AEROSPACE
& DEFENSE

Q&A
TOTAL QUALITY MANAGEMENT

Dive into the world of total quality management (TQM) with Dassault Systèmes. Learn how the **3D**EXPERIENCE platform elevates aerospace and defense operations through a model-based approach, ensuring precision, innovation and quality across the product lifecycle.

Crucial TQM questions answered by our team of experts:

Enrico Scharlock | Aerospace and Defense Solution Experience Senior Director, DASSAULT SYSTÈMES
Francisco Rivera | Quality Industry Process Senior Specialist , ENOVIA
Guillaume Belloncle | MBSE Strategic Engagements Director, CATIA
Ron Watkins | Industry Process Expert, DELMIA
Stephan Erben | Senior Product Portfolio Manager, NETVIBES

Click here for an expanded view.

DASSAULT SYSTEMES

TOTAL QUALITY MANAGEMENT WITH DASSAULT SYSTÈMES

1. Can you describe how Dassault Systèmes' solutions enhance and support quality management through a 3D model-based approach?

With the collaborative **3D**EXPERIENCE® platform, model based systems, design and manufacturing engineering have become the standard to run a program from the first idea until the support and service in operations. Embedding the total quality management (TQM) process into the daily business process of program management and engineers, as well as into 3D modeling and simulation, is a key enabler to drive **quality proactively**, making it visible and **top of mind** for everyone in the company.

The use of a **3D model-based virtual twin** from the very start of product innovation sets the stage for a proactive collaborative platform to ensure quality throughout the lifecycle of the product. Linking quality information to the 3D model also enables quality data and knowledge management directly related to the virtual twin of an aircraft and systems, driving continuous quality improvements. Failure mode and effects analysis (P-FMEA/D-FMEA) utilizing the virtual build can identify potential quality issues and recommend controls and resolutions in the real world.

2. What are the main quality challenges encountered by customers and how do Dassault Systèmes' solutions facilitate the integration of TQM principles within the aerospace and defense industry workflows?

The aerospace and defense industry has recognized the significant benefits of adopting quality standards for enhancing collaboration between original equipment manufacturers (OEMs) and their value chain. This realization comes amidst an **industry-wide prioritization of quality**, quality-related standards, and the necessity of having quality experts on hand, which emerged as top priorities for aerospace OEMs and suppliers in 2023. Despite the reliance on various disconnected tools for managing tasks and documentation related to the advanced product quality planning (APQP) standard, much of the effort to control quality has been reactive, focusing on addressing issues as they arise in manufacturing and maintenance operations.

Dassault Systèmes' TQM solution aims to transform this reactive approach into a proactive **continuous improvement process for quality**. By offering an end-to-end (E2E) solution with digital continuity from engineering to operations, coupled with an integrated feedback loop for managing non-conformance and corrective and preventive actions (CAPA) based on real operations data, companies can shift from firefighting to actively improving quality. This continuous improvement loop, built atop the APQP standard, facilitates increased overall equipment effectiveness on the shop floor, **timely** and **first-time quality delivery** within the extended supply value network, and a **reduction in the total** cost of quality.

Concretely, Dassault Systèmes enables:

- **Synchronization of data**: Providing a flexible E2E platform solution for managing and interacting with design, manufacturing, quality, material, schedule, and requirements data
- **Prevention of defects**: Utilizing a virtual twin that models the product, processes, and required resources, allowing for simulations and comprehensive FMEA for both the process and design
- **Actionable data**: Implementing data-driven quality management and model-based safety design capabilities to enhance quality management throughout the product lifecycle

Through these strategies, Dassault Systèmes is not just addressing the current demands for quality in the aerospace and defense industry but is also setting a foundation for future advancements in quality management and operational efficiency.

3. Considering the extensive capabilities of ENOVIA, CATIA, DELMIA and NETVIBES, how do these solutions collaboratively enhance TQM across not just manufacturing but also maintenance, repair and overhaul (MRO) and operations?

The journey towards TQM and MRO operations begins with the foundational capabilities of the **3DEXPERIENCE** platform and ENOVIA. These systems manage design data, best practices, quality procedures and the change management process, ensuring quality throughout the entire lifecycle and setting a standard for continuous improvement.

