

Analysis of Turbofan Jet Engine Noise

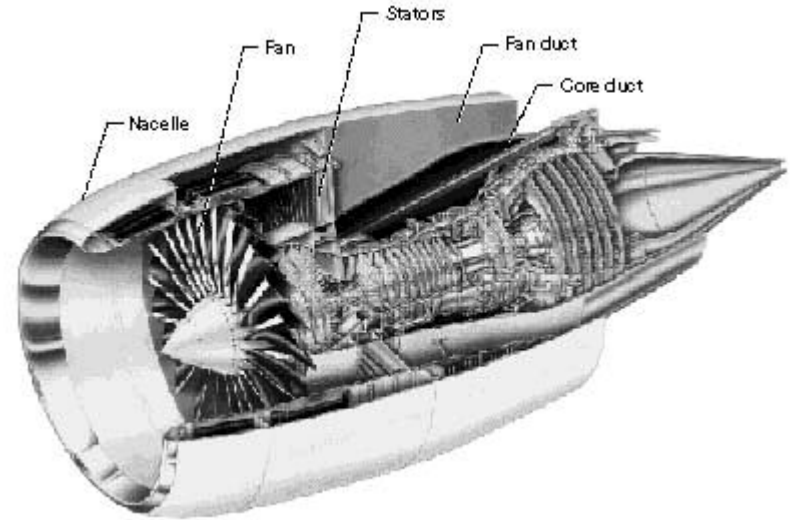
Lit Review by Erin McEneny & Logan Parker

Outline

- Lit Review
 - Turbofan Jet Engine Layout
 - Noise analysis of Turbofan Engines
 - Noise Reduction Methods
 - Noise Pollution surrounding Aviation
- Project
 - Motivation
 - Testing and Analysis
- Citations

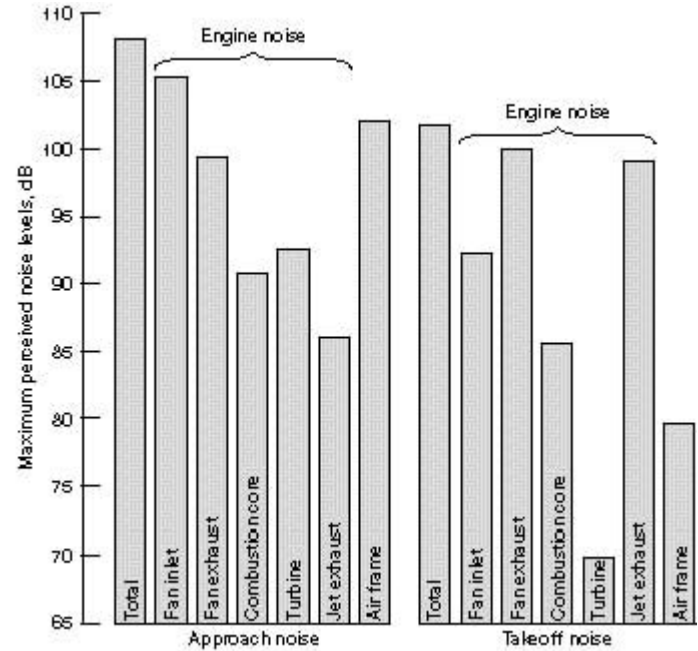
Turbofan Engine

- The figure to the left [12] is of a turbofan jet-engine
- Airplanes with turbofan engines produce two types of noise: engine noise and airframe noise [5]
- We are focusing on engine noise for the purpose of our project



Noise Analysis

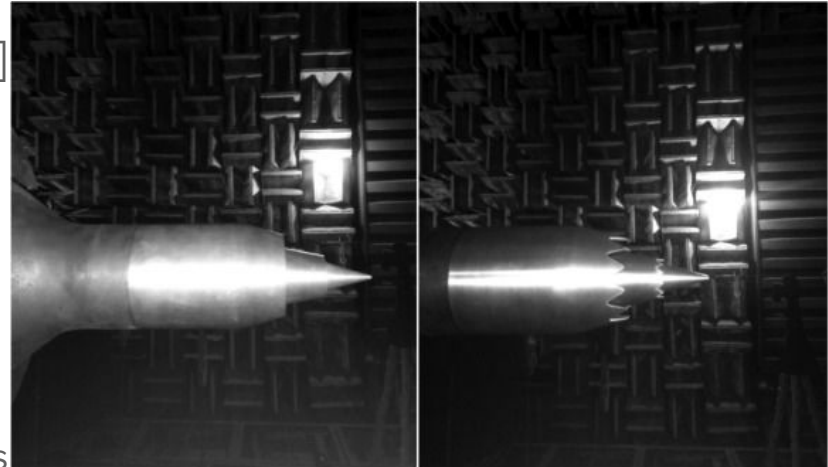
- Programs like ANOPP (Aircraft Noise Prediction Program) are used to predict the noise that we are analyzing, and they factor in all damping factors from the atmosphere, thermal and viscous effects [13]
- The takeoff and landing noise comes from various sources shown to the left [12], only some of which are from the engine
- We can easily obtain a frequency vs time graph, and from that an fft can be made





Engine Noise Reduction Methods

- Adding viscoelastic materials to an engine to dampen the sound that is produced [1]
- Changing the geometry of the engine [6] [11]
 - Dual flow processing
 - Chevron engines
 - Area ratio of the nozzle
 - Modifying the jet exhaust position
- The figure to the left [11] shows a regular engine vs. a Chevron engine
 - There are multiple experiments proving the effects that the Chevron engine has on noise reduction [1] [5] [6] [11]

