



Hochschule für Angewandte Wissenschaften Hamburg
Hamburg University of Applied Sciences

Aero – Aircraft Design and Systems Group

Current Status

Prof. Dr.-Ing. Dieter Scholz, MSME

08-12-04



Aero – Aircraft Design and Systems Group

- Aero is **part of**:
Research Focal Point Aeronautical Engineering
Department of Automotive and Aeronautical Engineering
Faculty of Engineering and Computer Science
- Aero's **aim** is to guide research assistants to cooperative dissertations and to conduct funded projects in research, development and teaching (short courses).

Aero – Aircraft Design and Systems Group

Emphasis of our work is on:

- Aircraft Design
- Aircraft Systems
- Flight Mechanics

Current projects with partner organisations:

- Green Freighter
- ALOHA, Efficient Airport (Aviation Cluster Hamburg)
- PAHMIR
- CARISMA

Past projects with partner organisations:

- FLECS

Cooperative Dissertations



Dipl.-Ing. Kolja Seeckt
(Green Freighter)

Dipl.-Ing. Francisco Gómez Carrasco
(ALOHA)



Dipl.-Ing. Mihaela Niță
(CARISMA)



Aero – Aircraft Design and Systems Group

Presently two **short courses** are being offered.

- **Aircraft Design**

Next course: May 2009 (one week)

- **Introduction to Aeronautical Engineering**

Next course: January 2009 (one week)



Aero – Aircraft Design and Systems Group

Research assistants at Aero:

Dipl.-Ing. Kolja Seeckt (Green Freighter)

Dipl.-Ing. Francisco Gómez Carrasco (ALOHA)

Dipl.-Ing. Mike Gerdes (PAHMIR)

Dipl.-Ing. Mihaela Niță (CARISMA)

Dipl.-Ing. Philip Krammer (Fuel Cell Integration)



Aero – Aircraft Design and Systems Group

Information available on the WWW:

<http://Aero.ProfScholz.de>

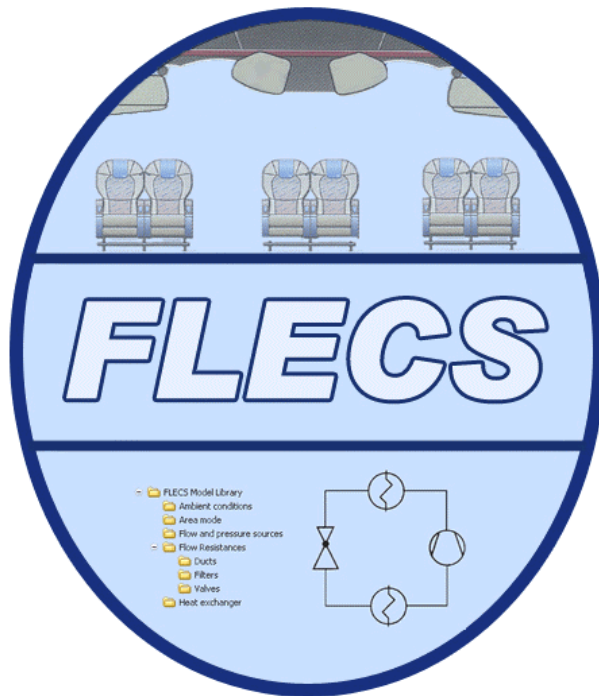
- Reports@Aero

<http://bibliothek.ProfScholz.de>

- **Digital Library: Student Projects, Thesis Work**

FLECS

Functional Model Library of the Environmental Control Systems



- Total: 648 k€
- HAW: 162 k€
- 2 years
- Partners:
Airbus, CeBeNetwork
- Sponsors:
Cities of Hamburg & Bremen





Functional Simulation of the Environmental Control System and the Cabin => FLECS Database

Support all Phases in the Design Processes

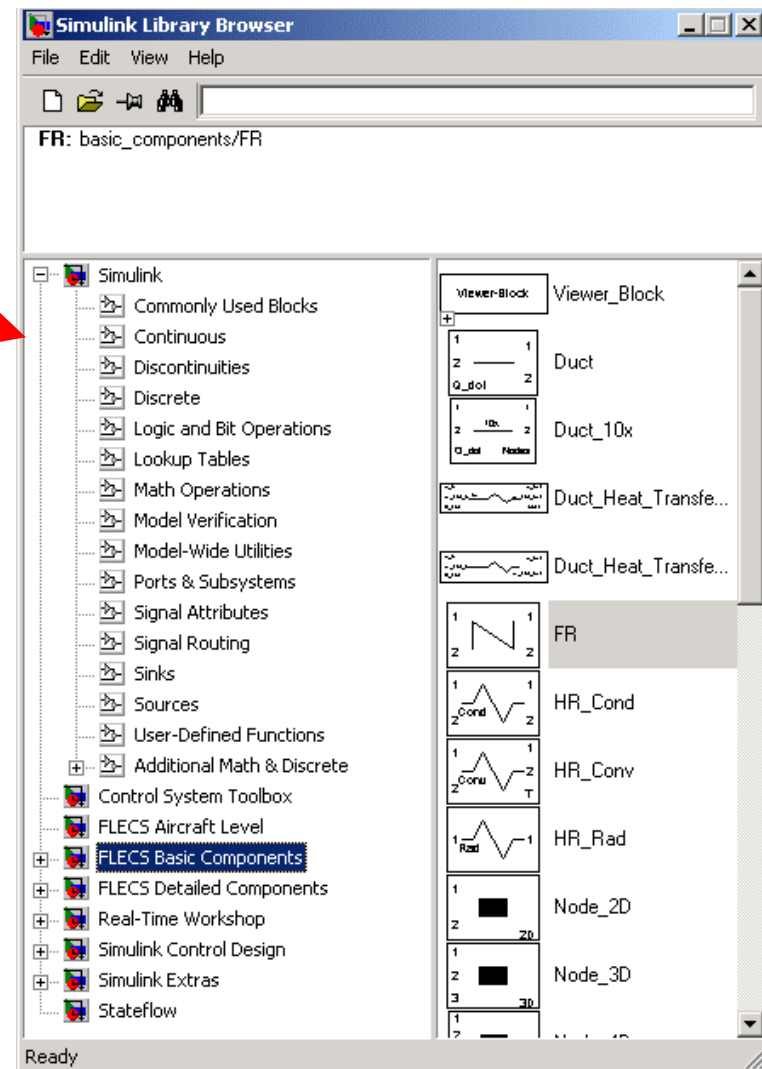
- Pre Design
- Simple Dynamics
- Detailed Dynamics

