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_x	measuring range	0–3000 ppm
NO	measuring range	0–2500 ppm
NO_2	measuring range	0–500 ppm
CO_2	measuring range	0–20%

Measurement of the concentrations of toxic components using the homologation methods (CO, CO2 – NDIR, HC – HFID, NOx – 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^{-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
Maximum measurement time		up to 48 h

4. PM mass and concentration measurement (Laser Aerosol Monitor by Sensors Inc.)

Voltage		12/24 V
PM concentration	measuring range	0–700 mg/m3
	resolution	0,01 mg/m3
PM Measurement	diameter range	100–10 000 nm
Mass measurement using exhaust gas flow meters		

5. PM mass and concentration measurement (Micro Soot Sensor by AVL)

PM concentration	measuring range	0–50 mg/m^3
	resolution	0,001 mg/m^3
Dilution ratio		1–5000
Mass measurement using exhaust gas flow meters		

6. PM mass measurement – weighted method (Mettler Toledo)

PM mass measurement		do 2,1 g
	resolution	0,001 mg

7. PM number measurement (CPC by AVL)

Measurement compliant with R83 regulation and PMP		
PM number	measuring range	0–10 000 cm^{-3}
	resolution	0,1 cm^{-3}
d_{50} 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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Measurement of Exhaust Emissions under Aircraft Real Operating Conditions

Institute of Combustion Engines and Transport
Poznan University of Technology

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).

Research equipment

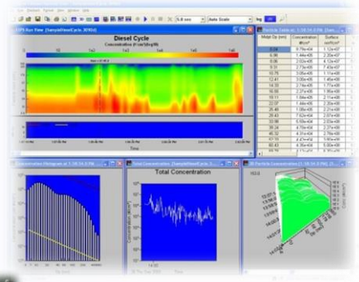
Institute of Combustion Engines and Transport at Poznań University of Technology, Faculty of Machines And Vehicles is one of the leading research and development centers in Poland in the field of transportation ecology – exhaust emissions in particular – in all applications: passenger vehicles, heavy 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).

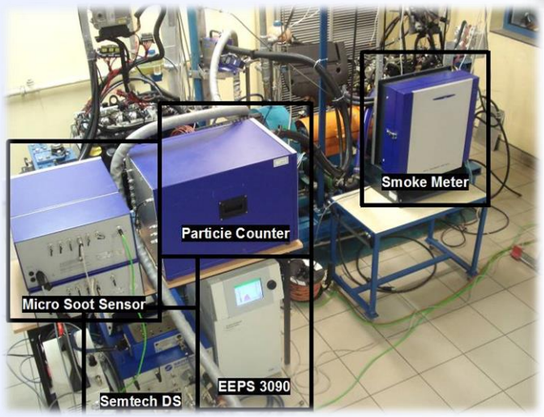
SEMTECH DS.
Sensor Emission Technology

CO_2, CO, HC, NO_x, O_2
pomiary w rzeczywistych warunkach ruchu

The institute offers research in the following areas:

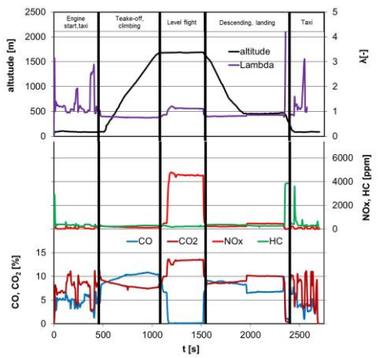
- Measurement of fuel consumption and exhaust emissions (including Particulate Matter) on engine dynamometers and under real conditions of operation,
- vibroacoustic measurements.

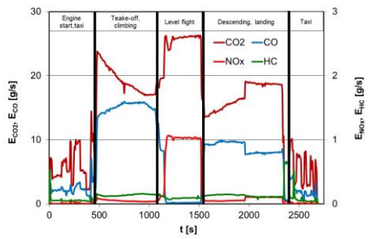


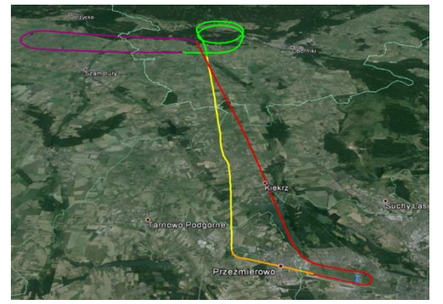


Measurements in real operating conditions

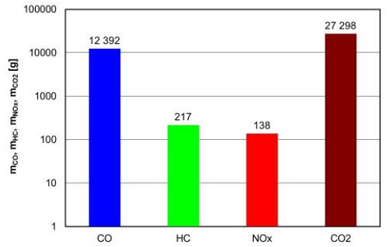
The analysis of the world trends in environment protection shows that in order to effectively reduce environment pollution a measurement of exhaust emissions in real road operating conditions is a necessary step to take. The institute owns a system of portable analyzers that enables the measurement of aircraft emission levels not only in stationary but also in dynamic conditions e.g. during engine start, warm-up phase, take-off, flight, landing and taxi. The system of analyzers is a set enabling a complex on-board measurement of exhaust emissions in real time under real operating conditions of aircraft and vehicles fuelled with different fuels (gasoline, diesel oil, LPG, CNG, E85 etc.). A complement to the existing system is an opacimeter and a PM measuring unit having the capacity to measure the PM mass and size (PM counter and mass spectrometer).







Aircraft trajectory during the tests:
taxi (blue), takeoff and climb (red), cruise (purple), approach to landing and landing (yellow), taxi (light blue)



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.