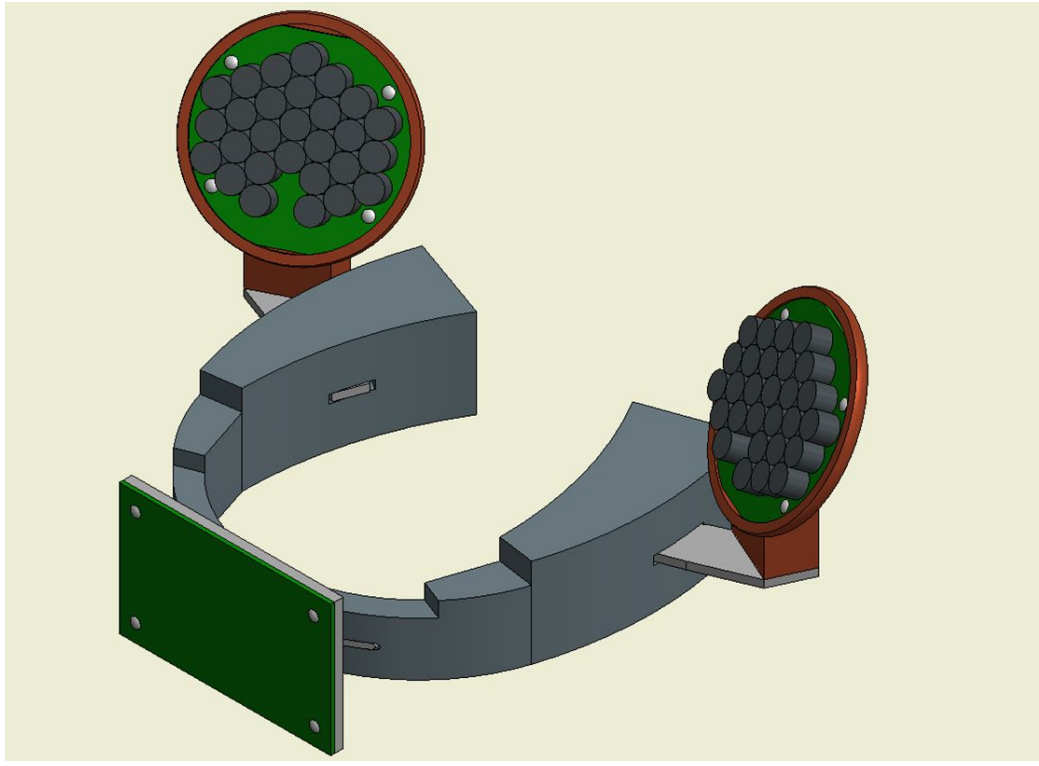
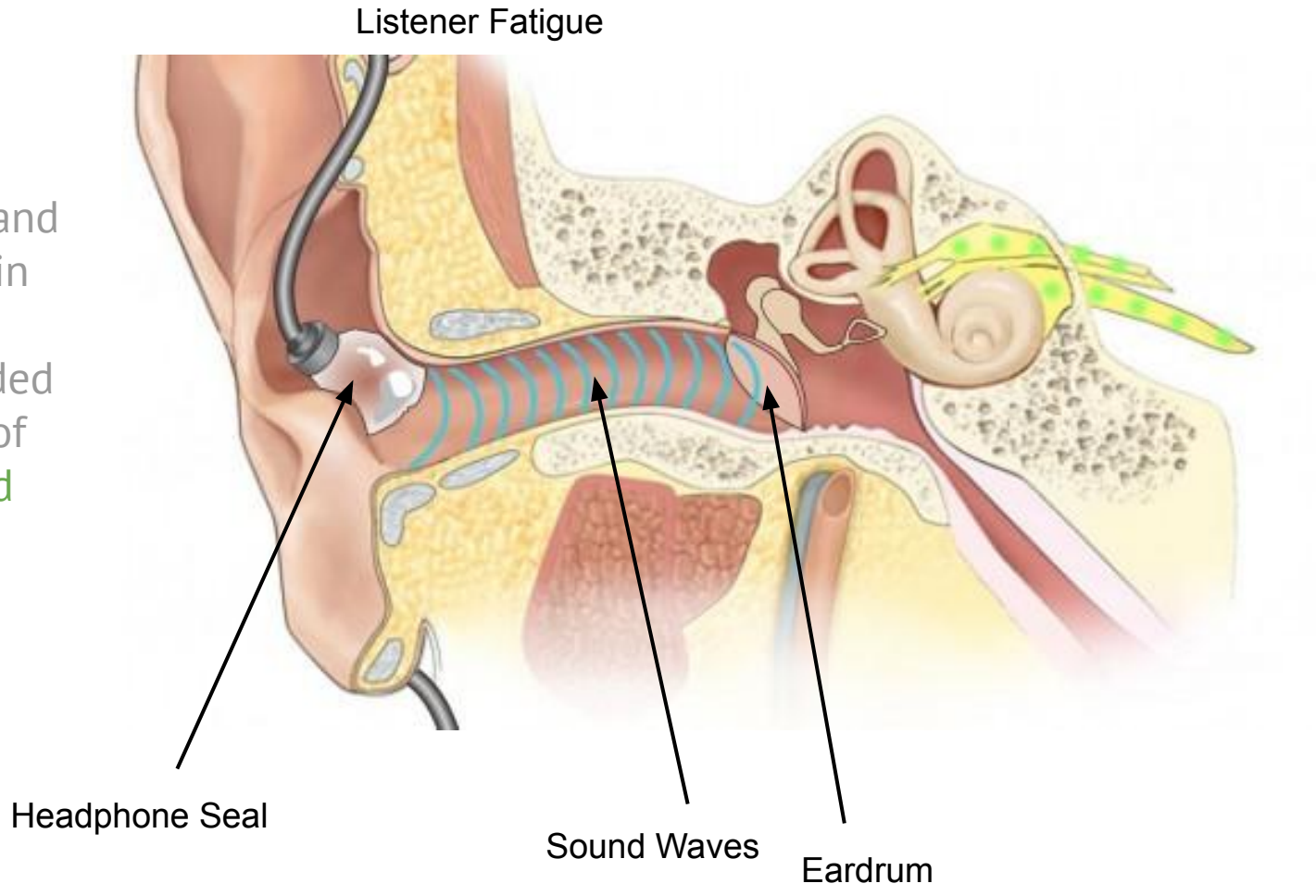


The Collarphone

By: Kevin Kang, Juan-Diego Florez

The Problem

Headphone earpieces cause soreness after around two hours of use according to consumer forums such as Head-fi, Ask.Metafilter, Giantbomb, Hydrogen Audio, and Yahoo Answers. According to research done in the University of Colorado, people in the United States who listen to music for extended periods of time with headphones complain of outer ear pain from both listener fatigue and unintentional crushing of the ear from an incorrect fit (University of Colorado).

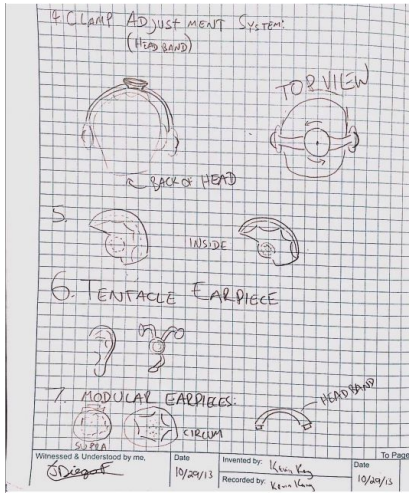


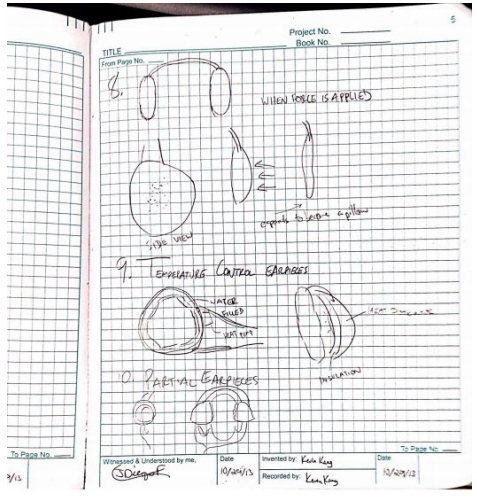
The Problem

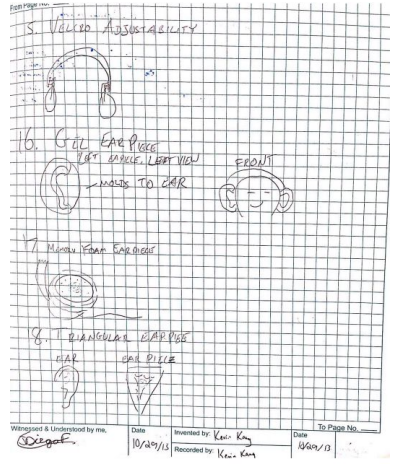
In Florida, headphones are mostly used by people between 10 and 21 years of age (Google Analytics), and, according to the forums previously mentioned, most users complain that they feel discomfort during and/or after headphone use. In a randomized survey of 30 people conducted at American Heritage School, around 90% of those interviewed complained of discomfort after extended (more than two hour) use.

