Decision Intelligence for Inventory Management

IE3100R Systems Design Project (AY2024/2025)
Department of Industrial Systems Engineering & Management (ISEM)

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01 INTRODUCTION

Company Background

Thales drives innovation in aerospace, defence, transportation, and security. Through collaboration with government, industry, and academia, Thales delivers advanced solutions, enhancing aircraft safety and efficiency, and positioning Singapore as a leader in aerospace innovation.

Problem Statement

Thales' aviation repair supply chain faces disruptions due to material shortages, extended lead times, and obsolescence. Delays in critical repair parts create bottlenecks, straining staff and risking deadlines. Constant firefighting limits proactive, long-term inventory strategies to mitigate future disruptions.

Project Objectives

To develop a robust monitoring system for pre-emptive planning, ensuring timely repairs and an efficient inventory management. The goal is to establish a Just-In-Time (JIT) system that minimizes overstock of inventory while ensuring critical parts availability to meet customer demand.

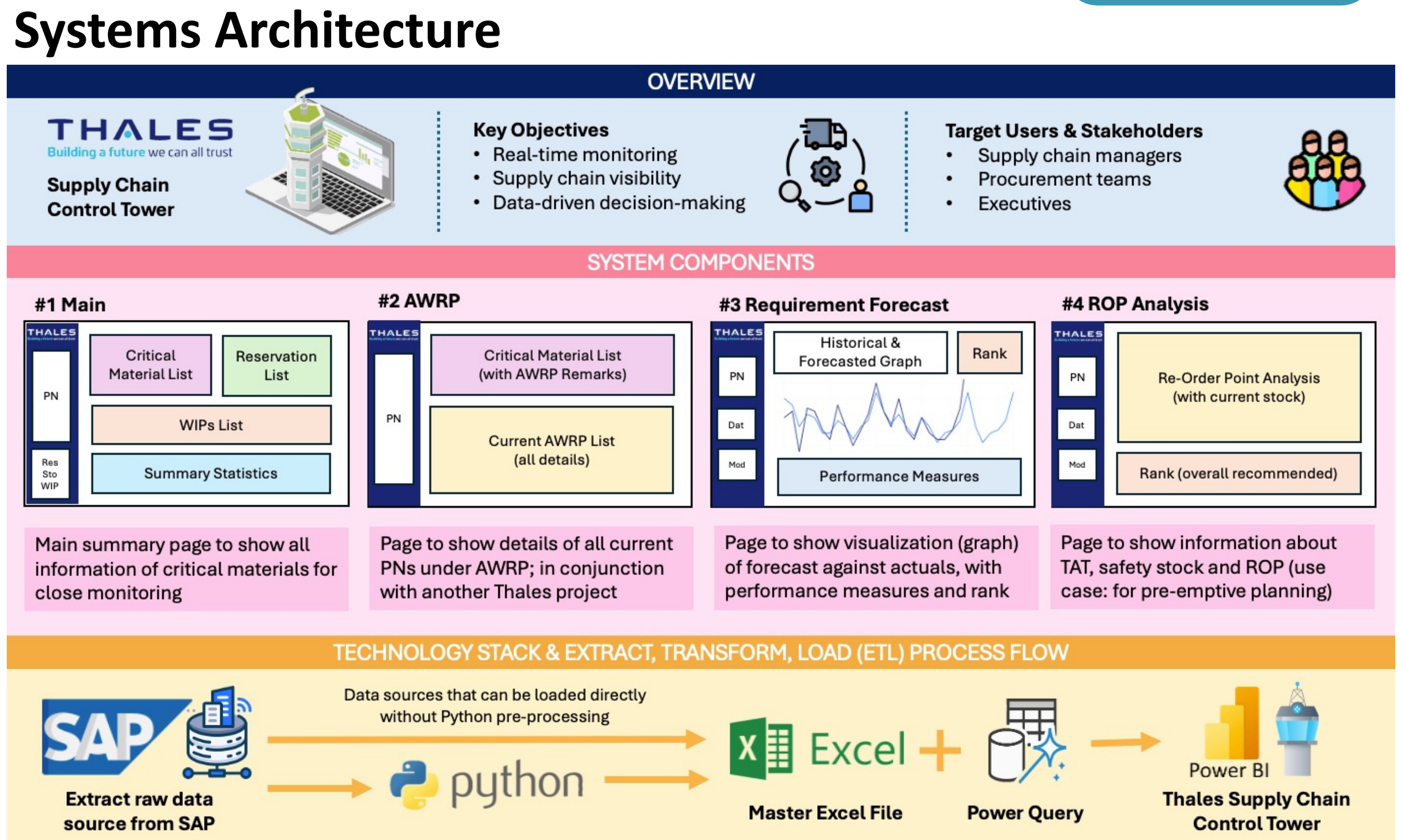
02 METHODOLOGY

Proposed Approach

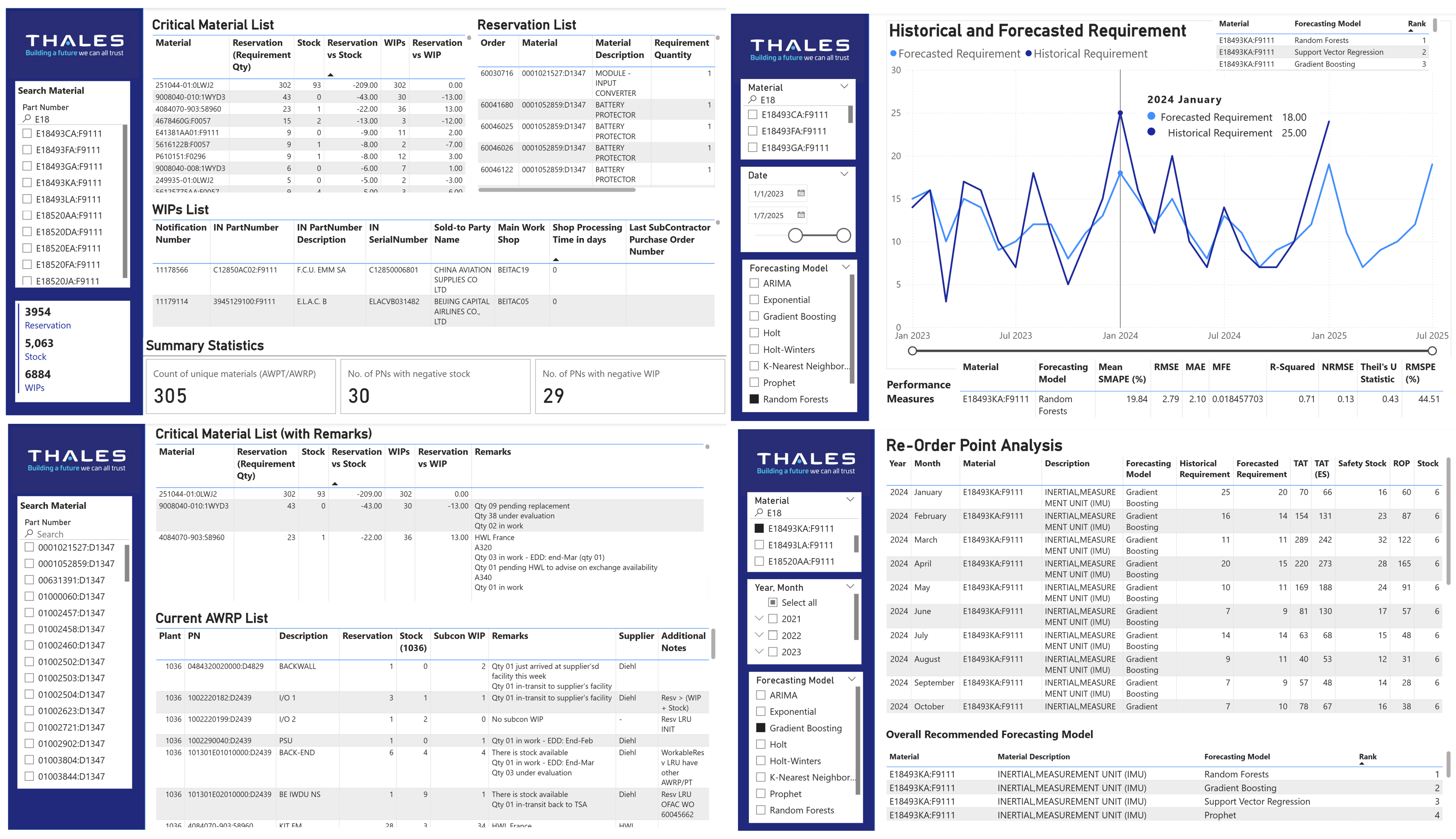
The solution adopts a pre-emptive approach by establishing a Supply Chain Control Tower, a centralized platform providing real-time visibility and advanced analytics for Thales' supply chain operations. The Control Tower integrates three core components:

