Mobile Anechoic Test Chamber

Team: 506

Nick Ajhar, Marissa Jackson, Bryce Lankford

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Team Introductions

Marissa Jackson
Project Manager

Bryce Lankford
Systems Engineer

Nick Ajhar
Mechanical Engineer

Sponsor

This engineering project, "Mobile Anechoic Test Chamber," is funded by Danfoss Turbocor.

Objective

Design a way to efficiently and consistently record sound power for centrifugal compressors while managing surrounding noise

Project Background

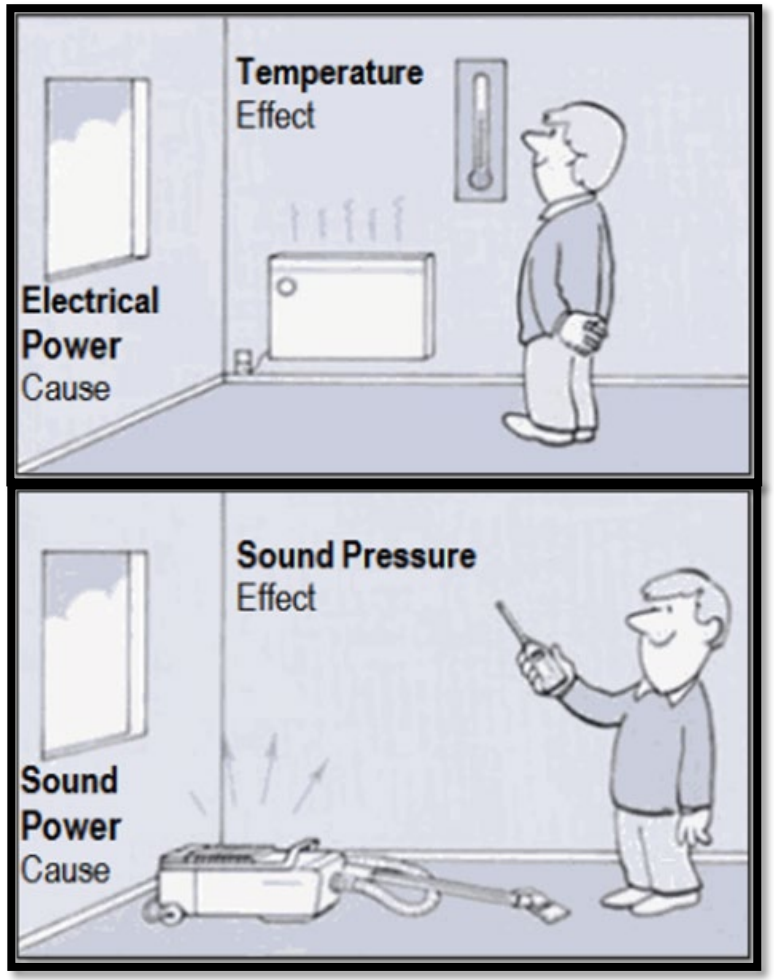
Nick Ajhar

Centrifugal Compressors

- TT Series
  - 4 Different Models: 300, 350, 400, 700
- Capacities: 211-702 kW
- R134a refrigerant
- Quiet Operation (92 dB)
- Background noise (78 dB)