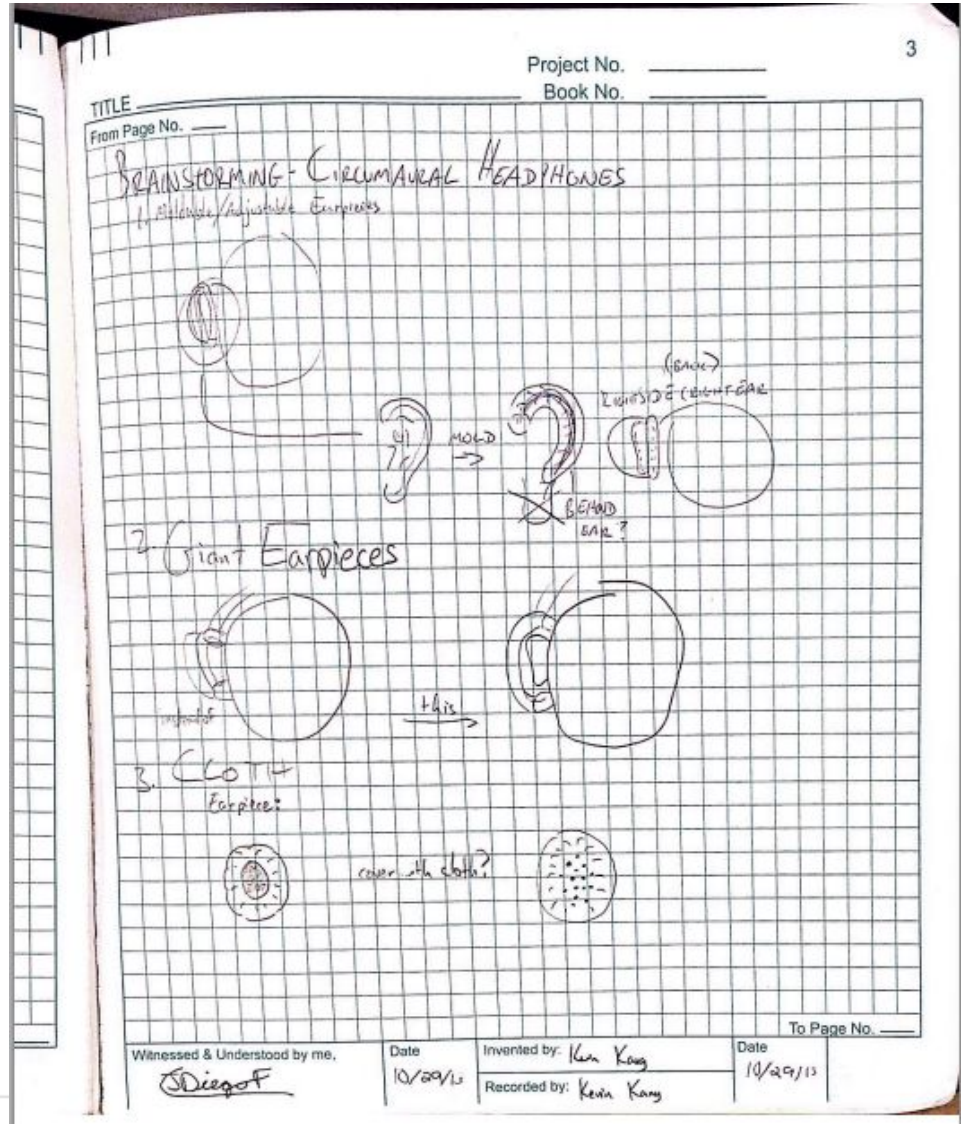
Brainstorming Sketches

We used hand sketches in order to understand each others' ideas and communicate them to others. These sketches allowed us to better understand our project and conceptualize solutions.









Previous Solutions: In-ear Headphones

Earbuds and In-ear Monitors

Pros:

- Put no pressure on the outer ear
- Do not cause ears to overheat
- Do not cause sweating
- Portable

Cons:

- Cause ear fatigue and pain
- Are more invasive than other alternatives
- Do not allow users to be aware of their surroundings

Previous Solutions: Semi-in-ear Headphones

Earphones

Pros:

- Put no pressure on the outer ear
- Do not cause ears to overheat
- Do not cause sweating
- Are not very invasive
- Portable
- Allow users to be aware of their surroundings

Cons:

- Cause ear fatigue and pain
- Get uncomfortable very quickly

Previous Solutions: Over-ear Headphones

Circumaural Headphones

Pros:

- Are not invasive
- Do not cause ear fatigue
- Can be open or closed, allowing some awareness
- Isolate the sound well

Cons:

- Press on the outer ear and the sides of the head
- Can cause overheating and sweating
- Not very portable

Supra-aural Headphones

Pros:

- Are not invasive
- Do not cause ear fatigue
- Can be open or closed, allowing some awareness
- Tend to be the most comfortable

Cons:

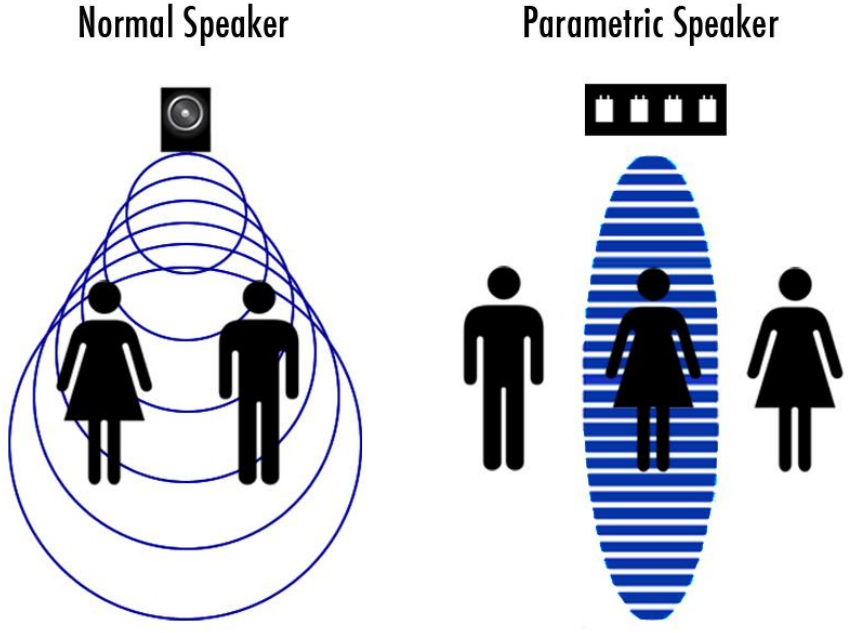
- Press solely on the outer ear
- Can cause overheating and sweating
- Can slip off easily
- Are not portable

