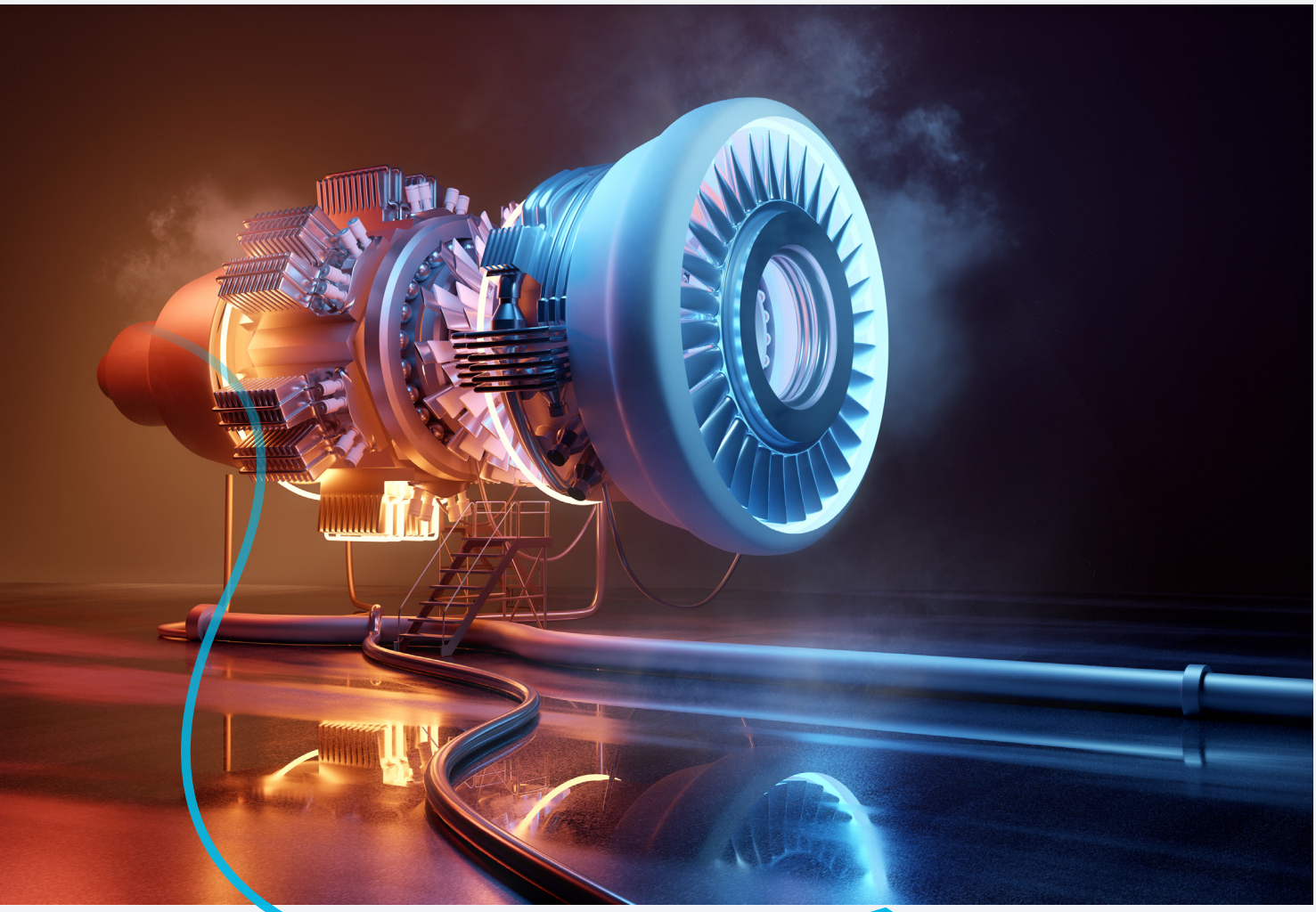


The *evolution of quality* in an era of aerospace and defense acceleration

Capgemini

Air transport has become the safest form of travel in human history: a remarkable achievement built on decades of engineering excellence, regulatory rigor, and uncompromising standards for quality.

However, recent in-service incidents across civil, defense, and space programs show that even in a highly regulated industry, critical failures can still occur. In today's world, especially in aeronautics, one major accident is already one too many.

At the same time, the pressure to scale is rising. Aircraft production is ramping up. Defense programs are accelerating. And yet, many of the quality assurance systems in place were built for a slower, more stable era. They are no longer fit for purpose.

To meet this moment, the industry must fundamentally rethink its approach to quality. It must be embedded from day one, not as a final check, but as a continuous safeguard. This signifies a serious model shift. It means transitioning from a Reactive Model, which means only tackling quality issues after they have occurred with palliative solutions, to a Preventive Model, which means setting things-up with the best conditions possible to prevent the occurrence of issues with quality. Ultimately transitioning to the most advanced model which consists of being able to predict and avoid all quality issues before they even occur. Predictive Quality Model is a new promise from digital, innovation, data and Artificial Intelligence (AI) enablers combined. Indeed, data drives decisions, Artificial Intelligence (AI) sharpens insights and supports decision making processes. People will bring all that together, and this model will be smarter, faster, and more connected than ever to ensure perfect predictability.

