The FabLab Classroom

Learning Middle School Science

through Engineering Design and Manufacturing

The FabLab Classroom

The FabLab Classroom adapts Gershenfeld's concept of a fabrication laboratory (Fab Lab) for integration into K-12 classrooms.

A full fledged Fab Lab for a university or community can cost more than $100,000.

A new generation of inexpensive fabrication technologies suitable for K-12 classrooms is now emerging.

The FabLab Classroom

- Advanced Manufacturing
- Desktop Manufacturing
- Digital Fabrication

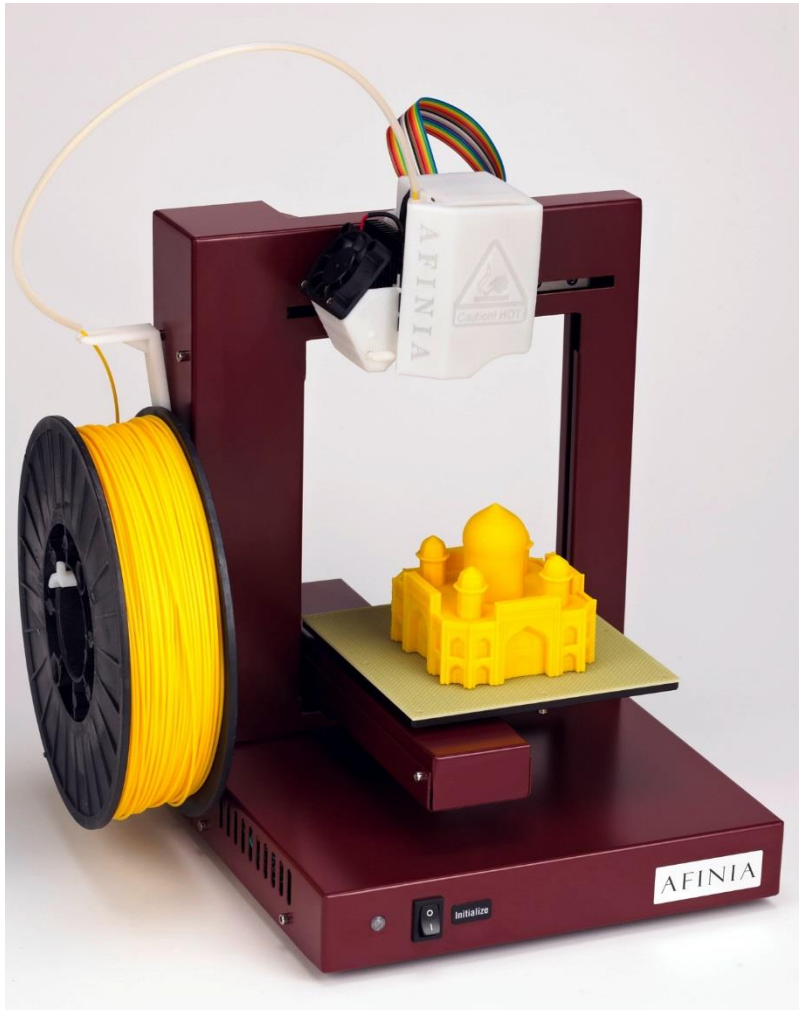
The FabLab Classroom

The Fab@School 3D printer developed through the FabLab Classroom initiative was the first 3D printer designed explicitly for K-12 schools.

It could be assembled in less than a day with only $1,000 in parts.

The FabLab Classroom

Today, compact desktop 3D printers suitable for K-12 classrooms can be acquired fully assembled for less than $2,000.



The FabLab Classroom

Other affordable desktop manufacturing technologies such as computer controlled die cutters extend possibilities for advanced manufacturing in the K-12 classroom.

The FabLab Classroom

Integrate engineering concepts into science instruction to allow students to learn science in a meaningful context.

Prepare students for high-tech jobs in a competitive global economy:

- The Commonwealth of Virginia forecasts over 6,800 jobs in advanced manufacturing by 2017.
- Each of these positions is estimated to generate an additional 16 ancillary jobs.

Laboratory School for Advanced Manufacturing

- Funding provided through the NSF FabLab Classroom, the Commonwealth of Virginia, and Charlottesville City Council (federal, state, and local funding)
- Construction will begin June 6, on Buford Middle School and open, August 21, 2013
- It is not designed as a magnet school; all students will have the opportunity to participate.
- The high school will open a year later; the same technologies found in the University's Center for Advanced Manufacturing – 3D printers and mechatronics systems – will be replicated in the Laboratory School

Laboratory School for Advanced Manufacturing

The high school, middle school, and university will be connected by an always-on video conferencing link.

Current Curricular Activities

- Force and motion
- Electricity and magnetism
- Periodic motion

Periodic Motion

- Sound Waves unit
- 8th Grade Physical Science
- Physical Representations
- Mixed Reality Systems
- Engineering Design through Advanced Manufacturing

