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The Next Control Tower : Agentic AI for Airline Operations

From Predictions to Autonomous Decisioning

CONTENT

The Contextualization

The airline industry has long embraced technology as a catalyst for transformation. Today, predictive AI stands as a powerful tool—enabling forecasts of demand, disruptions, maintenance requirements, and customer behavior with increasing accuracy. Yet, prediction alone is not the destination. The next great S-curve in airline technology lies in what comes after foresight: the ability to take intelligent, autonomous action in real time.

This is the shift from knowing what might happen to ensuring the best response happens automatically. While predictive models have matured, there remains an enormous gap between generating insight and executing the optimal decision. Closing this gap will fundamentally redefine how airlines operate, recover, and serve their customers.

Imagine an airline ecosystem where:

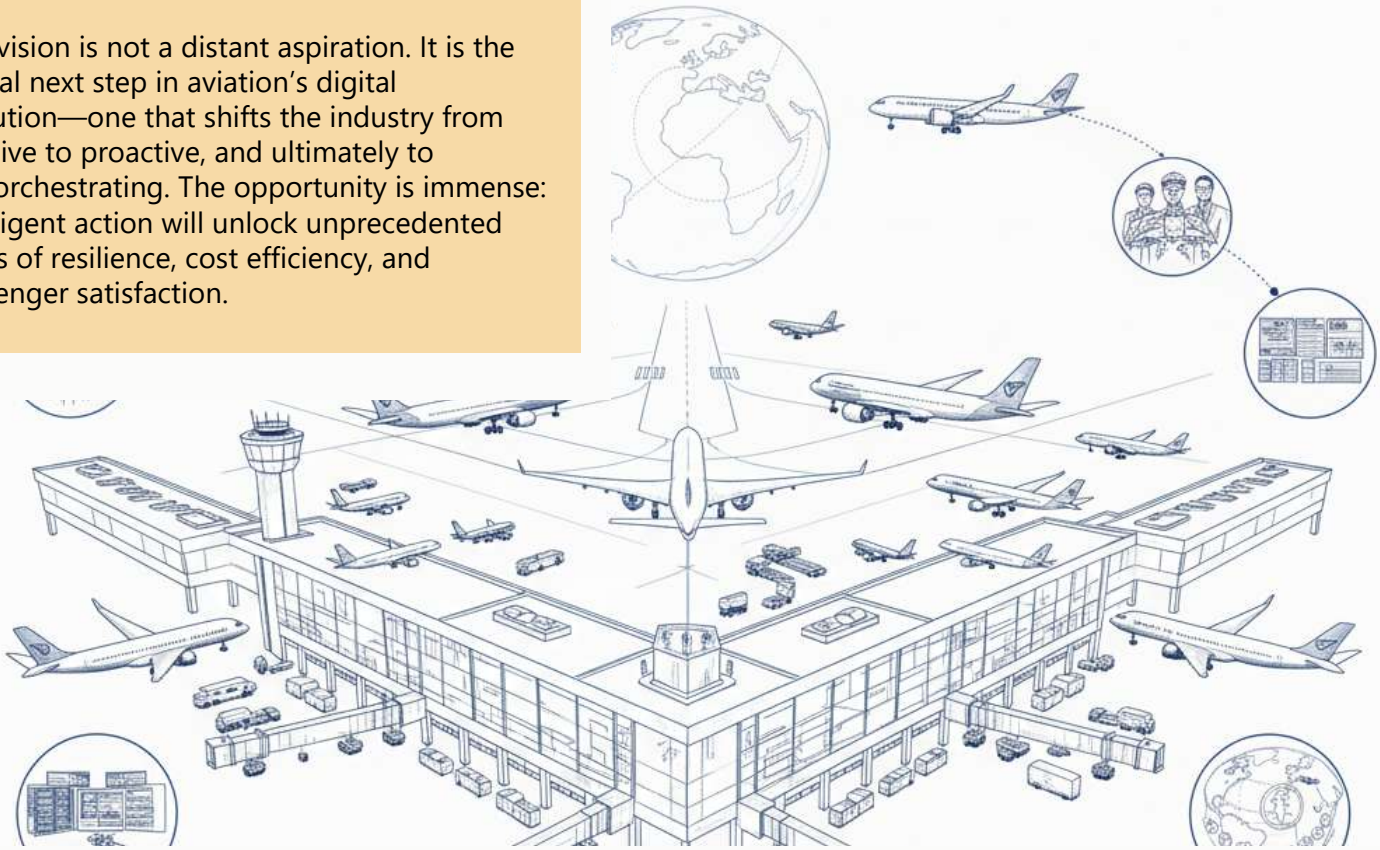
Passenger disruptions are resolved instantly, with autonomous, context-aware rebooking that considers not just seat availability, but loyalty status, onward connections, and customer preferences.

