

## Impulse Responses for Various Acoustic Environments

In order to provide researchers the ability to synthesize signals in various acoustic environments, impulse responses were measured for various environments. For each environment, a pair of direct channel impulse responses (left source to left microphone and right source to right microphone) and a pair of cross channel impulse responses (left source to right microphone and left source to right microphone) were measured as in Fig. 1. The impulse responses are only accurate to within a delay since the stimulus used to excite the room response was not synchronized to the recorder. In order to simplify, all responses begin 50ms before the main peak (direct path) and extend a total of 3sec. Typically, the cross channel responses have a longer delay than the direct channel since the path is longer.

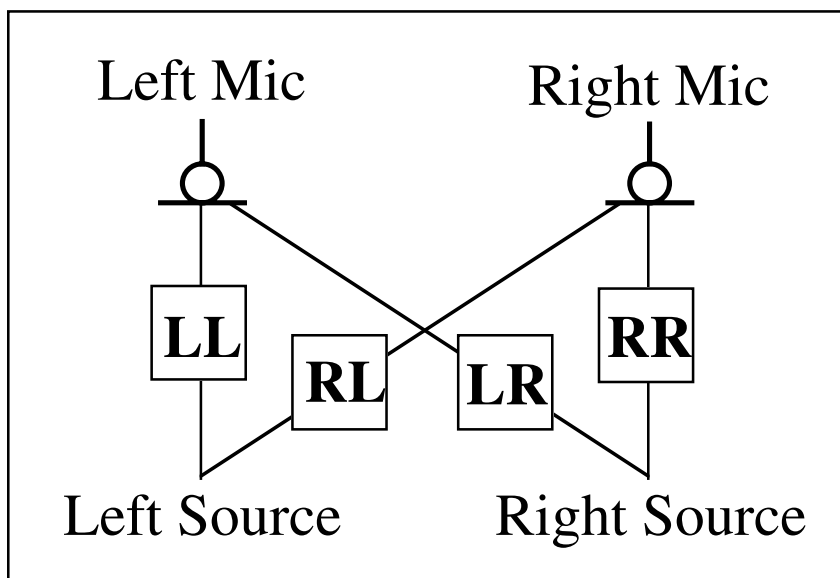


Figure 1: Direct and cross channel impulse responses.

### **Recording Equipment Used in All Impulse Response Measurements**

- (1) Dell Dimension XPS R400 PC (Pentium II @ 400MHz, 128MB RAM, 40GB disk, Windows 98)  
([www.dell.com](http://www.dell.com))
- (1) Echo Layla 20-bit multitrack recording system ([www.](http://www.))
- (2) Shure omni-directional microphone Model VP64A2 ([www.shure.com](http://www.shure.com))
- (2) Applied Research And Technology (ART) Professional processor series tube preamp ([www.art.com](http://www.art.com))
- (2) Balanced (XLR) microphone cables from microphones to preamps
- (2) Balanced (XLR) microphone cables from preamps to Layla

### **Recording/Editing Software**

- Syntrillium Software Corporation's Cool Edit Pro v1.2 for recording and ([www.syntrillium.com](http://www.syntrillium.com))  
Aurora Convolve with Clipboard and Generate Log Sweep plug-ins for Cool Edit pro for impulse response measurements ([www.ramsete.com/aurora/](http://www.ramsete.com/aurora/))  
SoundApp PPC v2.7.3 for sample rate conversion to 16kHz from 48kHz ([www.download.com](http://www.download.com))

### **Room Impulse Response Measurement**

The Aurora plug-in for Cool Edit Pro utilizes a Chirp (sinusoidal sweep) stimulus in order to compute the room impulse response which is sampled at 48kHz. Impulse responses are also provided at a 16kHz sample rate.

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## **Anechoic Chamber**

The anechoic chamber is located on the New Mexico State University campus in the Klipsch School of Electrical and Computer Engineering (Thomas and Brown, Room 311). Figs. 2(a) – (c) show the anechoic chamber from three viewpoints. Fig. 3 shows the schematic of recording setup with dimensions.



(a)



(b)



(c)

Figure 2: Anechoic chamber viewed from (a) front left door, (b) front right door, and (c) back left wall.

