



## *A SKY Computers White Paper*

### *COTS Supportability Across the Program Lifecycle*

*A Look at the COTS Evolution in the DOD Market*



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## **COTS Supportability Across the Life-Cycle**

Commercial off-the-shelf (COTS) utilization in the United States is now almost 30 years old. But, it was less than 10 years ago that U.S. Defense Secretary Bill Perry sponsored the Strategic Acquisition Initiative (SAI) that brought COTS to a full mandate. The initial goals set for COTS including cost reduction, performance improvement, and accelerated development cycles have, to some degree, been realized. However, in the defense and military sectors, specifically in large-scale weapon and electronic system development, the utilization of COTS has created as much complexity as it has simplified. For example, technology advances at a far greater speed than it did 30 years ago. Thus, over the course of a single defense and military program the COTS microprocessors chosen for a program 5 years ago have advanced multiple generations and their speed has increased by a factor of 10x. Balancing program life cycles with COTS product life cycles, technology insertion, and obsolescence management are some of the major issues facing the COTS initiative.

Beyond technology, additional complexity lies in the number of organizations involved in each procurement. Each program involves the procuring Government agency, the selected defense contractor, and numerous commercial suppliers. Each of these organizations has differing product life cycles and business models, which creates lifecycle management issues that, left unmanaged, threaten to obviate the original cost advantages of COTS.

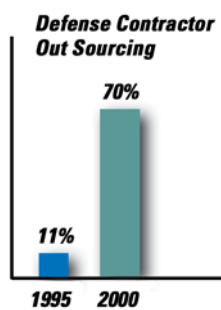
The question that needs to be answered as we move through the next decade is can the cost and development promises of COTS be realized throughout the program lifecycle? In the last 8-10 years COTS has experienced a quick start and a tough implementation. In spite of the challenges, COTS will move forward -- not regress. There are further questions about the COTS implementations including: how can we integrate rapidly evolving technology? How can the Government agencies, defense contractors and COTS suppliers work together given their varying objectives? These answers require some historical perspective. We need to take a look at what has already been attempted, improved upon, and adapted to make COTS work today and to look at ways to improve the results for the future.

## **History of COTS**

In 1972, Bob Costello, then the Deputy Director of Defense, coined the acronym COTS (commercial-off-the-shelf) to describe a shift in military procurement priorities and practices. This was the beginning of the initiative to decrease costs and shorten development cycles for

military and weapons systems. Since then, the companies who target the military markets have been struggling to strike a balance between the needs of the government/military agencies, the capabilities of the defense contractors, and the advanced technology that COTS compliance, mandated by law in the U.S., provides.

To project where COTS has the most impact now and in the future, it is important to remember and understand where COTS has been. Its evolution over the last 30 years, and more importantly over the last 10-20 years, has been significant. During the 1980's business trend of 'right sizing', companies focused their energies, efforts, and budgets on their core strengths and began to streamline their organizations accordingly. This fueled the need for outsourcing and COTS as thousands of specialized engineers were redirected. Down sizing was especially beneficial for commercial electronics and computer companies whose products replaced the proprietary systems previously invented by the engineering divisions of the defense contractors/integrators.



As recently as five years ago, defense contractors spent 11% of their budget on outsourcing component and subsystem requirements. Today, the outsourcing percentage has risen to 70%, and the success of many COTS suppliers is due wholly or at least in part to this paradigm change within the defense/military community. Contractor acceptance of the rightsizing trend opened up a \$55 billion market to COTS suppliers.

In 1991, Bill Perry initiated the Streamlining Acquisition Initiative (SAI), which mandated that for new technology and upgrades, U.S. Defense contractors must look at COTS as the first consideration in their program development. If there was no commercial solution available, a custom development could be justified. Reviewing commercial alternatives vs. custom development is still a common occurrence in full milspec programs.

While the SAI and outsourcing initiatives drive the expansion and adoption of COTS, changes in the worldwide political climate have changed the priorities and funding allocations for the defense community. Instead of targeting the global threat of one or two superpowers, the U.S. Department of Defense has moved toward evaluation and preparedness in the face of multiple regional threats from smaller nations. The lack of a centralized threat has resulted in decreased defense budgets in the U.S. and has spawned a movement to limit large-scale production of new weapons systems. Procurement programs have shifted to modernization, technology insertion in existing systems, and smaller quick start programs to address the narrower scope of regional threats. The effect on COTS is that modernization efforts demand rapid development and deployment of upgrade and modernization programs.