Crew resources are dynamically reallocated within minutes of an irregular operation, minimizing cascading delays and fatigue risks.

Maintenance windows adapt fluidly based on real-time aircraft health and operational context, balancing safety, reliability, and utilization.

Connection times are continuously optimized, ensuring passengers make flights seamlessly while protecting network integrity.

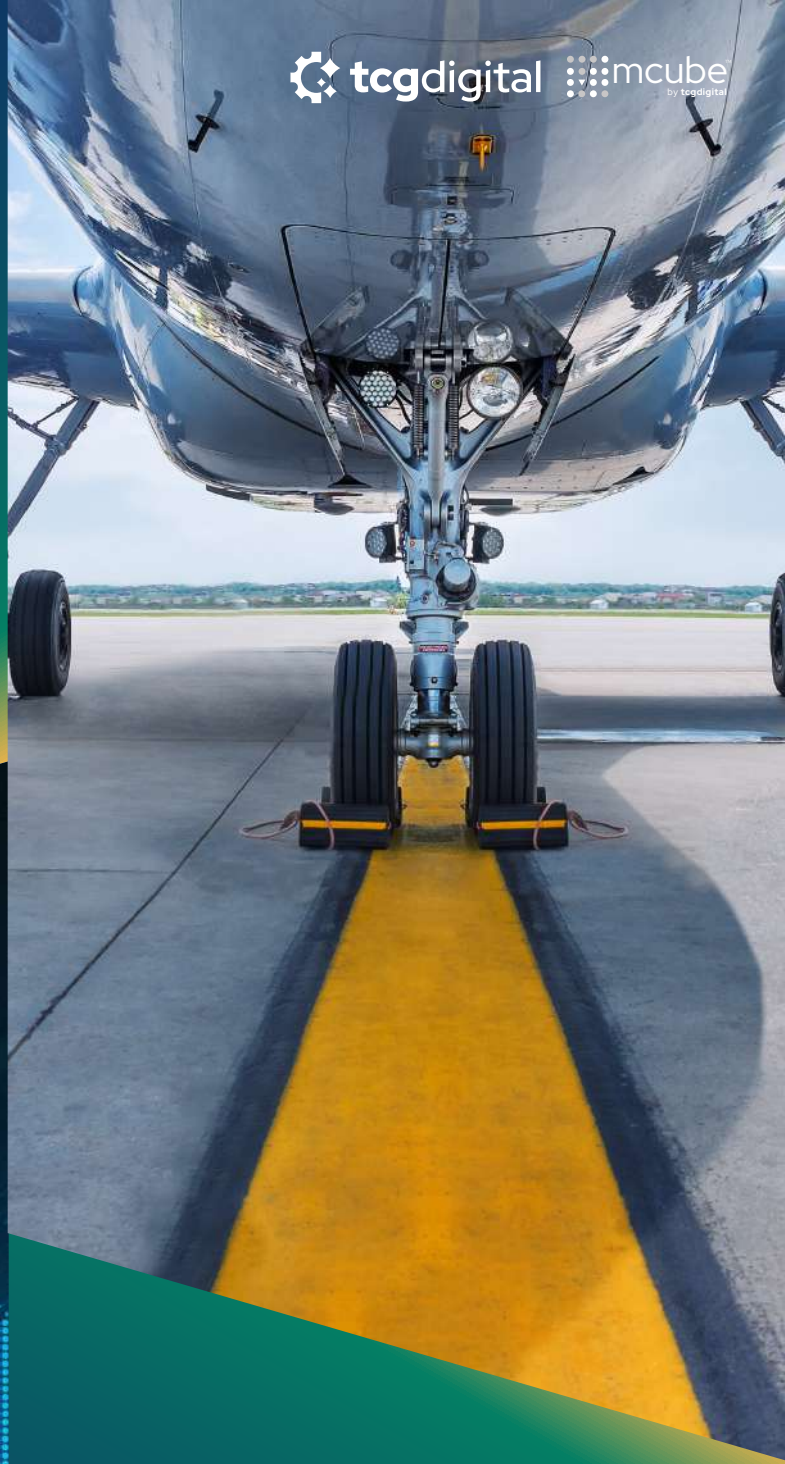
This vision is not a distant aspiration. It is the logical next step in aviation's digital evolution—one that shifts the industry from reactive to proactive, and ultimately to self-orchestrating. The opportunity is immense: intelligent action will unlock unprecedented levels of resilience, cost efficiency, and passenger satisfaction.



