Welcome to the HFNOsplitter project

This project is dedicated to doubling the capacity for High Flow Nasal Oxygen (HFNO) treatment by simultaneously connecting two COVID-19 patients to one HFNO-device by adding 3D printed parts. This project is currently only aimed at the Airvo™ 2 Optiflow™ system (Fisher & Paykel Healthcare Limited, Berkshire, United Kingdom).

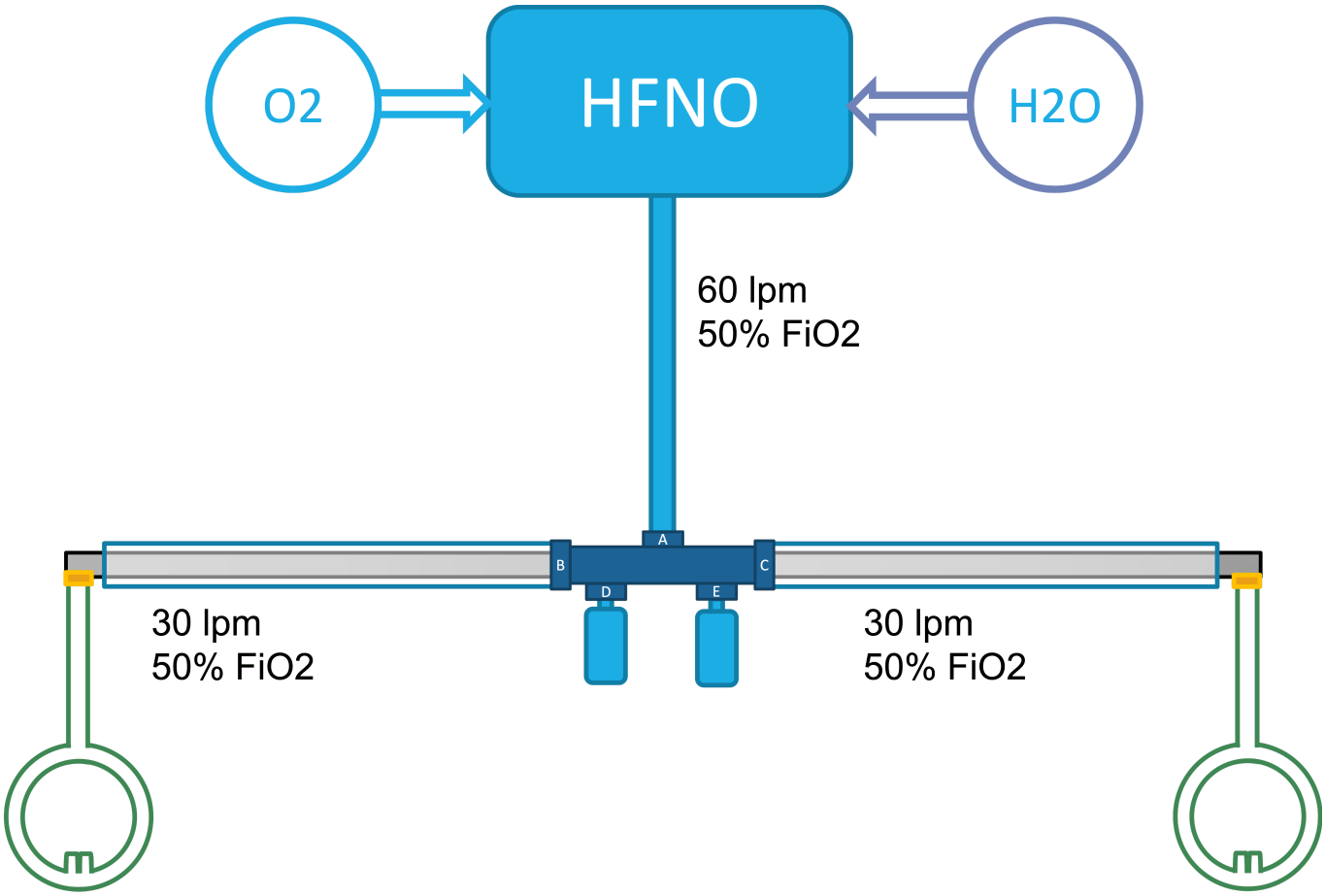

Fig 1. SHFNO Schematic setup

N.B. 1 This solution is provided as is with no express or implied warranty. *Provided under the CERN-OHL-S license*. In no event will the authors be held liable for any damages arising from the use of this solution. *Legal notice*.

N.B. 2 This project is not done in conjuction or collaboration with, nor under the influence of the original manufacturer of any equipment, medical or otherwise.

N.B. 3 While this solution has now been taken into use we are still actively developing. If your needs or setups is not met, please reach out and maybe we will be able to help you out.

Status / Progress

- [x] Develop solution
- [x] Risk assessment
- [x] Medical instructions (Swedish)
- [x] Medical instructions (English)
- [x] Validation of prototypes (*Further validation ongoing even after launch*)

- [x] First clinically aimed production
- [x] Roll out (*First standby usage 2020-04-09*)

Summary

HFNO is a valuable treatment in the ongoing COVID-19 pandemic. Its importance has risen as many healthcare systems now discourage using more readily available Non Invasive Ventilation (e.g. BiPAP). Access to HFNO is severely limited. Treatment guidelines for COVID-19 now stipulate maximum treatment levels of 30 litres / minute. The popular HFNO device Airvo™ 2 ("Optiflow") has a maximum capacity of 60 litres / minute but uses only proprietary connectors and cannot be connected to other devices. **The basic premise of this project is to provide 3D-printable parts to be able to split the Airvo™ 2 HFNO air flow to enable the system to treat two patients simultaneuosly, thus doubling the treatment capacity.** This should not be used if ***any*** other method of providing HFNO exists!