Sound Power

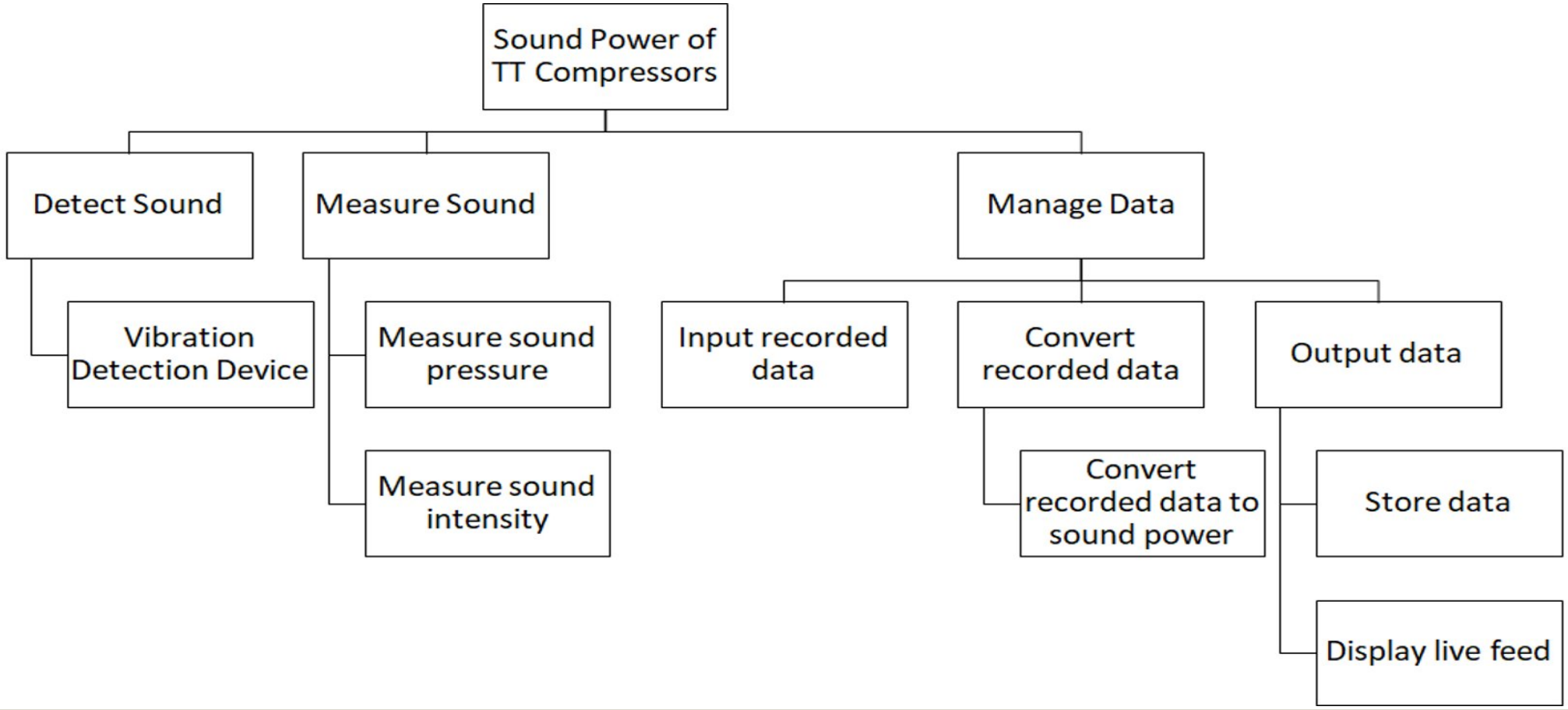
- Rate at which sound is emitted
- Measured in Watts (W)
- Deviated from sound pressure (dB)
- Indicator for how intense the sound of a machine will be



Project Summary

- Measure the sound power of the TT series compressors
- Sound power is the energy emitted by the source and is measured in Watts
- Reduce the surrounding sound to get a consistent reading from the compressors
- Must be able to be easily assembled and portable