Demand Forecasting | Lead Time Estimation | Safety Stock & Re-Order Point → Optimize inventory management

Systems Architecture



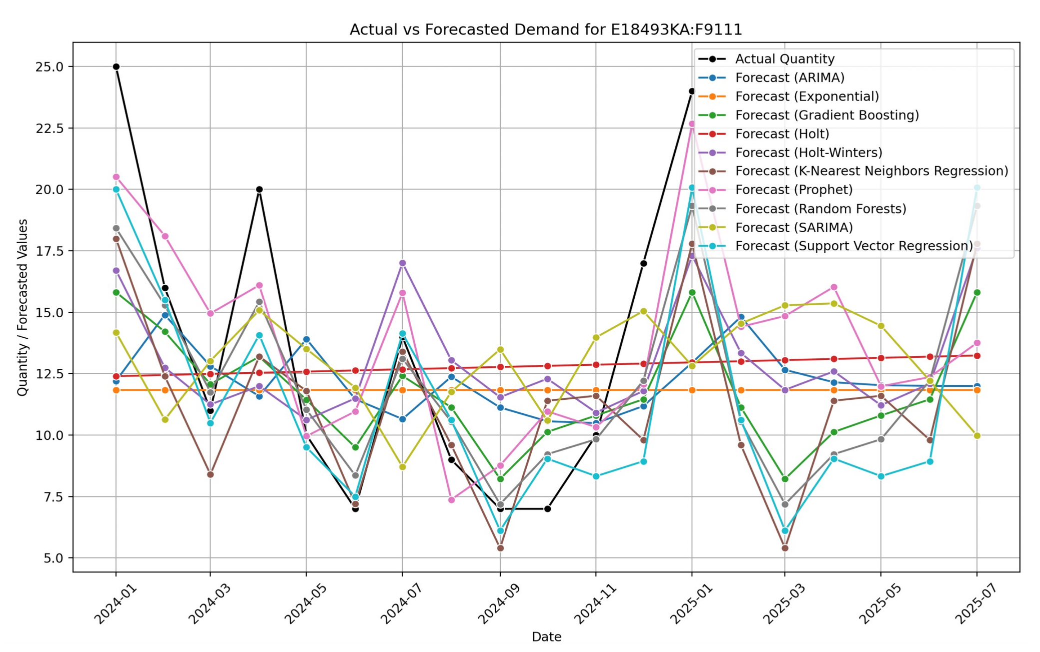
Supply Chain Control Tower



The Supply Chain Control Tower, developed using Microsoft Power BI, is a decision intelligence tool offering user-friendly dashboards and advanced analytics. It consists of several key system components designed to provide predictive insights with comprehensive visibility to anticipate disruptions and maintain operational stability.

