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Deloitte Case Study

AeroPro Airlines Supply Chain Strategy

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Date of Submission:

November 19, 2024

Executive Summary - Aeropro (API) is grappling with significant maintenance-related inefficiencies that have led to rising operating expenses. Due to flawed maintenance processes, the airline is struggling to lower expenses relative to the industry standard. These inefficiencies result in a high volume of Non-Operational Aircraft (NOA) — planes grounded for maintenance reasons — which disrupt flight schedules. This increases both flight delays and cancellations, directly leading to lost revenue. In response to these challenges, we propose a solution that focuses on bringing down these operational expenses through predictive maintenance. Our primary objective has been to improve maintenance performance, specifically targeting the reduction of NOA, in order to streamline operations and drive greater efficiency across the fleet. To accomplish this, we recommend implementing Internet of Things(IoT) technology and digital twin technology to existing aircraft and leveraging artificial intelligence to create more accurate predictive maintenance. By addressing these issues, Aeropro will be able to regain its competitive advantage, reduce delays and cancellations, and ultimately improve its profitability.

Problem Explained - Various factors are contributing to elevated levels of NOA, including a combination of reactive maintenance practices, inefficient workflow management, delayed part deliveries, and inadequate preventive measures. API's current maintenance tracking systems have not been sufficient. AeroPro Inc. is facing significant operational inefficiencies, primarily due to its daily NOA exceeding the target of 25, with an average of 35 NOA per day. This results in substantial daily costs, estimated at $39,125 per NOA, leading to an annual financial impact of approximately $142.8 million if reduced by the target of 10 NOA (Figure 3). Key areas for improvement include maintenance scheduling and delays, which not only increase costs but also affect customer satisfaction. Additionally, the company is incurring high expedite fees for maintenance parts, suggesting inefficiencies in inventory planning and supply chain management. Furthermore, AeroPro's excessive WIP (Work-in-Progress) inventory, totaling $3.95 billion, particularly in expendables and rotables, highlights potential overstocking and poor inventory turnover. Internally, API faces significant challenges with its current reactive maintenance approach, which has led to frequent unplanned downtimes, inefficiencies in resource utilization, and higher operational costs. Managing maintenance for a diverse fleet of aircraft adds further complexity, resulting in delays and reliance on expensive expedite fees. Industry benchmarks show that adopting predictive maintenance systems can significantly reduce NOA, with some competitors reporting improvements of 30 percent, potentially saving API over $140 million annually if it reduces its NOA by just 10 aircraft per day. (Murugan)[Figure 3]

Recommendations - Our proposed solution is specifically designed to address three critical operational levers that directly impact AeroPro Airlines Inc.'s efficiency and cost structure: NOA, WIP Inventory, and Expedite Fees. By targeting these levers, we align with API's strategic objectives of reducing operational expenses, improving reliability, and enhancing service quality.

The integration of IoT technology will reduce expedite fees, minimize WIP inventory, and reduce NOA – all of which contribute to significant cost savings and operational improvements . IoT sensors will be embedded in critical aircraft systems, such as engines, landing gear, and electronics, allowing API to continuously track their wear and performance. Through the use of RFID and barcode technology in maintenance hubs, IoT provides continuous monitoring of parts availability, allowing airlines to proactively manage inventory, avoid costly emergency orders, and reduce expedited shipments. This approach can lead to a reduction in expedite fees by as much as 25%, resulting in millions of dollars in savings annually. Airlines adopting IoT for inventory management have experienced reductions in WIP inventory by 15%, reducing storage costs, and improving operational efficiency. One example of how successful this could be is Aventus, a company which tested this innovative solution at Heathrow Airport in partnership with Airport Perishables Handling (APH). By equipping ground handlers with a mobile app that digitizes the tracking of aircraft containers using IoT technology, the system reduced manual errors and allowed for real-time data sharing across secure networks involving airports, airlines, and freight forwarders

(See Figure 4) (Nilson).

