



THE A&D EXECUTIVE'S GUIDE TO  
REALIZING DIGITAL TRANSFORMATION

## Component 6: Optimized sustainment and availability

Keeping fleets in service to drive operational efficiency  
and revenue opportunities

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## Executive Summary

The decades-long lifespan of aircraft, space and defense systems is much more than a simple distinguishing characteristic of the aerospace and defense (A&D) industry. It makes **optimized sustainment and availability** a singularly valuable stage of the product lifecycle.

The upkeep of A&D assets over their long operational lives bears directly on the profitability of commercial programs and the efficacy of space and defense missions. To confirm the importance of A&D sustainment, one need look no further than the early 2024 headlines and consequences of four missing bolts on an Alaska Airlines Boeing 737-9 door plug assembly. The subsequent grounding of all Boeing 737-9 aircraft has escalated the cost of this maintenance error into the billions of US dollars.

A&D manufacturers, owners, operators and agencies face interrelated sustainment challenges. How do you keep fleets in service? More than that, how do you increase the availability and serviceability of each unit? How do you maximize service revenue opportunities, which are critical to profitability, and eliminate costly service issues?

Successful sustainment of today's highly complex A&D assets requires digital transformation of the service and support process. A new approach is needed to keep all stakeholders in sync with real-world data of each asset – as-designed, as-certified and as-maintained. Digital solutions are central to this proactive approach to optimized sustainment and availability.

Siemens solutions for optimized sustainment and availability integrate service and safety considerations from the very start of the design process. They dynamically aggregate and connect all product and service lifecycle data in a single accessible digital twin. And they employ in-service data to optimize the whole support system and close the loop for continuous improvement across the product and service lifecycle.

This eBook explains how digital solutions for optimized sustainment and availability will empower the A&D industry to keep fleets operational and maximize service revenue.

# Embrace a new approach to sustainment and service

The 2024 Alaska Air incident demonstrates that it takes just a small issue to cause an aircraft, if not an entire fleet, to be pulled from service. The incident cast a negative light on the A&D industry, but it also highlights an opportunity to enhance sustainment and service programs to the benefit of the entire industry and its customers. With optimized sustainment, A&D fleets around the globe will attain greater product safety and maximized availability. Additionally, improved reliability, maintainability and support efficiency will increase net revenues throughout the service life of each aircraft, spacecraft or defense system.

Of course, this opportunity arises because there is substantial room for improvement over current sustainment programs. Consider, for example, the U.S. Government Accountability Office (GAO) finding that **53% of U.S. military aircraft did not meet mission-capable goals in any year between 2011–2021**. What's more, only two of 49 aircraft met the service-established mission-capable goal in 2021.<sup>1</sup>

Specific challenges in maintenance and repair programs include unexpected needs for part replacement or repair, limited access to technical data, a shortage of trained maintenance personnel, and shortages or delayed delivery of spare parts. While the defense and commercial aircraft sectors have long faced these challenges, the advent of reusable rockets and in-service refueling of space systems makes sustainment a newly critical area for the space sector, as well.

Naturally, the value of a fleet is realized only when it is available for use. In the case of defense systems, grounding fleets for maintenance may pose considerable safety and security risks. For any A&D program, extended downtime also introduces significant unanticipated costs. When Boeing has to ground hundreds of airplanes worldwide to inspect them for potential loose hardware in the rudder control systems,<sup>2</sup> for example, this translates to at least 700 hours of downtime and lost revenue, plus the costs of labor and inspections.

How can space and defense agencies, A&D OEMs and fleet owners and operators overcome these issues? **How can the industry keep fleets operational and maximize service revenue?**

Drawing on the extensive knowledge and experience Siemens has gained through longstanding partnerships with A&D companies, we have created connected digital solutions that address these questions. These solutions support a new approach to optimized sustainment and availability.

To achieve the service gains offered by this approach, it is crucial to implement a practical digital transformation strategy.

<sup>1</sup> [U.S. Government Accountability Office](#)

<sup>2</sup> [U.S. Federal Aviation Administration](#)





## Drive service efficiency through digital transformation

Digital transformation is key to optimized sustainment and availability because it enables a strategic approach to service engineering, planning and delivery. It supports proactive and efficient sustainment activities throughout the operational life of your assets in the field. Without the capabilities of integrated digital solutions, traditional design and maintenance efforts are not connected. This means the design process is not closely integrated with maintenance and supportability requirements, making it unlikely that these are considered early in product design. Design, maintenance and logistics professionals operate in isolation, leading to higher maintenance costs, lower reliability and a lack of available assets.

