AI in aviation: From potential to operational value

ICF perspective on practical implications of new technology solutions in real-world aviation operations.

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Executive summary

Artificial intelligence (AI) is rapidly moving from experimentation to operational deployment across the aviation industry. At the 2026 AGIFORS Airline Operations & Maintenance Conference, discussions consistently focused on how airlines, airports, technology providers, and maintenance organizations are applying AI and advanced analytics to solve real operational challenges.



The examples shared throughout the conference demonstrated that organizations are finding new ways to improve decision-making, accelerate analysis, and unlock value from existing operational data. One common theme emerged: While AI technologies continue to advance, lasting results depend on organizational alignment, effective governance, user readiness, and trust as much as on the technology itself.

Based on ICF's decades of engagement with the aviation industry, we identified five key insights:

- Organizations are creating more integrated operational views by connecting previously fragmented data sources.
- AI is increasingly embedded into everyday workflows as an assistive capability.
- Simulation and advanced analytics are helping organizations evaluate operational scenarios more efficiently.
- Most successful applications focus on extracting greater value from existing data rather than acquiring new data sources.
- Adoption challenges often present greater obstacles than technical limitations.

For aviation leaders, the opportunity extends beyond implementing individual AI use cases. Realizing value at scale requires the organizational capabilities to deploy, govern, and continuously improve AI-enabled solutions across the enterprise.

A shift from AI exploration to AI adoption

Only a few years ago, much of the aviation industry's discussion around artificial intelligence centered on future possibilities. Today's conversation has evolved significantly.

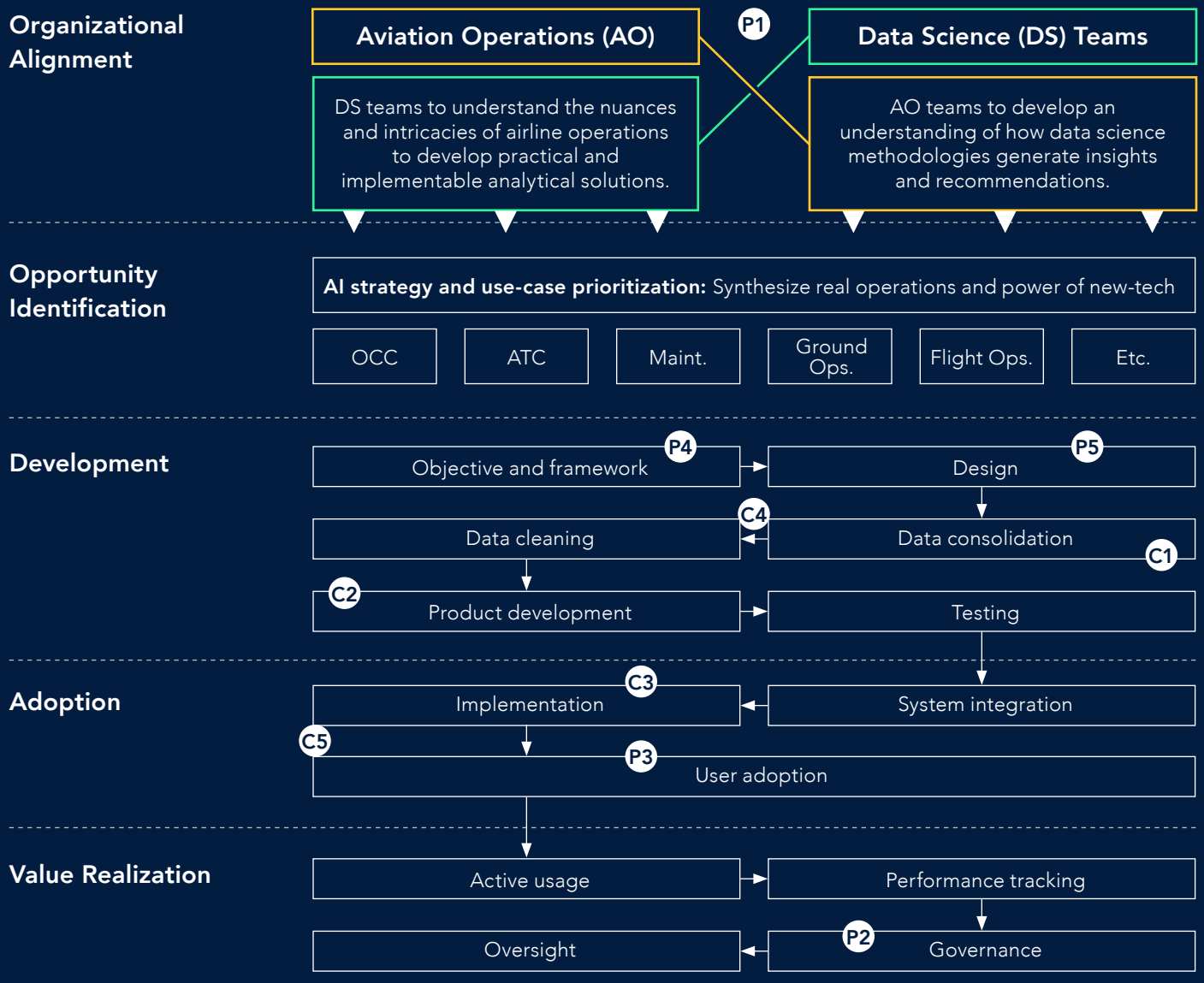
Across the 2026 AGIFORS Airline Operations & Maintenance Conference presentations, speakers focused less on whether AI can add value and more on how organizations can successfully operationalize these technologies. Industry emphasis has shifted toward effective deployment, organizational readiness, responsible oversight, and measurable business impact.

