2U High-Performance Rugged Server

Naval Anti-Submarine Warfare (ASW)

Captec delivered a fully ruggedised 2U server for use in naval Anti-Submarine Warfare (ASW) systems. Designed for harsh maritime environments, the server integrates a proprietary module, supports high-performance computing, and provides extensive onboard storage, enabling reliable ASW operations across a range of Indian Navy surface vessels.

The customer is a major defence technology provider supporting all three branches of the Indian armed forces - Army, Navy, and Air Force.

Their product range spans armoured vehicles, underwater warfare systems, radars, and surveillance platforms. For this project, they required a specialised computing solution for naval applications.

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The Challenge

The customer required a high-performance computing platform to support advanced Anti-Submarine Warfare (ASW) software, demanding maximum CPU cores, RAM, and sustained data throughput. The system needed to run from the ship's 48V DC power supply and integrate a proprietary PCI-E card, as well as accommodate over 100TB of onboard RAID protected storage; all within a compact 2U rackmount form factor. Deploying such compute capability in a naval environment introduced complex mechanical, thermal, and electrical integration challenges.

The 48V DC input required custom EMI filtering to achieve strict defence compliance, while the PCI-E module necessitated precise mechanical alignment and thermal management, via balanced and directional forced air cooling. Environmental survivability against shock, vibration, temperature, and humidity had to be proven under both UK and Indian military standards. Off-the-shelf systems could not meet these combined demands, making custom engineering essential to ensure compatibility, long-term reliability, and full qualification for sustained defence deployment.

The Solution

Captec collaborated closely with the customer's system architects from the outset to deliver a custom rugged server platform. Embedded CPUs were carefully selected to optimise compute density while maintaining thermal efficiency, with the added benefit of a long-life roadmap to extend system lifecycle and minimise obsolescence risk. A custom DC-DC power supply was designed with integrated EMI filtering to ensure compliance with stringent military emissions standards.

The proprietary PCI-E card was accurately modelled in 3D CAD and mechanically isolated within the chassis to safeguard against shock and vibration. Storage was configured through 14 x 2.5" SATA SSDs in RAID, with a defined upgrade path to >1PB using NVMe drives. Electronics assemblies were conformally coated to protect against moisture and dust ingress, addressing the environmental challenges of high humidity and salt fog. Rugged MIL-spec connectors were also incorporated to meet the application's mechanical and EMC requirements.

The complete system was fully qualified to the relevant military environmental and EMC standards and is now being deployed across multiple Indian Navy surface vessels.

The Outcome

The customer was able to test and develop their software on early non-rugged prototypes, accelerating the delivery timeline and de-risking integration. Once qualified, the ruggedised servers were deployed across multiple platforms with minimal modification. The customised hardware design supports seamless PCI-E card integration and delivers high-capacity storage for real-time ASW operations. Through conformal coating and rugged construction, the server offers long-term reliability in challenging marine environments.

Captec also developed a custom obsolescence management plan to ensure lifecycle continuity and long-term platform support. Following the project's success, the solution has been adopted as a reference design for related defence applications, leading to subsequent orders and recommendations from additional programme teams facing similar technical and environmental challenges.

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