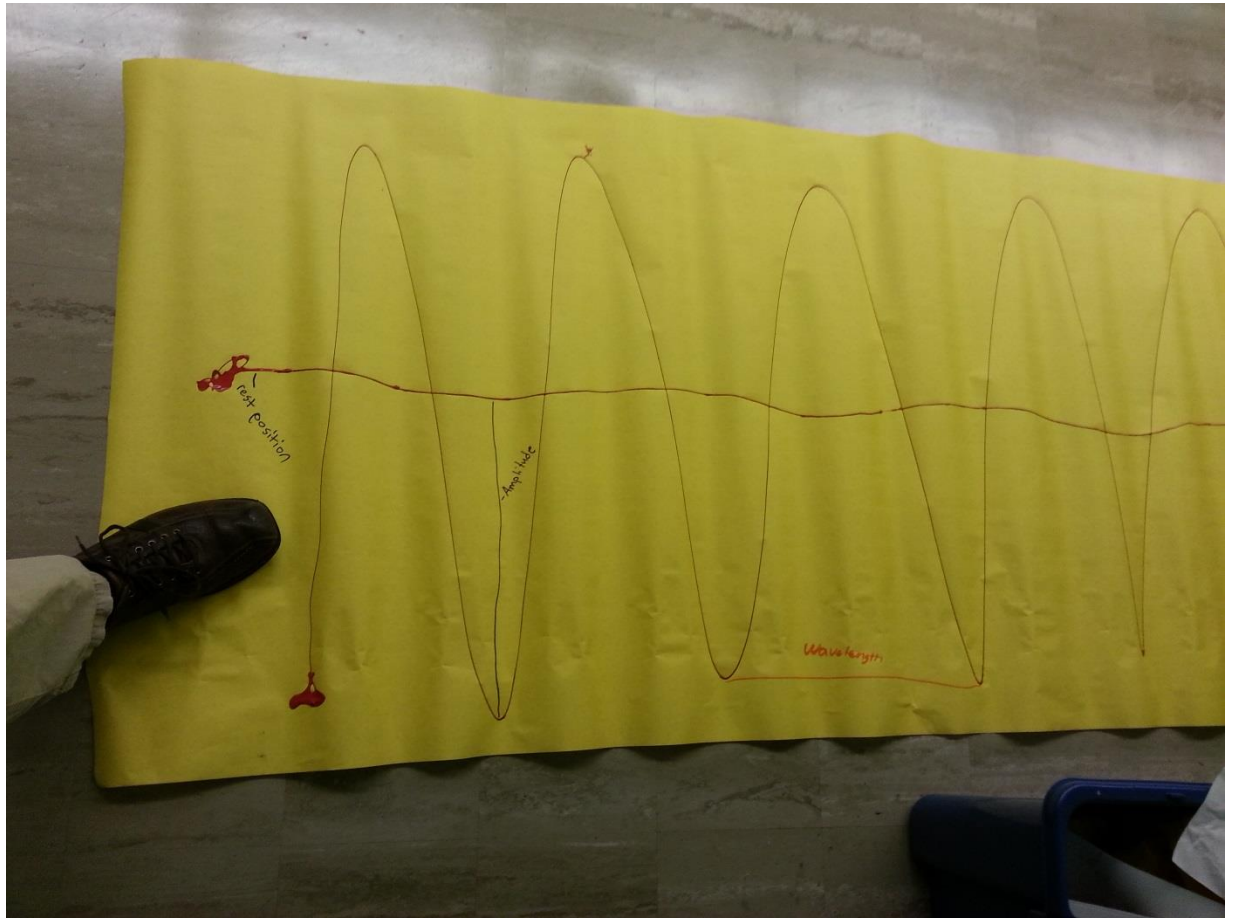
Paint Pendulum

Procedure

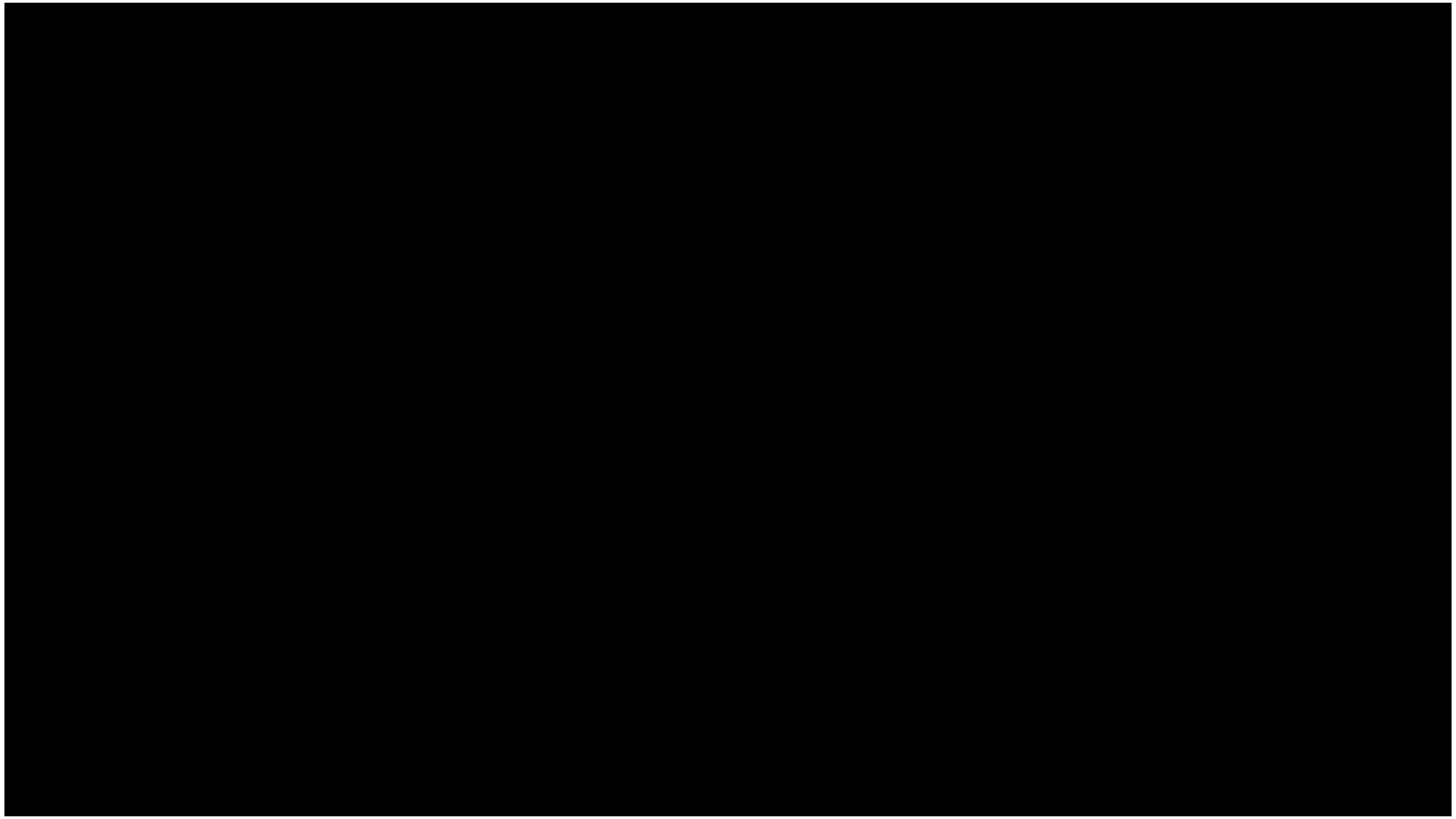
- Predict
- Communicate
- Test
- Compare

