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Toronto Chapter 26

CREHS Inc
DIGITAL SOLUTIONS
IN HEALTH SERVICES
Centre for Rehabilitation and Health Services

NAME : DR. GODFREY ONWUBOLU, PhD, FBCS, CEng, PEng

TOPIC : RAPID MEDICAL RESPONSE (RMR): ADDITIVE MANUFACTURING/3D PRINTING OF VENTILATOR VALVES AND OTHER CRITICAL DEVICES.

DATE: MAY 20, 2021

1. Introduction

- CREHS Inc. provides digital solutions in healthcare (Medical, Dental and O&P) services.
- Owns a digital dentistry laboratory having 21st Century digital technologies mainly from Dentsply-Sirona: inEos X5 lab scanner; inLab SW; inLab Mill; and SprintRay 3D printer. Company has chosen Digital Healthcare field because it is the technology of today and tomorrow.

Healthcare programs at CREHS:

- Providing orthodontic devices to local dental clinics
- Collaborative provision of healthcare solutions to practitioners at disparate locations (overseas); this is a new dimension in healthcare industry

2. Rapid Medical Response Story

- Timely Networking (Rapid Medical Response)
- 3D printing applications for COVID-19
- Engagements for Solutions
- Personal protective equipment (PPE): Face Masks and Face Shields
- Venturi Valve for Ventilator Systems

3. Timely Networking (Rapid Medical Response)

- March 17, 2020: Ontario Lockdown declared
- First step taken was to network with a number of professionals, institutions and companies to provide AM/3D printing solutions to the pandemic outbreak.
- March 28, 2020: Contacted several organizations/individuals for a Teamwork to 3D-print Medical Devices to combat COVID-19

3D-printed Charlotte valve

Medical devices
- Ventilator valves
- Mask connectors for CPAP and BiPAP
- Emergency respiration device
- Non-invasive PEEP mask

3D-printed respirator

Personal protective equipment (PPE)
- Face shield
- Respirators
- Metal respirator filters

3D-printed NP swab

Testing devices
- Nasopharyngeal (NP) swabs

3D-printed customizable mask

Personal accessories
- Face masks
- Mask fitters
- Mask adjusters
- Door openers

3D-printed medical manikin

Training and visualization aids
- Medical manikins
- Bio-models

3D-printed isolation wards

Emergency dwellings
- Isolation wards

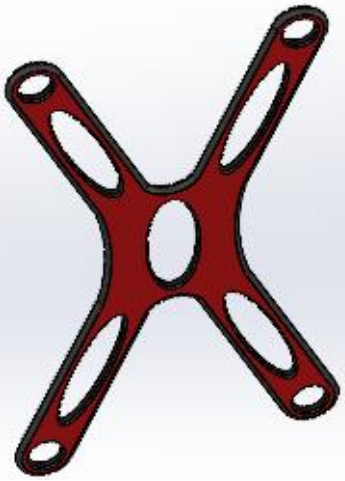
(4) 3D printing applications for COVID-19

