EigenFlow 2

Enhancing
ECMO
Training

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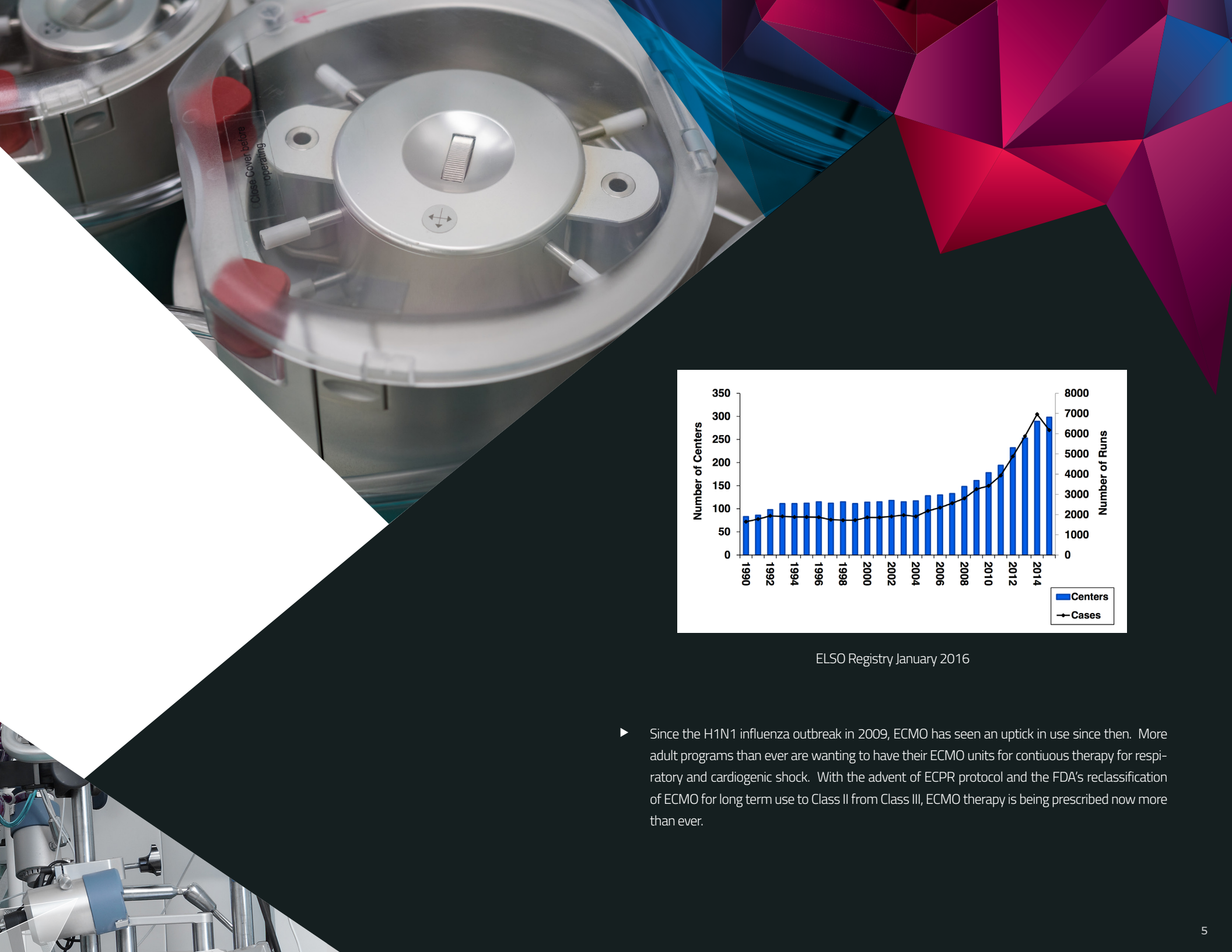
Introduction

At the forefront of new medical simulators, EigenFlow addresses the need for high quality ECMO simulation. Training nurses and respiratory therapists can be very challenging. ECMO Specialists must be attentive to even the slightest changes in the oxygenator circuit, be able to quickly evaluate problems, and take corrective actions.

Until now, an ECMO educator was present in the sim environment, manipulating the circuit in the presence of the trainee. As institutions began to develop their own ECMO simulations many realized that higher-fidelity simulation would not be possible without the development of a remote controlled simulator connected to an ECMO circuit.