Functional Decomposition

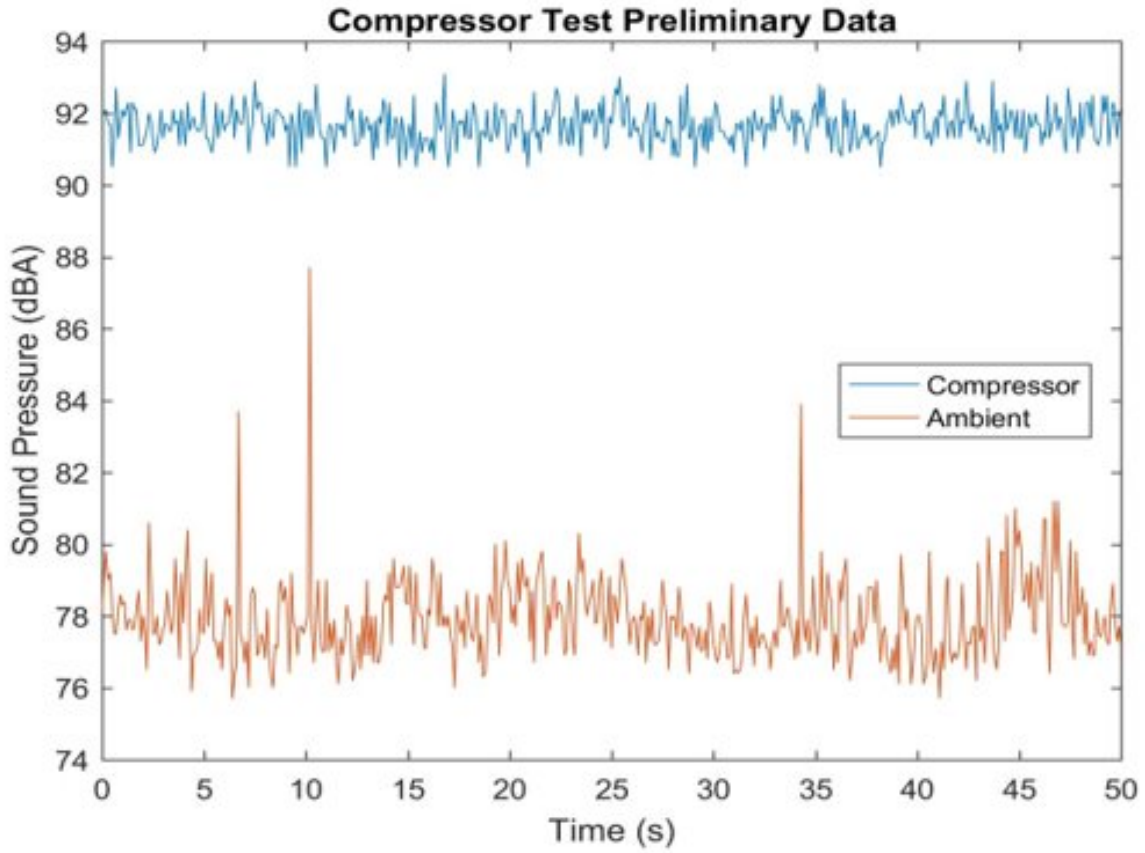


Concept Generation

Nick Ajhar

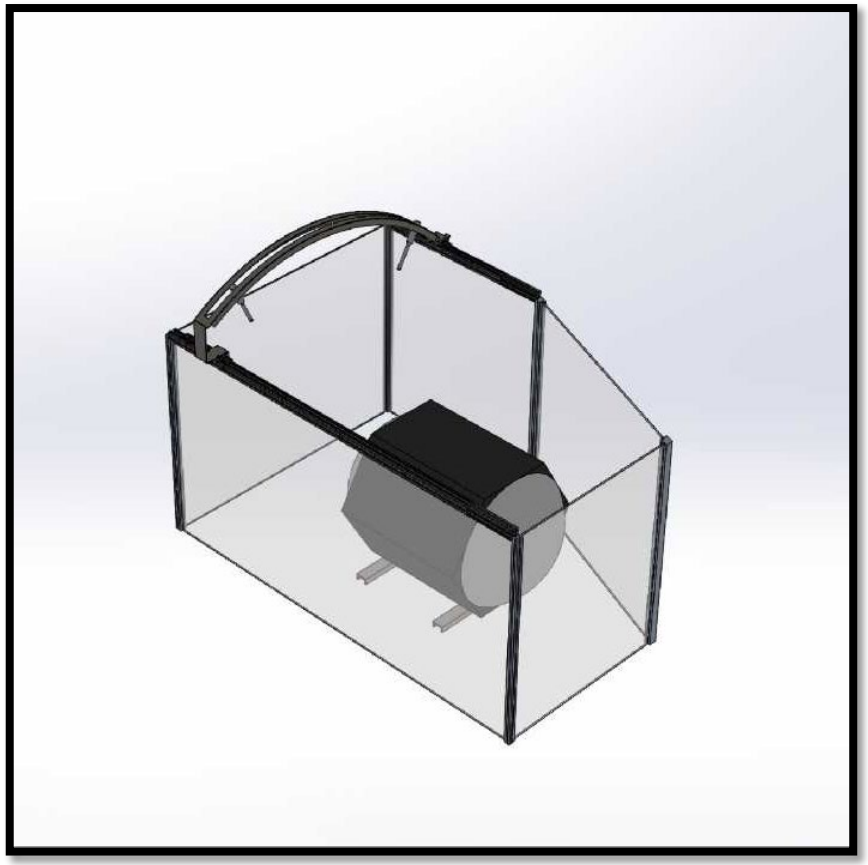
Ambient Noise

- ISO 3746
  - Background noise must be greater than 3dB below the mean sound pressure level of source
- Low pass filter will be used for unwanted sounds