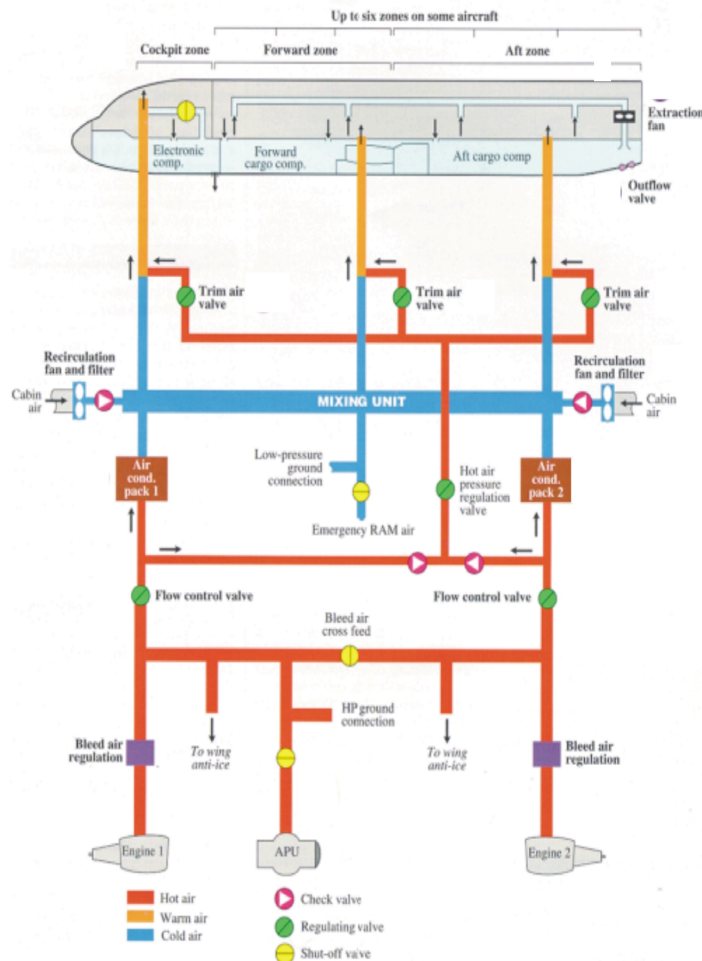
Investigation of a large Number of System Architectures

=> Optimum Architecture

Graphical User Interface

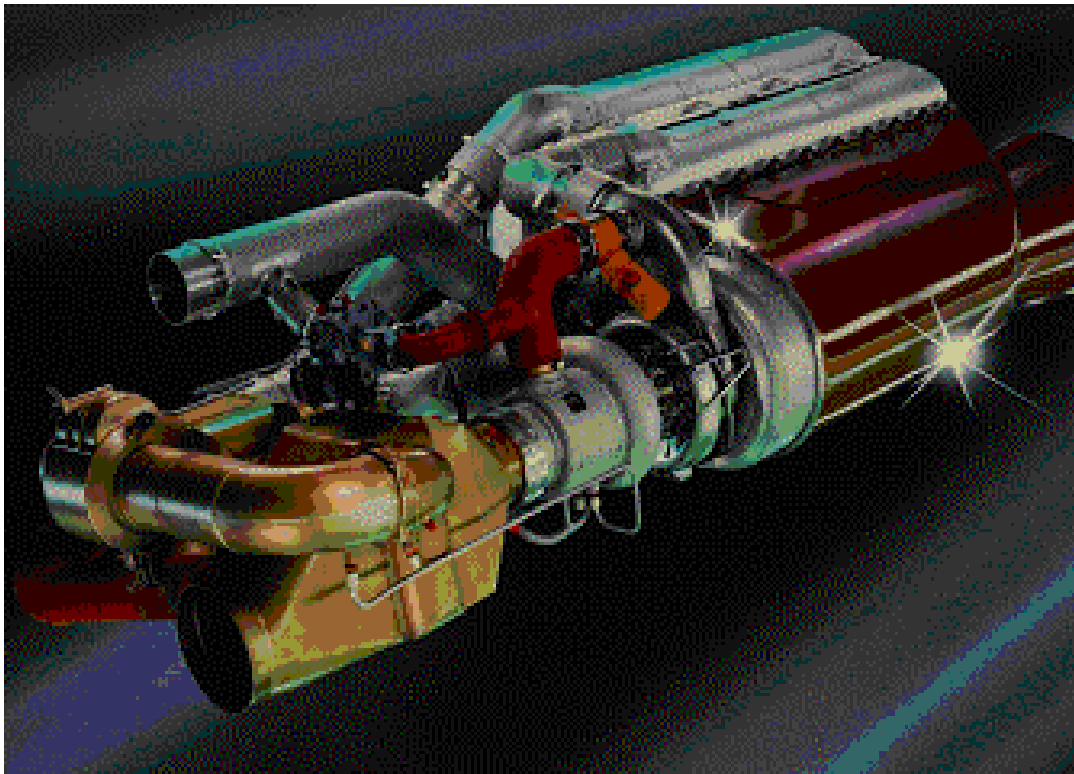
- Parameter Input Masks
- Main GUI
 - Cockpit GUI, Display GUI
 - Interactive Mode, Batch Mode





