AVIATAR – Deep dive into prediction with AVIATAR with in-service examples from airlines

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ABSTRACT

This paper demonstrates how AVIATAR prediction successfully improves operational stability. It will explain a specific use case example, presented with customers to complete the holistic view on big data models and predictive recommendations through the eyes of an airline. A deep dive in the ATA chapter 36 (EBASS-suite) will illustrate how Lufthansa Technik's predictive maintenance knowledge achieves numerous cost savings and provides increased operational stability.

1. BACKGROUND OF AVIATAR

AVIATAR is a cloud-based platform not just for airlines but also MROs (Maintenance Repair and Overhaul providers), OEMs (Original Equipment Manufacturers) and lessors. The general idea is to accumulate, consolidate and evaluate information in one data repository. By applying analytical models on collected information, instructive interpretations can be derived. Thus, operators can base their decisions and actions on predictive insights, recommendations and notifications.

The platform also promotes its openness to maintenance providers, operators and organizations as defined by the owner of the data. It is not limited to certain providers, but can be connected to other IT (Information Technology) systems and has many interfaces. AVIATAR also benefits from its modularity – in regards to the conceptual design of the platform and to the way of offering it to operators. They can choose from a central connecting hub of applications according to their needs.

With reference to the Air Operations of an airline, the AVIATAR ecosystem (Figure 1) supports and facilitates technical operations (Tech-Ops). The term Tech-Ops comprises all maintenance and engineering, as well as MRO activities and issues an airline has to deal with.

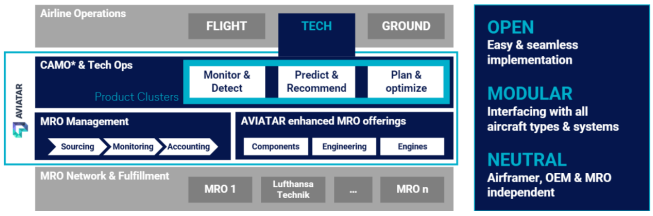

Figure 1: AVIATAR Ecosystem in Airline Operations

2. FUNCTIONS OF AVIATAR

The platform is divided into the different clusters of 'Monitor and Detect', 'Predict and Recommend' and 'Plan and Optimize'. Within each clusters, there are different applications (Figure 2) users can interact with, based on their respective needs. In the following subsection, the focus will be on the 'Predict and Recommend' and 'Monitor and Detect' clusters, where the main modules within each cluster will be explained further.

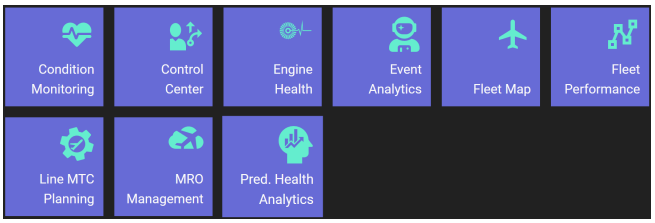

Figure 2: AVIATAR Platform and some applications

2.1. Predictive Maintenance

Within the 'Predict and Recommend' cluster, the Predictive Health Analytics (PHA) application is the gateway to Predictive Maintenance. PHA combines engineering experience and data science expertise to build use cases fitting perfectly to airline Tech-Ops needs. With live data from aircraft, systems and components data, it predicts failures during operation. Analyzing different failure modes and combining this information with aircraft data is one of the key features required by engineering teams. Building on decades of

operational experience Lufthansa Technik has developed this unique digital platform technology.

These best in class analytics connect airline data for nose to tail solutions across all different aircraft types and ATA (Air Transport Association) chapters displayed on one screen for system engineers and troubleshooters. PHA collects the data your fleet is sending and analyses it with AVIATAR's unique algorithms, which had been developed with industry leading airlines and low-cost operators.

3. EBASS SYSTEM

The engine bleed air system (EBASS) is a vital component of an aircraft engine, typically used in gas turbine engines. The system is designed to extract compressed air from the engine's compressor section for various purposes throughout the aircraft. It involves tapping into the high-pressure section of the engine to supply air to other aircraft systems. The primary function of the engine bleed air system is to provide air for the aircrafts environmental control system (ECS). The ECS utilizes bleed air for cabin pressurization, air conditioning, heating and ventilation. The extracted air is directed through heat exchangers, which control its temperature and pressure before it is distributed to different areas of the aircraft. Bleed air can be also used for other purposes, like anti-icing and de-icing in the wings and engine inlets. Another application possibility is for the pneumatic systems. This can comprise operating pneumatic devices like air-driven starters or hydraulic pumps.