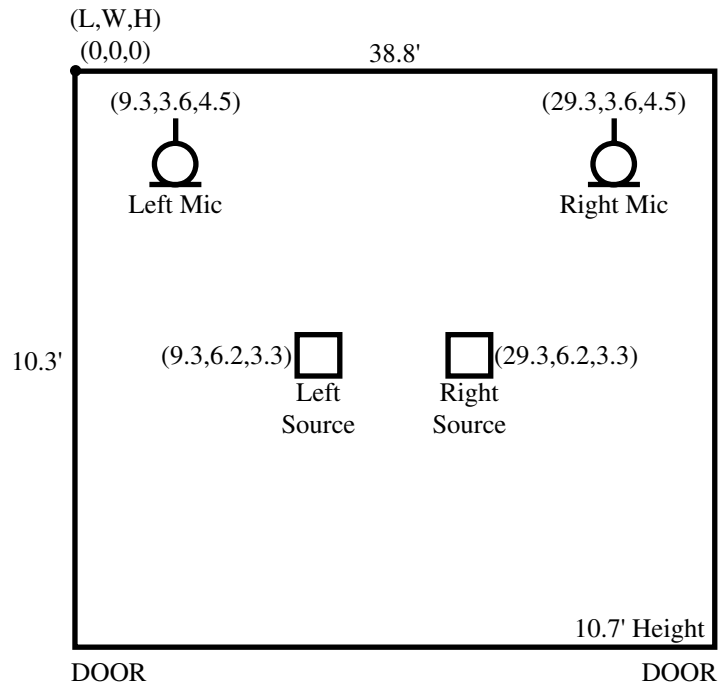


Figure 3: Schematic of recording setup.

The available impulse response files are:

Anechoic\_ImpResp\_16k\_LL.wav  
 Anechoic\_ImpResp\_16k\_LR.wav  
 Anechoic\_ImpResp\_16k\_RL.wav  
 Anechoic\_ImpResp\_16k\_RR.wav

Anechoic\_ImpResp\_48k\_LL.wav  
 Anechoic\_ImpResp\_48k\_LR.wav  
 Anechoic\_ImpResp\_48k\_RL.wav  
 Anechoic\_ImpResp\_48k\_RR.wav

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## Bathroom

The men's bathroom is located on the New Mexico State University campus in the Klipsch School of Electrical and Computer Engineering (Goddard Hall, Room 101). Figs. 4(a) and (b) show the bathroom from two viewpoints. Fig. 5 shows the schematic of recording setup with dimensions.



(a)



(b)

Figure 4: Men's bathroom, Goddard Hall first floor.

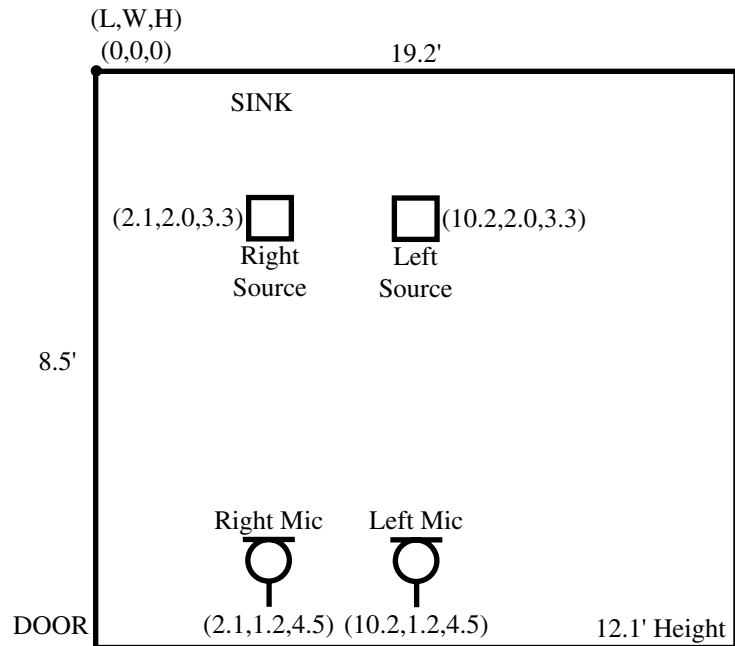


Figure 5: Schematic of recording setup.

