

# Risk and Safety M.Sc.

Welcome session



# Background

## Boeing 737Max



Source: Washington Post

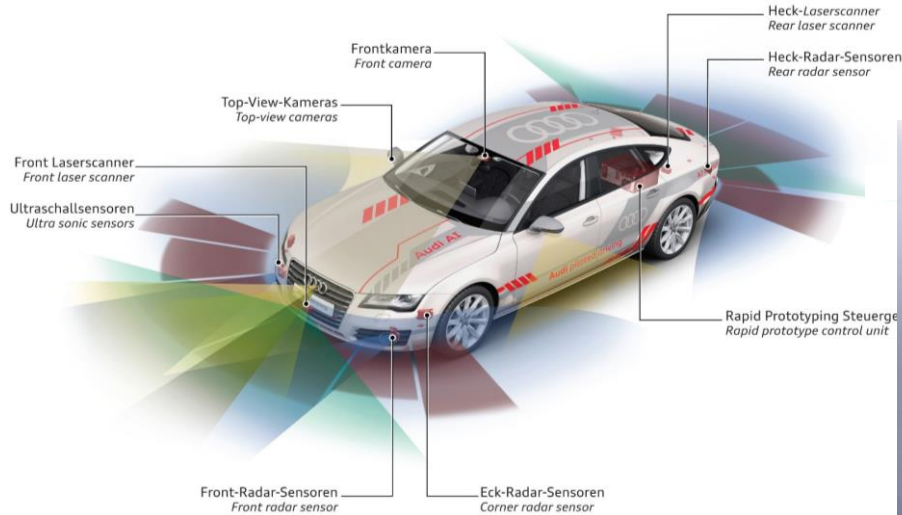
## Brumadinho dam failure 2019



By Senado Federal - Bento Rodrigues, Mariana, Minas Gerais, CC BY 2.0,  
<https://commons.wikimedia.org/w/index.php?curid=45118997>

# Background

## Novel technologies

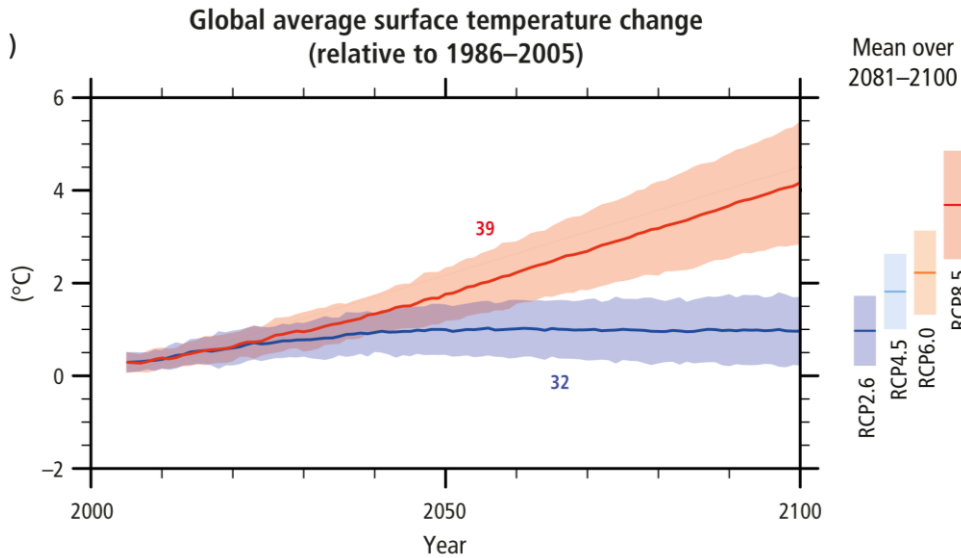


Adapted from: <https://www.audi-mediacyber.com/de/fotos/album/audi-a7-piloted-driving-concept-646> (28.09.2016)



# Background

## Climate risks



Source: IPCC (2019): Summary for Policymakers

## Natural hazards



Source: Rhein-Erft-Kreis, dpa

# Background and goals

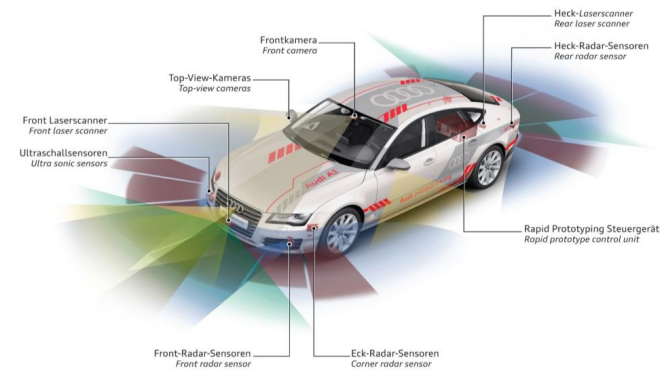
- Requirements to Safety and Reliability increase constantly
  - Processes and systems are getting more complex and interconnected
  - Risk management based on legacy experience and isolated standards is no longer sufficient
  - Cultural and organisational aspects are often central to a good risk management
- Goal: Education of experts for development and implementation of integral risk management

