Instandhaltungsplanung von Triebwerksflotten

MATLAB Expo 2019

N. Theilig | Engine Services | 15. April 2019

Lufthansa Technik

Lufthansa Group – The business segments

Passenger transportation

The Lufthansa Group airlines rank among the world’s leading carriers.

Logistics

Lufthansa Cargo – one of the world's leading cargo carriers in international air traffic.

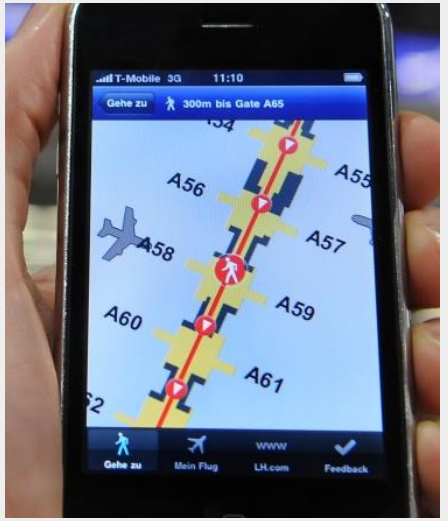
Lufthansa Technik
Maintenance, Repair, Overhaul

Lufthansa Technik – leading provider of MRO services in the world's airline business.

Catering

LSG Sky Chefs – leading provider of airline catering and integrated in-flight solutions.

Other activities



Lufthansa Aviation Training
Lufthansa AirPlus
Lufthansa Industry Solutions
(and many more)

Lufthansa Technik AG – Product Divisions

Aircraft Services
(Maintenance, Overhaul)

Engine Services

Component Services

Landing Gear Services

VIP & Special Mission Aircraft Services

Coverage of any conceivable requirement of an aircraft owner or operator

We are experienced in fulfilling customer-specific requirements around the globe

EUMEA

AMERICAS

ASIA PACIFIC

Agenda

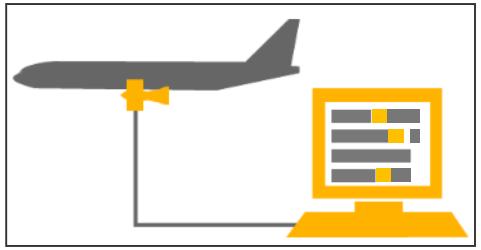
- Engine Fleet Management
- MATLAB GUI as Platform for Calculations
- Core Functionality
- Visualization and Reporting Functions
- A growing number of Interfaces
- Summary

Engine Fleet Management

A complex Task

Engine Fleet Management

- Removal forecast
- Work Scope forecast
- Scenario Analysis



Engine Fleet Management

A complex Task

Aircraft Fleet

- Engine Type Rating
- Utilization
- Flight Profile

Engine Fleet

- Hardware Version
- Module Data
- Part Data
- Spare Availability

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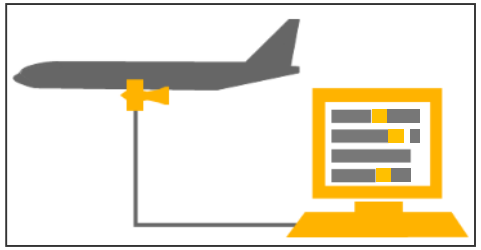

Customer

Engine Service

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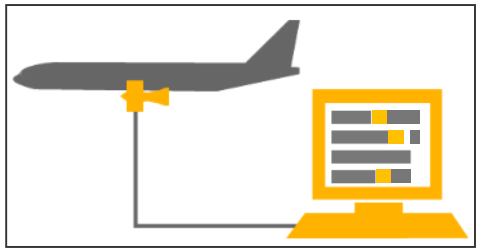

Service Contract Commercial Parameter

- Price Model
- Customer Work Scopes
- Customer Requirements
- Lease Return Conditions

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Engine Service

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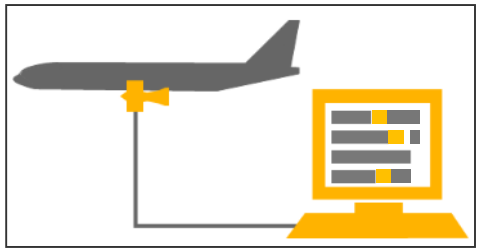

Engine Shop

- Expert Knowledge
- Customized Work Scopes
- Cost Data

Maintenance Documents

- Manufacturer Recommendations
- Airworthiness Directives
- Technical Limits

Service Contract Commercial Parameter

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Customer

Engine Service

MATLAB GUI as Platform for Calculations

Migration from Prototype to new Framework was performed

- Robust Framework
  - Developed and integrated with MathWorks Consulting
  - Quickly adjustable
  - Modular

