14026 WEEK 5 DEMO

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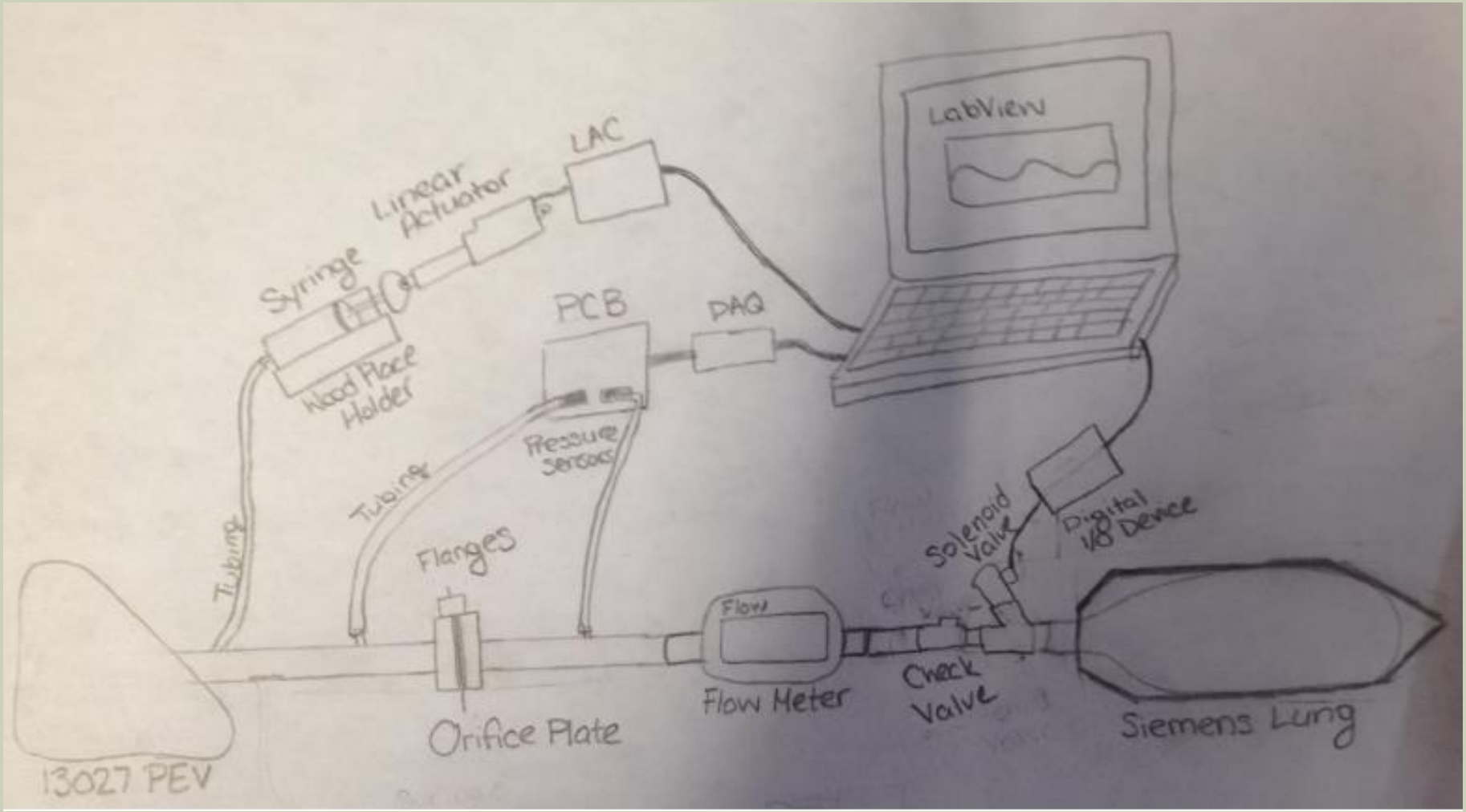
AGENDA

- Design Changes Since End of MSD I
- Bill of Materials
- Budget
- Test Plans
- Status Updates
- Problem Tracking
- Week 8 Expectations
- Project Plan Milestones