Component Classes

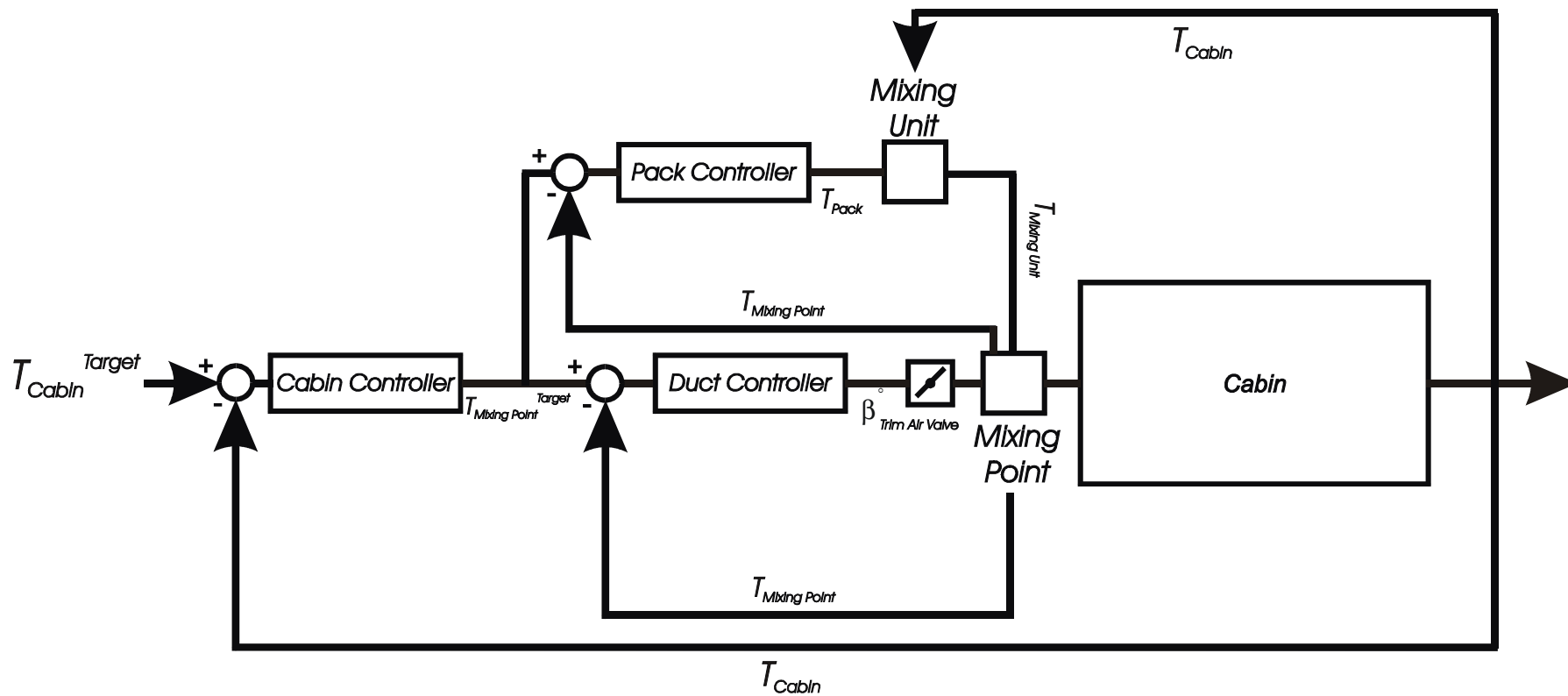
- Ambient Conditions
- Aircraft Boundaries
- Flow Resistances
- Flow and Pressure Sources
- Volumes
- Area models
- Mixing Unit
- Heat Exchangers
- Air Cycle Machine and Air Compressor
- Ram Flow
- Vapor Cycle Systems
- Sensors
- Controls