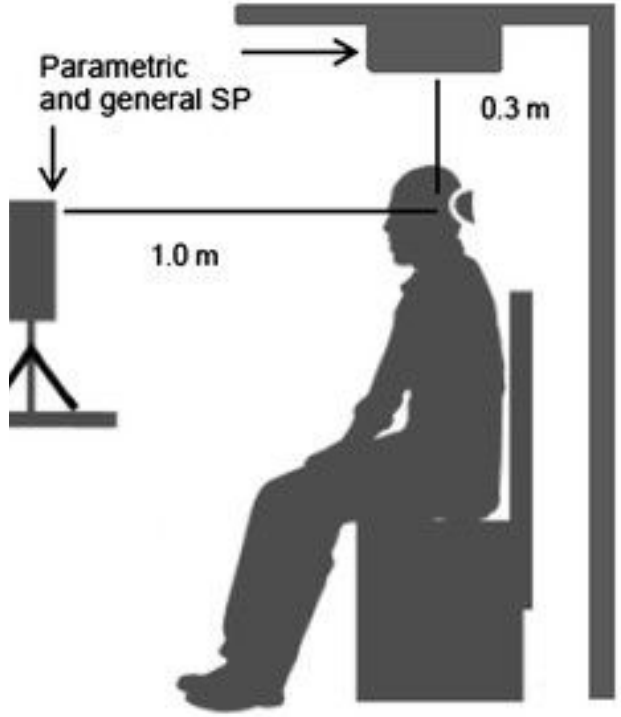
Previous Solutions: Soundlazer

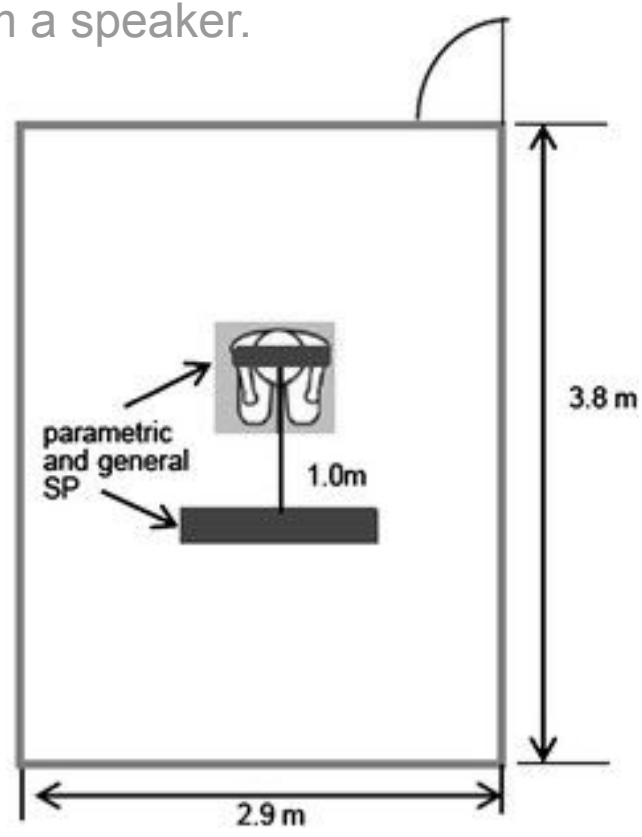
The Soundlazer project is a low-cost, open source, parametric speaker array that allows users to utilize ultrasonic waves to transmit audio in a beam. Soundlazer started as a Kickstarter project and since its release it has been popular with all users. The Soundlazer can be used for experimentation and innovation because all of the design files and programming instructions come with the speaker.

Parametric speakers use transducers, which at 100 to 110 dBSPs alter the speed of sound in the air that it passes through. A listener outside the beam hears nothing.

Regular loudspeakers do not allow this as sound radiates in all directions from a speaker.



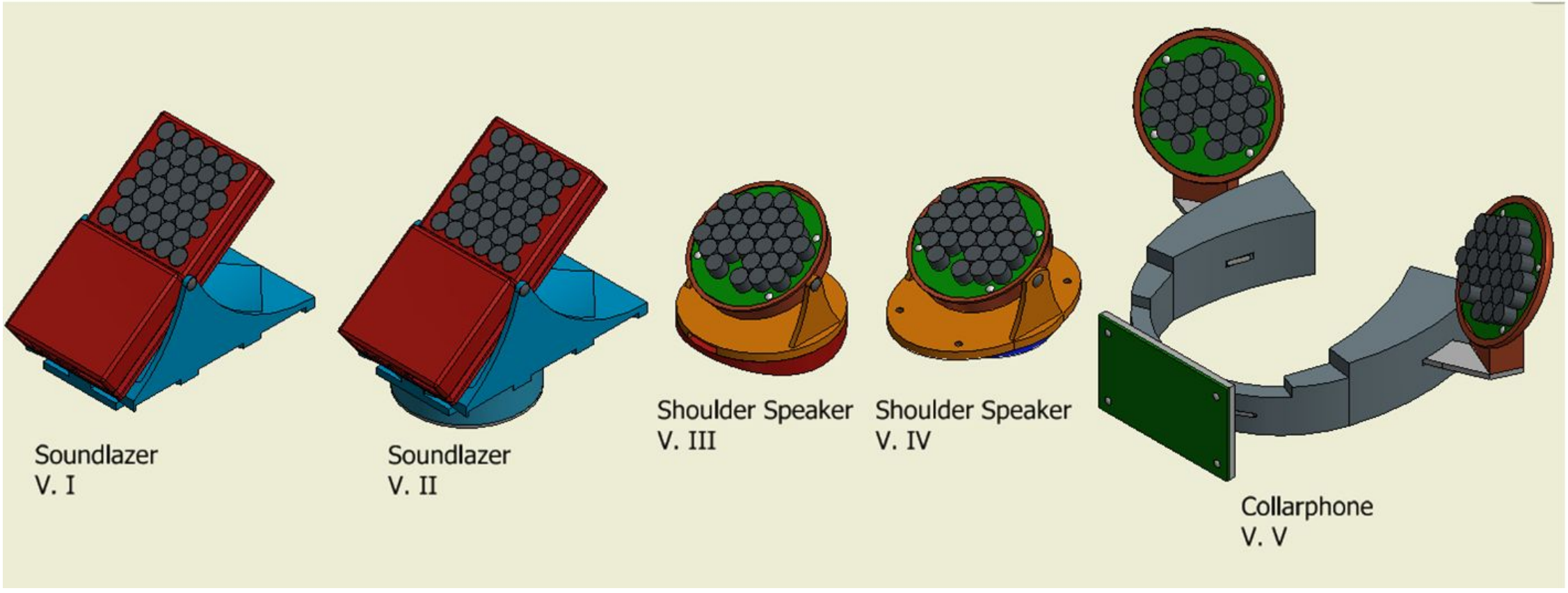




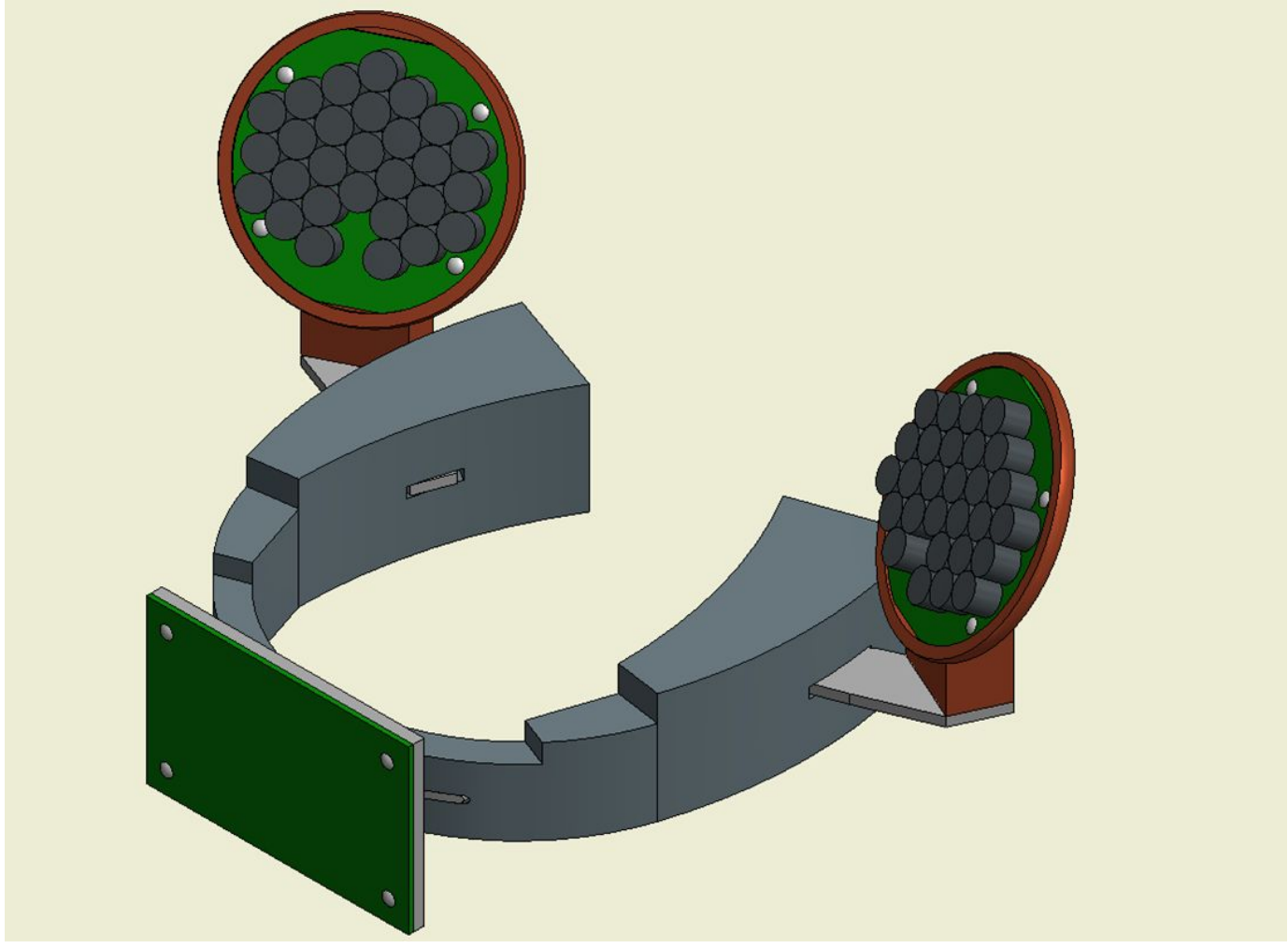
Design Matrix

Idea	Comfort	Weight	Mounting Time	Ease of Use	Contact with Ear/Head	Sound Quality	Sound Isolation	Noise Cancellation	Size	Portability	Cost of Production vs Consumer Interest	Personal Preference	TOTAL:
Shoulder-Mounted Parametric Speaker Array	5	3	4	5	5	4	3	1	5	5	4	5	**49**
Custom-Noise-Canceling Earpieces	4	3	3	5	1	5	5	5	4	5	4	5	49
Sound Dome Headband	2	3	3	4	3	5	5	1	1	2	2	2	33
Hook Headphones	4	5	2	3	3	3	3	2	5	5	4	3	42

