATURE:

**Military FPGA-based SDR**

GUEST FEATURE:

**Military Solid State Drives**



### Optimized solid state drives for military mission-critical applications



By Vikram Karnaker

Military requirements for drive technology are among the most demanding, as they require sustained operation in an extreme environment.

Traditional hard drive solutions frequently fail to pass such requirements. Their performance is adversely affected by extreme environmental conditions, and they only offer sustained operation within a narrow band of ideal environmental conditions.

In this article, Vikram describes Solid State Drive (SSD) technology, and its use in military mission-critical applications.

#### Hard drive characteristics

Hard drives are subject to mechanical failures and have low reliability because they incorporate a spinning circular disk and a moving arm with a read/write head. Hard drives also have poor data protection as file deletion only results in an update to the File Allocation Table (FAT), and not actual data deletion. In addition, hard drive formatting is a time consuming process.

#### SSD overview

Solid state drives are an alternative to traditional hard drives, and offer the following benefits:

- Reliability – They are very reliable even in extreme environmental conditions.
- Power use – They use much less power than traditional hard drives.
- Security – They incorporate leading-edge security features that comply with the most rigorous military security standards.
- Physical size – They are very small in size, with some SSDs less than 9.5 mm in height.

#### SSD characteristics

Solid state drives are available with industry standard interfaces. The ATA interface (100 MBps) is the most popular standard interface, while the Serial ATA (SATA) interface (150 MBps) is slowly gaining in popularity. Solid state storage subsystem capacity ranges from 10 to 500 GB.

SSDs are available in standard form factors (such as 2.5 and 3.5 inch), and non-standard form factors. SSD height is less than 9.5 mm, which results in significantly improved storage densities.

#### SSD security features

Military content security requirements range from the declassification of the drive over a period of several hours, to the destruction of the drive in a matter of seconds. Available SSD content security features comply with Department of Defense, National Security Agency, Air Force, Army, and Navy requirements.

#### Mission-critical environment

Solid state drives in military mission-critical applications operate continuously with environmental extremes in:

- altitude
- humidity
- sand and dust
- shock
- temperature
- vibration

Solid state drives excel in such environments, and can easily satisfy military environmental requirements such as the MIL-STD-810F.

#### Solid state storage subsystem applications

Solid state drives are ideally suited for mission-critical systems that read, write, and store large amounts of data in real time. In these applications, an SSD is usually part of a solid state storage subsystem that typically consists of a high-speed interface and one or more solid state drives.

#### Solid state storage subsystem examples

##### Aircraft data recorder

Mission data recorders for fixed wing fighter aircraft include SSDs that record all data and audio communications for an entire eight-hour mission. The aircraft are used for patrols, surveillance, and other tactical operations.

##### Image exploitation computer

Image exploitation computers for tracked ground systems are used for target recognition, and they include SSDs. The computers process an enormous amount of data that is collected from a variety of sensors. The ground system is designed for combat operations.

##### Navigation system

Navigation systems include SSDs, and they combine Global Positioning System (GPS) and Inertial Navigation System (INS) features to deliver precision position, velocity, altitude, and pointing data. The systems are linked to a digital battle management system to transmit and receive operational data in real time.

##### Field-deployed PC applications

Solid state drives are also ideally suited for field-deployed PCs. These include handheld devices, notebooks, vehicle-mounted PCs, tablet PCs, and wearable PCs. The computer itself will typically have a storage drive, CPU, memory, a display designed for outdoor use, a network or wireless interface, a power supply, and a rugged casing.

# SOLID STATE DRIVES

In these applications, a solid state drive is a drop-in-replacement for the traditional hard drive. The solid state drive capacity ranges from 4 to 80 GB. Because it is solid state, the standard hard drive mounting dampeners and insulation are not required. The solid state drives for field-deployed PCs use standard IDE or ATA interfaces. Drive throughput up to 20 MBps is sufficient for most applications.

## Field-deployed PC examples

### Integrated GPS PC

This field-deployed notebook and tablet combination includes an integrated GPS. The field-deployed PC features Windows XP, an Intel processor, and a 40 GB SSD. The solid state drive consumes 30 percent less battery power than a traditional hard drive, resulting in a much longer period of operation.

The PC stores sensitive mission data (such as maps and directions) on a designated solid state drive partition. This classified partition can be purged in between missions, so the PC is declassified and ready for its next assignment.

### Leg-mounted PC

This small, lightweight, and leg-mounted PC is used in cockpit and soldier environments. The PC features a database of detailed moving maps with GPS-driven charts and locations. The PC includes an 8 GB SSD and is capable of withstanding an airdrop by parachute.