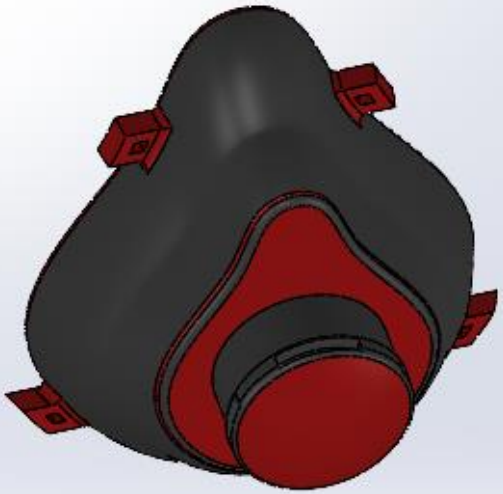
5. Engagements for Solutions

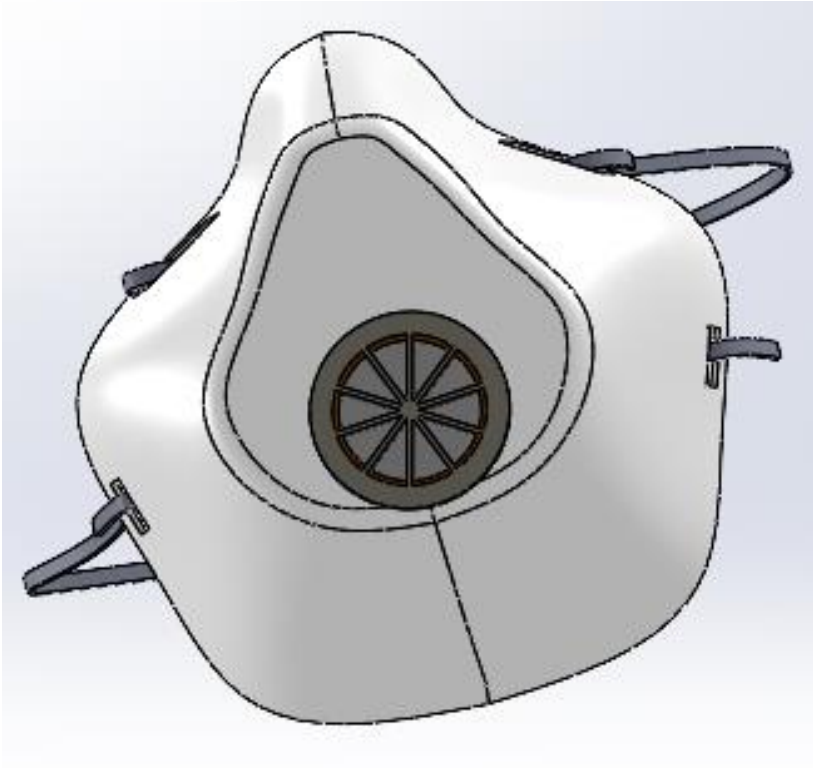
- 20 engineering graduate students were engaged during the March to May 2020 lockdown, focusing on basic personal protective equipment (PPE)
- 17 engineering graduate students were engaged in early 2021 focusing on ventilators
- Several others engaged to provide solutions
- Engineering graduate students were limited because most solutions are in STL formats which cannot be edited!

6. Personal protective equipment (PPE)

- **FACE MASKS**:
- -Copper3D-Antimicrobial-Mask-1
- -3D printable face shield: Filtertraeger
- -Lafactoria3D: use only with P3 particle filters
- -The Self-Assembly Filter for Emergencies (S.A.F.E.) Cartridge System of Medical University of South Carolina: STL
- -Copper3D – Chile: STL
- Do 3DP Face Masks really provide solutions?



