Aero – Aircraft Design and Systems Group

Current Status

Prof. Dr.-Ing. Dieter Scholz, MSME

09-03-26

Aero: Projects and Activities

- FLECS
- Green Freighter
- ALOHA
- PAHMIR
- Efficient Airport 2030 (Aviation Cluster Hamburg)
- CARISMA
- MOZART - Health Monitoring of Fuel Cell Systems in Aviation

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

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 2030 (Aviation Cluster Hamburg)
- PAHMIR
- CARISMA
- MOZART

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: June 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://bibliothek.ProfScholz.de

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

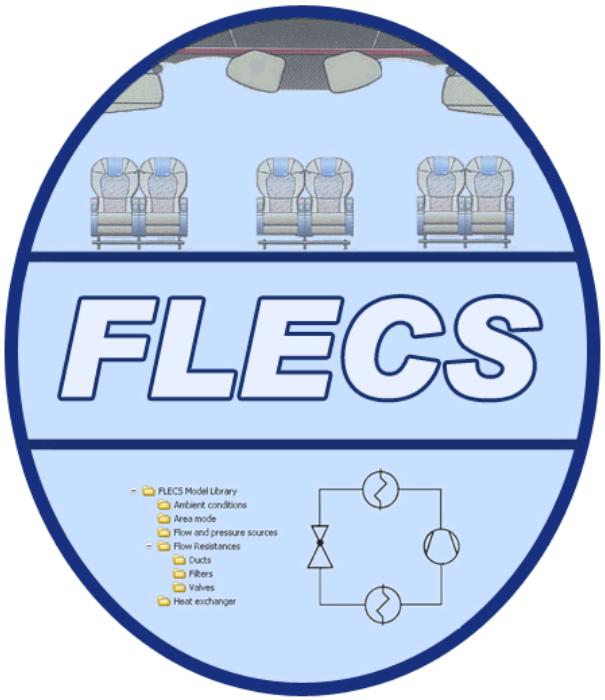
http://Aero.ProfScholz.de

- **Reports@Aero**

http://server_at_Aero.ProfScholz.de

- **News**

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

AIRBUS

CeBeNetwork Group

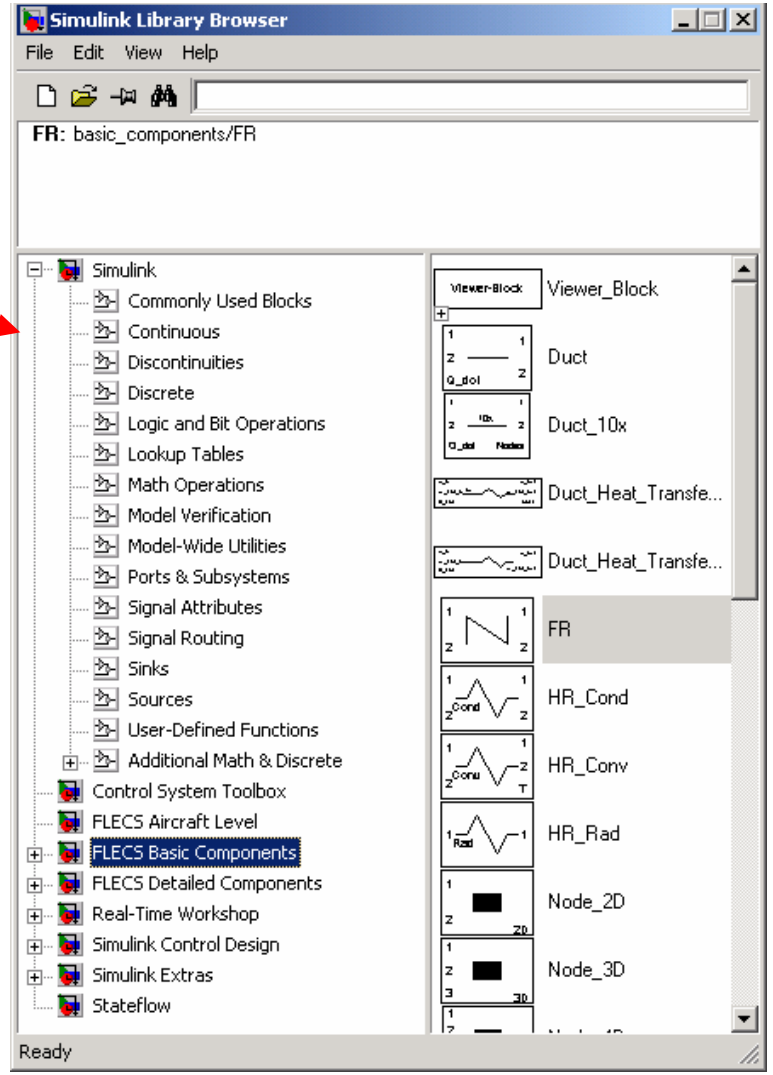
Freie und Hansestadt Hamburg
Behörde für Wirtschaft und Arbeit

