

TCS Engineering & IT Support for A&D Value Chains

CIMdata Commentary

Key takeaways:

- *A&D value chain processes and technologies have to support a wide variety of complexities including development cycles of five to ten years; increasing complexity of systems, materials, and electronics; strict compliance and maintenance requirements; and decades long service lifetimes*
- *A critical concern in most A&D related companies is knowledge loss; over 35% of employees are baby boomers who started retiring in 2008*
- *Many product-related IT systems are obsolete and need to be replaced to support increasing business and product complexity as well as to capture and manage the knowledge that is leaving through retirement*
- *TCS provides A&D companies a broad and deep mix of technical services ranging from R&D, cross-functional and specialized engineering, as well as supplying parts, sub-assemblies and assemblies through an eco-system of Tata Group companies and IT consulting and systems integration support*

A&D products are among the most complex products man has developed. They push the limits of known sciences. Historically, the product complexity existed in silos, but advancements in strategy and enabling technology have allowed A&D products to become integrated systems and systems of systems to meet evolving requirements. The growing requirements that increase complexity include product capabilities, value chain complexity, new materials, compliance, information technology changes, and an aging workforce.

Aircraft, land vehicles, ships, and weapons have many components that need to function as an integrated system to meet business or mission requirements. Mechanical, structural, electrical, communication, navigation, and powertrains need to work together as a system of systems. Electronics and software are the glue that enable systems integration. Software is used to add capabilities while making products easy to use and reliable in operation, but ensuring that the software interfaces with and controls hardware effectively and correctly is not simple to achieve.

Like other industries, A&D is moving to a supply chain-based configuration. Suppliers or subcontractors design and manufacture many of the systems and subsystems used in products. The OEM or prime contractor is responsible for the overall product but delegates production, and sometimes design responsibility to the suppliers. Ensuring suppliers have current, accurate information to work from, and keeping track of their progress and performance are complex tasks that add risk to programs and projects.

Advancements in electronics and software are not the only areas of innovation. Materials science has seen a renaissance in recent years due to composite structures and additive manufacturing. Both of these areas are changing the way products are designed, produced, and supported. The manufacturing processes typically become more coupled to the design leading to more complexity because changes in the part design can have significant impacts on the manufacturing process. Furthermore, communication limitations in the organization as well as among IT systems (e.g., transforming the EBOM to the MBOM) can make supporting changes difficult.

Compliance impacts many facets of the civilian and defense markets. Environmental requirements include reporting of the presence of materials, such as conflict minerals, and the roll up of hazardous substances. Project costs driven by requirements and schedule changes can have a significant impact on finances and must be reported to support financial compliance. In the defense market ITAR reporting requirements are critical to ensure that national security rules are not violated.

A&D products have some of the longest lifecycles in industry. Aircraft can have a useful life of more than 50 years, and aircraft carriers have a target life of 100 years. During the lifecycle there may be redesigns and upgrades installed after delivery, and managing replacement and maintenance parts is absolutely essential. In contrast, enterprise IT solutions has a typical lifespan of about 10 years before a major upgrade is required, so it is easy to see that product definition data will need to be migrated through several IT systems over the typical A&D product lifecycle. Unfortunately, many A&D systems are running on very old IT. While newer products are developed on newer platforms, legacy products and data remain in their original, out-of-date environments.

Much has been written about the aging workforce in A&D. Many products in use today were designed using drafting boards. The current drawing-based records describe what was designed, but not why it was designed the way it is. This knowledge is stored in the heads of the retired and soon to be retired. Capturing that knowledge is a critical gap that CIMdata regularly hears about in its industrial consulting activities.

There is no silver bullet to solve A&D complexity issues. To address them, companies need to take a holistic view of their business, identify issues and develop an end-to-end strategy. A roadmap that leverages commercial off-the-shelf (COTS) solutions and supports flexible frameworks that are proven to solve a company's issues must be developed and implemented. An implementation plan, and enlisting partners that have the scale, resources, industry knowledge, and track record will help ensure that complexity can be successfully managed.

TCS's A&D Offering

Tata Consultancy Services (TCS) is one of the largest global enterprises focused on providing IT and engineering services, consulting, and business solutions. Their over 340,000 employees support virtually all industries. Within A&D they have over 2,800 engineers supporting a wide variety of programs, a variety of A&D solutions to support the value chain, and are certified by AS9100 and CEMILAC and also have solutions that can be made compliant with ITAR.

Figure 1 shows the areas where TCS engages with the A&D Industry. In addition to IT-related services for which they are well known, TCS has significant capabilities in engineering, design, and R&D.

