IMPACT MONITOR

University of Stuttgart
Germany

Deutsches Zentrum für Luft- und Raumfahrt
German Aerospace Center

Iterative Aircraft and Engine Sizing Using SUAVE and TurboMatch in Remote Component Environment (RCE)

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Objectives

- Demonstrate a higher fidelity sizing methodology for aircraft and engines using SUAVE and TurboMatch within the Impact Monitor Project
- This solves the problem of high-fidelity engine performance map becoming obsolete after reiterating the airframe sizing

Software

SUAVE: Aircraft Design Environment
Hosted at **University of Stuttgart**

cpacs
A Common Language for Aircraft Design

Data definition for the air transportation system: (https://cpacs.de/)

TurboMatch

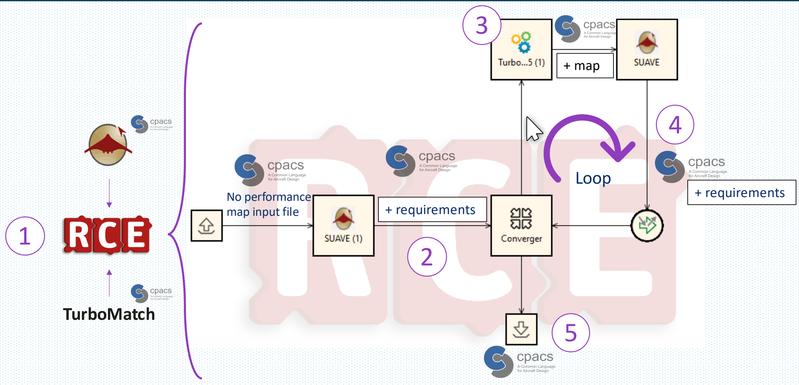
Engine modelling tool
Hosted at **Cranfield University**

RCE

Remote Component Environment: Open Source workflow-driven integration environment from DLR: (https://rcenvironment.de/)

Methodology

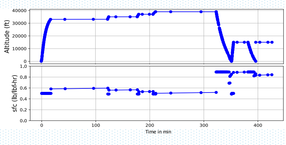
1. Make both SUAVE and TurboMatch cpacs-compatible and connect via RCE
2. Engine thrust requirement based on low fidelity engine calculations in SUAVE
3. Generation of engine performance map in TurboMatch based on thrust requirements generated in SUAVE. Performance map is exported into the cpacs file
4. SUAVE imports the cpacs file and converts performance map into .csv file, that is used to recalculate the aircraft with a high-fidelity engine. New thrust requirements are forwarded in cpacs
5. Process is repeated until convergence is reached



Results

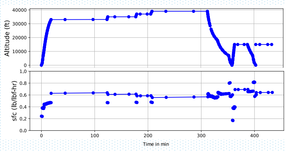
SUAVE only: Empirical engine in SUAVE

OEM: 51052 kg
PAX: 24000 kg
FUEL: 18464 kg
MTOM: 93516 kg
Wing Span: 35.80 m
Cruise TSFC: 0.469 $\frac{lb}{lbf \cdot h}$



1 Loop: Performance map scaled by SUAVE

OEM: 51059 kg
PAX: 24000 kg
FUEL: 18477 kg
MTOM: 93535 kg
Wing Span: 35.80 m
Engines scaling in SUAVE for realistic performance



n loops: New performance map each loop until no further scaling required

Calibration to:
OEM: 51000 kg
PAX: 24000 kg
FUEL: 18500 kg
MTOM: 93500 kg
Wing Span: 35.80 m
Results in no engine scaling required

Conclusion:
- New engine sized in every loop
- Final engine exactly matches the final aircraft
- Design loop can be transferred to every aircraft and engine size by changing the SUAVE input

Funded by the European Union

Funded by the European Union, under Grant Agreement No 101097011. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them..

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Project Website