Innovative Global Solutions Enterprise

An Engineering Enterprise Focused on Creating Products and Solutions for Developing Countries

Low-Cost Ventilator for Developing Countries

Project Overview

- Typical ventilator found in a hospital costs a minimum of $40,000
- Approximately 120,000 ventilators in hospitals worldwide; 700,000 needed in a flu pandemic
- IGS is developing a low cost ventilator that is a simplified form of a major hospital ventilator
- Current model costs about $850

Basis for Model 2.0

	Ventilator Model 1.0 & 1.1	Ventilator Model 2.0
1.	Accepts specific user inputs	Accepts specific user inputs
2.	Displays specific information	Displays specific information
3.	Inexpensive and simple	Inexpensive and simple
4.	Sturdy	Sturdy
5.	Easily repairable	Easily repairable
6.	Ventilate unconscious patients who are not breathing	Incorporates oxygen into the patient circuit
7.		Ventilate conscious and unconscious patients who are breathing inadequately or not at all

Comparison Between Current Model 1.0 Functions and Desired Functions of Model 2.0.

Collaboration with Pavlis

Field Testing in Ghana

- Model 1.1 was brought to Ghana summer of 2015 with Pavlis students and a member of IGS.
- Presented to professors of computer science and biomedical engineering at KNUST and doctors and engineers at Sunyani Regional Hospital.

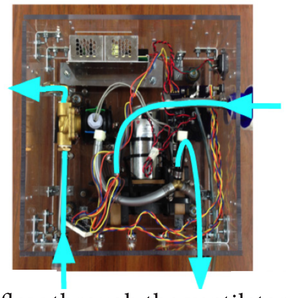
Feedback

- Model 1.0 had too much vibration and was distractingly loud
- Larger and more professional display
- Suggested oxygen incorporation utilizing a flow regulator
- Add a pressure assist mode to allow use on multiple differnet types of patients

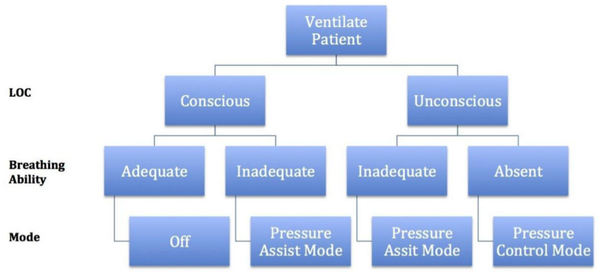
Functions Team

Functions Overview

- Model 1.0 is only meant to ventilate a non breathing, unconscious patient.
- Model 2.0 is desired to be able to ventilate patients who are unconscious or conscious and breathing inadequately or not at all.
- Expanded function of the new model will need to have CMV and SIMV mode.



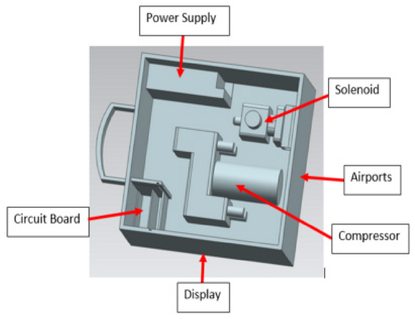
Air flow through the ventilator



Model 2.0 Desired Functions Flowchart

Model 2.0 Layout

- Smaller packaging unit
- Circuit board housed in its own compartment
- Weight distribution of components
- Considering handle placement, fan to dissipate heat, air tight seal, and vibration and noise dampening padding

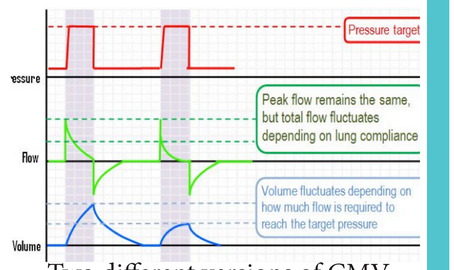


Faculty Advisors and Team Leaders
Ventilator Team Advisor—Dr. Michelle Miller & Dr. Robert Warrington
CEO—Julie Karl
Controls Team Leader—Breanna Merritts
Functions Team Leader—Chelsea Strong
User Manual Team Leader—Rachel Nankervis

Controls Team

CMV- Controlled Mechanical Ventilation

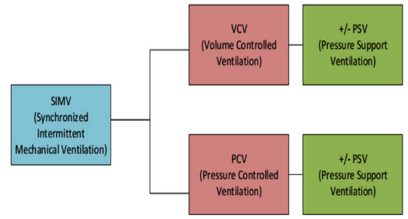
- Pressure control mode
- Allows for unconscious apneic patients to be ventilated on a controlled cycle for a length of time
- Only function of this mode is forced mechanical ventilation



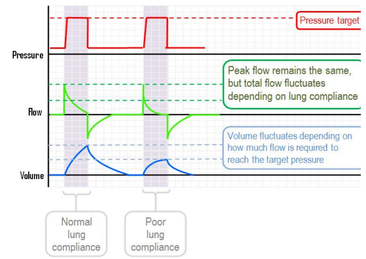
Two different versions of CMV mode

SIMV- Synchronized Intermittent Mandatory Ventilation Mode

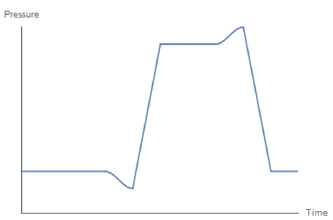
- Pressure support mode which allows for conscious or unconscious patients to be ventilated by assisting existing breathing pattern but not all breaths are assisted



Two different Versions of SIMV mode



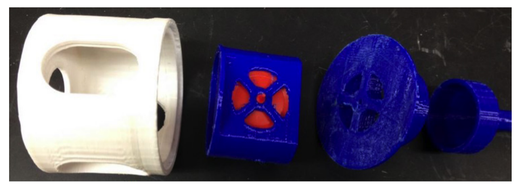
CMV Mode Related to Lung Compliance



Ideal SIMV Waveform

Oxygen Incorporation Overview

- Current oxygen incorporation piece is a 4 piece 3D printed custom part
- Can be attached to a reservoir bag and hooked to an O2 tank to accept oxygen into system



Oxygen Incorporation Part