



# REALIZE EFFECTIVE QUALITY MANAGEMENT IN AEROSPACE AND DEFENSE MANUFACTURING

Leveraging digital solutions to enhance efficiency in the quality management process

NEW FLIGHT PATHS IN THE A&D MANUFACTURING INDUSTRY

WHAT ARE A&D MANUFACTURERS' OBJECTIVES?

WHAT HINDERS EFFICIENT QUALITY MANAGEMENT?

QUESTIONS THAT DRIVE STRATEGIC IMPERATIVES

BENEFITS OF CHANGING TO A PROACTIVE QUALITY APPROACH

REACHING NEW HEIGHTS IN A&D WITH DELMIA

BRIDGING THE GAP BETWEEN VIRTUAL AND REAL

OPTIMIZE A&D MANUFACTURING WITH DELMIA OPERATIONS MANAGEMENT

ENHANCING QUALITY WITH AUGMENTED REALITY BY DELMIA

HOW DELMIA BRINGS OPERATIONAL DATA TO THE VIRTUAL WORLD

SOAR NOW WITH QUALITY OPTIMIZATION



# NEW FLIGHT PATHS IN THE A&D MANUFACTURING INDUSTRY

In recent years, the Aerospace and Defense (A&D) sector has witnessed a seismic shift in its operational landscape, particularly in the relationships between Original Equipment Manufacturers (OEMs) and their supply chains. Once-effective traditional transactional strategies used by manufacturers for decades have proven insufficient in the face of significant global disruptions, prompting a critical need for reinvention.

The upheavals experienced within the supply chain have created a unique opportunity for stakeholders to rethink and redefine their business models. A pivotal shift is underway, transcending transactional relationships toward the establishment of a comprehensive value network. This transformative approach spans the entire spectrum of the A&D industry, encompassing design, manufacturing, and maintenance processes.

Amidst these changes, the industry also faces escalating pressure to embrace sustainability, necessitating a profound transformation within the commercial aircraft sector. Several factors are driving the emergence of new revenue streams, such as the integration of groundbreaking technologies, consideration of new mobility models, and a commitment to delivering products and services that are not only efficient and reliable, but also environmentally sustainable. Moreover, the perpetual need to maintain a cost

focus remains a constant in the A&D landscape. The demand for cost reduction persists, challenging industry players to innovate and streamline their processes continually.

Quality has emerged as a lynchpin in this evolving landscape. Irrespective of production location, brand integrity demands products that consistently meet high-quality specifications. The cost of quality (COQ) has been identified as a substantial percentage of customers' total sales, ranging from 4.3% to 8.6%. As organizations grapple with the economic implications of COQ, the imperative to reduce these costs has become a paramount quality management objective for both large corporations and smaller enterprises.

Simultaneously, enhancing the quality of manufactured products has taken center stage as a critical priority. This focus is not only about meeting regulatory standards but also about exceeding customer expectations and reinforcing the industry's commitment to excellence.

As the impact of grounded or damaged aircraft on the OEM, suppliers, airlines, passengers, or armed forces is significant and mission-critical, quality within the Aerospace & Defense Industry cannot be managed after the fact.

**In this eBook, delve into and learn more about:**

**1** The multifaceted landscape of quality management in the A&D manufacturing sector

**2** Evolving supply chain strategies to tackle the persistent challenge of cost reduction

**3** Solutions that help manufacturers achieve quality objectives

NEW FLIGHT PATHS IN THE A&D MANUFACTURING INDUSTRY

WHAT ARE A&D MANUFACTURERS' OBJECTIVES?

WHAT HINDERS EFFICIENT QUALITY MANAGEMENT?

QUESTIONS THAT DRIVE STRATEGIC IMPERATIVES

BENEFITS OF CHANGING TO A PROACTIVE QUALITY APPROACH

REACHING NEW HEIGHTS IN A&D WITH DELMIA

BRIDGING THE GAP BETWEEN VIRTUAL AND REAL

OPTIMIZE A&D MANUFACTURING WITH DELMIA OPERATIONS MANAGEMENT

ENHANCING QUALITY WITH AUGMENTED REALITY BY DELMIA

HOW DELMIA BRINGS OPERATIONAL DATA TO THE VIRTUAL WORLD

SOAR NOW WITH QUALITY OPTIMIZATION

# WHAT ARE A&D MANUFACTURERS' OBJECTIVES?

While the A&D industry has experienced significant transformation, the goals of manufacturers have remained more or less constant. Operational efficiency and cost-effectiveness remain key business objectives, with the addition of sustainability as an industry-wide imperative.

**The five key objectives for A&D manufacturers are:**

1

## Increase Installed Base Overall Equipment Efficiency (OEE)

In an industry where OEE often hovers around 70%, a 2-3% improvement signifies a substantial achievement, underscoring the importance of enhancing quality as a pivotal component of broader efficiency goals.

2

## Reduce Total Cost of Quality (COQ)

As 4.3% to 8.6% of total sales is attributed to the Cost of Quality, significantly reducing this metric is key to optimizing costs. Achieving a 49% reduction in COQ not only signifies fiscal prudence but also positions the organization favorably for CFOs.

3

## Increase First Time Quality Deliveries

Aiming for First Time Quality (FTQ) deliveries within both the manufacturing plant and the Research and Development (R&D) Supplier Value Network is pivotal. Addressing the root causes of quality issues and incomplete deliveries is critical, considering that 32% of late deliveries are attributed to such issues. Hence, there is a strong emphasis on precision in the manufacturing process.