AVIATAR provides an extensive EBASS-suite of Predictors that deal with specific elements of the bleed air system (Figure 3). This includes among others the bleed sensors, the pressure regulator valve (PRV) and the high pressure valve (HPV).

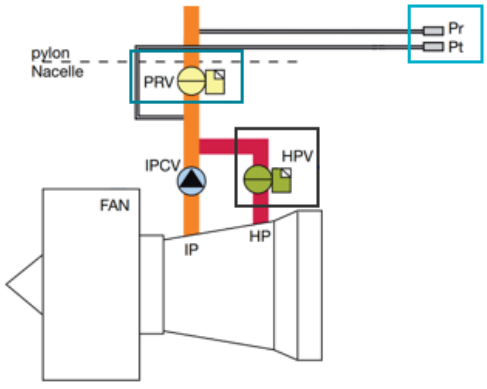

Figure 3: Schematic illustration of the EBASS system of a jet engine, with bleed sensors, PRV and HPV highlighted

4. RESULTING BENEFITS

As the bleed air system is one of the biggest troublemakers on an engine, AVIATAR recognized to draw attention to that system, as it can have a big impact on airline's operations. A failing of the single components can lead to delays and cancellations, an operation of the aircraft under MEL restrictions or it could ultimately results in "in flight turn backs", which would like to be strictly avoided.

AVIATAR's Predictors cover all critical components of the EBASS. It furthermore considers dependencies between different modules, which enables a reliable fault isolation. The health monitoring of the bleed sensors for instance allows validating the valve performance and predicting sensor failures. As an example, the PRV Predictor demonstrates how troubleshooting effort and fuel can be saved through root cause detection (Figure 4).

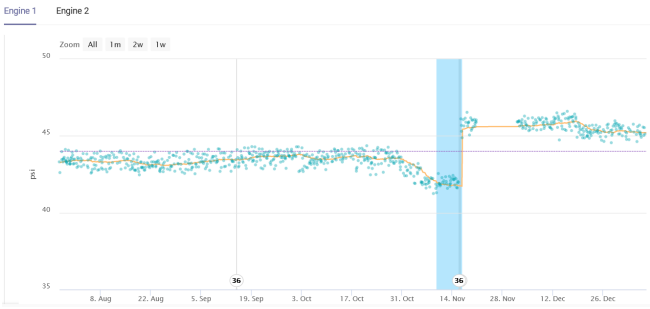

Figure 4: PRV Predictor visualization showing Predictor alert

The above shown Predictor chart makes the steady decrease of the PRV data points visible. Once the alert threshold was triggered, an action was recommended, namely to replace the PRV. By complying with the recommendation quickly, the PRV performance recovered immediately. In that case, the direct removal prevented a complex troubleshooting. Multiple maintenance hours could be saved. Fuel burn was reduced due to avoided engine-run up for fault confirmation. Additionally, the risk of operational interruptions was reduced.

5. DISCUSSION & CONCLUSION

The EBASS is one of the key components of an aircraft that AVIATAR is able to predict certain failures for. Avoiding failures of this component contributes to a higher aircraft availability and a reduction of operational incidents. And although the EBASS-suite is already savings costs for several operators, the suite is yet to be labelled fully developed. Aspects like pneumatic interactions between the components through sense lines, a difficult failure isolation or tough on ground testing capabilities are challenges that have to be met. Nevertheless, feedback of many customers shows, that the EBASS Predictors add a lot of value and help airlines to stabilize their technical operations.

ACKNOWLEDGEMENTS

Sebastian Lang is Head of Sales & Customer Development Asia Pacific – Digital Fleet Solutions Lufthansa Technik. Sebastian is based in Singapore for 3.5

years, managing a regional team to support airlines on the digital transformation of their technical operations, backed by best-in class software services of AVIATAR.
In 2016, Sebastian joined Lufthansa Technik as a Management Trainee. The two-year program provides him with significant knowledge of the company and the MRO industry. As one of the early joiners of the digital initiative, focused on the independent platform AVIATAR, he shaped software developments, agile teamwork and customer collaborations to contribute to the successful Go-To-Market of the platform as the centerpiece of Lufthansa Technik's digital eco-system.
Prior to Lufthansa Technik Sebastian founded and managed a start-up in the event management industry that spread over several cities in Germany with regional representatives. He is holding a Master's degree in Business Administration from the University of Mainz, Germany

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