## Beyond the U.S.A, COTS Around the World

Outside of the United States, of course, COTS is not mandated. The concept of utilizing standard off the shelf products has gotten varying amounts of support and is in various stages of adoption outside the U.S. Australia, and many of the countries of Western Europe have embraced concepts similar to those adopted in the U.S. and are using COTS in both the development and deployment phases of their programs. The highly industrialized countries in Asia historically have taken a cautious approach to the adoption of COTS. Recently however, the demand in Japan, Singapore, Korea, and China has accelerated for COTS for their development systems. Deployment for most Asian programs is handled by having the contractor license technology from the COTS supplier.

## Lifecycle Differences Require Continuity Among Organizations

There is a disparity in the length of the product lifecycle between the Government, the defense contractors, and the COTS suppliers. The typical COTS suppliers' product life-cycle is 2-3 years. The typical defense contractors' program life-cycle is 7-15 years. The typical Government program lifecycle and sustainable platform life is 25-40 years. This disparity has forced the defense contractors and the COTS supplier base to look more closely at the costs of obsolescence management and technology insertion.



*(Caption: One example of the life of a military platform is the P-3 Orion which entered Military Service in 1962 and is still in use and being upgraded.)*

Defense contractors incur 60-70% of their costs after initial deployment in the form of maintainability, reliability, and supportability programs. Thus, it is of paramount importance that Defense contractors consider these issues when choosing a COTS supplier. More importantly, only the hardware costs are easily quantified, but the majority of lifecycle costs are software-related. Environments and tools that emphasize software portability without expensive and labor intensive rewrites and re-optimization are crucial.

The U.S. DoD has realized that the program cycle (which can have a platform life of 40+ years) needs to look toward shorter design/insertion cycles. Successive refinements, rather than a series of point-designs, are the approach that best fits the COTS model. Low startup costs and the need

for continuity between generations of a product design were historically the reasons for the success of COTS programs. The rapid prototyping and accelerated implementation capabilities that COTS brings to the defense contractors' programs are now regarded as the real benefits of COTS.

### **Choosing a COTS Supplier**

Both the Government agencies and the defense contractors participate in the selection of the COTS supplier for any given project or program. The Government considers some of the following costing elements in the selection of COTS suppliers:

- Initial Product Price
- Maintenance Costs
- Operational Costs
- Training Costs
- Disposal
- Installation Costs
- Software Change/Upgrade Costs
- Software Tools (System Design and Models) Costs
- Technology Costs
- Software Integration Costs
- Fault Isolation/Redundancy Costs
- Support (Integrated Logistics Support, Sparing, Test & Repair, and Documentation) Costs
- Planned Product Improvement and Lifecycle Installation Costs
- Interchangeability of Hardware/Software Architecture, form fit, function- Replacement and expandability capabilities
- Supplier Longevity and Financial Stability
- Risk Mitigation
- Past Performance

In their business model, most COTS suppliers are able to provide statistics on only a few of these elements. The Government's 'supplier ideal', however, is one that focuses on most or all of these elements. This information provides a more realistic life-cycle cost model which provides the Government and military with solid insights into projected behavior and costs.

From the defense contractor's perspective, the basic cost considerations are similar to those of the Government. However, profit motive and competitive pressures come into play at this level and are added complexities that determine which COTS suppliers are considered. As a result it is the long-range upgrade plan, software development, and maintenance costs which have the most impact on the potential profit that can be realized.

Software development can represent a \$15-20 million, multigenerational investment, with maintenance adding \$2-3 million over and above that. To keep overall lifecycle costs in check, the management of upgrade costs, proven software portability and reuse have now become the key elements in COTS supplier selection. If defense contractors are unable to get realistic predictions of cost performance from their COTS suppliers, both for initial deployment and over the program lifecycle, they should look elsewhere for a supplier. Surprisingly, there only a few COTS suppliers that understand how critical this is to the life-cycle proposition.