4

## Improve Global Fleet Availability

Over 10 million hours of repair time are wasted on identifying the right parts and understanding instructions. By streamlining and optimizing maintenance, repair, and overhaul (MRO) processes, A&D manufacturers not only reduce downtime but also contribute to the overall efficiency and reliability of global fleets.

5

## Share, Improve, and Extend Know-How Across the Value Networks

Over 30% of reported Defense Aircraft In Service issues go unshared with the OEM and are repeated yearly, highlighting the importance of breaking down silos and cultivating a culture of shared learning and continuous improvement. In an industry where knowledge is a strategic asset, fostering collaboration and knowledge-sharing across the value network is paramount.

NEW FLIGHT PATHS IN THE  
A&D MANUFACTURING  
INDUSTRY

WHAT ARE A&D  
MANUFACTURERS'  
OBJECTIVES?

WHAT HINDERS EFFICIENT  
QUALITY MANAGEMENT?

QUESTIONS THAT DRIVE  
STRATEGIC IMPERATIVES

BENEFITS OF CHANGING  
TO A PROACTIVE QUALITY  
APPROACH

REACHING NEW HEIGHTS IN  
A&D WITH DELMIA

BRIDGING THE GAP BETWEEN  
VIRTUAL AND REAL

OPTIMIZE A&D  
MANUFACTURING WITH  
DELMIA OPERATIONS  
MANAGEMENT

ENHANCING QUALITY  
WITH AUGMENTED  
REALITY BY DELMIA

HOW DELMIA BRINGS  
OPERATIONAL DATA TO THE  
VIRTUAL WORLD

SOAR NOW WITH  
QUALITY OPTIMIZATION

# WHAT HINDERS EFFICIENT QUALITY MANAGEMENT?

Disparate quality systems and data sources



Lack of collaboration throughout the value chain



Quality metrics not measured effectively



Quality is a "department" not a "responsibility"



No formal process to manage risk



Lack of visibility into supplier quality



No formal process for continuous improvement



Ad hoc audit and compliance management



No formal process to capture non-conformance



Lack of executive support



Engineering lacks feedback on quality



NEW FLIGHT PATHS IN THE A&D MANUFACTURING INDUSTRY

WHAT ARE A&D MANUFACTURERS' OBJECTIVES?

WHAT HINDERS EFFICIENT QUALITY MANAGEMENT?

QUESTIONS THAT DRIVE STRATEGIC IMPERATIVES

BENEFITS OF CHANGING TO A PROACTIVE QUALITY APPROACH

REACHING NEW HEIGHTS IN A&D WITH DELMIA

BRIDGING THE GAP BETWEEN VIRTUAL AND REAL

OPTIMIZE A&D MANUFACTURING WITH DELMIA OPERATIONS MANAGEMENT

ENHANCING QUALITY WITH AUGMENTED REALITY BY DELMIA

HOW DELMIA BRINGS OPERATIONAL DATA TO THE VIRTUAL WORLD

SOAR NOW WITH QUALITY OPTIMIZATION

# QUESTIONS THAT DRIVE STRATEGIC IMPERATIVES

In the process of optimizing processes and decision-making, A&D manufacturers inevitably find themselves asking the same questions. These questions are what drive the pursuit of strategies that allow for the delivery of high-quality products, whilst remaining on time and within budget.

## Q How can I shorten the development cycle?

**A:** The bulk of a product's cost is committed early in the aircraft development cycle, even though expenditures may not materialize until later stages. Hence, shortening the development cycle becomes crucial to cost containment.

Employing advanced technologies, concurrent engineering, and agile methodologies can compress the development timeline, ensuring products reach the market faster with optimized costs. Shifting the focus on first-time quality towards engineering also shortens the production maturation and increases the production rate ramp-up.

## Q How can I ensure timely development?

**A:** Timeliness in product development is synonymous with market competitiveness. Being late to market incurs substantial opportunity costs, including diminished market share and lower profit margins.

Adhering to project management best practices and an APQP governance, implementing agile methodologies, and fostering a culture of efficiency and accountability are key elements in ensuring on-time delivery and market readiness.

## Q How can I avoid design issues?

**A:** The cost of rectifying design flaws and faulty decisions escalates exponentially as a project progresses. Identifying and rectifying issues at earlier stages is not only cost-effective but also essential for ensuring the overall integrity of the final product.

Embracing robust risk assessment and design validation processes, coupled with thorough collaboration between engineering, manufacturing, and testing teams, can mitigate the risk of costly rectifications in the later stages of development.

Leveraging the 3D Model-Based data available during Design and Manufacturing Engineering contributes to the Quality of Design, as well as Process Failure Mode and Effect Analysis. With this, the engineer can analyze the 3D Model and all connected Engineering content, knowledge, and know-how.

NEW FLIGHT PATHS IN THE A&D MANUFACTURING INDUSTRY

WHAT ARE A&D MANUFACTURERS' OBJECTIVES?

WHAT HINDERS EFFICIENT QUALITY MANAGEMENT?

QUESTIONS THAT DRIVE STRATEGIC IMPERATIVES

BENEFITS OF CHANGING TO A PROACTIVE QUALITY APPROACH

REACHING NEW HEIGHTS IN A&D WITH DELMIA

BRIDGING THE GAP BETWEEN VIRTUAL AND REAL

OPTIMIZE A&D MANUFACTURING WITH DELMIA OPERATIONS MANAGEMENT

ENHANCING QUALITY WITH AUGMENTED REALITY BY DELMIA

HOW DELMIA BRINGS OPERATIONAL DATA TO THE VIRTUAL WORLD

SOAR NOW WITH QUALITY OPTIMIZATION

Q

## How can I ensure First Time Right on the production line?

**A:** Having to rectify quality problems after the fact can be costly, with as much as 32% of late deliveries caused by quality issues. Therefore, by ensuring "first time right" quality, operators avoid delays and keep production on schedule.

