Digital twins in commercial aviation
How next-generation technology can power MRO service excellence

MROs of all sizes can leverage the technology of digital twins to better serve customers, differentiate their service offerings and increase understanding of the specialist assets with which they work.

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The global digital twin market size is expected to reach USD 26.07 billion by 2025—registering a strong CAGR of 38.2% over the forecast years. Digital twins provide a valuable bridge between the physical and digital worlds across a range of industries, and the business case for the remarkable growth comes from the need for cost and time-efficient operations, reducing time to market and the growing demands of service-based customers.

Industries spearheading digital twin innovation include healthcare & life sciences, aerospace & defense, automotive & transport, manufacturing, and energy & utilities. Indeed, we are now starting to see the first successful use cases of digital twins in action in commercial aviation. GE has already built digital twin components for its GE60 Engine family and also helped develop the world’s first digital twin for an airplane’s landing gear. In this last scenario, sensors placed on typical landing gear failure points, such as hydraulic pressure and brake temperature, provide real-time data to help predict early malfunctions or diagnose the remaining lifecycle of the landing gear.

Technology—four strategic enablers

These major advances in digital twin capabilities have been driven by four key technologies:

- **IoT & Big Data**—The proliferation of sensors on assets or components combined with connected systems allow organizations to gain detailed insights into live performance.

- **Advanced analytics**—Through machine learning we can use this data to predict and simulate the future condition or deterioration of the asset in question.

- **Computing power**—Cloud-based technology vastly improves the affordability and availability of the computing power required to run large-scale digital twin models.

- **Accessibility**—Where previously a digital twin may have been locked in the control room of a factory or organization, this data can now be accessed from anywhere via mobile devices.
Digital twins work differently in different situations, applications and processes. It all depends on where the organization is in the business chain.

Digital twins aren’t limited to just physical assets
But how do you define a digital twin? An accepted definition would be a replica of anything which gives you real-time insight into the status of real-world equipment to enable organizations to better manage assets and inform business decisions. To some degree, digital twins have actually been around for a while, but they’ve taken names such as ‘mirrored systems’ and ‘connected factories.’

However, these deployments have been focused on physical assets, unlike digital twins which are not limited to a 3D model of a single piece of equipment. Running a digital twin for a single asset is only the first step and, thanks to the four enabling technologies mentioned above, this can now be extrapolated to create a digital twin of a whole fleet of assets. Take this a step further and a digital twin of the whole fleet can become part of a digital twin of an entire business or organization, with process flows visualized and bottlenecks flagged in real time—much more valuable than one fancy 3D model.

Different organizations, different twins
Digital twins work in different situations, applications and processes depending on the context of the organization in the chain. Component manufacturers, for example, are primarily focused on individual components, while engine OEMs care mainly about the engine as an entire asset. Heavy/base maintenance inspectors and regulators are more focused on overall maintenance business processes and standards, and this continues right up to line maintenance providers who look primarily at MRO data and the airline/operator which wants to piece together a digital twin of the entire aircraft.
Drilling down to the data requires enterprise software support

These differing priorities have a consequence on what a business application needs to do to manage digital twin data. A lot of the data required for digital twin technology sits within supporting business applications: assets are mapped within enterprise software, including historical maintenance data, work orders and original engineering and design data.

From this we can see that enterprise applications are hugely beneficial in constructing different kinds of digital twins. In some cases, the supporting enterprise application acts as a digital twin of certain processes—whether that is the entire business or running a 3D model by taking in data from several third-party systems. In others, the enterprise software could be the source of the digital twin, becoming part of a larger data ecosystem which builds up a digital twin somewhere else. However, this requires flexible and agile enterprise software that has been designed to support digital twin initiatives and is suitable to fulfill a variety of roles—failure to track and deliver data in the right place at the right time could lead to a weak link in the chain and undermine an entire digital twin operation.

Four MRO business opportunities

Independent MROs who are regularly capturing key data streams in their enterprise software can start to quickly take advantage of digital twinning to differentiate their service offerings against other independent MROs, and also against large, inflexible OEMs that have a number of disparate systems in place.