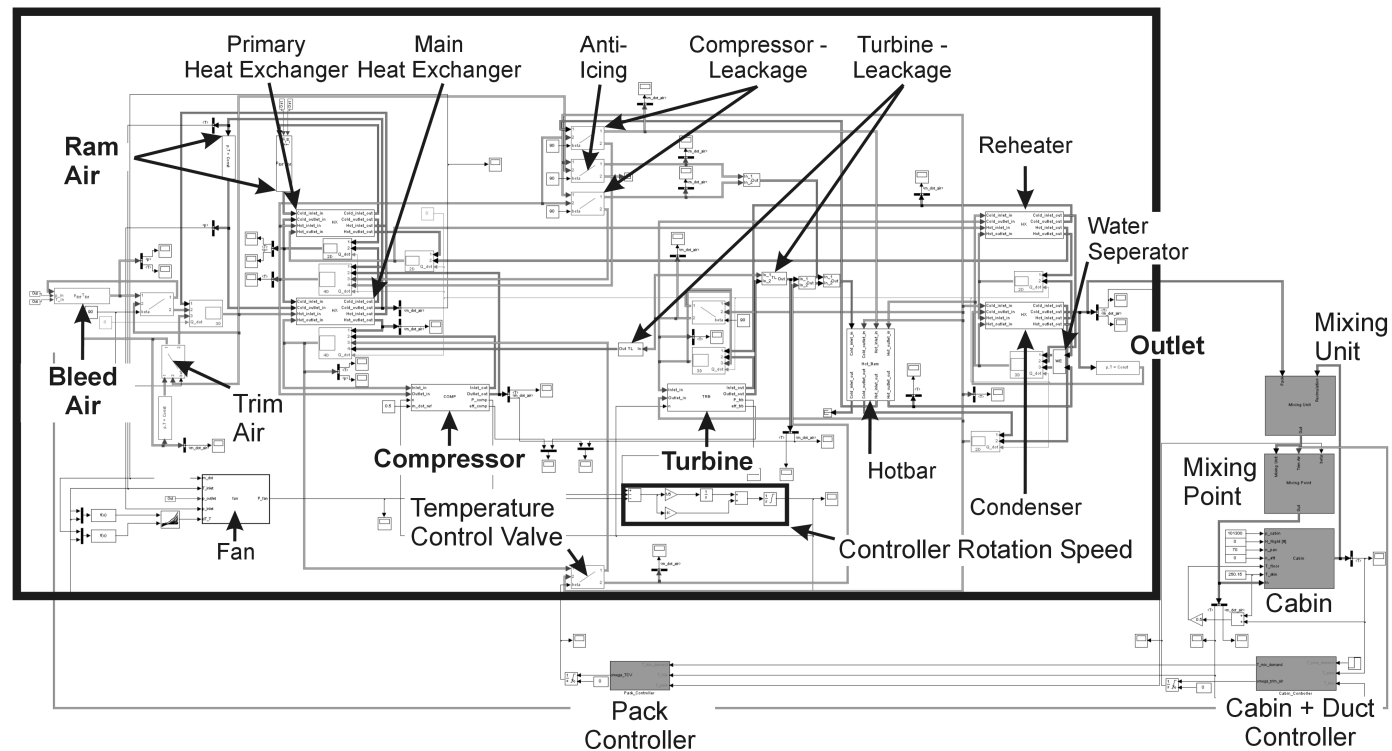
Example: Airconditioning Pack

- Air Cycle Machine
(Compressor, Turbine)
- Heat Exchangers
- Water Separator

From the Block Diagram ...



... to the Simulation of Detailed Dynamics

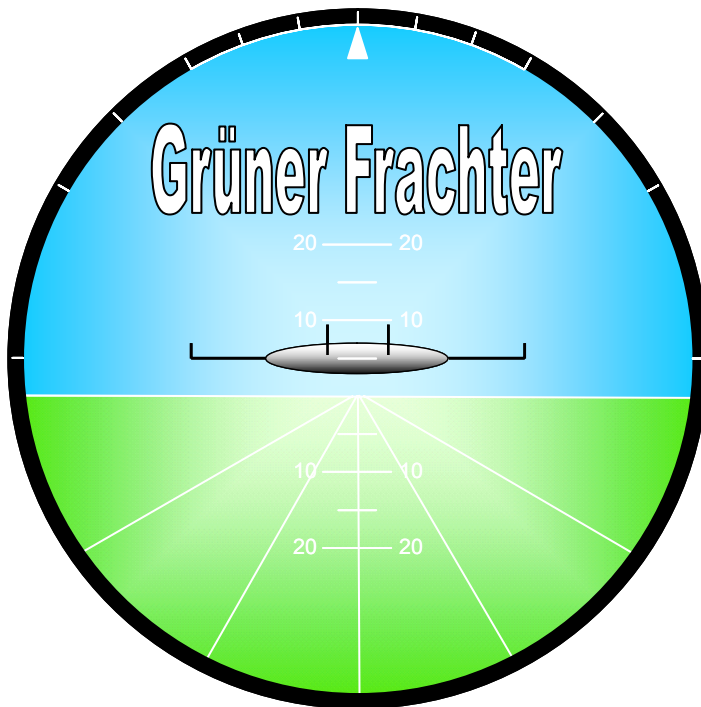


MATLAB/Simulink

- C-Code Generation
 - Real-Time Capability
- Hardware in the Loop Testing

GF

Green Freighter



- **Total: 646 k€**
- **HAW: 234 k€**
- **3 years**
- **Partner:**
Airbus, TU Braunschweig, Bishop GmbH
- **Sponsors:**
Federal Ministry of Education and Research



