

Analysis of Turbofan Jet Engine Noise

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Outline

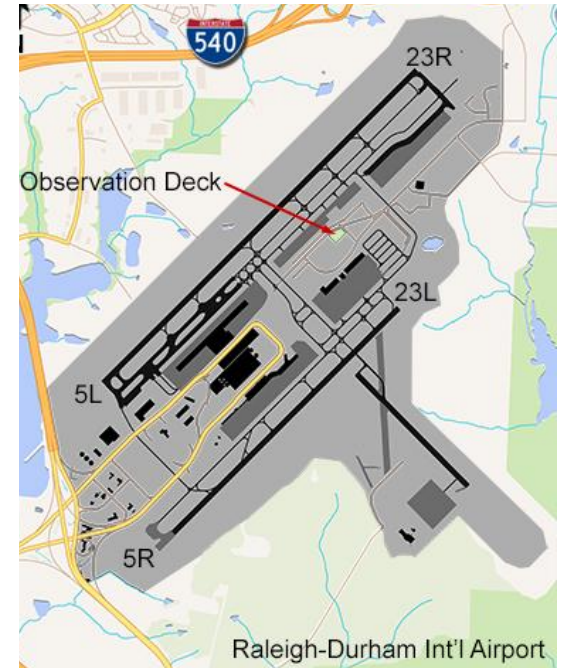
- Project overview
 - Brief overview of the project
 - Our goals we hoped to achieve
- Testing
 - How we did our testing
 - Errors in testing
- Results
 - Data obtained from testing
 - Manipulating it in Matlab
- Conclusion
 - What do our results mean
 - How it fits into our project goals

General Overview/Goals

- We tested the noise produced by jet engines during takeoff and landing procedures
 - The noise level of a jet about 60 m away is 120 dB [9]
- This noise contributes to the growing problem of noise pollution, which is becoming much more prominent as we become an increasingly industrialized society [14]
 - This also has a harmful effect on airport workers[9][14], which we discussed in our lit review presentation
- Our goal was to get a measurement of the sound during takeoff and landing, and then use the plane specs to analyze the differences between noise produced by each type of plane and engine

Testing Process

- We went to the RDU observation deck to record the takeoff and landing noise
 - The observation deck is about 100 yards away from the runways we were observing (shown in the first picture)
- Using our phones, we recorded each plane taking off and landing on runway 5L/23R
 - We were able to find the flight numbers using the RDU website, and from there gather information about each plane
- Possible Sources of Error
 - iPhone recording quality
 - Windspeeds of 10 mph SE caused interference with our recordings