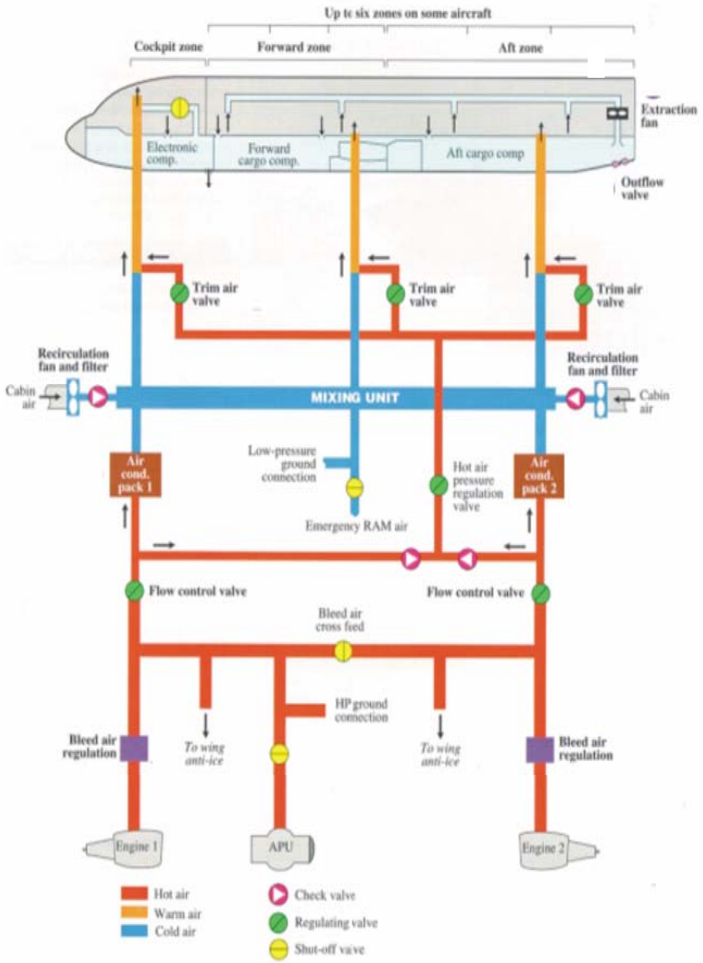
Functional Simulation of the Environmental Control System and the Cabin
=> FLECS Database

Support all Phases in the Design Processes
- Pre Design
- Simple Dynamics
- Detailed Dynamics

Investigation of a large Number of System Architectures
=> Optimum Architecture

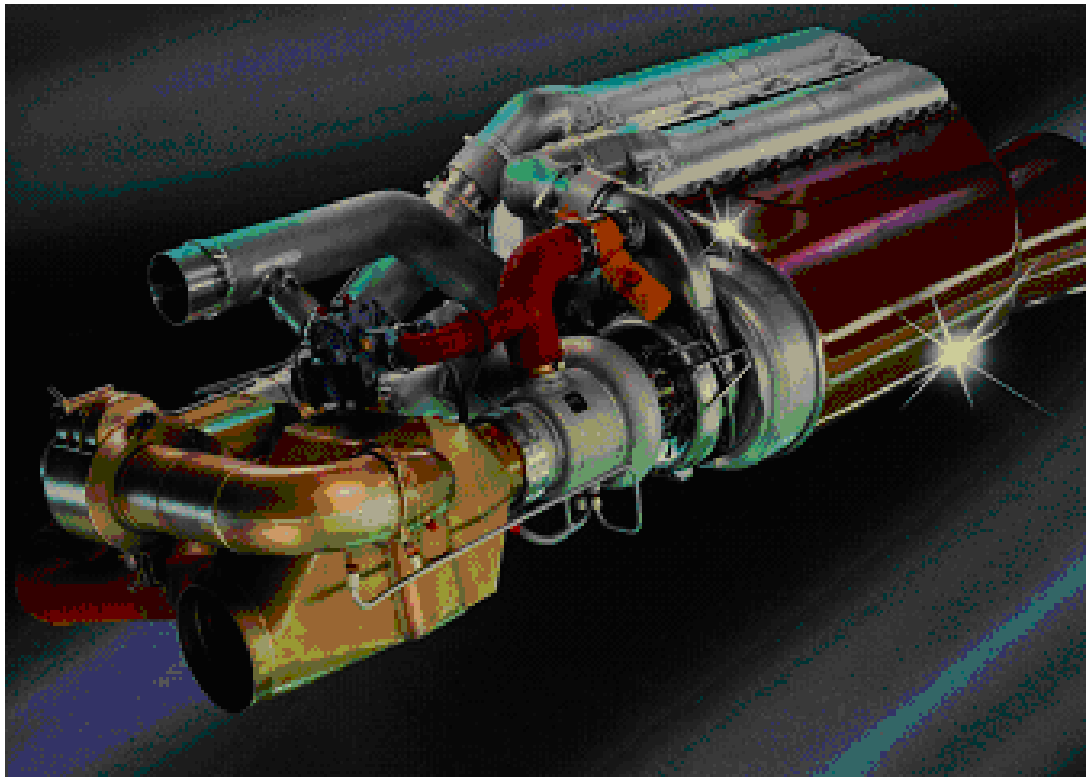
Graphical User Interface
- Parameter Input Masks
- Main GUI
  → Cockpit GUI, Display GUI
  → Interactive Mode, Batch Mode