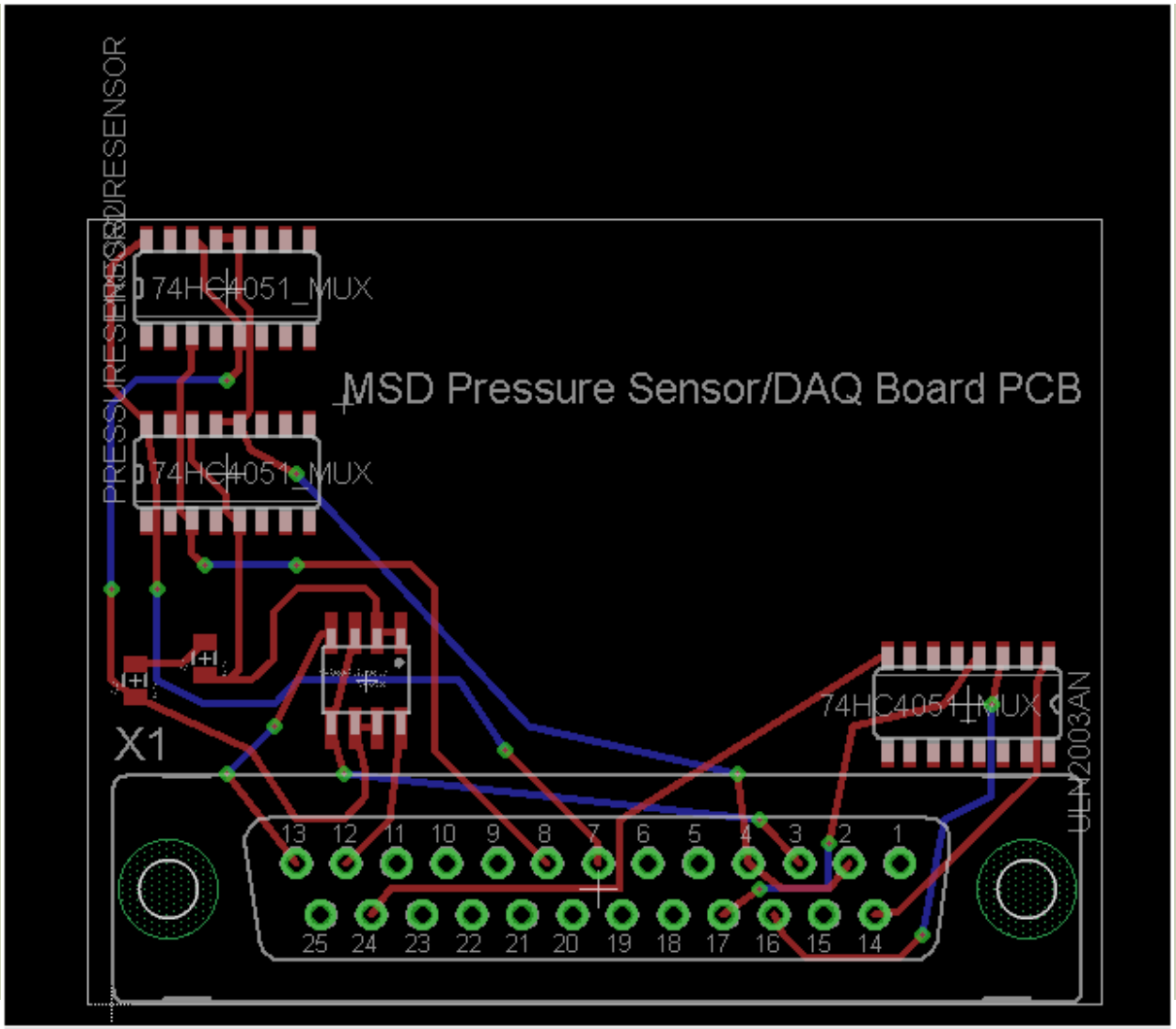
UPDATED SYSTEM DRAWING



CHANGES MADE FROM END OF MSD I

- Integration of a check valve pending availability; if not implement solenoid valve.
  - Will protect the flow meter
  - Keep pressure adding to the lung instead of leaking elsewhere
- Got rid of the gears and motor idea to move the syringe.
- Instead we will use a linear actuator.
  - Allows maximum speed of 32mm/s
  - Uses a LAC Board to control the actuation
  - The LAC has a USB output and can be used through LabView
- Addition of a solenoid valve
  - Allows the team to control when air will be released from the lungs