Aim of the project

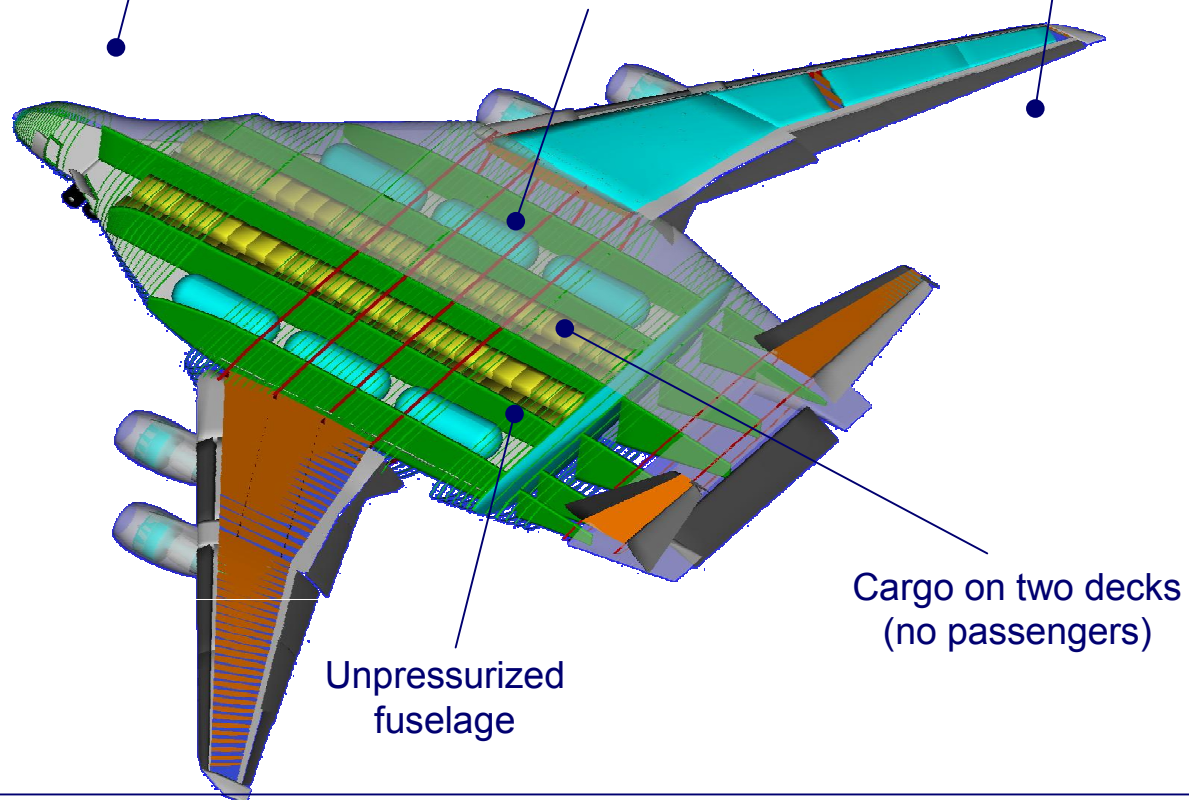
- Investigations on environmentally friendly and cost effective freighter aircraft configurations
- “Environmentally friendly” due to:
 - Low fuel consumption
 - Low emissions (CO₂, NO_x)
 - Future fuels (Liquid hydrogen – LH₂, Synfuel, Biofuel)
 - Low noise level

Design analysis

No crew
(UAV-operation)

Fuel tanks
with liquid hydrogen

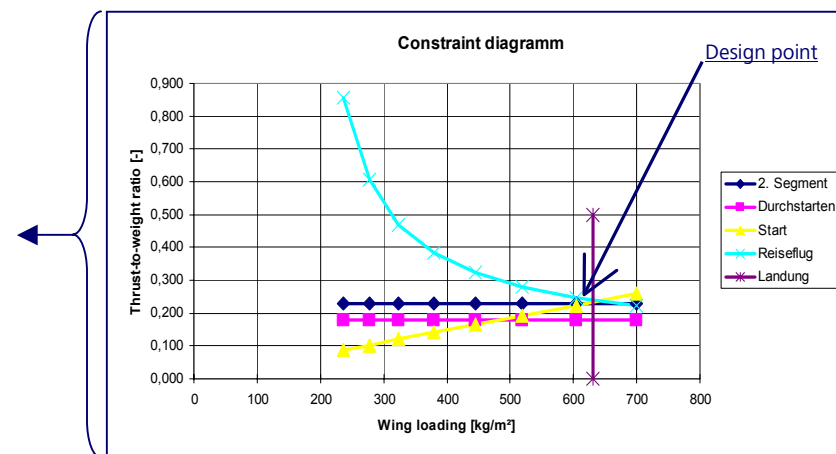
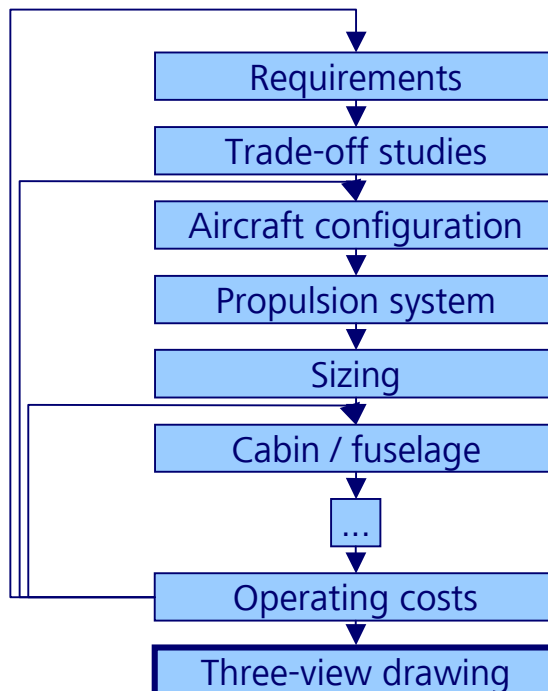
kerosene in
wing tanks



Cargo on two decks
(no passengers)