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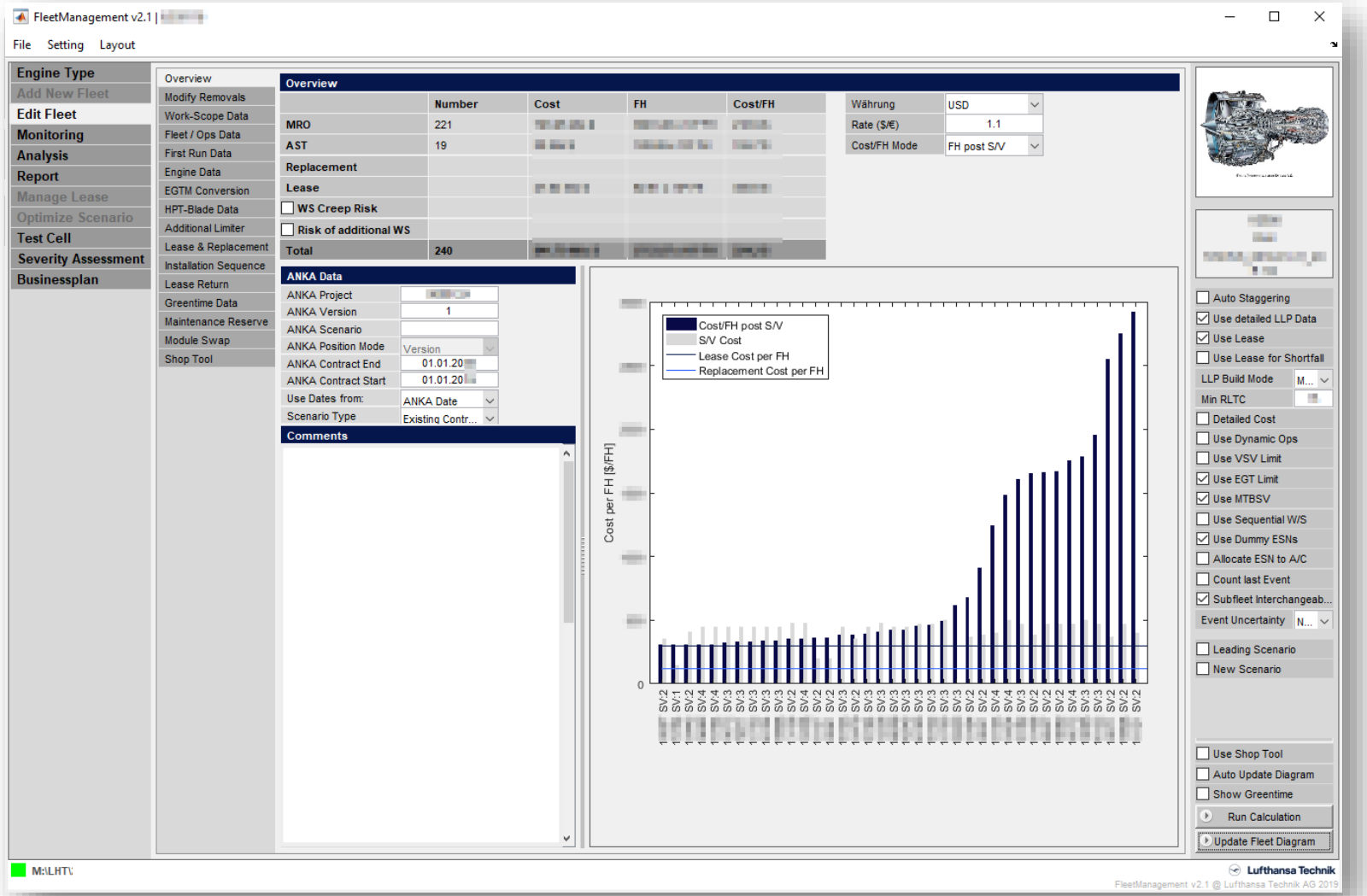

