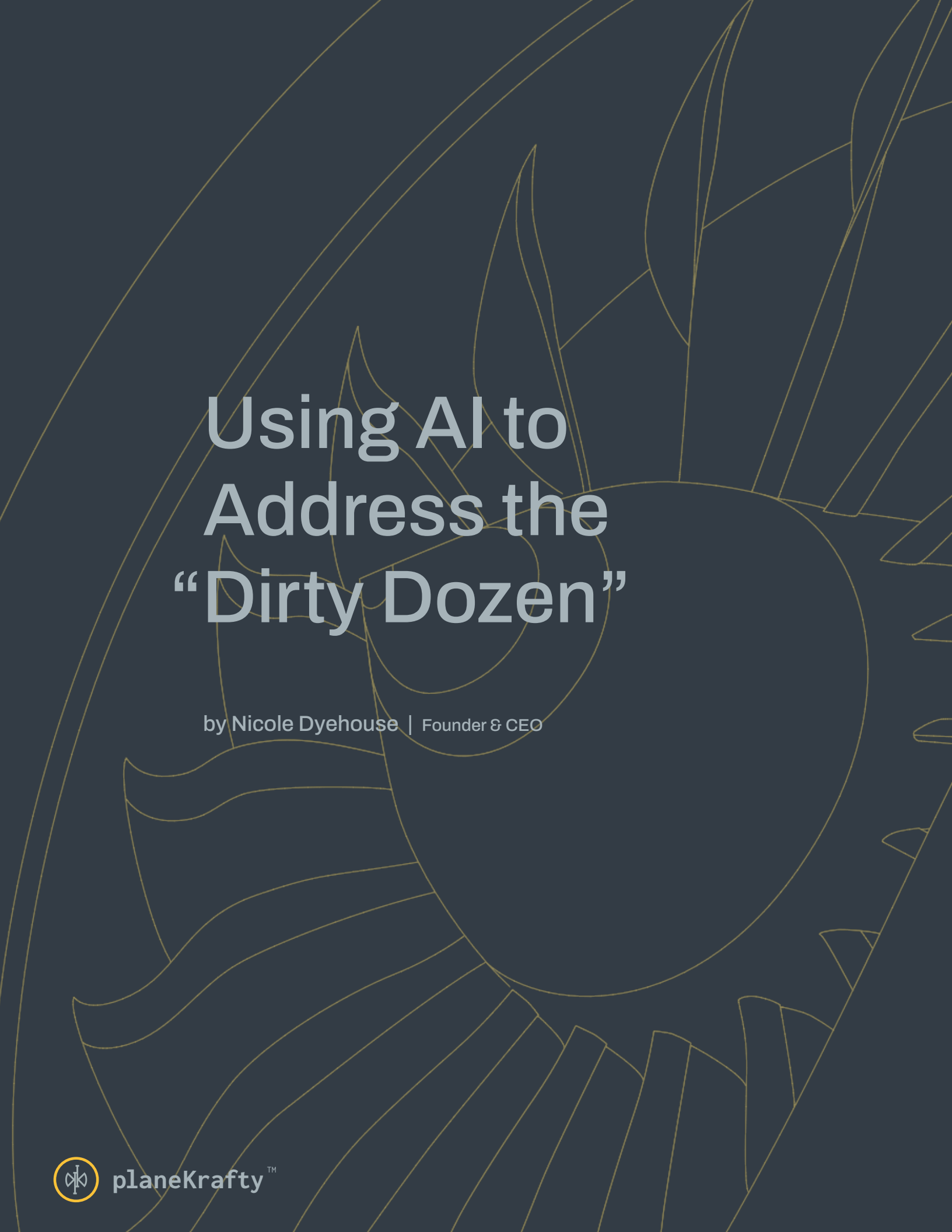

Using AI to Address the “Dirty Dozen”

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planeKrafty™

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Introduction

The FAA reports about 80% of aviation maintenance mistakes involve human factors. These errors, if not detected, can lead to accidents. Aviation maintenance errors or oversights, such as late or missed inspections or life limited component replacements, can also greatly reduce the value of an aircraft for future sale.

Research also shows the average person loses focus on a work task roughly every 15-20 minutes, after which the individual has to refocus on the previous task. Known as the “switch cost”, this time to refocus adds to the lost time of the distraction, significantly increasing the time to complete a specific work task. The mental task of “switching” also increases stress.