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

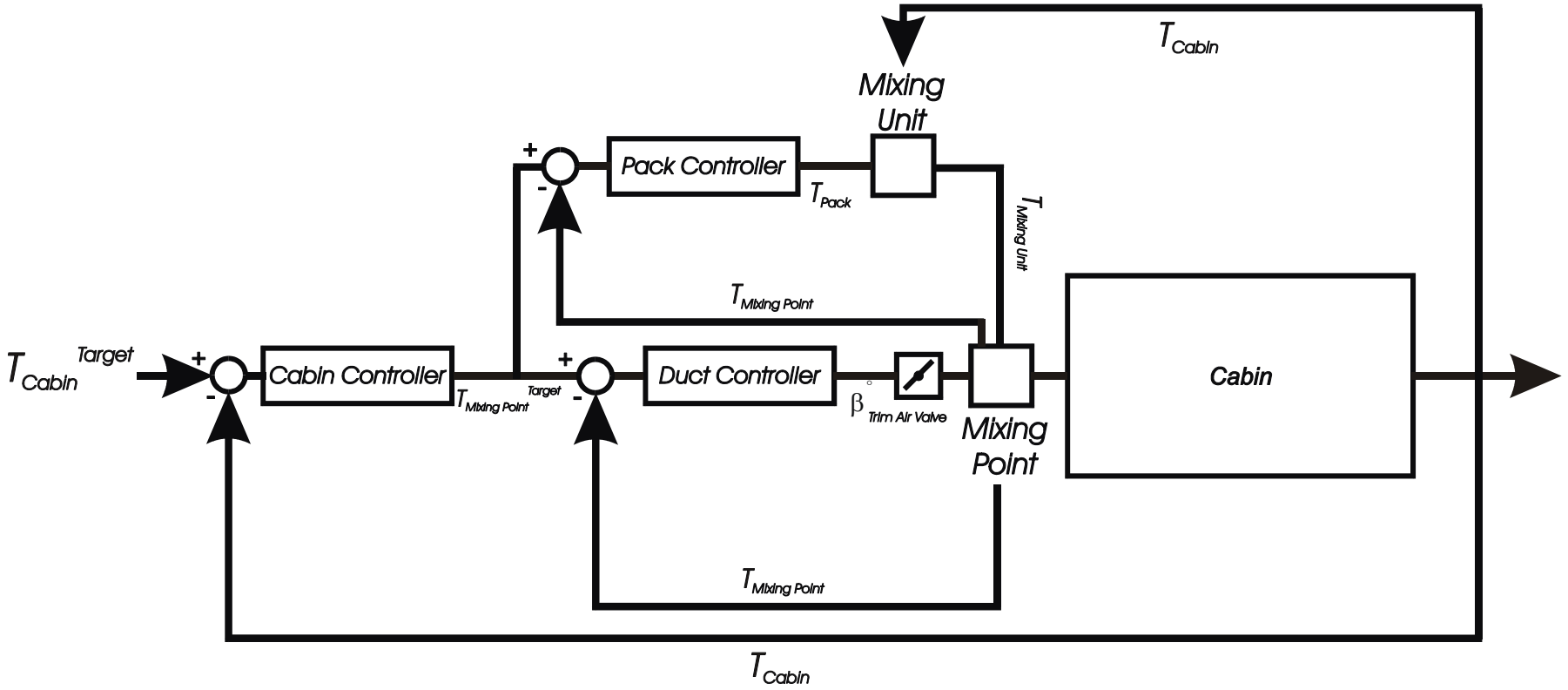


Example: Airconditioning Pack