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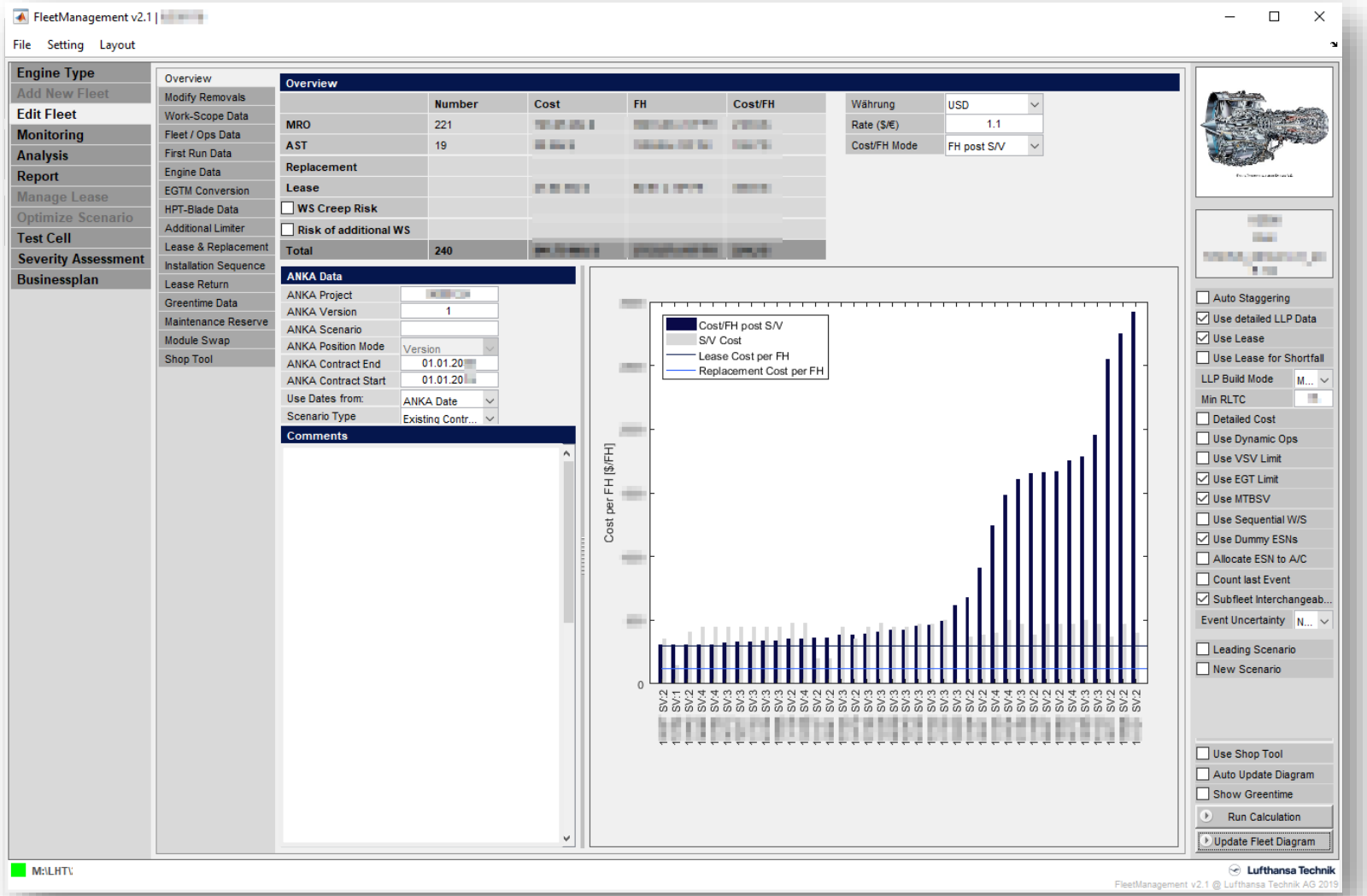
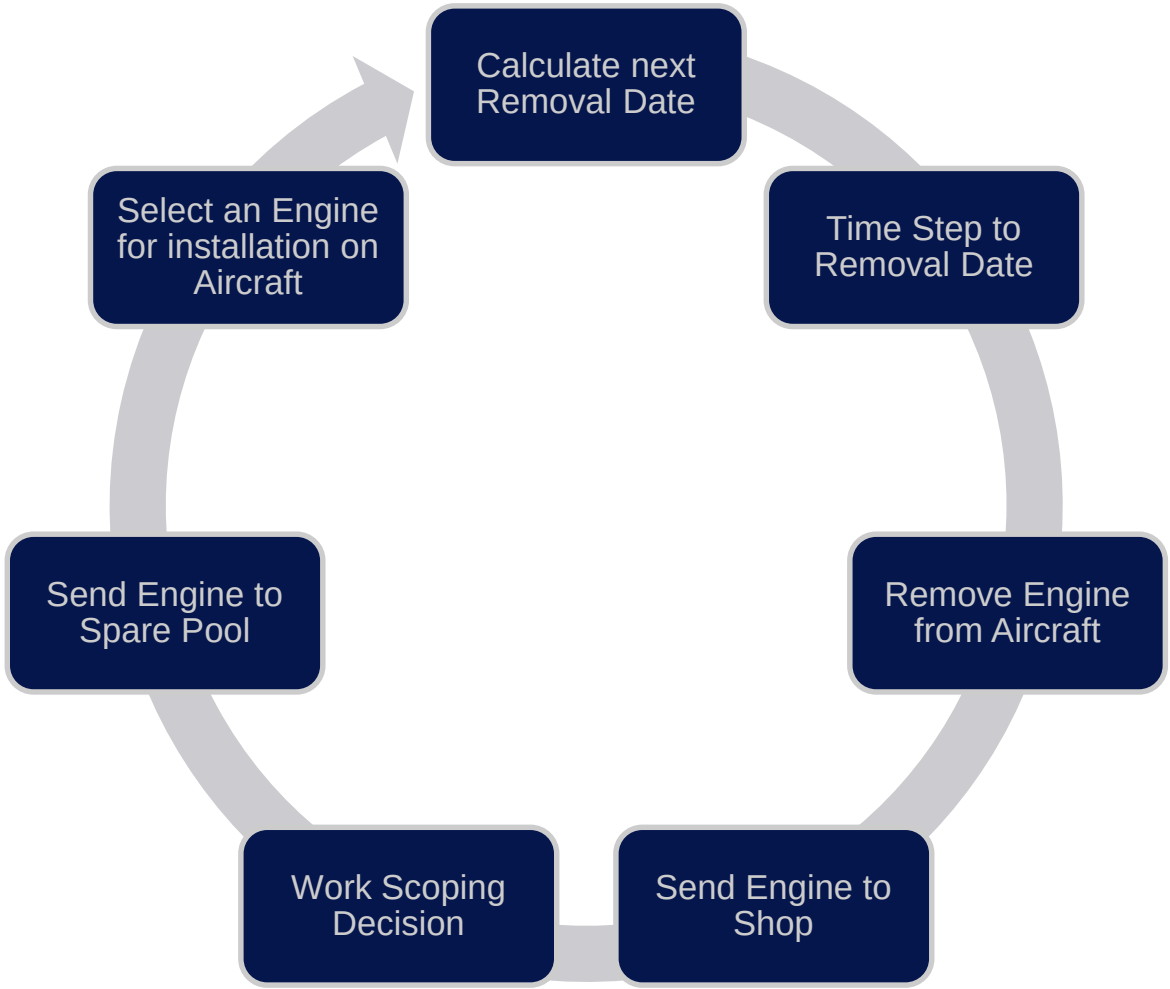


- Robust Framework
  - Developed and integrated with MathWorks Consulting
  - Quickly adjustable
  - Modular

