



WINGS OF INNOVATION

Transforming
Aircraft MRO
with Infosys
Generative AI
Solution

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Charting a course to the destination

Maintenance, Repair, and Overhaul (MRO) business is critical within the aviation industry, as it is responsible for the safety, performance, and longevity of 25000 aircraft globally. It encompasses a wide range of services, from routine maintenance and inspections to complex repairs and overhauls, serving as the backbone of aircraft fleet sustainability and air travel safety.

After a few turbulent years, things are looking up in this segment as air travel returns to pre-pandemic levels. A 2022 IATA report¹ pegged this segment at close to \$80 billion and growing steadily at a CAGR of over 4%. Despite this promising outlook, challenges such as labor shortages, regulations, technological advancements, and

cost pressures continue to plague this industry.

Generative artificial intelligence (AI) offers a beacon of hope as it can activate innovative ways to overcome these challenges and improve the efficiency, productivity, and sustainability of the industry.

A long track record in the aviation industry, especially in product engineering, enabled Infosys to recognize the potential of Generative AI in addressing some underlying issues in the MRO field. An application to tackle document management challenges, a persistent problem, is among the first solutions developed by Infosys using this game changing technology.

¹IATA - Maintenance Cost Conference 2022

Significant headwinds/Navigating the turbulence

Aircraft engineers must frequently handle a variety of documents, including aircraft configuration details, operations manuals, maintenance procedures, service bulletins, warranty claims and airworthiness directives. In addition, this industry is subjected to intense scrutiny by aviation authorities like the Federal Aviation Administration (FAA) and European Union Aviation Safety Agency (EASA), which issue airworthiness directives (AD) periodically to ensure safety. As a result, compliance assumes mission-critical importance as even a single lapse could lead to grounded aircraft and, hence, lost revenues.

Engineers must frequently access these documents for specific information on ADs to further analyze and ensure adherence to airworthiness compliance directives. However, it is no easy task. The

documents are voluminous, and engineers must cater to multiple regulatory agencies. Furthermore, documents contain unstructured text with problem descriptions, resolutions, and references to other documents. Search requires the use of filters and keywords, making the process time consuming. In fact, it can take several days to search, access, and analyze documents, resulting in increased time and possibly errors while also frustrating users with its unwieldiness.

As a result, regular activities such as document search, analysis and interpretation, and management turn out to be complex, making airworthiness compliance analysis highly difficult and laborious. In addition, a significant part of the maintenance budget is devoted to document search and interpretation, underlining the effort involved.

Generative AI Takes Flight: Transforming Maintenance Engineering

That's where Infosys' Infosys After Market Services Team's Generative AI solution in partnership with AWS can help. Its objective is to furnish accurate responses at scale to maintenance engineers' inquiries sourced from the aircraft document repository, minimizing engineering workload and expediting decisions to uphold the aircraft's airworthiness.

Maintenance engineers can use this solution to access the most relevant ADs for a given criteria or to answer airworthiness compliance related questions.

Solution overview

An amalgamation of generative AI, knowledge engineering techniques, and an Infosys-patented framework for supporting aircraft repair processes forms the foundation of this solution. Large language models (LLMs) and knowledge graphs with domain-specific ontologies make the solution powerful.

Context based Semantic search

Amazon Bedrock hosted Claude, Titan models for Query planning, Prompting

Aviation domain focused

Use of prompting technique and domain ontologies, Finetune models on aerospace engineering/AD documents to improve accuracy