Efficient workload management and AR-based work instructions can guide workers on the shop floor throughout assembly and inspection tasks, decreasing the number of quality issues caused by incorrect interpretation of work instructions or missing control points during the quality check process.



Q

## How do I break down silos?

**A:** Cross-functional collaboration is recognized as a linchpin for effective problem-solving in the complex and dynamic environment of A&D product development.

Breaking down silos involves cultivating a culture that values interdisciplinary collaboration, encourages open communication, and establishes cross-functional teams. These teams can provide holistic solutions to intricate problems, fostering innovation and efficiency.



Q

## How do I best leverage organizational capabilities?

**A:** Early simultaneous involvement in product development by cross-functional teams, utilizing structured processes, is a powerful strategy for optimizing organizational capabilities.

Integrating teams from various departments (such as engineering, manufacturing, procurement, and others) in the initial phases enables a comprehensive understanding of project requirements, reduces the likelihood of rework, and ultimately saves both time and money over the entire product life cycle.



NEW FLIGHT PATHS IN THE A&D MANUFACTURING INDUSTRY

WHAT ARE A&D MANUFACTURERS' OBJECTIVES?

WHAT HINDERS EFFICIENT QUALITY MANAGEMENT?

QUESTIONS THAT DRIVE STRATEGIC IMPERATIVES

BENEFITS OF CHANGING TO A PROACTIVE QUALITY APPROACH

REACHING NEW HEIGHTS IN A&D WITH DELMIA

BRIDGING THE GAP BETWEEN VIRTUAL AND REAL

OPTIMIZE A&D MANUFACTURING WITH DELMIA OPERATIONS MANAGEMENT

ENHANCING QUALITY WITH AUGMENTED REALITY BY DELMIA

HOW DELMIA BRINGS OPERATIONAL DATA TO THE VIRTUAL WORLD

SOAR NOW WITH QUALITY OPTIMIZATION

# BENEFITS OF CHANGING TO A PROACTIVE QUALITY APPROACH

The shift in approach from reactive firefighting to proactive continuous quality improvements and prevention presents A&D manufacturers with significant benefits in today's competitive and dynamic business environment. This change is more than just a best practice; it is a strategic imperative for manufacturers seeking sustainable growth, customer satisfaction, and a competitive edge in today's challenging business environment.



## Cost Savings

Reactive firefighting is often an expensive proposition. Addressing quality issues after they arise can involve extensive rework, production stoppages, and sometimes even recalls. Proactive quality improvements and prevention help identify and mitigate potential issues early in the production cycle, reducing the overall cost of poor quality.



## Enhanced Productivity

Continuous quality improvements contribute to increased efficiency and productivity. By identifying and rectifying potential bottlenecks or inefficiencies in processes, manufacturers can streamline operations, reduce downtime, and ensure a smoother production flow.



## Customer Satisfaction

Proactive quality management is directly tied to meeting or exceeding customer expectations. By preventing defects and consistently delivering high-quality products, manufacturers can enhance customer satisfaction, foster brand loyalty, and gain a competitive edge in the market.



## Brand Reputation

Reacting to quality issues can have detrimental effects on a brand's reputation. High-profile recalls or quality-related incidents can erode consumer trust. Proactive quality improvements not only prevent such incidents but also contribute to building a positive brand image associated with reliability and excellence.

NEW FLIGHT PATHS IN THE  
A&D MANUFACTURING  
INDUSTRY

WHAT ARE A&D  
MANUFACTURERS'  
OBJECTIVES?

WHAT HINDERS EFFICIENT  
QUALITY MANAGEMENT?

QUESTIONS THAT DRIVE  
STRATEGIC IMPERATIVES

BENEFITS OF CHANGING  
TO A PROACTIVE QUALITY  
APPROACH

REACHING NEW HEIGHTS IN  
A&D WITH DELMIA

BRIDGING THE GAP BETWEEN  
VIRTUAL AND REAL

OPTIMIZE A&D  
MANUFACTURING WITH  
DELMIA OPERATIONS  
MANAGEMENT

ENHANCING QUALITY  
WITH AUGMENTED  
REALITY BY DELMIA

HOW DELMIA BRINGS  
OPERATIONAL DATA TO THE  
VIRTUAL WORLD

SOAR NOW WITH  
QUALITY OPTIMIZATION



### Regulatory Compliance

The A&D industry has stringent regulatory requirements. Proactive quality measures ensure compliance with standards and regulations. This not only mitigates legal and financial risks but also demonstrates a commitment to meeting the highest industry standards.



### Risk Mitigation

Reactive approaches often involve responding to crises or emergencies, which can be chaotic and unpredictable. Proactive measures allow manufacturers to identify and mitigate risks before they escalate, providing a more controlled and predictable operating environment.



### Continuous Improvement Culture

Shifting to proactive quality improvement fosters a culture of continuous improvement within the organization. It encourages employees at all levels to actively engage in identifying areas for enhancement, promoting innovation, and driving overall organizational excellence.



### Time Efficiency

Reactive approaches can lead to prolonged resolution times, causing delays in production and delivery schedules. Proactive quality improvements save time by identifying and rectifying issues before they become significant, ensuring that operations remain on schedule.



### Long-Term Sustainability

Proactive quality improvements contribute to the long-term sustainability of a manufacturing business. By minimizing waste, optimizing processes, and maintaining a focus on quality, organizations create a foundation for enduring success in a rapidly evolving business landscape.