To accelerate this process, the management of non-conformances and the CAPA process is enhanced through the automatic execution of standard quality processes provided by **ENOVIA** and the **3DEXPERIENCE** platform. This enables the rapid analysis and implementation of necessary corrective actions and engineering changes, streamlining the resolution process towards manufacturing and maintenance execution.

CATIA brings another layer of precision with model-based FMEA utilized for ensuring safety. Design FMEA is conducted directly on the 3D model of the product, identifying potential risks that can be mitigated through improvement actions. Similarly, process FMEA applied to the manufacturing process definition minimizes operational risks through targeted improvement actions, securing benefits long before the product is manufactured.

The **DELMIA** brand enhances manufacturing and maintenance operations management by providing the technology and business processes necessary for executing operations within the context of operations and quality data management. DELMIA Digital Manufacturing introduces the virtual twin for the product and process and defines the as-planned manufacturing and quality baseline, which is used both for simulation and execution. DELMIA manufacturing operations management (MOM) adheres to this plan with a guided manufacturing process that directs operators through each step, integrating quality as an essential component of the workflow.

Further enriching the TQM framework is the ability to capture data from the workforce, machines, sensors, and other IIoT (industrial internet of things) data sources, seamlessly interfacing with **NETVIBES** Data Perspective solutions. NETVIBES excels in leveraging and harmonizing structured and unstructured data to reveal and share quality KPIs and trends, and predict future quality impacts. Through machine learning and AI capabilities, NETVIBES transforms numerous quality-related data sources into actionable insights, fostering continuous optimization.

Together, ENOVIA, CATIA, DELMIA and NETVIBES form the **robust backbone** of TQM for manufacturing and MRO operations, ensuring a comprehensive approach to quality management that is both **predictive and proactive**.

4. In the context of TQM, how does Dassault Systèmes suggest aerospace and defense companies manage and improve quality across their extensive supplier ecosystem?

In the realm of APQP, a crucial aspect of the quality management process within the extended supply chain is delineated by the production part approval process (PPAP). The integration of the supply chain with the OEM on the **3D**EXPERIENCE platform revolutionizes the manner in which suppliers manage collaboration, data exchange and reviews for the 18 required PPAP qualification documents. **This approach transitions from the traditional, disconnected, document- and email-based processes to a digital, largely model-based methodology**. Such a transformation facilitates significant gains in visibility, innovation and improvements by collaboratively working towards enhanced quality objectives. This proactive strategy is key in identifying and mitigating potential quality risks before their manifestation, thereby elevating quality across the extended supply chain.

Dassault Systèmes further empowers this collaborative ethos by extending quality business processes into the supply chain. This encompasses critical operations such as supplier qualification, PPAP, source inspections, audits, design reviews, change management, root cause analysis (RCA), and the resolution of supplier corrective actions. Through these mechanisms, **Dassault Systèmes not only fosters a more integrated and transparent quality management process but also ensures that quality objectives are met and exceeded, highlighting the importance of collaboration and digitalization in achieving superior quality outcomes in the supply chain**.

5. How do Dassault Systèmes' solutions assist aerospace and defense organizations in identifying, assessing and mitigating quality risks in line with TQM practices?

Dassault Systèmes' solutions and TQM best practices are rooted in the APQP standard processes. This framework allows for the identification of quality risks at virtually any stage within the aircraft lifecycle. Leveraging the capabilities of the **3D**EXPERIENCE platform, these solutions enable the capture, identification and classification of quality risks at any phase as a crucial input for quality issue management. This encompasses a broad spectrum of data sources, from workforce communications in documents or communities to standardized template-based FMEA, model-based and quality-related simulations, first article inspections, and quality control, data collection, and analysis in manufacturing and maintenance operations. Beyond merely capturing and sharing extensive quality data, the integration of automated processes, platform, and best practice-based recommendations alongside intelligent corrective actions, facilitates achieving quality right the first time.

The recommended best practice in aerospace and defense is to prioritize the virtual aspect to build preventive quality from the early stages of the product lifecycle when the cost of improvements is notably lower. Potential quality risks may arise from various phases such as ideation, design, simulations, virtual trade studies and directly on the manufacturing shop floor. This indicates that roles across engineering, tooling, testing, suppliers, marketing, project management, sustainment, manufacturing, shop floor and quality departments all have the potential to introduce risks. **These risks are then integrated into a common product thread, making them reviewable in a comprehensive manner**. This strategic approach ensures that potential quality issues are identified and addressed across all stages of product development, enhancing the overall quality and reliability of the final product.