The international aviation industry recognizes 12 most common human factors that serve as precursors to accidents or incidents, known as the “Dirty Dozen”, which include factors like distraction and stress. The concept was first developed by Gordon Dupont, then at Transport Canada, in 1993 and has since become the foundation of human factors investigations and training in aviation.

International Civil Aviation Organization (ICAO) Circular 240-AN/144 Human Factors Digest recognizes hundreds of human error precursors. However, those that make up the Dirty Dozen are the most common causes of human factors errors.

How can computer-generated Artificial Intelligence (AI) be the solution to the Dirty Dozen? This paper shares how an overlay of AI will, without a doubt, help deter human errors and raise safety standards in your organization.

“The FAA reports about 80% of aviation maintenance mistakes involve human factors.”

The Dirty Dozen

Lack of Communication

Complacency

Lack of Knowledge

Distraction

Lack of Teamwork

Fatigue

Lack of Resources

Pressure

Lack of Assertiveness

Stress

Lack of Awareness

Cultural Norms

Read on for more about:

Understanding the basics of AI and how your team may already be using it without realizing it.
Embracing the use of AI to address security concerns, dependency on manual processes, inefficiencies, and lack of visibility/access to reporting.
Real-life examples of the impact of AI as well as the support of the dirty dozen.

> **More effectively implementing AI into a maintenance organization could save up to 10 hours a week in document review and management and reduce aircraft conformity tasks from 400 hours to less than 40 hours.**

Terms to Know

Machine Learning (ML)
A subset of AI that uses algorithms to teach computers to learn from data without explicit programming; If you use Siri or Alexa to check the delivery status of a package, conduct an internet search, or get directions, then you already use machine learning.

Deep Learning (DL)
One step further than ML, where neural networks learn from a large database.

Generative AI
An even more advanced subset of AI in which models are used to create new content or data; A simple example of generative AI is your favorite streaming platform's recommendations for your next movie or TV show based on your previous watch history.

AI Prompt
The input or instruction you give to an AI system, essentially a question, phrase, or set of details, that guides the AI to generate a specific response or perform a desired task. Many of the solutions below involve using prompts effectively to most fully realize the benefits of AI.

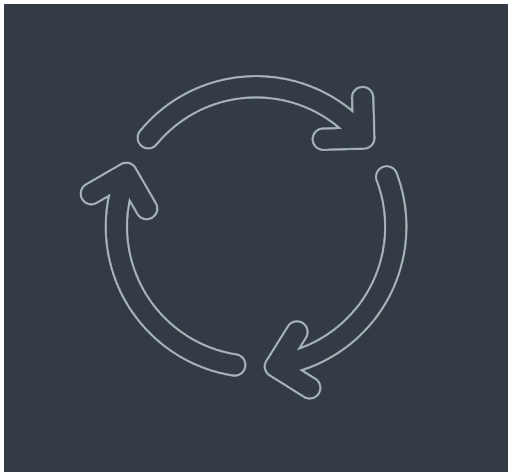
AI

Artificial Intelligence (AI) might look a bit like sorcery or might even seem creepy at times but AI is essentially a program with human-like learning and reasoning capabilities. This includes some every-day, common applications including robot vacuums and computer troubleshooting. More effectively implementing AI into a maintenance organization could save up to 10 hours a week in document review and management and reduce aircraft conformity tasks from 400 hours to less than 40 hours.

AI is already integrated into many aspects of aircraft maintenance, often without teams realizing it. Predictive maintenance systems use AI to analyze aircraft health data and forecast potential failures before they occur. Digital logbooks, automated documentation tools, and troubleshooting assistants leverage AI to streamline record-keeping and error detection. Even common software, like inventory management systems and scheduling tools, may use AI to optimize resource allocation. By understanding these basics, maintenance teams can better leverage AI-driven tools to improve efficiency, accuracy, and safety in their daily operations.

The Dirty Dozen

Each cause identified in the list of the Dirty Dozen can be mitigated in some way by AI. Let's dive into how.



