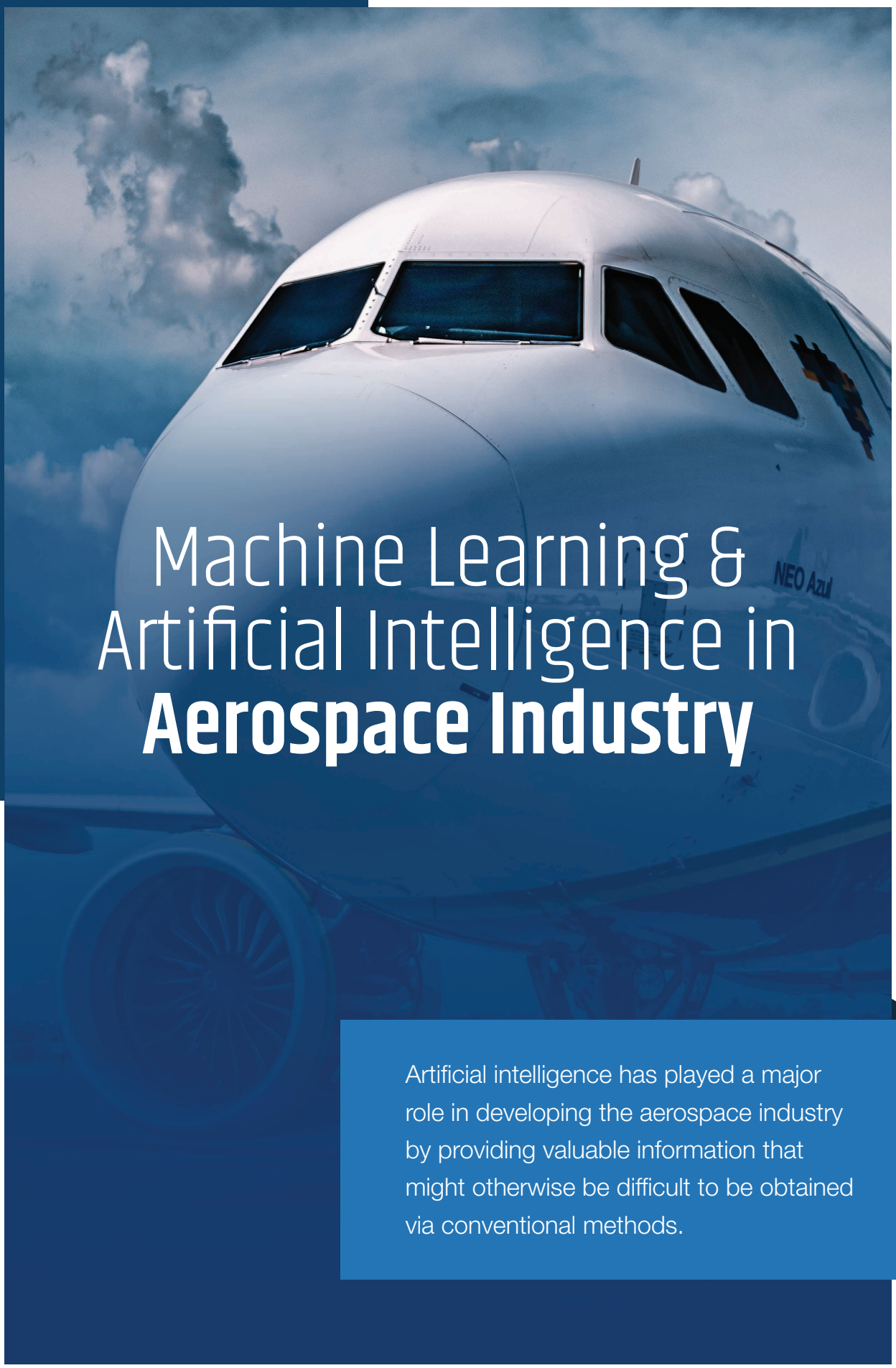
AXISCADES



Machine Learning & Artificial Intelligence in **Aerospace Industry**

Artificial intelligence has played a major role in developing the aerospace industry by providing valuable information that might otherwise be difficult to be obtained via conventional methods.