The examples shared at the conference span airline operations, maintenance, workforce management, disruption recovery, and operational planning. While the use cases varied, they revealed five common themes about how aviation leaders are approaching AI implementation today:

- **AI adoption is primarily an organizational challenge**
- **Data quality remains foundational**
- **Cross-functional collaboration is essential**
- **Trust drives adoption**
- **Governance determines long-term success**

Collectively, these ideas reinforce a broader conclusion: Organizations are now focusing on how they can scale AI's value across real operational environments.

Framework: AI adoption value chain



Common themes

C1 Disparate data sources to a unified operational view

C2 Generative AI as an assistive layer in everyday operations

C3 Operational simulations faster and more cost-effective

C4 Solutions focus on how to use historical data better

C5 Decision speed as a design principle

Key pain points

P1 Disconnect between operational and analytics

P2 Unclear ownership of new tech solutions

P3 Limited trust in AI-driven recommendations

P4 Conflicting operational priorities limit optimization

P5 Some decision drivers cannot be modeled

The framework highlights an important reality: delivering value from AI requires more than building models. It requires coordination among operational stakeholders, data science teams, oversight functions, and end users throughout the solution lifecycle.

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Industry examples: Where aviation organizations are applying AI today

Airlines, maintenance organizations, and technology providers are applying AI and advanced analytics to improve operational performance. The examples below highlight both the opportunities and the challenges AI creates as the industry moves from experimentation to implementation.

Creating a unified operational view

Airlines generate and consume information from numerous systems, making it difficult to develop a complete picture of performance. Organizations are using AI and advanced analytics to bring together fragmented operational data, strengthen visibility, and support more informed planning.

Example: Improving ETA predictions through data integration

Aviation organizations rely on information from numerous airline, airport, airspace, regulatory, and environmental systems. However, fragmented data often limits network-wide visibility and makes it difficult to understand the broader impact of operational changes across the network.

One technology provider demonstrated how **integrating more than 50 independent aviation data feeds into a unified operational platform** created a consolidated view of airline operations. By combining **data integration, predictive analytics, and business rules**, the platform improved expected arrival time predictions and supported faster operational responses. Airlines using the solution were better able to anticipate disruptions, optimize staffing, improve connection management, and strengthen day-of-operations execution.

Key takeaway:

A reliable, integrated view of operations often provides the foundation for more advanced AI initiatives.

AI as an assistive layer in everyday operations

Many aviation organizations are applying generative AI and natural language processing to support document-intensive processes, streamline routine tasks, and reduce manual effort while maintaining human oversight.

Example: Automating technical documentation reviews

Maintenance organizations manage large volumes of technical content that must meet strict documentation standards. Converting technical records into Simplified Technical English (STE) has traditionally required significant manual effort, creating challenges for consistency, efficiency, and scalability.