→ Migration from individual GUI to robust framework was worthwhile

Core Functionality – Removal Planning Algorithm

Simulation of Aircraft and Engine Fleet Operation for Contract Period



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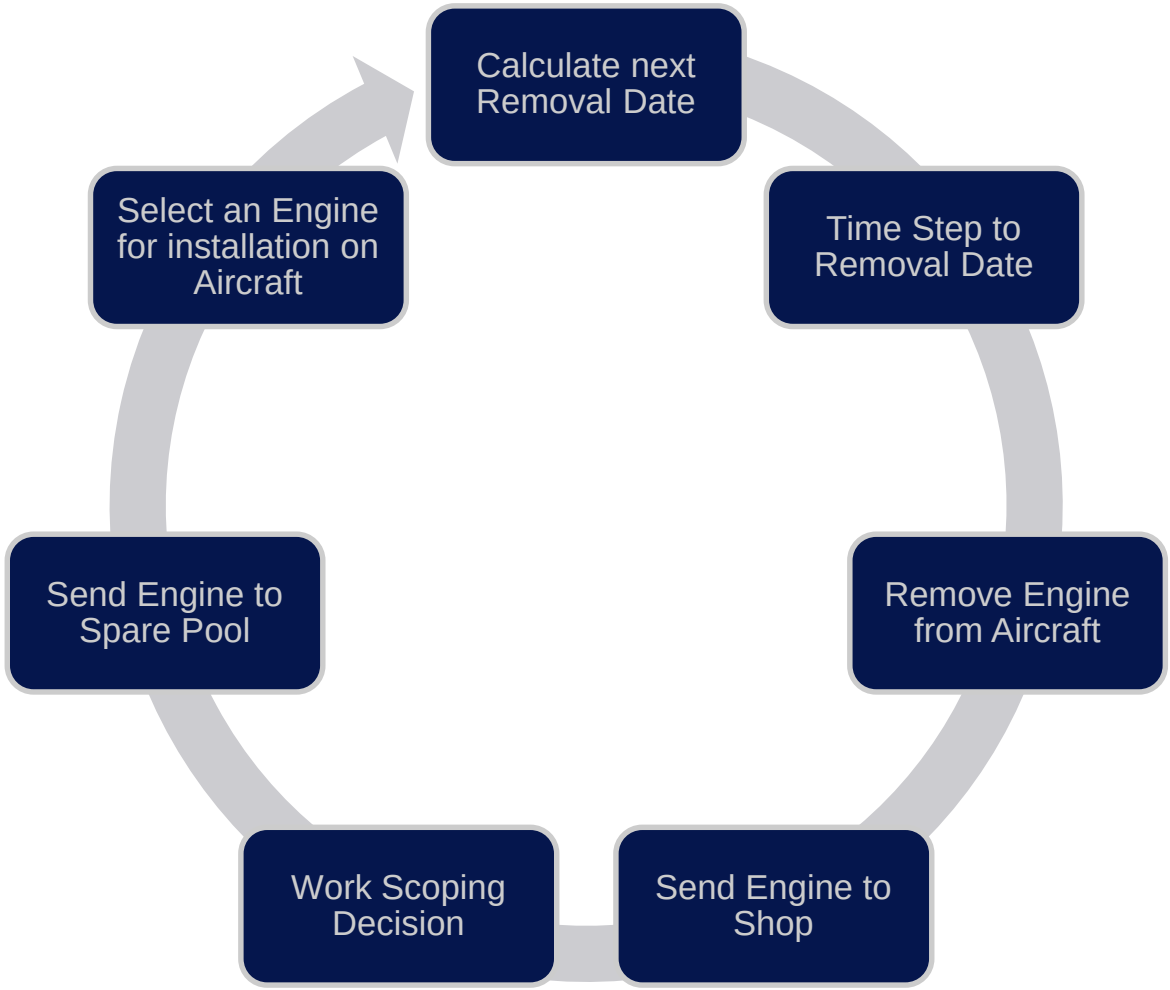

- Growing complexity by introduction of new Features due to increasing user demand
  - Stagger Removals
  - Park Aircrafts
  - Insert additional Shop Visits
    e.g. for Lease Return Requirements

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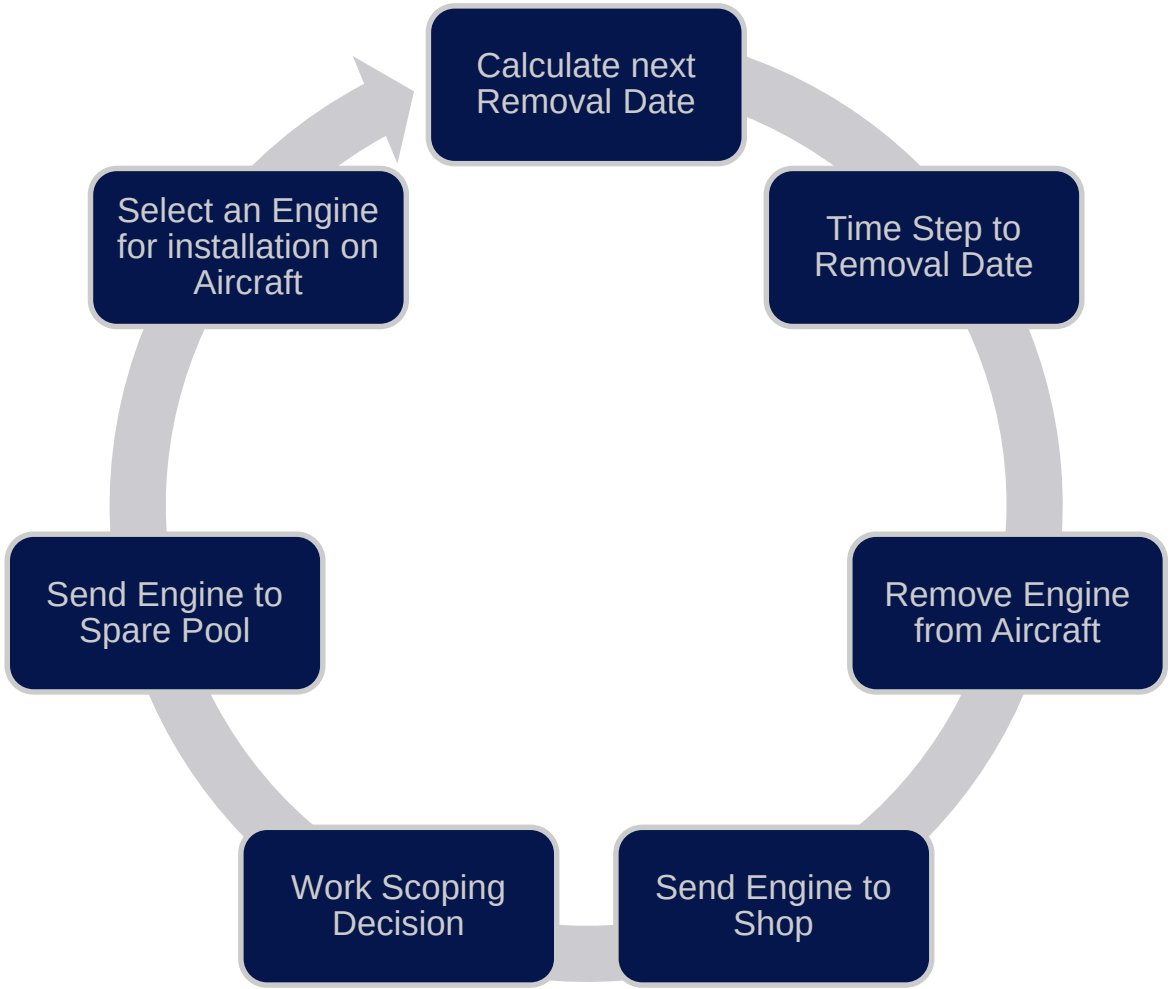