Educate experts and future leaders in risk and safety who

- master stochastic modeling and reliability assessment
- understand and shape the societal dimensions of risk
- know tools and strategies for an effective risk management
- translate these skills and knowledge into specific engineering domains



- Risk methods & analytics**
- Risk management**
- Risk & society**
- Risk in practice**



# Market situation

Unique Situation in the Munich area:

- Many large industrial companies
- Companies in safety and certification, e.g., TÜV Süd, IABG
- Infrastructure-, construction und transportation companies
- Public authorities
- Insurers: MunichRe, Allianz, ...
- Many Startups

but of course also a national und international market

## Industry Network



# TU Munich in numbers

**1868** established by King Ludwig II

**11** TUM schools and faculties

**> 50** Bachelor degree programs

**> 100** Master degree programs

**48,296** students, 36% female students, 38% international students (winter semester 2021-22)

~ **14,000** newly enrolled students (winter semester 2021-22)

~ **9,500** graduates per year (in 2021)

**> 1,000** PhDs per year

**9,455** publications in international journals (in 2021)

**623** professors (including those at hospitals)

~ **11,500** employees (in 2021)

**18** Nobel Prizes since 1927 (as of 2022)

<https://www.tum.de/en/about-tum/facts-and-figures/tum-in-figures>

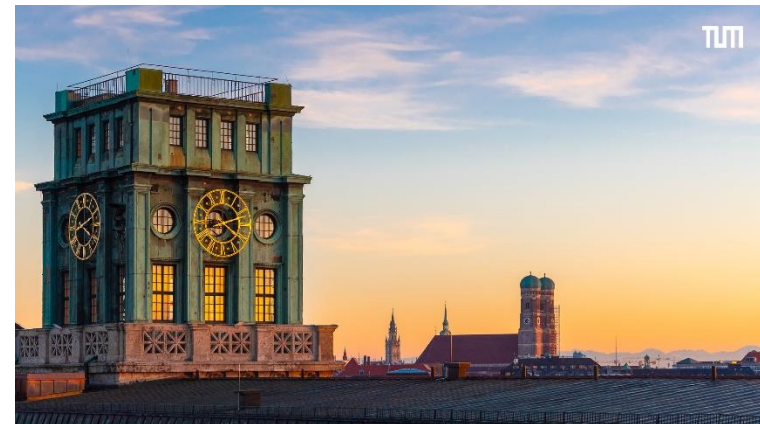
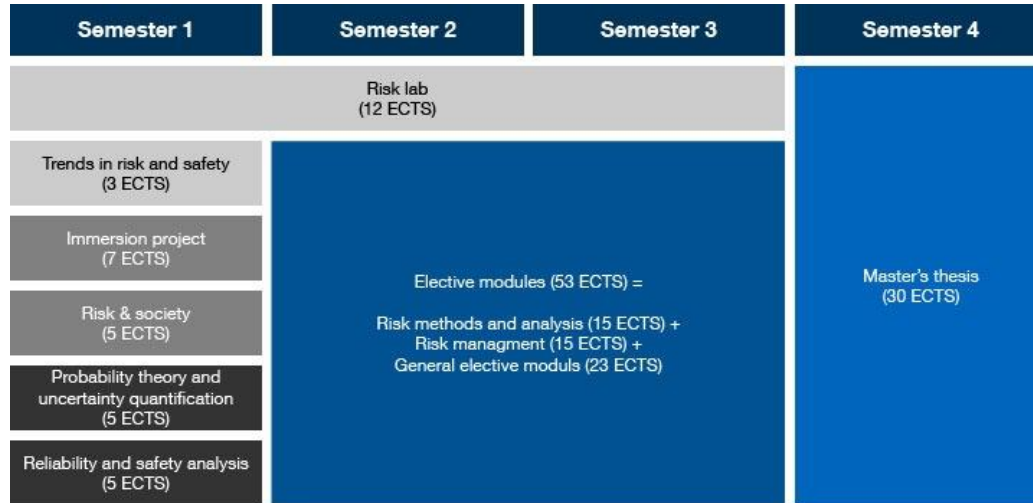


photo: Andreas Heddergott



# Structure of the Master



Credits represent workload:  
1 Credit  $\triangleq$  30 hrs workload.