In the end, the goal is non-negotiable: zero non-conformities. Zero accidents. But achieving this standard today requires new thinking, new tools, and a renewed commitment to excellence—at speed.

Quality is transverse
and always has been

Quality isn't one function. It must be addressed at every stage of the product lifecycle – as a shared responsibility across design, manufacturing, supply chain, and operations. When something goes wrong in service, the root cause is often found upstream in design or production. That's why we say quality is transverse: it connects everything and closes the loop.

Design	Products must be engineered with safety, reliability, and serviceability in mind from the start.
Manufacturing	Quality depends on process adherence, accuracy, and repeatability, especially under accelerated timelines.
Supply Chain	Managing quality today means managing outsourced parts, processes, and partners across a complex network.
Customer Operations	In-service issues must feed back into design and production to prevent recurrence and improve performance.

In today's environment, this end-to-end approach is more critical than ever. Teams are moving faster, systems are more complex, and functions are often siloed. It isn't just about adopting new technologies—it's about rethinking how quality is defined and delivered. It's no longer confined to a department or a final gate. Without a transverse view of quality, risks build up silently, until they become visible in the field.

The reality on the ground: *Quality is under strain*

Across aerospace and defense, quality systems are under mounting pressure. Production volumes are rising rapidly, supply chains are stretched, and experienced personnel are leaving faster than they can be replaced. The people, processes, and tools that once delivered consistency and reliability are now being tested at scale – and many are no longer suited to today's pace of operations.

To address this growing strain, we need a clear-eyed understanding of where the pressure points are – and why longstanding assumptions about quality are starting to break down.

Unprecedented Production Acceleration

Production across the sector is ramping up at an extraordinary rate:

- **Airbus** is targeting a production rate of 75 A320 aircraft per month by 2027, compared to a pre-COVID average of around 48, according to the company.
- **Dassault** has affirmed it can increase Rafale fighter jet production to five per month, responding to the demands of a wartime economy.
- **KNDS**, the European defense manufacturer, has doubled output of its Caesar artillery system – from six units per month in 2023 to twelve in 2025.
- **MBDA** has increased its production of Mistral missiles from 20 units per month to 40 over the same period.

OEMs and suppliers across the industry are being asked to deliver more platforms, more capabilities, and more services at an incredible speed without compromising safety, quality, or reliability.

Yet many of the systems supporting that delivery – design processes, workforce structures, production infrastructure, and quality controls – were built for a different era. They were optimized for volume stability, not volume spikes.

Today's accelerated pace reveals just how misaligned these legacy systems have become. What once worked reliably is now showing its limits.

Note: Please refer to the end of the report for source information on Dassault, KNDS, and MBDA.

Non-Conformities are a Persistent Challenge

This gap between pace and preparedness is most visible in the rise of non-conformities on the shop floor.

I recently spoke with a former colleague who described a situation where an aircraft entering final testing still an important number of non-conformities (NC) – every one of which had to be addressed within a single month. Under today's compressed timelines and production pressure, cases like this are becoming more frequent. Each instance carries significant implications for safety, reliability, and delivery schedules.

From my own experience, I've seen that the processes to prevent these issues often exist. However, when teams are operating under pressure – without the right tools, training, or time – those processes aren't applied consistently. That's when risk accumulates quickly.

According to reporting by BISInfotech, non-conformance can account for as much as 20% of total aerospace manufacturing costs. The financial impact is substantial – but the operational risk is even greater.

There is some good news. Digital thread initiatives are starting to make a difference. Programs that improve traceability, visibility, and process control have been shown to reduce non-conformance rates by up to 30%. These are promising early signals – but scaling them across the sector remains a challenge.

The Talent Gap

The other critical pressure point is people.

COVID-era retirements have accelerated the loss of senior expertise, and the pipeline of skilled talent hasn't kept pace. At Boeing, for example, 50% of the machinist workforce has less than six years of experience – double the proportion from before the pandemic, according to The Wall Street Journal. There is a growing shortage of qualified aircraft mechanics, avionics technicians, and manufacturing engineers across the industry. Gallagher Aerospace has reported that demand for these roles continues to outstrip supply.

Many of the individuals entering production today are incredibly capable but often lack the operational maturity or deep process familiarity that quality adherence depends on. These teams are being asked to operate in high-pressure environments, where production timelines are compressed, and systems aren't always intuitive or integrated.

Without sufficient onboarding, mentorship, and continuous upskilling, even strong engineering teams can struggle to apply quality processes consistently.

Process Degradation

Strong processes are foundational to quality in aerospace and defense. But in many organizations, procedures have been layered over time – often in response to past issues or compliance updates. This creates procedural fatigue, confusion, and resistance across engineering, production, and support functions.

With the loss of senior operational leadership, many newer employees haven't had the time or mentorship to understand the "why" behind these procedures. As a result, compliance becomes mechanical, and quality systems lose their effectiveness.

In some cases, teams are navigating overly complex processes without the support of real-time tools or feedback. This makes it harder to detect and correct deviations early, even though the technology now exists to do so.