Whitepaper

Artificial intelligence plays a significant role in cutting costs, reducing the design cycle time, simulation, prototyping, optimization, maintenance, manufacturing and updating products and is all set to drive many developments in the aerospace sector in the next 15 years. Advances in AI could help aerospace companies optimize their manufacturing processes. However, there is limited adoption of machine learning techniques in the aviation industry and the main reason for this is the lack of access to high-quality data, increased dependability on simple models as compared to complex models and a lack of skilled workforce and partners to implement it effectively.

But with the right partner, AI can be a disruptive technology that will impact the efficiency, productivity as well as the speed and innovation of the aerospace companies.

In this whitepaper, let's explore the various areas in which AI and machine learning is being used in the aerospace industry today along with some real life examples and case studies.

Here are the top areas that AI is being used by aerospace manufacturers today:

Predictive Maintenance

Aircraft maintenance is necessary to ensure its safety. There are many unexpected maintenance issues concerning an aircraft. Aviation companies are using predictive maintenance enabled by AI to resolve these issues. Predictive maintenance allows for faster identification and reporting of potential failures in real-time. It predicts the repair timeline and ensures that the process schedule is smoother and faster. A huge amount of data is given as the input and with use of AI and predictive maintenance solutions, data points and meaningful insights are deduced as output. The entire process helps in fixing an issue before it arises.

Optimized flight performance

Fuel efficiency is one of the top parameters of aerospace OEMs and this can be optimized with the help of artificial intelligence. Any minor improvement in fuel efficiency can have a major impact on the aircraft's emission and this is achieved by manufacturing lightweight aircraft components. AI is helping pilots during flights by analyzing critical data like the fuel system, system status, weather conditions as well as other major parameters that can be assessed in real-time to optimize a flight path. Additionally, AI helps in optimizing time-consuming activities in the aerospace industry and paves the way to better human-machine collaboration.

Generative design

Artificial intelligence is increasingly being used to create efficient, faster and lighter parts in the aerospace industry and is applied to find innovative ways to design them. Based on the existing requirements new innovative product designs are being created using machine learning techniques. Multiple options are available in a very short span to find the best design, making it easier for engineers and product designers

Efficient supply chain management

Implementing AI in the supply chain is making operations in the aviation industry more streamlined. Increased supply chain efficiency enables maintaining the equipment and its regular repairs much easier than doing it manually and also saves money and cuts the downtime as it is known in prior to knowing exactly when to conduct the repair tasks. Automated data collection makes it easy to improve the efficiency of supply chain management.

Improved quality control

Quality assurance is all about ensuring that that the desired level of quality in a product or service is maintained. This is done by giving a special level of attention during each and every stage of the process of production. By automating the QA with the help of an autonomous AI solution can save a lot of time and resources. Automating quality testing with the help of machine learning has increased the rate of defect detection by almost 90%.

Training

Artificial intelligence can be used to enhance pilot training facilities with pilots being provided with a realistic simulation experience with the help of AI-enabled simulators coupled with virtual reality systems. These simulators can also be used to collect and analyze several data with regards to training for creating personalized training data with biometrics to track an individual's performance.

The aviation industry relies heavily on data that are derived from a great deal of research, design, and production of its products and services. Machine learning has played a major role in developing the aerospace industry by providing valuable information that might otherwise be difficult to be obtained via conventional methods.

The integration of machine learning in the aerospace industry guarantees cost-effectiveness and safety. Example areas where machine learning is effectively applied in the aerospace industry today:

- Smart Concessions Management.
- Smart Repairs Management.
- Automatic Part Geo Location.
- Identification in a DMU or Assembly Line.
- NC Documentation Device.
- Knowledge-Based Engineering.
- Alternative Fastener Selection.
- Predictive Maintenance of Aircraft Components.
- Sizing of Aircraft Components.
- Reverse Engineering.
- Prediction of in-service damages to aircraft based on the region of operation.
- Smart Factory Building.
- Any repetitive non-engineering activities etc.

