

Overcoming the Achilles Heel in Today's Aerospace and Defense (A&D) Weapon Systems Development

Why the Lack of Access to Timely, Accurate Product Data Hobbles A&D Programs, and How PTC's Unique Approach to Total Lifecycle Systems Management Can Fix It

The wars in Iraq and Afghanistan have exposed critical gaps in U.S. military readiness and now provide vivid examples of the ever-present need to stay ahead of an adaptive enemy. The U.S. military has responded by fielding new and upgraded weapon systems more rapidly than ever before, but this response has presented its own set of readiness challenges.

As the array of fielded systems has grown in cost and complexity, so too has the logistics footprint. The impetus to rush new capabilities into theater often outweighs the need to spend precious time analyzing how to optimize maximum availability at minimum cost. The result? U.S. forces find that their weapon systems are not always available when needed, in large part due to the poor flow of accurate information from product design to product sustainment.

To solve this problem – without introducing unacceptable delays in effectively equipping the Warfighter – dramatic improvements are needed to provide accurate, authoritative, and readily available sources of detailed product data on all weapon-systems configurations throughout a product's lifecycle.

“Implementing lifecycle management is a top priority for the Department of Defense. To achieve that objective, DoD must seamlessly integrate its acquisition and lifecycle sustainment policies.”

- Memorandum of the United States Under Secretary of Defense for
Acquisition Technologies and Logistics,
July 21, 2008

Pitfalls of Poor or Inaccessible Product Data

When the correct information is not available, and the demands of schedule cannot be moved, improvisation is the logical result, as evidenced by the MRAP platform on numerous occasions. The problem is that these improvisations occur in different entities throughout the value chain, all the way down to the Warfighter. Configuration-managed product data that once started from the OEMs' engineering activity has been dissected, repurposed and distributed across a host of applications and environments. Assessing the impact of change, and rapidly responding to mission or requirement changes, perpetuates and exacerbates the guesswork, adversely affecting readiness and performance in the field.

US DoD Policy Guidance Is on Track, But Systems Need to Be Re-engineered

Although not new, the problem of poor or inaccessible product data is fast becoming acute. The latest US DoD policy guidance, released on December 2, 2008, recognizes the issue and provides a host of techniques to help guide the acquisition communities through the process of producing highly complex, engineered systems to support the Warfighter. Total Life Cycle Systems Management (TLCSM) is that very framework: a disciplined prescription for how to deliver weapons systems that perform as required in a fully enabled support environment.

One of the tenets of TLCSM, System Operational Effectiveness (SOE), promotes a normalized view of the system in terms of effectiveness throughout the lifecycle. As shown in Figure 1, SOE is the composite of performance, availability, and process efficiency, and system life cycle cost. SOE explains the dependency and interplay between system performance, availability (reliability, maintainability, and sustainability), process efficiency (system operations, maintenance, and logistics support), and system life cycle cost.

