Module Description, available in: EN

Advanced Aircraft System Design

General Information

Number of ECTS Credits

3

Module code

TSM_AdvAirDes

Valid for academic year

2025-26

Last modification

2024-01-10

Coordinator of the module

Michel Guillaume (ZHAW, michel.guillaume@zhaw.ch)

Explanations regarding the language definitions for each location:

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Winterthur			
Instruction	**X** E 100%			
Documentation	**X** E 100%			
Examination	**X** E 100%			

Module Category

TSM Technical scientific module

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

The students are expected to have knowledge of the basics of Fluid Dynamics / Aerodynamics, Structural Mechanics, Thermodynamics (Gas Turbines), and Systems Engineering.

An interest in Aircraft Systems is important.

The knowledge of simulation tools (Matlab, Simulink, Modelica, Comsol, etc.) and performance calculations or optimization calculations is an advantage.

Brief course description of module objectives and content

The course will focus on the design of advanced aircraft systems, aiming towards more electric types of aircraft for a new generation beyond the Airbus A380 and Boeing 787.

Today, aircraft design is more than just aerodynamics, flight dynamics, propulsion, structures,and equipment. The new technologies require a systems engineering approach, which guides the way towards a sustainable aircraft. New methods for system engineering towards collaborative engineering will be presented.

The whole design process will be discussed and the students will learn to do a conceptual and preliminary design.

In this module, the whole design process of a complex system such as an aircraft will be discussed and the students will learn how to do a conceptual and preliminary design. The course is structured in lectures as well as with small case studies (practise), which will be done in groups.

3 lectures will take place at FFA Altenrhein Museum with practical visit at Jet & Prop Heritage.

Outside of the course a visit of CatAviation is planned to look into design details of an advanced Falcon Business Jet.

Aims, content, methods

Learning objectives and competencies to be acquired

The students will learn how the design process of a complex system such as an aircraft is done, with a focus on the early stages between concept and the preliminary design stage.

All important disciplines, which play a key role in aircraft design, will be addressed: weight distribution estimation, performance, propulsion, on the basis of systems engineering.

The students will be able to understand the architecture of modern aircraft, focussing on the advancing system integration with the trend towards electric and more environmentally sustainable aircraft.

The students can apply the current design standards and analyze the design of new aircraft for the efficiency and performance of the operation.

Learning experience working in a design team to define an aircraft concept (airliner fuselage concept).

Module content with weighting of different components

The course will start with an introduction to aircraft conceptual design.

The aerodynamics for wing design, propulsion technology, and engine integration and the electrical, hydraulic and pneumatic systems will be discussed to provide an aircraft architecture from the system point of view.

The available methods of aircraft design optimization will be discussed in the light of perfect design or an illusion of the existence of such.

The concept of increasingly electrical aircraft and the concept of hybrid propulsion for new aircraft layouts will be discussed at the end of the course.

The course will deliver the knowledge to the design of new aircraft generations to meet the reduction of CO2 and noise footprint towards greener aviation.

Teaching and learning methods

- Lectures with focus on practical cases for commercial airplanes
- Self study and performance of literature research
- Performance of small case studies for an aircraft design working together with teams which cover different design aspects

Literature

- Aircraft Design: A Conceptual Approach, Daniel P. Raymer, AIAA Education Series
- Fundamental of Aerodynamics, John D. Anderson Jr., McGraw-Hill Series in Aeronautical and Aerospace Engineering
- Airframe Structural Design, Practical Design Information and Data on Aircraft Structures, Michael C. Y. Niu, Hong Kong Conmilit Pres Ltd.

Assessment

Additional performance assessment during the semester

The module does not contain an additional performance assessment during the semester

Basic principle for exams

As a rule, all standard final exams are conducted in written form. For resit exams, lecturers will communicate the exam format (written/oral) together with the exam schedule.

Standard final exam for a module and written resit exam

Kind of exam

Written exam

Duration of exam

120 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids

- No programmable calculator

Other permissible aids

- Open book
- No AI tools

Exception: In case of an electronic Moodle exam, adjustments to the permissible aids may occur. Lecturers will announce the final permissible aids prior to the exam session.

Special case: Resit exam as oral exam

Kind of exam

Oral exam

Duration of exam

30 minutes

Permissible aids

No aids permitted