Why now?

Traditional predictive AI → tells you what will happen
(e.g., "This flight will be delayed").

Agentic AI → autonomously acts
(e.g., "Delay is predicted, so I've already rerouted high-value passengers, reassigned crews, and informed ground handlers").



Catalysts enabling this shift:

Maturity of predictive AI models.

Gen AI for real-time reasoning and decision contextualization.

API-driven airline/airport ecosystems.

Regulatory acceptance of AI-assisted decision-making in safety-adjacent area

In this paper, we have considered **4 core value creation levers** for the conceptualization and treatment of Agentic AI for Airline operations.

Faster IROPS recovery (minutes not hours)

Seamless passenger handling → NPS uplift

Reduced crew/aircraft misallocation costs

Revenue protection through smarter disruption management

We'll explore agentic AI for airlines through four lenses—its core value levers, the operational use cases it transforms, and the implementation and integration of agents within current airline systems.

IROPS Prediction and Recovery Agents

The current challenge

- A single disruption can cost millions in re-accommodation, compensation, and lost revenue.
- Current processes are manual and reactive, with dispatchers juggling multiple constraints under pressure.
- Recovery delays create dissatisfied passengers and brand damage.

What the Agent will do

- Perception: Monitors flight status, weather, ATC, crew rosters, aircraft rotations, passenger itineraries.
- Reasoning: Predicts cascading disruptions across flights, connections, and crew.
- Decisioning: Optimizes recovery actions (rebooking, aircraft swaps, holding flights).
- Action:
  - Auto-rebooks passengers based on revenue/NPS value.
  - Suggests crew swaps that comply with legality.
  - Executes aircraft swaps when feasible.
  - Sends real-time updates to customers.
- Learning: Improves recovery strategies from outcome data.

15–25% faster recovery
protects revenue on downstream flights

5–10% lower disruption costs
(rebooking, hotels, compensation)

High-value passengers protected
through early auto-rebooking

Significant NPS uplift
from proactive handling

Connection Saver Agent

The current challenge

Passengers miss connections even when small adjustments could have prevented it. Manual intervention is inconsistent.

What the Agent will do

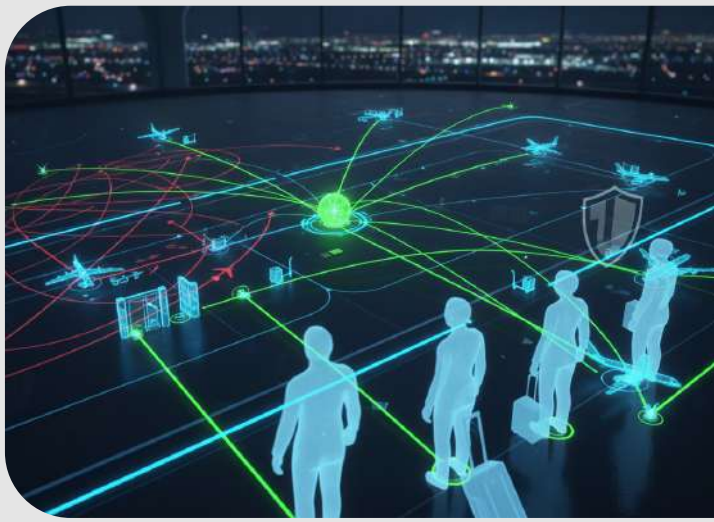
- Perception: Tracks inbound/outbound connection matrices.
- Reasoning: Models trade-offs between holding a flight vs. rebooking costs.
- Decisioning: Calculates optimal decision within OTP and cost guardrails.
- Action: Holds departure dynamically (e.g., 5 min) or auto-rebooks pax.
- Learning: Continuously improves cost vs. loyalty trade-offs.

1–3 pp increase in successful connections

Reduced rebooking and hotel costs

Higher loyalty retention

Smoother bank operations with fewer misconnect cascades



Crew Pairing & Roster Agent

The current challenge

Crew scheduling is constrained by legality, fatigue rules, and training, but disruptions make manual adjustments costly and error prone.