6. With the increasing complexity of aerospace products, how do Dassault Systèmes' software tools help in analyzing quality data?

Dassault Systèmes' solutions, grounded in a model based enterprise approach, utilize the core APQP technical quality management data in conjunction with model-based design, manufacturing engineering and operations. This synergistic approach offers early, in-depth, and continuous insights into quality data, enabling automated and continuous learning to distinguish between good and bad quality. This is particularly vital in aerospace and defense, where the complexity of the flying systems necessitates understanding past quality issues. Learning from these issues and connecting to new model-based aircraft system engineering is essential to navigating the future of manufacturing and maintenance for first-time quality operations.

By adopting a **data-driven strategy that can detect unexpected events across the design, engineering, supply chain, manufacturing, product delivery, and even customer feedback**, this solution streamlines investigations to promptly determine immediate corrective actions and identify root causes. This preemptive approach aims to prevent recurrence of the problem.

The ability to have a 360° view of the products, operations and processes facilitates informed decision-making on a daily basis as soon as quality deviations, issues, claims or derogation requests are identified at any step in the value chain. Learning from the past to enhance the future involves:

- Training artificial intelligence models on historical data to pinpoint event sequences that could lead to quality issues. **Providing early warnings about potential quality drifts** to allow business users to preempt problems.
- **Detecting recurring quality** issues in similar contexts or on similar types of products to identify emerging problems warranting further investigation.
- This extensive feedback loop aids in **pinpointing the root causes of problems**, initiating CAPA or change requests (CR). In the long term, this contributes to reducing capital expenditure (CAPEX) by delivering more reliable products, thereby enhancing overall product quality and operational efficiency.

7. Implementing TQM often requires a significant cultural change within organizations. How does Dassault Systèmes support aerospace and defense companies in fostering a culture of quality and continuous improvement?

Technology alone is insufficient for executing a TQM transformation that impacts nearly every team within an organization. The key to success lies in the amalgamation of new processes, organizational change, transparency, and a holistic view of quality, risk, opportunities, innovation, and most importantly, leveraging the global workforce's knowledge and know-how for quality prevention and improvements. Dassault Systèmes goes beyond merely providing technology and applications on the **3D**EXPERIENCE platform; it offers recommended business processes, best practices, and years of consulting expertise to guide the entire organization towards embracing TQM across the enterprise and supply chain.

To embed a quality culture effectively, it must be supported and promoted from the top-down, with metrics and incentives aligned towards fostering good quality practices, making quality adherence a natural aspect of the organizational culture. The **3D**EXPERIENCE platform plays a pivotal role in this cultural shift by enabling the standardization of quality processes, metrics, dashboards, and gates across the organization. **This standardization ensures uniformity in practices and standards, fostering a culture of collaboration, continuous improvement, and enterprise-wide quality**.

At Dassault Systèmes (3DS), we enhance this transformation through our 3DS value engagement process, dedicating significant time to understand our customers' businesses, identify their challenges and quantify the potential value creation. This collaborative approach, once agreed upon in the joint value definition, leads to a mutual commitment to advance, further cementing the foundation for a successful transition to TQM. This comprehensive support structure ensures that organizations are not just implementing new technologies but are also adopting a culture and practices that perpetuate quality improvements and operational excellence.

Discover more: Elevating Quality, Empowering Your Vision

OUR TEAM OF EXPERTS

Enrico Scharlock, A&D

Enrico is the **Dassault Systèmes Aerospace and Defense Solution Experience Senior Director**. Since 2017, he has been providing leadership and strategic direction for the company's aerospace and defense end-to-end **3D**EXPERIENCE solutions focused on manufacturing and aftermarket. Working with our global customer base, Enrico focuses on addressing customers' challenges in these domains.

Francisco Rivera, ENOVIA

Francisco is a seasoned **Quality Industry Process Senior Specialist** with over a decade of experience. He joined Dassault Systèmes in 2021, where he applies his knowledge on quality management. With a stint on the shop floor of a leading automotive OEM, Francisco delved into the core of manufacturing excellence, understanding its nuances firsthand. Transitioning to software product management, he engaged with global clients, tailoring technology solutions to enhance manufacturing processes. His multicultural leadership approach enables him to implement technology tailored to manufacturing needs worldwide.