FINISHED SCHEMATICS



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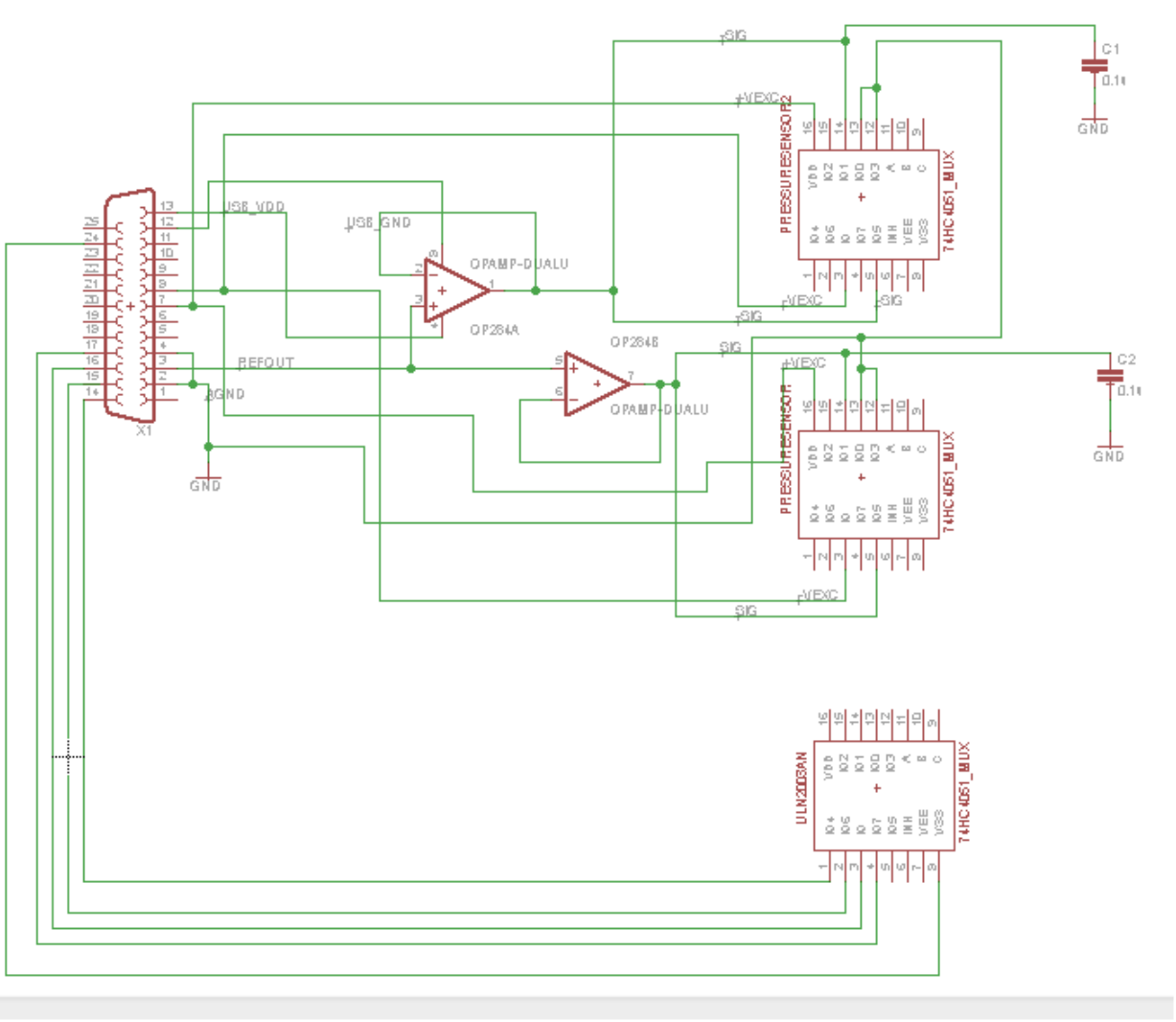