NEW FLIGHT PATHS IN THE  
A&D MANUFACTURING  
INDUSTRY

WHAT ARE A&D  
MANUFACTURERS'  
OBJECTIVES?

WHAT HINDERS EFFICIENT  
QUALITY MANAGEMENT?

QUESTIONS THAT DRIVE  
STRATEGIC IMPERATIVES

BENEFITS OF CHANGING  
TO A PROACTIVE QUALITY  
APPROACH

REACHING NEW HEIGHTS IN  
A&D WITH DELMIA

BRIDGING THE GAP BETWEEN  
VIRTUAL AND REAL

OPTIMIZE A&D  
MANUFACTURING WITH  
DELMIA OPERATIONS  
MANAGEMENT

ENHANCING QUALITY  
WITH AUGMENTED  
REALITY BY DELMIA

HOW DELMIA BRINGS  
OPERATIONAL DATA TO THE  
VIRTUAL WORLD

SOAR NOW WITH  
QUALITY OPTIMIZATION



## REACHING NEW HEIGHTS IN A&D WITH DELMIA

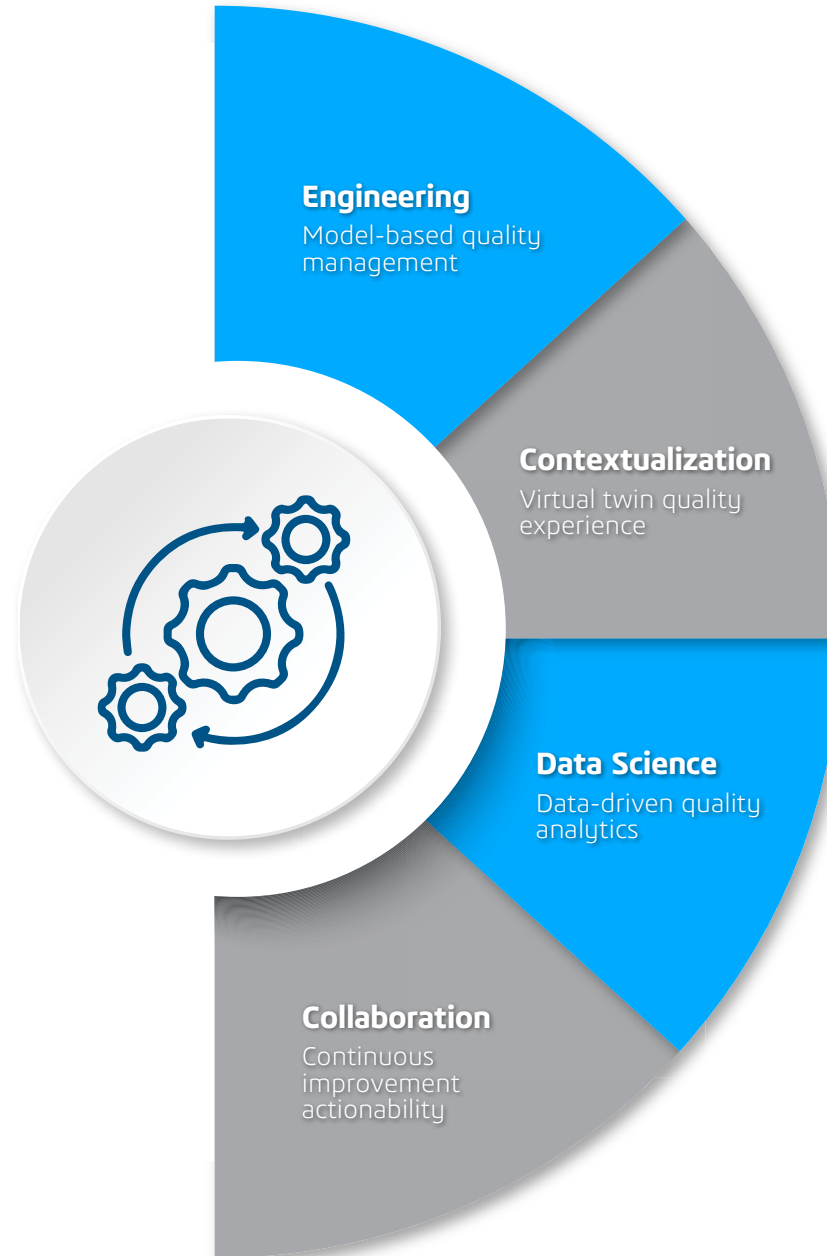
Leveraging the opportunities presented by digital transformation enables optimized operations in the A&D sector, leading to enhanced asset availability, swift decision-making, and effective response to disruptions. This approach also enables businesses to strategically align with sustainability imperatives.

With DELMIA integrated into the production line, A&D manufacturers can further augment these benefits and their operational capabilities. DELMIA's distinctive capability to consolidate contextualized data into a comprehensive virtual model empowers decisions based on data, proactive measures, and the seamless management of intricate maintenance requirements.

Utilizing advanced simulation capabilities and strategically optimizing operational processes, DELMIA solutions contribute to a holistic perspective of the maintenance landscape. These solutions propel asset management and MRO operations to new levels of efficiency and effectiveness within your organization, engineering positive change throughout the value chain.



## The Four Pillars that Drive Change



NEW FLIGHT PATHS IN THE  
A&D MANUFACTURING  
INDUSTRY

WHAT ARE A&D  
MANUFACTURERS'  
OBJECTIVES?

WHAT HINDERS EFFICIENT  
QUALITY MANAGEMENT?