Once an aircraft, spacecraft or defense system is deployed, information that connects as-maintained configuration data back to as-engineered data is not readily available through a traditional sustainment approach. It simply can't keep up with asset configuration in the field, which changes every day based on flight hours, service updates, maintenance on-the-fly and the like. Field maintenance using partial or out-of-date information leads to costly downtime and inefficient ad hoc service and repair. Problems also arise due to shortages of spare parts and other supply chain and logistics issues.

All these shortcomings of current sustainment programs lead to sub-optimal fix rates, and in the worst-case scenario, they lead to missing bolts and other potential risks of catastrophic failure.

As your company develops designs for the next generation of products, lack of connectivity between engineering and service lifecycle data from the current fleet also makes it extremely difficult to integrate lessons learned. Program or mission support vulnerabilities are repeated. On the other hand, integrated digital solutions for optimized sustainability and availability drive excellence in fleet performance, which in turn generates profitability and customer loyalty for these high-value, long-life A&D products. Service lifecycle management (SLM) and related software gives stakeholders visibility and control over maintenance programs, improving your customer's or end user's experience and spawning brand loyalty and future growth.

For OEMs, the service revenue stream from decades lifespan of these assets is often more profitable than the sale of the asset itself. Predictable processes for services and better knowledge of the conditions of your customers' assets help increase revenue opportunities for OEMs. New revenue opportunities, such as "asset as a service," are opening up new possibilities for asset utilization in the field.

By digitally transforming your sustainment approach, your A&D organization can enhance fleet performance and availability, leading to increased net revenue.

# Meet the success requirements of optimized sustainment and availability

The aim of optimized sustainment and availability is to keep fleets operational and maximize service revenue. By cultivating into your business culture the following success requirements, which are uniquely supported by Siemens Xcelerator, you will set the stage for achieving this aim.

**Design for service and safety requirements early.** Implementing a **design for service** strategy means that service engineering must start during product design. When product reliability, serviceable architecture, ergonomics and other serviceability attributes are designed in at the beginning, you have created a strong foundation for efficient asset maintenance and right-first time repairs. Likewise, early service planning provides a well-organized knowledge base, including factors that trigger service events and the resources (e.g. spare parts) needed to deliver that service. Efficient and effective asset servicing follows.

**Connect real-world, as-maintained to as-designed data to keep data in sync across the product and service lifecycles.** Centralizing and managing service information, including maintenance updates, creates an accessible resource for any support and service operations. Linking this data to the digital twin keeps all stakeholders up to date with the latest information. A complete and accurate view of assets enables proactive maintenance and reduces failures. This gives insights into asset performance and usage, allowing customers to identify opportunities for aftermarket services.

**Optimize the support system and close the loop using in-service data.** Accurate in-service data drives confidence in fleet maintenance and deployment. Keeping all data connected to the digital twin facilitates access for all stakeholders, regardless of location. When technical publications, manuals and configuration data are always up-to-date, maintenance operations can be streamlined with confidence. Manufacturers can also access as-design, as-certified and as-serviced data to improve next-generation designs and serviceability.

These requirements represent the cultural shift, which is needed at any A&D organization wishing to implement the proposed approach to optimized sustainment and availability. Of course, this cultural shift must be accompanied by a technology shift. Let's take a look at what is needed to digitally transform your sustainment efforts.





# Digitally transform A&D sustainment

To keep fleets in service and drive revenue opportunities, transformational solutions for optimized sustainment enable you to design products for availability and serviceability. Deployed assets and maintenance resources – no matter where they are located – are connected to the digital twin throughout the service lifecycle. And the digital twin of each asset comprises as-designed, as-certified and as-maintained data that is always up-to-date.

Siemens digital solutions for optimized sustainment and availability provide digital continuity for end-to-end service lifecycle management. From the earliest design stage through the entire lifespan of each A&D asset, this digital continuity ensures that all stakeholders can make better, faster decisions about their areas of responsibility, doing their part to maximize the availability and performance of each unit in each fleet.

These solutions are supported through the power of the unique, flexible and open Siemens Xcelerator business platform. The Siemens Xcelerator portfolio amplifies the benefits of sustainment and availability solutions by providing a comprehensive view of your mission or program, its collaborators, stakeholders and requirements. It does so through integrated digital tools that facilitate well-informed decisions about every aspect of sustainment and availability – from decisions made as early as when the product and configuration are defined to real-time decisions throughout the service lifecycle.