BILL OF MATERIALS

Purchasing Req #	Part Name	Part Number	Vendor	Quantity, Amount	Total Price	Order Status	Ordered By	Expected Receive Date
1	PVC Tubing	6.11942E+11	Home Depot	1, 10 ft, 1/2 inch diameter	$5.70			
2	Syringe	SYRMJ140LL	syringepump.com	1, 140 mL	$4.95			
3	Computer	Dell Precision T1700	Dell	1, use lab computer	$0.00			
4	Pressure Sensor	987-sm5470-015-g-b	mouser.com	2, 0-1.5 psi	$37.07			
5	TSI Mass Flowmeter 4040	1980339, Rev G	TSI	1, 0-300 Std L/min	$0.00			
6	Aluminium Sheet	53538520052	hardwareandtools.com	1	$21.09			
7	Bolts	TBHS- 104	monsterfastener.com	4	$1.40			
8	O-Rings	AS568-021	oringsonline.com	2	$14.86			
9	PVC Flanges	854-005	zorotools.com	2	$15.59			
10	PVC Cement		VP Supply Corp	1	$4.53			
11	DAQ Board	EMANT300 USB 24 bit DAQ Module	EMANT	1,	$99.00			
12	LabView			1, use lab computer	$0.00			
13	Siemen Lung	6006832	Medical Support Products	1, have	$0.00			
14	Computer Cable (mini-DIN to 9-bin D-Sub)	1303583	TSI	1	$0.00			
15	RS232 Serial Command Set Manual	1980340	TSI	1	$0.00			

BILL OF MATERIALS

Purchasing Req #	Part Name	Part Number	Vendor	Quantity, Amount	Total Price	Order Status	Ordered By	Expected Receive Date
16	Op-Amp (buffer)	512-KA2904DTF	mouser.com	2	$8.13			
17	PCB		oshpark.com	3	$25.00			
18	CKD Series PVC Check Valve for low pressure	CKD050V-PV	Plast-O-Matic (amazon.com)	1	$36.91		Danielle	
19	Wood Block			1	$0.00			
20	Polyolefin Heat Shrinkable Tube	700836075233	Amico (amazon.com)	10m	$5.23			
21	Brass tubing				$0.00			
22	Tygon tubing				$0.00			
23	Capacitors at .1 uF	77vj0305y104kxaat	mouser.com	3	$7.59			
24	Capacitors at .1 uF	310-c2012x5r1h105k85	mouser.com	3	$7.77			
25	Low Cost USB Digital I/O Device	192317-50	National Instruments	1	$106.63			
26	Solenoid Valve	LVM11-5A-1-6-Q	Coast Pneumatics, Inc	1	$87.50		Danielle	12-Mar
27	140mm Linear Actuator	L16-140-35-12-5	Firgelli Automation	1	$116.63			
28	LAC Board	LAC	Firgelli Automation	1	$0.00			
29	Low Power Relay Driver	ULN2003V12DR	mouser.com	2	$5.57			
30	Y-Connection			1			Danielle	