System Operational Effectiveness

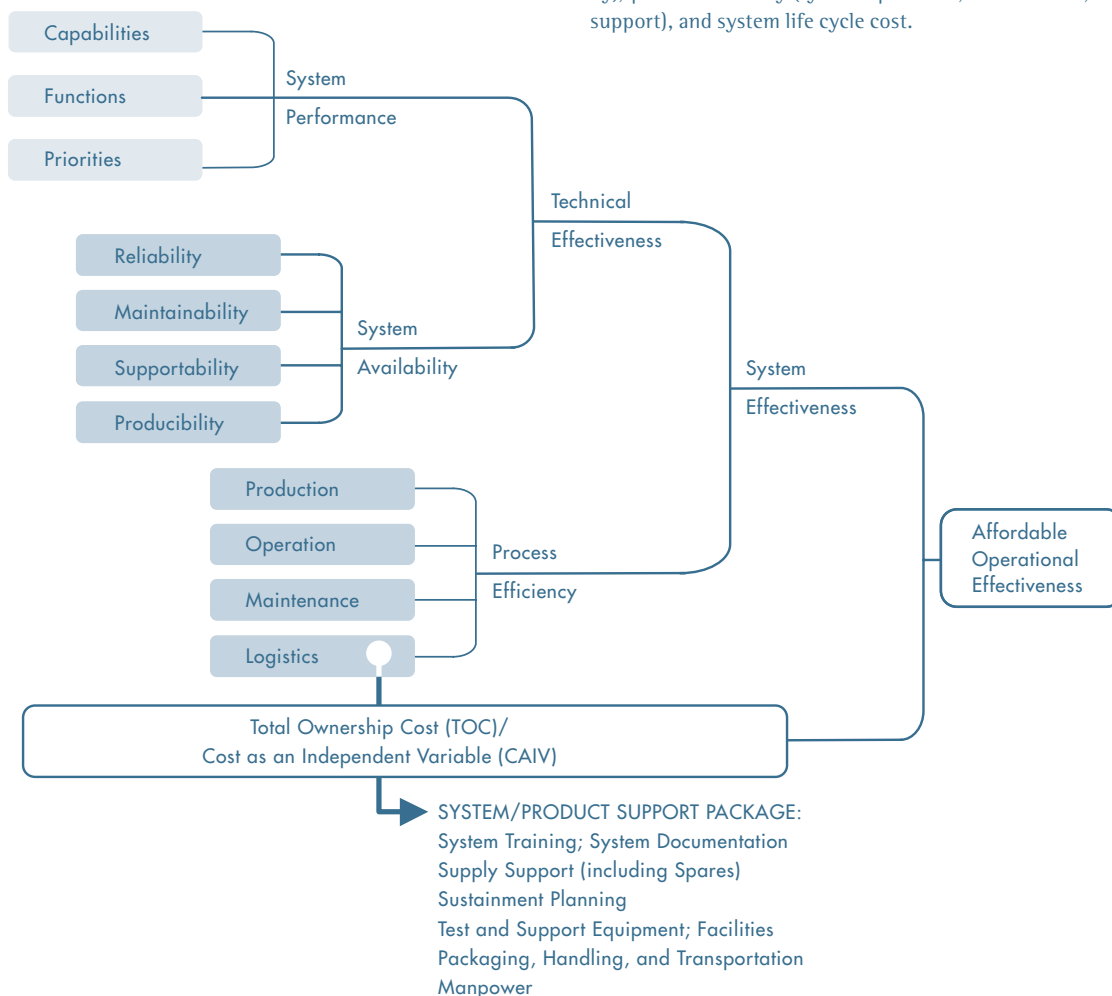
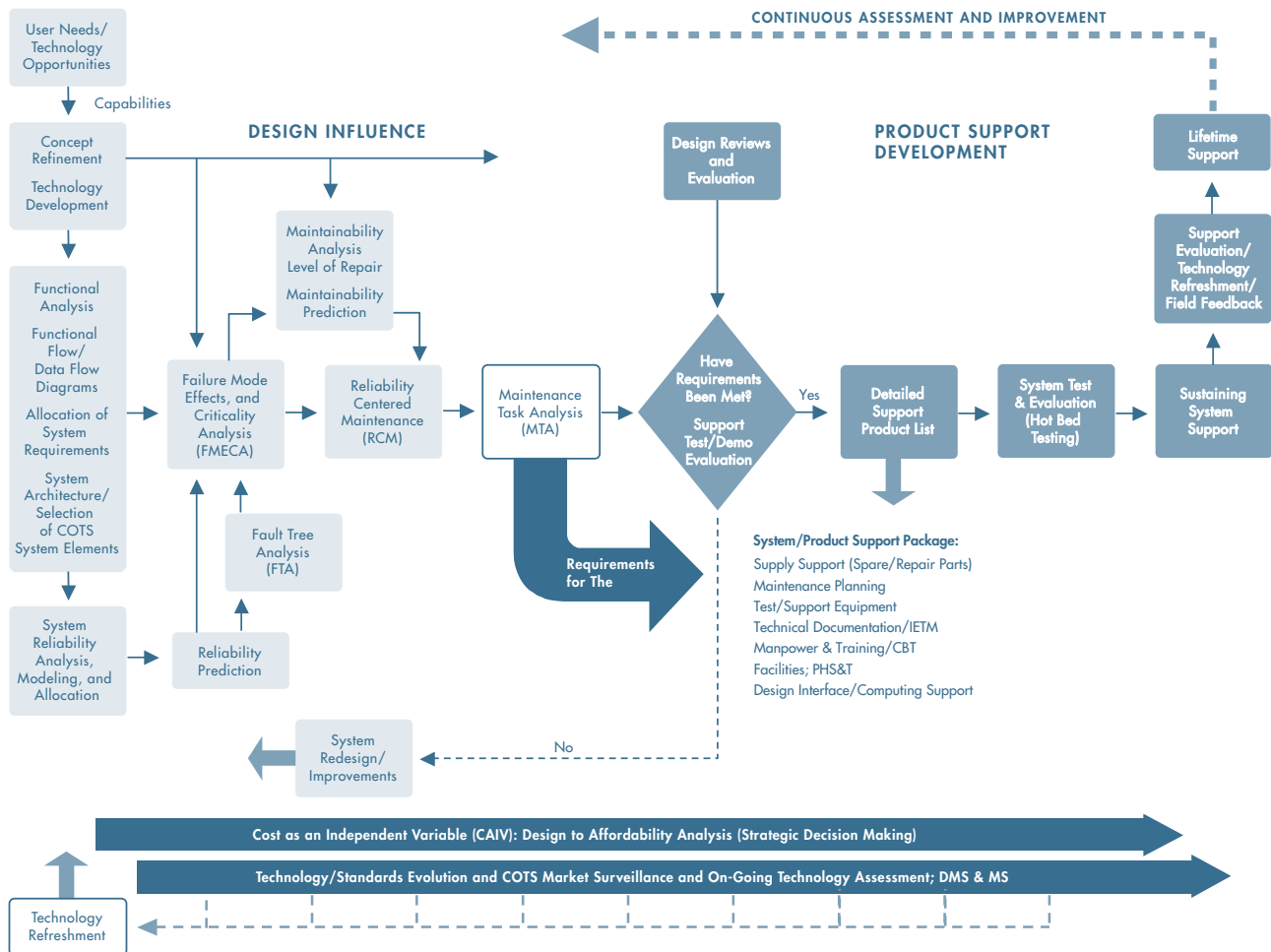