The available impulse response files are:

Bathroom\_ImpResp\_16k\_LL.wav  
 Bathroom\_ImpResp\_16k\_LR.wav  
 Bathroom\_ImpResp\_16k\_RL.wav  
 Bathroom\_ImpResp\_16k\_RR.wav

Bathroom\_ImpResp\_48k\_LL.wav  
 Bathroom\_ImpResp\_48k\_LR.wav  
 Bathroom\_ImpResp\_48k\_RL.wav  
 Bathroom\_ImpResp\_48k\_RR.wav

## Large Room (Conference Room)

The large room is located on the New Mexico State University campus in the Klipsch School of Electrical and Computer Engineering (Goddard Hall, Room 167). Figs. 6(a) – (c) show the large room (conference room) from three viewpoints. Fig. 7 shows the schematic of recording setup with dimensions.



(a)



(b)



(c)

Figure 6: Conference room viewed from (a) front left door, (b) front right door, and (c) back right wall.

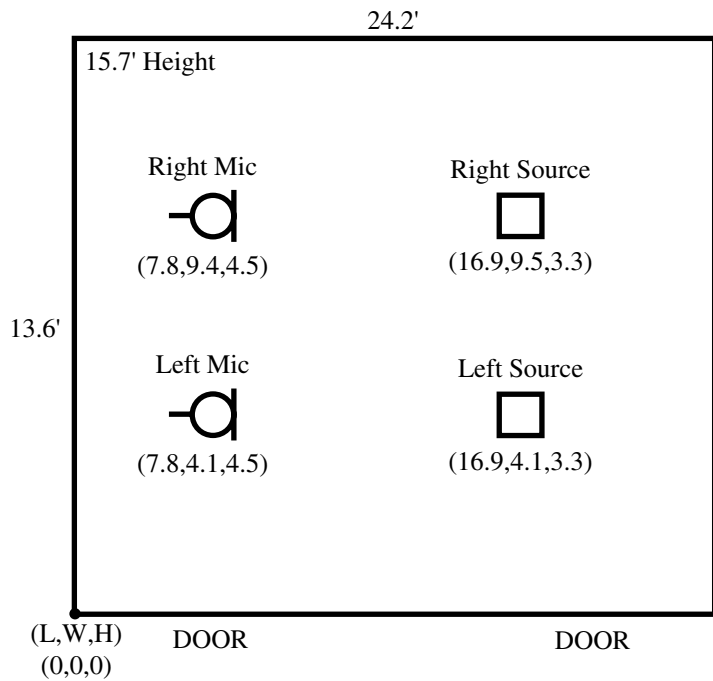


Figure 7: Schematic of recording setup.

The available impulse response files are

LargeRoom\_ImpResp\_16k\_LL.wav  
 LargeRoom\_ImpResp\_16k\_LR.wav  
 LargeRoom\_ImpResp\_16k\_RL.wav  
 LargeRoom\_ImpResp\_16k\_RR.wav

LargeRoom\_ImpResp\_48k\_LL.wav  
 LargeRoom\_ImpResp\_48k\_LR.wav  
 LargeRoom\_ImpResp\_48k\_RL.wav  
 LargeRoom\_ImpResp\_48k\_RR.wav

## Lecture Hall

The lecture hall is located on the New Mexico State University campus in the Klipsch School of Electrical and Computer Engineering (Thomas and Brown, Room 104). Figs. 8(a) and (b) show the lecture hall from two viewpoints. Fig. 9 shows the schematic of recording setup with dimensions.



(a)



(b)

Figure 8: Lecture hall viewed from (a) audience forward and (b) stage sideward.