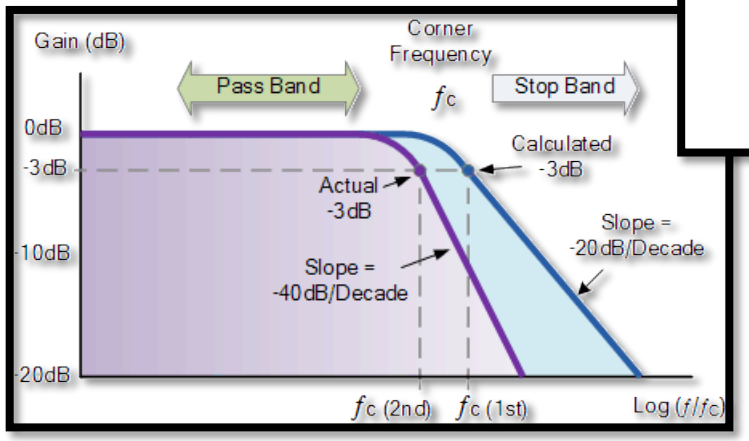
Sound Recording

- Array of Microphones
  - 2 microphones equidistant around compressor
  - Microphones can be moved to different locations about arc
  - Can map sound intensity at specific points on compressor



Conversion to Sound Power

- Direct connection from microphones to computer
- Program to convert data to sound power after initial data is converted to decibels
- Low pass filter removes unwanted noise from data



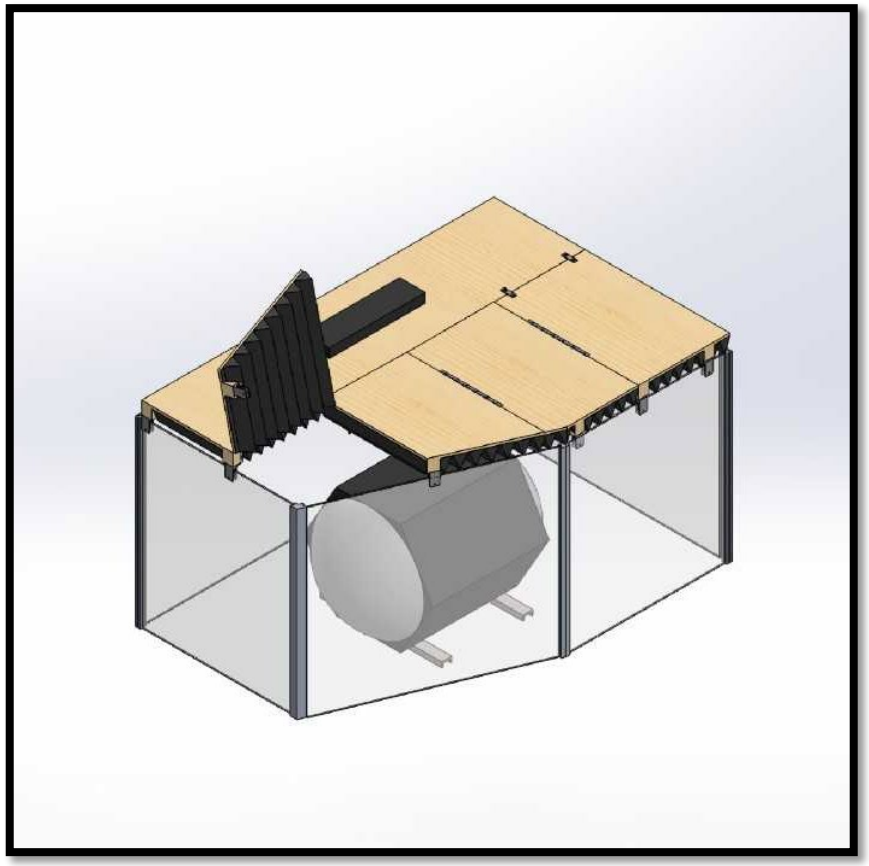
Embodiment

Bryce Lankford

Acquiring Materials

Part Name	Part Number	Quantity	Ordered	Ordered Date	Cost	Expected delivery
Microphone (1/2")	SD506001	2	Yes	2/15/2019	$ 495.00	3/1/2019
Digital ICP – USB Signal Conditioner	SD506002	1	Yes	2/15/2019	$ 950.00	3/15/2019
BNC Cable (6 Feet)	SD506003	2	Yes	2/6/2019	$ 8.95	2/8/2019
Sleeve Bearing Carriage	SD506004	2	Yes	2/6/2019	$ 95.85	2/13/2019
Guide Rail (250mm)	SD506005	2	Yes	2/6/2019	$ 20.00	2/13/2019
M5 Fastener (Pack of 4)	SD506006	1	Yes	2/6/2019	$ 4.27	2/13/2019
Microphone holder (Clip)	SD506007	2	Yes	2/6/2019	$ 5.95	2/13/2019
M4 Fastener (Pack of 25)	SD506008	1	Yes	2/6/2019	$ 4.13	2/13/2019
				Sum	$ 2,293.34	