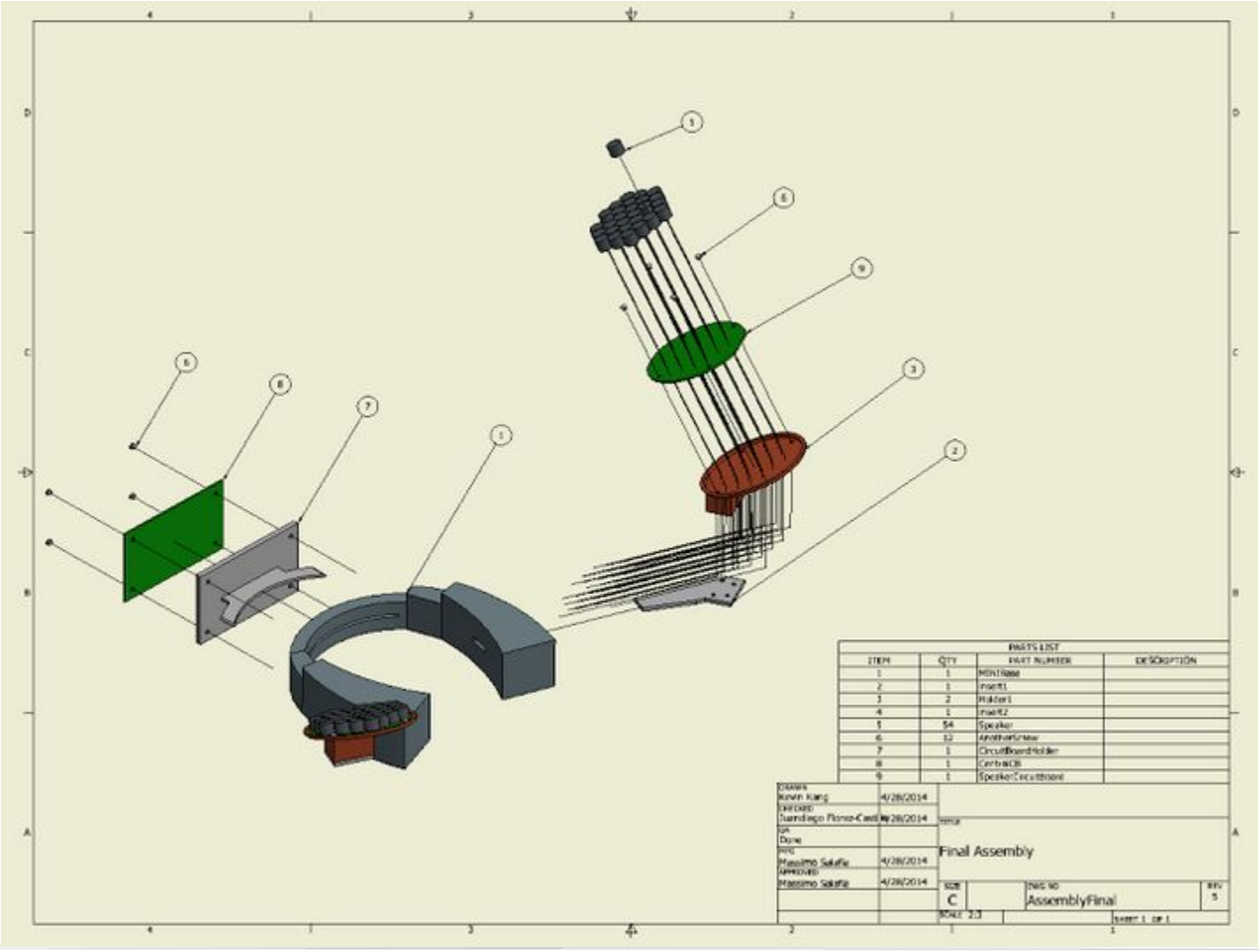
Design Evolution



Collarphone Assembly



The Collarphone is meant to be worn around the neck, projecting sound from two parametric speaker arrays on both sides of the Collarphone.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QTY
PART NUMBER
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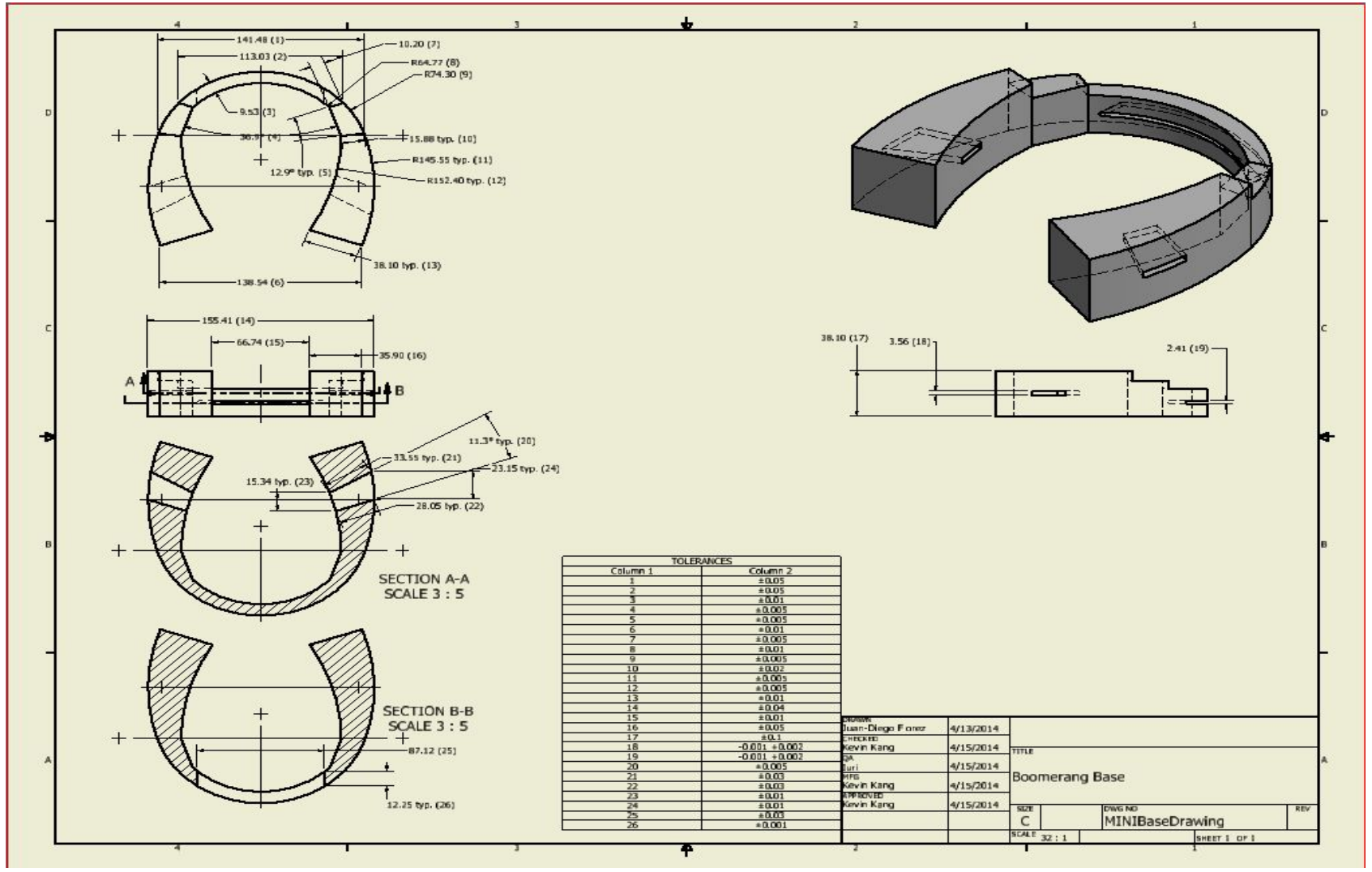
2 1 ment1
3 2 Holder1
4 1 ment2
5 54 Speaker
6 12 AntiVortex
7 1 CircuitBoardHolder
8 1 Carbac3i
9 1 SpeakerCircuitBoard
Kevin Kang 4/28/2014
Juandiego Flores-Cast 4/28/2014
Done
Massimo Saluffo 4/28/2014
Massimo Saluffo 4/28/2014
Final Assembly
SIZE
C
DWG NO
AssemblyFinal
REV
5
SCALE 2:3
SHEET 1 OF 1

