A.R.M.E.E. Ventilator

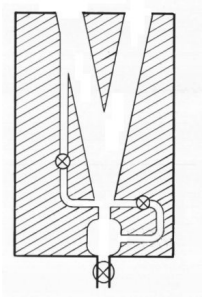
Automatic Respiration Management Exclusively for Emergencies

ArmeeVent

TECH COVID-19 VENTILATOR CHALLENGE

Tech. & Team

1965 US Army Harry Diamond Labs Design
With modifications for positive PEEP



HelpfulEngineering.org
#project-oscillating-ventilator

Core Team:
Medical Device Engineer, CNC Manufacturing Expert, CFD Researcher, Project Manager
(+ many more non-core)

Mission Alignment

- **Pneumatic** (air powered), no moving parts
- **Patient-Triggered** and **Automatic Pressure-Controlled**
- Calibrations for PIP, PEEP, I:E
- **PEEP 5-20** cmH2O
- RR and TV depend on calibrations and patient Lung Volume, Compliance, Resistance
- **Modular**. Alarms/sensors/release valves not included.
  - We have makeshift manometer + emergency release valve + alarm designs
- about 35 lpm pressurized air or O2 needed. (currently)
  - about 10 lpm expected (next design iteration)

Technical Viability

- Well-researched fluid dynamics science (**"bistable fluidic amplifier"**)
- Dimensions are pulled directly from the original 1965 device, found in a museum and scanned with an MRI (to preserve it)
- Our PEEP Loop modification fixes the original's negative switching pressure, using positive source pressure instead
- Built and run with variety of manufacturing methods already
- Aim is to characterize calibrations per patient profile
  - One ventilator "size" per patient type
  - Predict safe for ranges:
    8-30 target RR, 10-35 PIP, 5-20 PEEP

Regulatory

- Awaiting clinical testing, regulatory approval (EUA)
- Developed in 1965 US Army paper for gas attack treatments. Concept continued with other patents
- Original device **tested on dogs** for 5+ hours, blood tests indicated "good pulmonary ventilation"
- **Tested on humans** 15 mins, "performed well as assistor and controller" (Straub, Meyer, 1965)
- We've tested with multiple prototypes successfully, parameters within safe ranges. **Consistent over days of operation**
- Easily detached for quick bagging

Speed

- **High Pressure Die Casting:** Aluminum or Plastic (estimate in aluminum), 2 pieces, $2.75 +/- $1 each, one machine at approx 4.5 cycles a minute (slower piece) can produce 10k devices in about 2.2 days. 1.5 cpm faster piece 0.73 days. Days lead-in.
- **CNC MIlling:** Aluminum, <$30 each for materials, <$100 with labor. Hundreds per day. 1 machine - 20-50 days to produce 10k devices. Hours lead-in.
- **FDM/Resin 3D printing** (1-3k days to 10k, one machine),
- Other methods possible
- Assembly (3 screws), calibration and testing overhead should be considered (minutes per device).