Paint Pendulum

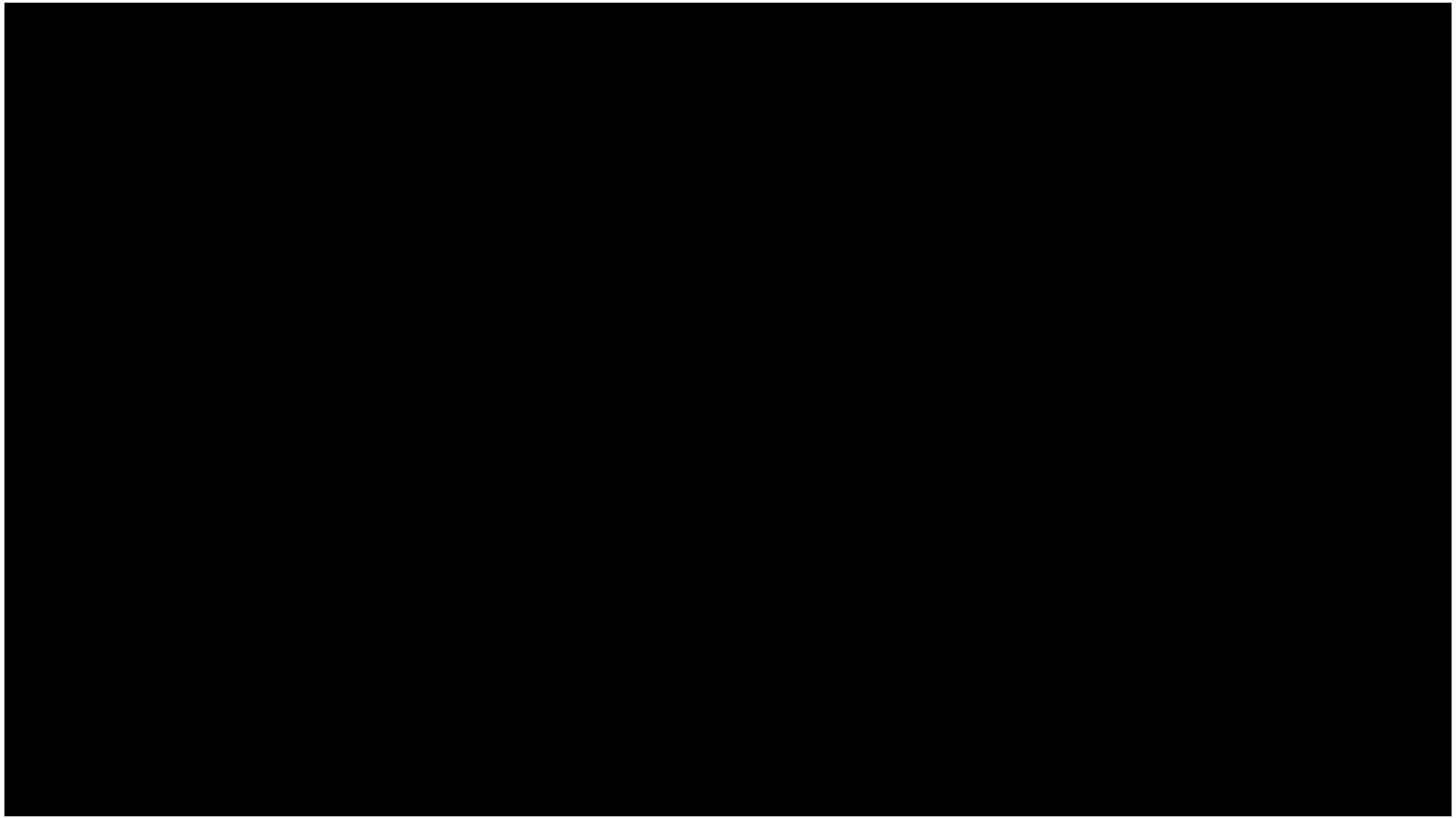
- Knowledge
  - Frequency
  - Amplitude
  - Wavelength
- Scientific Application
  - Measurement
  - Physical representation