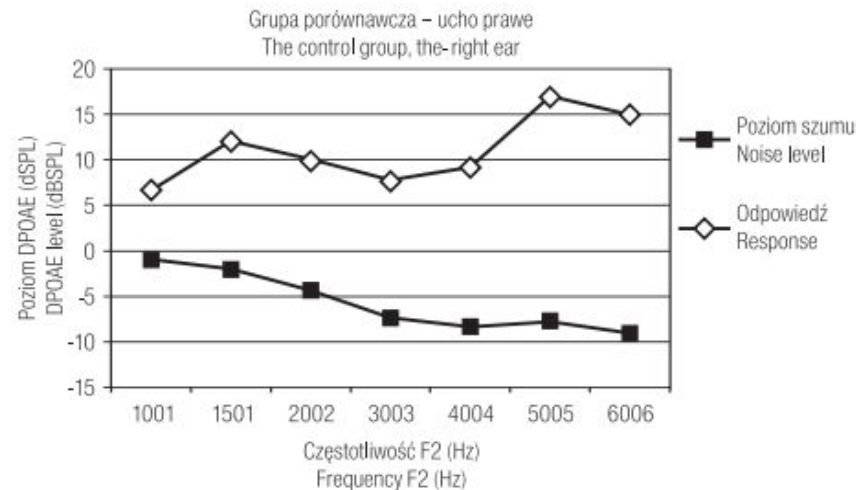
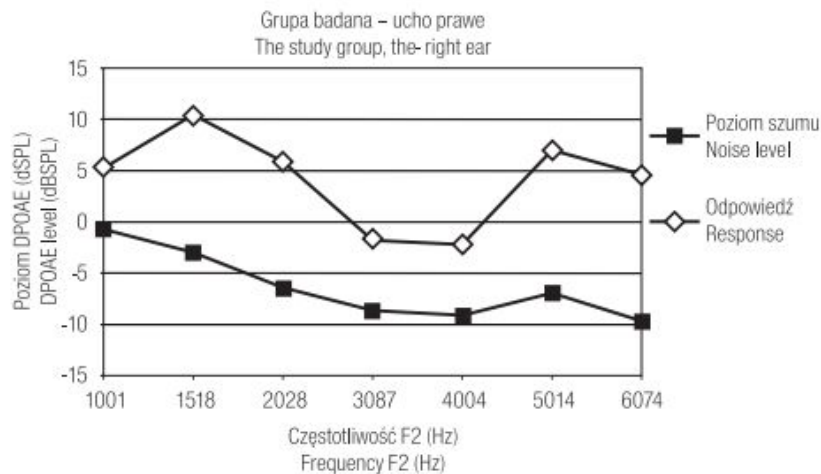


Noise Pollution Causes/Effects

- As society has become more industrialized, noise pollution has become an extremely prominent pollutant [14]
- For reference: [9]
 - Whisper: 30 dB
 - Jack-hammer: 80 dB
 - Chainsaw: 110 dB
 - Threshold of discomfort in humans: 120 dB
- The noise level of a jet about 60 m away is 120 dB [9]
- This can affect the health and work efficiency of airport workers, as well as the surrounding community [9] [14]
 - High blood pressure, coronary disease, migraine headaches, etc. [9]
 - Hearing problems [15]

Hearing experiment [15]

Control vs. Study group, hearing in the right ear



It can be noted that the response from the study group is lower than that of the control group, especially when the frequency rises

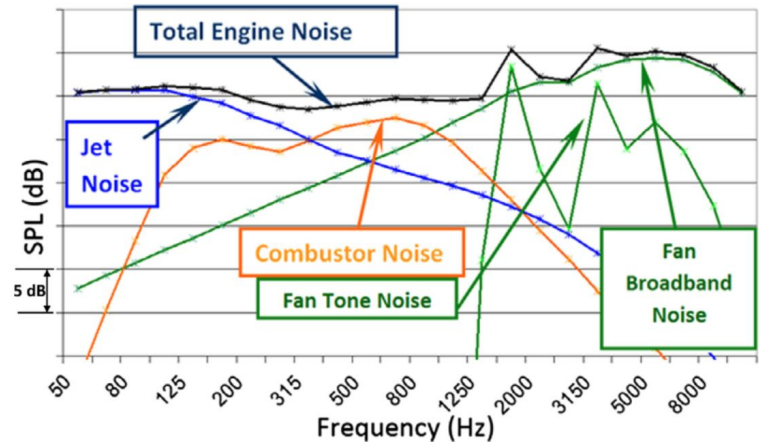
Project

Motivation

- We are interested in the sound as it pertains to the field of Vibrations
 - Planes are the largest scale of that we currently have access to
- We both have family who worked in or around airplanes, and have grown up fascinated with them
- We could see ourselves working in the field of aviation one day, and it has been interesting to learn more about the intricacies of aircraft engines
- We were also really interested to learn more about how noise pollution stemming from airports and planes has an impact on the surrounding community and airport workers

Testing and Analysis

- We will be recording the sound of an airplane taking off
- We will analyze the vibrations and the frequencies of the sound through the use of matlab and mathematica
- We will assess the different types of planes and engines and how that changes the data that we attain



Citations

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