BUDGET

P14026's Budget			Total Cost	$	631.72
Date:	25-Feb		Budget Remaining	$	368.28

Item Ordered	Manufacturer	Units	Total Cost	Comments
Aluminum Sheet	Amazon	1	$ 15.01	
Flanges	McMaster	2	$ 16.67	For testing
PCB	oshpark.com	1	$ 18.55	Leslie bought
Pressure Sensors	Mouser	2	$ 64.79	
Op Amps	Mouser	2	$ -	(included in pressure sensor price)
DAQ Board	EMANT	1	$ 119.00	Soham bought
Polyolefin Heat Shrinkable Tube	Amazon	10 m	$ 5.23	Stephanie bought
Flanges	McMaster	2	$ 16.67	For actual design
PVC Cement	VP Supplier	.5 pint	$ 4.53	Andrew bought
Syringe	CVS	2	$ 2.00	Danielle bought
O-Rings	Lowe's		$ 7.50	
Bolts	Lowe's		$ -	(included in orings) Andrew bought
Capacitors 1uF	Mouser	6	$ 7.59	
Actuator	Firgelli Automation		$ 116.63	
LAC Board	Firgelli Automation		$ -	(included in actuator price)
Check Valve				
Solenoid Valve	Coast Pneumatics, Inc		$ 87.50	
Capacitors 1uF	Mouser	3	$ 7.77	
USD Digital I/O Device	National Instruments		$ 106.63	
Additional Pressure Sensors	Mouser		$ 35.65	
Low Power Relay Driver	Mouser		$ -	(included in additional pressure sensor)

TEST PLANS

- Test Plans A: These are tests to determine that our prototype (the tester) is working properly and as expected.
  - Is our team's device able to be used as a tester?
  - Is it a valid instrument to test the PEV?
- Test Plans S: These are tests to determine the outputs of the PEV using our prototype.
  - Does the MediResp IV work as team 13027 said it does?
  - Collect data on the MediResp IV
- https://edge.rit.edu/edge/P14026/public/Build%2C%20Test%2C%20Document

STATUS UPDATE

Subsytem Functional Demo	Status	Comments	Lead
Demonstrate LabView can be used to log data values measured by the flow meter		Done	Stephanie & Mike
Demonstrate LabView can be used to log in values read by the pressure sensor		Still testing for the pressure sensor	Leslie & Soham
Demonstrate knowledge on how to operate the PEV		Done	Leslie & Kris
Perform leak test		Done	Danielle
Test manometer		Done	Andrew
Show accurate pressure drops across the orifice plates via manometer		Test in progress	Andrew
Test that pressure sensors are accurate		Test in progress	Leslie & Stephanie
Test different ways in which we can change the the calibration of the lung		Test in progress	Mike
Preliminary airway resistance analysis over at leat one resistance value		Test in progress	Andrew
Present a soldered PCB board with established connections to pressure sensors		Still testing for the pressure sensor	Leslie

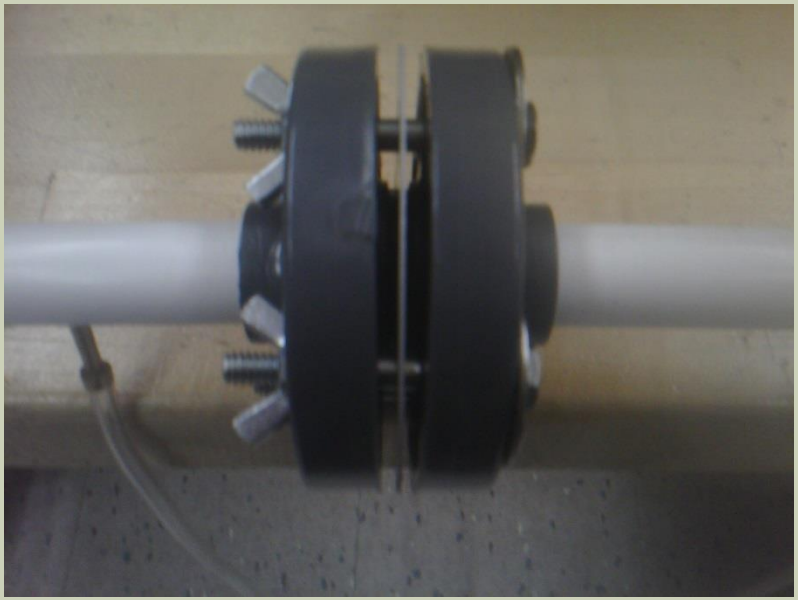
KNOWLEDGE OF 13027'S PEV

- Read through 13027's User Manual
- Learned 13027's PEV:
  - Is for adult aid only
  - Breath Characteristics are supposed to be:
    - Volume Flow Rate: 12 – 32 L/min
    - Tidal Volume: 0.2 – 2.0 L
    - Max. Pressure: 0.15 – 1.0 psi
  - The manual says that assist mode is triggered on the exhale
    - Our team found that this was not true.
  - Manual mode is supposed to administer a breath after a certain amount of time if the button is not pushed
    - Our team found this was not true.