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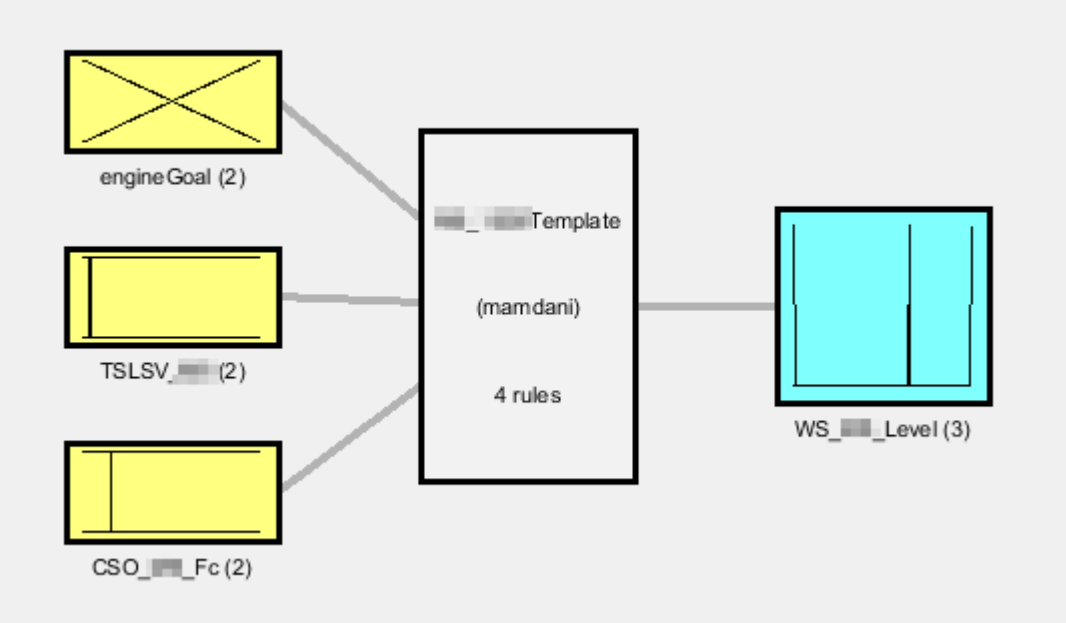
→ Reorganization of Data Structure and algorithm in progress

Core Functionality – Work Scoping Decision

Decision making based on a Fuzzy Logic algorithm



- Combing hard Criteria and Expert Knowledge
- Transparent Decisions
- Dynamically adjusted Templates
- Modelling of Uncertainties

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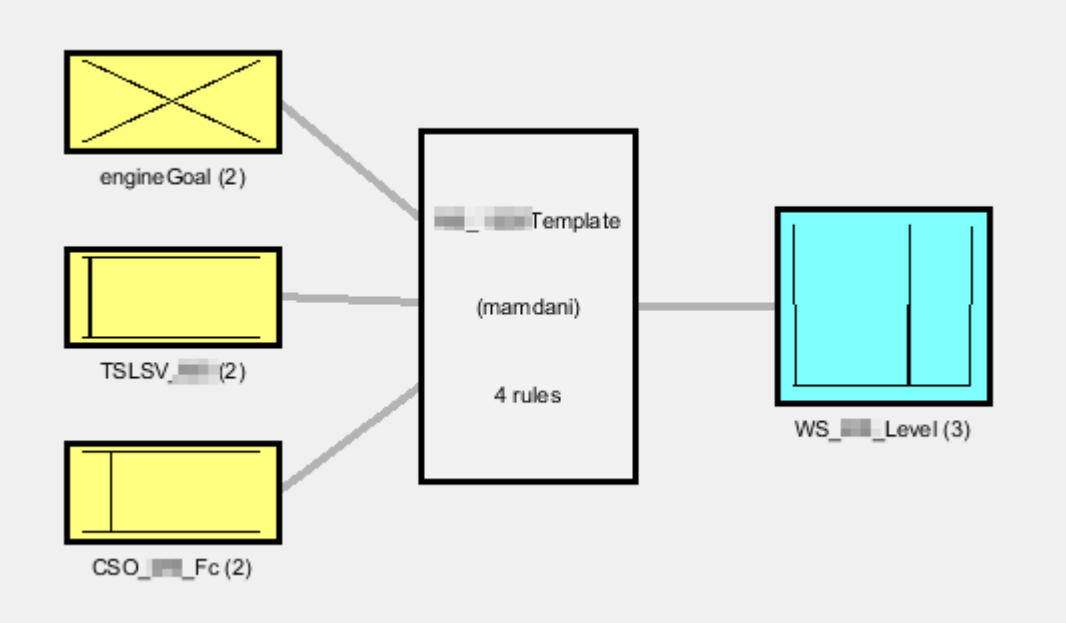

- Combing hard Criteria and Expert Knowledge
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→ Integration of Fuzzy Logic Toolbox

→ New algorithms and features can be integrated with a moderate effort

Visualization and Reporting Functions

Prepare Result for further Analysis

- Requirements
  - Prepare Overview of Fleet
  - Assessment of Scenarios
  - Support Decision Making
  - Export Results to internal and external Customers