Siemens is also collaborating with long-term partner IBM to offer a combined software solution that integrates the two companies' offerings for product and service lifecycle management and asset management. In the realm of sustainment, the integrated solution combines Siemens Teamcenter SLM with IBM Maximo enterprise asset management (EAM). The result is a digital powerhouse that streamlines your program's or mission's service engineering and planning, information management, service execution and asset performance management.

Digital transformation with these tools allows you to implement a proactive approach to sustainment and availability. The digital solutions feature three key capabilities:

- **Designing for service and safety from the start** improves service lifecycle efficiencies
- **Connection of real-world, as-maintained data to as-designed data** keeps data in sync across product and service lifecycles
- **Optimized support system using in-service data** drives confidence in the accuracy of all in-service asset data

Let's look at each of these key features in detail.

## KEY #1

# Design for service early to improve service lifecycle efficiencies

For greater service lifecycle efficiencies, Siemens solutions for optimized sustainment and availability allow you to start at the very beginning of the product lifecycle. Reliability criteria and failure triggers integrated with operational and maintenance requirements in the earliest stage of design help manufacturers to limit failure rates while generating predictable in-service maintenance schedules.

Faster maintenance, increased availability, reduced downtime and improved safety are the primary benefits of Siemens unique approach and design for service capabilities. Your team can account for maintainability, serviceability, testability and safety early in product development. And the closed loop supported by this approach enables you to also consider lifecycle insights and service analysis data from current fleets as you design the next generation.

This approach begins with a model-based logistics analysis to assess reliability and maintenance requirements during the conceptual phase and provide input to engineering prior to detailed design. The software allows your team to identify and address serviceability issues virtually, well before engineering release, which reduces service complexities.



*The AERALIS Advanced Jet Trainer. Image courtesy of AERALIS.*

## USE CASE

# AERALIS

Recognizing that the proliferation of military training aircraft types and configurations adds complexities to design and serviceability, AERALIS has pursued a revolutionary modular approach to design. The company developed a Common Core Fuselage (CCF) concept, which can be assembled with different engine and wing attachments and be tuned to achieve different performance characteristics.

AERALIS uses Siemens solutions to carry out end-to-end digital engineering, including service engineering, generating a comprehensive digital twin of each aircraft. The standardized service requirements of the CCF enhance maintainability and service efficiency of each aircraft type. One specific outcome of design for service is that the AERALIS aircraft fuselage and wing are **designed to allow the use of less costly and more easily serviced commercial off-the-shelf landing gear, rather than the bespoke landing gear** included in an early concept stage.

For more information read the [case study](#).



*Aircraft on the runway. Image has no affiliation to Safran Landing Systems.*

## USE CASE

# Safran Landing Systems

Safran Landing Systems has designed and produced landing gear for more than 25 key airframers of commercial, regional, business and military fleets. As a Tier 1 A&D supplier that has advanced its digital transformation, the company is contributing to optimized fleet sustainment.

Safran landing gear is designed for reliability and supportability. The design team integrates reliability criteria and failure triggers at the earliest design stages, and the team conducts upstream simulations to minimize risks and optimize designs before physical production. **Key outcomes are reduced failure rates and predictable in-service maintenance schedules.**

Safran's optimized lifecycle management ensures access to accurate as-certified and as-serviced configuration data. Predictable service processes improve operational availability, with the alignment of maintenance schedules and operational needs maximizing fleet uptime and promoting OEM revenue growth.

For more information read the [case study](#).

## KEY #2

# Connect as-maintained to as-designed data to keep it in sync

Siemens solutions for optimized sustainment and availability provide digital continuity, which leverages the comprehensive digital twin to ensure product and service visibility to all stakeholders, regardless of location. Linking all field maintenance updates to the digital twin keeps everyone up to date with the latest information, and it ties as-designed, as-certified and as-maintained data together for an all-inclusive view of each asset.

Aggregated data from connected products gives maintenance engineers a complete and accurate view of assets. They can use this real-world information to generate proactive maintenance programs and reduce failures.

Within Siemens solutions, robust change and configuration management employs the centralized design, build and maintenance data of the digital twin to ensure that the service plan is always current with engineering changes. This capability reduces compliance risks.

Siemens digital solutions also support customers as they gain insights from the comprehensive digital twin. They can review asset performance and usage to identify opportunities for aftermarket services, such as spare parts sales, upgrades and tailored maintenance contracts.