1. Lack of Communication

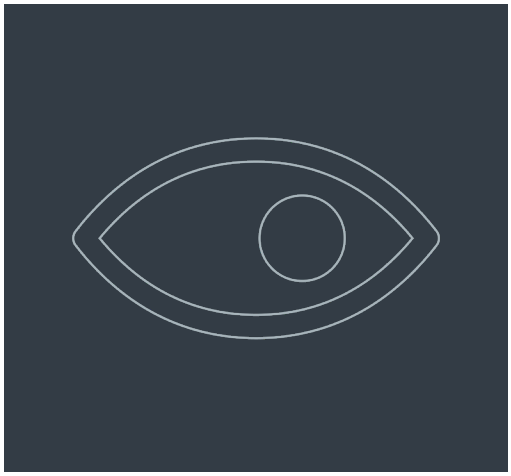
Lack of or poor communication creates inefficiencies in organizations and can lead to errors. Verbal communication can be especially ineffective—studies show only about 30% of a spoken message is received and understood. Written messages—through emails or memos—can be much more effective than verbal communication but only if the written communication is clear. AI can improve communication in your organization by drafting and revising emails and other communications to be more effective and efficient.

AI-powered tools enhance aviation maintenance by enabling real-time communication for instant updates on task progress, technical findings, maintenance logs, and ensure proper documentation. Automated transcription captures verbal instructions and meetings, ensuring nothing gets lost in translation—literally or figuratively. Built-in language translation bridges communication gaps for global teams, improving clar-ity and collaboration across borders.

2. Complacency

Complacency is often brought about by familiarity with a particular situation, the result of not critically challenging the environment. Complacency is an increased risk when completing tasks that are routine and habitual. It can be considered "coasting." Fatigue and stress – two other Dirty Dozen causes – can also lead to complacency. AI can be used to break patterns of complacency.

AI tools are transforming aircraft maintenance by proactively flagging anomalies and alerting mechanics before issues escalate. Automated checklists ensure every inspection step is completed, eliminating the risk of oversight. Performance dashboards provide insights into individual trends, helping catch signs of complacency before they impact safety.



3. Lack of Knowledge

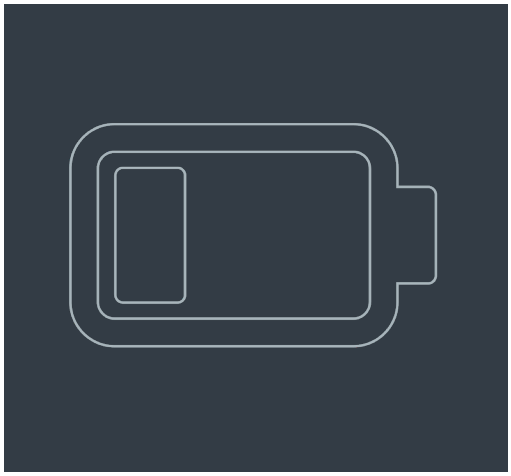
Inadequate technical knowledge or unfamiliarity, for example, with a new aircraft model, can lead to errors. In today's ever-changing world, it can be difficult for technicians to stay up-to-date with all instructions. Resource-challenged maintenance organizations might not provide training beyond the minimum required by regulation. AI can help mechanics stay up on new technologies and inexpensively augment required training events.

Intelligent training systems use AI to pinpoint gaps in a technician's skill set and deliver personalized learning modules to close them. When tackling maintenance issues, AI offers step-by-step guidance tailored to the task at hand. AI-powered knowledge bases also provide instant access to relevant procedures, making critical information just a click away.

4. Distraction

Distractions divert attention from critical tasks. Workplace distractions have never been more prevalent than they are today—text dings, Slack's "tap, tap tap", and even more global, long-term distractions draw attention away from the task at hand. Once distracted, when a person returns to the task, they often remember being further ahead in the task than the reality.

AI applications assist in automating routine tasks, delivering real-time alerts, and managing workflows to keep technicians locked in and dialed up. Focus-enhancing AI tools monitor attention levels and provide timely nudges to refocus when needed. Combined with task prioritization algorithms that reduce cognitive overload and deliver clear, step-by-step guidance, these tools help prevent overlooked procedures and boost both safety and efficiency.



