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

AVIATOR

European Commission

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

Horizon 2020 Project (European Commission)

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EFCA

KIT Karlsruhe Institute of Technology

GOBIERNO DE ESPAÑA MINISTERIO DE DEFENSA

INTA INSTITUTO NACIONAL DE TÉCNICA AEROESPACIAL

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

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

Consortium


Canada
NRC·CNRC
ÉTS
Le génie pour l'industrie
ROLLS
ROYCE
MANCHESTER
1824
The University of Manchester
CARDIFF
UNIVERSITY
Manchester
Metropolitan
University
Copenhagen Airports
CP
INTA
IBERIA
DLR
aena
Ciemat
Centro de Investigaciones
Energéticas, Medioambientales
y Tecnológicas
Janicke Cons
Environmento
FLUGHAFENZÜRIC
IngenieríaAnalítica
Chromatography & Spectrometry
RAMEM
Your Engineering and Manufacturing Partner
ONERA
THE FRENCH AEROSPACE LAB

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.

Aim 4. Protocols and Guidance for Air Quality and Health Impact Assessment.

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

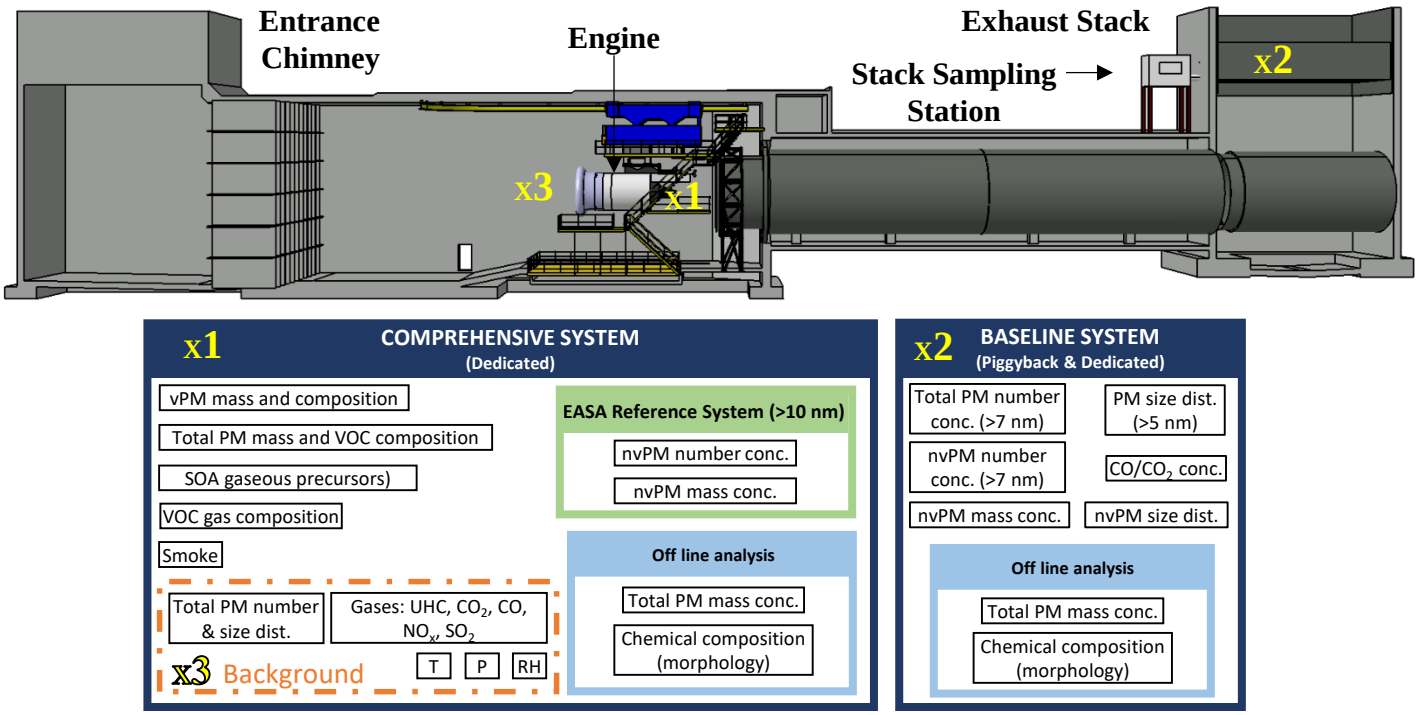


Figure 1. Test-cell engine emission measurement schematic

A1. Improved Measurement Systems for Aircraft Engine Emissions

On-wing

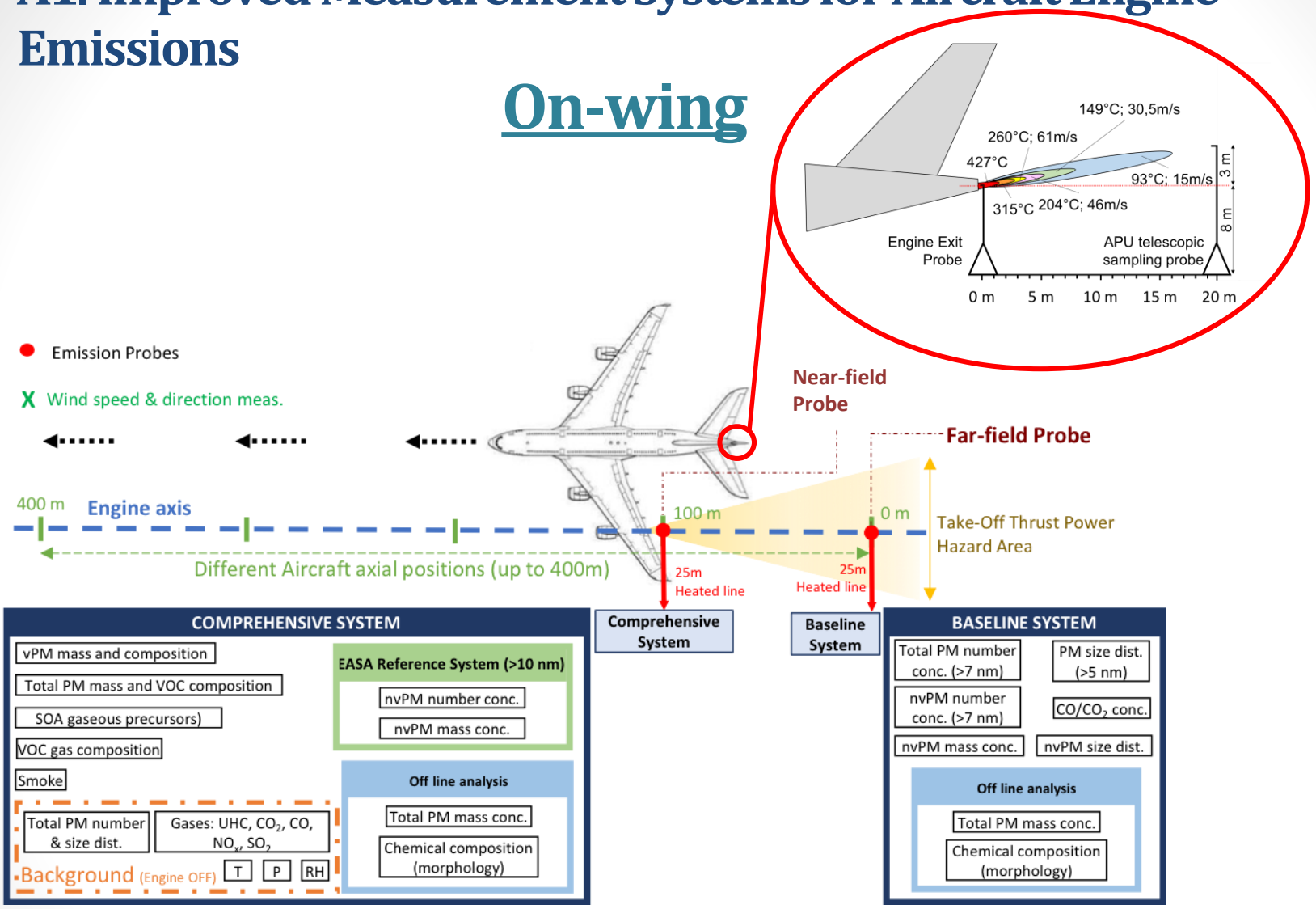


Figure 2. On-wing engine emission measurement schematic - sampling at multiple aircraft positions

A1. Improved Measurement Systems for Aircraft Engine Emissions

Ambient

Figure 3. Indicative location of low-cost sensors

Madrid

Zurich | Copenhagen

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.

