

Human Respiratory Mechanics Demonstration Model, Project 26

CLIENTS: Dr. Andrew Lokuta, Dr. Kevin Strang

TEAM MEMBERS: Lynn Murray (Co-Leader)
Kristen Seashore (Co-Leader)
Janelle Anderson (Communicator)
Chris Goplen (BWIG)
Malini Soundarrajan (BSAC)

DATES: 3/14/08 to 3/27/08 (includes spring break)

PROBLEM STATEMENT:

Currently, a basic balloon and latex membrane model is being used to represent the lungs and diaphragm, respectively, for classroom instructional purposes. While they demonstrate respiratory mechanics, the models have a short lifespan and do not display alveolar and intrapleural pressure changes. Further, current models do not accurately depict the anatomical scaling of the lungs with respect to the thoracic cavity.

Our goal is to design and build an adequate mechanical respiratory model for class instruction purposes. This model should demonstrate relative pressure differences between alveolar and intrapleural spaces. It must further demonstrate the expansion of the thoracic cavity from the rib cage as well as the diaphragm, thereby displaying a 3-D expansion. The scaling of the lungs relative to the size of the thoracic cavity enclosure should be more anatomically correct than the current model. The device must be portable and small enough to use with a document camera. This model should also incorporate BioPac® software to graph real-time pressure changes.

RESTATEMENT OF PREVIOUS WEEK'S TEAM GOALS:

This week and next, the team will submit the SSBS IRB application. Once the second pressure sensor arrives, the team will also begin connecting and testing the new compound sensors with our prototype.

INDIVIDUAL GOALS FOR NEXT WEEK:

Lynn Murray: Complete integration of sensors to prototype, compile results of pilot testing, and create lungs.

Kristen Seashore: IRB approval, pilot testing, begin surveying classes (pending IRB approval), and connect sensors.

Janelle Anderson: Figure out what the BioPac ADC is doing to our nice signals and start lung dip-molding process.

Chris Goplen: Integrate sensors into model, work out Biopac software problems, and begin surveying.

Malini Soundarrajan: Pilot testing, complete connecting sensors to the device, and begin surveying Physiology students.

SUMMARY OF ACCOMPLISHMENTS:

- Chris updated the website
- Chris and Janelle wired sensors and started working with Biopac interface
- Janelle contacted BioPac and is working with them to debug the program
- Kristen contacted IRB and met with Professor Chesler to get IRB protocol submitted
- The team met to communicate updates about BioPac and IRB protocol as well as split up paper sections and lab sections to survey
- Kristen began pilot testing
- Chris bought the NPT pieces required to attach the sensors to the prototype

STATEMENT OF THIS WEEK'S TEAM GOALS:

We plan to meet with our clients on Friday, March 28, to discuss the design and allow them to acquaint themselves with the physical model. The only physical construction remaining is the fixation of the pressure sensors on the device which we hope to accomplish on Friday before our client meeting. After the client meeting we need to update our PDS report. As a group, we will conduct pilot testing to determine if the survey is difficult enough to give us valid results. We scheduled design team members to attend labs beginning Thursday, April 3, to being the pre-survey testing.

PROJECT SCHEDULE:

Post- spring break our attention is going to focus on testing the functionality and the efficacy of our prototype. We scheduled a client meeting to discuss the prototype and the testing before we begin surveying next week.

DIFFICULTIES:

The biggest difficulty we have is the BioPac A/D converter which is altering our input signal. We checked the values of the input signal with a multimeter and concluded the values entering the converter are correct. Somehow BioPac is corrupting the linearity of the pressure increases. Janelle and Chris have been working to complete the connections and are in contact with Alex from BioPac to debug any programming issues that may be the cause of our problem.

Another minor difficulty that we had was the official submission of the IRB exemption application. Professor Lokuta, who we had listed as the principal investigator, was unable to submit the application. Professor Chesler submitted the application for us and is now listed as the principal investigator of our design.