QUESTIONS THAT DRIVE  
STRATEGIC IMPERATIVES

BENEFITS OF CHANGING  
TO A PROACTIVE QUALITY  
APPROACH

REACHING NEW HEIGHTS IN  
A&D WITH DELMIA

BRIDGING THE GAP BETWEEN  
VIRTUAL AND REAL

OPTIMIZE A&D  
MANUFACTURING WITH  
DELMIA OPERATIONS  
MANAGEMENT

ENHANCING QUALITY  
WITH AUGMENTED  
REALITY BY DELMIA

HOW DELMIA BRINGS  
OPERATIONAL DATA TO THE  
VIRTUAL WORLD

SOAR NOW WITH  
QUALITY OPTIMIZATION

## Scope

## Solution

### Streamlined Collaboration

- ✓ Lean Team Management
- ✓ Real-time Team Communication
- ✓ Collaborative
- ✓ Problem-Solving

### Enhanced Optimization

- ✓ Process Engineering
- ✓ Manufacturing Quality Engineering
- ✓ Fabrication
- ✓ Ergonomics
- ✓ Robotics
- ✓ Global Process Management

### Virtual Asset Modeling

- ✓ Process Engineering
- ✓ Manufacturing Quality Engineering
- ✓ Fabrication
- ✓ Ergonomics
- ✓ Robotics
- ✓ Global Process Management

### Flawless Execution

- ✓ Production
- ✓ Quality
- ✓ Material Synchronization & WMS (Warehouse Management System)
- ✓ Maintenance
- ✓ Machine Connectivity

### DELMIA 3DLean

- ✓ Empowers seamless lean collaboration across all actors involved in asset management and asset maintenance for improved efficiency and overall performance.

### Manufacturing, Support, and Service Planning

- ✓ Optimizes service schedules, maintenance and workers for synchronized operations.

### Manufacturing, Support, and Service Engineering

- ✓ Enables Systems of Systems (SoS) models to optimize maintenance and resource allocation, improve decision-making and enhance operational efficiency, safety and cost-effectiveness by identifying potential risks and streamlining maintenance activities.

### DELMIA Augmented Experience

- ✓ Enhances industrial operations with digital instructions for assembly, inspection, and maintenance via AR.
- ✓ Uses virtual twin technology for real-time visualizations on actual products.
- ✓ Improves task execution, reduces errors, and facilitates data collection.
- ✓ Virtual twin acts as a quality reference, boosting productivity, quality, and traceability.

### Manufacturing and Maintenance Operations Execution (Quality, Warehouse and Line Supply Management)

- ✓ Integrates operations management and execution for efficient maintenance and production planning, scheduling and optimization.
- ✓ Ensures high-quality execution of plans while maximizing labor utilization and optimizing inventory management for streamlined maintenance and production operations.
- ✓ Ensures required materials and components are available to execute both maintenance and production.

## NEW FLIGHT PATHS IN THE A&D MANUFACTURING INDUSTRY

### WHAT ARE A&D MANUFACTURERS' OBJECTIVES?

### WHAT HINDERS EFFICIENT QUALITY MANAGEMENT?

### QUESTIONS THAT DRIVE STRATEGIC IMPERATIVES

### BENEFITS OF CHANGING TO A PROACTIVE QUALITY APPROACH

### REACHING NEW HEIGHTS IN A&D WITH DELMIA

### BRIDGING THE GAP BETWEEN VIRTUAL AND REAL

### OPTIMIZE A&D MANUFACTURING WITH DELMIA OPERATIONS MANAGEMENT

### ENHANCING QUALITY WITH AUGMENTED REALITY BY DELMIA

### HOW DELMIA BRINGS OPERATIONAL DATA TO THE VIRTUAL WORLD

### SOAR NOW WITH QUALITY OPTIMIZATION

## Scope

- ✓ Modeling
- ✓ Simulation and Visualization
- ✓ Predictive Maintenance

## Solution

### 360° Operations Excellence with the Virtual Twin Experience

A cloud-based platform, rooted in the **3DEXPERIENCE** platform, the Virtual Twin Experience enhances MRO capabilities in A&D through the convergence of the virtual and real worlds of operations to seamlessly bridge the gap between planning and execution, enabling:

- ✓ Model-based design and planning for optimized maintenance processes.
- ✓ Visualization and simulation of maintenance operations to identify challenges.
- ✓ Direct implementation of virtual plans in the real world.
- ✓ A continuous feedback loop between real-world data and the virtual model.
- ✓ Ongoing optimization and performance improvement through data exchange.
- ✓ A closed-loop capability for refining maintenance strategies.
- ✓ Scenario testing and analysis for informed decision-making.

Innovation  
for the future

NEW FLIGHT PATHS IN THE  
A&D MANUFACTURING  
INDUSTRY

WHAT ARE A&D  
MANUFACTURERS'  
OBJECTIVES?

WHAT HINDERS EFFICIENT  
QUALITY MANAGEMENT?