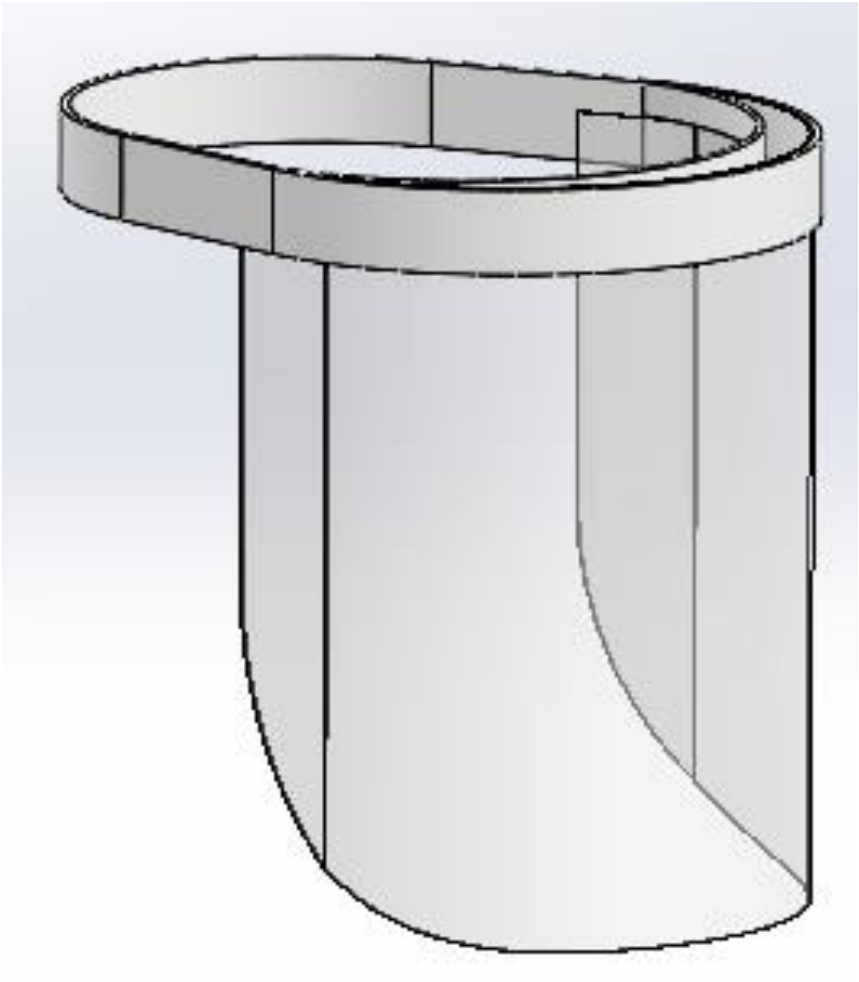




Realized Face Masks

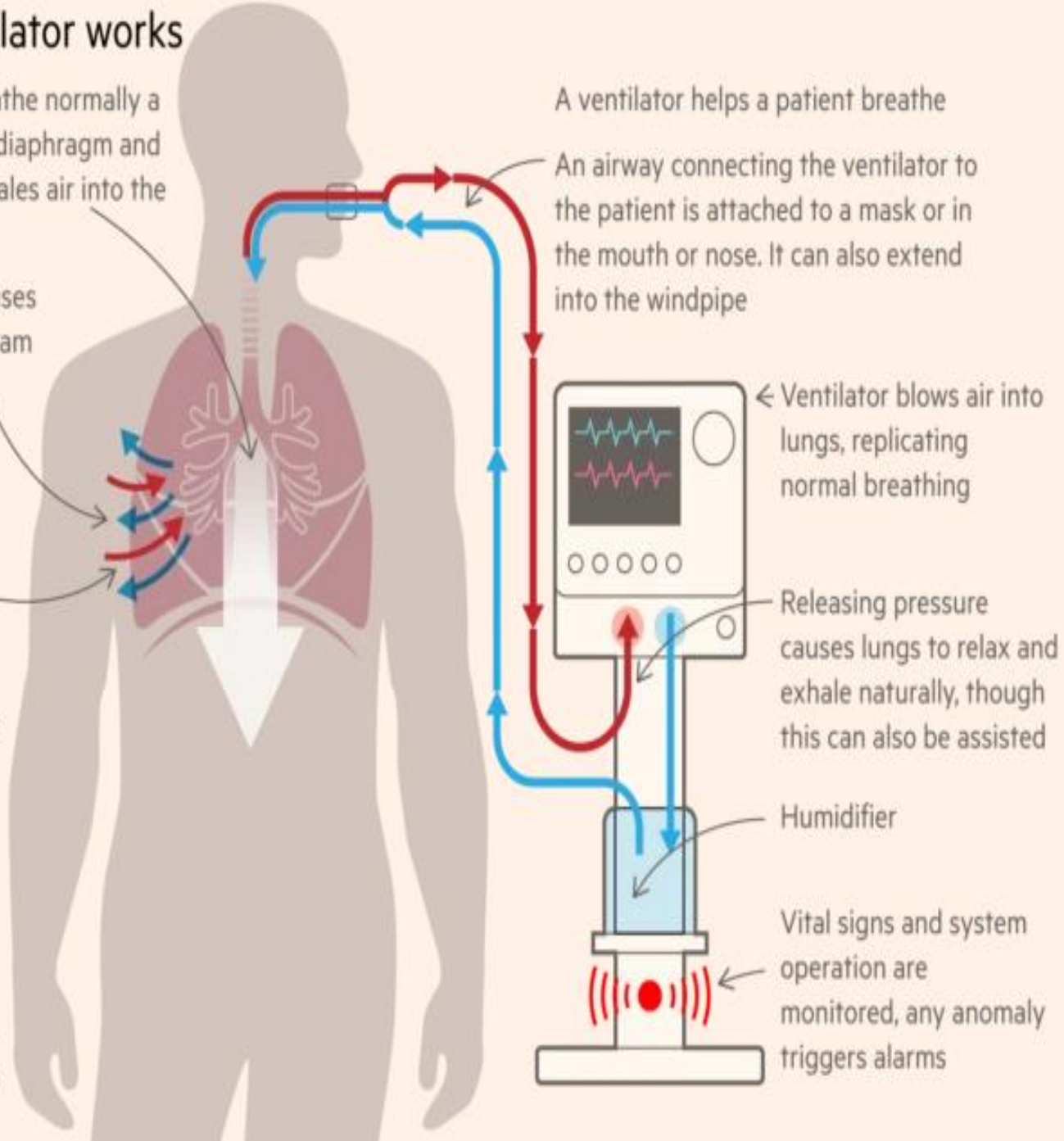
7. Personal protective equipment (PPE)