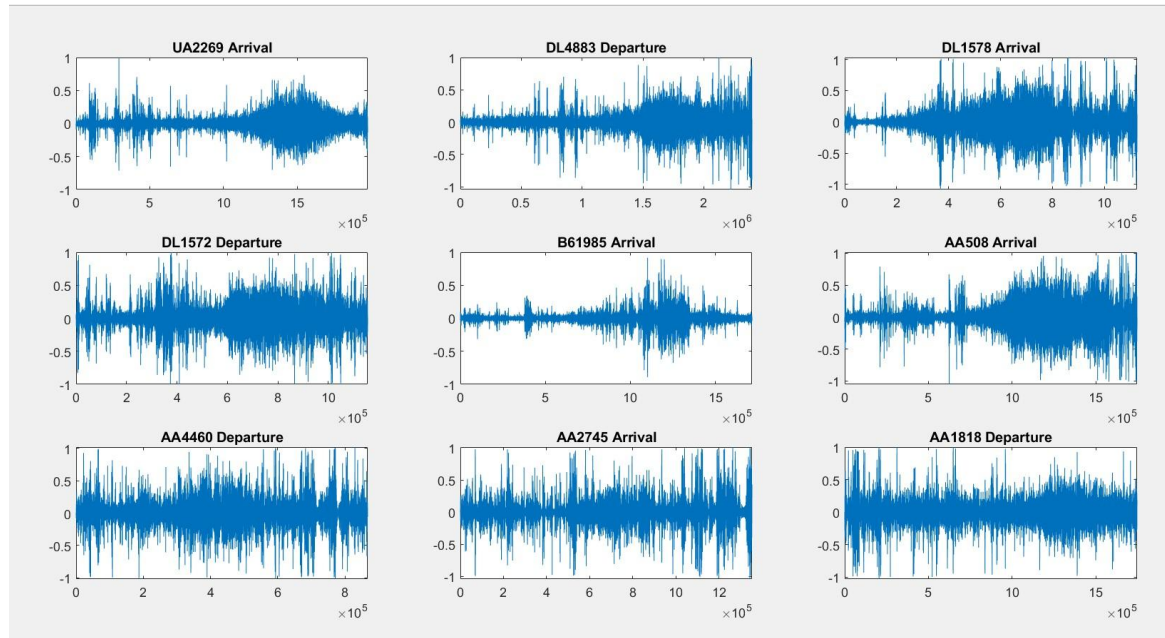


Our View



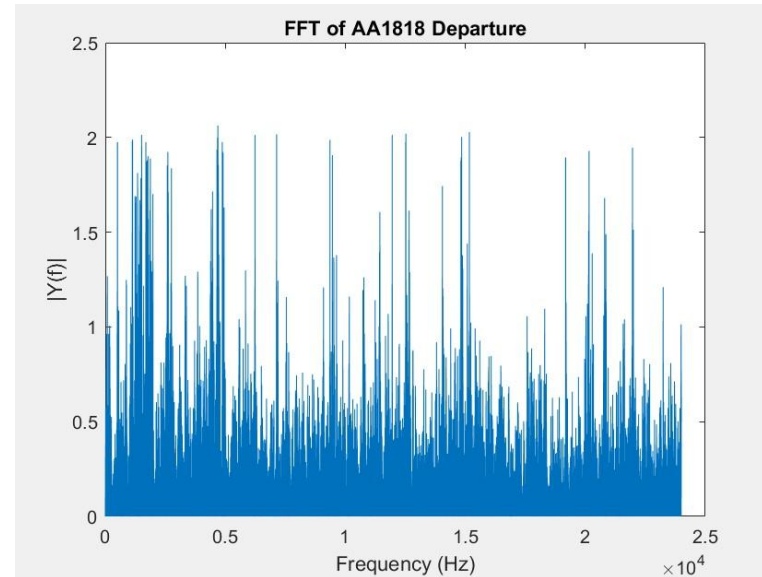
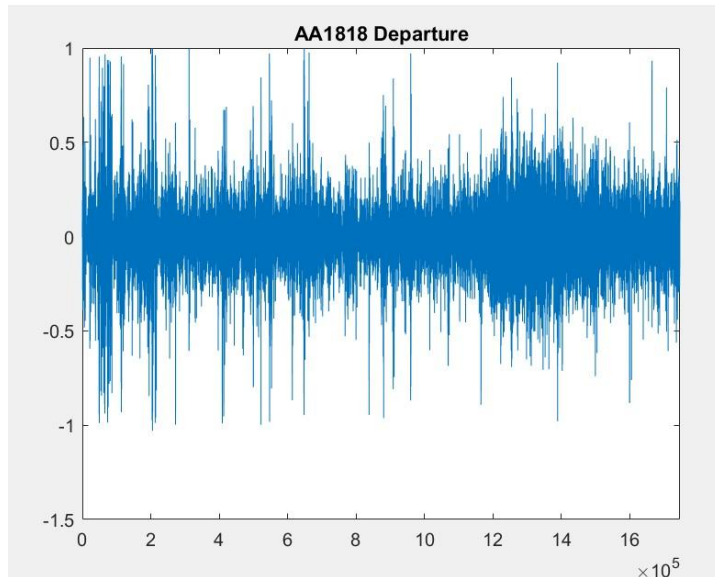
Results

- We uploaded our recordings into Matlab, and when just plotting the y-values given by the function audioread the graphs below were obtained



