

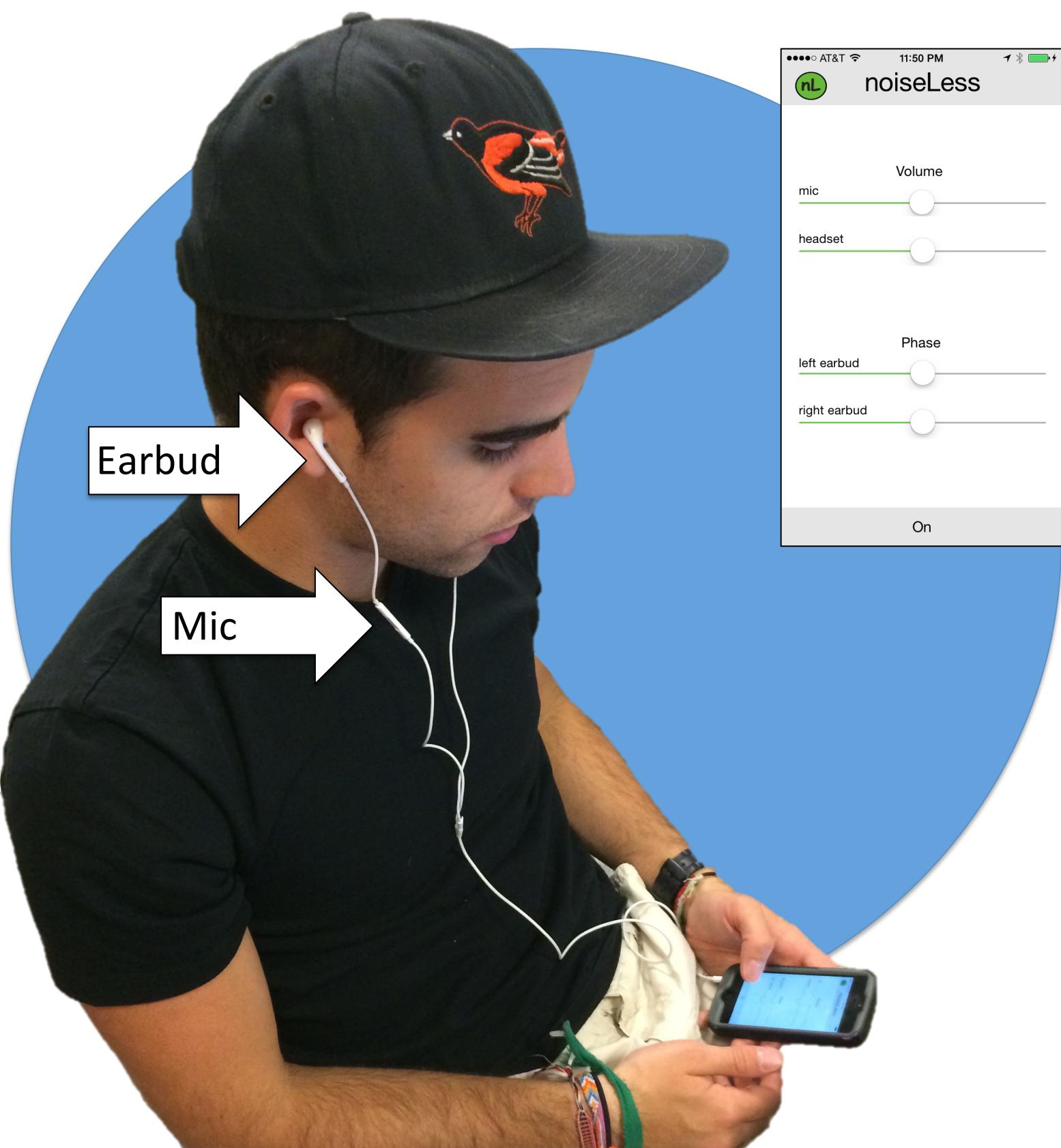
# Active Noise Cancelling iPhone Application

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## Motivation

Build a low-cost alternative to traditional noise-cancelling headsets.