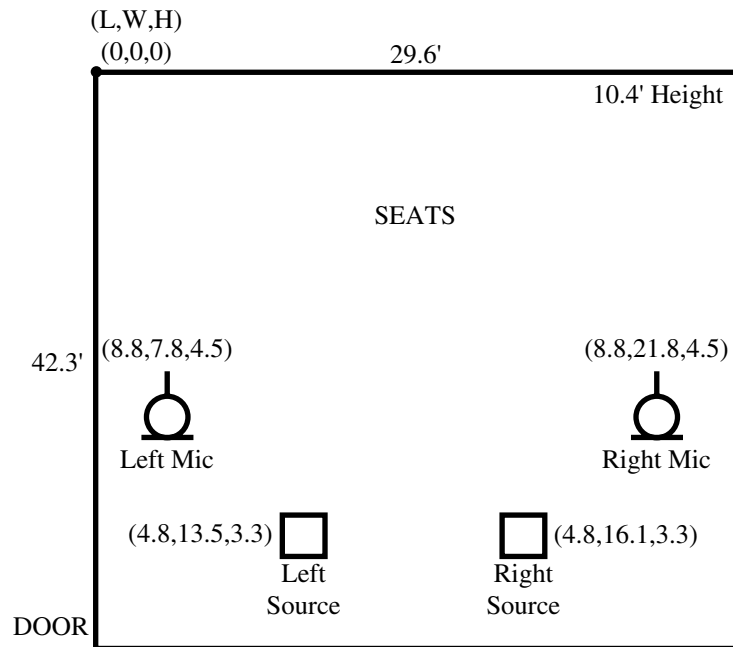


Figure 9: Schematic of recording setup.

The available impulse response files are

Lecture\_ImpResp\_16k\_LL.wav  
Lecture\_ImpResp\_16k\_LR.wav  
Lecture\_ImpResp\_16k\_RL.wav  
Lecture\_ImpResp\_16k\_RR.wav

Lecture\_ImpResp\_48k\_LL.wav  
Lecture\_ImpResp\_48k\_LR.wav  
Lecture\_ImpResp\_48k\_RL.wav  
Lecture\_ImpResp\_48k\_RR.wav



## Small Room (Office)

The Small Room is located on the New Mexico State University campus in the Klipsch School of Electrical and Computer Engineering (Goddard Hall, Room 171). Fig. 10 show the Small Room. Fig. 11 shows the schematic of recording setup with dimensions.



Figure 10: Small room.

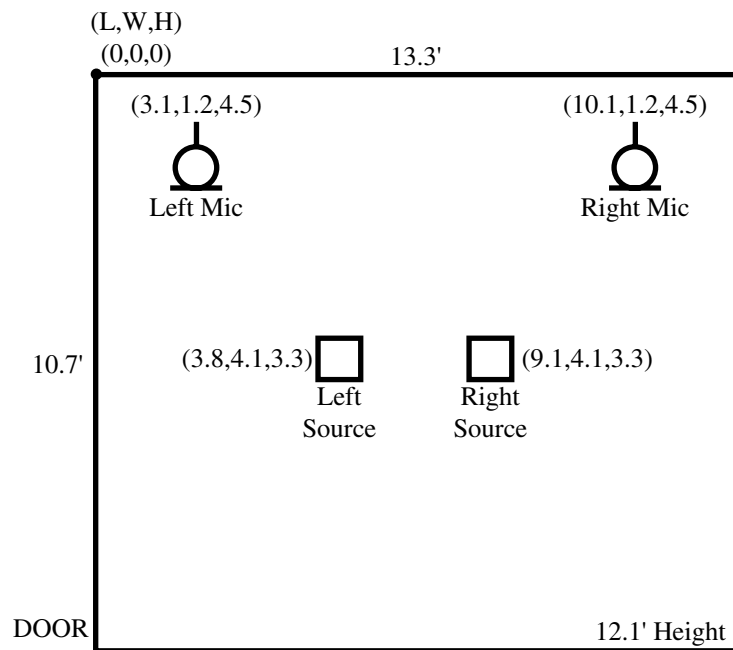


Figure 11: Schematic of recording setup.

The available impulse response files are

SmallRoom\_ImpResp\_16k\_LL.wav  
SmallRoom\_ImpResp\_16k\_LR.wav

SmallRoom\_ImpResp\_48k\_LL.wav  
SmallRoom\_ImpResp\_48k\_LR.wav

SmallRoom\_ImpResp\_16k\_RL.wav  
SmallRoom\_ImpResp\_16k\_RR.wav

SmallRoom\_ImpResp\_48k\_RL.wav  
SmallRoom\_ImpResp\_48k\_RR.wav

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## Stairwell

The stairwell is located on the New Mexico State University campus in the Klipsch School of Electrical and Computer Engineering on the second floor. Figs. 12(a) and (b) show the stairwell from two view points. Fig. 13 shows the schematic of recording setup with dimensions.



(a)



(b)

Figure 12: Stairwell viewed from (a) upstairs and (b) downstairs.