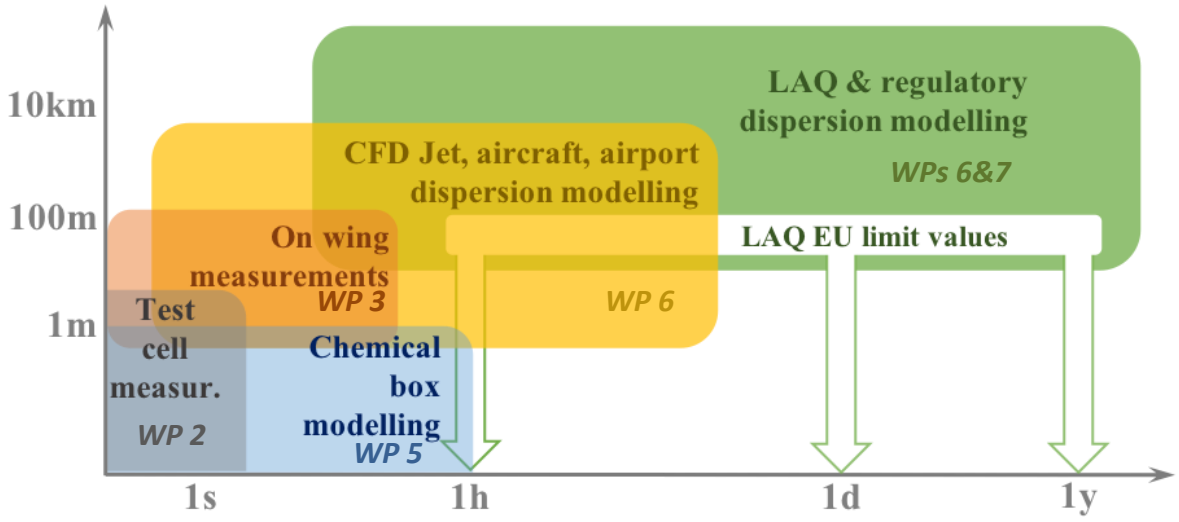


Figure 4. Temporal and spatial scales covered by the AVIATOR models and measurement devices