Design Report																				
Meetings																				
Client				X																
Team	X	X	X	X	X	X	X	X	X		X									
Professor		X	X	X	X	X	X	X	X		X									
Website		X	X	X	X	X	X	X	X		X									

EXPENSES:

Description	Manufacturer	Part Number	Qty	Price (each)	Price (Tot)
8" outer diameter acrylic tube (thickness= 3/16")	McMaster-Carr	8486K837	1	\$41.40	\$41.40
5" outer diameter acrylic tube (t= 1/4")	McMaster-Carr	8486K583	1	\$25.65	\$25.65
5" inner diameter acrylic tube (t= 1/8")	McMaster-Carr	8486K582	1	\$21.35	\$21.35
Silicone Adhesive (3.0 oz)	McMaster-Carr	7587A37	1	\$3.37	\$3.37
Epoxy Adhesive (1.7 oz)	McMaster-Carr	7467A55	1	\$13.55	\$13.55
Hose clamps: (7/32")	McMaster-Carr	5388K14	1	\$4.68	\$4.68
Tube-to-tube Y fitting (3/8")	McMaster-Carr	53415K241	1	\$14.29	\$14.29
12"x12"Acrylic Sheet (t= .177")	McMaster-Carr	8560K211	4	\$5.05	\$20.20
O-ring (diameter = 5")	McMaster-Carr	9452K352	1	\$4.90	\$4.90
Rubber stopper with through hole (13/64"), size 7	McMaster-Carr	9545K33	1	\$11.05	\$11.05
Compound Pressure Gauge 0 to -30"Hg/0-15psi	McMaster-Carr	3941K53	2	\$9.37	\$18.74
Natural Latex (t= .008") by yd.	McMaster-Carr	85995K13	2	\$2.31	\$4.62

8" diameter acrylic tube (thickness=1/4")	McMaster-Carr	8486K597	1	\$51.13	\$51.13
Polyurethane tubing: inner diameter 3/8" (t=1/16")	McMaster-Carr	5108K56	2	\$0.92	\$1.84
Helicoil (insert length =.138" thread #6-32)	McMaster-Carr	91990A219	2	\$6.36	\$12.72
Button head socket cap screws #6-32	McMaster-Carr	92949A146	1	\$6.53	\$6.53
Metal knob (1/4" -28 threads)	McMaster-Carr	6079K32	2	\$4.54	\$9.08
Piston O-ring (inner diameter = 4.125")	McMaster-Carr	9452K193	1	\$9.45	\$9.45
1/32" pure gum rubber sheet	Small Parts, Inc	PGRS-0031-F	1	\$8.55 + shipping	\$13.45
12"x12"Acrylic Sheet (t= .177")	McMaster-Carr	8560K211	4	\$5.05	\$20.20
15"x55" Polycarbonate Sheet (t= .25")	Midland Plastics	n/a	1	\$42.20	\$42.20
Polycarbonate Cement	Midland Plastics	n/a	1	\$8.02	\$8.02
Small #8 knobs	Dorn True Value Hardware	n/a	2	\$2.46	\$5.19
#8 nylon washers	Dorn True Value Hardware	n/a	4	\$0.07	\$0.30
#8 nylon wing nuts	Dorn True Value Hardware	n/a	2	\$0.65	\$1.37
Nylon hose clamps	Dorn True Value Hardware	n/a	2	\$0.50	\$1.06
Rubber stopper	Dorn True Value Hardware	n/a	1	\$0.13	\$0.14
9 pin D-Sub Male	Radioshack	2761427	2	\$1.99	\$4.20
9 pin D-Sub Female	Radioshack	2761428	2	\$1.99	\$4.20
9 pin SubD Hood	Radioshack	2761539	2	\$1.99	\$4.20
Autonics	Autonics, Inc.	PSA-C01	2 (one	\$120.00	\$120.00

Pressure Sensor			was donated)		
Total					\$499.08

No new receipts available at time of report