QUESTIONS THAT DRIVE  
STRATEGIC IMPERATIVES

BENEFITS OF CHANGING  
TO A PROACTIVE QUALITY  
APPROACH

REACHING NEW HEIGHTS IN  
A&D WITH DELMIA

BRIDGING THE GAP BETWEEN  
VIRTUAL AND REAL

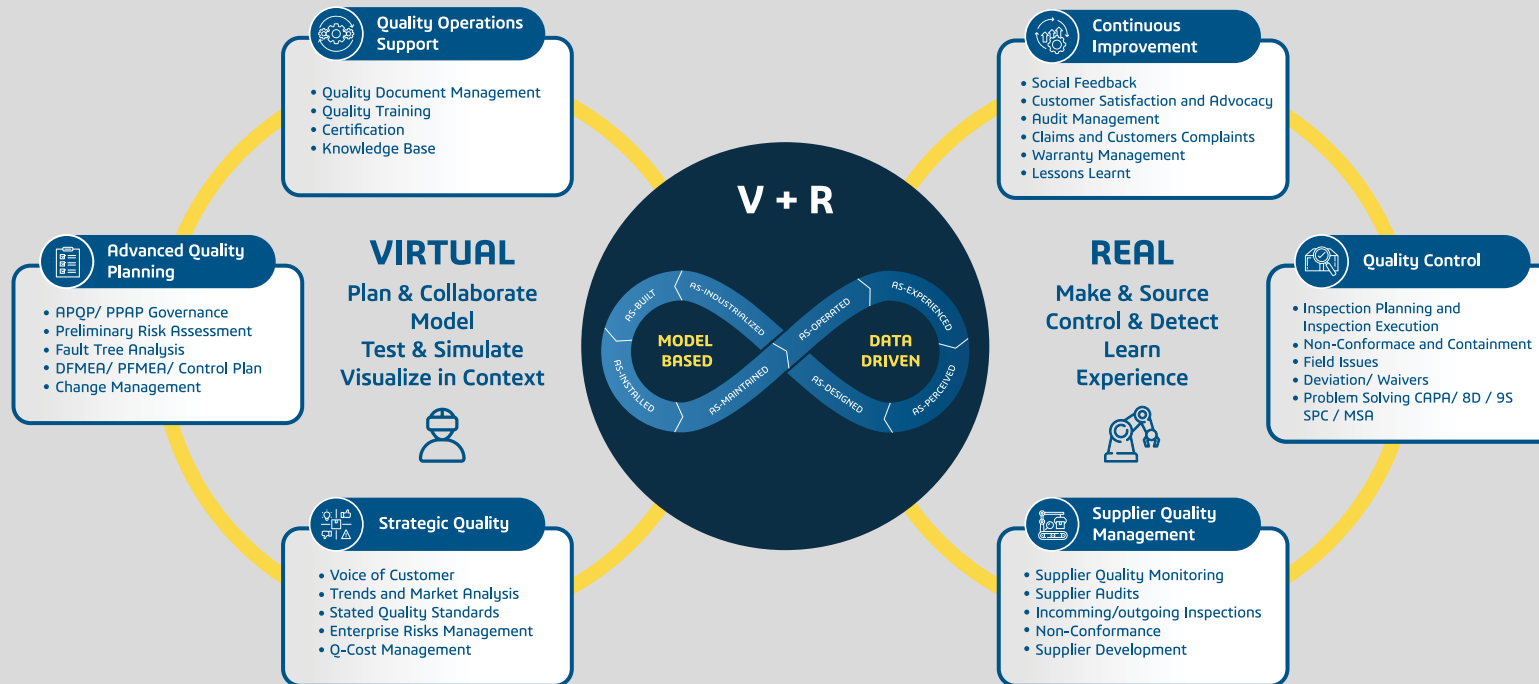
OPTIMIZE A&D  
MANUFACTURING WITH  
DELMIA OPERATIONS  
MANAGEMENT

ENHANCING QUALITY  
WITH AUGMENTED  
REALITY BY DELMIA

HOW DELMIA BRINGS  
OPERATIONAL DATA TO THE  
VIRTUAL WORLD

SOAR NOW WITH  
QUALITY OPTIMIZATION

### Virtual Twin Experience for Quality



## BRIDGING THE GAP BETWEEN VIRTUAL AND REAL

DELMIA Manufacturing & Operations solutions facilitate global operational excellence by establishing a unified digital platform that enhances visibility, control, and synchronization across manufacturing operations and supply chain processes worldwide. This digital landscape enables real-time manufacturing intelligence, promoting automated production, quality control, and continuous improvement.

By connecting the physical and virtual worlds, manufacturers can identify and address areas of waste, ultimately optimizing results. The solutions utilize manufacturing execution systems (MES) and augmented reality capabilities, including interactive 3D, computer vision, AI, and deep learning, to track and document the transformation of raw materials to finished goods, supporting sustained operational excellence.



## OPTIMIZE A&D MANUFACTURING WITH DELMIA OPERATIONS MANAGEMENT

In the A&D sector, managing Advanced Product Quality Planning (APQP) and Failure Modes and Effects Analysis (FMEA) processes manually often results in increased program costs and delays in implementing product and process changes.

DELMIA addresses these issues by introducing a more efficient and automated approach to APQP and FMEA management, simplifying the process by eliminating administrative burdens and enabling the tracking, reuse, and leverage of data across multiple programs and locations, reducing manual, menial labor needed.

Moreover, DELMIA facilitates the adoption of a zero-defect strategy in product development and manufacturing. Through the implementation of proper controls and risk analysis, the system helps prevent foreseeable errors, enhancing failure detection and optimizing processes. As a result, this reduces costs associated with poor quality and prevents unnecessary expenses for high-quality production.

Beyond quality control, DELMIA promotes innovation within the constraints of quality standards and regulations. Compliance with industry requirements allows for fearless innovation, and additionally aids in minimizing scheduled aircraft maintenance and enhancing working conditions.

The effectiveness of DELMIA lies in its utilization of data-driven technology. With a comprehensive set of tools for conducting FMEAs, control plans, and managing key characteristics, DELMIA leverages 3D models and digital twins to enhance accuracy and efficiency in manufacturing processes. This approach reduces risks, instills confidence, enables early error detection, and supports informed decision-making based on real-time data.

NEW FLIGHT PATHS IN THE A&D MANUFACTURING INDUSTRY

WHAT ARE A&D MANUFACTURERS' OBJECTIVES?