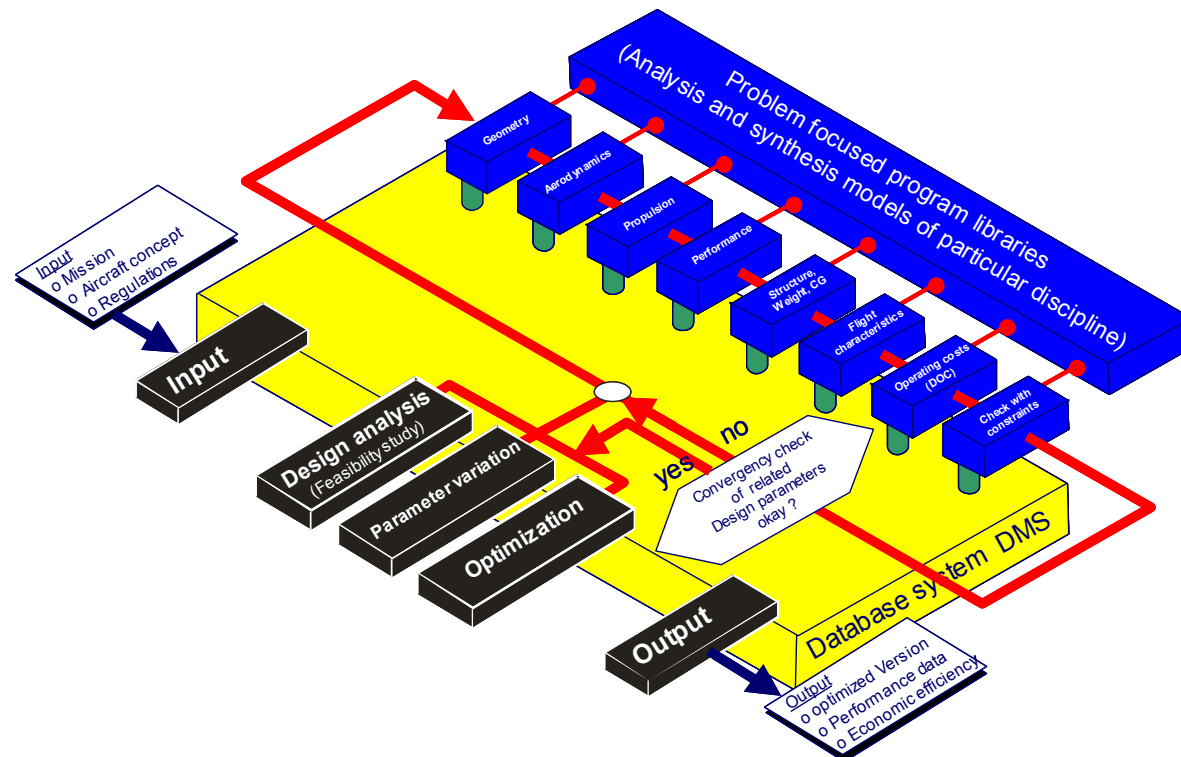
Tools

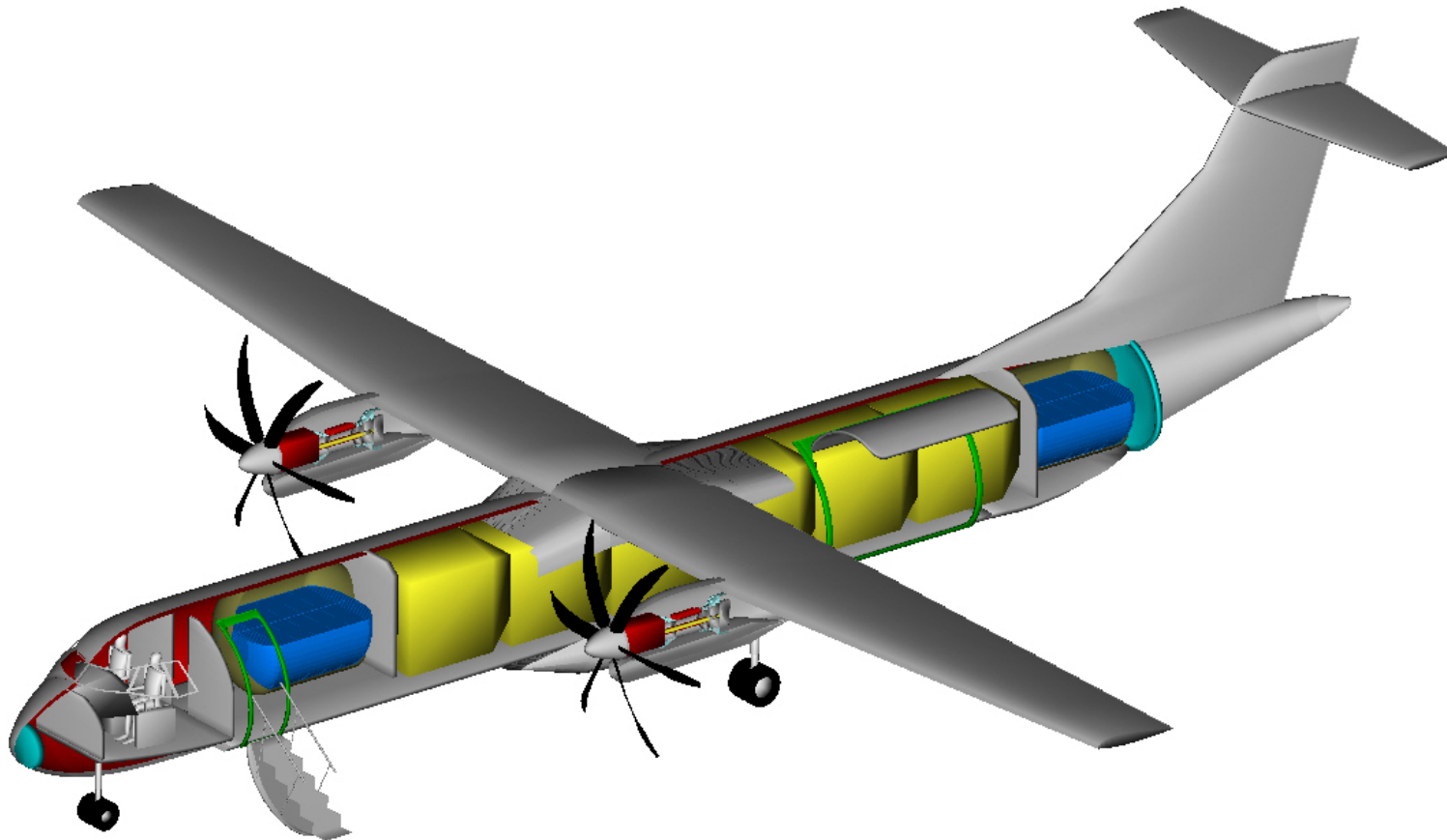
- PreSTo:
Aircraft Preliminary Sizing Tool