5. Lack of Teamwork

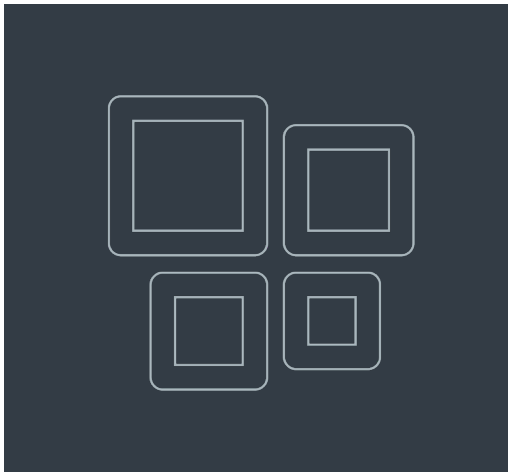
Poor teamwork affects coordination and efficiency. While teamwork is largely driven by company culture and effective leadership, teamwork can be improved through AI tools, which can streamline workflows and identify gaps in teamwork.

AI enables real-time collaboration, centralized data sharing, and task coordination, ensuring all team members have access to up-to-date information—cutting down miscommunication and inefficiencies. It also streamlines maintenance recordkeeping by digitizing, organizing, and automatically updating logs, making historical data easily accessible and audit-ready. Together, these capabilities foster a more cohesive workflow, improve accountability, and significantly enhance overall maintenance reliability.

6. Fatigue

Fatigue reduces cognitive performance and decision-making. Acute fatigue can come after long periods of work. Chronic fatigue can lead to medical conditions. Both types of fatigue can lead to errors. AI can analyze facial expressions and other biometrics to identify and help mitigate fatigue. AI scheduling processes can schedule tasks for times of less fatigue or in an order which reduces fatigue.

AI can help mitigate fatigue by automating repetitive tasks, optimizing work schedules, and providing real-time alerts for potential errors. They assist technicians by reducing cognitive load and ensuring critical procedures and documentation aren't overlooked. This enhances safety, efficiency, and overall workforce well-being.



7. Lack of Resources

Aviation organizations often face resource challenges, whether in parts, tools, or personnel. Many of the AI solutions described in this paper help address lack of human resources, but AI can also help manage parts and tools needed to help your personnel be successful.

AI applications help address resource shortages in aircraft maintenance by optimizing workforce allocation, streamlining parts inventory management, automating routine inspections, and documentation review. They provide real-time data to maximize efficiency and reduce downtime. This ensures maintenance teams can operate effectively, even with limited resources, while maintaining safety and compliance.

8. Pressure

Aviation organizations are often high-pressure environments and the pressure to perform can lead to errors by unintentionally omitting necessary steps in a maintenance task, which can lead to errors. Pressure can be related to other Dirty Dozen causes, such as lack of resources, and can lead to another Dirty Dozen cause: fatigue. Lack of assertiveness, the next of the Dirty Dozen, can allow pressure to continue unchecked. AI can identify employees who might be under excessive pressure and help ease that pressure by reassigning tasks or modifying timelines.

By streamlining record-keeping, automating compliance, and ensuring accurate documentation AI can be leveraged to optimize scheduling, enable predictive maintenance, and provide real-time diagnostics, minimizing delays. By enhancing communication and reducing paperwork, AI improves efficiency, reduces stress, and helps maintenance teams stay focused on safety and accuracy.

9. Lack of Assertiveness

Individuals have different natural propensities to act assertively or passively in different environments. An individual who might act passively in normal daily conditions might be more assertive in a stressful situation or might be too timid to speak up. Company culture also plays a role in an individual's ability to express concerns.

By providing data-driven insights, real-time alerts, and standardized decision-making tools AI empowers technicians with accurate information, reinforcing confidence in identifying and addressing safety concerns. This reduces hesitation, enhances accountability, and ensures maintenance actions are carried out decisively and in compliance with regulations.

10. Stress

Just like fatigue, stress can be either acute or chronic. Acute stress can be from dealing with an emergency or working under pressure. Chronic stress is caused by long-term demands, including family concerns, grief, financial issues, and so on. Real-time situation awareness of stress levels can help individuals mitigate stress.

Using AI-assisted applications for document manage-ment, helps tech-nicians manage workload efficiently by prioritizing tasks and minimizing uncertainty. This leads to improved focus, reduced errors, and a safer, more organized work environment, reducing the stress of multitasking.

