

## **Delivery of Aerosol Drugs through Continuous Airway Positive Pressure (CPAP) Progress Report 03/18/2010-03/24/2010**

### **Names**

Patrick Kurkiewicz, Co-leader  
Anne Loevinger, Co-leader  
Joe Decker, BSAC  
Ryan Kimmel, BWIG  
Steve Welch, Communications

### **Client**

Dr. Mihai Teodorescu

### **Problem Statement**

The CPAP system is most commonly used nightly in the homes by patients who struggle with sleep apnea. A method is needed for automated delivery of respiratory anti-inflammatory drugs, like albuterol, while using the CPAP device. Delivery of the necessary dose of such drugs should either be continuous or at timed intervals over a patient's sleep cycle.

Side Project Suggested by Dr. Teodorescu: Create an ultrasonic nebulizer from an ultrasonic humidifier.

### **Last Week's Goals**

- Construct new reservoir prototype
- Add baffles or splash-guard to current reservoir prototype
- Test efficacy of aerosol formation and level of splashing for new and current prototypes
- Obtain medical adhesives for final prototype construction
- Complete construction of pressure sensor system and test with written program code
- 03/19/10 Tong Entrepreneurship Lecture scheduled for 12:15-1:15pm  
(Talk with advisor before or after?)
- 03/24/10 Mechanical sub-team meeting

### **Summary of Accomplishments**

- Observation of nebulizer air flow with baffle addition (splashing still occurred)
- Construction of nebulizer modification to block splashing and induce turbulent flow
- Brainstorm ideas for new nebulizer reservoir and how to construct it
- Completion of pressure sensor system
- Programming to sync pressure sensor system with nebulizer and CPAP
- Programming to alert when patient breathing not synced satisfactorily with nebulizer

### **This Week's Goals / Schedule**

- Test efficacy of aerosol formation and level of splashing for reservoir with splash-guard
- Construct new reservoir prototype
- Obtain medical adhesives for final prototype construction
- Complete accessory program codes
- 03/26/10 Meeting with advisor scheduled for 12:00-12:30 PM
- 03/29/10-04/02/10 Spring Break (No class)
- 04/07/10 Mechanical sub-team meeting

## **Project Difficulties/ Reason for Missing Goals**

Necessity of new nebulizer reservoir is debatable. Multiple designs have been proposed in addition to various designs for splash-guards or baffles. The team is considering design options and conducting qualitative tests when possible. This process has involved more time and planning than the team anticipated.

## **Activities**

### **Team**

03/19/10 Discussion with advisor (Patrick and Annie) - 12:05-12:15 PM  
03/19/10 Tong Entrepreneurship lecture (All team)  
03/24/10 Mechanical sub-team meeting (Ryan, Steve, Joe, and Patrick)

### **Patrick**

- Discuss reservoir options (new vs. modifications) with advisor
- Attend Tong Entrepreneurship Lecture
- Attend mechanical sub-team meeting
- Construct nebulizer modifications
- Wrote weekly summary email to team

### **Annie**

- Discuss reservoir options (new vs. modifications) with advisor
- Attend Tong Entrepreneurship Lecture
- Re-order medical adhesives
- Attend mechanical sub-team meeting
- Brainstorm designs for nebulizer modifications and new reservoir design
- Wrote weekly progress report

### **Joe**

- Attend Tong Entrepreneurship Lecture

### **Ryan**

- Attend Tong Entrepreneurship Lecture
- Attend mechanical sub-team meeting
- Construct modification (splash-guard) for nebulizer reservoir
- Brainstorm designs for nebulizer modifications
- Update project website

### **Steve**

- Attend Tong Entrepreneurship Lecture
- Complete construction of pressure sensor system
- Programming to sync pressure sensor system with nebulizer and CPAP
- Programming to alert when patient breathing not synced satisfactorily with nebulizer

## **Budget**

- Ideally, final prototype should cost less than about \$400.

## **Expenses**

- Total carried over from Fall 2009 Semester: \$260
- Total from Spring 2010 Semester so far: \$52.85
  - HDPE plastic solid for nebulizer reservoir (McMaster.com) \$12.00
  - Parking at UW- Hospital during meeting with Pulmonary Specialist \$5.00
  - Fittings for prototype including tubing and tubing adaptors (ACE) \$13.06
  - Polycarbonate tubing for nebulizer reservoir lid and base (McMaster.com) \$17.53
  - Plumbing kit (Polypropylene) for removable nebulizer design (ACE) \$5.26
- Unit cost of current prototype: \$183.12

# Project Schedule

Task	J.	February					March				April					M.
Week of:	29	5	12	19	26	5	12	19	26	2	9	16	23	30	7	
<b>Deliverables (Date Due)</b>																
Website																
PDS		Patrick					Patrick								Patrick	
Formal Progress Report	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick		Patrick	Patrick	Patrick	Patrick	Patrick	
Informal Week Summary	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick		Patrick	Patrick	Patrick	Patrick	Patrick	
Notebook							Patrick								Patrick	
Midsemester Presentation						Patrick									Patrick	
Final Presentation															Patrick	
Final Poster														Patrick	Patrick	
Final Report															Patrick	
Client Evaluation															Patrick	
Peer and Self Evaluations															Patrick	
<b>Meetings</b>																
BSAC	Patrick		Patrick		Patrick		Patrick				Patrick		Patrick			
Team (Other than w/ client or advisor)					Patrick	Patrick								Patrick	Patrick	
Electrical Team (When meeting separately)	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick		Patrick	Patrick	Patrick	Patrick	Patrick	
Mechanical Team (When meeting separately)	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick		Patrick	Patrick	Patrick	Patrick	Patrick	
Client	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick		Patrick	Patrick	Patrick	Patrick	Patrick	
Advisor (in class)	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick		Patrick	Patrick	Patrick	Patrick	Patrick	
Dist. Entrepreneur Lec.								Patrick								
<b>Project Research*</b>																
Brainstorm Reservoir Options	Patrick	Patrick	Patrick	Patrick	Patrick											
Programming Options	Patrick	Patrick	Patrick	Patrick	Patrick											
Albuterol Delivery Rate	Patrick	Patrick	Patrick	Patrick	Patrick											
<b>Project Development</b>																
Order Parts Necessary For Improved Reservoir	Patrick	Patrick	Patrick	Patrick	Patrick											
Work On Reservoir / Mechanical Portion		Patrick	Patrick	Patrick	Patrick											
Finish Mechanical Portion of Design				Patrick	Patrick	Patrick	Patrick	Patrick	Patrick							
Test, Modify and Improve Mechanical Portion				Patrick	Patrick	Patrick	Patrick	Patrick	Patrick							
Test Albuterol Delivery Rate to Mask								Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	
Test Entire Assembly												Patrick	Patrick	Patrick	Patrick	
Brainstorm Programming Options	Patrick	Patrick	Patrick	Patrick	Patrick											
Order Parts Necessary for program		Patrick	Patrick	Patrick	Patrick											
Work on Program		Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick		Patrick	Patrick	Patrick	Patrick	Patrick	
Refine Circuitry		Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick	Patrick							

\*After this, research will be done on an as-needed basis.

KEY	
Full Team	Patrick
Electrical Team	Annie
Mechanical Team	Joe
	Ryan