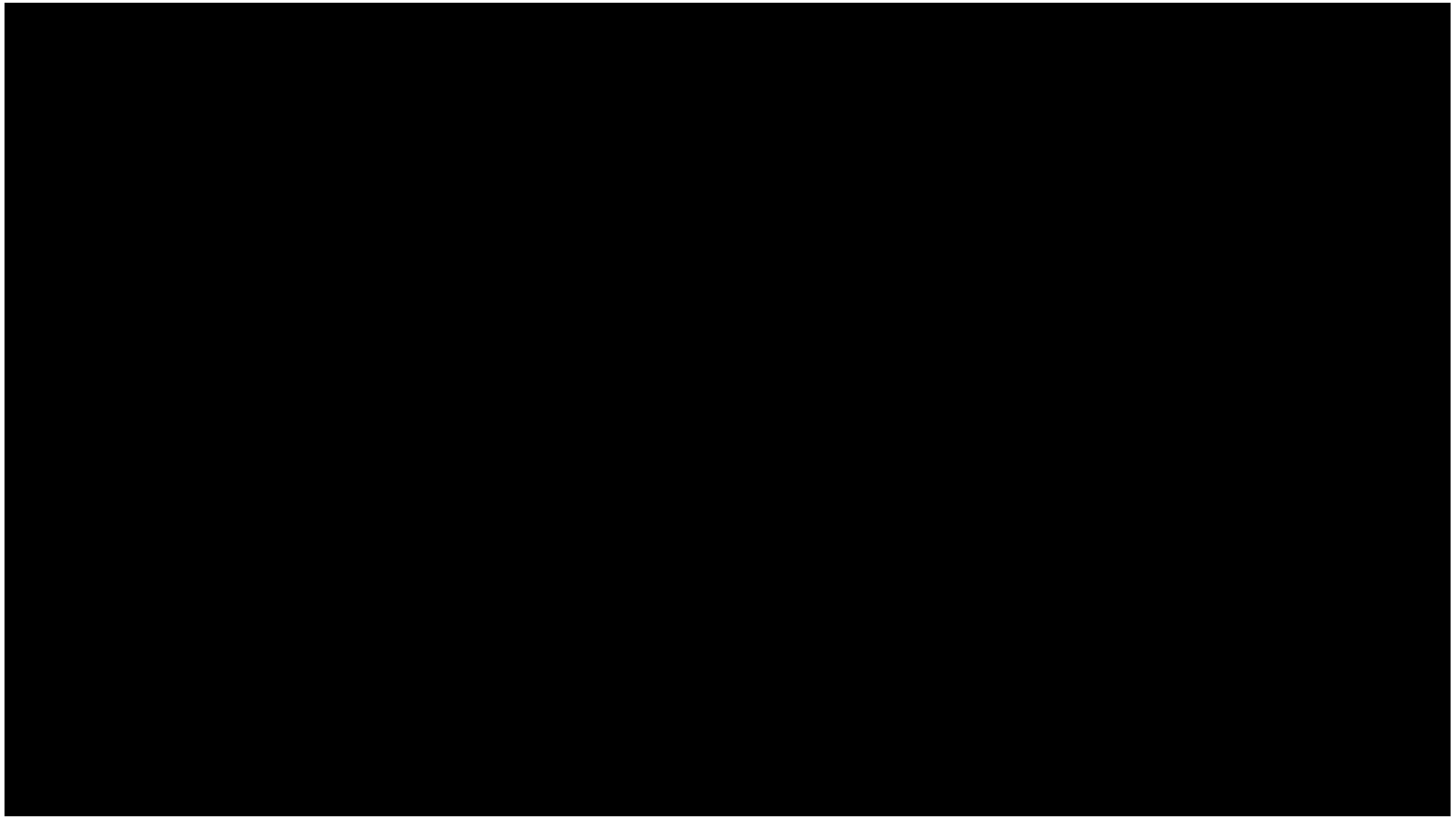
Paint Pendulum



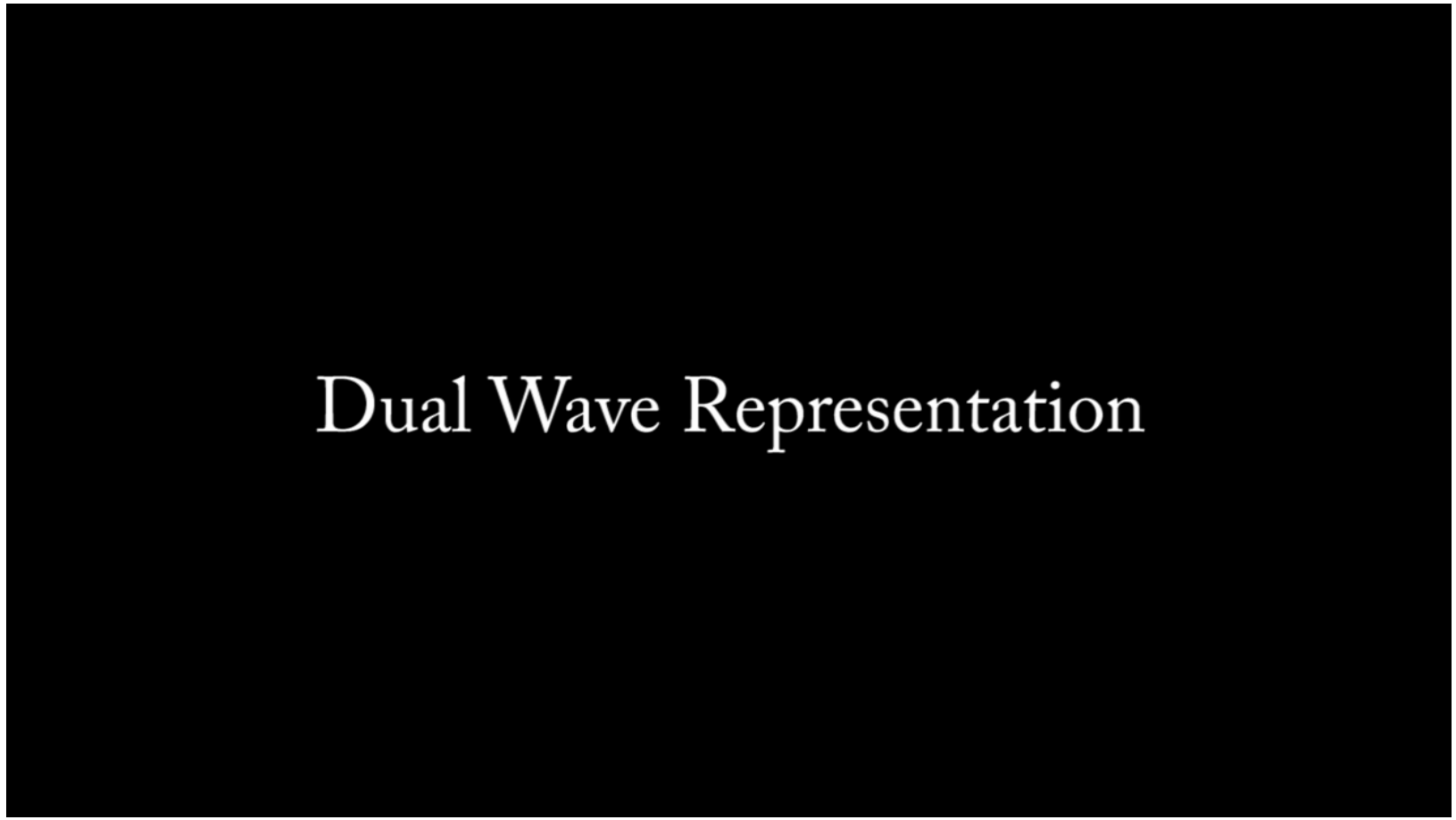