11. Lack of Awareness

Working as a technician often means detailed, focused tasks. While that's a necessity of the job, it's important to be aware of other tasks and projects being conducted on the same aircraft. For example, if a technician conducting a repair knows an inspection is due in 10 hours, aircraft downtime and shop costs could be minimized by conducting the two tasks at the same time.

AI-powered aircraft records management applications enhance awareness by ensuring log entry accuracy, automating document reviews, and flagging incomplete or inconsistent records. They provide real-time alerts for missing data, compliance gaps, and discrepancies, keeping maintenance teams in-formed. This reduces oversight, improves record integrity, and strengthens overall airworthiness and regulatory compliance.

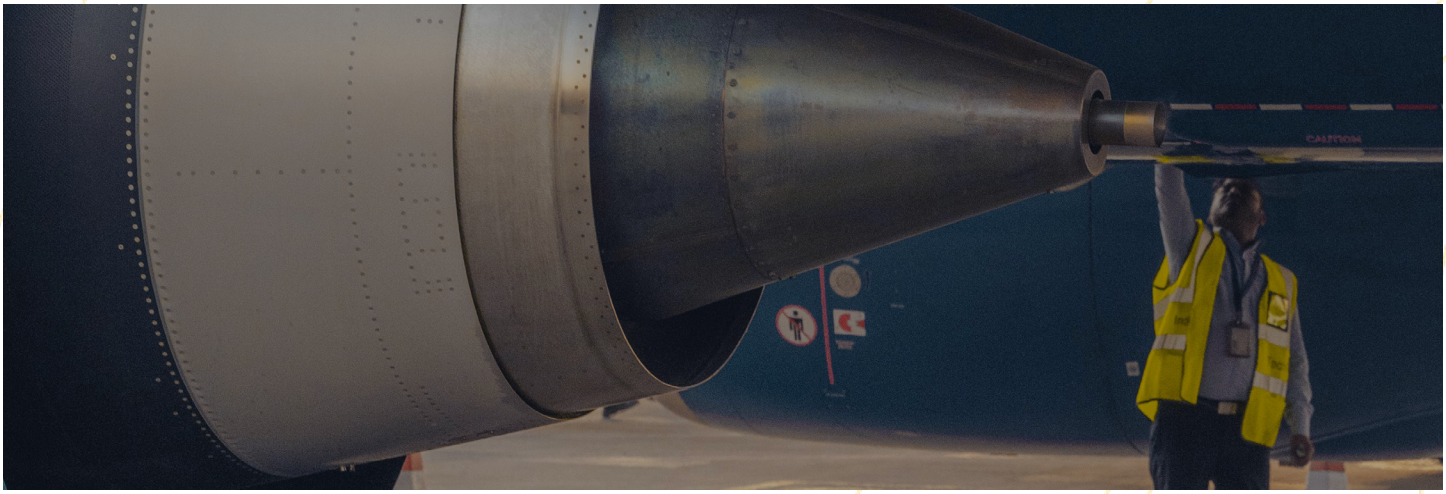
12. Cultural Norms

Norms are unwritten rules or behaviors commonly accepted in a group or organization. In aviation, a company's culture is made up of the values, beliefs, and behaviors of the individuals in the organization. Unsafe norms can perpetuate errors. A poor company culture can lead to errors being covered up due to fear of reprisal or errors not identified.

AI applications influence norms and culture in aircraft maintenance by standardizing best practices, reinforcing compliance, and promoting a data-driven approach to decision-making. They help shift mindsets toward proactive maintenance by providing real-time insights and reducing reliance on outdated habits. This fosters a culture of accountability, efficiency, and continuous improvement.

Real-Life Scenarios

It's easy to see how these Dirty Dozen factors can feed on each other. Consider the following real-life scenarios to see how AI can mitigate the risks of the Dirty Dozen.



Scenario 1:
Pre-Buy Inspection After Multiple Employee Retirements

An organization is conducting a pre-buy inspection after multiple experienced technicians retire within a short period of time and new technicians cannot be hired immediately or new technicians lack experience. Lack of resources, combined with lack of knowledge by new technicians, can easily lead to stress, fatigue, and pressure. This can result in oversights or errors in the pre-buy inspection, potentially costing the new aircraft owner in repairs and aircraft downtime.

Implementing AI solutions that mitigate the risk of each of these factors by extension mitigate the risks of the other factors. Effectively using AI in your organization can have exponential benefits.