- **WIth the growing use of ECMO in adults and the sporadic admission of ECMO candidates, training is ready to adapt for an on-demand learning expereince. One that is immersive, repeatable, and precise enough to create mechanical troubleshooting scenarios.**



ELSO Registry January 2016

- Since the H1N1 influenza outbreak in 2009, ECMO has seen an uptick in use since then. More adult programs than ever are wanting to have their ECMO units for contiuous therapy for respiratory and cardiogenic shock. With the advent of ECPR protocol and the FDA's reclassification of ECMO for long term use to Class II from Class III, ECMO therapy is being prescribed now more than ever.

EigenFlow 2

EigenFlow is a multifunction wireless ECMO simulator ideal for in situ training of perfusionists and ECMO specialists. Simply interpose the EigenFlow into your existing adult or pediatric ECMO circuit and remotely simulate thrombi, line obstruction, air emboli, hypovolemia, and changes in pulmonary and cardiac function.

At the heart of EigenFlow is an intuitive iOS interface available for free from the App Store. Rather than tethering control of the EigenFlow to desktop computers, we developed an intuitive iPhone/iPad app that wirelessly controls the EigenFlow. With one hand controlling EigenFlow, it allows your other hand to control manikin vitals. EigenFlow connects wirelessly through Bluetooth, so you can create simulations from 100 feet away.

- **EigenFlow 2 now features a customizable blood monitor, intermittent air embolus, and a hypovolemia module.**

THROMBOSIS

Generate variable flows and pressures with two variable controlled valves for inlet or outlet obstruction, thrombi, kinking, pump chatter, catheter malposition, and variable pre and post oxygenator pressures.

AIR EMBOLUS

Inject small (5cc), medium (25cc), or large (50cc) emboli of free air into an ECMO circuit. Customize the amount you would like to inject and do it silently with EigenFlow 2. Train students when to spot and eliminate an air embolus before it becomes fatal.

HYPOVOLEMIA

Drain up to 850 mL of fluid into EigenFlow's internal reservoir this will automatically refill the ECMO circuit when the simulation is complete.

BLOOD MONITORING

Display simulated vital blood parameters PaO2, PaCO2, SvO2, Hb, Hct, arterial and venous temperatures, simulated flow rate, activated clotting time (ACT), TEG, and aPTT directly to the ECMO trainee.

ECMO TRAINING REDEFINED

Arterial

pO_2 158 mmHg

T_{ART} 35.0 °C

SO_2

T_{VEN}

Hb

Hct

EigenFlow

DESIGN

We've taken the complexities of ECMO training and boiled them down to only the bare essentials: thrombosis, air entrainment, cannulation, and hypovolemia. Next, we asked ourselves, how can we make ECMO training as simple as launching an app on your phone? It's simple. We began with an elegant design that is beatiful from the inside and out.

Simplicity was one of the foundations to the creation of EigenFlow. From the CPC quick connect adapters, to using one port for both air entrainment and hypovolemia scenarios. EigenFlow can quickly get you to the next scenario and still leave your trainee wondering what could go wrong next.

Elegant design comes only from inspiration. Here's how EigenFlow went from a rough prototype to a finished production.

COMPACT **DESIGN**

Stitting at just 6cm wide and 14cm tall. Most people are pleasantly surprised to see just how small EigenFlow is. From the 850mL reservoir, two CPUs, 5 sensors, and two industrial strength valves found inside EigenFlow. There is little space left to waste in this precisely engineered compact design.

3D-PRINTED **PARTS**

Each EigenFlow 2 comes with four internal 3D-printed parts that are used to store everything from air, fluid, and mounts for the components inside EigenFlow.

SUBTLE **MINIMALISM**

Everything you need to run an ECMO simulation, right when you need it. EigenFlow was designed for in-situ based simulations making it easier for ECMO coordinators to plan their simulations around the number of reserve pumps they have in one session.

INTUITIVE **INTERFACE**

The EigenFlow iOS App is simple and easy to use. Each EigenFlow function is divided into 4 tabs at the bottom of the app. Controls and interfaces are plainly written and easy to find. You'll never have an issue creating a scenarios with EigenFlow's easy access to critical blood parameters.

CONNECTIVITY

EigenFlow can easily connect to any ECMO circuit (pediatric or adult, centrifugal or roller pump). Select two locations on your ECMO practice circuit that you would like to manipulate pressures (usually pre and post oxygenator), splice the circuit, and interpose EigenFlow with our CPC quick connect adapters.

Hypovolemia and air entrainment are connected via a small hose to any port on your circuit.

Once your hoses are connected from the ECMO circuit to EigenFlow, launch the EigenFlow app and you will have complete wireless control of your ECMO circuit up to 100 feet with Bluetooth.

