

Team Spirometer Progress Report **June 18, 2009 – June 24, 2009**

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Goals for the past week

- Continue fluid dynamics study related to spirometer design
- Correlate % reading from ZMD software with voltage output from sensor
 - This will allow us to convert the % we see on the ZMD software with the actual differential pressure recorded by our pressure sensor
- Build new spirometers with Fleisch and Lilly-type design
- Post progress updates to the blog
- Decide on software platform
- Test alternate pressure sensors

Accomplishments

- Made a preliminary decision to develop software with Adobe AIR
 - Main Pros: Advanced graphics capabilities, easiest to use programming interface, widest developer base to ask questions or hire for assistance
 - Main Cons: High RAM usage, no direct access to USB ports.
 - USB access can be solved by using bridge program called the Merapi Project and a Java application
- Refined Software Specifications and sent them to programming contacts
- Built a Fleisch and a Lilly spirometer
 - Will test these in the upcoming days. Hopefully, they will provide the linear flow-pressure relationship (from laminar flow) that we are interested in.
- Discovered the patent for the original (most likely) Fleisch flow meter
 - Contains lots of useful fluid dynamics calculations and examples for us to model
- Created numerous fluid mechanics calculators in Excel
 - Allows us to calculate Reynolds number, resistance, air density and viscosity with a variety of parameters
- Worked with Medecal interns to delegate programming roles
 - Their main focus is to write a program to acquire data from a USB port in Java
 - AIR has no direct access to USB ports. Thus, we must use a Java program to acquire data from our spirometer.

- Posted updates to openspirometry.org (Ctrl + click [here](#) to see) including a design matrix

Goals for the upcoming week

- Meet with additional interns currently at University of Minnesota
 - They are part of the same group of interns that are currently working with us, these (poor souls) got placed at U of M instead of here. We are meeting with them this Saturday (6/27).
- Gather enough input to make informed decision on Lilly vs Fleisch type spirometer
 - Will hopefully get feedback from blog postings, e-mails, personal queries and laminar flow testing
 - Refine design matrix to encompass new input, and evaluate results
- Investigate software development options
 - Determine how much we can do and how much will we need outside assistance?
- Develop another newsletter
 - The first one had a 50% open rate. Hopefully, this can be a good source of feedback on our spirometer design.
- Continue to test alternate pressure sensors
 - We now have 3 spirometer bodies and 3 pressure sensors. We will try to find the best combinations of those by testing 1) spirometer's ability to achieve laminar flow 2) Magnitude of the output signal from the pressure sensor
 - Cost, ease of cleaning, ease of manufacturing, and other criteris will also be considered
- Validate our fluid mechanics calculations with testing to ensure that the prototype resistance is indeed within ATS standards
 - Resistance=Pressure/Flow. We can measure pressure and flow to calculate R

Difficulties

- Attempts to correlate volts with % on ZMD software using power supply and multimeter yielded unexpected, and most likely erroneous, results.
 - Our pressure sensor can only output a maximum voltage of 25 milivolts.
 - When connected to ZMD software, we see a % increase of >10% with a spirometry maneuver, which is far from the max pressure of the sensor.
 - Yet, it required 50 mV from the power supply to generate a .7% increase
 - Cause is unknown. It is likely we either wired something wrong, or we don't understand how the iLite converts its input voltages into percent values.
 - To fix, we are developing a LabView program that uses the ELVIS board as a mulitmeter and then logs the data. We also contacted ZMD to understand more about their software, replies are expected by Friday.
- It would be helpful to have raw data from a spirometer that the interns couls test their algorithms on to see if they calculate the same values as the commercial software,
 - This data is normally not seen by technicians, and is also hard to locate and store
 - We have e-mailed two PFT contacts to hopefully acquire this data

Areas we would like assistance/feedback

- Reminder to approve our work hours on Kronos. We will submit our approvals by Friday evening.