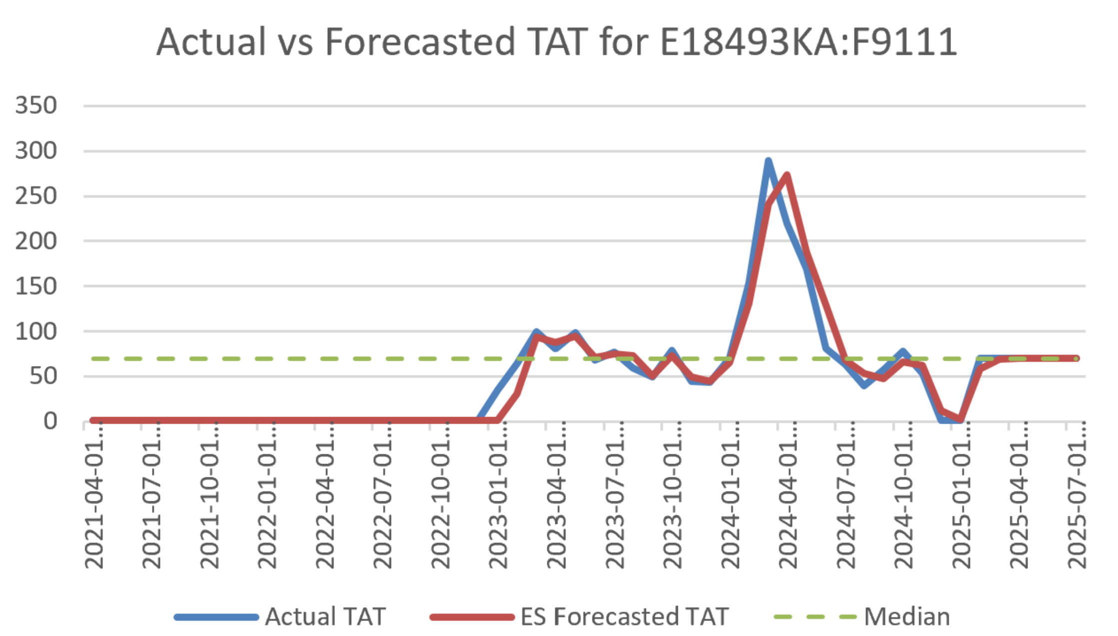
(1) Demand Forecasting

Time Series Analysis was implemented for its effectiveness in predicting future values, capturing any demand patterns, trends, cyclical variations, seasonal patterns and autocorrelations. 10 models were utilized with Time Series Cross Validation and hyperparameter optimization through GridSearchCV. The best-performing model for each material is selected based on ranked performance metrics.



(2) Lead Time Estimation

A hybrid forecasting approach was used for Lead Time estimation. Historical monthly values were averaged to establish a baseline, followed by a median-based preliminary forecast to mitigate outliers, and finally, exponential smoothing was applied to refine trends. This method reduces noise and minimizes sensitivity to short-term fluctuations, ensuring more reliable predictions.

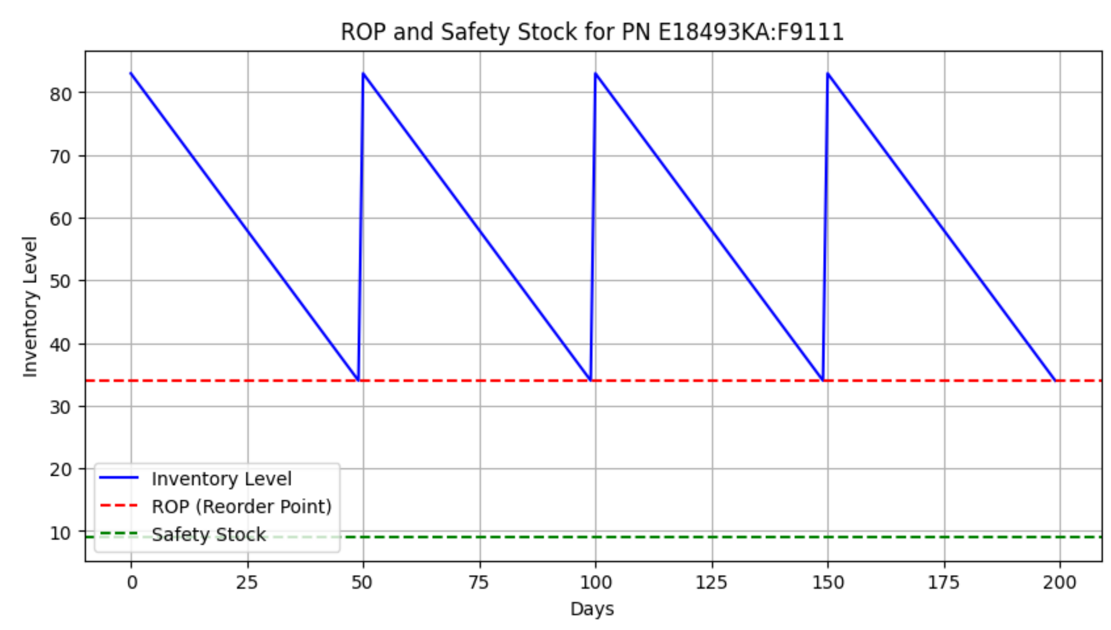


(3) Safety Stock & Re-Order Point

Safety Stock (SS) and Re-Order Point (ROP) ensure inventory availability, preventing stockouts. The proposed inventory optimization model is:

$$ROP = SS + \text{Demand during Lead Time}$$

where SS is based on a 95% Cycle Service Level (CSL) and demand variability. Accurate demand forecasts improve ROP effectiveness, minimizing excess inventory and holding costs.



03 CONCLUSION

Project Achievements

This pioneering solution enhances supply chain resilience and ensures long-term operational efficiency. The Control Tower empowers Thales to build a robust inventory management system, marking a breakthrough in proactive decision-making and operational stability in aerospace.

Future Developments

- User Training & Adoption
- Expanded Coverage
- Enhanced Analytics
- Continuous Refinement

Skill Sets Acquired

- Data Analysis & Modelling
- System Architecture
- Dashboard Development
- Problem-solving in Supply Chain