MINI Base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113.03 (2)
10.20 (7)
R64.77 (8)
R74.30 (9)
9.53 (3)
15.88 typ. (10)
R145.55 typ. (11)
12.9° typ. (5)
R152.40 typ. (12)
38.10 typ. (13)
138.54 (6)
155.41 (14)
66.74 (15)
35.90 (16)
A
B
11.3° typ. (20)
33.55 typ. (21)
23.15 typ. (24)
15.34 typ. (23)
28.05 typ. (22)
SECTION A-A
SCALE 3 : 5
SECTION B-B
SCALE 3 : 5
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12.25 typ. (26)
38.10 (17)
3.56 (18)
2.41 (19)
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Column 2
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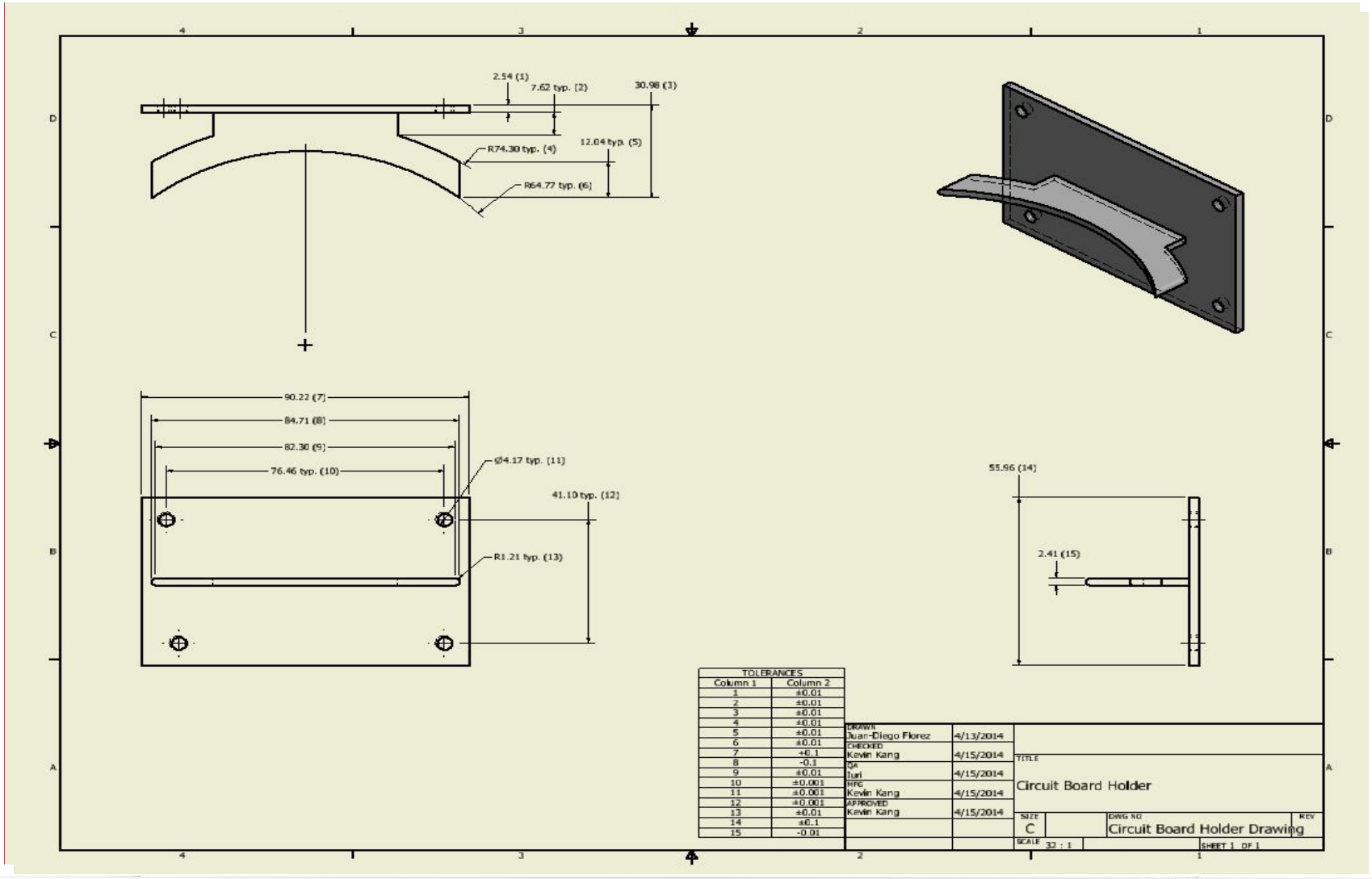
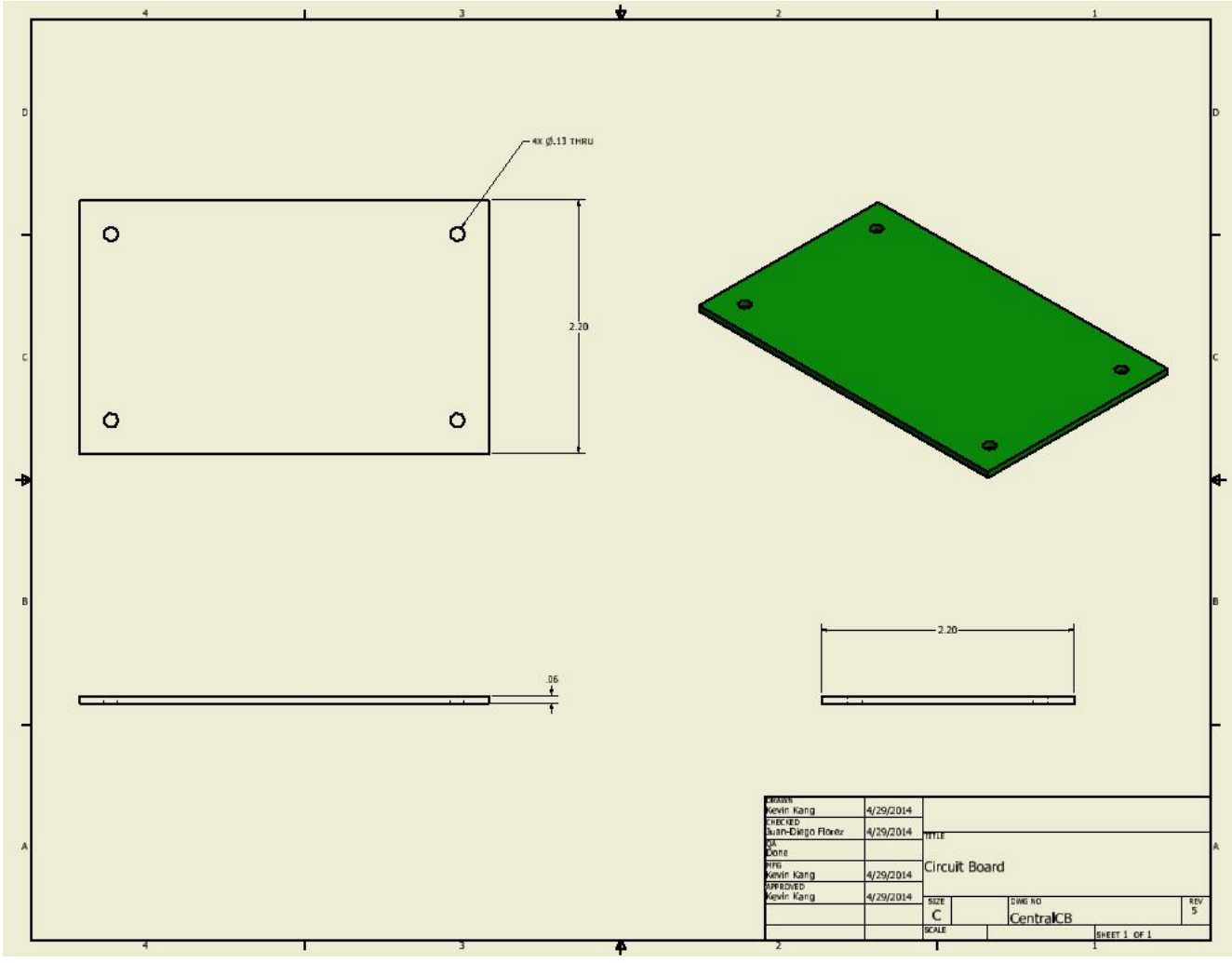
2 ±0.05
3 ±0.01
4 ±0.005
5 ±0.005
6 ±0.01
7 ±0.005
8 ±0.01
9 ±0.005
10 ±0.02
11 ±0.005
12 ±0.005
13 ±0.01
14 ±0.04
15 ±0.01
16 ±0.05
17 ±0.1
18 -0.001 +0.002
19 -0.001 +0.002
20 ±0.005
21 ±0.03
22 ±0.03
23 ±0.01
24 ±0.01
25 ±0.03
26 ±0.001
DRAWN Juan-Diego Florez 4/13/2014
CHECKED Kevin Kang 4/15/2014
QA Juri 4/15/2014
MFG Kevin Kang 4/15/2014
APPROVED Kevin Kang 4/15/2014
TITLE
Boomerang Base
SIZE C
DWG NO MINIBaseDrawing
REV
SCALE 32 : 1
SHEET 1 OF 1