This project provides both the 3D-models of parts needed for split HFNO treatment as well as ***suggested*** instructions for use and manufacturing instructions. We also aim to continuously provide the validation from both simulations / calculations as well as real world usage (when ready).

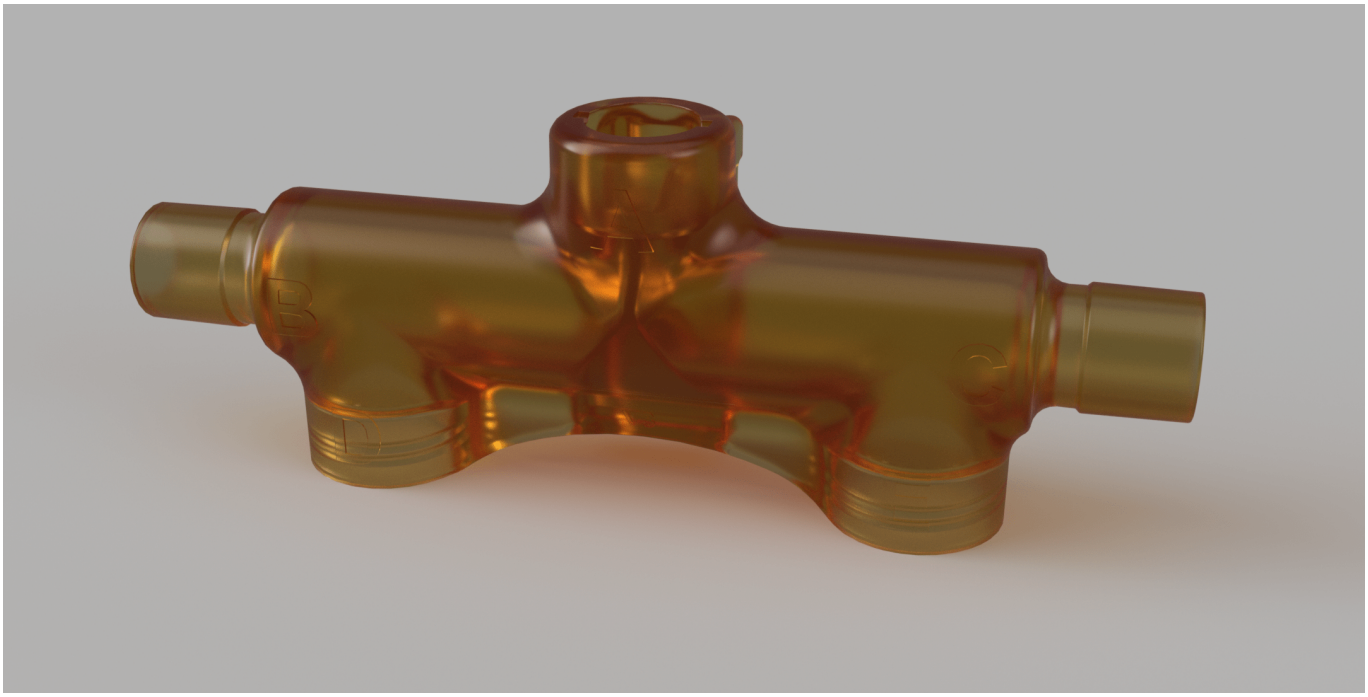

Fig 2. Render of the T-shaped connector that enables SHFNO

Documentation

0. **About This Documentation** (view as pdf)
1. **Overview - Introduction** (as pdf)
2. **Preparation** (as pdf)
3. **Models and Instructions** (as pdf)
4. **Setup and Treatment** (as pdf)
5. **Troubleshooting** (as pdf)
6. **Hygiene** (as pdf)
7. **Validation** (as pdf)
8. **FAQ** (as pdf)

Demo

This AR demo, only available on iOS, shows the 3D printed parts in actual size in Augmented Reality. Launch the demo by opening the link using an iPhone or iPad:

Launch AR-Demo

Working group

Name	Title	Place of Work	Role in Project
Jesper Hessius	MD, Internal Medicine and Cardiology Resident	Västmanland Hospital Västerås, Region Västmanland	Project initiator and coordinator, documentation, risk analysis
Erik Cederberg	Chief Engineer	3Dverkstan	CAD and design
Erik Ekbom	Biomedical Engineer	Imaging and Functional Technology, Skåne University Hospital Lund	3D printing
Petter Frieberg	MD, Engineer, PhD-Student	Clinical Physiology and Nuclear Medicine, Skåne University Hospital Lund	Validation and flow simulations
Einar Heiberg	Associate Professor, engineer	Clinical Physiology, Skåne University Hospital Lund	3D printing, regulatory affairs
Per Nordqvist	Biomedical Engineer	Department of Medical Technology Skåne, Region Skåne	Regulatory affairs, documentation, risk analysis
Göran Petersson	Biomedical Engineer	Department of Medical Technology Skåne, Region Skåne	Validation and documentation

Thanks to

3Dverkstan for providing their time, effort, expertise and printers for this project. Without them none of this would have happened.

All the online communities, doctors, nurses and medical technicians who have provided their input and knowledge into every step of this process.

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