Paint Pendulum



Mixed Reality Pendulum

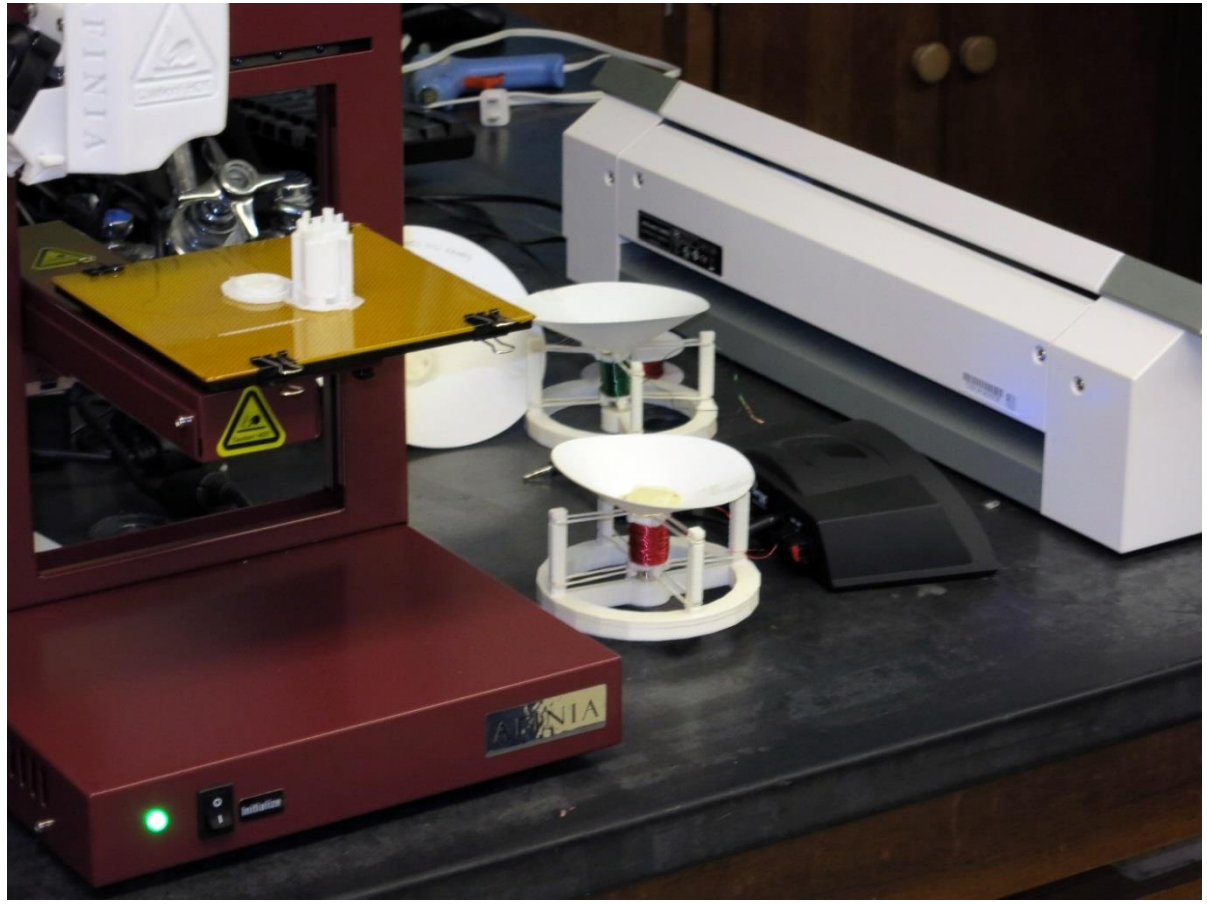


Mixed Reality Pendulum