An aircraft manufacturer demonstrated how **using LLMs, generative AI, and rule-based validation** can support this process while **preserving author control and oversight**. The solution generated recommendations aligned to STE standards, explained the rationale behind proposed changes, and integrated into existing authoring workflows. Authors remained responsible for final decisions while benefiting from faster reviews and more consistent outputs.

Key takeaway:

By augmenting rather than replacing human expertise, AI can streamline reviews while preserving author oversight and control.

Faster and more efficient simulation

Simulation continues to play an important role in operational planning and disruption recovery. AI techniques can improve simulation performance, allowing organizations to evaluate more scenarios within operationally relevant timeframes.

Example: Enhancing disruption recovery simulations

Simulation models help organizations evaluate decisions such as delays, cancellations, and aircraft swaps. However, evaluating a large number of possible scenarios can be computationally intensive and time consuming.

One aviation technology provider demonstrated how **Random Forest and Decision Tree machine learning could identify which decisions were most likely to influence operational outcomes before simulations were run**. These models learn from past disruption events and identify which recovery actions, such as delays or cancellations, are most likely to matter. By reducing the number of unnecessary scenarios evaluated, the organization significantly decreased computation time while maintaining comparable results. This enabled faster analysis during operational disruptions, when decision speed is critical.

Key takeaway:

AI can improve both the efficiency and practicality of simulation-based decision support.

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Unlocking more value from existing data

Many of the applications used by the aviation industry do not depend on new data sources. Instead, organizations are finding better ways to connect and analyze the operational, maintenance, and workforce information they already possess.

Example I: Upgrading maintenance analytics through connected data

Airlines generate large volumes of maintenance data, including alerts, technician actions, work orders, inspections, and repair outcomes. However, these records are often analyzed independently, making it difficult to identify broader patterns that may influence maintenance performance and reliability.

One airline demonstrated how historical maintenance records could be connected into **graph-based maintenance episodes** that linked alerts, maintenance activities, and outcomes across time. This approach provided greater visibility into how issues evolved from initial detection through resolution and helped uncover patterns that were difficult to identify through traditional reporting methods. By incorporating temporal and relational context into the analysis, the organization improved its ability to distinguish meaningful predictive signals from operational noise.

Key takeaway:

Organizations can often create greater value by improving how existing information is connected and analyzed rather than acquiring entirely new data sources.

Example II: Improving predictive workforce planning

Workforce planning often relies on historical staffing assumptions and limited visibility into future operational demand. This can lead to inefficient shift allocation, reactive staffing decisions, and increased overtime requirements.

One airline demonstrated how **predictive analytics could be applied to workforce availability, productivity patterns, seasonal trends, holiday impacts, and operational demand** to generate predictive workforce insights. The solution helped forecast staffing gaps, estimate future resource requirements, and identify more appropriate staffing baselines under different demand scenarios. The airline reported improvements in workforce visibility and reductions in overtime requirements as a result.

Key takeaway:

When analyzed collectively, historical workforce data can provide practical insight into future staffing needs.

Accelerating operational decision-making

In aviation, the value of any insight often depends on how quickly it can be acted upon. AI-enabled tools are helping airlines make faster and more informed operational responses in dynamic environments.

Example: Enhancing aircraft return-to-service timeline predictions

Aircraft-on-ground (AOG) events require airlines to make rapid operational decisions, often before maintenance teams can fully understand the scope or duration of a technical issue. Limited visibility into return-to-service timelines can increase operational uncertainty during disruptions.

One technology provider demonstrated how machine learning could be used to estimate return-to-service timelines by **analyzing patterns from approximately 2,000 historical AOG events. Machine learning models** were trained on historical aircraft-on-ground service data to estimate return-to-service timelines. This evolving view enabled airlines to make more informed decisions regarding aircraft substitutions, recovery planning, and schedule adjustments.

Key takeaway:

AI can convert complex maintenance data into actionable intelligence that supports faster responses during disruptions.

Five challenges limiting AI adoption

While conference discussions highlighted numerous examples of AI delivering value, presenters were equally candid about the barriers that continue to limit adoption. Several challenges appeared consistently across use cases, regardless of technology, organization, or operational function.