LEAK TESTS

- There were 5 leak tests done on the trachea subassembly.
- There was one additional test done to make sure that our process was valid.
- These tests are shown at:
- https://edge.rit.edu/edge/P14026/public/Build%2C%20Test%2C%20Document

PRESSURE DROPS ACROSS ORIFICE PLATE – SETUP



PRESSURE DROPS ACROSS ORIFICE PLATE – RESULTS & REVISIONS

	Measured Q (averaged) [Lpm]	Experimental Values ΔP (cmH2O)					Expected Value	Percent Difference
		Trial 1	Trial 2	Trial 3	Trial 4	Avg		
Upper Bound Flow Rate	26.08	5.00	5.20	5.00	5.00	5.05	2.17	132.718894
Lower Bound Flow Rate	11.04	0.50	0.33	0.50	0.33	0.42	0.92	54.71014493
Median Flow Rate*	18.50	2.25	2.00	2.00	2.00	2.06	1.55	33.06451613
Equivalent Resistance value for median flow rate = 6.75								

* This was the flow rate used for the design of the orifice plate(s): designed for 21LPM and actual median flow rate is 18.5 LPM

Possible testing Issues:

- Manometer's orientation
- Small leak around the connection to the flow meter
- Orifice surface finish
- Human error

Revision to test plan:

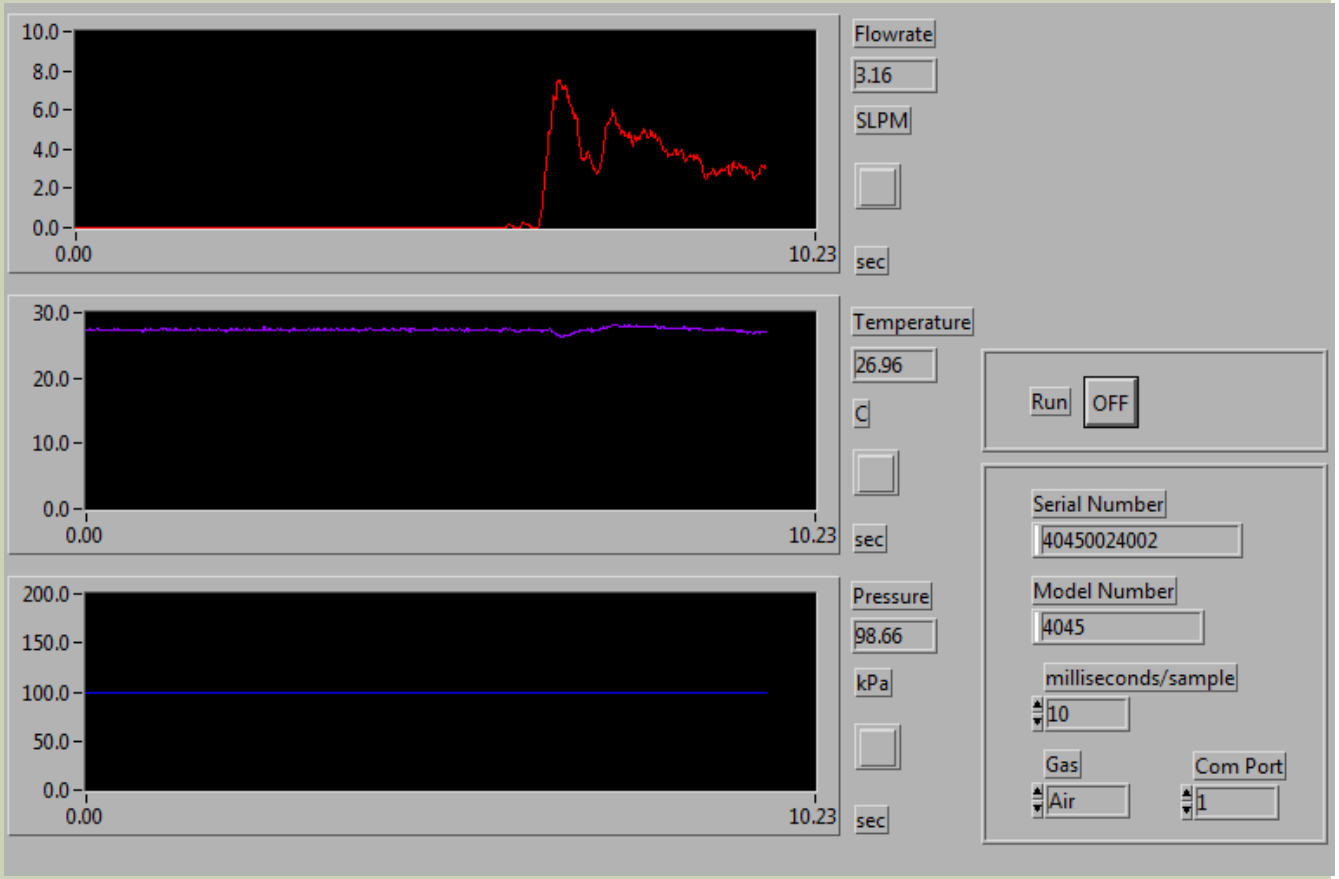
- Take flow rate and manometer measurements simultaneously.