- **FACE SHIELDS**:
- -faceshield-master
- -MyPalate Aegis Face Shield
- -NanoHack: STL digital files
- -Prusa 3D printable face shield: STL
- -Mascara decathlon
- -Tangible_Choksi_3_FaceShield



Realized Face Shield

How a ventilator works



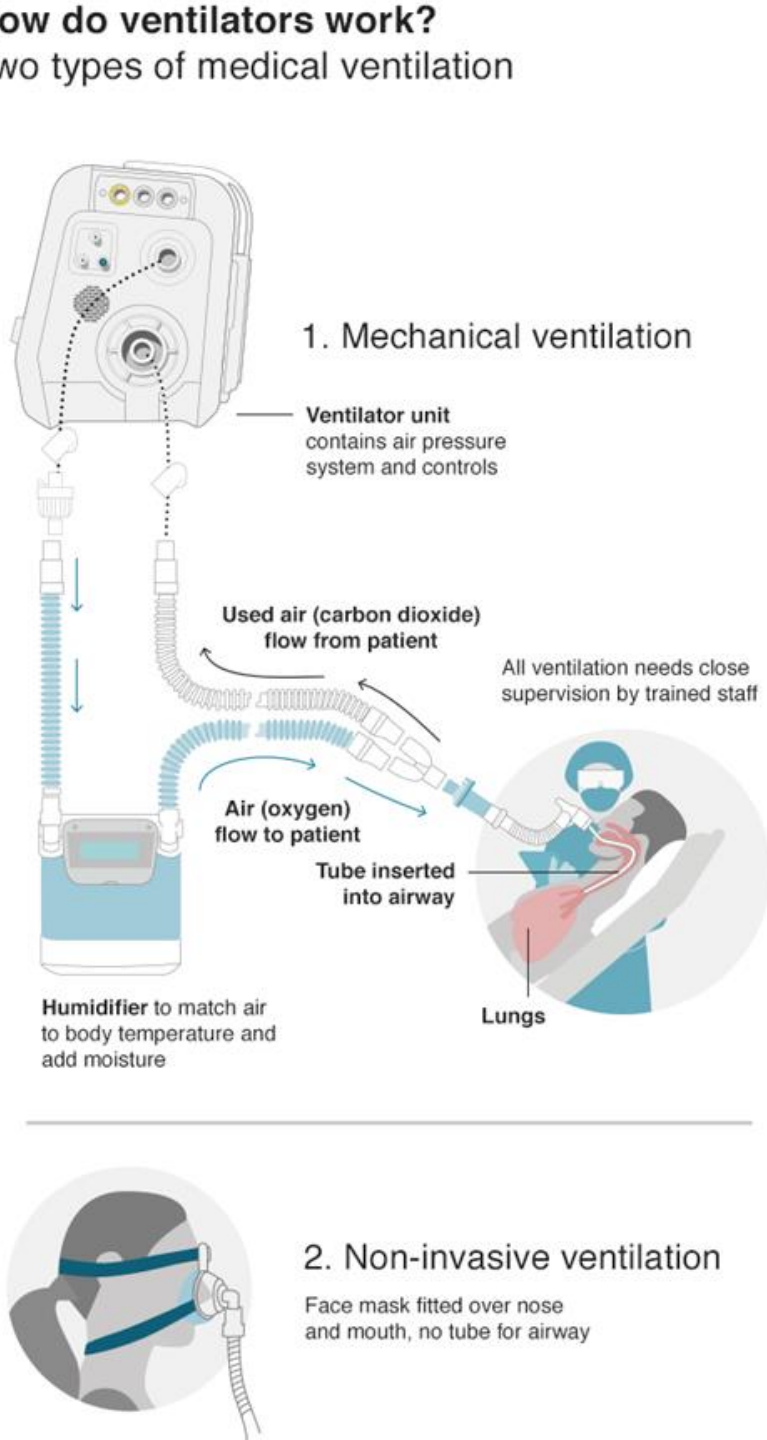
FT visual journalism: Ian Bott
Source: FT research