Figure 1. US DoD's approach to System Operational Effectiveness (OSD 2003)

SOE Lifecycle Framework



The methods and practices reflected here are applied iteratively, particularly for evolutionary acquisition and spiral development. Figure has been adapted from: Verma, D., T. Parry, and J. Beck, Maximizing Operational Effectiveness through Acquisition Logistics, Proceedings, NDIA Conference on Systems Engineering, San Diego, October 2003.

Figure 2. The US DoD SOE LifeCycle Framework, linked to the Systems Engineering Process (OSD 2003)

SOE is accomplished by influencing early design and architectural considerations as well as focusing on sustainment outputs. Reliability, reduced logistics footprint, and reduced system life cycle cost are most effectively achieved through inclusion from the very beginning of a program—starting with the definition of required capabilities. This process is depicted as the SOE Lifecycle Framework in Figure 2.

By contrast, today, we traditionally see a functional or physical representation of the system. For example, Requirements are typically written and constructed in a functionally based hierarchical structure while the Detailed Design (CAD) is typically a physically based hierarchical structure. People are always working—with a lot of effort—to map the two and maintain relationships between the two. Normalizing the picture in terms of effectiveness eliminates the extra effort. The SOE framework is designed to put everyone on the same playing field, reading from the same play book. Further, TLCSM looks at this problem from a global perspective, embracing the total system and the complete lifecycle in a way that will transform program management and execution for the better.

While TLCSM sounds like a compelling new paradigm, it still poses fundamental questions for any OEM:

- What then do I do as an OEM for a fielded platform?
- How do I begin to institutionalize a normalized view of a highly complex, highly engineered system developed over the past 15 years across a distributed value chain, part of which might not even exist today?
- How do I react and respond to new demands on schedule, when I barely understand what the requirement is?