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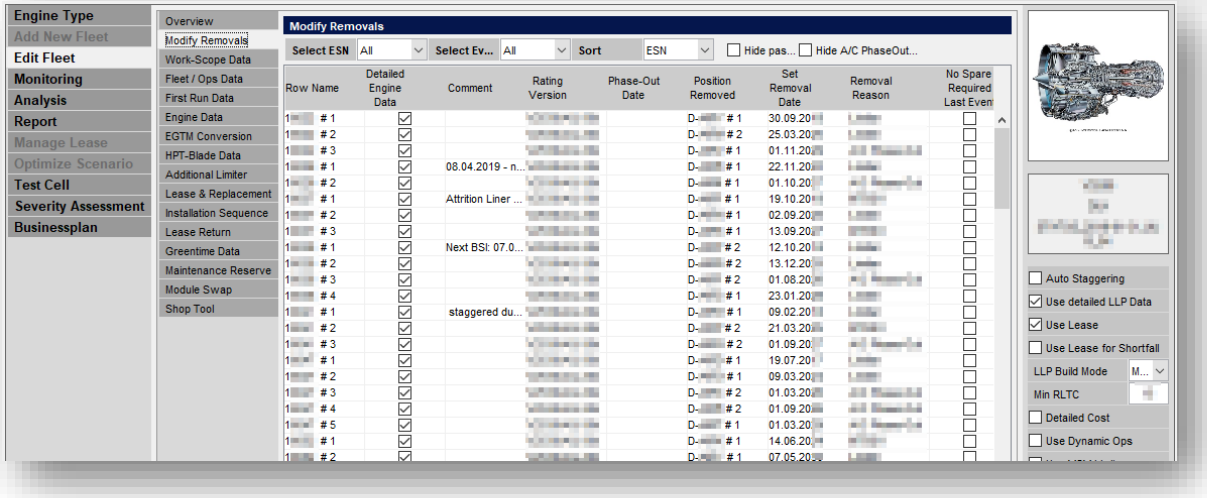

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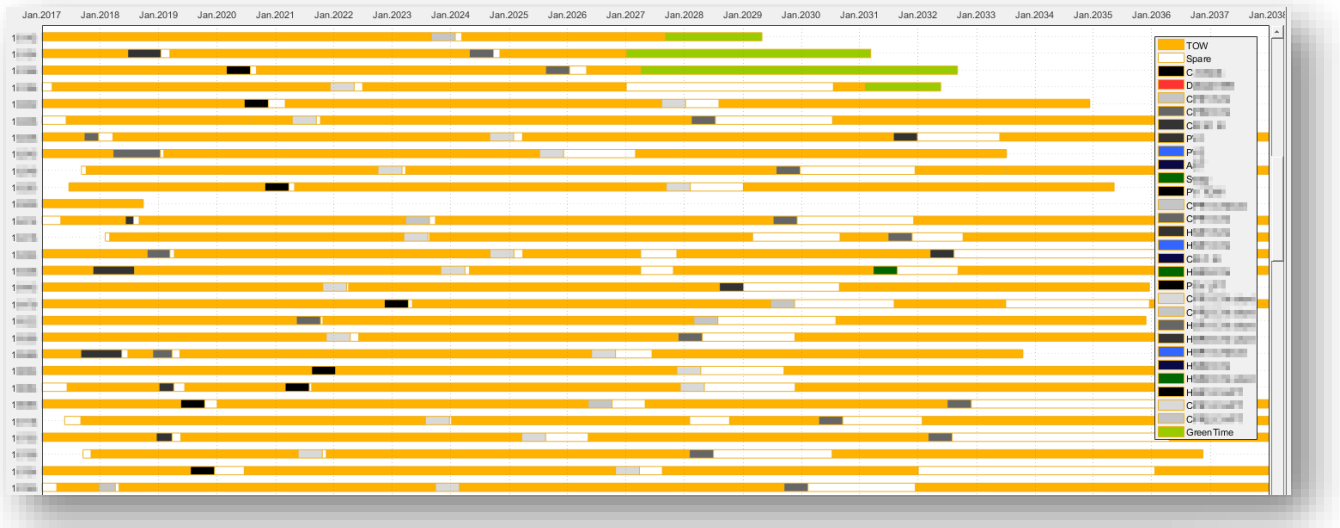