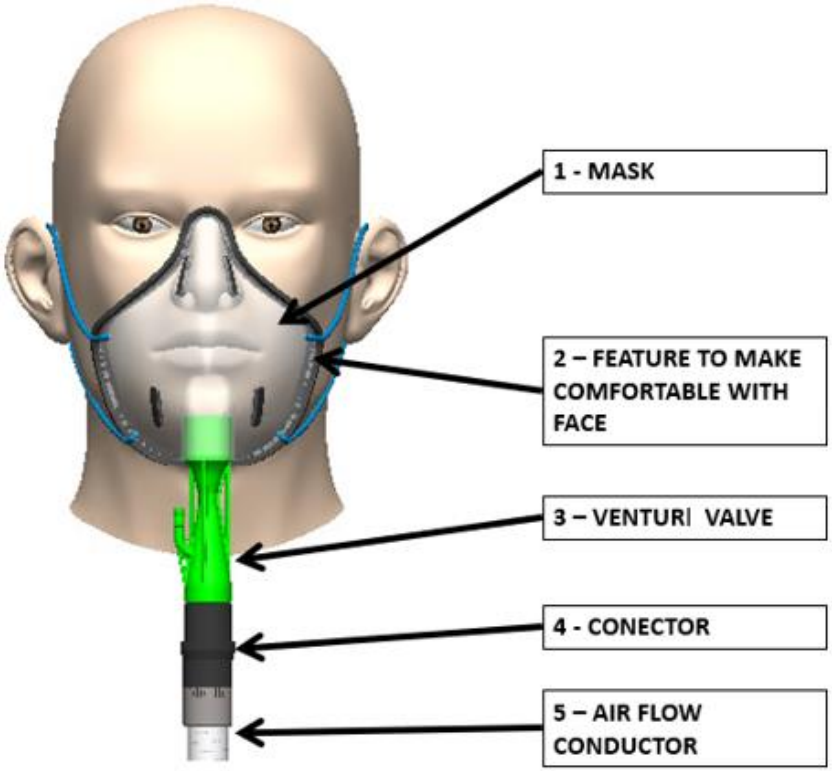
What is a ventilator and what does it do?

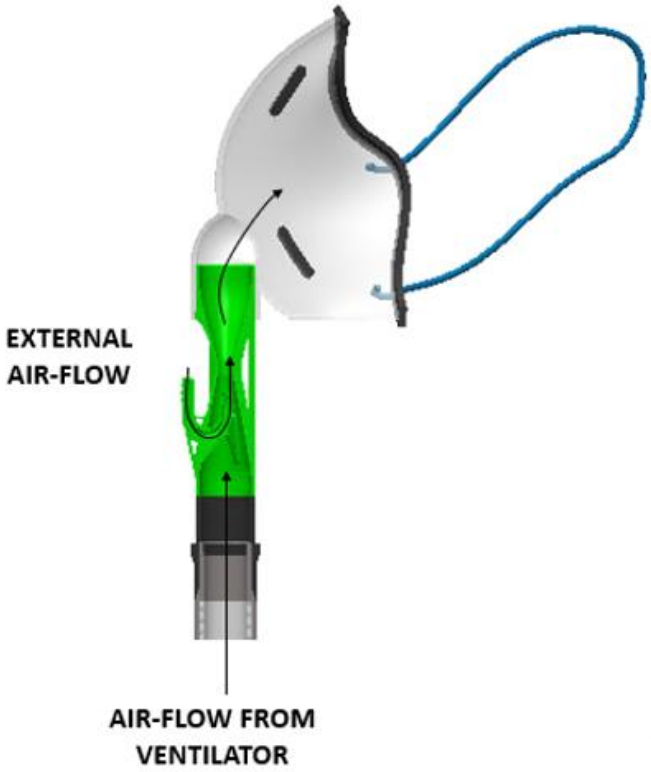
A ventilator takes over the body's breathing process when disease has caused the lungs to fail.