Twenty years of experience with COTS has resulted in a formula for success that complements innovative technology with a programmed set of working relationships that bridge the gap between the government/military, defense contractors and the COTS community. It takes more than the typical customer/vendor relationship or the implementation of a volume purchase agreement for all parties to have a vested interest in the program's success. Forging and fostering strategic partnerships that span the program lifecycle is one of the ways to ensure that the COTS initiative can work in the marketplace. The COTS supplier base must now focus on methods for containing upgrade costs and providing a path for continuous cost reductions over the program lifecycle. These approaches must be standard considerations and be reflected in proposals obtained from the COTS source. The realization of the COTS promise is to merge cost-reduction with the vision of an adaptable family of products and flexible methods of doing business across the program life-cycle. Without this, COTS fails in the long-term.

### **COTS in Harsh Environments**

Many of today's military/defense programs can use commercial components with commercial-level cooling, operating temperatures, and shock and vibration ranges. Ground-based radar systems, receiving sonar systems, and some airborne applications utilize COTS without consideration for harsh or rugged environments. However, as systems deployed into the field become increasingly sophisticated more and more weapons systems are being deployed with computer subsystems that require consideration for harsh environments.

While, each 'rugged' COTS computer vendor has its own nomenclature for building boards and subsystems for harsh environments, the COTS requirements for ruggedization fall into four main categories:

1. Commercial components with no enhancements beyond the manufacturer's specifications. These systems are usually used in lab environments, or development platforms, and can be deployed in benign environments.

2. When a project requires an extended temperature range (-20°C to 65°C) and is subject to increased vibration, boards are conformally coated and fitted with a central stiffening bar.
3. In deployed environments, such as fighter aircraft, where temperatures and vibration are more extreme, additional measures are taken for operation in very harsh environments. Beyond the central stiffener and conformal coating, additional stiffeners are added to accommodate vibration levels. At this level conduction cooled designs can be used to accommodate the temperature requirements of -40° to 85°C.
4. In very harsh environments where temperatures range from -62° to 125°C compliance to full mil-spec standard is mandatory.

Each COTS supplier has a different approach to ruggedizing their products. Some vendors such as DY4 and Radstone develop products for extremely harsh environments. The specialized technologies employed by these companies results in products that are expensive and typically do not keep pace with the industry standard price/performance ratio (Moore's Law). In terms of performance per dollar, per watt, and per square inch, the design goals of these technologies are focused on different targets.

The companies that specialize in high performance embedded computing such as SKY Computers, utilize third-party partners to provide several levels of rugged high performance computer systems to their customers. SKY has just announced a partnership with an industry packaging expert who will take SKY's current generation of multiprocessor, the MPC7400-based Merlin and add the capabilities described previously as criteria #2 and #3. This partnership allows SKY to provide a family of products, as a one stop shopping source, to satisfy the full life-cycle solution.

### **One Vendor's Approach**

SKY Computers has been supplying COTS products for 20 years. The SKY approach is to develop a long-term partnership with the customer, and to work together during development, deployment, and well into the upgrade/retrofit phases. Our experience has helped us build our business in parallel to the requirements of the Government and the defense contractors. We are able to provide lifecycle costing and estimating that is critical to both the Government and the defense contractors to project and determine their overall lifecycle costs. We maintain flexibility in our working relationship with the defense contractors and we strive to understand the divergent

needs of different programs through consistent communication with program managers. This contact level has netted not only long-term customer relationships, but also an understanding of the changing needs of the defense/military marketplace as a whole.



*(Caption: The SKY Computers Merlin multicomputer is a COTS product build from the off-the-shelf MPC7400 microprocessors.)*

The foundation for SKY Computers' business is always a COTS solution with full life-cycle support. However as a leader in high performance computing technology, we routinely make adaptations to standard COTS products by reformatting, repackaging or by delivering program-specific enhancements. Programs whose needs are not fully met by COTS or hybrid COTS solutions can be addressed with technology licensing, strategic partnerships, or co-technology developments with SKY and its partners. This approach can often be the best solution for the defense contractor, keeping development costs at a minimum and creating a consistent flow of technology solutions.

SKY's model works for COTS and the industry is starting to stand up and take notice. Recent program wins have confirmed that being the biggest is not always, as important as, being adaptable and providing the right program solution.

For complete information on SKY Computers go to [www.skycomputers.com](http://www.skycomputers.com), or call one of our regional sales offices.