Scenario 2:
Conforming New Aircraft Type to Commercial Operations

An organization is adding an aircraft type new to the organization to commercial operations. The aircraft owner was promised commercial revenue as soon as possible. Technicians lack knowledge in that aircraft type and feel pressure to complete the conformity task quickly. They might also feel stress due to lack of availability of FAA resources to process the conformity.

Implementing AI solutions, such as virtual or augmented reality training, can help mitigate the risk of lack of knowledge and also offset the feelings of pressure and stress.

Real-Life Scenarios

Scenario 3:
Return to Service of Multiple Aircraft

Multiple aircraft are being returned to service on the same day. Each one has just completed a large maintenance event. With hundreds of inspections to cross check and ensuring accuracy in all the supporting documentation creates an environment ripe with dis-tractions, lack of awareness, and potentially a lack of teamwork is born.

Implementing AI solutions, such as a document management solution that allows the user to simply upload the logbook and work records which can analyze the documents and provide 90% of the mental lift to review for completeness and accuracy there by mitigating distractions, reducing lack of awareness, and improving teamwork.

As the aviation industry faces a growing talent gap with the retirement of Baby Boomers and Gen X, effectively supporting maintenance teams requires a strategic blend of technology, training, and knowledge retention. AI-powered applications can help bridge this gap by digitizing institutional knowledge, automating routine tasks, and providing real-time guidance to newer technicians. Mentorship programs, paired with AI-driven learning tools, can accelerate skill development and ensure critical expertise is passed down efficiently. Additionally, optimizing workforce management through AI-driven scheduling and predictive main-tenance can reduce operational strain on smaller teams. By leveraging technology and fostering continuous learning, the industry can mitigate the impact of workforce shortages while maintaining high safety and efficiency standards.

Conclusion

Aviation organizations are often high-pressure environments and the pressure to perform can lead to errors by unintentionally omitting necessary steps in a maintenance task, which can lead to errors. Pressure can be related to other Dirty Dozen causes, such as lack of resources, and can lead to another Dirty Dozen cause: fatigue. Lack of assertiveness, the next of the Dirty Dozen, can allow pressure to continue unchecked. AI can identify employees who might be under excessive pressure and help ease that pressure by reassigning tasks or modifying timelines. Now more than ever, integrating AI into your organization's workflows will ensure that the Dirty Dozen challenges will be kept at bay.

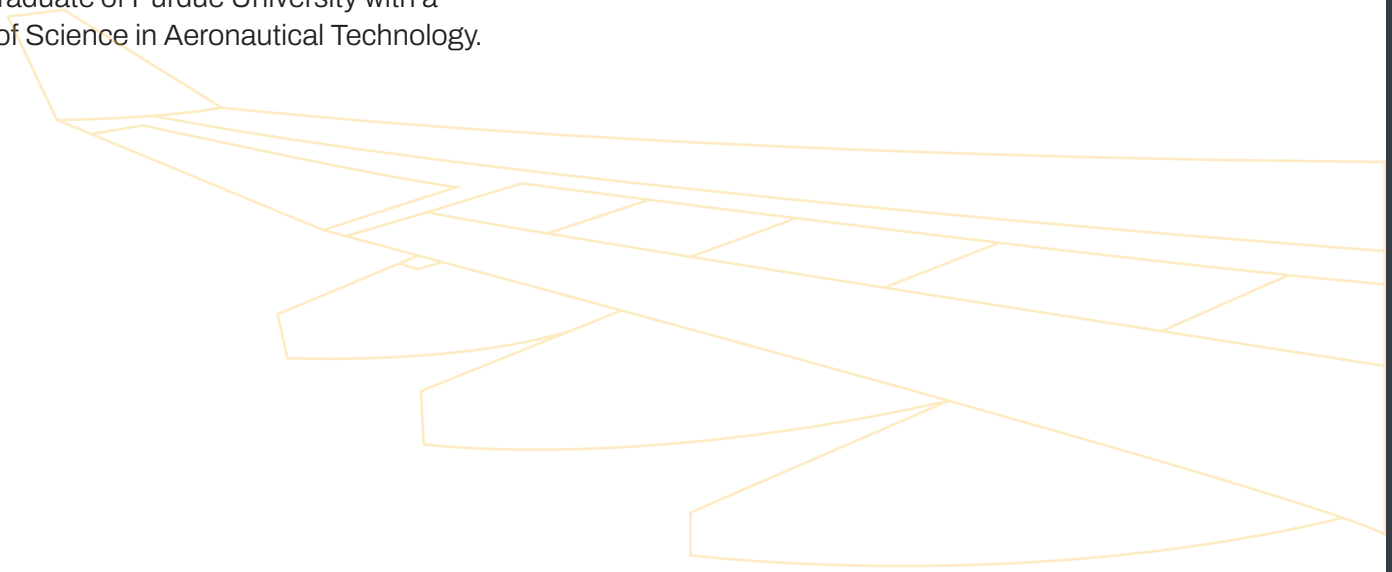
"Now more than ever, integrating AI into your organization's workflows will ensure that the Dirty Dozen challenges will be kept at bay."

