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## Short Course on Aircraft Noise

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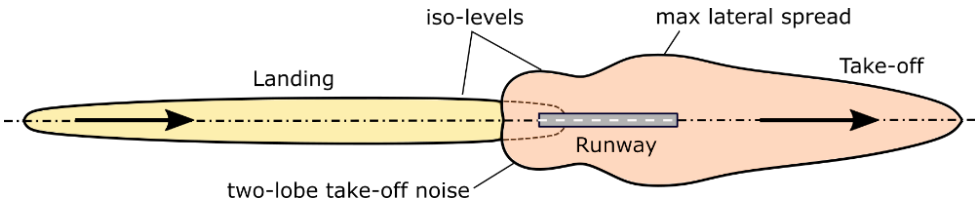
## Synopsys

Aircraft noise is a prominent environmental issue that concerns airports, aircraft operators, decision-makers, aviation regulators, and communities living near airports. Nearly all airfield operations are regulated and there is now a vast body of technical documentation, law and local regulations on the general problem of aviation noise. This course will address many of the environmental issues from a technical and engineering point of view. It will focus specifically on the aspects of noise generation, noise propagation and mitigation strategies (design & operational). There will be consideration of certification, compliance requirements, with access to the latest noise regulations for commercial aviation (ICAO/EASA).




## Course Outline

**Class 1: Critical introduction to aircraft noise**

- Psychoacoustics effects of aircraft noise (commercial and military)
- Basic definitions of sound and noise
- Airports regulations, noise certificates, and aircraft noise trends
- Legal aspects of aircraft noise (including ICAO, FAA)

**Class 2**: **Definition of noise metrics**

- Instantaneous noise metrics
- Tonal and broadband noise
- Time-averaged metrics (ANSI definitions)
- Integral metrics (EPNL, SEL)
- Short- and long-term metrics (day, season, year)
- Noise quotas and Quota Counts (QC)
- **Demo**: interpreting key noise metrics

**Class 3**: **Aircraft noise measurements techniques**

- Standard equipment, description, accuracy (SLM, or sound level meters)
- Noise event identification
- Measurement locations; integration with other systems (FDR, GPS, ADS-B/Mode-S)
- Automatic noise tracking at airfields (FIDS)

**Class 4: Practical demo of noise measurements**

- Statistical analysis and data processing
- Beamforming techniques
- Comparison between departure and arrival noise signatures
- Noise characterisation (turbofan and turboprop engines)

**Class 5**: **Airframe Noise Sources**

- Engineering systems and network analysis
- Sources, characterisation, modelling, prediction
- Lifting surfaces noise (broadband noise models)
- Landing gear noise (various alternatives)
- High-lift system noise

**Class 6**: **Propulsion Noise Sources, Part I ***

- Network analysis of propulsion noise
- Fan system noise
- Acoustic liners

**Class 7**: **Propulsion Noise Sources, Part II ***

- Engine core noise (compressor, combustor, gas turbines)
- Jet noise and corresponding models (single and dual stream jets)
- Jet noise shielding
- Auxiliary Power Unit (APU) noise
- **Demo**: Use of APU on the ground

**Class 8: Propeller and propfan noise**

- Nature of noise generation
- Tonal noise modelling
- Broadband noise models
- Minimum-noise design and configurations: synchrophasing, etc.
- Contra-rotating propeller noise

**Class 9**: **Introduction to aircraft noise propagation**

- Long-range noise propagation models
- Effects of atmospheric winds, humidity, turbulence on propagation
- Low-order methods:
    - ANSI/SAE-AIR method
    - Noise-Power-Distance (NPD)
- High-order methods
    - Wave equation
    - Ray tracing methods
    - Other field methods

**Class 10**: **Aircraft noise reduction by trajectory optimisation**

- Elements of multi-objective optimisation
- Trajectory constraints and typical operations
- Noise abatement procedures: NADP (*noise abatement departure procedures*)
- **Demo**: Steep-descent, continuous descent, displaced landing; noise breakdown analysis

Sessions marked by a (*) are very technical and may be skipped by those who may not have interest in this subject. Please enquire for alternative materials, such as regulatory noise, legal and operational aspects.