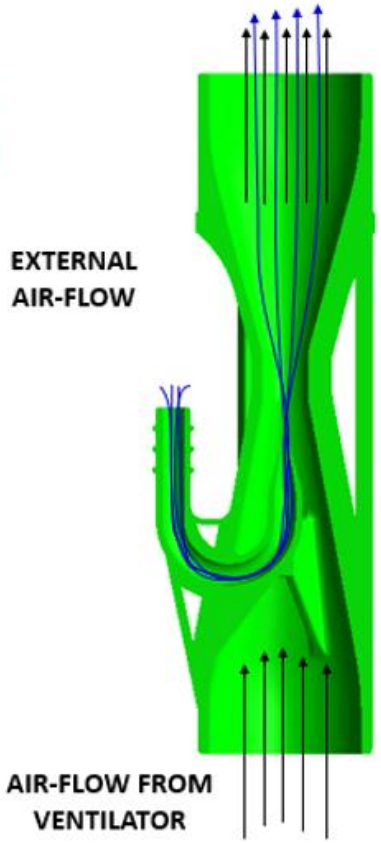
This gives the patient time to fight off the infection and recover.

Various types of medical ventilation can be used.









Venturi Valve

It is an adapter that can be attached with a mask for supplying high flow oxygen. Venturi valve is used to control the percentage of oxygen being delivered as well as the flow rate required to deliver that percent of air.

8. Ventilators Manufacturers in Canada

Key players in Canada for Ventilator Systems:

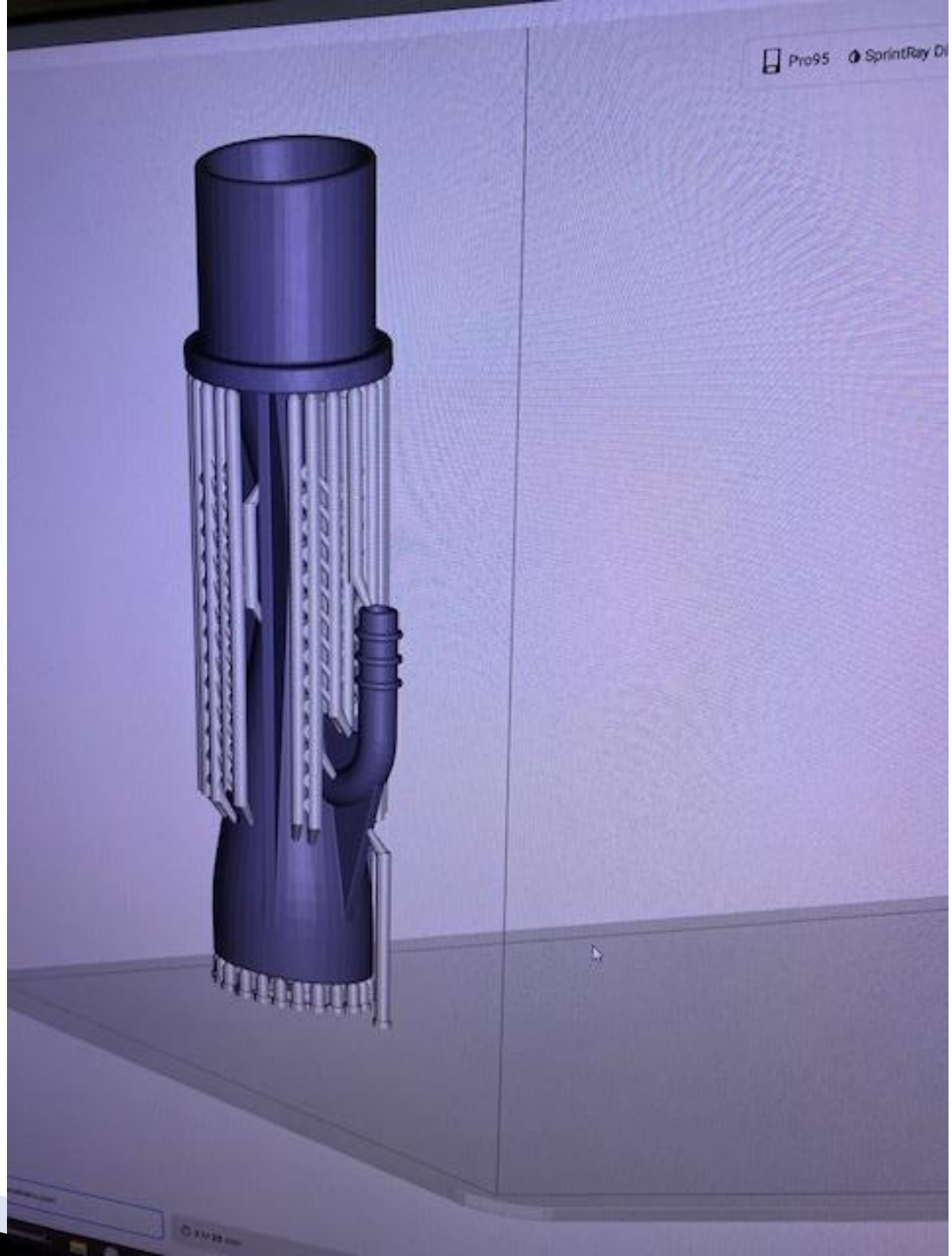
- **Thornhill Medical**, Toronto-based
- **Linamar**, Guelph-based
- **Celestica**, Toronto-based
- **Starfish**, Winnipeg-based
- **O-Two Medical Technologies**, Brampton-based