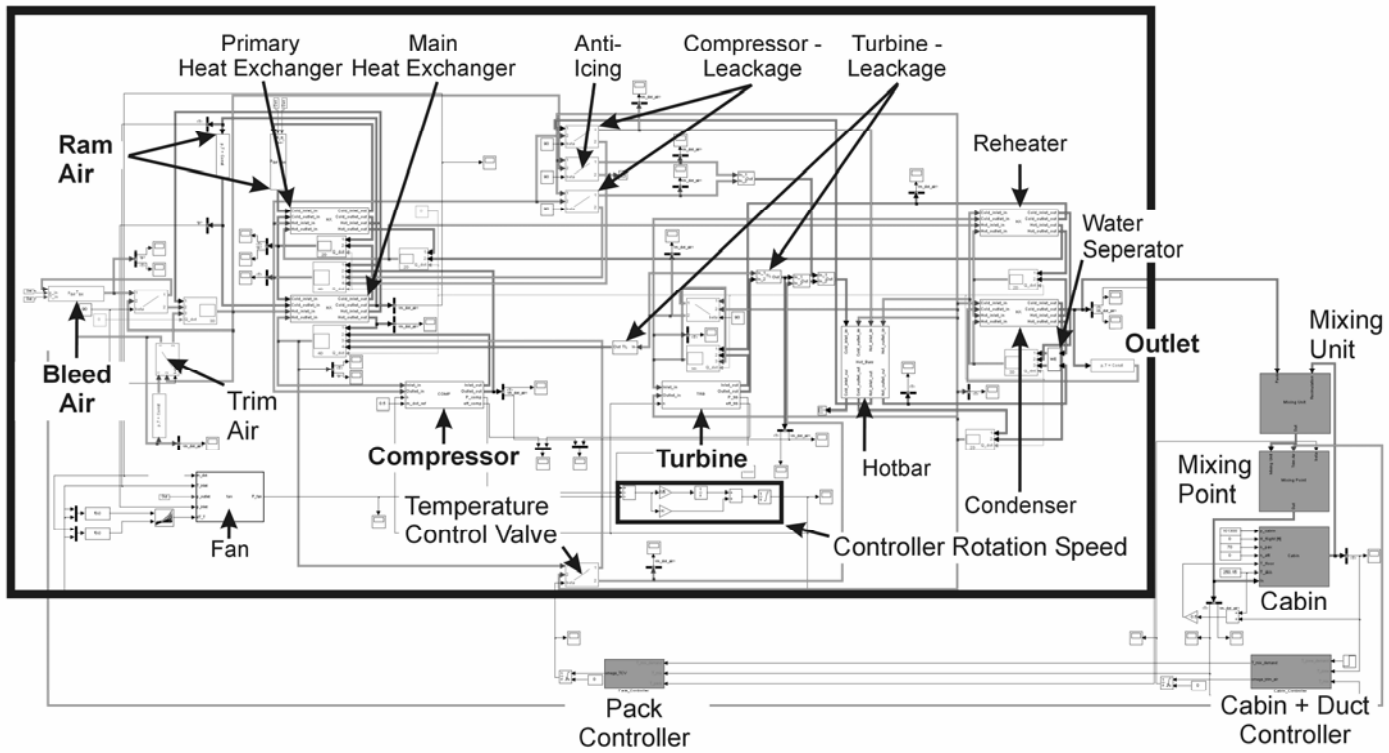
- Air Cycle Machine

  (Compressor, Turbine)
- Heat Exchangers
- Water Separator

From the Block Diagram ...