There are a number of ways independent MROs can leverage digital twins to benefit themselves and their customers:

1) Further improve aircraft safety

Using serialized asset digital twins in conjunction with real-time/near real-time monitoring and predictive analytics can help detect a defect earlier, through prior insight into the component’s condition. The net result is that part safety is increased, making airlines safer. One strong example is Dutch carrier KLM—it has reduced its minimum equipment list defects and delays and cancellations by 50% since introducing AI to manage predictive maintenance.

2) Moving from ‘fix when it breaks’ to proactive in-service support

Digital twins can transform the maintenance models offered by independent MROs toward offering lifecycle support contracts with individual serialized inspection and service schedules that reduce maintenance visits and costs. By inheriting the pressure of asset maintenance management, MROs allow airlines to focus on their core business of flying passengers, not spending cycles managing wrench turning. They can also redefine service contract terms for the specific assets being maintained based on their digital twin history and performance.

3) Prolong equipment lifecycles

Digital twins also enable MROs to build a broader understanding of supported assets while in service. They can use predictive maintenance techniques to maximize their availability and time on-wing or overlay health monitoring data with a digital asset twin to trend performance and reliability on a serial number basis. This gives them unparalleled insight into the assets they support over time. As more asset information is built into the digital twin, MROs can learn from this to cement their reputation as particular asset or component experts.

4) Drive supply chain integrity

The benefits of a digital twin spread more widely than just the single component in question. By knowing in advance which component will fail, this also allows supply chain managers to plan and have parts and material ready and available when needed—either to replace the failed component or for use as part of the repair process. The net result is that supply chain managers have better control of their stocks.
IFS software is a key facilitator in digital twin projects—and can take on multiple roles depending on the required digital twin scenario. For example, the IFS Enterprise Operational Intelligence solution provides visibility of data that otherwise would exist in silos within the business. IFS creates an integrated view of all business areas, right down to processes and key performance indicators, risks, compliance and financial results. Reporting quality and time-to-action significantly improves because IFS Enterprise Operational Intelligence provides model-driven predictive analysis capabilities that combine data mining algorithmic models and forward-looking what-if scenario planning. This visibility empowers companies to create a digital twin of an entire organization, enabling decision makers to make informed asset management strategy choices based on enterprise-wide performance data.

In other scenarios, IFS software can be a source of digital twin data for part of a larger ecosystem. For example, IFS Maintenix processes key data points during the MRO process. It could be that MRO forms one part of an over-arching digital twin strategy in an aerospace organization. IFS software can feed back information into a third-party system to ensure critical and accurate asset maintenance data makes it back into the larger digital twin ecosystem.
Customer example: TEST-FUCHS

One IFS customer that has designed a dedicated digital twin program is TEST-FUCHS, a leading manufacturer of test systems and components for aerospace and defense organizations. TEST-FUCHS has a dedicated digital twin approach for ground support assets and test equipment.

As the manufacturer of the assets, TEST-FUCHS looks at the engineering & design and procurement data of the asset it is selling, and also has full control of the IoT-enabled test facility to provide maintenance data in real time, then execute that maintenance in its repair shop. This gives the company a deep view of the data which builds up in an asset's lifecycle and provides visibility across the entire digital twin landscape around every asset. IFS Cloud plays a prominent role in this environment—enabling TEST-FUCHS to build up an enterprise-wide picture of their business processes to put the digital twin strategy into action.

Tap into digital twin opportunity

MROs are ideally placed to harness the ROI and benefits of digital twin technology to improve and optimize their service offerings and business performance. But in all the examples highlighted, to effectively put a digital twin strategy in place requires the support of agile and flexible enterprise software geared toward data-driven decision-making. With a strategy that is both solid and visionary, coupled with the right software support, independent MROs can take a slice of the USD 26.07 billion opportunity the growing digital twin market represents, and better serve their increasingly demanding airline customers.
About IFS

IFS develops and delivers enterprise software for companies around the world who manufacture and distribute goods, build and maintain assets, and manage service-focused operations. Within our single platform, our industry specific products are innately connected to a single data model and use embedded digital innovation so that our customers can be their best when it really matters to their customers—at the Moment of Service. The industry expertise of our people and of our growing ecosystem, together with a commitment to deliver value at every single step, has made IFS a recognized leader and the most recommended supplier in our sector. Our team of 4,000 employees every day live our values of agility, trustworthiness and collaboration in how we support our 10,000+ customers.

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