Tools

- **PrADO:**
Preliminary Aircraft Design and Optimization





ALOHA

Aircraft Design for Low Cost Ground Handling



- Total: 510 k€
- HAW: 140 k€
- 2 years and 4 month
- Partner:
Airbus, Airport Research Center GmbH,
Hamburg Airport
- Sponsor:
Federal Ministry of Education and
Research

Background

- Low Cost Airlines (LCA) fly today with mostly **Boeing B737** und **Airbus A320**.
- Ryanair was the first European LCA founded in 1985.
- The B737 was developed in the 60th, the A320 in the 80th - also still at a time, where **LCA requirements were not included into the aircraft design**.
- Aircraft manufacturers started to work on **replacements for the models B737 and A320**.
- ALOHA helps to **include LCA requirements already from the start into the development of the successors of current single aisle aircraft**.

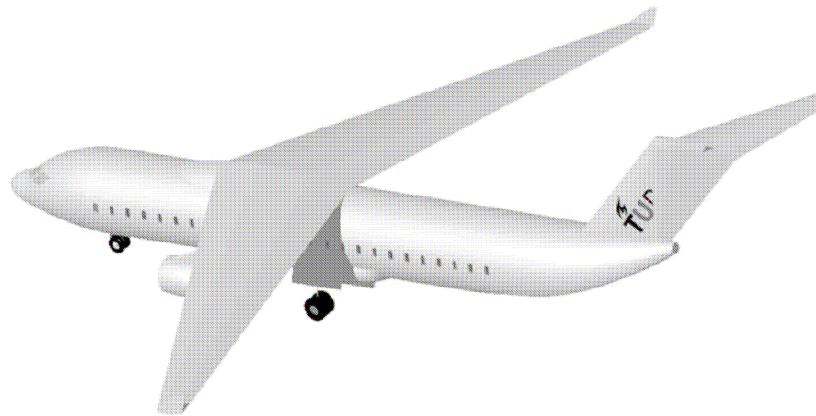


Turn Around Time and Cost Reduction

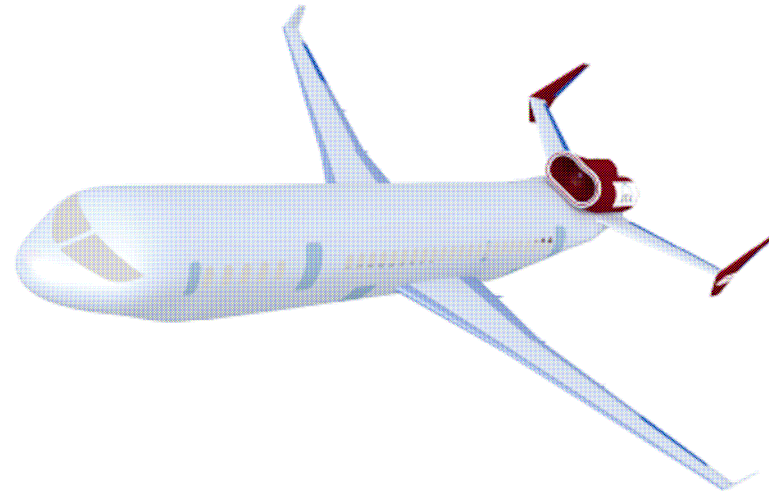
- New aircraft designs (lower sill height, ...)
- Faster boarding and deplaning (new door arrangement)
- Simpler baggage loading (moving belt, sliding carpet, ...)
- Autonomous boarding (integrated stairs, ...)
- Autonomous push-back
- Autonomous taxiing
- New handling operations
- Less airport charges



New Aircraft Designs (Previous Studies)