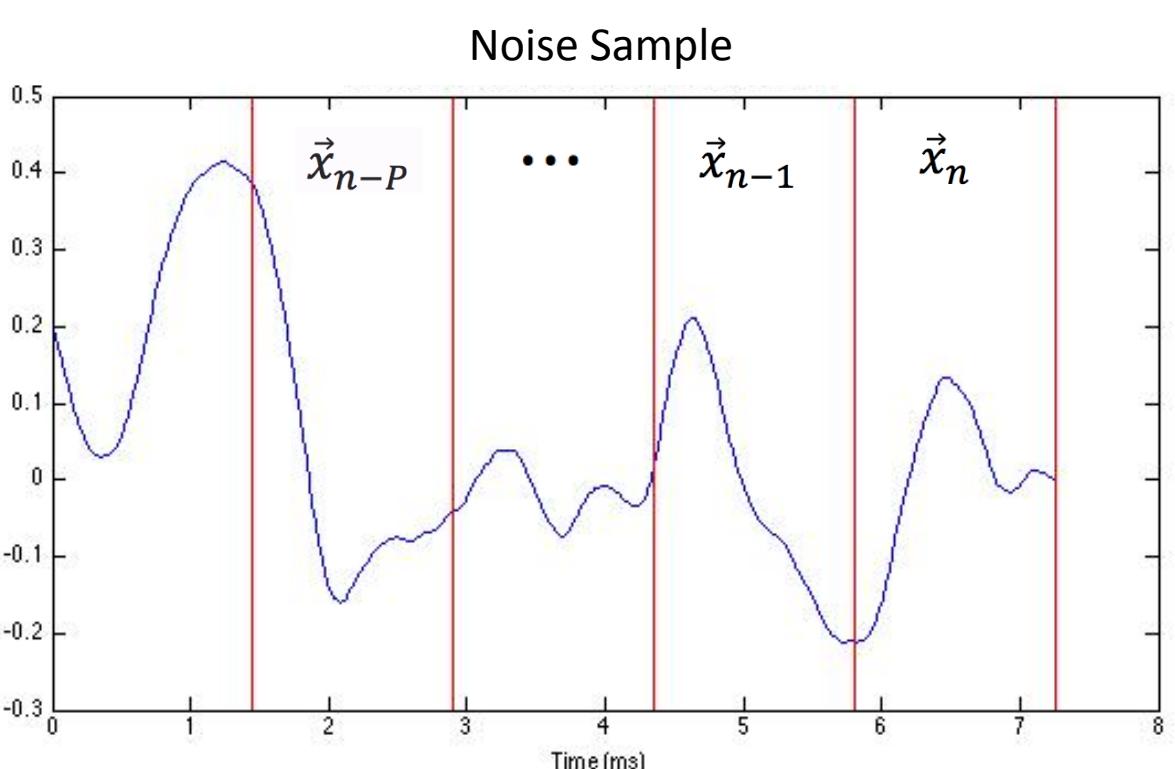
**How?** Engineer an iPhone application that reduces low-frequency ambient noise (< 600 Hz) without requiring any additional hardware aside from the standard Apple headset.



## Algorithm Overview

- 1) Sample noise with headset mic.
- 2) Predict future samples
- 3) Phase-shift predictions
- 4) Play back predictions through earbuds

## Stage 1: Training



**Goal:** Generate a model of the ambient noise by estimating  $A_1$  through  $A_p$ , the matrices that relate each vector of data to its  $P$  past vectors.