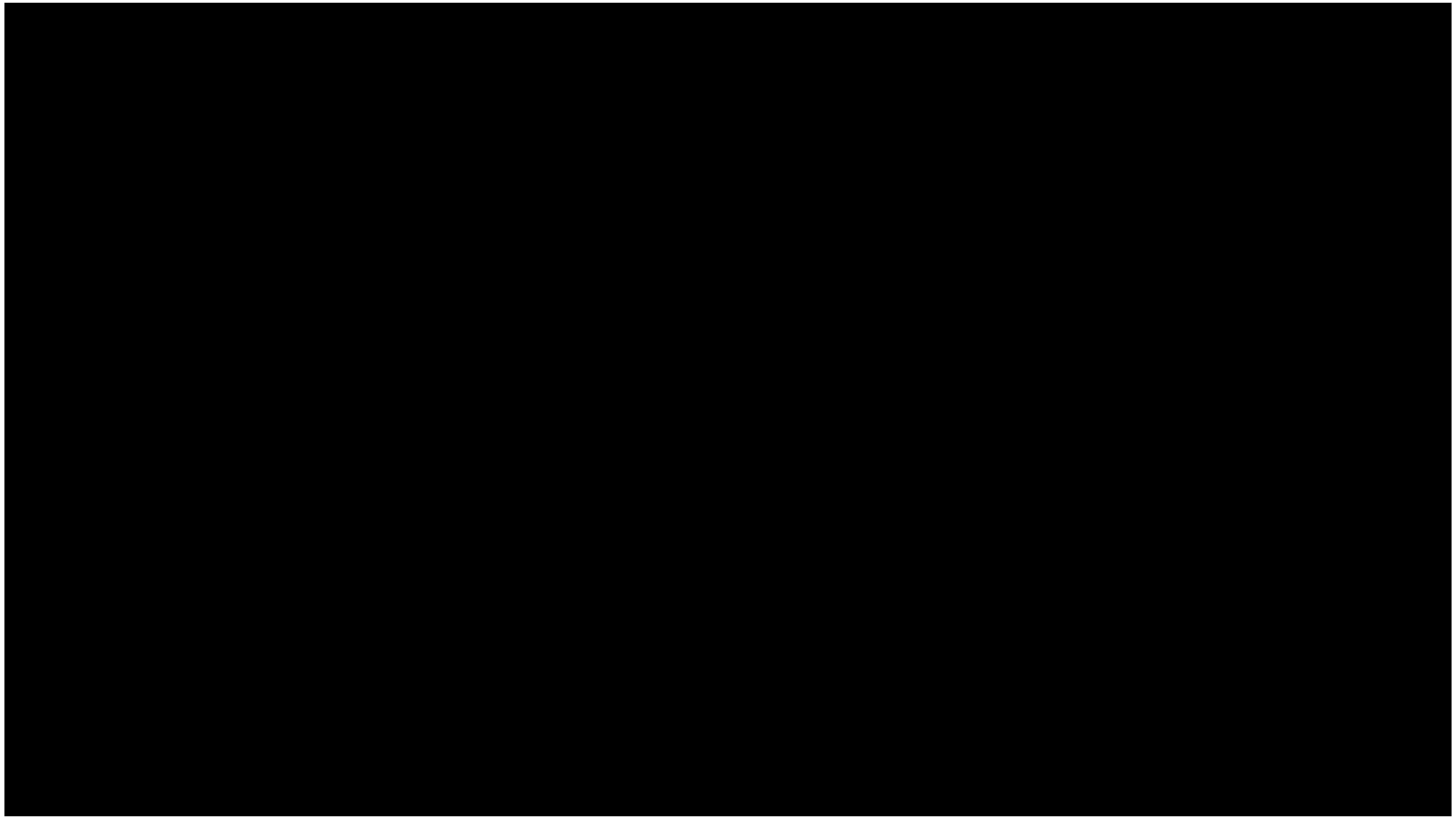


Speaker Systems

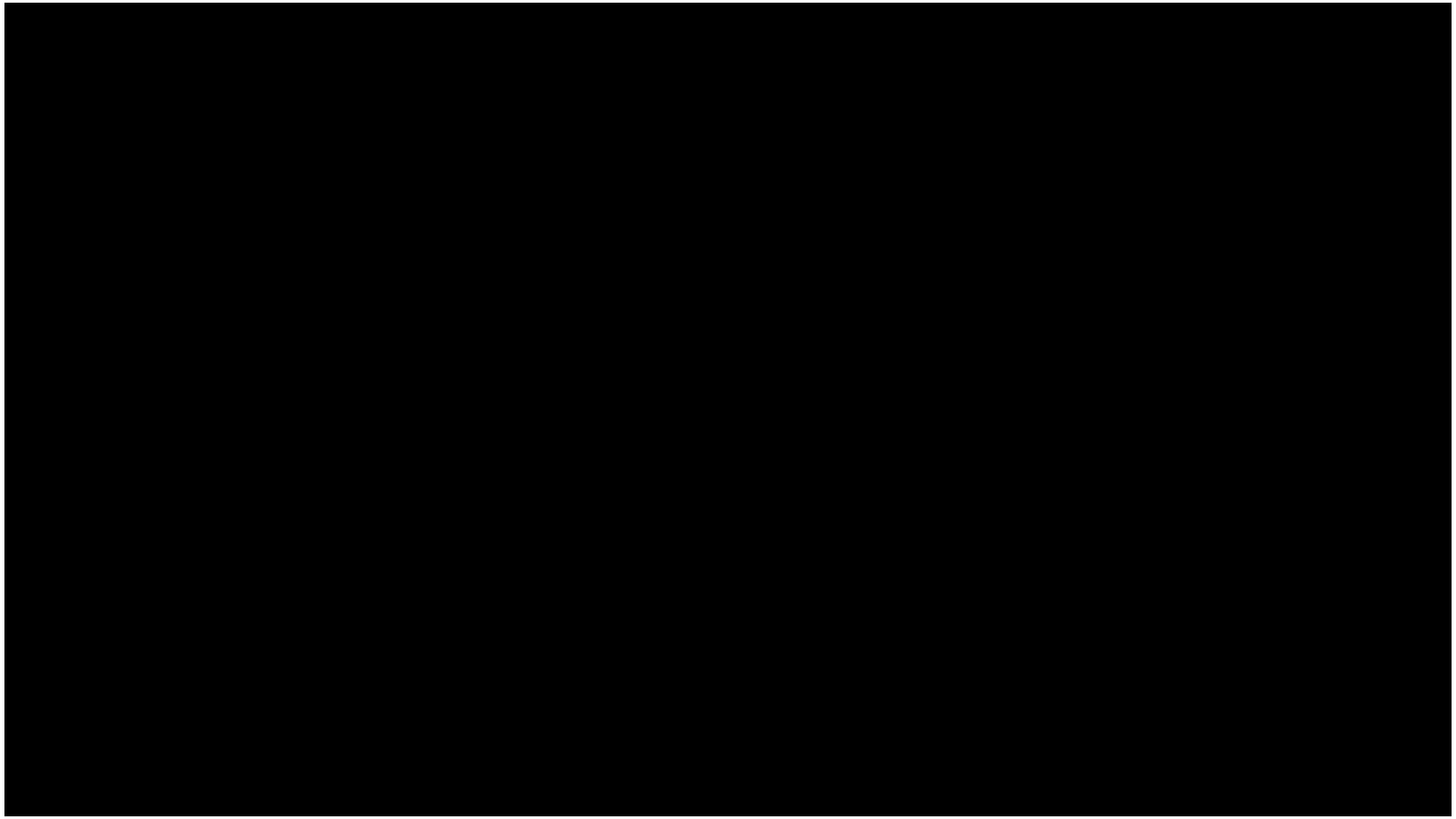
- Design Phase
  - Engineering principles
- Build Phase
  - Advanced manufacturing
- Test Phase
  - Scientific tools