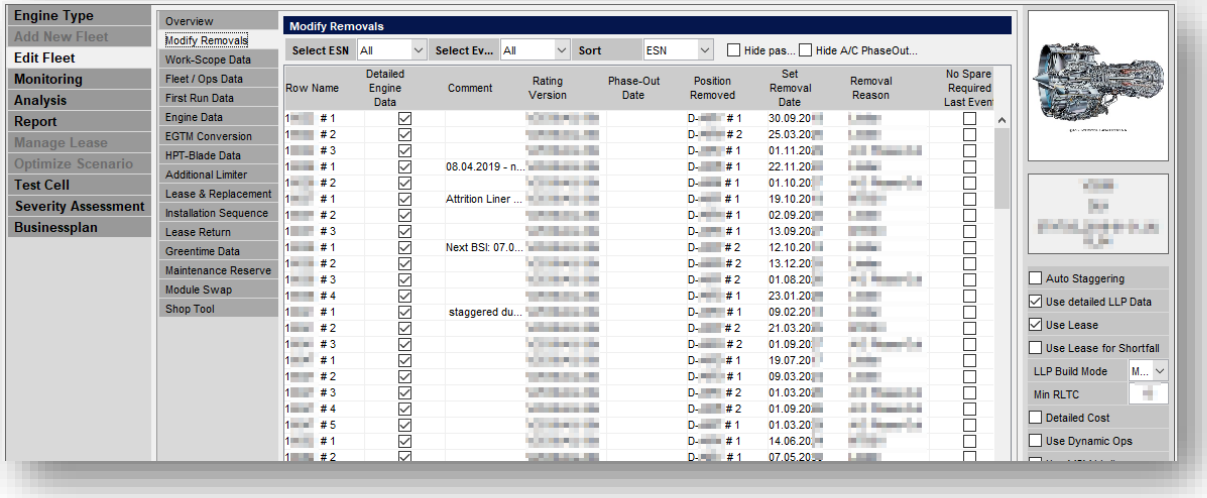

Database

.xlsx, .pdf

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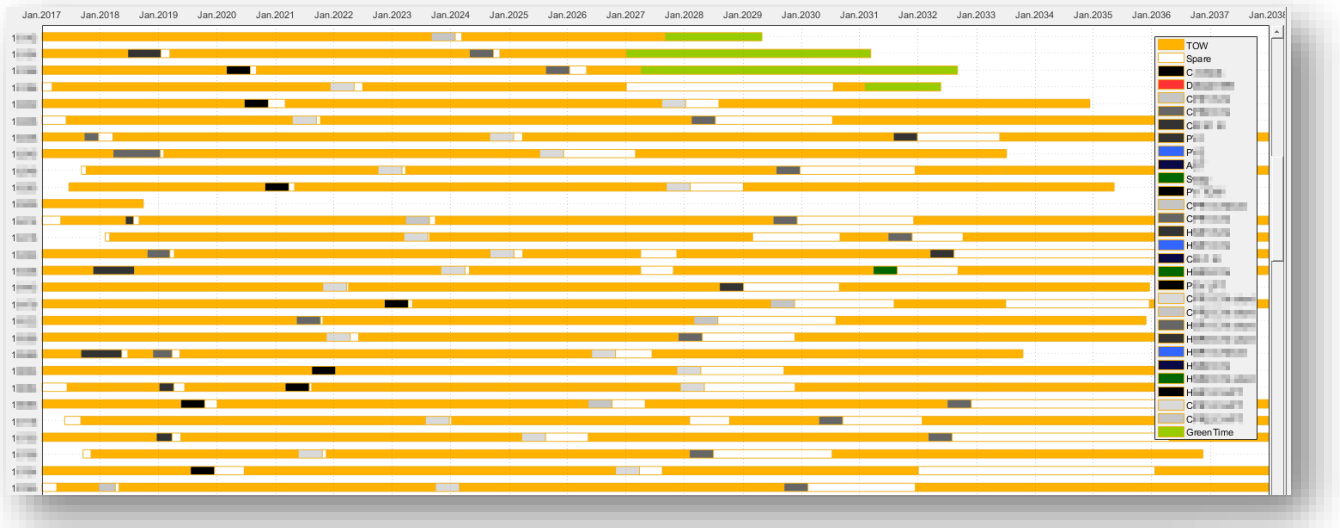

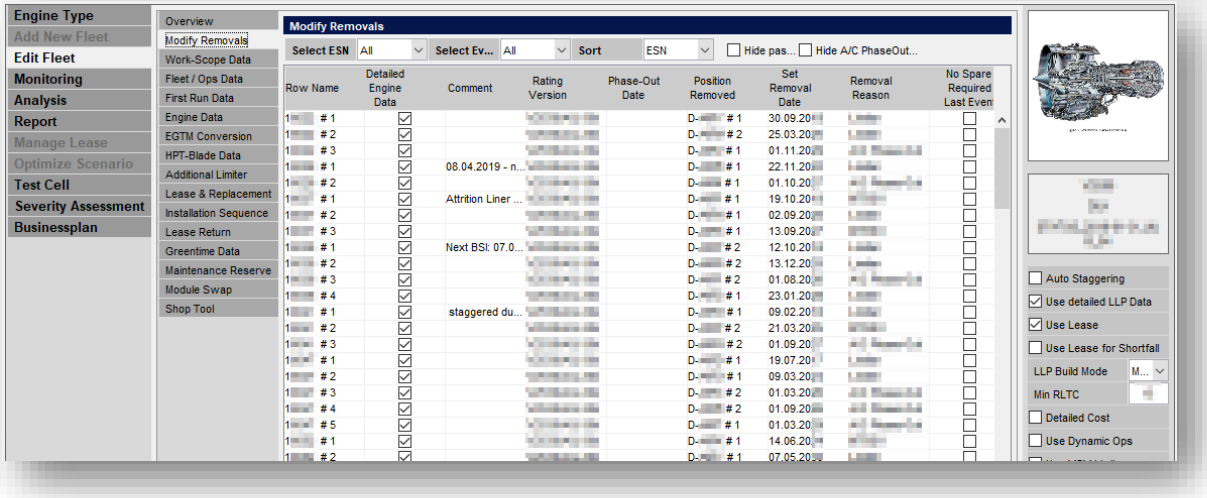

- Requirements
  - Prepare Overview of Fleet
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  - Export Results to internal and external Customers