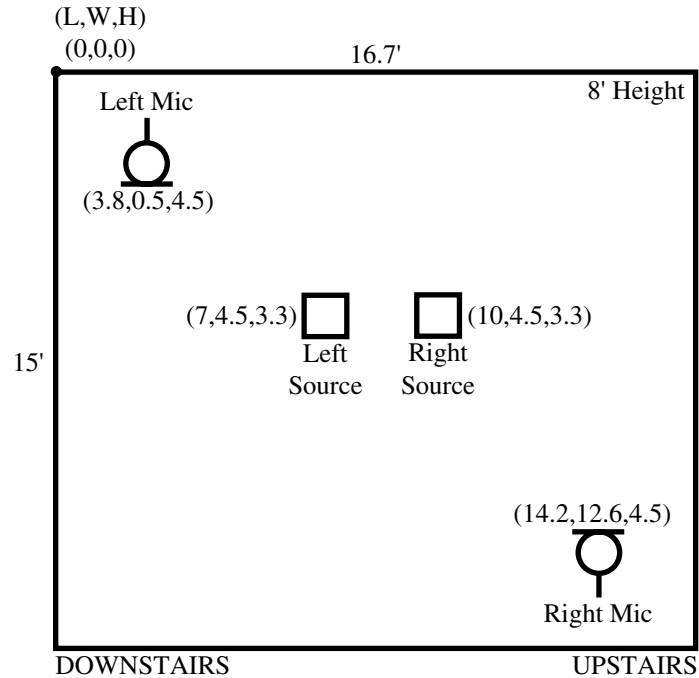


Figure 13: Schematic of recording setup.

The available impulse response files are

Stairwell\_ImpResp\_16k\_LL.wav  
 Stairwell\_ImpResp\_16k\_LR.wav  
 Stairwell\_ImpResp\_16k\_RL.wav  
 Stairwell\_ImpResp\_16k\_RR.wav

Stairwell\_ImpResp\_48k\_LL.wav  
 Stairwell\_ImpResp\_48k\_LR.wav  
 Stairwell\_ImpResp\_48k\_RL.wav  
 Stairwell\_ImpResp\_48k\_RR.wav

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## Study Lounge

The study lounge is located on the New Mexico State University campus in the Klipsch School of Electrical and Computer Engineering (Thomas and Brown, Room 102). Fig. 14 shows the study lounge. Fig. 15 shows the schematic of recording setup with dimensions.



Figure 14: Study lounge.

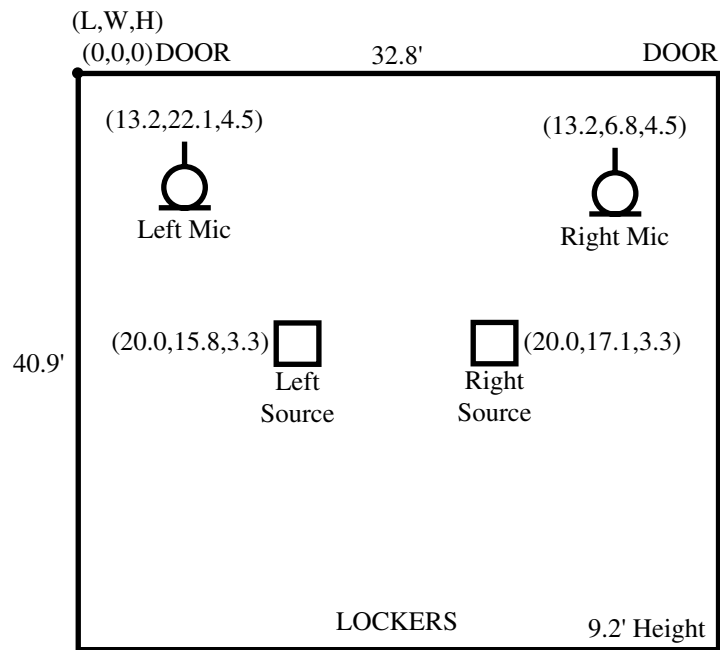


Figure 15: Schematic of recording setup.

The available impulse response files are

Study\_ImpResp\_16k\_LL.wav  
 Study\_ImpResp\_16k\_LR.wav  
 Study\_ImpResp\_16k\_RL.wav  
 Study\_ImpResp\_16k\_RR.wav

Study\_ImpResp\_48k\_LL.wav  
 Study\_ImpResp\_48k\_LR.wav  
 Study\_ImpResp\_48k\_RL.wav  
 Study\_ImpResp\_48k\_RR.wav