Disconnects between operations and analytics teams

Analytics and operational teams often approach challenges from different perspectives. Technical teams may focus on model performance and analytical sophistication, while operational teams prioritize usability, practicality, and real-world decision-making constraints. Without ongoing collaboration between the two groups, even technically strong solutions can struggle to gain traction.

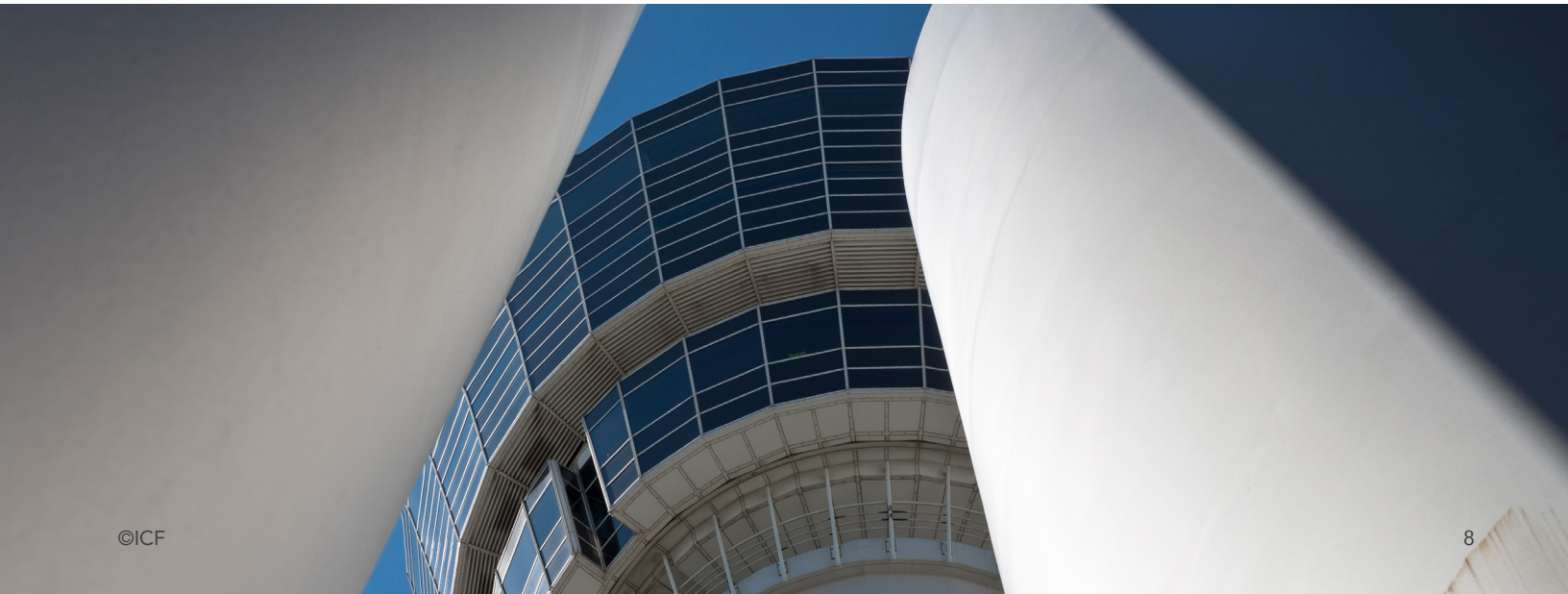
Example: Strengthening a disruption optimizer through collaboration

In many organizations, balancing technical sophistication with operational usability remains an ongoing challenge. Even well-designed analytical solutions often require refinement before they can effectively support real-world decision-making.

One airline demonstrated how a flight-schedule disruption recovery optimizer evolved through **ongoing collaboration between operations personnel and data science teams**. Following initial deployment of an **operations decision model (ODM)** that helps operations choose between options by providing cost-benefit scenarios, stakeholders incorporated operational feedback and refined the optimization logic to enhance solution speed, usability, and decision quality. The revised solution was subsequently used during a major operational disruption.

Key takeaway:

Continuous engagement between technical and operational stakeholders is critical throughout solution development and deployment.



