## Research possibilities

1. Gas components measurement (Semtech DS, Ecostar by Sensors Inc. and MOVE by AVL)
   - **Voltage**: 12 V
   - **CO**: measuring range 0–8%
   - **HC**: measuring range 0–40 000 ppm
   - **NO**: measuring range 0–3000 ppm
   - **NO\textsubscript{x}**: measuring range 0–2500 ppm
   - **NO\textsubscript{2}**: measuring range 0–500 ppm
   - **CO\textsubscript{2}**: measuring range 0–20%
   - Measurement of the concentrations of toxic components using the homologation methods (CO, CO\textsubscript{2} – NDIR, HC – HFID, NO\textsubscript{x} – HCLD).
   - Measurement of road emissions (g/km) or unit emissions (g/kWh), fuel consumption depending on the used fuel and type of power-train etc. There is also a possibility of recording the GPS data. The tests results can be used to evaluate the aircraft environment impact depending on the aircraft use, emission limit, mileage or operating conditions.

2. Smoke level Measurement (Opacimeter by AVL)
   - **Voltage**: 12/24 V
   - **Opacity (430 mm)**: measuring range 0–100%
   - **Opacity (215 mm)**: measuring range 0–100%
   - **Absorption coefficient**: measuring range 0–99 m\textsuperscript{-1}

3. PM mass measurement (Ecostar PM by Sensors Inc. and PM MOVE by AVL)
   - **Voltage**: 12 V
   - **PM mass measurement**: resolution 0,002 ug
   - Measurement of exhaust gas flow meters

4. PM mass and concentration measurement (Laser Aerosol Monitor by Sensors Inc.)
   - **Voltage**: 12/24 V
   - **PM concentration measuring range**: 0–700 mg/m\textsuperscript{3}
   - **PM Measurement diameter range**: 0,03 mg/m\textsuperscript{3}
   - **PM Measurement**: 100–10 000 nm
   - Measurement of exhaust gas flow meters

5. PM mass and concentration measurement (Micro Soot Sensor by AVL)
   - **PM concentration measuring range**: 0–50 mg/m\textsuperscript{3}
   - **PM Measurement**: 0,001 mg/m\textsuperscript{3}
   - **PM Measurement**: 1–5000
   - Measurement of exhaust gas flow meters

6. PM mass measurement – weighted method (Mettler Toledo)
   - **PM mass measurement**: do 2,1 g
   - **PM mass measurement resolution**: 0,001 mg

7. PM number measurement (CPC by AVL)
   - **PM number measuring range**: 0–10 000 cm\textsuperscript{-3}
   - **PM number resolution**: 0,1 cm\textsuperscript{-3}
   - **d\textsubscript{np} particle measurement efficiency**: od 23 nm do 3 um

8. PM size distribution (EEPS 3090 by TSI)
   - **Measurement of particle diameters**: 5–560 nm
   - **Number of channels**: 32
   - **Number of channels per decade**: 16
   - **Dilution ratio**: first (hot) 10–10 000
   - **Dilution ratio**: second (cold) 1, 5, 15, 20
   - Measurement of diluted and undiluted exhaust gases

### Contact

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It is assumed that commercial aviation will double in number in the next 20 years, which will in turn increase the exhaust emissions generated by this mode of transport. The research on the aircraft exhaust emissions aims at the improvement of the existing powertrains with new fueling options with a greater share of alternative fuels or a reduced amount of harmful components. Recently, a great progress is being observed in this matter as well as new problems arising out of the need to adapt the engines to new types of fuel. Currently applicable regulations related to the influence of air transport on the environment pertain to noise and exhaust emissions (particularly the emission of carbon dioxide and nitric oxides).

**Institute of Combustion Engines and Transport** at Poznań University of Technology, Faculty of Machines And Vehicles is one of the leading research and development centers in Poland in the field of transportation ecology – exhaust emissions in particular – in all applications: passenger vehicles, heavy duty vehicles, transit buses, rail vehicles, heavy machinery and non-road vehicles, marine vessels and aircraft. The institute is also a recognized R&D center on a European scale, which is proven by the membership in EARPA (European Automotive Research Partner Association).

**SEMTECH DS.**  
**Sensor Emission Technology**

The institute offers research in the following areas:
- Measurement of fuel consumption and exhaust emissions (including Particulate Matter) on engine dynamometers and under real conditions of operation,
- vibroacoustic measurements.

The existing exhaust emissions standards for aircraft engines (EPA, ICAO, JAR – 34, FAR – 34) are related to turbine engines exclusively and allow for the performance of procedures for stationary tests at specified engine operating parameters. To date, no normalization of the exhaust emissions testing procedures on piston aircraft engines under actual operating conditions have been made.

Our institute also performs research on the exhaust emissions from general aviation aircraft. Stationary tests are developed for the emissions from objects for which in-flight testing is impossible. These are small GAA and transport and multi-purpose military aircraft. The institute also conducts research on exhaust emissions from helicopters under actual operating conditions.