$$\vec{x}_n = - \sum_{i=1}^P A_i \vec{x}_{n-i}$$

Noise Model

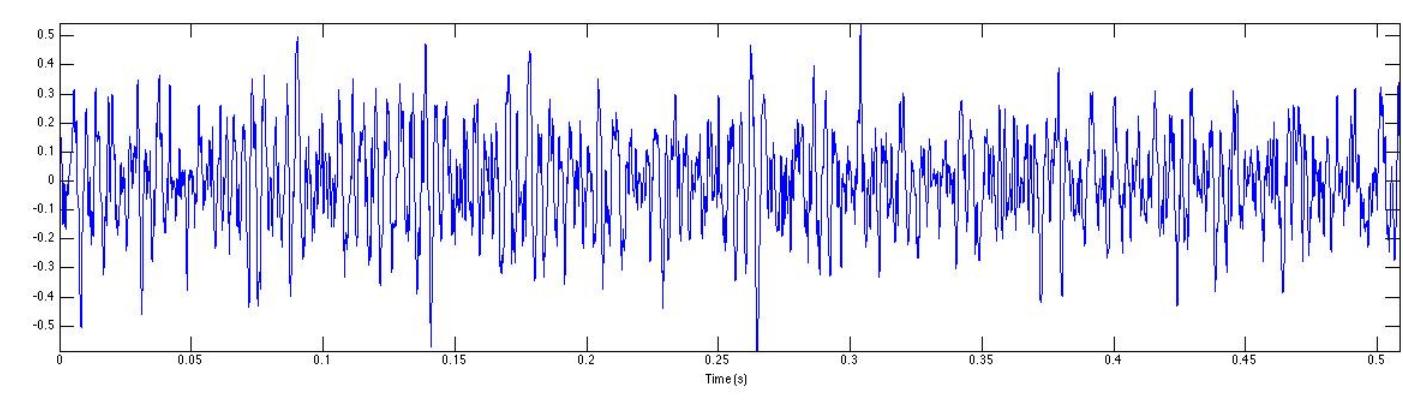
$$\begin{bmatrix} \vec{x}_n \vec{x}_n^T & \dots & \vec{x}_n \vec{x}_{n-P}^T \\ \vdots & \ddots & \vdots \\ \vec{x}_{n-P} \vec{x}_n^T & \dots & \vec{x}_{n-P} \vec{x}_{n-P}^T \end{bmatrix} \begin{bmatrix} I \\ A_1^T \\ \vdots \\ A_P^T \end{bmatrix} = \begin{bmatrix} C_u \\ 0 \\ \vdots \\ 0 \end{bmatrix}$$