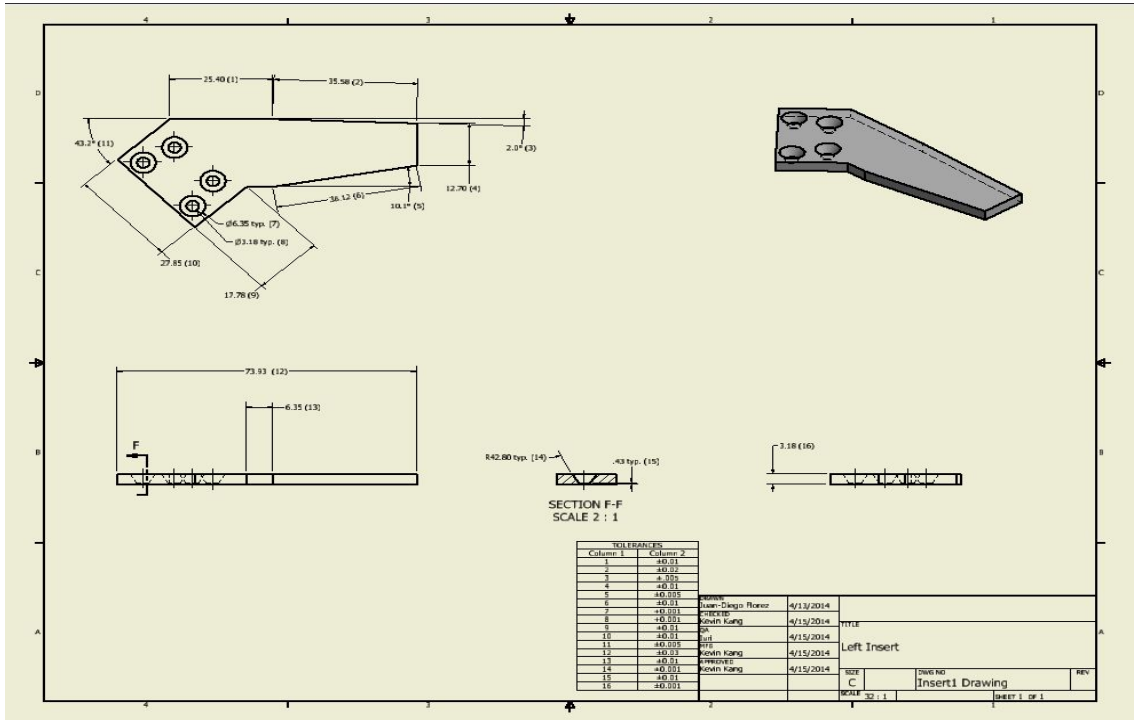
Circuit Board Holder



Central Circuit Board



Inserts



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