What the Agent will do

- **Perception:** Tracks crew schedules, duty hours, fatigue constraints, training requirements
- **Reasoning:** Identifies risk of legality breaches during disruptions
- **Decisioning:** Balances cost vs. compliance vs. downstream impact
- **Action:** Proposes or executes dynamic crew pairing adjustments
- **Learning:** Refines rostering heuristics over time

3–7% crew cost reduction (standby, deadhead, hotels).

Fewer legality violations, reducing union disputes

Faster recovery during disruptions

More stable and compliant crew schedules

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Turnaround & Ground Ops Agent

The current challenge

Turnaround delays often stem from baggage, catering, fueling, or boarding. Current monitoring is reactive and siloed.

What the Agent will do

- **Perception:** Integrates IoT sensor feeds, ground support equipment (GSE), airport systems
- **Reasoning:** Predicts bottlenecks (e.g., delayed baggage unloading)
- **Decisioning:** Reoptimizes task order to minimize impact
- **Action:** Reassigns tasks to staff, re-sequences ground service equipment dispatch
- **Learning:** Improves predictions of bottleneck patterns

5–8% OTP improvement, boosting brand and codeshare reliability.

Value Creation

Reduced penalties from ground delays

Higher aircraft utilization

More predictable and efficient turnaround operations

Predictive Maintenance Agent

The current challenge

Predictive maintenance insights still require manual planner action, causing delays and inefficiency

What the Agent will do

- **Perception:** Ingests aircraft sensor data, MRO history, line maintenance logs.
- **Reasoning:** Detects components likely to fail.
- **Decisioning:** Plans optimal maintenance window aligned with aircraft availability.
- **Action:** Autonomously schedules tasks, initiates parts procurement.
- **Learning:** Improves accuracy from outcomes of scheduled interventions.

10–15% fewer AOG events

Lower unplanned maintenance costs

Higher aircraft utilization

More reliable and planned maintenance operations

Our approach for **'velocity to value'**

At TCG Digital, we follow a structured 5-stepped approach to implementing Agentic AI solutions for airlines.

Agentic AI implementation for airlines

A structured pathway to deploy AI agents across operations

01 **Value mapping and prioritization**

Identify business critical pain points and quantify potential value

02 **Data readiness and integration**

Build the data backbone for agent intelligence

03 **Pilot and shadow mode validation**

Test AI agents recommendations against human experts decisions

04 **Phased autonomy with governance guardrails**

Transition from decision support to partial autonomy

05 **Scale and orchestration of multi-agent system**

Expand from singleagent pilots to holistic operational orchestration

This provides clients with:

- **Faster ROI & Prioritized Value Delivery** – By starting with value mapping, airlines invest first in use cases with the highest financial and operational impact.
- **De-risked Adoption** – Shadow mode validation ensures AI agent decisions are tested safely against human experts before autonomy.
- **Data-Driven Resilience** – A structured data backbone enables agents to act on realtime operational signals across crew, aircraft, passenger, and weather.
- **Controlled Autonomy with Governance** – Gradual rollout with guardrails balances innovation with regulatory, safety, and compliance requirements.
- **Scalable Transformation** – Expands from single-agent pilots (e.g., IROPS) to multi-agent orchestration, driving system-wide efficiency and disruption recovery.

Ending thoughts

Airline operations are too complex and dynamic for legacy systemsalone to manage effectively. Agentic AI changes the game—movingfrom reactive decisions to proactive, real-time optimization acrossdisruptions, crews, connections, and maintenance. Our structuredframework ensures safe, phased adoption: starting with value-drivenpilots, validating against human expertise, and scaling into multi-agentorchestration.

This is not about replacing human judgment but augmenting it with AIagents that anticipate, recommend, and act faster than traditionalprocesses. The outcome: greater resilience, lower costs, and strongerpassenger trust.

Airlines that embrace Agentic AI now will not just adapt to disruption—they will define the next era of operational excellence.

TCG Digital is the digital & AI arm of The Chatterjee Group (TCG), a multi-billion dollar conglomerate with a diverse portfolio in Aviation, Pharmaceuticals, Biotech, Petrochemicals, and Real Estate across the US, EU, and South Asia. Our umbrella includes companies such as LabVantage, Lummus Technology, and TCG LifeSciences. At TCG Digital, we are driven by our mantra of delivering "Velocity to Value", helping enterprises transform faster and smarter. Our AI Analytics platform mcube™ is at the heart of these transformations. We enable organizations unlock the full potential of their data, and by seamlessly integrating AI/ML capabilities into their business processes, we empower businesses to accelerate their digital transformation journey, enhancing agility and driving impactful results.

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