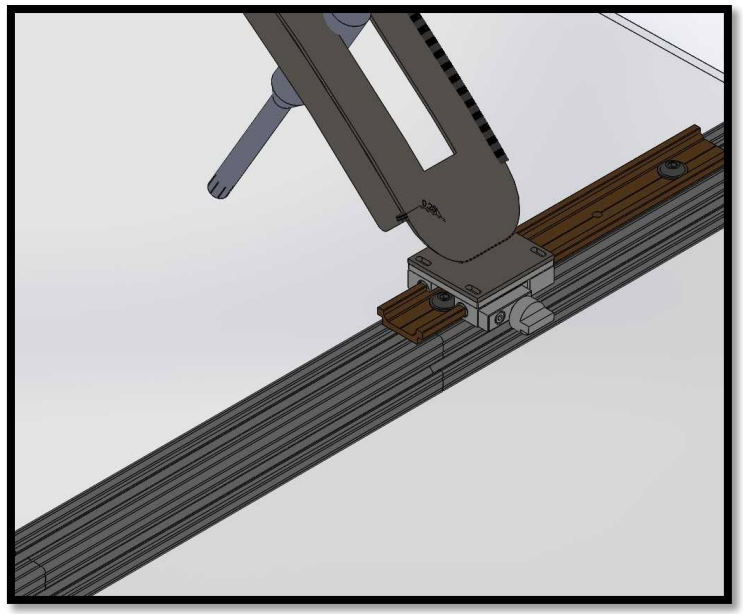
Design Overview



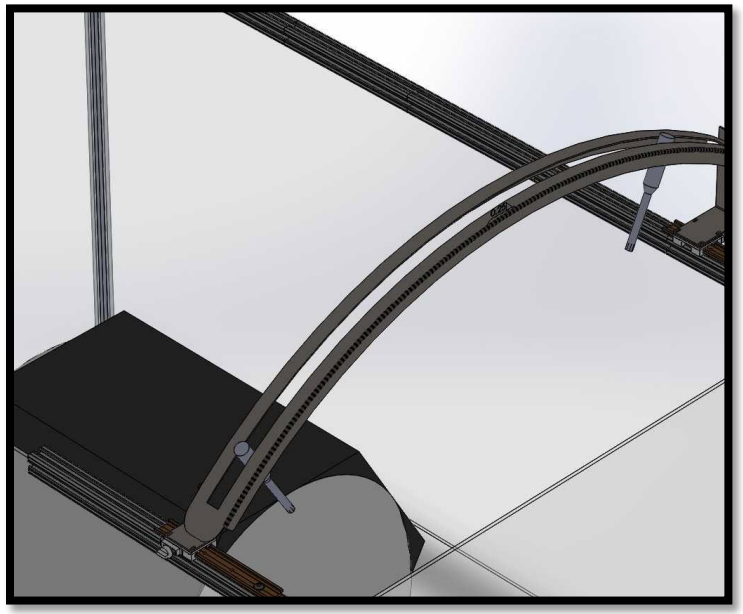
- Smaller structure for holding microphones
- No need for anechoic foam
- Movable microphones

- Better accessibility to compressor
- Consistent radius for microphone placement
- Room for additions

Detailed Design



- Sliding mechanism to maneuver array to different positions
- Arc is welded to plate on sleeve carriage
- Track fits 80/20 posts



- Microphones can be positioned into different slots on arc
- Slots will be at 10° increments
- More microphones can be added

Future Work

- Program the microphones and DAQ system
- Cut and shape steel frame for microphone arc
- Create testing protocol
- Develop risk assessment
- Calibrate and test microphone system
- Test overall design
- Engineering Design Day

Questions?

Most Important Points from this Lecture

1. The quick brown fox jumps over the lazy dog.
2. The quick brown fox jumps over the lazy dog.
3. The quick brown fox jumps over the lazy dog.
4. The quick brown fox jumps over the lazy dog.
5. The quick brown fox jumps over the lazy dog.
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Reference

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Questions (be sure to design your own)

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