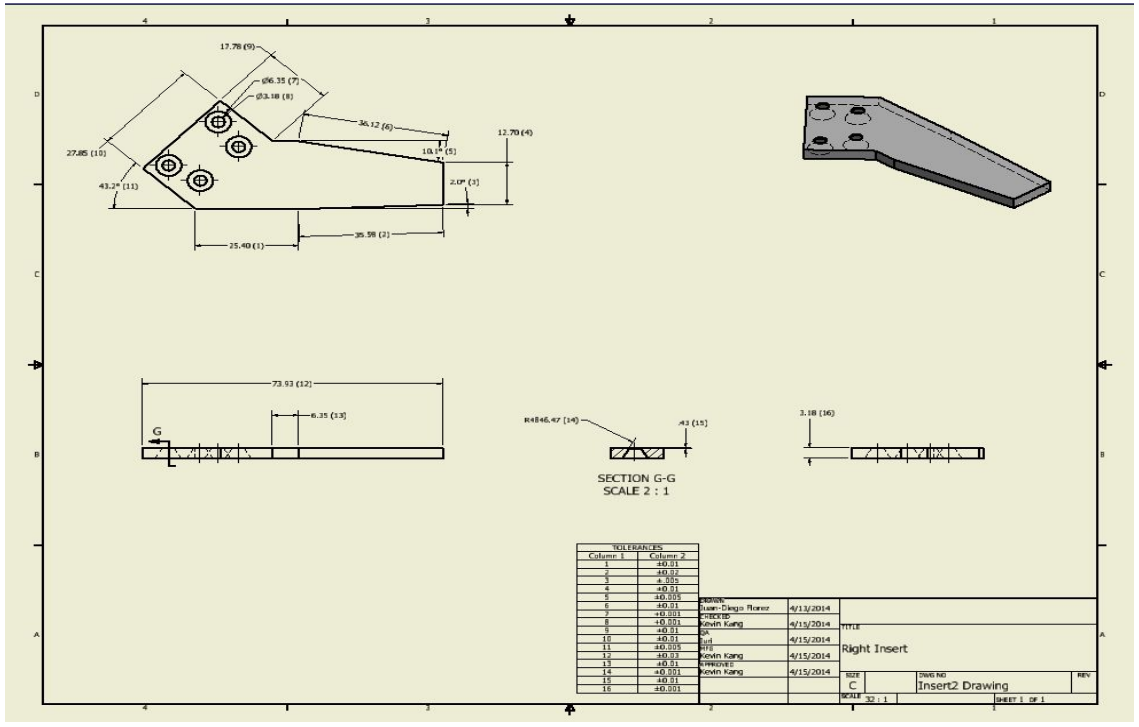
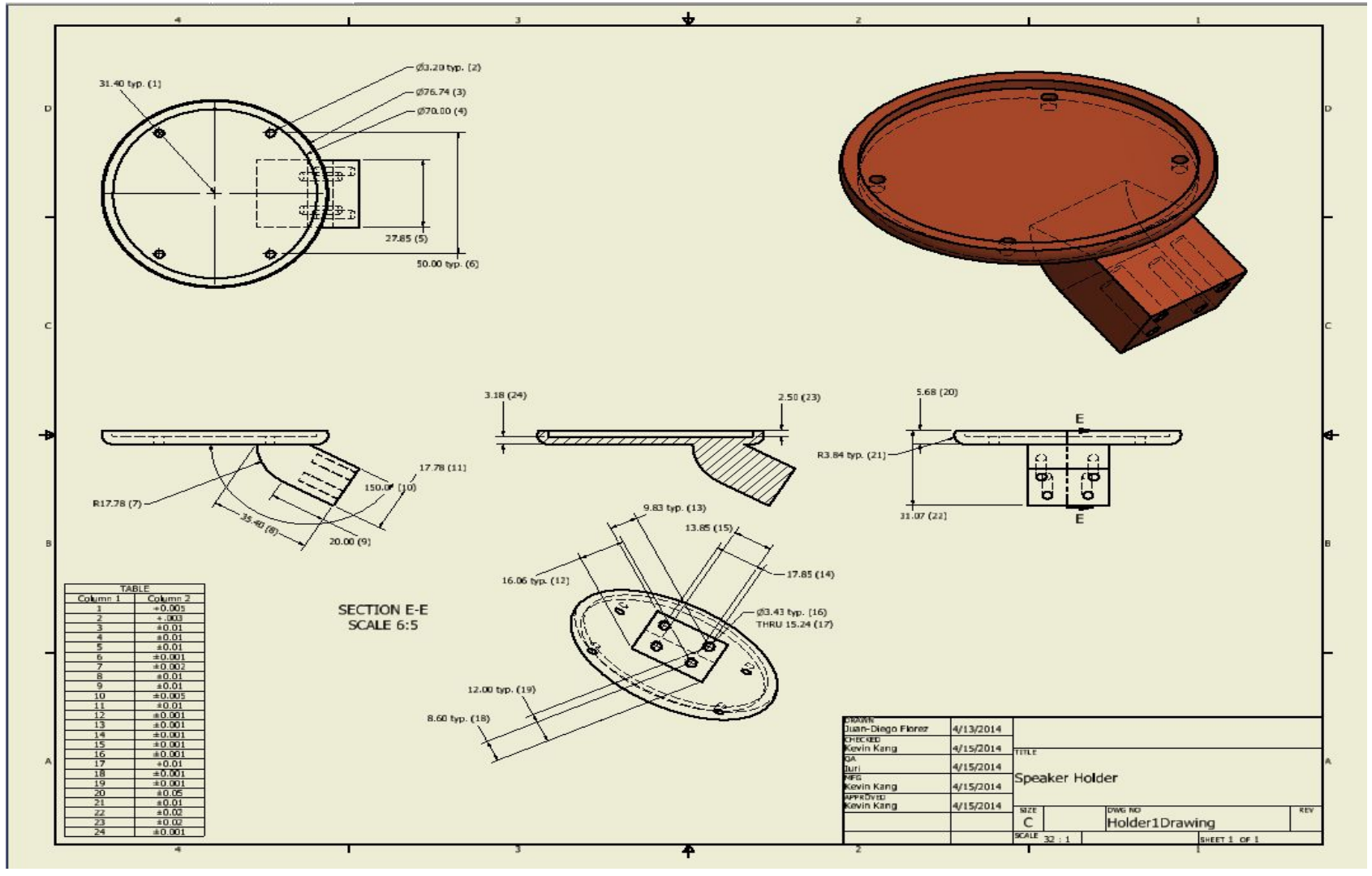
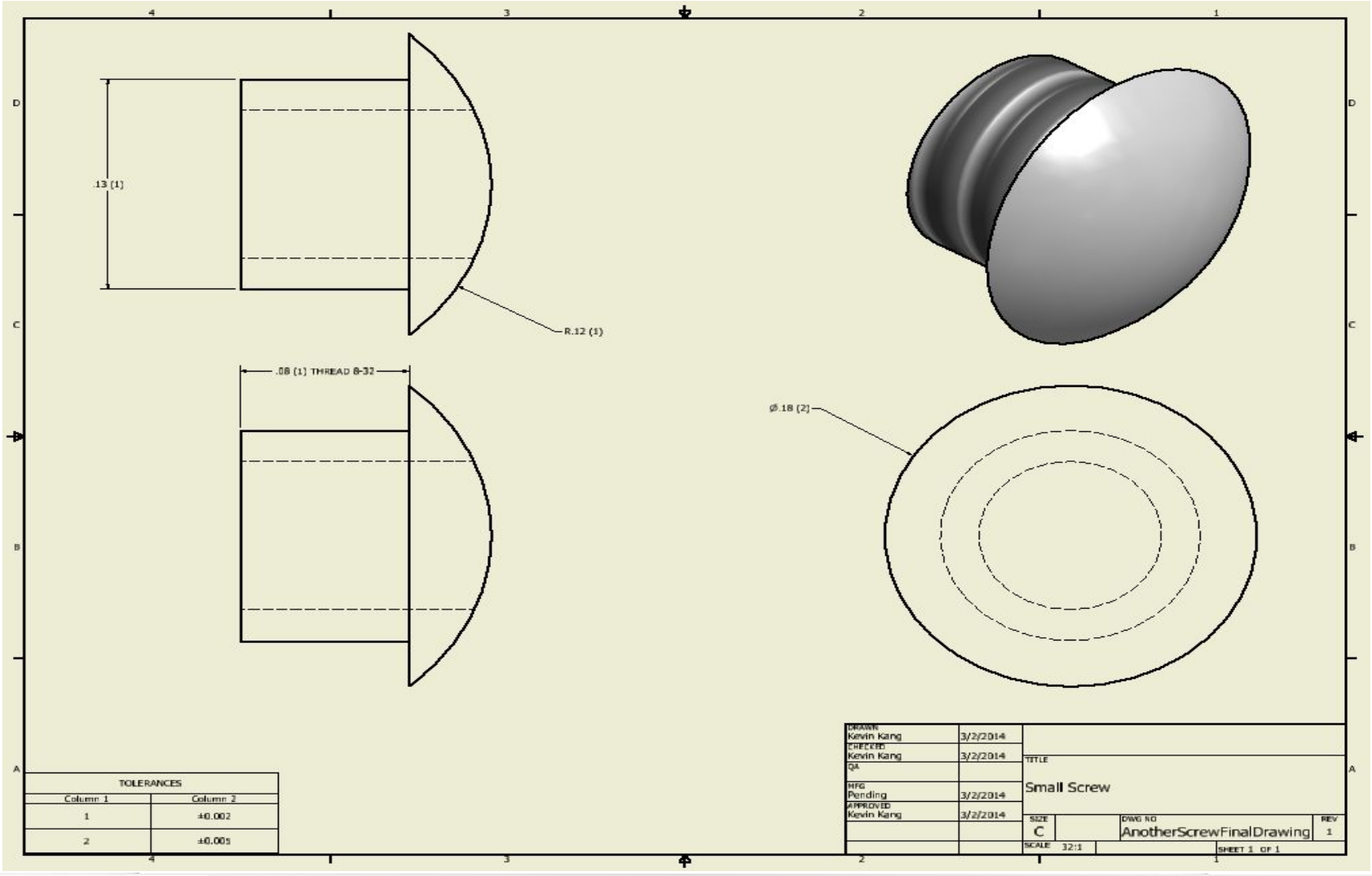