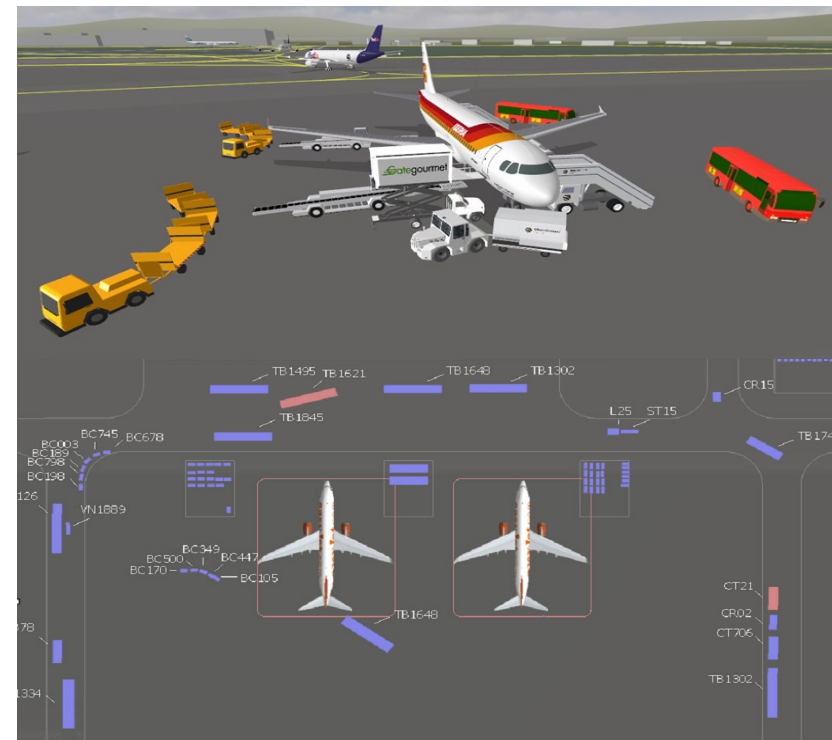
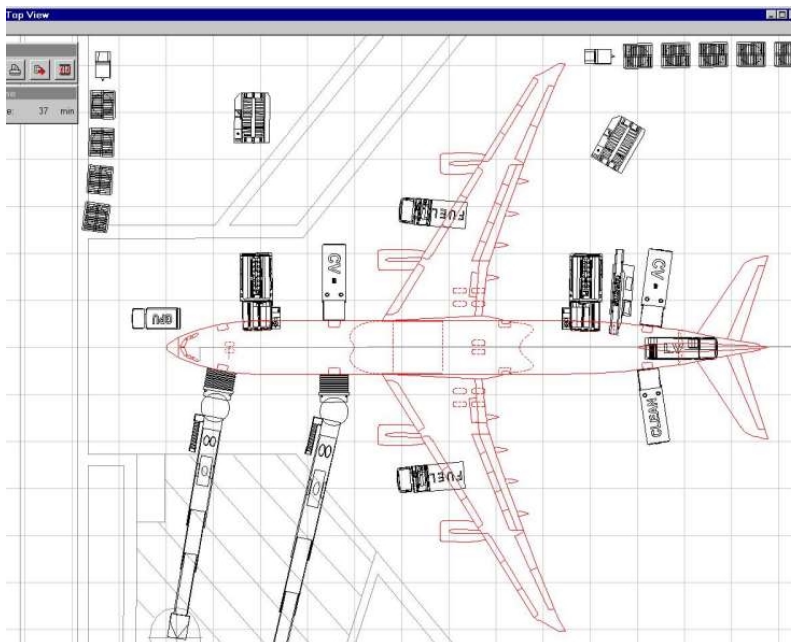
TU Delft



University of Stuttgart

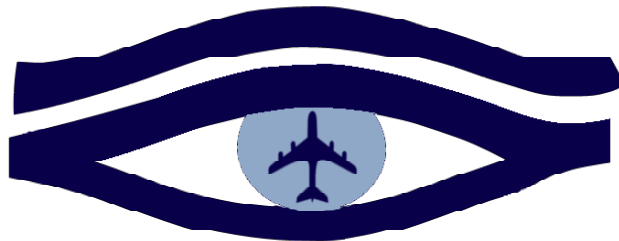
Ground Handling Studies

- Ground handling analysis at airports
- Ground handling simulation (SIMBA)
- Analytical cost predictions



PAHMIR

Preventive Aircraft Health Monitoring for Integrated Reconfiguration



PAHMIR

- Lead: Airbus
- HAW: 195 k€
- 3 years
- Partners:
Airbus, Philotech
- Sponsors:
Cities of Hamburg



AIRBUS

philotech



Work Structure

Two topics in the area of aircraft cabins and cabin systems:

- a) the **reconfiguration** of cabins,
cabin modules and components
- b) error detection and **diagnostic systems**
for **preventive maintenance**
of cabin systems.



CARISMA

Aircraft Cabin and Cabin System Refurbishing Optimization of Technical Processes

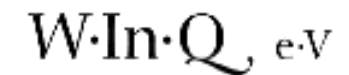
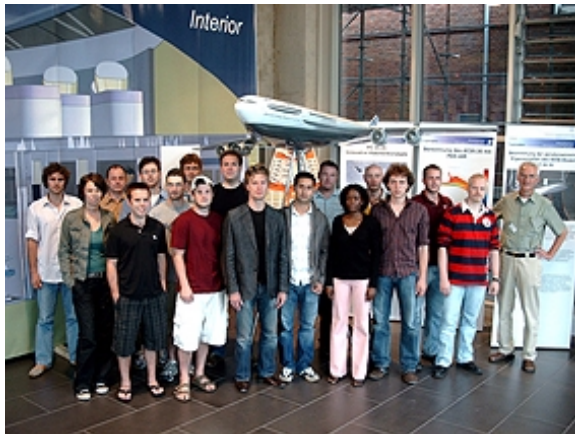
- HAW: ??? k€
- 3 years
- Partner:
ELAN GmbH



Training on Airbus A320 System Simulators



Short Course: Aircraft Design



Summary

- **Aero: Aircraft Design and Systems Group**
- FLECS
- Green Freighter
- ALOHA
- PAHMIR
- Efficient Airport (Aviation Cluster Hamburg)
- CARISMA
- Fuel Cell Integration (future project in the Aviation Cluster Hamburg)

- Training on Airbus A320 System Simulators
- Short Courses:
 - Aircraft Design
 - Introduction to Aeronautical Engineering