Module Description, available in: EN

Managing complexity and innovation in aviation

General Information

Number of ECTS Credits

3

Module code

TSM_CompAvi

Valid for academic year

2025-26

Last modification

2025-16-06

Coordinator of the module

Siddhartha Arora (ZHAW, xars@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

No prerequisites.

Brief course description of module objectives and content

This course is designed for students of the MSE in Aviation, though students of other engineering disciplines are welcome to attend as well.

At the end of this course, you will be able to articulate the importance and impact of innovation - at both a micro (individual or firm) and macro (societal/national) level. Why is innovation given such importance? How can it be measured, accelerated and when can it go awfully wrong? In a nutshell: understanding the impact of innovation in aviation.

Students will learn to think critically when something is presented as "new" or "innovative". Equipped with methods, tools, techniques and a standard vocabulary, students can challenge claims made outside the academic setting as to the relevance and expected impact of innovation. The focus will be given on examples from the aviation industry (civil, general, military, manned and unmanned), though examples may also occasionally be drawn from outside aviation.

Through weekly group assignments, students will prepare a short presentation based on the past lecture and assigned readings. This will help apply the methods learned in the course on real-world scenarios.

A final term assignment will permit each student to individually apply all the material learned on addressing a clearly defined problem and applying the methods taught to implement methods of innovation. Depending on the selected problem, students will be able to conclude whether the innovation applied is truly impactful (and for whom).

The weekly and term assignments will also permit students to strengthen their presentation skills.

Aims, content, methods

Learning objectives and competencies to be acquired

- Understanding the imapact of innovation in aviation.
- Macro: Role of innovation within aviation industry, growth-driven economy, National Innovation Systems, mission oriented policies, the entrepreneurial state, importance of Sustainability Development Goals (SDGs), competitive forces
- Micro: Role of innovation at product and firm level, as well as the role of the entrepreneur (*Unternehmer*)
- Appreciation and understanding of complexity and complex systems, particularly from an innovation perspective, identifying and understanding problems and identifying solutions through entrepreneurial methods.
- Measuring, visualising and modelling complex systems.
- Methods for protecting and exploiting ideas, incl. patents, trade secrets, standards and lobbying.
- Methods and principles of innovation incl. open innovation, technology readiness assessments (TRA), technology roadmaps, biomimicry, technological determinism and momentum, serendipity, uncertainty, risks vs. rewards, business model innovation and application of the business model canvas.
- Failures, frauds and fiascos – a closer look and where innovation can go wrong and methods of mitigation (e.g. whistleblowing, better planning).
- Importance and relevance of maintenance (incl. MRO) in ensuring sustanable innovation practices.
- Based on availability, experts from industry will be invited to share their experiences on related topics.

Module content with weighting of different components

- Principles of Innovation

- Principles of Complexity

- Standards and Regulations

- Business Model Innovation & Design

- National Innovation Systems & Innovation Relevant Aviation Policies

- Frauds, Failures & Fiascos

Teaching and learning methods

- Classroom lectures (in exceptional cases, access via video/remote can be organized)
- Student presentations as part of tutorials (group exercises)

Literature

- Assigned readings (papers, case studies, patent filings etc.) will be distributed via Moodle.

- Some readings will be optional (not required for exam or completing assignments) but can help enrich the course experience and gain deeper understanding of course objectives.

Assessment

Additional performance assessment during the semester

The module contains additional performance assessment(s) during the semester. The achieved mark of the additional performance assessment(s) applies to both the regular and the resit exam.

Description of additional performance assessment during the semester

- A weekly assignment will be covered during the tutorial sessions.

- The assignments will be based on prior lectures and assigned readings.

- Depending on the size of the class, students should work in groups of 2-3 to complete the weekly assignments.

- Weekly assignments make up 15% of the final grade.

- A term assignment (completed individually, and presented orally at the end of the term, makes up 15% of final grade.

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

- Non-programmable calculator

Other permissible aids

- Single A4 page of personal notes

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