Solution Path:

- Conduct a second series of testing
- Confirming / changing orifice diameter (open it up)

LABVIEW

- Successfully programmed LabView to capture flow meter data
- Can export data to a data file
- Data can be opened and analyzed in Excel



CHANGING LUNG COMPLIANCE

- Attached the MediResp IV, lung, and a manometer
- Watched the pressure change without any weight on the lung and then tested again with a book and wallet on top of the lung.
- The pressure increased when weight was added.
- https://edge.rit.edu/edge/P14026/public/Build%2C%20Test%2C%20Document

TEST PRESSURE SENSORS

- Pressure sensors are not giving the output that we want.
- Confirmed that pressure sensors are set-up properly with Dr. Slack.
  - Suggested that the pins may be touching.
- A breakout board is being built for us by the Micro-E department to further test the pressure sensors
  - Board should be built by early next week.

SOLDERED PCB BOARD

- As soon as we know the pressure sensors work, the team will work on soldering the PCB.

LOG VALUES READ BY PRESSURE SENSORS

- As soon as the pressure sensors are tested on the break-out boards and soldered to the PCB, the team will be able to log values through LabView

PROBLEM TRACKING

- Document to track problems the team experiences and process that we use to solve them.
- https://edge.rit.edu/edge/P14026/public/Build%2C%20Test%2C%20Document

	Identifying & Selecting Problem PSP 1	Analyzing Problem PSP 2	Generating Potential Solutions PSP 3	Selecting & Planning Solution PSP 4	Implementing Solution PSP 5	Evaluating Solution PSP 6
Rating	R1	R2	R3	Y4	Y5	G6
CRITICAL	The pressure sensor is not reading a voltage change on the o-scope.	1) Pressure sensor is defective. 2)Team does not know what they are doing.	1) Seek expert advice to confirm that team has it hooked it up right. 2) We could buy additional pressure sensors. 3) Look for different pressure sensors. 4) Switch to a digital manometer.	Seek expert advice to confirm the team has hooked it up right.	Went over testing setup with Dr Slack. Suggested that we get a breakout board to check that pins are not touching. Having Dr Fuller build us a breakout board. Will resume testing to evaluate the solution.	
MAJOR	Having trouble getting in the queue to waterjet the orifice plates.	1) Could not get a hold of Mr Bonzo.	1) Build the orifice plate in the machine shop. Pros- plate will be built. Cons- it will not be as precise. 2) Continue to try to get a hold of Bonzo. Pros- will hopefully get rifice plate waterjetted. Cons- Need to move forward.	Continue to try to get a hold of Mr Bonzo	Found Mr Bonzo in his office after MSD meeting.	The team has an orifice plate built.
ORDINARY	The file dialoge in LabView is stopping the rest of the program from running.	1) There is a syntax error. 2) Problem linking across programs.	1) Trace through the program to find the error. 2) Put in a text file, then import to Excel.	Trace through the program to find the error.	Use the context window in LabView to locate the problem.	