... to the Simulation of Detailed Dynamics

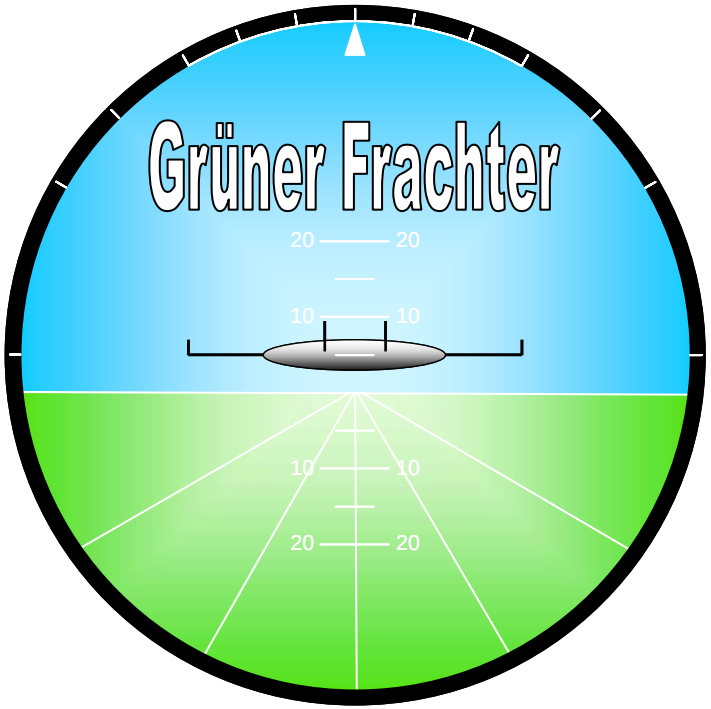


MATLAB/Simulink

- 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

AIRBUS

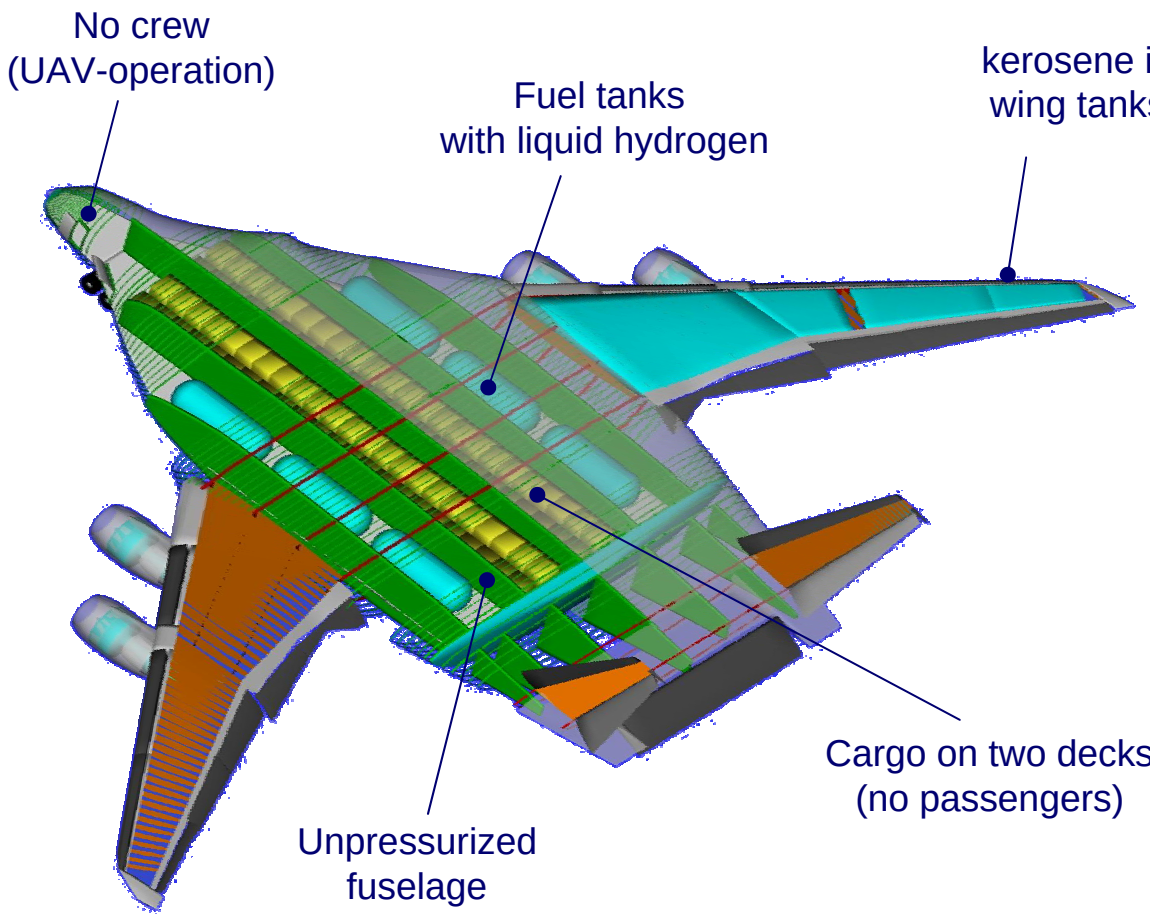
Bundesministerium
für Bildung
und Forschung