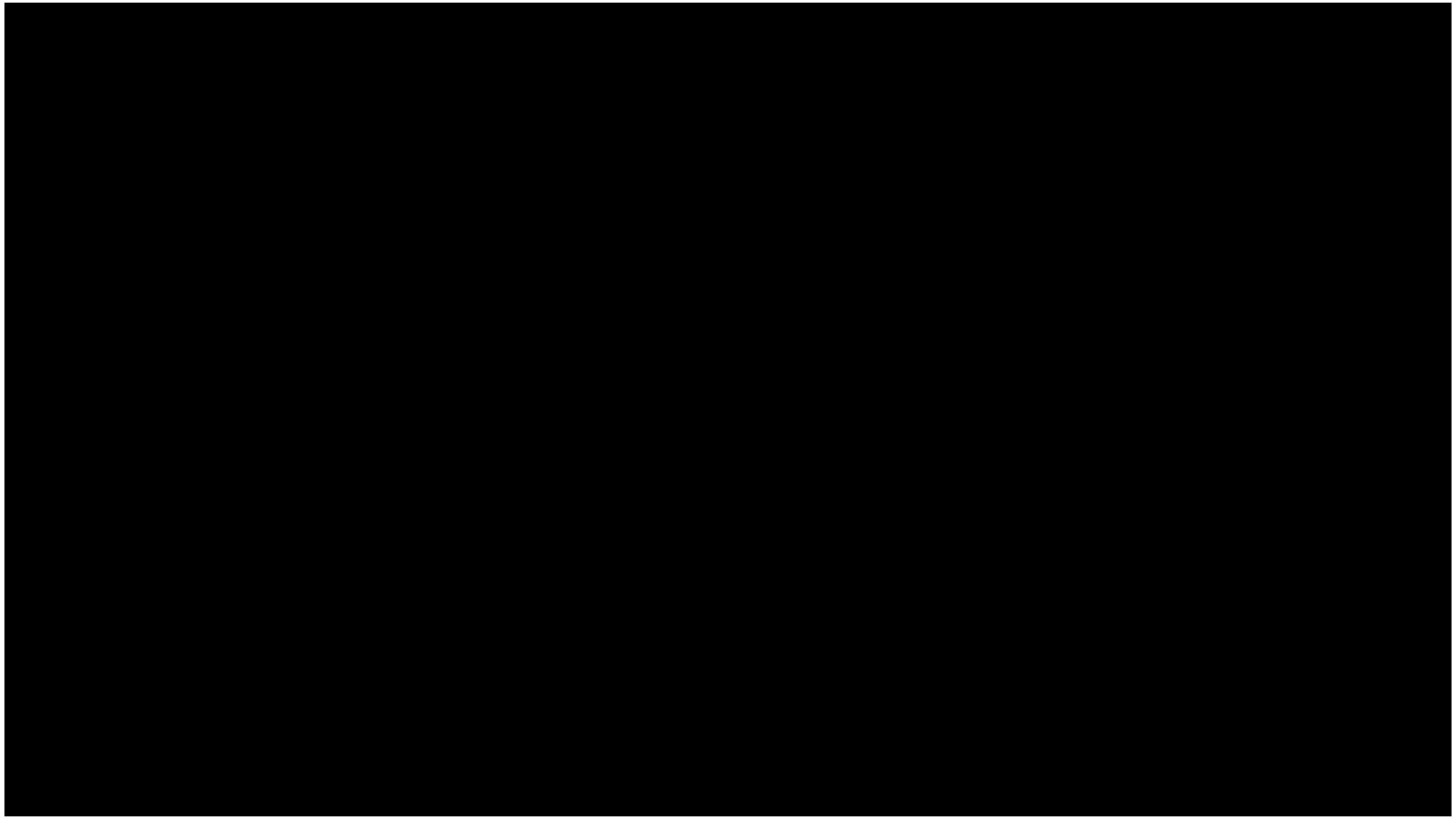
Design Phase



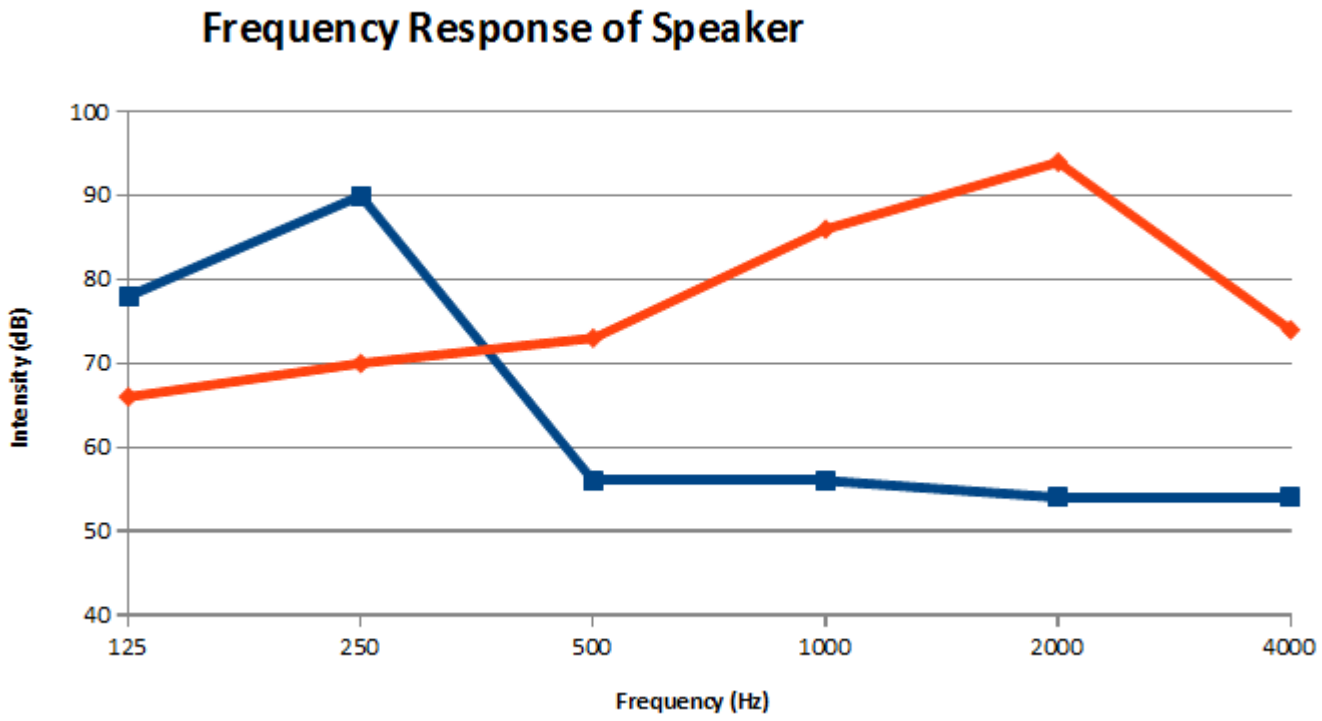
Build Phase



Test Phase



Test Phase


Frequency Response of Speaker
100
90
80
70
60
50
40
Intensity (dB)
125
250
500
1000
2000
4000
Frequency (Hz)

Future Plans and Applications

- Continued Collaboration
  - Engineering and education collaboration
  - Undergraduate curriculum
  - Professional development for teachers
  - Digital Fabrication Laboratory
- Lab School Development
  - K-12 curriculum development
  - Congruent with Next Generation Science Standards
  - Continued implementation of advanced manufacturing in K-12 schools

Learn More

- Websites
  - http://wisengineering.org/soundwaves/
  - http://www.maketolearn.org/
  - http://tpackcases.org/elementary-cases/science/

- Flyer