The US’s Proven Use of Commercial-Off-the-Shelf Speeds and Lowers the Cost of Military System Development

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It’s a simple fact that, around the globe, regional military organisations are increasingly seeking more cost-effective and affordable electronic systems that can be supplied in shorter and shorter delivery schedules. A proven model for addressing these requirements is found in the use of commercial-off-the-shelf (COTS) electronics, long adopted in the US as an effective approach for lowering costs and speeding the deployment of advanced solutions. Additional benefits that result from the use of COTS electronics include improved interoperability and the easing of system upgrades through the use of open standards and well-defined technology roadmaps.

Military system developers in Australia and New Zealand can look to the American aerospace and defence industry’s successful use of COTS electronics as building blocks for critical rugged systems. For over twenty years the United States Department of Defence (DoD) has proven that using COTS electronics in rugged systems deployed in harsh battlefield environments, such as Mission Computers, Radar, EW/ISR and Network Switches, will lower the cost of ownership while speeding their development and deployment.

The old approach of developing rugged defence systems, using custom designs and proprietary technologies no longer makes economic sense. US system integrators have found that custom designs cost significantly more and take longer to field. They’ve turned to COTS solutions as an alternative to custom military, space, and commercial aerospace solutions that lock them into a single supplier. The COTS approach gives system integrators access to a broad range of fully tested and field qualified open architecture products. In the US, over the last two decades, in program after program, it’s been conclusively proven that the use of COTS building blocks lowers the costs and speeds the delivery of innovative solutions to the warfighter.

The compelling question for system designers is whether they can afford not to use COTS technologies? Those tasked with managing military platform budgets should take a look at what COTS can do for their critical programs. They will find a new world of widely used open standards and open architectures that delivers access to the highest performance electronics today while also providing a clear and faster roadmap to tomorrow’s technologies. In the past, some International Defence Integrators, while interested in leveraging the benefits of the COTS model, were hesitant because of concerns over ITAR restrictions.
The good news today is that there are leading COTS suppliers with a well-established European presence that manufacture ITAR-free products or have no potential ITAR restrictions. While the use of COTS hardware reduces costs and program risks it also protects the in-country system integrator’s added value content. Any required integration, application and system level development needed to modify a COTS-based platform (to meet specific end-user needs), can still be performed in country.

Another important and growing trend in military system development is the reduced timeframes in which working solutions need to be demonstrated to the customer.

In the US, the DoD has made a major shift toward a “show me” mentality. As budgets for research & development projects shrink, the DoD demands that systems integrators demonstrate a working application based on today’s technology as a candidate solution, after which the final deployable system is implemented using next generation technology. This approach, called “spiral development” is very well supported via the COTS model. A related trend is the DoD’s desire to acquire electronic solutions that have a provable high Technology Readiness Level (TRL), meaning that the proposed solution can be demonstrated and hopefully has been pre-qualified and validated through prior deployment. The COTS electronics approach is ideal for supporting requirements for tried and trusted technology. COTS products deliver increased reliability because they are field qualified and improved through their use by multiple customers in multiple programs across numerous environmental and operational conditions. This result is real world data used to continually improve the system’s performance and reliability.

The historic move away from costly bespoke system designs and towards the widespread use of COTS electronics and open architectures was first driven by a memo written by former US Secretary of Defence William Perry in 1994.

Secretary Perry’s memo directed the DoD to use COTS products whenever and wherever possible. Over the last two decades, the US DoD has made the COTS approach a contractual mandate. Helping to make the COTS approach a success was the development of a strong ecosystem of competing electronics hardware vendors. These vendors, working together in trade organisations, such as VITA, alongside participants from prime defence contractors and government agencies, have continually defined, improved, and fostered the use of today’s leading COTS hardware and electrical standards. These standards, such as the VMEbus, and its more rugged and higher performance successor, VPX, define and update the most widely used hardware module form factors, connectors and electrical interfaces for building today’s military systems. Today, the VMEbus and VPX module and system architectures have become the de facto standards for building US military systems.
It’s important for the reader to understand that the term “COTS” as used here does not refer to system components developed for use by the commercial market.

In contrast, Military COTS products, are specifically developed by COTS vendors who focus on the Defence Market. These vendors uniquely address and solve the challenges that confront system designers who must build systems and solutions that are able to perform optimally in harsh environments.

Design expertise is applied to packaging, cooling and device selection to ensure that COTS modules and systems will perform optimally when exposed to the extreme heat, vibration, and shock conditions that are typically experienced by military air, ground and naval platforms.

Military COTS products differ from commercial products in their use of specialised packaging and advanced thermal management technologies to support the extremely long life of military platforms, while making it possible for them to use the latest cutting-edge electronics technology, such as Intel Xeon processors, FPGA, and GPGPU devices. What’s more, military COTS subsystems uniquely address the size, weight, and power constraints that make it difficult to add new capabilities onboard increasingly space-limited vehicles, such as tanks, helicopters and unmanned aircraft.

Even better, the use of COTS building blocks speeds innovative new military capabilities by freeing the system developer from having to design, build and qualify their solution’s basic hardware infrastructure. Today’s existing ecosystem of COTS hardware vendors, supported by a military community that strongly embraces the proven advantages of open architectures and open standards, enables system designers to better focus on their own core competitive strengths in integration and software capabilities. In these days of reduced military funding and smaller R&D budgets, the use of COTS building blocks enables system designers to better spend more of their limited resources on developing critical new capabilities.

Simply put, the big breakthrough driven by the COTS approach is that OEMs are freed from having to develop their system’s basic processing infrastructure. Instead, processing hardware can be acquired, far more rapidly and cost-effectively, from vendors who have developed unique and extensive expertise in ruggedising and packaging state-of-the-art commercial technologies. What’s more, leading COTS vendors have put in place sophisticated and mature services to mitigate the risks of obsolescence, enabling COTS electronics to effectively support the extremely long life of most military platforms.

In the years since Secretary Perry first launched the COTS initiative, an important shift has taken place in where leaps in capability originate. Many years ago, functionality came from hardware. That’s no longer the case. Today, functionality is mainly driven by software innovations such as the complex FFT software algorithms used in advanced signal, radar, and image processing applications.

To support these software applications, COTS vendors develop hardware modules and compact subsystems using today’s most powerful microprocessors, FPGA and
GPGPU devices. This enables the defence industry to focus on the areas where investment in innovation will have the greatest impact, the high value-add innovations that enable them to differentiate themselves from their competition and provide the warfighter with the advanced capabilities they need as soon as possible.

Today, COTS VME and VPX-based processors, network switches, and graphics modules form the backbone of US military hardware infrastructure. The advantages are indisputable. For example, it makes far more sense for EW and radar system designers to invest their resources on the “hard” part of the system solution, rather than spending their time developing an Intel processor module that they can easily, rapidly, and cost-effectively acquire from a number of reliable COTS suppliers. System designers also reduce their program risk because COTS hardware is already developed, proven and pre-qualified.

The end result is the faster delivery of new advanced capabilities to the warfighter in the battlefield. The COTS approach enables OEMs to focus their limited resources on the development of unique software based applications that can run on top of proven, readily available COTS building blocks. It also helps drive innovation, making it easier for OEMs to leverage the next wave of emerging technologies, such as Artificial Intelligence, Deep Learning, Cognitive EW, machine learning, 3D displays, and augmented reality.

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