The mission of Flight Mechanics is to describe the aircraft motion and to determine and improve aircraft performance and handling qualities of pilot-aircraft systems.

All three disciplines cooperate in the development of modern airplanes that are made of light and flexible structures.

### Teaching:
In the lecture *Flight Mechanics*, the equations of motion are formulated, stationary and dynamic flight conditions are investigated, including aircraft response to pilot inputs and atmospheric perturbations as well as the consequences on handling qualities (stability and control).

The *Performance* course addresses calculation and flight test measurements of performance characteristics such as range, take off and landing distance, fuel consumption and payload.

*Experimental Flight Mechanics* introduces the basics of flight testing, needed to determine characteristic airplane data.

*Methods of Control Theory* introduces the essentials of control theory required for the follow-on course *Flight Control*, dealing with architecture and function of flight control systems and their respective control loops, such as damper, attitude and flight path control.

*Aeroelastics* extends methods and modeling techniques to elastic airplanes.

### Research:
Research activities focus on handling quality studies and the respective models and methods. Understanding of pilot-airplane interaction is of vital importance. Essential tools for analyses in this field are flight simulation with the research simulator SEPHIR (*Simulator for Educational Projects and Highly Innovative Research, under construction*) and with the certified Airbus A330/340 Full-Flight-Simulator at the institute (Figs. 2 & 3).
Impact of aeroelastic deformations and complex flow conditions is being calculated with special, real-time methods developed at the department of Flight Mechanics.

Current research projects include:

- Impact of wake vortices on flight safety (Figs. 4 & 6),
- Development of pilot models,
- Handling quality analysis of elastic airplanes,
- Simulator studies of low-noise approach procedures supported by novel control surfaces (Fig. 5),
- Optimization of flight simulator motion cueing for specific research requirements.

Most of the projects concentrate on analyzing pilot reaction to external perturbations, such as wake vortices, or modified handling characteristics due to unconventional airplane configuration or aeroelastic deformations.

Furthermore the department develops advanced control concepts for Unmanned Aerial Vehicles.