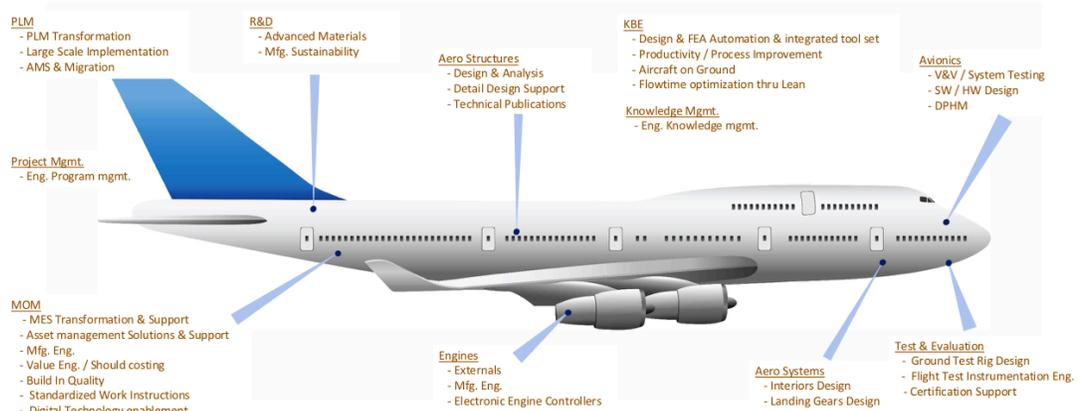


Figure 1—TCS’s Areas of Engagement with A&D

TCS has Centers of Excellence (CoEs) for aerodynamics, structures, engines, systems, interiors, avionics, and manufacturing engineering. The engineering teams work for a who’s who of aerospace and defense companies including 8 out of the largest 10 Aerospace & Defense companies. TCS is especially proud of their work in avionics, where they have developed and qualified their own Integrated Modular Avionics (IMA) platform to support one of India’s new civil aircraft programs.

TCS has developed an A&D Process Reference Model they use to engage with clients across the product lifecycle. The model enables TCS to help clients identify the appropriate areas for improvement based on their maturity. TCS then uses their industry knowledge and experience, technology, and resources to address the customer’s issues. For a North America based large commercial aircraft OEM, TCS’ knowledge-based engineering tool has saved 100,000 hours of effort resulting in design cycle time reduction for fuselage design.

Other A&D successes noted by TCS include a 30% increase in throughput and a 20% reduction in rework and rejections at a major aerospace engine manufacturer through the use of a TCS developed manufacturing engineering solution. TCS also claims a manufacturing execution system developed for a North American airframe manufacturer reduced aircraft assembly time by 10%. TCS helped another North American A&D company reduce supervisor-walking distance by 10 kilometers per week during aircraft assembly by providing mobile access to product data.

Within the PLM market, TCS is well known as a full service systems integrator with solutions that cover the breadth and depth of the product lifecycle across many industries. Product Development Information Technology (PDIT) is TCS’s service offering to optimize and transform the entire product lifecycle. CIMdata previously [reviewed PDIT¹](#) and found it to be comprehensive and able to support the complex IT system issues faced within A&D including strategy, development, implementation, integration, application and data migration and upgrades while supporting ITAR and Export Administrative Regulations (EAR) compliance.

Perhaps the most intriguing solution developed by TCS is Diagnostic Prognostic Health Monitoring (DPHM), an IoT solution. By leveraging data from engine sensors TCS was able to create a solution to monetize the data within a Premium Engine Service program. Predictive analytics are used to forecast maintenance and repairs reducing aircraft downtime.

¹ <http://www.cimdata.com/en/resources/complimentary-reports-research/commentaries/item/3426-tcs-pdit-holistic-product-development-it-systems-transformation-commentary>

What makes TCS exceptional is their use of large scale IT systems and technology to support their A&D product development and production work. Their engineering and IT skills enable TCS to develop knowledge management solutions and knowledge based engineering solutions that capture critical knowledge and enable consistent application and reuse as the knowledge is developed. This helps reduce the impact when people with critical knowledge retire or leave the company as well as improve quality, cost, and time to market on projects they work on.

Conclusion

The A&D business has many complexities. While product performance is still the most important criteria, A&D companies must also meet their business targets. The profitability of A&D product and service portfolios is always under pressure from competition as well as business environment complexities. To effectively address the complexities and challenges companies need to have a holistic strategy that leverages their strengths and reduces the impact of their weaknesses across the whole A&D lifecycle. In order to realize their strategy, A&D companies need to select a service provider who has the product and technical domain knowledge and the right IT skillset to deliver the desired transformation.

TCS's long-term engagements with its well known customer base demonstrate that it has the technical and consulting experience and expertise to develop and deploy holistic solutions to meet the requirements of A&D companies. CIMdata sees TCS's support for R&D, product development, and IT as an excellent example of providing value to an industry, and TCS has capabilities and solutions that can support their customers anywhere within the lifecycle, or across the complete lifecycle. A&D companies looking for help with product development and related IT services should reach out to TCS.

About CIMdata

CIMdata, an independent worldwide firm, provides strategic management consulting to maximize an enterprise's ability to design and deliver innovative products and services through the application of Product Lifecycle Management (PLM). CIMdata provides world-class knowledge, expertise, and best-practice methods on PLM. CIMdata also offers research, subscription services, publications, and education through international conferences. To learn more about CIMdata's services, visit our website at <http://www.CIMdata.com> or contact CIMdata at: 3909 Research Park Drive, Ann Arbor, MI 48108, USA. Tel: +1 734.668.9922. Fax: +1 734.668.1957; or at Oogststraat 20, 6004 CV Weert, The Netherlands. Tel: +31 (0) 495.533.666.