Aim of the project

- **Investigations on <u>environmentally friendly</u> and cost effective freighter aircraft configurations**

- **"Environmentally friendly" due to:**
  - **Low fuel consumption**
  - **Low emissions (CO_2, NO_x)**
  - **Future fuels (Liquid hydrogen – LH_2, Synfuel, Biofuel)**
  - **Low noise level**

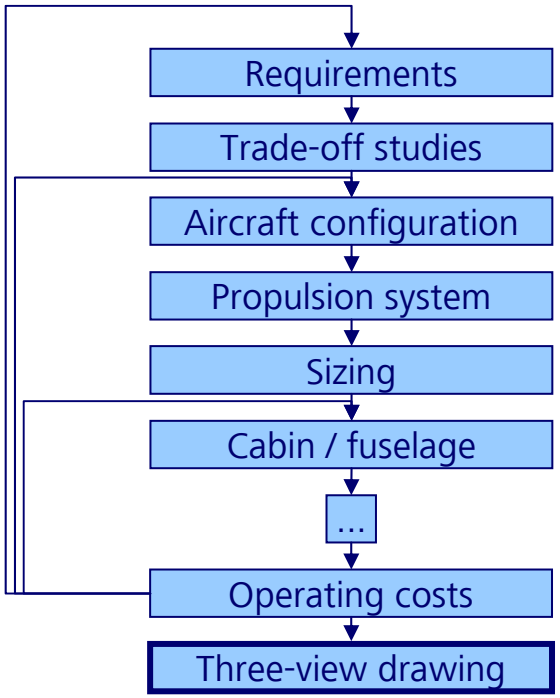
Design analysis

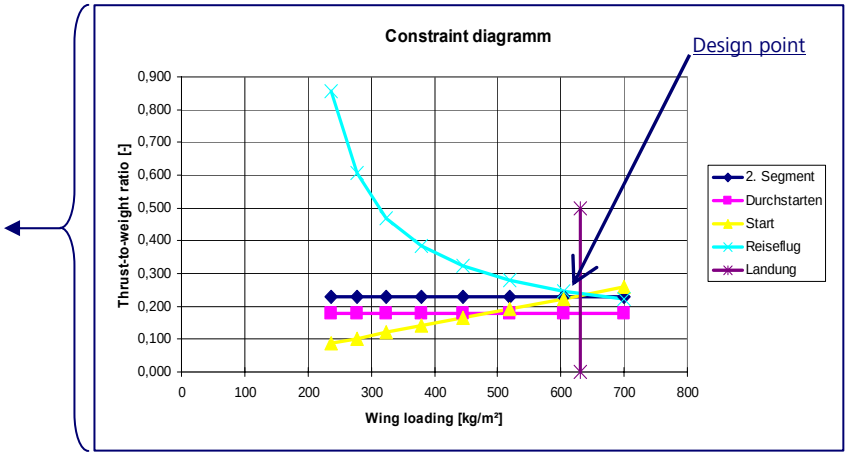


Tools

- **PreSTo:**

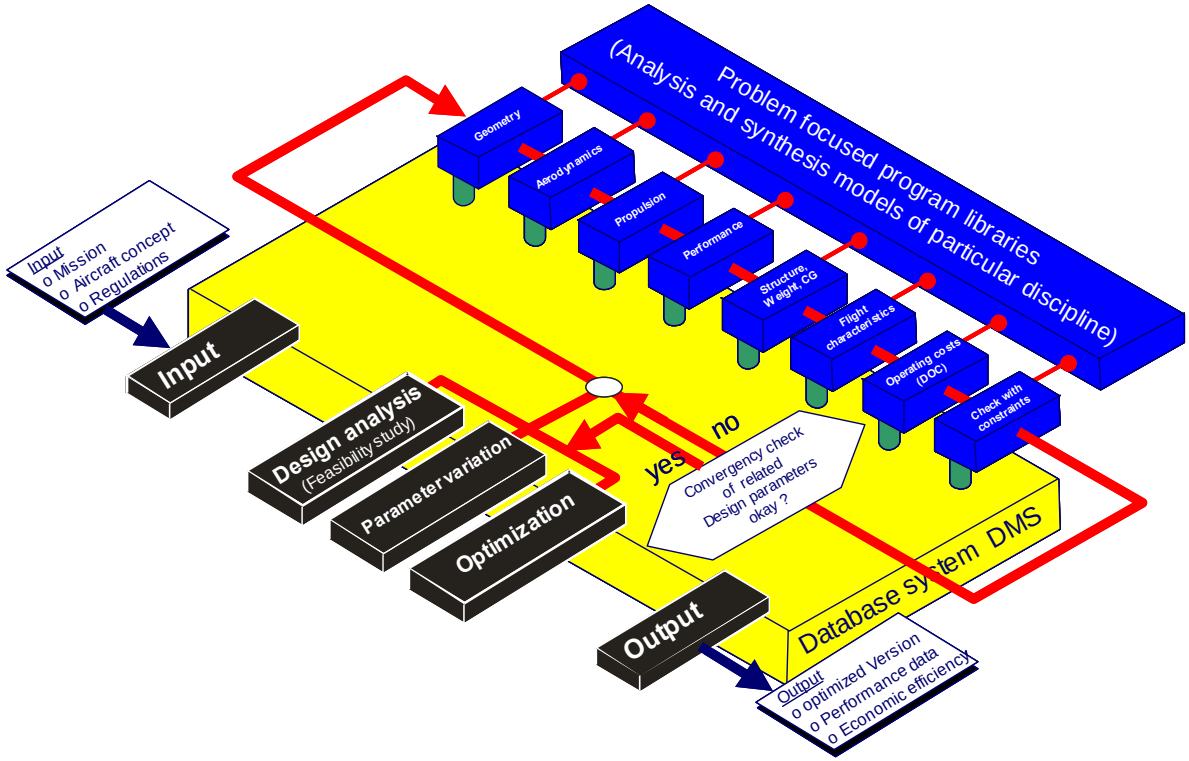
  Aircraft Preliminary Sizing Tool

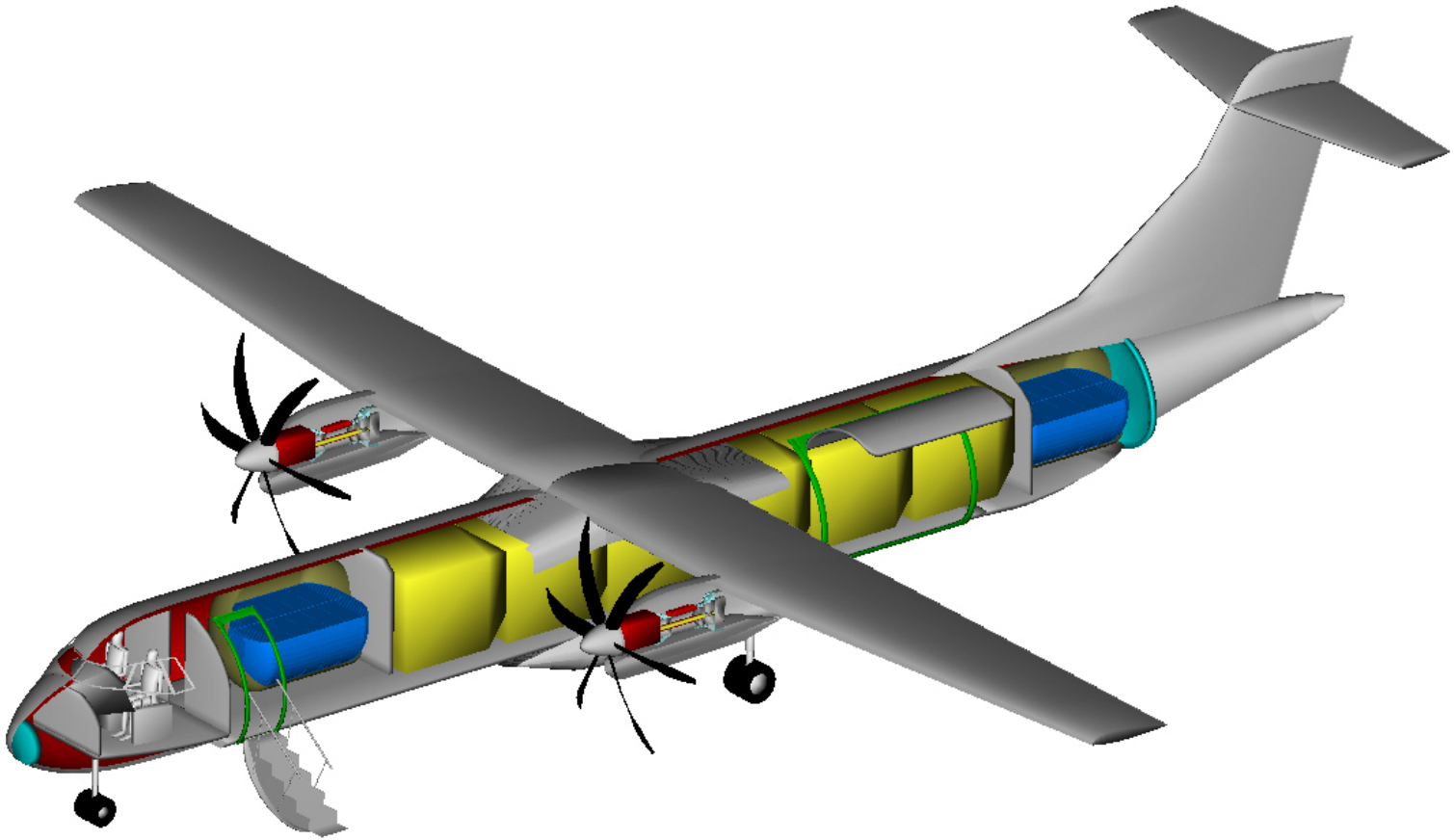




Tools

- **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

AIRBUS

Hamburg Airport

Airport Research Center