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

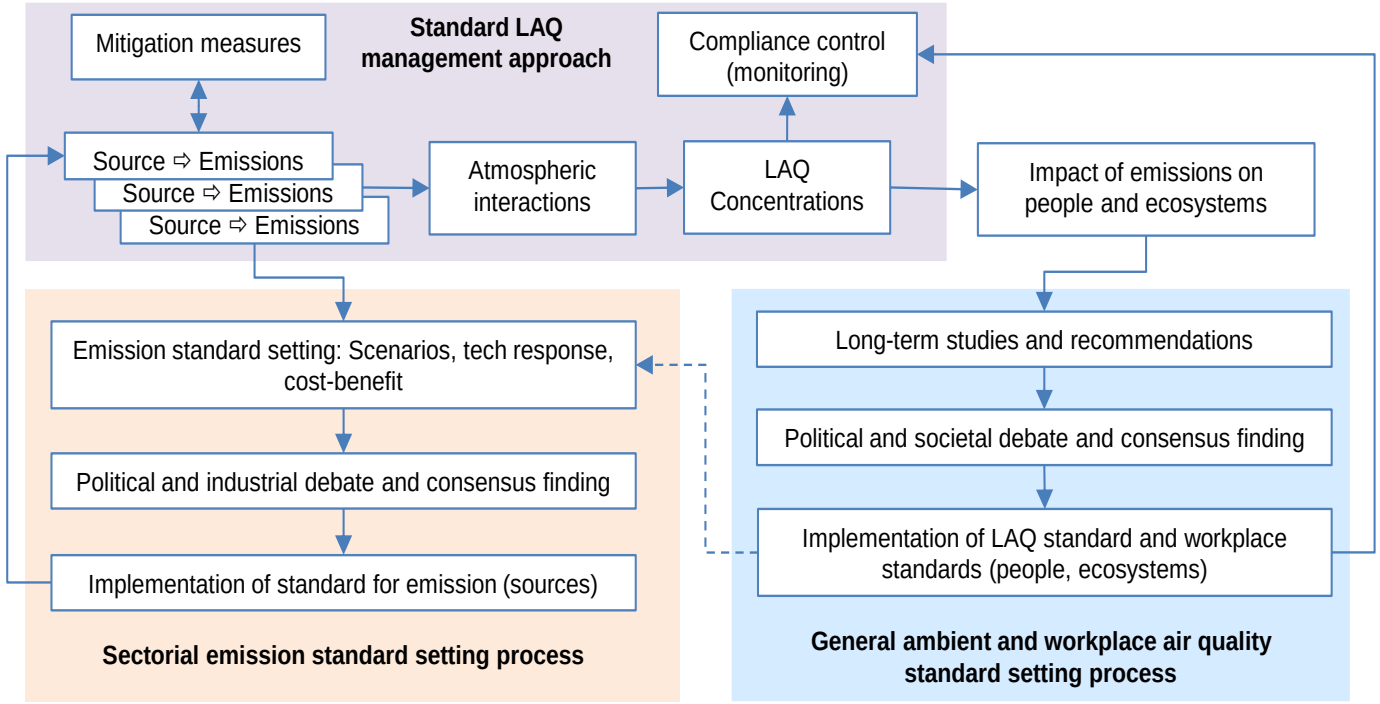
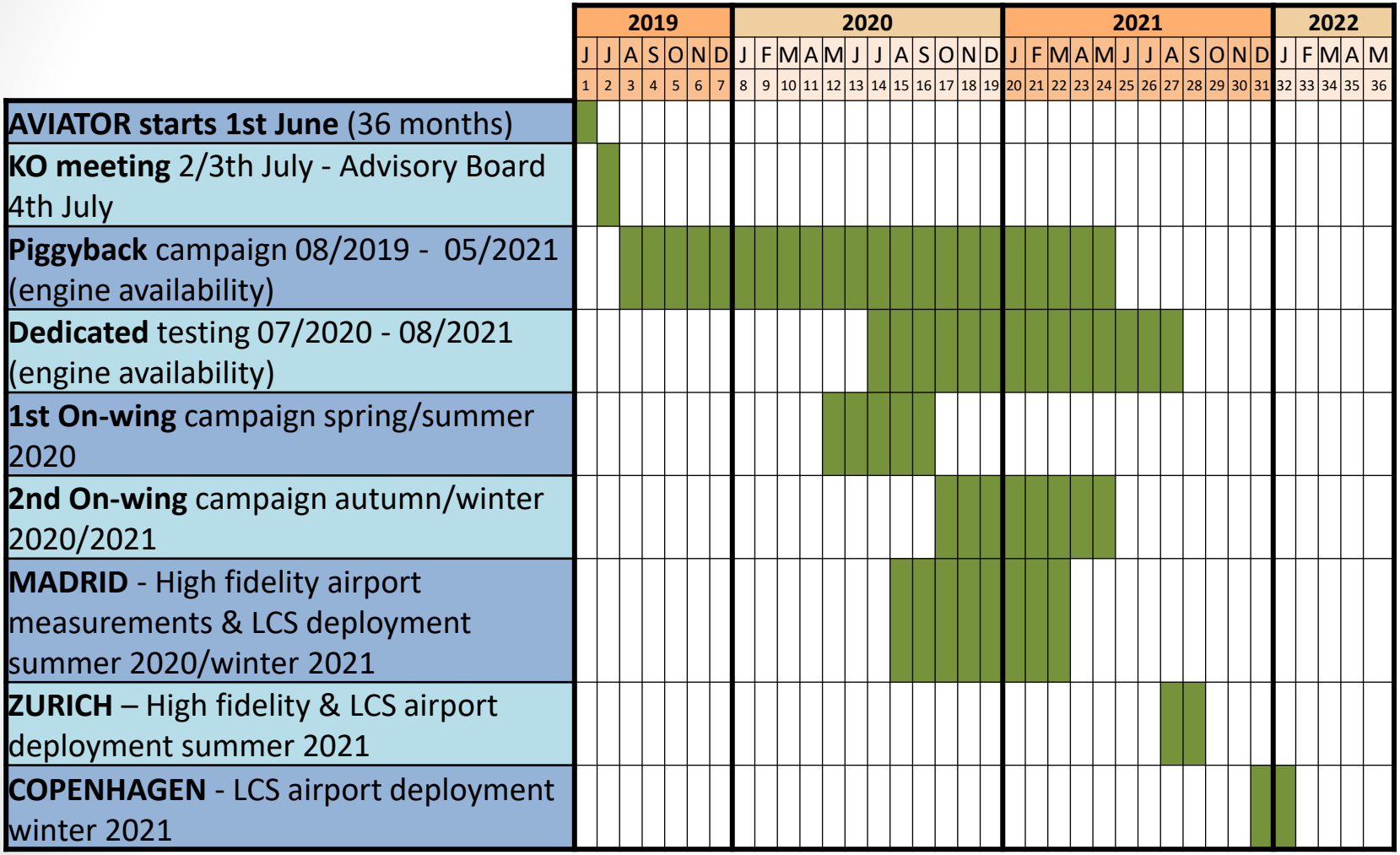


Figure 5. Regulatory Frameworks

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


2019
2020
2021
2022
J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
AVIATOR starts 1st June (36 months)
KO meeting 2/3th July - Advisory Board 4th July
Piggyback campaign 08/2019 - 05/2021 (engine availability)
Dedicated testing 07/2020 - 08/2021 (engine availability)
1st On-wing campaign spring/summer 2020
2nd On-wing campaign autumn/winter 2020/2021
MADRID - High fidelity airport measurements & LCS deployment summer 2020/winter 2021
ZURICH – High fidelity & LCS airport deployment summer 2021
COPENHAGEN - LCS airport deployment winter 2021

Thank you for your attention