Airlines that have successfully implemented IoT solutions have reported significant reductions in inventory costs, expedited shipping fees, and aircraft downtime. These improvements translate into millions of dollars in savings and a more reliable, efficient fleet (Figure 5).

A core aspect of our predictive maintenance recommendation is the implementation of AI-driven predictive analytics systems. These systems will monitor aircraft components in real time, incorporating both current and past data to identify potential part defects before they occur. Predictive analytics will improve fleet availability by allowing API to be more proactive in planning maintenance during down time. For API, achieving a reduction in non-operational aircraft by even 10 per day could generate annual savings exceeding $149 million. (Figure 3) In addition, AI-enhanced demand forecasting optimizes resource distribution by accurately predicting parts and labor needs, minimizing the costly delays caused by supply chain disruptions and unplanned maintenance. For example, Delta's AI-driven predictive maintenance cut cancellations from 5,600 to 55 annually, dramatically improving reliability and customer satisfaction. (Estes)

The next essential component of predictive maintenance is the adoption of digital twin technology. This technology will create a virtual “twin” model of each aircraft, showing the expected health and efficiency of each part of the real plane at all times. These virtual replicas will offer detailed real-time data on fleet and engine performance, enabling API to proactively address inefficiencies and streamline maintenance processes. This will eliminate the error that comes from guessing when a part needs to be replaced and the unexpected downtime that this can cause. Airlines and manufacturers that have embraced digital twins, such as Boeing, have demonstrated significant gains, including a 40% improvement in first-time quality of parts. (Bellamy) For API, this technology provides an opportunity to simulate “what-if” scenarios, optimize fleet usage, and fine-tune maintenance schedules without interrupting live operations.

Our solution ensures visibility into stock levels and future requirements, enabling API to anticipate part shortages and align procurement processes accordingly. This will minimize the need for emergency shipments, with our target being a 30% reduction in expedite fees. Our proposed solutions all complement each other to create a single integrated solution. Better data gathering feeds into AI-driven predictive analytics: optimizing maintenance schedules, preventing disruptions, and enhancing operational efficiency. IoT-enabled inventory tracking enables the use of digital twin technology to simulate aircraft performance and maintenance scenarios, enabling API to make data-driven decisions giving it a competitive advantage in a highly dynamic industry.

Risks and Mitigations - Our proposed predictive maintenance solution offers significant benefits but comes with challenges that must be carefully managed. The primary concern is the financial burden, with an estimated implementation cost of $162.5 million and annual upkeep expenses of $37.8 million, which include operational costs, software updates, cloud services, sensor maintenance, and expert staffing. To mitigate this financial risk, a phased rollout is essential, allowing for measurable results before advancing and validating ROI early to secure stakeholder support. Technical complexity is another challenge. API will need to partner with experienced vendors, conduct thorough testing, and pilot each technology before full deployment. Regular monitoring will ensure smooth integration. Data security and reliability are also concerns, as cloud-based systems are vulnerable to cybersecurity threats. API will need to invest in strong cybersecurity measures, such as encrypted data transmission, system audits, and failover systems to maintain operational continuity. Financially, the solution offers substantial returns, with projected savings of $149.9 million annually from NOA reduction, $592 million from WIP inventory optimization, and $337,000 in expedite fees creating a cost-to-savings ratio of over 9:1. (Figure 6)