Bundesministerium für Bildung und Forschung

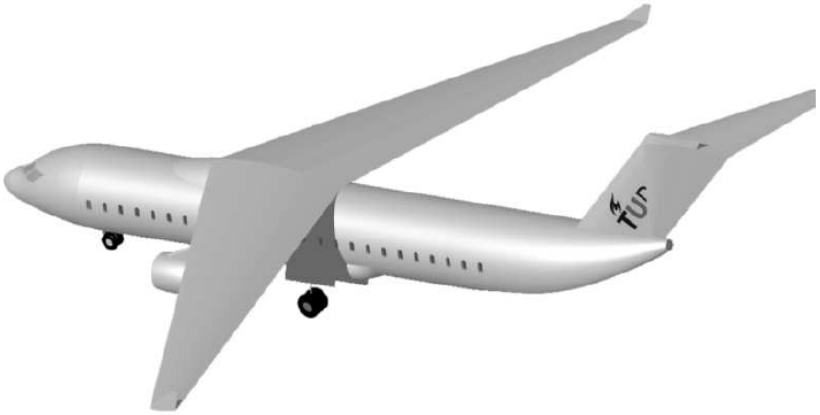
Background

- 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

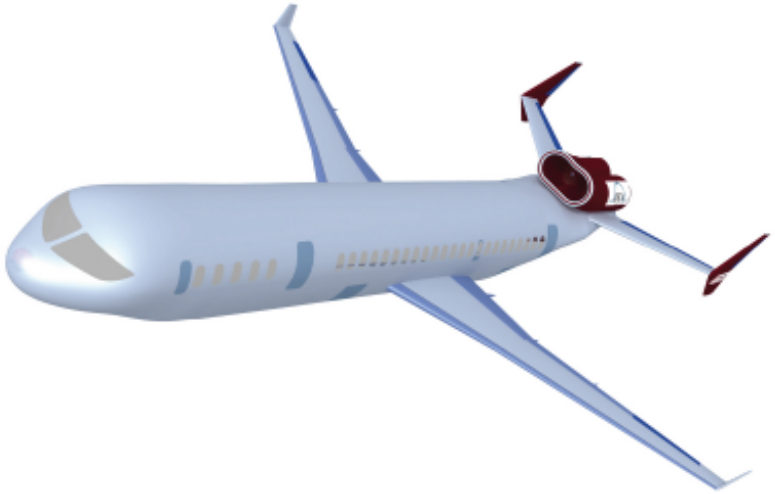
- New aircraft designs (lower sill height, ...)
- Faster boarding and deplaning (new door arrangement)
- Simpler baggage loading (moving belt, sliding carpet, ...)
- Autonomous boarding (integrated stairs, ...)
- Autonomous push-back
- Autonomous taxiing
- New handling operations
- Less airport charges

New Aircraft Designs (Previous Studies)



TU Delft

ORCA
optimized rapid cycle aircraft



University of Stuttgart

PAHMIR
Preventive Aircraft Health Monitoring for Integrated Reconfiguration

PAHMIR

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

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.

MTTC Maintenance Technologies Test Center

CARISMA
Aircraft Cabin and Cabin System Refurbishing
Optimization of Technical Processes

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

Training on Airbus A320 System Simulators

Short Course: Aircraft Design

AIRBUS

Luftfahrtstandort Hamburg

epma

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Summary

- **Aero: Aircraft Design and Systems Group**
- **FLECS**
- **Green Freighter**
- **ALOHA**
- **PAHMIR**
- **Efficient Airport 2030 (Aviation Cluster Hamburg)**
- **CARISMA**
- **MOZART**

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