9. Venturi Valve for Ventilator Systems

- We examined venturi valves for Ventilators. Most venturi valve solutions are in STEP or STL formats.
- –Charlotte Valve by Isinnova: STEP
- –Valve regulator–STL

Designing Valve

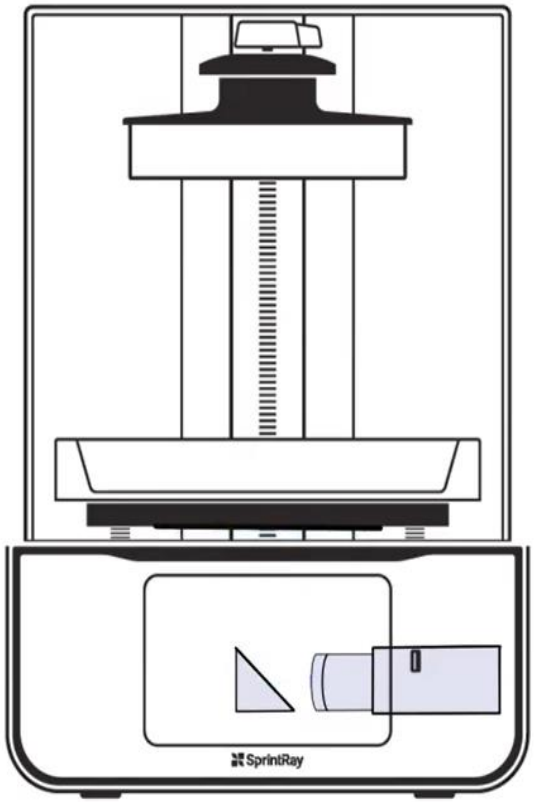
Processing Valve for 3DP



Transfer Valve for 3DP

Multiple Valves for 3DP using SprintRay

How SprintRay Pro Works



SprintRay Pro is powered by a DLP projector of our own design, enabling it to 3D print models quickly and with outstanding accuracy.

SprintRay Materials

Open-Certified

SprintRay Pro printed Valves

3D Printed Valve

10. SprintRay/CREHS Collaboration

- SprintRay is supporting CREHS with SprintRay 3D Printer Ecosystem for this ventilator valve project.
- This will benefit the community at large in mitigating the impact of COVID-19 pandemic
- SprintRay 3D Printer achieves the goal of accuracy, speed, and functionality.

11. R & D Manufacturing Ecosystem

- Need to form a R&D Manufacturing Ecosystem in providing solutions to the pandemic, if there is not one already
- Government funds are available to support such initiatives
- SprintRay 3D Printer Ecosystem available to support such initiatives
- Are you in?

12. Rapid Medical Response Story

- Additive Manufacturing/3 D printing was useful in addressing medical supply challenges and the crisis response. It's application was vital to slowing the spread and mitigating the many adverse consequences of the virus – leading to saving many lives.
- But how effective are most of the PPE solutions? Questions have to be answered.
- Ventilators are still needed worldwide, so we need to be involved in providing solutions!

Q/A and Closure!!!

- Thank You for Your Attention!

Contacts:

51 Queen St E,
Brampton, ON L6W 2A7
Canada

https://crehsinc.com/

Email: onwubolu@gmail.com

godfrey.onwubolu@crehsinc.com