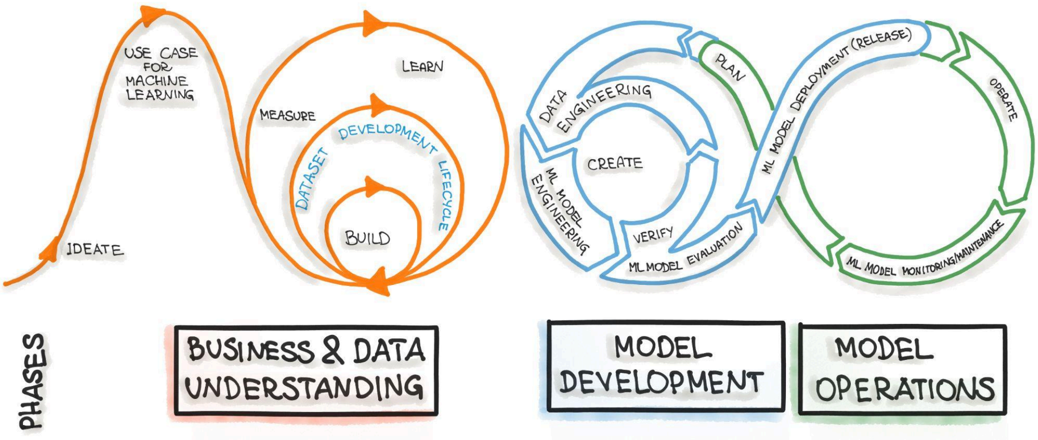
EXECUTIVE SUMMARY

This report follows the structure of critical phases in a machine learning development process, following MLOps principles. We've progressed through initial phases such as Business and Data Understanding, Data Engineering (Data Preparation), and Machine Learning Model Engineering. Subsequently, we've focused on evaluating our Machine Learning Model, aiming to optimize Airbus fleet maintenance management and reduce Aircraft on Ground time (AOG) by identifying fuel leaks reliably and efficiently. In conclusion, we offer insights into future Deployment considerations and their potential impact on Airbus operations. Please find our code on [GitHub](https://github.com/ellagoesbeyond/Capstone_Project_Airbus_Fuel_Leak_Detection/tree/main).[1]



[2]

The primary challenge we aim to address in collaboration with Airbus is the inherent inaccuracy of automatic fuel leak detection systems onboard aircraft. This inaccuracy stems from errors in fuel volume measurement within the tanks, often attributed to factors such as tank sealant degradation and structural damage to the fuel tanks themselves. These failures result in a critical problem for Airbus and its operators: the inability to promptly and accurately detect fuel leaks can lead to Aircraft on Ground (AOG) situations, where aircraft become unavailable for service. This not only disrupts individual flight schedules but can also have cascading effects on the entire fleet planning process and overall operational efficiency for operators. Moreover, it's important to note that the current detection system can only identify leaks, a minimum of a total sum of 3000kg, that exceed a certain threshold over time.

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[1] https://github.com/ellagoesbeyond/Capstone_Project_Airbus_Fuel_Leak_Detection/tree/main
[2] https://ml-ops.org/content/crisp-ml#acknowledgements

In developing our fuel leak detection model, we utilised an LSTM (Long Short-Term Memory) model for its ability to track and remember feature relationships over time. This approach has proven effective; through tests on various aircraft (MSN10-MSN53) ingested with artificial leakages, we've managed to identify about 10% of total leakages. This is significant because it allows us to catch leakages earlier, using just 2.5 minutes of flight data, thereby cutting down on unscheduled maintenance. A key strength of our model is its robustness, evidenced by a very low false-positive rate of less than 0.0136%. Maintaining such a low rate is vital to avoiding unnecessary AOG, crucial for Airbus's efficiency.

After potential future improvement of this model an implementation of it holds the promise of significant benefits for Airbus and its operators. By effectively identifying previously undetected smaller fuel leaks, the model has the potential to minimize unscheduled maintenance activities, thereby reducing associated costs and enhancing the overall availability of the fleet. Reducing high severity maintenance to low severity through earlier leakage detection, our model facilitates a substantial cost saving of approximately $88,622.05 or 54% of savings per early detected leak. This advancement stands to optimise operational efficiency and improve the reliability of Airbus aircraft, contributing to a more streamlined and cost-effective fleet management process.