Unclear ownership

Assigning responsibility during solution development does not necessarily establish accountability after deployment. Without a clear structure for validation, oversight, maintenance, and user support, confidence can erode over time.

Example: Adoption challenges in maintenance planning

Many organizations establish ownership for developing new technology solutions, but responsibility for long-term adoption, governance, and maintenance is not always clearly defined. This can hinder confidence and limit implementation success.

One airline developed a **maintenance planning optimization model** alongside an **improved user interface** designed to enhance planning visibility. While operational teams quickly adopted the interface, confidence in the underlying optimization model remained limited. Presenters attributed this challenge in part to the **absence of a structured adoption framework**, including stakeholder validation, governance processes, and clearly defined ownership after deployment.

Key takeaway:

Sustained use requires clear accountability, defined operating processes, and stakeholder involvement in addition to sound technical execution.

Limited trust in AI recommendations

Trust emerged as one of the most frequently discussed factors influencing AI adoption. Even when solutions produce accurate recommendations, users may hesitate to rely on them if they do not understand how recommendations are generated or whether important operational factors have been considered.

Example: Maintenance prioritization and user confidence

Building trust in AI-enabled recommendations remains one of the most significant barriers to adoption, especially when recommendations appear disconnected from operational realities.

One airline demonstrated a maintenance prioritization framework using a **multi-factor prioritization model** designed to support aircraft readiness by ranking work packages according to operational and business impact. Although the framework introduced a structured decision-making process, some users questioned whether the recommendations adequately reflected day-to-day operating conditions. As a result, adoption varied despite the model's underlying design.

Key takeaway:

Transparency, stakeholder engagement, and trust are essential for successful adoption of AI-driven decision support capabilities.

Competing operational objectives

Many aviation decisions require balancing competing objectives across multiple functions. Priorities such as operational performance, maintenance compliance, customer experience, and cost do not always align, making effective decision-making more difficult.

Example: Balancing operations and maintenance priorities

A consulting organization demonstrated how operations and maintenance teams frequently interpret the same flight schedule differently based on their respective objectives. Decisions that improve outcomes for one function may introduce risks or inefficiencies for another. This tension emphasizes the importance of decision frameworks that allow organizations to **evaluate trade-offs and align stakeholders around shared goals** rather than optimizing individual functions in isolation.

Key takeaway:

Many operational challenges cannot be reduced to a single optimization objective.

Human judgment remains essential

Although AI can improve analysis and support decision-making, stakeholders consistently emphasized that operational expertise remains critical. Many operational decisions depend on contextual information that is difficult to represent within analytical models. As a result, organizations continue to rely on human judgment to evaluate recommendations and determine appropriate actions.

Example: Quantifying the cost of disruption

Airlines regularly make decisions during disruptions that affect costs, schedules, passenger experience, crew operations, and network performance. However, understanding the full financial implications of these actions can be difficult because disruption costs are distributed across the network.

One airline demonstrated an analytical framework designed to quantify the broader cost of disruptions by **combining operational and financial data cost analytics and decision-support modeling**. The model provided a more consistent basis for evaluating trade-offs by considering both direct and indirect impacts across the network. At the same time, presenters acknowledged that disruption costs remain highly dependent on operational context and cannot be fully captured through a single analytical model.

Key takeaway:

AI and analytics can strengthen decision-making, but operational expertise remains essential when evaluating complex real-world situations.

Moving from AI potential to operational value

Taken together, the conference discussions point to an aviation industry that is moving beyond experimentation and toward the practical application of AI across operations, maintenance, workforce planning, and disruption recovery. The examples highlighted throughout this paper demonstrate that these technologies can strengthen visibility, improve analysis, and support more informed decisions. They also show that technical capability alone does not determine whether a solution delivers lasting value.

For aviation organizations, the next stage of AI adoption will require an equal focus on people, processes, and technology. Clear ownership, trusted data, cross-functional collaboration, effective governance, and sustained engagement with operational users will be essential to moving solutions from pilots into everyday workflows.

Organizations that build these foundations will be better positioned to scale AI responsibly while preserving the human judgment required in complex operational environments. The opportunity ahead for the aviation industry is to create organizational conditions that allow AI tools to produce meaningful and durable operational value.



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