## Compulsory modules

■ Risk in practice   ■ Fundamentals   ■ Risk and society

## Compulsory fields of study

- Fundamentals (10 ECTS)
- Risk & Society (12 ECTS)
- Risk in practice (15 ECTS)
- Master's Thesis (30 ECTS)

## Elective fields of study

- Risk methods & analysis (15 ECTS)
- Risk management (15 ECTS)
- General elective modules (23 ECTS)

# Compulsory Courses

## Compulsory Modules: Fundamentals

Nr.	Name	Semester	Credits
MW2360	Probability Theory and Uncertainty Quantification	1	5
ED130037	Reliability and safety analysis	1	5

## Compulsory Modules: Risk & Society

Nr.	Name	Semester	Credits
SOT55204	Risk & Society	1	5
SOT57205	Immersion project	1	7

## Compulsory Modules: Risk in practice

Nr.	Name	Semester	Credits
ED130035	Trends in risk and safety	1	3
ED130050	Risk Lab	1-3	12

## Compulsory Modules: Master's Thesis

Nr.	Name	Semester	Credits
ED100020	Master's Thesis	4	30

# Elective Courses

## Elective Modules: Risk methods & analysis

15 credits must be chosen from the following modules:

Nr.	Name	Semester	Credits
N.N.	Mathematical Methods in Risk Analysis	2	5
ED130036	Risk Assessment	2	5
ED130009	System and Functional Safety	1, 3	5
EI04024	Python for Engineering Data Analysis - From Machine Learning to Visualization	1, 3	5

## Elective Modules: Risk management

15 credits must be chosen from the following modules:

Nr.	Name	Semester	Credits
MGT001387	Risk Management	1, 3	5
WI001290	Advanced Seminar Marketing, Strategy & Leadership: Risk Perception and Communication	2	5
N.N.	Operational Safety	1, 3	5
MW2131	Human reliability	2	5



From WS 24/25

# Elective Courses



## Elective Modules: General elective modules

Nr.	Name	Credits
BGU60017	Probabilistic Life Cycle Analysis and Integrity Management of Infrastructures	3
ED130013	Prognostics and Health Management	3
POL62500	The Ethics and Politics of Existential Global Risks	6
BGU54009	Flood Risk and Flood Management	6
BGU46026	Alpine Hazards	6
MW2282	Safety and Certification of Avionics and Flight Control Systems	5
MW2407	Safety and Certification of Aircraft	5
BGU68006	Road Safety	6
BGU60018	Estimation of Rare Events and Failure Probabilities	3
ED130006	Introduction to Random Vibration	6
BGU60019	Stochastic Finite Element Methods	6
ED130005	Uncertainty Quantification with Surrogate Models	3
MCTS0042	Core Topic: Industries & Innovation	5
CS0277	Sustainability and Risk Management	6
ED130019	System-Theoretical Principles of Risk Management for Business Processes and Real Estate Business Processes	6
ED0155	Knowledge and Risk	5
WZ1808	Horticultural Risk Management	5
MW0149	Occupational and Industrial Safety	3
AR30012	Occupational Health and Safety	6
MW2340	Operational Flight Safety	3
MW1399	Helicopter Safety and Certification	3
MW2089	Seminar Nuclear Safety Principles	5
WZ1167	Work Science and Work Safety	3
MW1104	Introduction to Nuclear Safety Analysis of Nuclear Reactors with State-of-Art Computer Programs	4
IN2247	Functional Safety	4
IN2385	Safety and Security for Cyber-Physical Systems	3
WZ5022	Quality Management and Product Safety	5
EI7644	Communication Network Reliability	5
EI71041	Preventive Reliability Techniques	5
EI71069	Reliability of Electric Drives	5
MA3405	Insurance mathematics 1	9
WZ0043	Risk Theory and Modeling	5
BGU67005	Landslides	5
BGU53053	Geodesy (for land management)	5
...	...	...

- Can be done alone or in groups of maximum 2 students
- Students must find their own projects. Projects do not necessarily have to be with TUM but also with research institutes or with industry. However, each project needs a supervisor from TUM.
- The projects should be focused more on practical issues and less about scientific research.
- The workload of the projects should roughly correspond to 12 ECTS points per student. 1 ECTS point corresponds to 30 working hours.
- There are no time requirements. Its up to the students how fast or slow they want to do their project.
- At the end of each project a presentation will be given. For this purpose, a meeting takes place once a semester where the projects are presented to the other students. After this presentation, the project must be finalized within one month.

# How to make sense of TUMonline

Manuals on TUMonline:

<https://wiki.tum.de/display/docs/Students>

Video tutorials:

<https://www.youtube.com/channel/UCx0umWxDASjFmTYltdkelA/videos>



# Study progress:

## Minimum total ECTS after each Semester

Semester 1	0 ECTS
Semester 2	0 ECTS
Semester 3	30 ECTS
Semester 4	60 ECTS
Semester 5	90 ECTS
Semester 6	120 ECTS

# German Language Requirement



Not required anymore

**But strongly recommended!**



# Campus Maps & Roomfinder

If you are looking for a specific room, you can use TUM's roomfinder:  
[https://portal.mytum.de/campus/index\\_html/roomfinder/index\\_html?](https://portal.mytum.de/campus/index_html/roomfinder/index_html?)



# Student Card

<https://www.tum.de/en/studies/application/enrollment-info-portal/student-card>

## What to do with your student card:

- student ID (including your photograph)
- semester ticket/MVV ticket
- access badge
- library card (barcode on back)
- electronic payment card to be used at the *Mensa* as well as in most bars, cafes, and vending machines on campus

