Aviation emissions transport and long-term characterization of ultrafine particles in and around airports. Introduction of the project AVIATOR.

Assessing aViation emission Impact on local Air quality at airports: TOwards Regulation

Horizon 2020 Project (European Commission)

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Context

- Air Quality is an increasingly important issue for the aviation industry.
- Impact - possible health implications for communities who live close to airports.
- Historical focus has been on NO\(_x\).
- Gathering momentum to examine - PM, UFP, SVOC.
  - Aircraft engine standards to regulate nvPM mass and number.
- Concern over vPM and emission of precursors.
- Disconnect between regulatory bodies.
**Consortium**

<table>
<thead>
<tr>
<th>Call:</th>
<th>H2020-LC-MG-1-1-2018</th>
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<tbody>
<tr>
<td>Work Programme Topic:</td>
<td>InCo flagship on reduction of transport impact on air quality; Subtopic E</td>
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<td>Co-ordinator:</td>
<td>INTA</td>
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<td>Duration:</td>
<td>3 years</td>
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<td>Budget:</td>
<td>6.3 M€ (5.85 M€ from EC + 0.44 M€ from Third party countries) → Funding: 5.1 M€</td>
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<td>Consortium:</td>
<td>17 partners (7 countries)</td>
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Consortium
Aims

Aim 1. Improved Measurement Systems for Aircraft Engine Emissions.

Aim 2. Advancing Aircraft Plume and Airport Modelling.

Aim 3. Bridging the gap between Aircraft Engine Certification and Local Air Quality (LAQ) Regulation.

A1. Improved Measurement Systems for Aircraft Engine Emissions

• To develop approaches for measurement protocols at engine exit and downstream.

• To measure on-wing main engine emissions.

• To measure emissions from aircraft engines using drop-in alternative fuel.

• To measure APU emissions.

• To perform measurements of air quality in and around 3 international airports.
A1. Improved Measurement Systems for Aircraft Engine Emissions

Test cell

Figure 1. Test-cell engine emission measurement schematic
A1. Improved Measurement Systems for Aircraft Engine Emissions

**On-wing**

- Emission Probes
- Wind speed & direction meas.

**Figure 2.** On-wing engine emission measurement schematic - sampling at multiple aircraft positions
A1. Improved Measurement Systems for Aircraft Engine Emissions

**Ambient**

![Map with indicative location of low-cost sensors]

**Figure 3. Indicative location of low-cost sensors**

- **AENA RedAir**
  - PM$_{10}$
  - THC
  - O$_3$
  - CO
  - NO$_2$
  - SO$_2$

- **AVIATOR Low Cost Sensors**
  - PM$_{10}$
  - PM$_{2.5}$
  - UFP (10 – 300nm)
  - VOCs
  - CO, CO$_2$
  - NO$_x$
  - SO$_x$
  - O$_3$
A2. Advancing Aircraft Plume and Airport Modelling

- To investigate the microphysics and chemistry of pollutant formation and evolution from the exit of the main engine and APU.
- To describe the physical dynamics of the main engine and APU exhaust plume.

Figure 4. Temporal and spatial scales covered by the AVIATOR models and measurement devices
A3. Bridging the gap between Aircraft Engine Certification and Local Air Quality (LAQ) Regulation

• To describe the causality between the regulated gaseous and nvPM engine emission species and the subsequently evolved total PM plume concentrations.

• To build on the knowledge gaps and requirements of stakeholders to develop new outline agendas.

• To develop understanding of vPM and secondary PM precursor emissions at fleet level and within the context of regulatory standards development.
A3. Bridging the gap between Aircraft Engine Certification and Local Air Quality (LAQ) Regulation

Bringing the regulatory community together to understand the various agendas

- ICAO
- EASA
- EEA
- EU-OSHA

Figure 5. Regulatory Frameworks
A4. Protocols and Guidance for Air Quality and Health Impact Assessment

- To provide detailed aircraft exhaust modelling guidance.
- To provide detailed guidance on measuring pollutants at airports.
- To provide contribution to ICAO Doc 9889 (Airport Air Quality Manual).
- To work together with Health impact stakeholders to develop protocols and methodologies for the capture of representative UFP, VOC and SVOC samples.
- To disseminate and communicate AVIATOR outcomes to the widest possible audience through existing regulatory, industry and community stakeholders.
## Timeline

<table>
<thead>
<tr>
<th>Event</th>
<th>Dates</th>
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<tbody>
<tr>
<td>AVIATOR starts 1st June</td>
<td>(36 months)</td>
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<td>KO meeting 2/3th July - Advisory Board</td>
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<td>Piggyback campaign 08/2019 - 05/2021 (engine availability)</td>
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<td>Dedicated testing 07/2020 - 08/2021 (engine availability)</td>
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<td>1st On-wing campaign spring/summer 2020</td>
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<tr>
<td>2nd On-wing campaign autumn/winter 2020/2021</td>
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<tr>
<td>MADRID - High fidelity airport measurements &amp; LCS deployment</td>
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<tr>
<td>summer 2020/winter 2021</td>
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<tr>
<td>ZURICH – High fidelity &amp; LCS airport deployment</td>
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<tr>
<td>deployment summer 2021</td>
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<tr>
<td>COPENHAGEN - LCS airport deployment</td>
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Thank you for your attention