Appendix

Figure 1

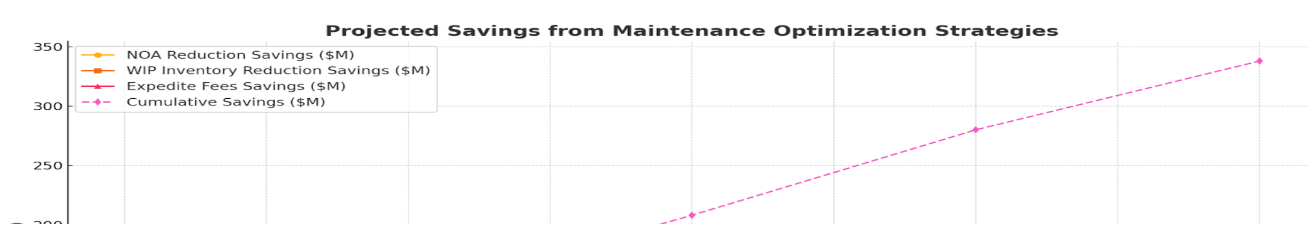


Figure 2

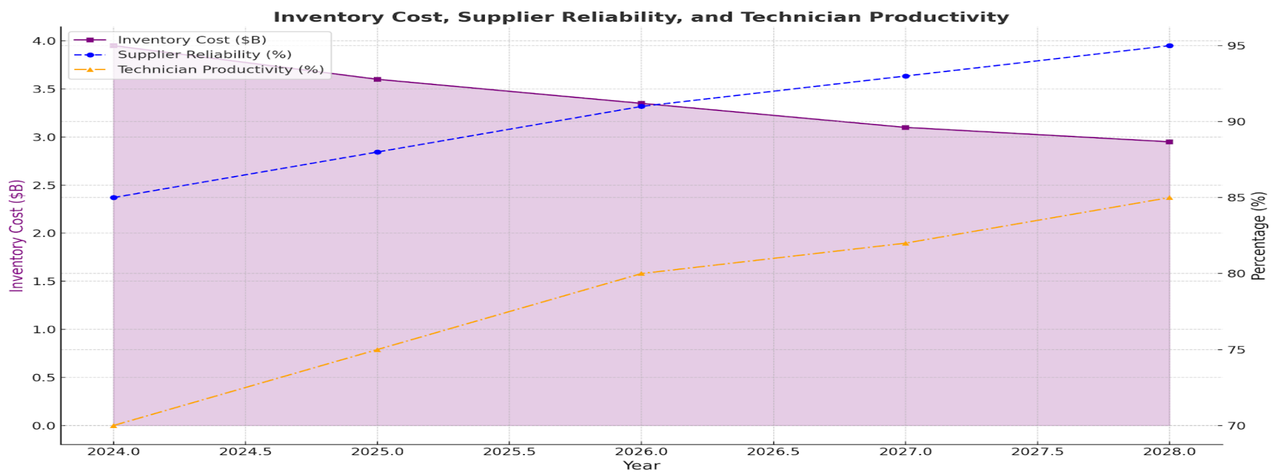
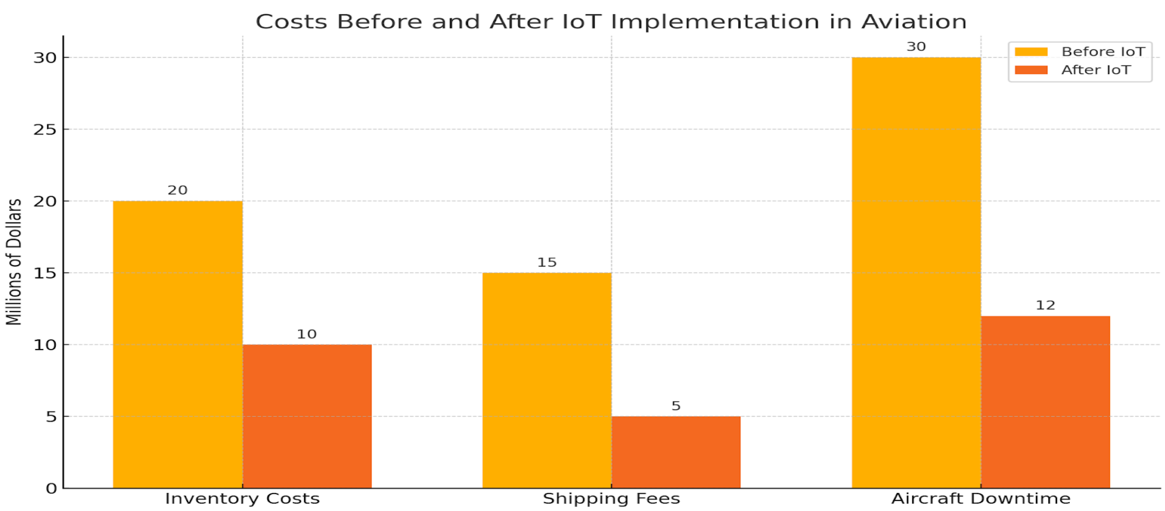