Siemens unique approach and capabilities here result in proactive maintenance, operational efficiency, increased revenue, new business opportunities and increased customer lifetime value.

### KEY #3

## Drive confidence by optimizing the support system with in-service data

Keeping all sustainment data connected to the digital twin consolidates it in one place. Stakeholders anywhere in the world have constant access to service engineering planning, support data analysis, support and service data, configuration data, technical publications and manuals. This access increases their confidence in maintenance operations.

Through integrated asset usage tracking provided by Siemens digital solutions, service planners can accurately understand the service forecast and optimize the service schedule. Additionally, maintenance teams can use the centralized, up-to-date sustainment data to accelerate workforce development. Through virtual and augmented reality, maintenance technicians can be trained on the current service plan, which reflects all engineering changes.

Closed-loop insights generated by recording, analyzing and reporting service data through the industrial internet of things (IIoT) enable maintenance engineers to improve service processes. Design engineers can leverage the failure reporting, analysis and corrective action (FRACAS) system and closed-loop deficiency tracking to improve product design. Siemens unique approach and capabilities associated with this key feature lead to shorter turnaround times, greater maintenance efficiency and fewer errors.



*Satellite orbiting Earth. Image has no affiliation to OX Origin.*

### USE CASE

## OX Origin

To support the major missions of European space agencies and companies, startup OX Origin offers its specialized consultancy services through a completely digital way of working. The company employs its comprehensive knowledge base of space industry design, simulation analysis, production and qualification testing processes on a fully integrated engineering platform.

By digitalizing and streamlining design and analysis processes, **OX Origin has reduced engineering time by up to 50 percent.** Key features of the Siemens digital solution for OX Origin include:

- Secure cloud access that empowers the geographically dispersed OX Origin team to collaborate with subcontractors and customers, including simultaneous work on the product's components and subcomponents
- Simplified reporting and documentation that shortens review processes from days to minutes

Validated simulation results are achieved with substantial savings of time and investment capital for OX Origin customers.

For more information read the [case study](#).



# Advance digital transformation maturity through optimized sustainment and availability

Digital transformation for industries like aerospace and defense has been at the forefront of the Siemens vision and mission for a long time. Our thought leadership in this area has led us to identify five levels of digital transformation maturity. As you implement Siemens solutions for optimized sustainment and availability, these solutions can play a critical role in advancing your business through these levels, which is vital to maintaining a competitive edge in the A&D industry.

Legacy systems that support sustainment programs typically offer entry-level digital transformation maturity, known as **configuration** control or product data management (PDM). Information from each sustainment stakeholder is digitally stored, with changes tracked and with ongoing access and search capabilities provided. Data sharing between product design and maintenance at the configuration level is limited. Performance of cross-database functions is primarily a manual undertaking.

The capabilities for optimized sustainment and availability discussed in this eBook offer data **connection** between the OEM, fleet owners, operators and agencies. These capabilities enhance data communication among stakeholders to help keep fleets in service and drive revenue opportunities. The need for human intervention in data management begins to decrease at this level of digital transformation maturity, although manual activities are still required for finding, collecting, tagging and moving data.

Digital solutions for optimized sustainment and availability are beginning to automate these manual tasks, advancing digital transformation maturity into the **automation** level. Automation enables continuous optimization of service engineering, planning and execution across all stakeholders and across the entire product and service lifecycles.

These solutions also allow you to advance within the automation level and eventually into the final two levels of digital transformation maturity, called **generative design** and **closed-loop optimization**. These final levels will become fully available as new artificial intelligence (AI) capabilities reach commercialization.

As you implement the digital transformation of your sustainment approach, you will begin to meaningfully reduce fleet downtime, increase asset availability, reduce errors and increase service efficiency and revenue. Do you want to lay a foundation to leverage future AI capabilities for even more optimized sustainment and availability in the future? Siemens can help you achieve this and more. Click [here](#) to learn more.

## About Siemens Digital Industries Software

Siemens Digital Industries Software helps organizations of all sizes digitally transform using software, hardware and services from the Siemens Xcelerator business platform. Siemens' software and the comprehensive digital twin enable companies to optimize their design, engineering and manufacturing processes to turn today's ideas into the sustainable products of the future. From chips to entire systems, from product to process, across all industries, Siemens Digital Industries Software – Accelerating transformation.

For more information on Siemens Digital Industries Software for A&D, visit our [website](#) or follow us on [LinkedIn](#) and [Twitter](#).

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