Benefits of machine learning for Operators and Maintainers:

Problem	Solution
Delays or cancellation of aircrafts on ground	Increases the up-time by recognizing the future-stoppage events with planned maintenance
Component failure	Increased utilization and allocation of resources by identifying components at risk with preemptive maintenance.
Unfulfilled SLA's	Customer delays are avoided by monitoring the aircrafts and assigning suitable aircrafts for critical missions.
Uncertainty in vendor performance	The third party vendor's performance will be tracked individually.

Benefits of machine learning for Original equipment manufacturers

Problem	Solution
Customer complains on equipment failures	Enhanced the process of troubleshooting/fault isolation and reporting due to increased responsiveness.
Using the strategy of poison pill parts	Improving the sourcing decisions among the vendors or PMA providers by finding the patterns in equipment
SLAs	Spot problems before it actually arises to support SLA and warranty management.
Contract requirements	Component reliability is increased to deliver profitable power in terms of hour or performance based contracts.

Today, AI and machine learning are not just providing the best customer experience with automation but also self-service solutions. The employee workflow is being optimized and higher air safety is ensured with predictive aircraft maintenance. Through the smart use of data, it also allows the aerospace companies to make informed decisions about the price and market positioning.

Example of real life application of AI in aerospace:

AXISCADES implemented AIML enabled solutions for engineering activities in the aviation sector.

The three main objectives were:

- Create digital platform to reduce / minimize the non-engineering tasks in concessions / repairs Management
- Apply AIML concepts that identify relevant or similar concessions & repairs
- Address unstructured data through text, image recognition techniques

Title	Scope
Smart Plant Engineering Management	Developing AI/ML based application to recognize and provide exactly matching similar/relevant concessions, and also recommend the solutions for Engineering problems
Smart Repair Solutions for In Service Aircrafts	A standard platform / application to record damage details / damage reports across the airliners. Develop an AI/ML application to recognize & provide an exactly matching or a similar/relevant repair solution
Automatic Part Geo-Localization in DMU by using KBE	Develop and showcase, automatic geo location recognition of a part in existing DMU of Single Aisle (SA) by keying a Picture of a part or 3D Model of the Part or Cloud of Point or a Mesh (in absence of DMU).
Digitization for Mechanics	Creation of Flowchart and decision tree

Outcomes achieved:

- Reduced the lead time & improves the quality
- Reduced human errors - aided by AR and VR
- Easily scalable and applicable to create hands-free manufacturing environment

AXISCADES can support you with an end-to-end workflow. Some of the examples are:

Create & Access Data	Generate and store data from multiple sources in cloud or on premises. Bring structured and un-structured in one toolkit.
Filter relevant data	Find relevant data from knowledge database. Use necessary data based on the application.
Prepare data for analysis	Data mugging (clean and prepare data). Use relevant open source software for cleaning data for processing.
Build & Train ML/DL models	Development of ML/DL models programmatically or visually using open source packages. Leverage of pre-trained models to meet requirements. Train models to its accuracy.
Deploy models	Deploy model to the specific area and scale automatically to any case.
Monitor and Manage	Continuously monitor the performance of the model and automatically trigger re-training and redeployment of models whenever necessary.

AXISCADES

AXISCADES is a leading, end to end engineering solutions and product company. We bring expertise that caters to the digital, engineering and smart manufacturing needs of large enterprises. With decades of experience in creating innovative, sustainable and safer products worldwide, AXISCADES delivers business value across the entire engineering lifecycle.

Our deep domain expertise and engineering solution portfolio covers the complete product development lifecycle from concept evaluation to manufacturing support and certification for the Aerospace, Defense,Heavy Engineering, Automotive, Medical Devices & Industrial Product industries.

AXISCADES is headquartered in Bangalore and has offices across India, North America, Europe and the Asia Pacific region.

AXISCADES Engineering Technologies Limited

Kirloskar Business Park, Block 'C', 2nd Floor, Hebbal, Bangalore – 560 024, India | Tel: +91 80 4193 9000 | Fax: +91 80 4193 9099 | www.axiscades.com