Right Insert

Speaker Holder



Screw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R.12 (1)
.08 (1) THREAD 8-32
Ø.18 (2)
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Column 2
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2
±0.005
DRAWN
Kevin Kang
3/2/2014
CHECKED
Kevin Kang
3/2/2014
QA
MFG
Pending
3/2/2014
APPROVED
Kevin Kang
3/2/2014
TITLE
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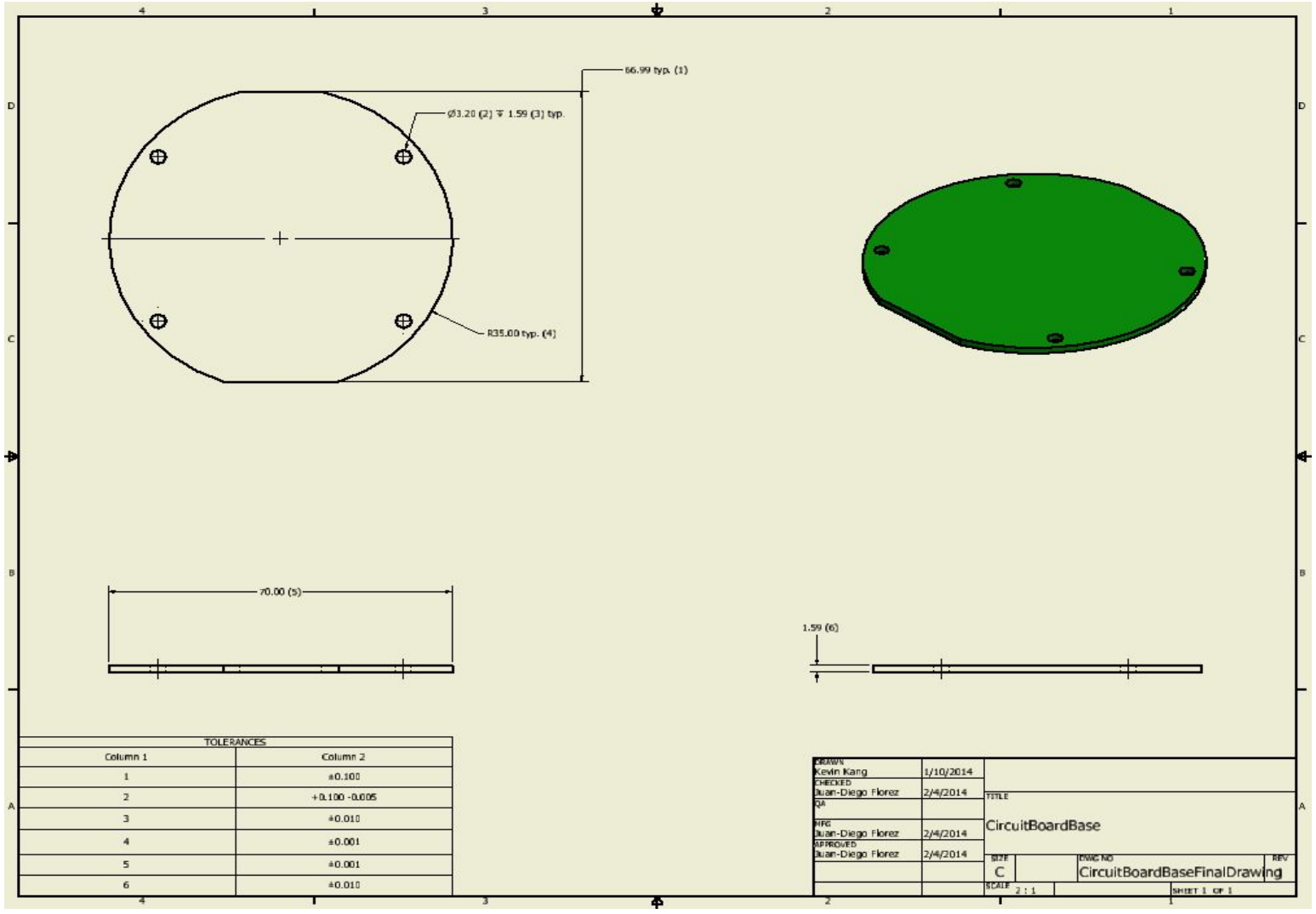
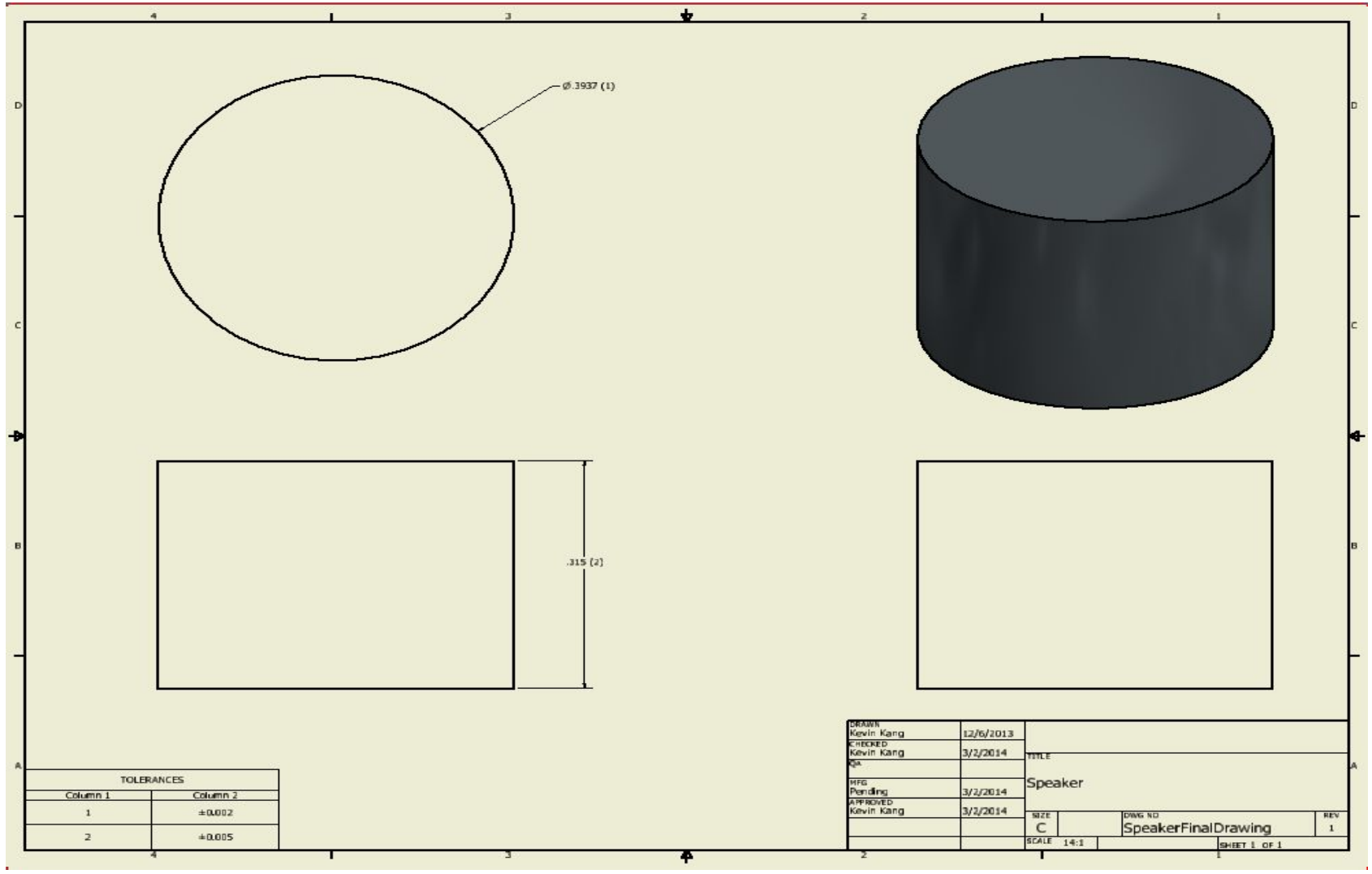
SIZE
C
DWG NO
AnotherScrewFinalDrawing
REV
1
SCALE
32:1
SHEET 1 OF 1

Speaker Board



Speaker


Ø.3937 (1)
.315 (2)
TOLERANCES
Column 1
Column 2
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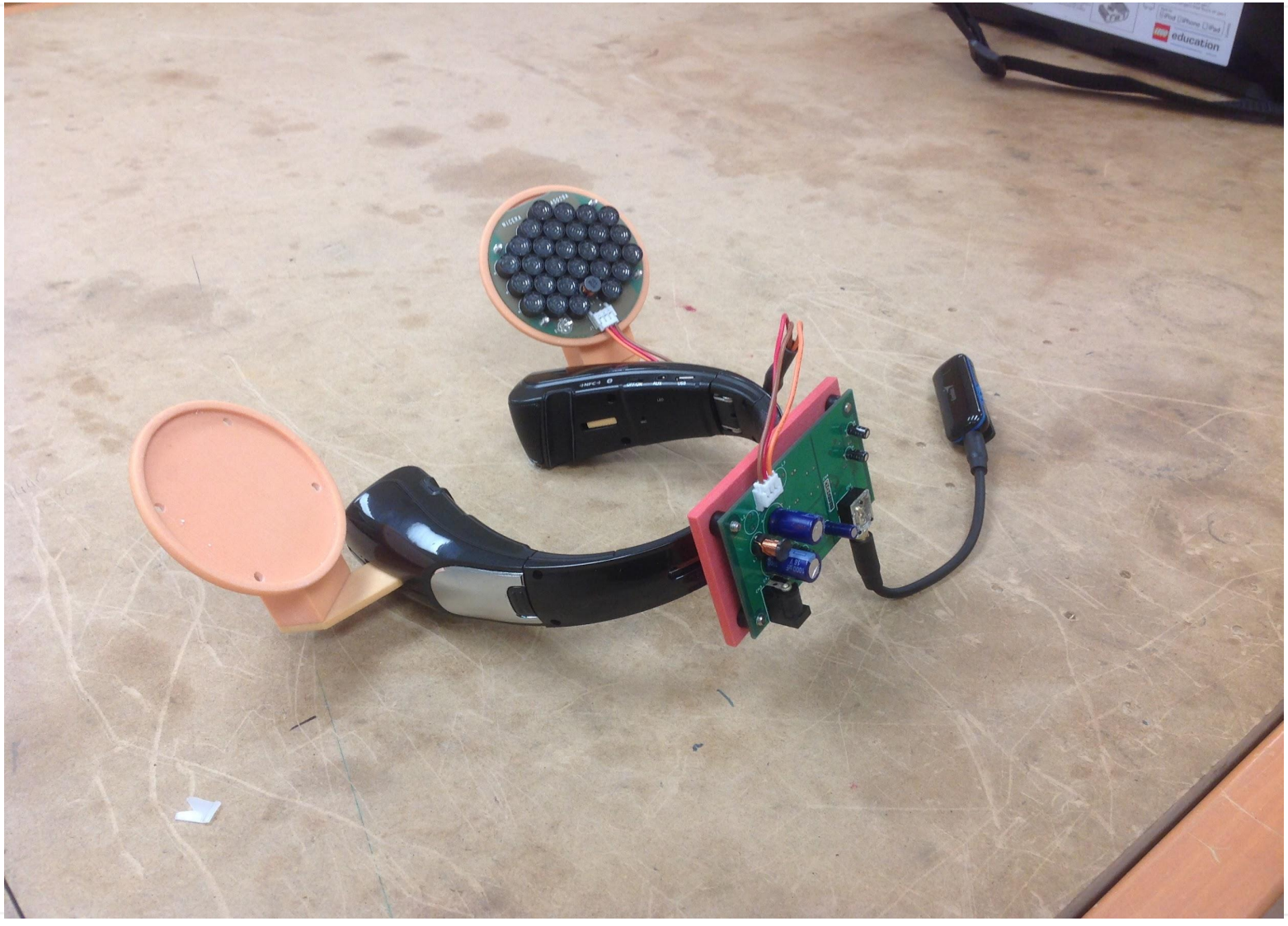
±0.002
2
±0.005
DRAWN
Kevin Kang
12/6/2013
CHECKED
Kevin Kang
3/2/2014
MFG
Pending
3/2/2014
APPROVED
Kevin Kang
3/2/2014
TITLE
Speaker
SIZE
C
DWG NO
SpeakerFinalDrawing
REV
1
SCALE 1:1
SHEET 1 OF 1

Of the many materials that could be used to make the main base and speakers holders, thermoplastics would be the best because of their flexibility and ability to be molded into many various shapes. In addition, thermoplastics are cheap, which makes them easier to procure. For comfort, thermoplastics would be best because they have a low coefficient of friction, which helps to keep the user's skin from irritating. A silicon-based material should be used in order to keep the user comfortable during use.

Prototype



Prototype

Thank you