Conversational Experience

Chatbot experience with context management

Enables deeper analysis and exploration

Leverages QA history to support follow-on question answering

Ensures traceability

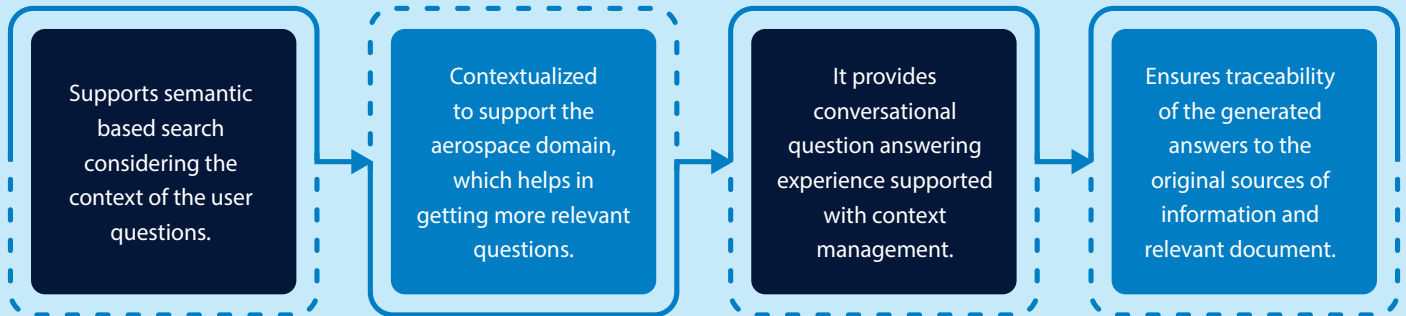
Supports traceability of generated answers to the original sources of information in the document.

Figure 1 The Infosys solution at a glance

Thanks to generative AI, the solution understands the intent and semantics of questions and uses knowledge graphs and language models to offer responses. It then evaluates answers objectively for relevancy and authenticity, which are critical for aviation safety and regulatory compliance. So, it boosts the availability and accessibility to pertinent aviation maintenance and repair content.

Key features

The solution is aimed at assisting maintenance engineers in airworthiness compliance, interpretation, resolution, summarization, and reporting. It helps in finding most relevant airworthiness directives for a given criteria such as aircraft model and problem description etc. It generates answers to various airworthiness compliance related questions. Following are some of the key features:



Solution architecture

The solution indexes and retrieves documents in the following way.

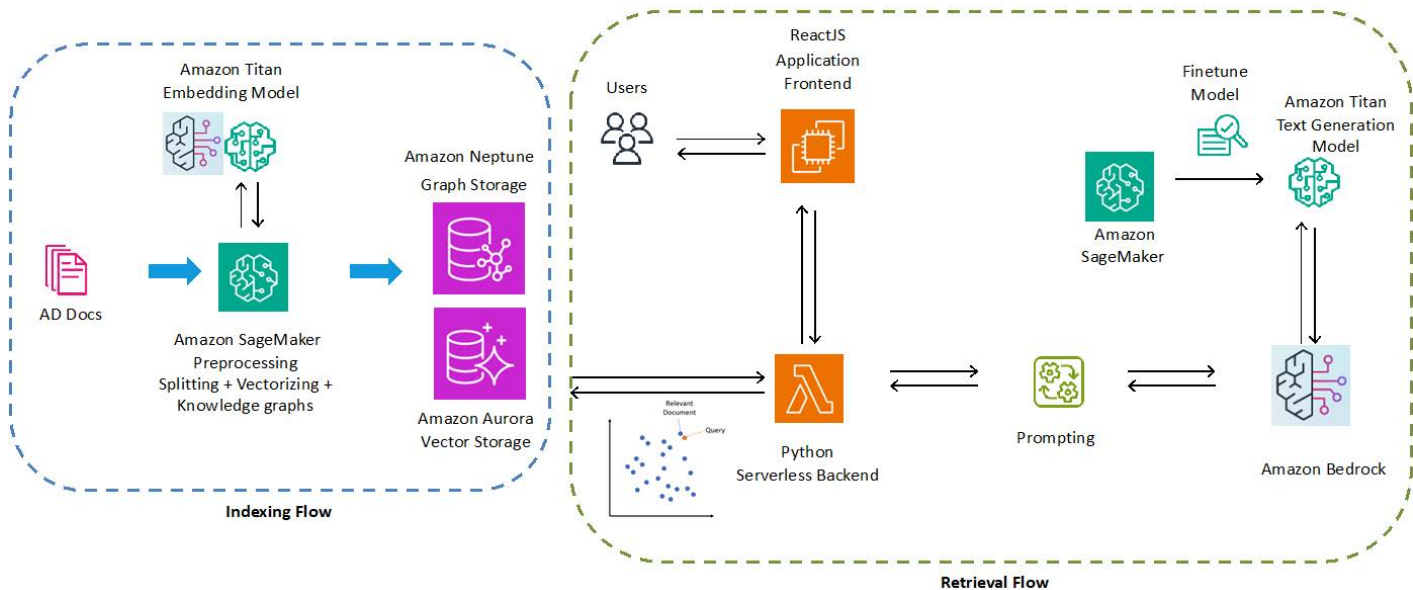


Figure 3 The solution architecture

Indexing, typically a one-time activity, involves pre-processing documents like ADs and transforming them into vectors and triplets (relational) representations. Document text and vectors are stored in a vector database (Amazon Aurora PostgreSQL), while triplets and metadata are stored in a knowledge graph (Amazon Neptune).