The Lifeblood of Operationally Effective Weapons Systems: Product Data

The answers to the above OEM questions all start and end with product data. But what exactly do we mean by “product data”? Every single attribute, every test report, every requirement, every drawing, every thought, every nugget of information that defines the “who, what, how, where, when and why” for that weapon system, throughout the complete lifecycle, constitutes product data. An OEM’s daily reality mirrors the data maze; there are issues of intellectual property and standards, as well as myriad other factors that impede the seamless ebb and flow of accurate data.

One of the key issues in managing this product data is the very construct of how the information is represented. Today, a typical OEM might have dozens of systems for capturing various components of this product information throughout the organization. These disparate silos of product content are fragmented and disjointed, with independent release and change management processes that are rarely, if ever, correctly synchronized. Consequently, there is a pressing need to figure out how to consolidate and synchronize the information across key development and sustainment processes.

What Does a Typical OEM Lifecycle Environment Look Like?

Figure 3 (below) depicts this data management problem in the form of fragmented systems and data silos, which must somehow be synchronized and integrated to facilitate TLCSM.

To say the least, this environment is complex, and does not take into account that the government originally conceived of the idea, contracted for it, and also operates the end product. It’s also important to consider that countless additional information sources also exist within those organizations, further complicating the data management issue.

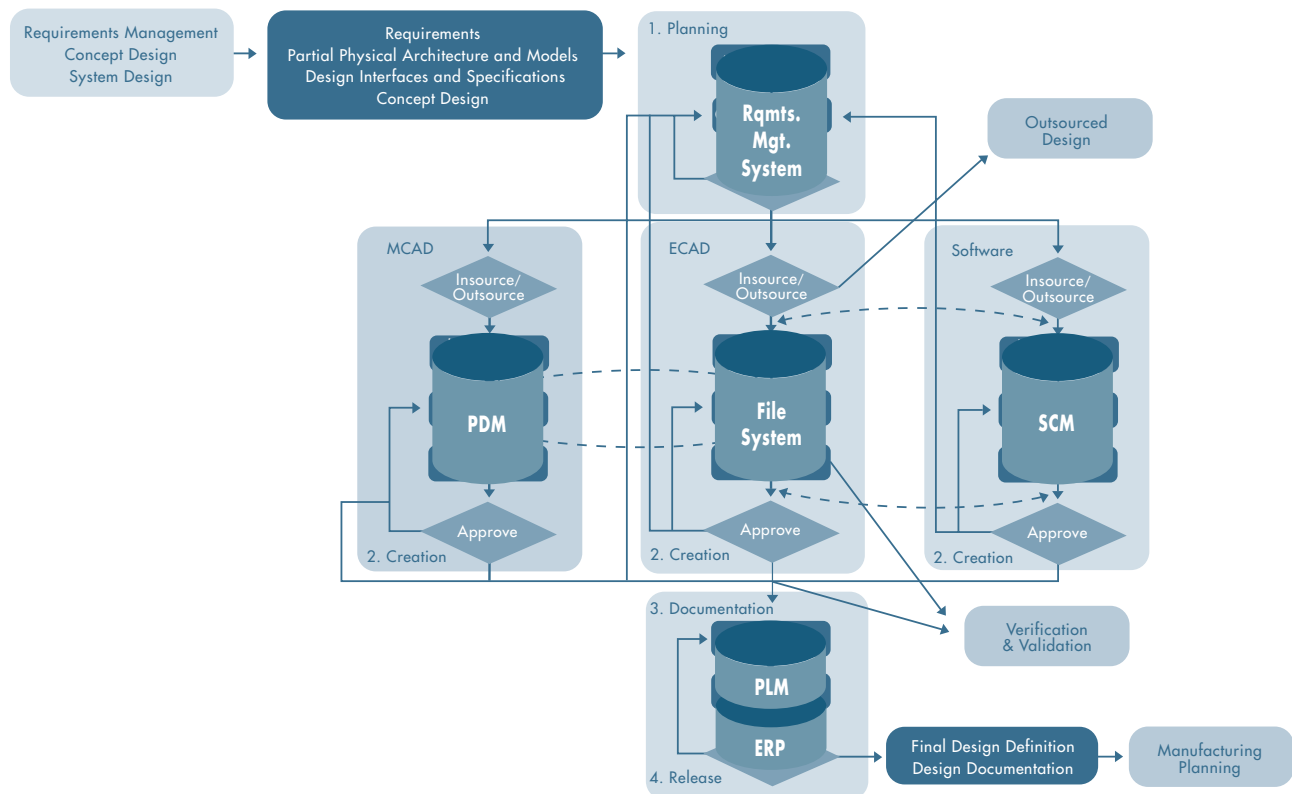


Figure 3. The Fragmented Product Life Cycle Environment in A&D Weapon Systems

PTC's Approach to Transforming Program Management

The US DoD has identified the need to approach things systematically. But how can you ever begin to manage, control and leverage this information in a normalized way, let alone in terms of affordable operational effectiveness?

Enter PTC. PTC is all about smart and dynamic management of product data. After establishing the de facto standard for engineering design software with Pro/ENGINEER 3D CAD (computer-aided design) software in the late 1980s, PTC has spent the last 10 years acquiring and developing products to support one mission: providing a framework and environment to manage the golden nugget of product development: product data. Our strategy and successful track record have been guided and strengthened by the needs of our many A&D customers, for whom smart management of product data is the currency of their success.

At the grass roots, our customers philosophically understand the need to relate and aggregate information. It started simply with the vision of "associativity". Associativity means that each individual artifact is fully associated with its surrounding artifacts; every artifact is ready to respond if a single parameter changes. For instance, if a dimension to a pump shaft is changed, the corresponding bearing automatically changes with it.

Enabling the smart management of information using PTC's associative solutions is gaining rapid momentum throughout every industry. And the latest guidance on defense policy only serves to highlight their critical role in designing for support and supporting the design.