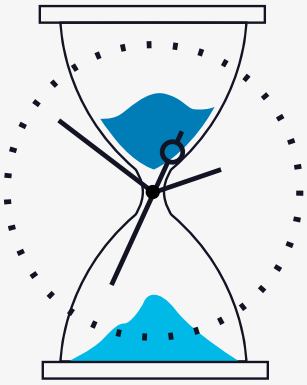
That's where the temptation to "move fast and fix later" comes in. Elon Musk's approach – launch, fail, learn, repeat – has disrupted other industries, but it doesn't translate to every product in aerospace and defense. We can't afford to blow up two or three aircraft to reach maturity. In civil aeronautics, especially, the product must be safe and reliable from day one.

A new quality assurance model: *From reactive to predictive through innovation and digitization*

For many years, quality in aerospace followed a reactive model. A defect would appear. A failure would occur. Only then would teams investigate and respond. When I started out as a crash investigator twenty years ago, that was how it worked – we were always late. We acted after the event.

More recently, the industry has started to adopt more proactive practices. Root cause analysis, earlier detection, and stronger process control have helped reduce certain risks. But in most cases, this still means reacting to problems that have already appeared.

To meet the demands of modern aerospace – where complexity is growing and timelines are shrinking – we need to go further. We need predictive quality.



Predictive quality is about anticipating failure before it occurs. It uses real-time data, artificial intelligence, and digital models to detect early signs of risk across the product lifecycle. Instead of relying on final inspections or field reports, teams can identify issues upstream – at the design phase, on the production line, or even during supplier integration.

Tools like digital twins – virtual models of real-world systems – make this possible. By simulating how a product or process should behave, and comparing that to what's actually happening, we can detect deviations early and respond before they lead to non-conformities. Artificial Intelligence (AI) can spot patterns that human teams might miss, such as repeated rework on the same part, subtle shifts in machine behavior, or gradual process drift.

This shift allows manufacturers to move from lagging indicators (like post-production defects) to leading indicators (like anomalies in real-time performance). The result is fewer surprises, faster resolution, and higher confidence in quality – even as output scales.

At Capgemini, we help clients make this shift by connecting their data environments, engineering systems, and manufacturing platforms into a digital backbone. This enables quality teams to act earlier, work smarter, and avoid the cycle of late-stage corrections.

Predictive quality isn't a nice-to-have. It's what allows aerospace and defense organizations to move at speed without compromising the integrity and safety that define the industry.

To meet the demands of modern aerospace – where complexity is growing and timelines are shrinking – we need to go further. We need predictive quality.

A culture shift **toward predictive quality**

In aerospace and defense, there is no room for compromise regarding quality and safety. The systems we build are complex, the environments unforgiving, and the consequences of failure are too great. Technical excellence is only part of the equation. True performance demands operational discipline, consistency, and trust.

In this context, how we deliver is just as critical as what we deliver. Meeting expectations in innovation, efficiency, reliability, and safety is essential – not just to succeed in the short term, but to sustain long-term partnerships in a highly competitive, highly regulated industry.

The quality and reliability of our outcomes reflect the rigor of our daily operations. Achieving excellence demands a culture of accountability and quality-driven behaviors from the very first day of a program, reinforced at every stage.

Because in this industry, quality is more than a benchmark. It's the foundation of trust – and trust is what keeps us flying.

> In this industry, quality is more than a benchmark. It's the *foundation of trust* – and trust is what keeps us flying.

Source 1: Article from Capital Magazine
www.capital.fr/entreprises-marches/missiles-mistral-canons-caesar-comment-la-france-a-mis-le-turbo-pour-son-rearmement-1513508

Source 2: Specific Dassault related Source : Eric Trappier Interview for JDD (Journal du Dimanche)
www.lejdd.fr/International/eric-trappier-pdg-de-dassault-aviation-nous-etudions-la-possibilite-de-produire-cinq-rafale-par-mois-156251

Source 3: Specific for KNDS & MBDA related Source : Official Visit from Ministre Des Armées, S.Lecornu on Roanne's KNDS Facilities
www.defense.gouv.fr/actualites/canon-caesar-sebastien-lecornu-salue-hausse-production-reduction-delais

About Capgemini

Capgemini is a global business and technology transformation partner, helping organizations to accelerate their dual transition to a digital and sustainable world, while creating tangible impact for enterprises and society. It is a responsible and diverse group of 340,000 team members in more than 50 countries. With its strong over 55-year heritage, Capgemini is trusted by its clients to unlock the value of technology to address the entire breadth of their business needs. It delivers end-to-end services and solutions leveraging strengths from strategy and design to engineering, all fueled by its market leading capabilities in AI, generative AI, cloud and data, combined with its deep industry expertise and partner ecosystem. The Group reported 2024 global revenues of €22.1 billion.

www.capgemini.com

Authors

Frédéric Combes
EVP, Global Aerospace & Defense
Quality Excellence Leader, Capgemini

Alexandre Malka
Global Aerospace & Defense
Quality Excellence Program

Capgemini

Get the future you want