WHAT HINDERS EFFICIENT QUALITY MANAGEMENT?

QUESTIONS THAT DRIVE STRATEGIC IMPERATIVES

BENEFITS OF CHANGING TO A PROACTIVE QUALITY APPROACH

REACHING NEW HEIGHTS IN A&D WITH DELMIA

BRIDGING THE GAP BETWEEN VIRTUAL AND REAL

OPTIMIZE A&D MANUFACTURING WITH DELMIA OPERATIONS MANAGEMENT

ENHANCING QUALITY WITH AUGMENTED REALITY BY DELMIA

HOW DELMIA BRINGS OPERATIONAL DATA TO THE VIRTUAL WORLD

SOAR NOW WITH QUALITY OPTIMIZATION

With DELMIA Operations Management, A&D manufacturers enjoy the following features and benefits:

Features	Benefits
<ul style="list-style-type: none"> <li>• Tracks and manages non-conformances</li> <li>• Tracks and analyzes quality defects across operations from instance to root cause</li> <li>• Built-in security controls, audit trails, electronic and double signatures – in compliance with 21CFR Part 11</li> <li>• Provides forward and reverse robust alerting and notification capabilities to manage escalation procedures</li> <li>• Synchronizes quality with major vendor ERP systems including SAP® and Oracle</li> <li>• Generative Quality Planning enables ease of creation and management of inspection plans</li> <li>• 3D Visual Quality Defect Tracking (3DvQDT) provides a visual way to capture and analyze quality defects in the context of the virtual twin on the shop floor</li> <li>• Statistical Process Control (SPC) for in-process and off-line quality control</li> <li>• Supports as-designed, as-built, and as-maintained attributes for performance metric visibility</li> <li>• Incorporates and endorses feedback throughout the entire process, from execution to design, fostering continuous improvement.</li> </ul>	<ul style="list-style-type: none"> <li>• Improves product quality by standardizing and enforcing quality processes across your enterprise</li> <li>• Lowers TCO for enterprise quality management as a single solution sharing a common process and a data model across multiple sites</li> <li>• Reduces total cost of quality with error proofing, real-time quality monitoring, and containment management</li> <li>• Lowers cost of regulatory compliance with interlocking genealogy and traceability</li> <li>• Reduces variability of production processes, supporting Six Sigma and Lean initiatives</li> <li>• Achieves U.S. FDA, FAA, DoD, and European Union ISO quality assurance regulatory requirements</li> <li>• Adheres to AS9100 quality assurance regulatory requirements</li> <li>• Supports Advanced Product Quality Planning (APQP) and TS16494 programs throughout the development and production phases</li> <li>• Generates Process Failure Mode and Effects Analyses (PFMEA) for you from the product and process model, updating as the process changes</li> </ul>

**NEW FLIGHT PATHS IN THE A&D MANUFACTURING INDUSTRY**

**WHAT ARE A&D MANUFACTURERS' OBJECTIVES?**

**WHAT HINDERS EFFICIENT QUALITY MANAGEMENT?**

**QUESTIONS THAT DRIVE STRATEGIC IMPERATIVES**

**BENEFITS OF CHANGING TO A PROACTIVE QUALITY APPROACH**

**REACHING NEW HEIGHTS IN A&D WITH DELMIA**

**BRIDGING THE GAP BETWEEN VIRTUAL AND REAL**

**OPTIMIZE A&D MANUFACTURING WITH DELMIA OPERATIONS MANAGEMENT**

**ENHANCING QUALITY WITH AUGMENTED REALITY BY DELMIA**

**HOW DELMIA BRINGS OPERATIONAL DATA TO THE VIRTUAL WORLD**

**SOAR NOW WITH QUALITY OPTIMIZATION**

# ENHANCING QUALITY WITH AUGMENTED REALITY BY DELMIA

DELMIA Augmented Experience offers AR-based assistance to operations to optimize your production process efficiency and improve quality management. By overlaying digital information from the virtual twin of the aircraft parts being produced on the shop floor, it provides operators with dynamic, context-specific guidance and information, enhancing their ability to perform tasks accurately and efficiently.

## Features

- Contextualized information through Augmented Reality offers real-time visualization of digital content superimposed on reality
- Interactive digital work instructions guide the operators step-by-step in their assembly and inspection tasks
- Compatible with an extensive range of hardware devices: tablets, projection systems, industrial cameras, AR glasses, etc.
- Collects field data, including defects referenced in the 3D model, to provide better documentation of assembly operations and inspection results
- Publishes and exploits operational field data for traceability and further analysis
- Improves worker onboarding, skill ramp-up, and job satisfaction
- Integrates into existing information systems, including your legacy MES, or deploy with DELMIA apps

## Benefits

Reaches “first time right” and reduces cycle time by

**Up to 80%**

Reduces the risk of errors in locating or interpreting defects by up

**Up to 90%**

**Saves up to 40%**  
on inspection time

Reduces skill ramp-up time by

**50%**

NEW FLIGHT PATHS IN THE A&D MANUFACTURING INDUSTRY

WHAT ARE A&D MANUFACTURERS' OBJECTIVES?

WHAT HINDERS EFFICIENT QUALITY MANAGEMENT?