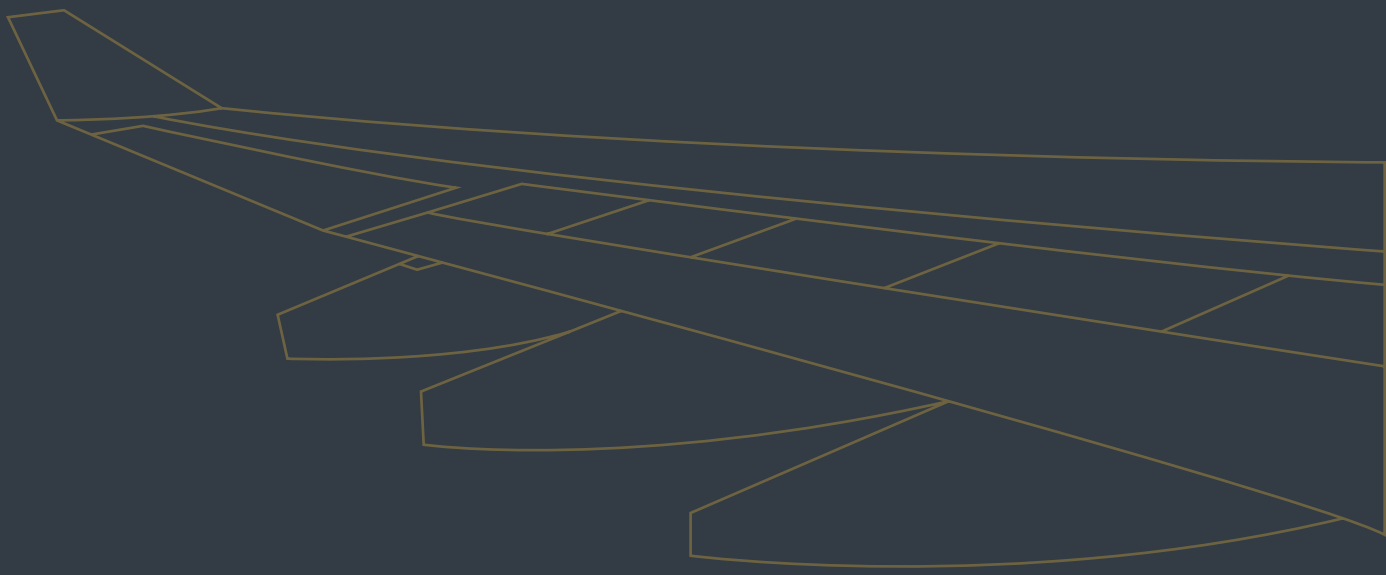
About planeKrafty™

At planeKrafty™, our software helps streamline, digitize, and organize millions of dollars' worth of aircraft records—turning what's often a paperwork headache into a strategic, value-boosting asset. From compliance tracking to instant analytics and cloud-based access, planeKrafty™ puts critical records on autopilot.

About Nicole Dyehouse

Nicole Dyehouse is the Founder and CEO of planeKrafty™, leveraging over 20 years of experience in the business jet sector. She is an accomplished aircraft mechanic specializing in both technical maintenance and the regulatory requirements of airworthiness documentation. This foundational expertise gave her the drive to revolutionize private jet maintenance records management at planeKrafty™, thus ensuring safety, efficiency, and traceability for owners, operators, and technicians. She is a graduate of Purdue University with a Bachelor of Science in Aeronautical Technology.





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