**Class 11**: **Noise footprints**

- Characteristics of noise footprints
- Determination of footprints, metrics, differential effects, and assessment
- Airport/airfield models
- Computational models for noise footprints
- **Demo**: unsteady effects on noise maps

**End of Programme**

## Schedule (all times are London times)

- Each session is approximately 50 minutes.
- There are two sessions/day, and 2 days/week.
- The course is completed in 2.5 weeks (10 hours of instruction time)

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|---|---|---|---|
| Week 1 | Day 1 | 13:00 – 15:00 | Session 1 and 2 |
| | Day 2 | 13:00 – 15:00 | Session 3 and 4 |
| Week 2 | Day 3 | 13:00 – 15:00 | Session 5 and 6 |
| | Day 4 | 13:00 – 15:00 | Session 7 and 8 |
| Week 3 | Day 5 | 13:00 – 15:00 | Session 9 and 10 |
| | Day 6 | 13:00 – 14:30 | Session 11 |

## About the Instructor

Antonio Filippone is Professor of Computational Aerodynamics at the University of Manchester, where he has now served for over twenty years. He has published extensively on aerodynamics and related subject, and is the author of 3 textbooks, 10 book chapters, 75 peer-review Journal papers, 90 international conference papers and many technical reports for industry and sponsors. Over the past 15 years he has developed, with some of his associates, the computer code **FLIGHT-X**, which can simulate the complete environmental emissions from modern aircraft (both acoustics and chemical species from aero-engine combustion). Further information is found on the web has his institutional website (www.manchester.ac.uk), Google Scholar, ResearchGate, LinkedIn. A compendium of the FLIGHT-X code is available with the most recent edition of his flight performance book, available from the AIAA.

## Course Price

Unit Price: £775
Late Booking: £875
Group Discount: 10% discount for group bookings of 3 or more delegates
Maximum number of delegates: 16

## Booking Details

Please enquire to receive a booking form (info@subsonic.aero ).

Version 1.3. Updated February 2024

## Recent Publications on FLIGHT-X


1. **Filippone A** and Parkes B. Evaluation of commuter airplane emissions: A European case study. *Transportation Research Part D*, 98, pp. 102979, Sept 2021. DOI: 10.1016/j.trd.2021.102979
2. Appleton W, **Filippone A**, Bojdo N. Interaction Effects on the Conversion Corridor of Tiltrotor Aircraft. *Aeronautical Journal,* April 2021. DOI: 10.1017/aer.2021.33
3. **Filippone** A, Parkes B, Bojdo N, Kelly T. Prediction of aircraft engine emissions using ADS-B flight data, *RAeS Aeronautical Journal*, pp. 1 – 25, 2021. DOI: 10.1017/aer.2021.2.
4. Smith D, **Filippone** A, Barakos N. Acoustic analysis of a counter-rotating open rotor with a locked blade row, *AIAA Journal*, 2020. DOI: 10.2514/J.059273
5. Bojdo N, **Filippone** A, Parkes B Clarkson R. Aircraft engine dust ingestion following sandstorms. *Aerospace Science & Tech*, **106**, pp. 106072, 2020. DOI: 10.1016/j.ast.2020.106072
6. Smith D, **Filippone** A, Bojdo N. Noise reduction of a counter rotating open rotor through a locked blade row. *Aerospace Sci. & Tech*., **98**, pp. 105637, March 2020. DOI: 10.1016/j.ast.2019.105637
7. **Filippone** A, Zhang M, Bojdo N. Validation of an integrated simulation model for aircraft noise and engine emissions. *Aerospace Science & Tech.* **89**, pp. 370-381, 2019. DOI: 10.1016/j.ast.2019.04.008.
8. Zhang M, **Filippone** A. Bojdo N. Multi-objective optimisation of aircraft departure trajectories. *Aerospace Science & Technology*, **79**, pp. 37-47, 2018. DOI: 10.1016/j.ast.2018.05.032
9. **Filippone** A, Bojdo N. Statistical model for gas turbine engines exhaust emissions. *J. Transp. Research Part D*. **59**, pp. 451-463, March 2018. DOI: 10.1016/j.trd.2018.01.019.
10. **Filippone** A. Options for aircraft noise reduction on arrival and landing. *Aerospace Sci. & Tech*. **60**(1), pp. 31-38, Jan 2017. **DOI**: 10.1016/j.ast.2016.10.027
11. **Filippone** A. & Harwood A. Flyover noise measurements and predictions of commercial airplanes, *Journal of Aircraft*, **53**(2), pp. 396-405, 2016. DOI: 10.2514/1.C033370.