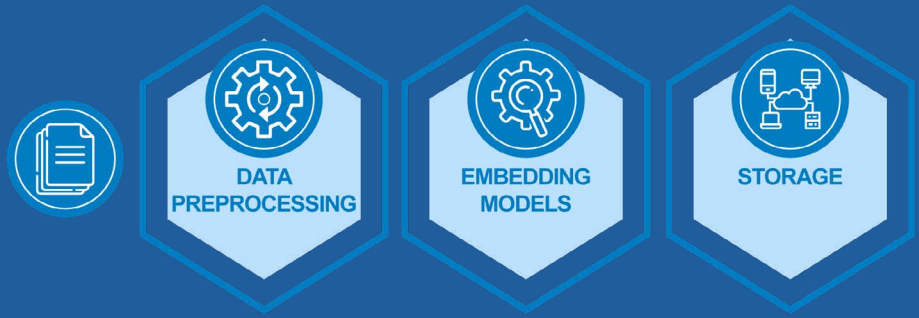


Figure 4 – Indexing flow.

Retrieval means finding relevant documents from the indexed repository based on the user's query. The solution arrives at the final answer by considering the selected set of documents, including references to these chosen documents.

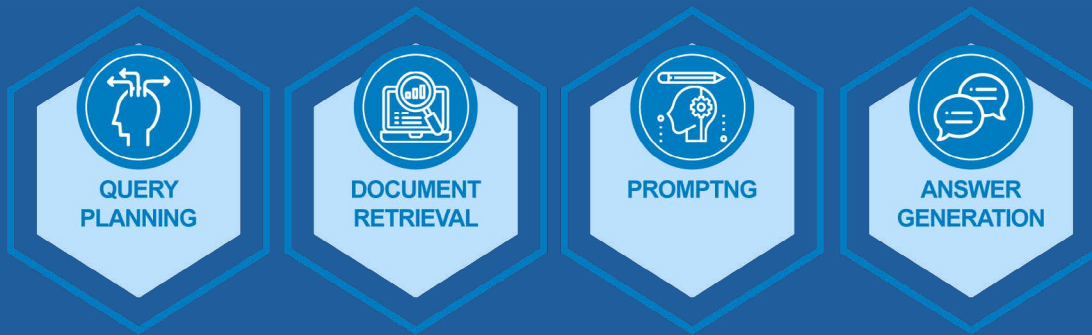


Figure 5 – Retrieval flow.

The Infosys solution significantly utilizes prompting techniques to build and fine-tune the model and compensate for the inaccuracies that LLMs can generate. It minimizes inaccuracies by allowing the LLMs to only produce answers from the relevant document set.

The solution uses an LLM-powered agents' framework for advanced query planning and orchestration of a detailed plan to answer user questions. In its quest to ensure accurate answers, the solution measures them on faithfulness, relevancy, and harmlessness.



Significant Rewards

Aircraft maintenance costs are the second highest cost after fuel costs for aircraft operators. Significant proportion of this is related with maintenance engineering. It involves referring, searching, analyzing, and interpreting various airworthiness directives and maintenance records to arrive at maintenance decisions. Considering the voluminous and varieties of documents with multiple regulatory agencies, frequent updates, and revisions, deeply cross referenced etc., with significant effort and costs being spent on this. The Infosys generative AI solution helps cut down this maintenance engineering costs and speeds up decision-making. Following are some of the key benefits:

Reduced maintenance engineering efforts by almost 50%

Enhanced accuracy, productivity, and efficiency at scale to search, analyze, interpret documents, and summarize the decisions.

Faster decision making, thus improving the aircraft on ground costs.



Soaring high with Infosys

Infosys' two decades of experience delivering results to various players in the aviation industry makes us the right choice for those looking to streamline MRO operations and reduce costs while amplifying the quality of output. Our experience and expertise garnered over the years help us tackle domain-specific nuances and

craft the right solution.

We have comprehensive AI backed offerings across the aircraft value chain and have further bolstered it by quickly capitalizing on Generative AI's promise to transform aircraft maintenance engineering.

For more information, reach out at TravelPractice@infosys.com.



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