### Vehicle-mounted PC

This field-deployed PC is ruggedized and vehicle-mounted. The PC features an Intel processor, 1 GB of SDRAM, and a 20 GB SSD. The PC must meet stringent environmental requirements including:

- Temperatures from -40 °C to 70 °C
- Temperature shock from -20 °C to 50 °C in two 10 minute intervals
- Exposure to salt fog for 48 hours
- Vibration common to standard fixtures for tracked and wheeled vehicles
- Exposure to wind blown sand and dust particles at a rate of 20 mph for 30 minutes

Ruggedized, shock-mounted hard drives failed to pass the requirements for vehicle-mounted PCs, but solid state drives passed with flying colors.

### SSD market share

The growing demand for real-time data storage, management, and analysis in military applications is increasing the rate

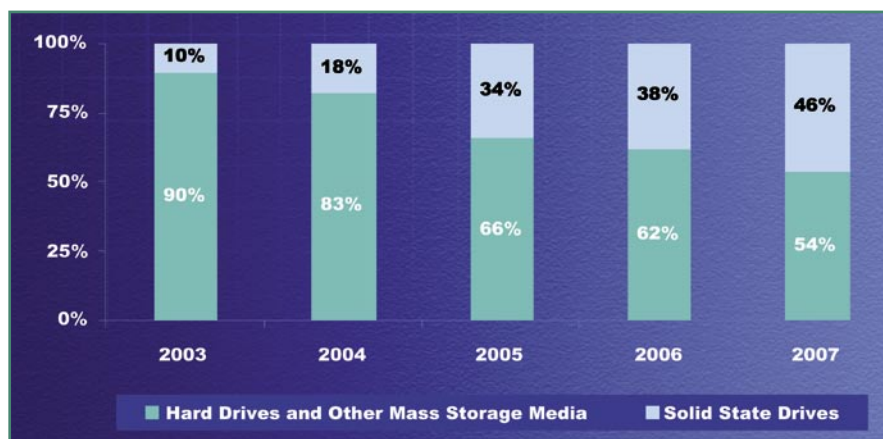


Figure 1

of adoption of solid state drive technology. The SSD market share for the military storage market is shown in Figure 1 (source: SimpleTech).

Solid state drives are the most technologically advanced storage media in the market, with the broadest environmental specifications, best reliability, most compact form factors, lowest power consumption profile, fastest data throughput, and most advanced content security feature set of any storage media.

The cost of solid state drive solutions is decreasing as the price of key components (such as NAND flash) continue to drop at an annual rate of over 30 percent. This is further driving the adoption of solid state drives by the military market.

Military market demand is in turn driving the introduction of solid state drive products geared towards the unique needs of military applications.

### SimpleTech Zeus drives

The SimpleTech Zeus SSD is shown without the case in Figure 2 and features the following:

- thin case heights
- capacities up to 128 GB
- ATA/IDE or SATA interfaces



Figure 2

- throughputs up to 60 MBps
- customized form factors
- standard 2.5 and 3.5-inch form factors

The Zeus SSD has been built and tested to a variety of military standards. For example, the drive has passed MIL-STD-810F tests for high and low temperature, temperature shock, sand and dust, explosive atmosphere, acceleration, vibration, and humidity.

The drive includes many advanced content security features that meet the requirements of military applications, including BasicPurge™, RapidPurge™, MilPurge™, and Intelligent Destructive Purge™.

The Zeus SSD is currently in use in a variety of military and aerospace applications, and its technology roadmap continues to advance rapidly to meet an increasingly broad spectrum of high-technology applications.

### Summary

The SSD market share continues to grow in the new network-centric military environment. In time, SSDs will become the de facto storage standard for military applications. Ω

*Vikram Karnaker is the Manager of Business Development at SimpleTech. In this role, Vikram is involved in the analysis and execution of a variety of projects of strategic importance to SimpleTech. His current responsibilities include the development, introduction, sale and support of a number of memory and storage products for civilian and military applications. Most significantly, Vikram plays a vital role in SimpleTech's Solid State Drive Team, and in providing rugged COTS mass storage solutions for military, aerospace and other computer systems.*

***SimpleTech***

**3001 Daimler Street  
Santa Ana, CA 92705**

**Tel: 1-949-260-8345 (US and Canada Only)**

**Fax: 1-949-851-2756**

**E-mail: [ssd@simpletech.com](mailto:ssd@simpletech.com)**

**Website: [www.simpletech.com](http://www.simpletech.com)**