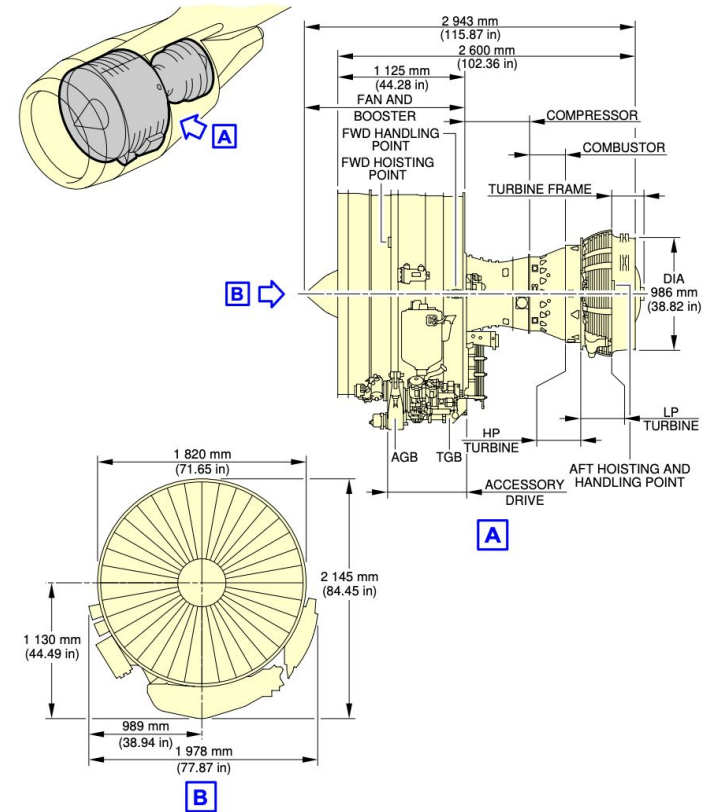
Results cont'd

- We also calculated the FFT's of all the plane graphs
- Taking a closer look at the plane in the previous video (AA1818), we have it's amplitude and fft graph below



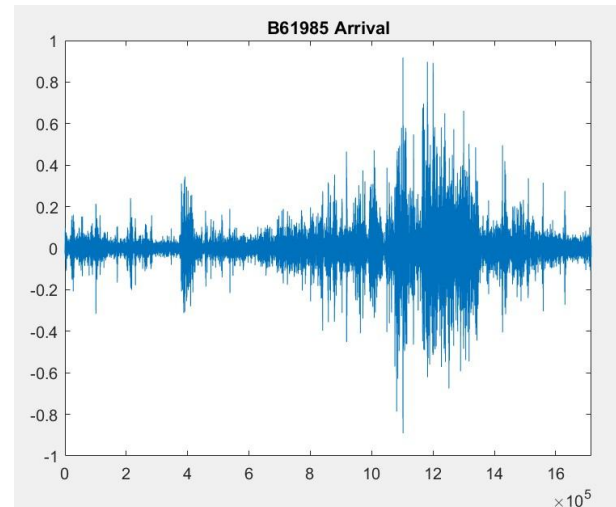
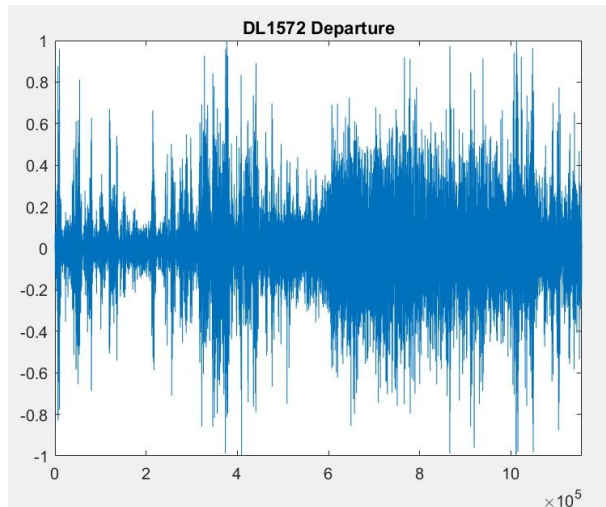
Interpreting Plane Type Results

- Using our results, we can then compare them to the airplane model of AA1818
 - AA1818 is an Airbus A319 plane with with twin CFM56-5B jet engines; which are dual-rotor, variable stator, high bypass ratio turbofan engines
 - The low pressure rotor(n1) RPMs is 5100 rpm, and the high pressure rotor(n2) RMPs is 15183 rpm for this engine type
- These RPMs can be used when analyzing the FFT, because the frequency spikes should fall between the n1 and n2 values



Interpreting Signal Results

- We can use the graphs created by the audio recordings to analyze the differences between the takeoff and landing noise, as well as the differences between each engine
 - The takeoff noise is generally louder and longer than the landing noise, and the bigger the plane, the louder the noise for each case



Conclusion

- As we stated before, our project goal was to obtain sound measurements from each plane, and compare the results based of the plane and engine types
- We were successful in finding information about each plane used, as well as the different engine types
 - All of this information has helped us create a detailed and informative report
- To relate this to the main problem of noise pollution, it was evident how far the noise from the airport reached into the surrounding community
 - We observed runway workers with heavy ear protective equipment
 - We could hear the takeoff and landing noise when arriving and leaving RDU, and it was evident that anybody working or living in the surrounding area would be negatively affected by the noise daily