Equations used to estimate  $A_1$  through  $A_p$

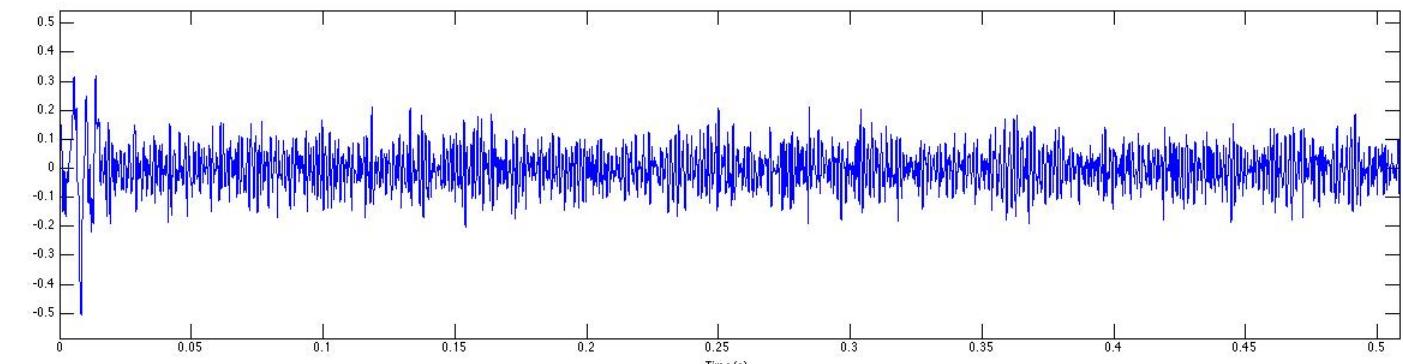
## Results

### Time Domain

Airplane Cabin Noise

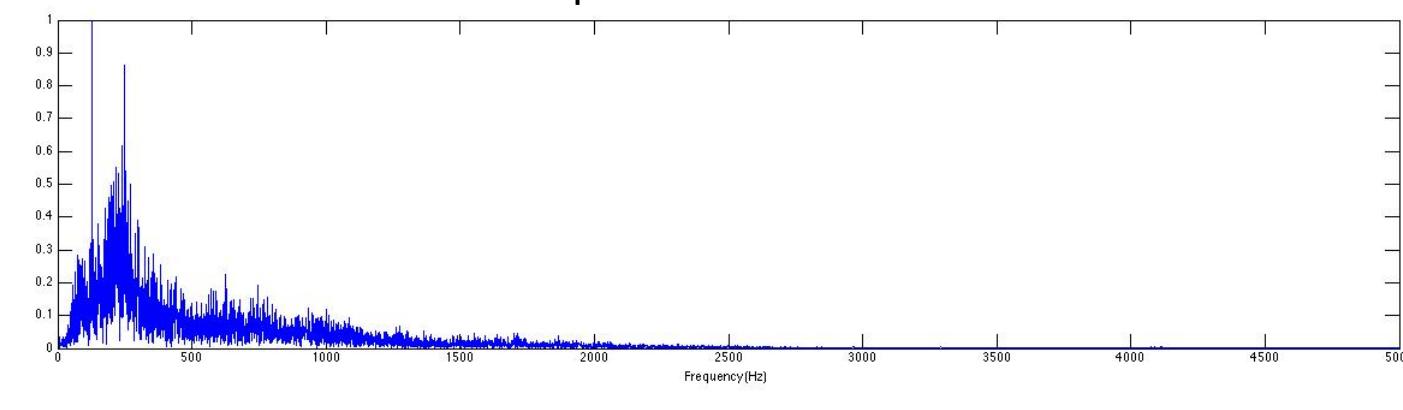


Reduced Airplane Cabin Noise

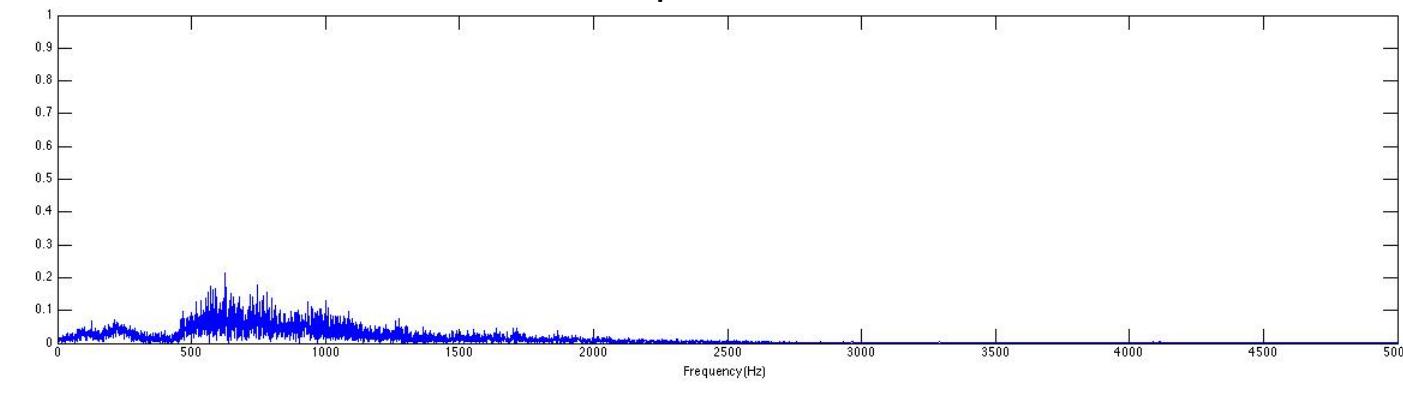


