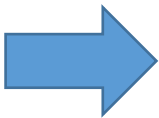
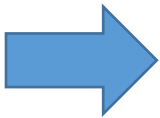


FORMATION OF AREA AND VOLUME DEVICES

INITIAL IDEAS

The initial idea was to use an expandable window shade to create an area device and to use Hoberman Sphere to create the volume device.



Observations:

After some tests we quickly realized that it's going to be difficult to create large area expansion with window share. Also it was difficult to open up the Hoberman Sphere and keep it open.

FIRST PROTOTYPE

For the first working prototype, we decided to try idea of inflating a shape cut from trash bag with air pressure similar to a balloon expanding. We first made this type of party popper type of design by cutting out the trash bag in a big rectangle shape and then closing all the gaps except for one part where we attach the straw. We blew through the straw and soon the bag was inflated so we sealed it with duct tape.



With the air pressure, the folded shapes cut out from trash bag would expand into a bigger area. We tried using a small battery powered aquarium pump to inflate the shape.

Observations:

Even though the idea worked and produced area expansion, the home made plastic shapes put together with tape were very unreliable with shape and expansion.

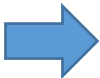
Additionally, aquarium pump proved very small and took more than 3-4 minutes to inflate the shape.

CHANGES TOWARDS FINAL WORKING AREA DEVICE

With the observations from the prototype, we decided to make following changes.



Homemade shape



Bam Bam Stick



Aquarium pump



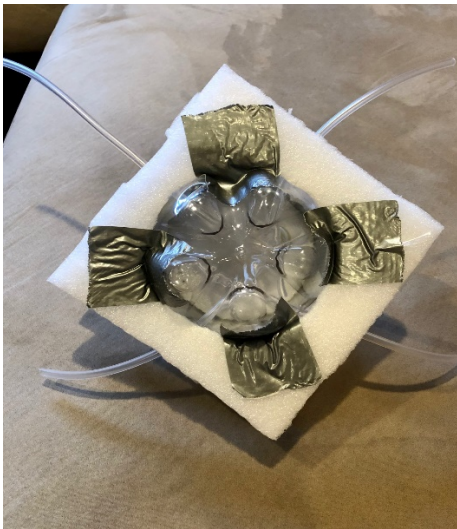
High flow air pump

FINAL WORKING AREA DEVICE

The materials we used in order to build this device is the following:

- Trash Bags
- Plastic Bottle
- Small air pump
- Scissors and Tape
- Straws

We built the center part of our device by using a small but strong plastic bottle and attaching the small air pump to generate the air pressure in the bottle. We attached 4 plastic tubes to the plastic bottle to pump the air into the inflating shape.



As the inflating shapes made from trash bag plastic were unreliable, we decided to use the bam bam sticks to instead.



Using bam bam sticks as the frame of the expansion device, we attached the triangles cut from the trash bag to the bam bam sticks to give us the complete area.



FORMATION OF VOLUME DEVICE

The volume device uses the same idea as the area but additionally we used a “L” shaped Styrofoam bracket to make part of the bam bam stick stand up vertically.



With four “L” shaped bam bam sticks and the plastic from trash bag attached between them, the inflated volume device looks like this.



DEVICES SPECIFICATIONS

AREA DEVICE

Weight – 0.55 lbs
Size (before expansion) – 9 in x 9 in x 6 in
Expanded Area – 1032 sq. inches

Before Expansion



After Expansion



VOLUME DEVICE

Weight – 0.7 lbs.
Size (before expansion) – 9 in x 9 in x 6 in
Expanded Volume – 3328 cu inches

Before Expansion



After Expansion



COST FOR MATERIAL

AREA DEVICE

Material	Store	Quantity	Price
Air Pump	Amazon	1	29.99
Trash Bags for webbing	Home	2	0.50
Duct Tape	Home Depot	1	2.00
Inflatable Bam Bams	Amazon	4	4.00
Plastic Bottle for the base	Home	1	1.00
Straws to connect to the air pump	Home	4	1.00
Total Device Cost			38.49

VOLUME DEVICE

Material	Store	Quantity	Price
Air Pump (Reused from area device)	Amazon	1	29.99
Trash Bags for webbing	Home	2	0.50
Duct Tape	Home Depot	1	2.00
Inflatable Bam Bams	Amazon	4	4.00
Plastic Bottle for the base	Home	1	1.00
Straws to connect to the air pump	Home	4	1.00
Styrofoam for L shaped bracket	Home	4	0.00
Total Device Cost			38.49