

Rolls-Royce and Microsoft collaborate to create new digital capabilities



Rolls-Royce

“The Microsoft Azure platform makes it a lot easier for us to deliver on our vision without getting stuck on the individual IT components. We can focus on our end solution and delivering real value to customers rather than on managing the infrastructure.

With the increase in the volume and velocity of data that we’re looking at, Microsoft Azure IoT Suite has a key part to play in our ability to reliably aggregate data across our customers’ fleets.”

Richard Beesley
Senior Enterprise Architect Data
Services - Rolls-Royce

“There’s no lack of data in our market today.... and many existing systems struggle to filter the signal from the noise. Our goal is not data for the sake of data, but to embrace the cloud and analytical technologies to deliver more expert insights to the right stakeholders at the right time.”

Nick Farrant
Senior Vice President - Rolls-Royce

Rolls-Royce has more than 13,000 engines for commercial aircraft in service around the world, and for the past 20 years, it has offered customers comprehensive engine maintenance services that help keep aircraft available and efficient. As the rapidly increasing volume of data coming from many different types of aircraft equipment overtakes the airlines’ ability to analyze and gain insight from it, Rolls-Royce is using the Microsoft Azure platform to fundamentally transform how it uses data to better serve its customers.

Worldwide, flight delays and disruptions cost the airline industry millions of dollars every year. Even a small reduction in “aircraft on ground” (AOG) time can translate into significant amount of money, so airlines are always looking for ways to improve the efficiency of maintenance activities.

The same applies to fuel costs. Fuel generally accounts for a whopping 40

percent of airlines' operating expenses. Even a 1 percent optimization of fuel consumption can save an airline millions of dollars annually. A lot of factors affect how much fuel is consumed on a flight, including the flight path selected, weather, engine efficiency, and operational choices such as how much fuel to carry on each flight. The heavier the fuel load, the more fuel the aircraft will burn. A clean engine burns less fuel, but washing engines is time consuming and expensive. Determining when the optimum time is for each of the engines in a fleet to get washed requires the analysis of a lot of data.

In fact, all the choices that affect operating costs and efficiency across an airline require an enormous amount of data analysis, but sorting out which information matters is becoming more difficult as technological advances unleash a rapidly increasing barrage of data. An engine 15 years ago had very few sensors and generated a small amount of signals and data. Today, each engine has many sensors and generates thousands of signals, with a corresponding increase in the number of data points produced. As a leading provider of aviation engine services, Rolls-Royce examined these growing data analysis challenges and emerged with a plan to address the changing market with a more compelling set of services to meet the broader needs of the marketplace.

Leading the industry with services

Across its history, Rolls-Royce has manufactured some of the world's most respected aircraft engines—from its first Eagle engine in 1915 and the Merlin engines that helped Allied aircraft fly to victory in World War II, up to today's top-of-the-line Trent series engines that power aircraft including the Boeing 787 and Airbus A380, A350, and A330neo.

Yet in the commercial airline industry, it isn't just Rolls-Royce's premium engines that customers value. About 20 years ago, Rolls-Royce went from manufacturing and selling engines to extending comprehensive maintenance services to the airlines that use its engines. The company's TotalCare® Services employ a "power by the hour" model in which customers pay based on engine flying hours. The responsibility for engine reliability and maintenance rests with Rolls-Royce, which analyzes engine data to manage customers' engine maintenance and maximize aircraft availability. This model has been very successful for Rolls-Royce and has created

relationships in which airline customers increasingly rely on the company to provide information that optimizes the costs and scheduling related to engine maintenance.

Now, Rolls-Royce has recognized an important opportunity to expand the services it offers by providing meaningful insights across more of the airlines' operations. "The market and the customer need have become much broader as aircraft and engines have gotten more talkative and the scope of our services has increased. There are terabytes of data coming from large aircraft fleets, with gigabytes per hour—rather than kilobytes—to process and analyze," says Nick Farrant, Senior Vice President, Rolls-Royce. "Just managing all this data is driving us into different areas, but it also gives us opportunities to solve different problems through machine learning and analytics. We can use data and insight in new ways to refine our customers' operations to add more value to them and allow them to do more with less."

Filtering the signal from the noise

To bring its vision of a powerful and scalable data analytics system to life, Rolls-Royce chose to build it on the Microsoft Azure platform. "We realized early on, as customer and engine data volumes increased, that we were looking at a big-data problem," says Richard Beesley, Senior Enterprise Architect Data Services, Rolls-Royce. "We quickly concluded that a cloud platform like Azure was a ready-made solution for us."

Beesley explains, "With Microsoft, it isn't just about the infrastructure, it's end-to-end and global. There are the skills, the capabilities, the service offering, the development environment, the security. It all just fit together." Once Rolls-Royce started to collaborate with Microsoft, it began to develop a number of new capabilities using an expansive set of Azure platform services.