Figure 3

Figure 4 (Frost, & Sullivan)



ACFT Type	NOA Cost / Day
Airbus A319	$ 22,000
Airbus A320	$ 32,000
Airbus A321	$ 41,000
Boeing 737-800	$ 34,000
Boeing 777-200	$ 35,000
Boeing 777-300	$ 60,000
Boeing 787-8	$ 36,000
Boeing 787-9	$ 53,000
AVG Cost/Day	**$ 39,125**

Figure 5(Impact of Blockchain at Heathrow Airport. [Bar Chart]. In Journal of Blockchain Applications in Transportation, 2024, p. 58)

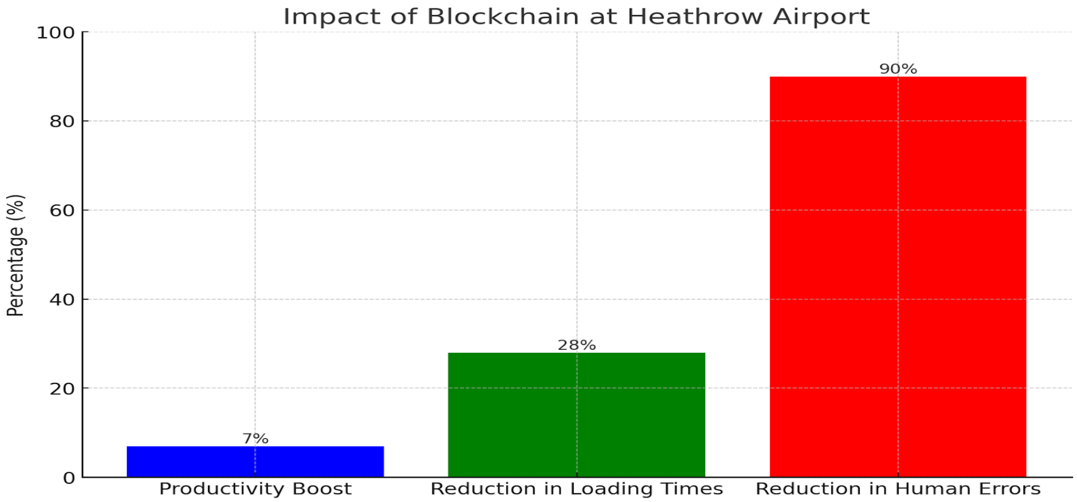


Figure 6 (Our calculations)

	Initial Cost	Yearly Cost	5- Year Total Cost		Yearly Savings	5 Year Savings		Yearly difference	5 Year diff incl. initial
Digital Twin	$200,000.00	$211,800.00	$1,259,000.00	WIP	$592,500,000	$2,962,500,000		$704,967,526	$3,199,777,628
IoT	$67,330,000.00	$37,605,000.00	$255,355,000.0(	Exp.	$337,763.00	$1,688,815.00			
AI	$95,000,000.00	$0.00	$95,000,000.00	NOA	$149,946,562.5(	$749,732,812.5(			
	$162,530,000.0(	$37,816,800.00	$351,614,000.0(		$742,784,326	$3,713,921,628			
sensors and har	45310000	fixed							
software (annua	31520000	annual	IoT Calcs						
connectivity	6085000	annual							
setup/integration	22020000	fixed				10.56249645			
total fixed	67330000								
total annual	37605000								

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