

**Module Description, available in: EN*****Systems engineering of safety critical systems*****General Information****Number of ECTS Credits**

3

**Module code**

TSM\_SafeSys

**Valid for academic year**

2020-21

**Last modification**

2019-08-31

**Coordinator of the module**

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**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			
<b>Instruction</b>	X E 100%			
<b>Documentation</b>	X E 100%			
<b>Examination</b>	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 basic knowledge of aircraft engineering such as:

- Aerodynamics
- Aircraft Structures
- Understanding of Aircraft Systems
- Understanding of Aircraft Propulsion
- Basic concepts of Maintenance
- Safety:
  - System Safety
  - Safety Process

## Brief course description of module objectives and content

Safety-critical systems are those systems whose failure could result in loss of life. An aircraft such as an airliner has more than one safety critical systems.

The system engineering activities required to design and manage these complex systems over their life cycles require a deep understanding of several disciplines and a systematic approach to problems such as:

- Requirements engineering
- Requirement based testing
- Validation and verification of complex function
- Coordination of teams

In this module the students will have an overview of Safety Critical Systems and related engineering activities and how these activities must be planned and executed in order to lead to successful certification and continued airworthiness.

## Aims, content, methods

### Learning objectives and competencies to be acquired

Understand core engineering and human-centered disciplines necessary to successful design, development and continued airworthiness of Safety Critical Systems (SCS).

The student are expected to acquire the following competencies:

- Understanding of safety critical system
- Understanding of system engineering principles
- Understanding of system components qualification
- Understanding of aircraft certification process
- System Thinking

### Module content with weighting of different components

Syllabus:

1. Introduction to Safety Critical Systems (SCS): General Concepts, Examples of SCS
2. Introduction to SCS: Complexity, Byzantine Problems, Multidisciplinarity
3. Requirement Engineering
4. Robustness, Redundancy, Dissimilarity and Integrity
5. Manned vs. Unmanned Systems
6. Manned Aircraft: Safety, DAL, Airworthiness
7. Unmanned Aircraft: Concept of Operations, Holistic Approach/SORA, Integration with Manned Aviation
8. System Modeling and Simulation
9. System Testing of SCS
10. Design and Development of Complex HW
11. Design and Development of SW
12. System Thinking
13. Risk Management
14. Team Management
15. Time Management

### Teaching and learning methods

- All lectures are strictly connected to current aviation practice and, where feasible, practical examples will be provided
- Real world examples with lessons learned will be provided for self study

### Literature

- SAE-ARP-4754A - *Guidelines For Development Of Civil Aircraft and Systems*
- Aircraft Design - A Systems Engineering Approach M. H. Sadraey, Wiley Aerospace Engineering
- SAE-ARP4761 - *Guidelines And Methods For Conducting The Safety Assessment Process On Civil Airborne Systems And Equipment*
- DO-178B, *Software Considerations in Airborne Systems and Equipment Certification*

## Assessment

### Certification requirements

Module does not use certification requirements

### 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

- A non programmable calculator

#### Other permissible aids

- Closed Book
- Formulary will be distributed

### Special case: Resit exam as oral exam

#### Kind of exam

Oral exam

#### Duration of exam

30 minutes

#### Permissible aids

No aids permitted