What Differentiates PTC's Approach To Life Cycle Management?

PTC is the only Product Lifecycle Management (PLM) software company that is singularly focused on helping companies solve the complex problems in managing and synchronizing product data. Our technology solutions represent product information in a variety of ways: relationally, hierarchically, functionally, graphically and organizationally.

Moreover, our products are architected in way to be able service this product information to and from different applications, organizations, individuals, and other entities across the total system life cycle. Further, we think like systems engineers: we think about the process and we think about the life cycle. Fundamentally, our products must support processes end-to-end across the life cycle, as well as across the enterprise and beyond—even into the extended supply chain. Our systems are reliable, scalable, functional and, most importantly, interoperable with other systems that make up the IT ecosystem.

The CIO's dilemma expressed earlier in this paper is here to stay. Specialization is paramount to achieving the best end result – that is, the most operationally effective system. When it comes to a complete product lifecycle management solution, there can be no "Jack-of-all-trades", as too much is at stake. PTC firmly believes this philosophy and has architected its products "from the ground up" to support this ideology. As good as we must be at managing and organizing the information, we place equal emphasis on being stewards of the product data community, able to interoperate with any and all comers.

PTC's Proven Track Record in the Most Demanding Digital Environments

Today, PTC products support the most complex, the most highly-engineered, and the most globally developed products across the broad spectrum of Aerospace and Defense (A&D) environments.

PTC process and technology solutions provide the foundation and enabling infrastructure for managing integrated and interoperable digital environments, such as the:

- Advanced Collaborative Environment (ACE) for the US Army's Future Combat System
- Integrated Collaboration Environment (ICE) for NASA's Constellation Program

Most recently, after an exhaustive, independent benchmark involving the world's leading PLM (Product Lifecycle Management) providers, PTC was selected as the technology backbone for managing the Master Product Definition of the EADS consortium, ultimately to support tens of thousands of users. (For more information, please click on www.ptc.com/go/eadsphenix.)

These examples share a common digital thread: they are all characterized by a single application, managing the authoritative source of product data.

PTC's Vision For Realizing Effective TLCSM

Building on 20 years of technology leadership in Aerospace and Defense, PTC is committed to expanding the richness of the capabilities we offer, the footprint of the processes and functions we support, and the scalability and flexibility within the domain of enterprise class software.

Our focus centers on the idea of realizing the infinite task. PTC's closed-loop TLCSM solution capability (shown in Figure 4 below) maps directly to the US DoD's SOE framework (see Figure 2 on page 3) and guides our company's strategic product development and acquisition initiatives.

