

Aero Rake

Project	Zurich UAS Racing	Revision A.1	Datum 27.10.2025
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Formula Student (FS)

The internationally highly regarded engineering competition Formula Student (FS) challenges teams of students to design and build a formula racing car and compete against other universities in various disciplines. The various competitions offer an exceptional opportunity for students to apply their academic knowledge in a practical setting.

Introduction Bachelor-Thesis

Aerodynamic validation plays a key role in the performance development of a Formula Student race car. While Computational Fluid Dynamics (CFD) simulations are used extensively during the design phase, experimental validation is crucial to ensure that the predicted aerodynamic behaviour corresponds with real-world performance.

An aero rake is an instrumented device mounted on the car that measures local air velocities and flow characteristics during on-track testing. By collecting pressure data at multiple points, it allows the correlation of simulation data with actual measurements, thereby improving the accuracy of the CFD model and supporting the iterative aerodynamic development process.

The project aims to design, manufacture, and validate an aero rake system that can be reused and improved in future seasons. The student will work closely with the aerodynamics and vehicle testing teams to ensure integration, reliability, and data acquisition compatibility.

Goal

The goal of this project is to develop an aero rake system that enables the validation of aerodynamic simulations and supports consistent aerodynamic testing across multiple seasons. The system should provide reliable, repeatable, and accurate pressure and velocity measurements to verify CFD predictions and guide future design improvements.

Objectives:

- **Research and Analysis:** Research existing Aero Rake concepts in industry, motorsports and Formula Student.
- **Concept Development:** Define requirements for the aero rake (measurement points, integration on the car, and data acquisition setup).
- **Design and Simulation:** Develop a CAD model of the aero rake structure considering aerodynamic interference, manufacturability, and safety.
- **Manufacturing:** Produce the aero rake components or a prototype using suitable methods (e.g., additive manufacturing, lightweight tubing).
- **Instrumentation and Calibration:** Integrate pressure sensors, tubing, and data acquisition hardware; perform calibration and functionality checks.
- **Testing and Data Evaluation:** Conduct track or wind tunnel tests; process and analyse measurement data to validate CFD results.
- **Documentation:** Provide detailed documentation of design, testing, and validation results, including recommendations for future improvements and reuse in upcoming seasons.

If you are interested in this project thesis, we kindly ask you to get in touch with us:

David Margreth - Teamleader Mechanics, **Teams:** margrdav,

E-Mail: david.margreth@zurichuusracing.ch