Starting with Azure IoT Suite, Rolls-Royce will be able to collect and aggregate data from disparate and geographically distributed sources at an unprecedented scale. "With the increase in the volume and velocity of data that we're looking at, Microsoft Azure IoT Suite will have a key part to play in our ability to reliably aggregate data across our customers' fleets," Beesley says. Initially, the types of data being processed include snapshots of engine performance that the planes send wirelessly during a flight, massive downloads of comprehensive "black box"—type data, technical logs, and flight plans as well as forecast and actual weather data provided by third parties.

Using Microsoft Cortana Intelligence Suite, Rolls-Royce will be able to analyze a rich set of data and perform data modeling at scale to accurately detect operational anomalies and help customers plan relevant actions. Farrant says, “Microsoft Cortana Intelligence capabilities are helping us filter the signal from the noise across large data sets so we can focus on finding the real value in the data. Our vision of future digital capability will need to aggregate many sources of data and provide a platform for collaboration with customers.”

Michael Chester, Product Manager Data Services, Rolls-Royce explains, “By looking at wider sets of operating data and using machine learning and analytics to spot subtle correlations, we can optimize our models and provide insight that might improve a flight schedule or a maintenance plan and help reduce disruption for our customers.”

For example, aircraft and engine components, such as a fuel pump, often have a “soft life”—the point at which it is recommended to remove it for maintenance based on its time in operation. By analyzing detailed data from each specific pump and comparing it to data models and other pumps in the fleet, it is possible to provide an alert that indicates that a specific pump might not be performing well and should be replaced sooner than its soft life. Conversely, if a pump is close to its soft life, but monitoring and analytics show that the performance is normal, a decision could be made to defer until a later, routine maintenance window. Moving to an approach based on components’ actual condition could potentially add up to tremendous savings across a fleet by minimizing the disruption and cost of maintenance. “We see emerging digital technologies and robust prognostic analytics allowing us to work with customers to realize these types of opportunities” Farrant says.

In expanding the scope of services Rolls-Royce offers its customers, fuel efficiency is one of the first and highest-yield areas that the company is targeting. By analyzing new data against existing forecasts, reference tables, and historical trends, Rolls-Royce will be able to help airlines understand exactly which factors—including flight plans, equipment maintenance, weather, and discretionary fuel—have the most impact on fuel performance. “By blending all these data sets, we can provide more targeted and actionable insights at the point of need to inform the decisions that optimize how the airlines go about doing business,” says Chester.

All of this requires a massive level of scalability that is greatly facilitated by employing a wide range of Azure platform services. From using Azure Data Factory for orchestration and Azure HDInsight for high-level data aggregation and summarization, to using Azure SQL and Azure Blob

Storage to handle all the different types of storage needs, Rolls-Royce is taking full advantage of the integrated Azure platform services. Beesley explains, “The Microsoft Azure platform makes it a lot easier for us to deliver on our vision without getting stuck on the individual IT components. We can focus on our end solution and delivering real value to customers rather than on managing the infrastructure.”

Delivering insights to the right stakeholders at the right time

Helping Rolls-Royce’s customers understand the value of the data analytics initiative is vital to the success of the project, and Microsoft Power BI has played a critical role in those efforts. “In the past, building our own chart and dashboard tools was laborious, and it really slowed down some of our product development,” Beesley says. “With Power BI, we can very quickly and easily create reports and dashboards that tell quite a compelling story.”

Rolls-Royce foresees that by gaining access to wider sets of operational data, it will be able to offer more valuable services to customers. Another important benefit is that the company will gain a better understanding of how it should structure its support contracts, how it can better manage risk, and what its product development needs are.

“There’s no lack of data in our market today. We and our customers are drowning in data, and many existing systems struggle to filter the signal from the noise and offer the means to analyze things in a consistent way. Our heritage and focus have been intelligent systems linked to engineering knowledge and designed to provide high-quality information and insight. Digital technology and analytical insight deliver a real, sustainable advantage in the services we provide,” says Farrant.

He continues, “Our goal is not data for the sake of data, but to embrace the cloud and analytical technologies to deliver more expert insights to the right stakeholders at the right time. If we can do that and link new digital capabilities into our services, we can collaborate more deeply with our customers and solve many more of their problems, as well as improve execution in our own business.”

Although Rolls-Royce’s vision for its new, digitally enhanced TotalCare Services is still in its early stages, there is compelling evidence that the aviation industry is ready to embrace it. According to the PwC Global Airline CEO Survey 2014, 71 percent of airline CEOs reported that they are developing future strategies or have concrete plans for making changes to their data management

and data analytics. With highly scalable and sophisticated data analytics services built on the Azure platform, Rolls-Royce's plan to use data to improve the reliability and efficiency of air travel has already taken off.