PTC's focus is predicated upon enhanced systems engineering capabilities for life cycle management, where product development processes are fully integrated or interoperable with product support processes. Beyond integration and interoperability, PTC's value proposition includes a framework for closed-loop feedback and analysis that enables organizations to learn and improve, leveraging the IP and knowledge derived in the lengthy sustainment phase of a lifecycle.

Summary

The TLCSM era has arrived. In a single environment, PTC can address your TLCSM needs, as the proven market leader for PLM turnkey enterprise tools and interoperable technologies that:

- Enable life cycle product development and life cycle product support
- Deliver affordable operational effectiveness
- Equip the Systems Engineer for enhanced effectiveness, across the enterprise and across the life cycle
- Enable scalable management of a portfolio of Performance-based Logistics (PBL) contracts geared towards optimal supportability of the Warfighter.

For More Information

To learn more about how Arbortext can help your company create and deliver high-quality product information, please visit our website at:
<https://www.single-sourcing.com/>

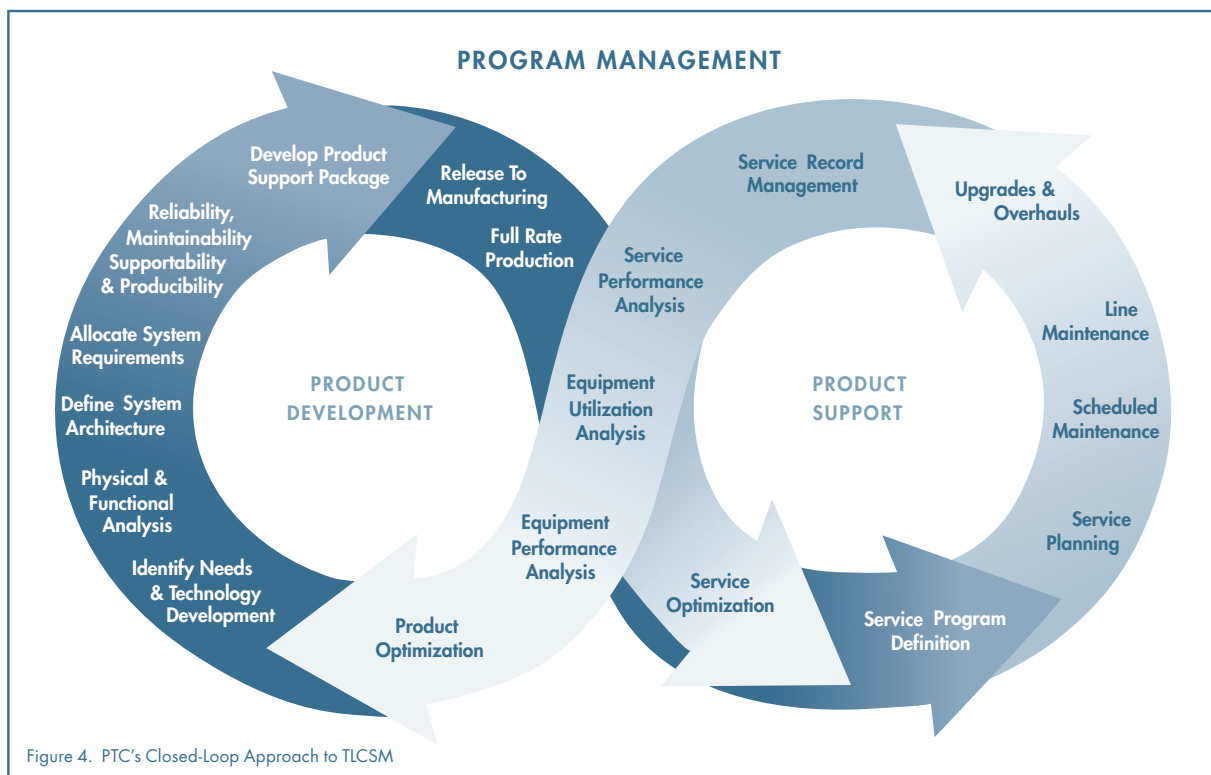


Figure 4. PTC's Closed-Loop Approach to TLCSM