WEEK 8 EXPECTATIONS

At the end of MSD II phase 3 the team will have a demonstration of our project's progress. Our expectations for our demonstration are:

- Have our prototype, the MediResp III, and the MediResp IV to show that the prototype can be attached to each device.
- Demonstrate that our prototype meets all instrument engineering requirements.
  - Be able to show the customer our test results for tests A1-A8
  - Be prepared to describe how we test each requirement
  - Be prepared to show how we tested each requirement
- Demonstrate that our prototype will read and store values from the MediResp IV in all 4 modes.
- Set expectations for the next phase review

PROJECT PLAN MILESTONES

- Week 2: End of Phase I
- Week 5: Demonstration (Today)
- Week 8: Demonstration, Complete prototype and all A tests
- Week 9: Begin testing MediResp IV
- Week 11: Demonstration
- Week 13: Imagine RIT, Complete testing of PEV
- Week 14: Demonstration
- Week 16: Gate Review

EXPECTATIONS FOR IMAGINE RIT

On May 3, 2014 our team will present our project at Imagine RIT. Our expectations for our Imagine RIT exhibit are:

- Have our prototype, the MediResp III, and the MediResp IV seen by the public
- Demonstrate our prototype testing MediResp IV
- Have our final poster displayed to describe our product
- We will have at least 2 team members present at all times
  - We will develop a team schedule closer to the date of the event (no later than the week before - April 26)
- We will develop an “elevator” speech to give
- Depending on the flow of traffic at our exhibit, we will allow the public to interact with our system.
  - Possibly allow visitors to breath into the prototype and see the results.

QUESTIONS

ADDITIONAL SLIDES

SYRINGE ACTUATION

Team 14026					
Project System Function					
Syringe Actuation					
	A	B	C	D	E
Selection Criteria	Linear Actuator	Rack and Pinion	Leadscrew	Mouse Trap	Human Movement
Constraints	DATUM				
4 inches of travel		S	S	S	S
At least 20N of force		S	S	S	S
System Design					
Repeatability		S	S	-	-
Accuracy		-	-	-	-
Cost		+	+	+	+
Sum +'s	0	1	1	1	1
Sum 0's	0	3	3	2	2
Sum -'s	0	1	1	2	2

LINEAR ACTUATION

Team 14026		
Project System Function		
Linear Actuator		
	A	B
Selection Criteria	Firgelli	Servocity
Constraints		
4 inches of travel		-
At least 20N of force		S
System Design		
Comes with DAQ board	DATUM	-
Plug-and-play		S
Easy LabVIEW link		-
Voltage Compatibility		-
Quick (at least 2 in/s)		-
Sum +'s	0	0
Sum 0's	0	2
Sum -'s	0	5

CHECK VALVE

Team 14026		
Project System Function		
Check Valve		
	A	B
Selection Criteria	Generant ICV	Asahi PDVF ICV
Constraints	DATUM	
< 0.15 psi cracking pressure		-
3/8" diameter		S
System Design		
PVC for easy bonding		+
Inline		S
US-made, quick shipping		-
Low Back-pressure for operation		-
Sum +'s	0	1
Sum 0's	0	2
Sum -'s	0	3

SOLENOID VALVE

Team 14026		
Project System Function		
Solenoid Valve		
	A	B
Selection Criteria	SMC	Nitra
Constraints	DATUM	
24VDC		S
3/8" Diameter		S
System Design		
Plug-and-play		-
Easy LabVIEW link		-
Operates with AC or DC		S
Sum +'s	0	0
Sum 0's	0	3
Sum -'s	0	2

RISK MANAGEMENT

- When we were trying to identify our problems for problem tracking we identified additional risks
- https://edge.rit.edu/edge/P14026/public/Build%2C%20Test%2C%20Document