Great recirculation wind tunnel, or outdoor wind tunnel
SZ.1.2. Fluid mechanical interaction among three truck models, as function of distance and relative wind direction

The aerodynamic drag and thus, the fuel consumption can be reduced if the distance between the vehicles is moderate ("platooning"), due to the interaction between the vehicles.

Assignment: experimental investigation and understanding of such interaction.

In the 45 min of the measurement, the following activities are to be carried out:

a) Calibration of the balance (in 2-3 points, using weights),
b) Investigation of a single truck model, at flow incidence parallel to the longitudinal axis: i) by visualization using oil smoke and taking photographs, ii) by force measurements,
c) Study b) is to be repeated with placing a second model upstream and downstream of the previously mentioned model, at two distances,
d) Using three models, at two distances (the middle model is to be measured).

Availabilities:

- Three 1:24 scaled-down truck models,
- Balance located in the wind tunnel measurement section, capable for measurement of longitudinal force,
- Pitot-static probe for wind velocity measurements,
- Oil smoke generator,
- Pipe and probe for introduction of the oil smoke,
- Manometer.

A camera is to be provided by the measurement group.

Background information (chapters from Lajos, T.: Fundamentals of Fluid Mechanics, 2004, 3rd Edition):
2.1.1. Pathline, streakline, streamline, 2.1.3. Flow visualization, 3.3.3. Static, dynamic, total pressure, 3.4.1. Euler component equations in the natural coordinate system, 3.4.2. Applications, 6.2.4. Instruments based on the deformation of a flexible body, 6.2.5. Practical pressure measurement problems, 6.3.1. Determination of velocity based on the measurement of dynamic pressure, 8.5.2. Preconditions for similarity of flows, 9.1.1. Characteristics of boundary layers, 9.2.2. Development of the boundary layer in streamwise direction, 9.3.1. Development of shear stresses in the boundary layer, 9.3.2. Boundary layer separation, 9.3.3. Flow past a cylinder, 9.3.5. Control and elimination of boundary layer separation, 10.1.2. Dimensional analysis, 10.1.3. Application of dimensional analysis, 11.1.1. Development of aerodynamic forces, 11.1.2. Aerodynamic force acting on a cylinder, 11.2.2. Aerodynamic force acting on bluff bodies. **Further recommendations: From 4th Edition**: 6.4.1. The aim of application of wind tunnels, 6.4.2. Types of wind tunnels, considering velocity and layout, 6.4.3. Structural elements of wind tunnels, layouts for measurement sections, 6.4.4. Practice of wind tunnel measurements, and/or Bradshaw, P., Mehta, R.: Wind tunnel design www-htgl.stanford.edu/bradshaw/tunnel/

Further information –
Vehicle model measurements:

CD appendix for 3rd edition: M.11.2.4. Vehicle aerodynamics PP presentation (in 4th edition: DVD appendix, M.11.3.1 presentation). From 4th edition: 11.3.1. Aims and approximations of vehicle aerodynamics, 11.3.2. Classification of flow domain past car bodies, the front surface drag and its moderation, 11.3.3. Rear surface, under-chassis and sidewall drag, 11.3.4. Flow past buses and trucks