→ Preparation of Graphical Output is challenging

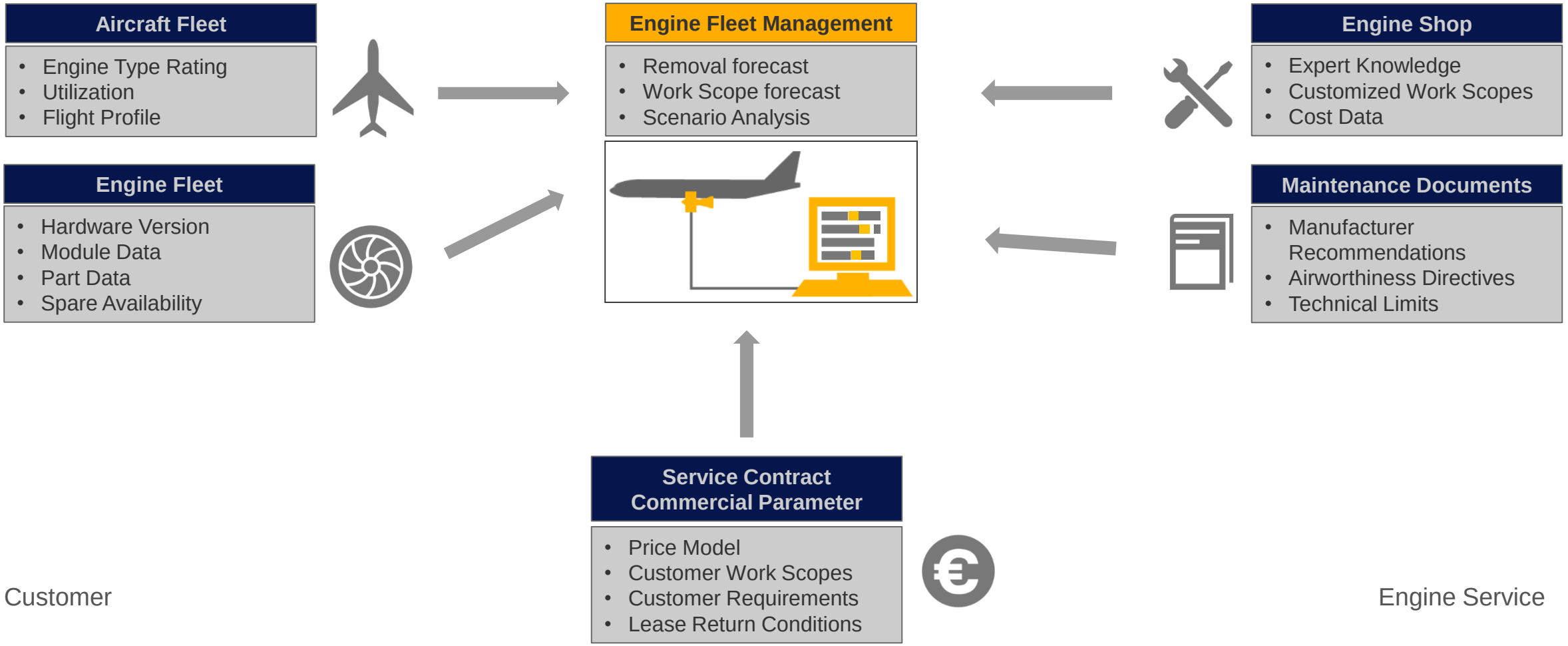
→ Flexible Export Function are easy to use

Database

.xlsx, .pdf

A growing number of Interfaces

Monitoring of an Engine Fleet



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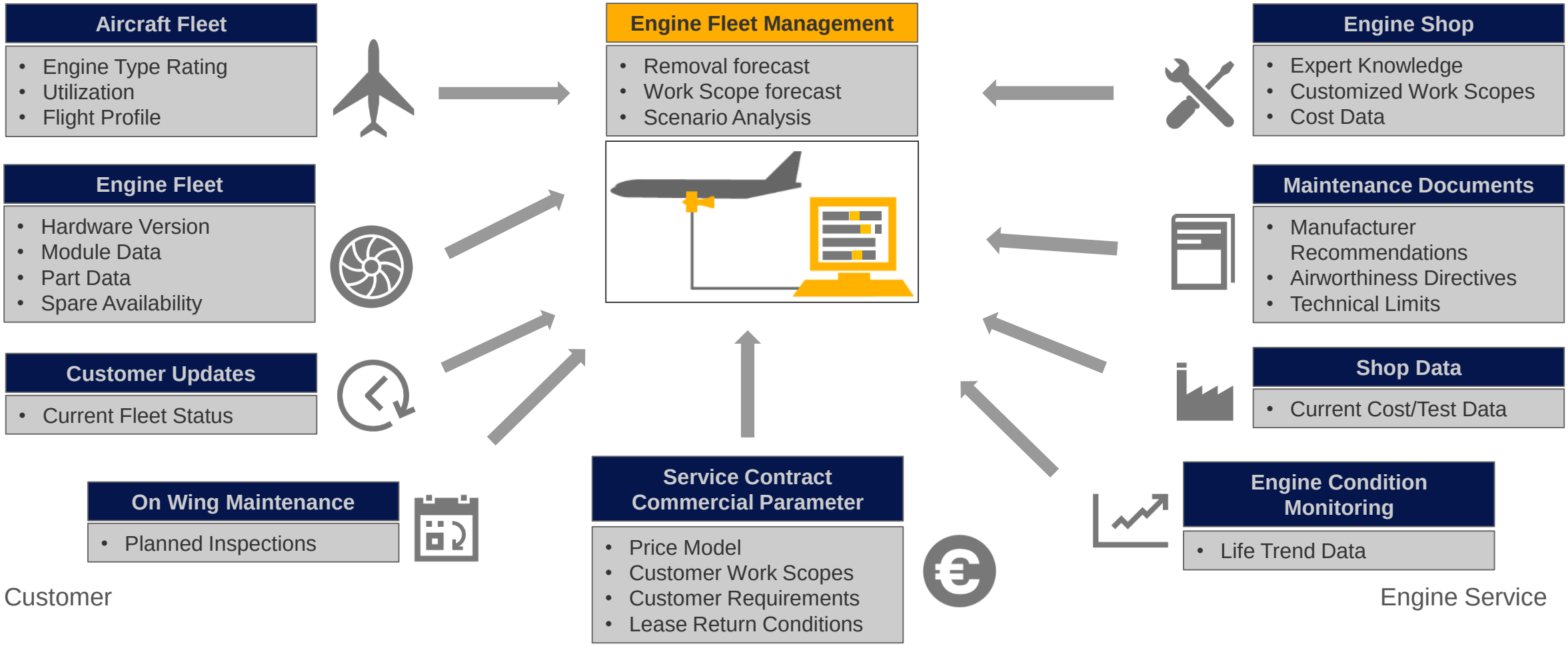

Summary
Challenges & Conclusions

Development Speed
→ Urgent Adaption to new Demands

Complexity of Decisions
→ Many Dependencies

Data Import
→ Unsteady Input Files/Systems

Data Management
→ Additional Parameter

Testing of new Functionalities
→ Qualitative Assessment of Calculation result necessary

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- Migration to new GUI
  → Completed and Worthwhile
- Enhancement of Program Structure
  → Transfer to Object Oriented Programming
- Modular Code
- Consulting & Continuous Revision of Code Segments

Thank you for your attention!

Contact Information, e.g. for Internships or B.Sc / M.Sc Thesis within our department

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