Guillaume Belloncle, CATIA

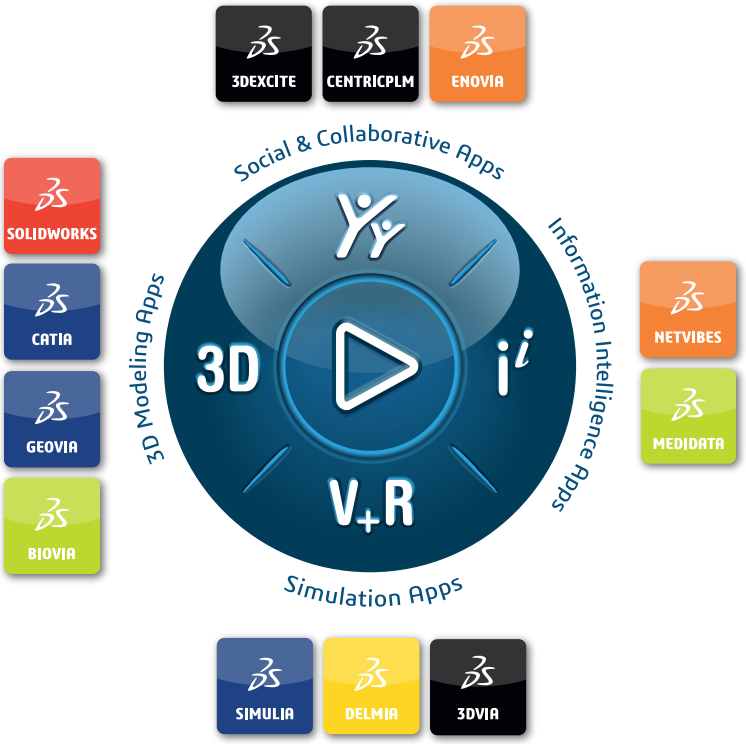
Guillaume joined Dassault Systèmes 18 year ago. He has 12 years of experience working with clients from multiple industries in systems engineering projects. He is currently **CATIA MBSE Strategic Engagements Director**, advising and supporting clients and partners in their model-based systems engineering transformation journey.

Ron Watkins, DELMIA

As a **DELMIA Industry Process Expert** for Dassault Systèmes, Ron brings over 25 years of specialization in the MES/MOM and ERP space, specifically strategic planning, evaluation, deployment and continuous improvement of customers' enterprise manufacturing and quality solutions. With a career spanning 11 years at Dassault Systèmes, Ron helps customers realize their strategic vision of deploying virtual twin experience-based manufacturing operations solutions.

Stephan Erben, NETVIBES

Stephan has over 20 years of experience as a system integrator in process control, optimization, manufacturing information systems, and enterprise resource planning systems. Within his role as **NETVIBES Senior Product Portfolio Manager** since 2020, Stephan uses AI and big data to develop intelligent solutions that enable customers to make informed decisions based on data-driven insights from machine learning models through the virtual twin experience.



Our **3D**EXPERIENCE® platform powers our brand applications, serving 12 industries, and provides a rich portfolio of industry solution experiences.

Dassault Systèmes is a catalyst for human progress. We provide business and people with collaborative virtual environments to imagine sustainable innovations. By creating virtual twin experiences of the real world with our **3D**EXPERIENCE platform and applications, our customers can redefine the creation, production and life-cycle-management processes of their offer and thus have a meaningful impact to make the world more sustainable. The beauty of the Experience Economy is that it is a human-centered economy for the benefit of all – consumers, patients and citizens.

Dassault Systèmes brings value to more than 300,000 customers of all sizes, in all industries, in more than 150 countries. For more information, visit **www.3ds.com**.

Europe/Middle East/Africa
Dassault Systèmes
10, rue Marcel Dassault
CS 40501
78946 Vélizy-Villacoublay Cedex
France

Asia-Pacific
Dassault Systèmes
17F, Foxconn Building,
No. 1366, Lujiazui Ring Road
Pilot Free Trade Zone, Shanghai 200120
China

Americas
Dassault Systèmes
175 Wyman Street
Waltham, Massachusetts
02451-1223
USA

DASSAULT SYSTEMES