QUESTIONS THAT DRIVE STRATEGIC IMPERATIVES

BENEFITS OF CHANGING TO A PROACTIVE QUALITY APPROACH

REACHING NEW HEIGHTS IN A&D WITH DELMIA

BRIDGING THE GAP BETWEEN VIRTUAL AND REAL

OPTIMIZE A&D MANUFACTURING WITH DELMIA OPERATIONS MANAGEMENT

ENHANCING QUALITY WITH AUGMENTED REALITY BY DELMIA

HOW DELMIA BRINGS OPERATIONAL DATA TO THE VIRTUAL WORLD

SOAR NOW WITH QUALITY OPTIMIZATION

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DELMIA's comprehensive approach to A&D manufacturing bridges the gap between real-world manufacturing operations and the virtual world, fostering a closed loop of data-driven insights. This closed loop not only enhances the understanding of real-world performance but also fuels a culture of continuous improvement. By seamlessly integrating operational data into the virtual world, DELMIA's approach leads to enhanced quality, efficiency, and continuous improvement throughout the production process.



## Capturing Quality Data with a 360-Degree View

DELMIA excels in capturing data around quality by providing a 360-degree view of manufacturing operations. This involves leveraging Artificial Intelligence (AI) capabilities and attaching relevant content to the virtual twin of the product. This holistic approach ensures that every facet of the manufacturing process is captured, providing a detailed and nuanced understanding of quality-related metrics.



## Continuous Improvement through Engineering

The captured quality data is not a static repository but a dynamic resource for improvement. DELMIA seamlessly provides this data to engineering teams, enabling a continuous improvement cycle for the aircraft. This iterative feedback loop ensures that engineering decisions are informed by real-world data, driving enhancements in design and manufacturing processes.



## Business Process Automation for Quality Intelligent Data

DELMIA goes beyond data capture by leveraging business process automation. It intelligently inserts quality data into enterprise non-conformance and Corrective and Preventive Actions (CAPA) processes. This automated integration ensures that quality insights are seamlessly incorporated into organizational workflows, expediting decision-making and corrective actions.

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BENEFITS OF CHANGING TO A PROACTIVE QUALITY APPROACH

REACHING NEW HEIGHTS IN A&D WITH DELMIA

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### Closing the Loop

DELMIA's approach to closing the loop involves two types of data: operational data and advanced analytical data. Operational data, including user-entered and equipment-captured information, forms a comprehensive as-built record. Advanced analytical data, sourced from the equipment/IIoT layer, is channeled into a data lake for AI and machine learning analysis. This predictive capability enables DELMIA to anticipate maintenance needs, ensuring proactive responses to potential issues.



### Prescriptive Insights

The analytical data collected across machines allows DELMIA to provide prescriptive insights. By informing operators before an issue occurs and prescribing solutions, DELMIA empowers teams to take preemptive actions, minimizing downtime and optimizing operational efficiency.



### Data as a Reflection of Reality

DELMIA integrates operational data into the virtual twin, providing engineers with a deeper understanding of how the product performs in the real world. Simultaneously, analytical data refines simulation models, ensuring they are continually updated for greater accuracy.



### Closing the Loop from the Shop Floor to Communication

DELMIA's closed-loop system extends from the shop floor to communication channels. It acknowledges that while some issues can be resolved on the shop floor, others require communication with broader teams. This comprehensive approach ensures that insights are disseminated effectively, leading to timely and informed decision-making.

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## SOAR NOW WITH QUALITY OPTIMIZATION

By seamlessly integrating quality data, leveraging AI capabilities, and connecting the virtual twin to real-world manufacturing operations, DELMIA not only facilitates continuous improvement but also ensures a closed loop of insights that drive efficiency and innovation. Manufacturers benefit from the ability to provide engineering teams with real-world data for ongoing enhancements, automate quality processes, and predict maintenance needs through advanced analytics.

As A&D operators navigate the evolving terrain of the manufacturing industry, DELMIA enables informed decision-making, optimized processes, and a future where the virtual and physical worlds converge to redefine the possibilities of operational excellence.

Find out how you can be a part of this future at:

<https://www.3ds.com/products/delmia/aerospace-defense>

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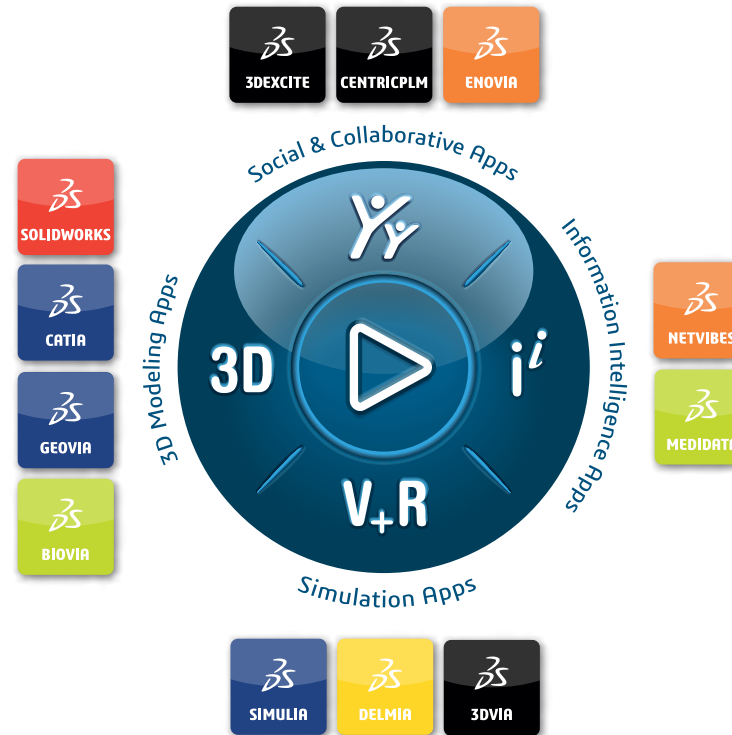
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