### Frequency Domain

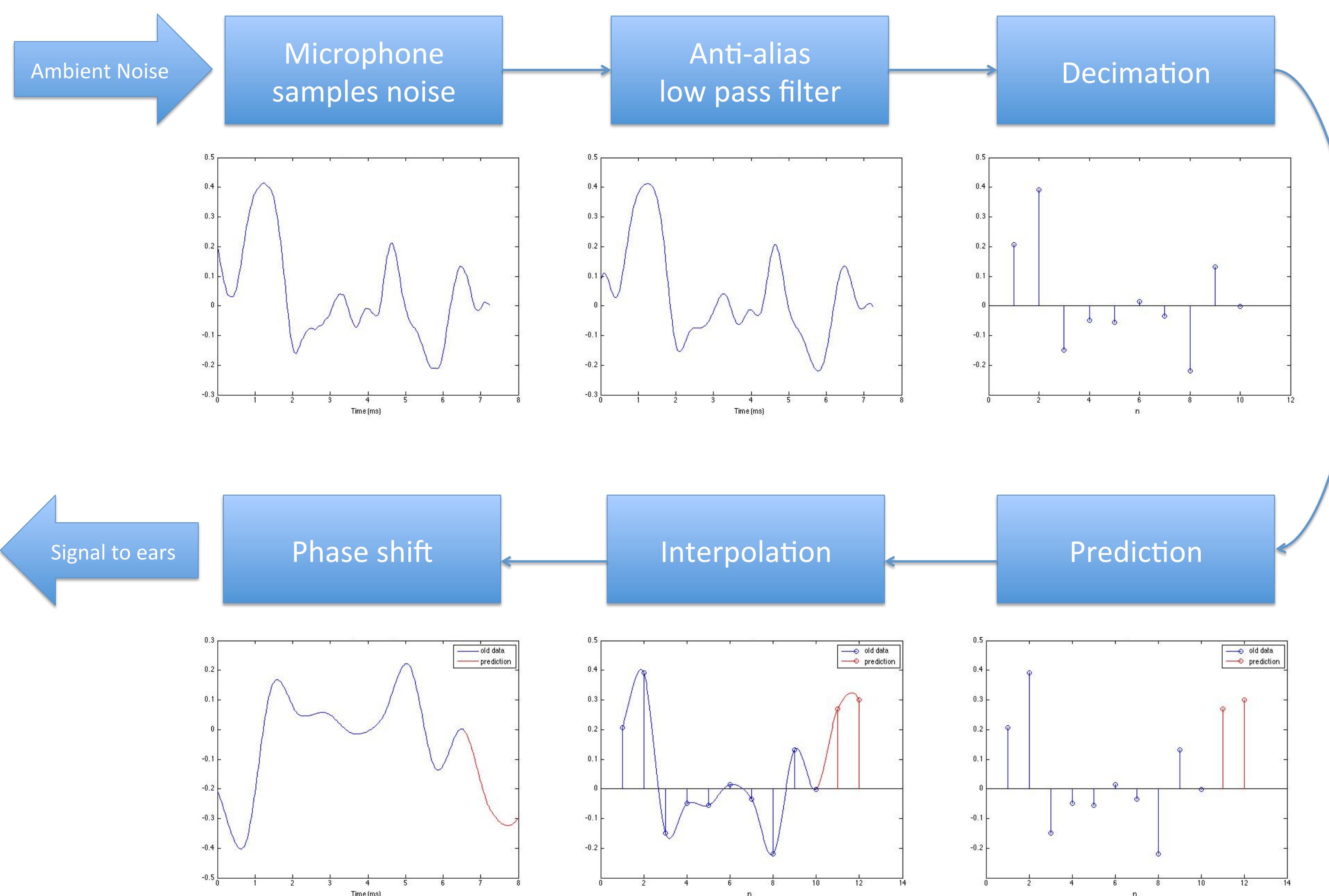
Airplane Cabin Noise



Reduced Airplane Cabin Noise



## Stage 2: Process, predict, shift



## Acknowledgements

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Team Blue



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