BLUETOOTH

EigenFlow is paired wirelessly through a Bluetooth LE connection to any iOS device. Bluetooth was chosen based on performance with security in mind. Bluetooth allows for multiple connections, so if there are mulitple EigenFlow in use, each one can be operated independently.

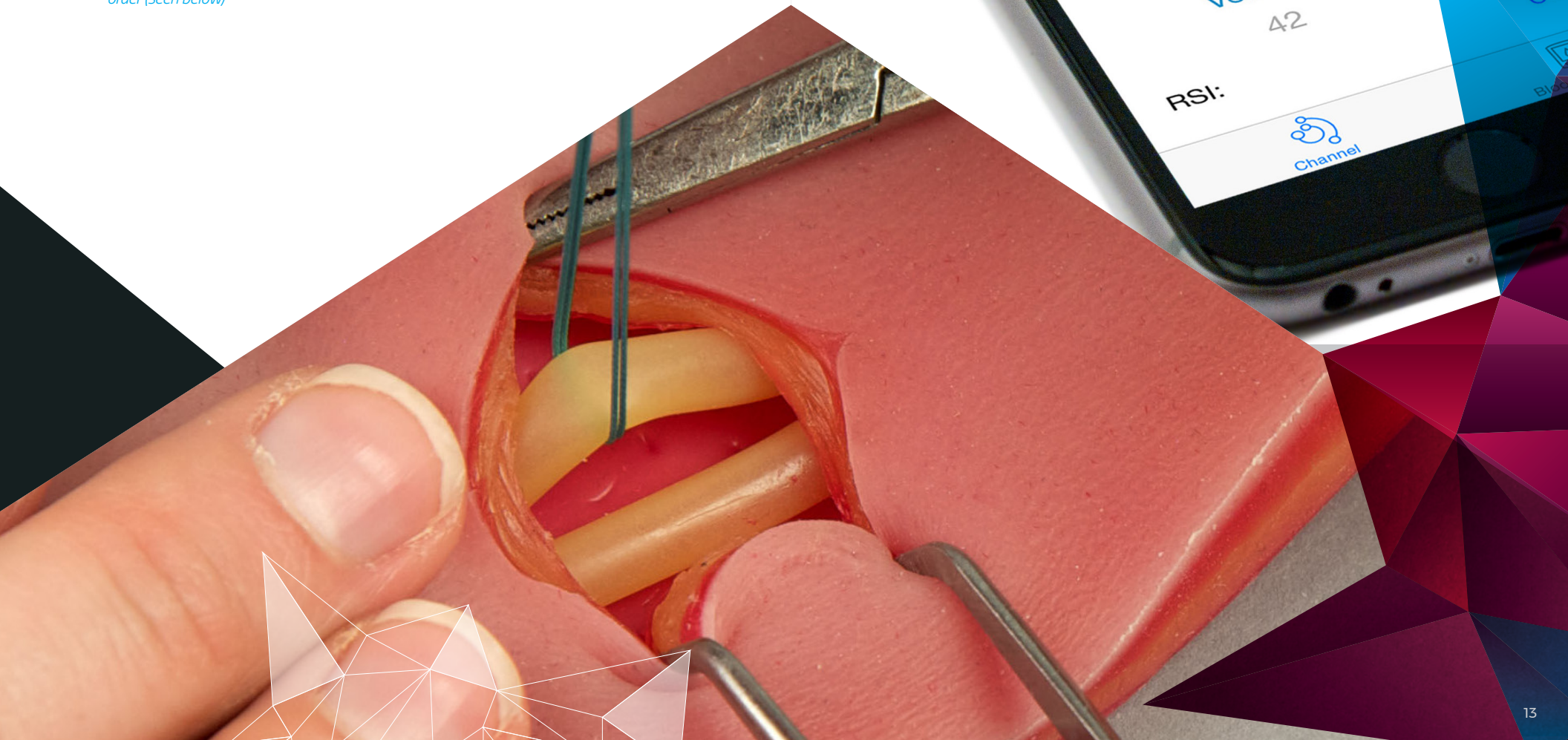
IOS APP STORE

The EigenFlow app is a free download on the Apple iOS Store. Updates to the app are will be made throughout the lifetime of the product to ensure EigenFlow can run on the newest versions of the iOS operating system.

Available on the App Store

- *EigenFlow can be connected to any place along your ECMO circuit that you would like to manipulate pressures. For most simulations we recommend configuring EigenFlow for two locations. These recommendations are illustrated in detail in our user manual.*

For cannulation connections, the **3-Dmed® Pediatric ECMO Cannulation Kit** *is available to order (seen below)*



SCENARIOS

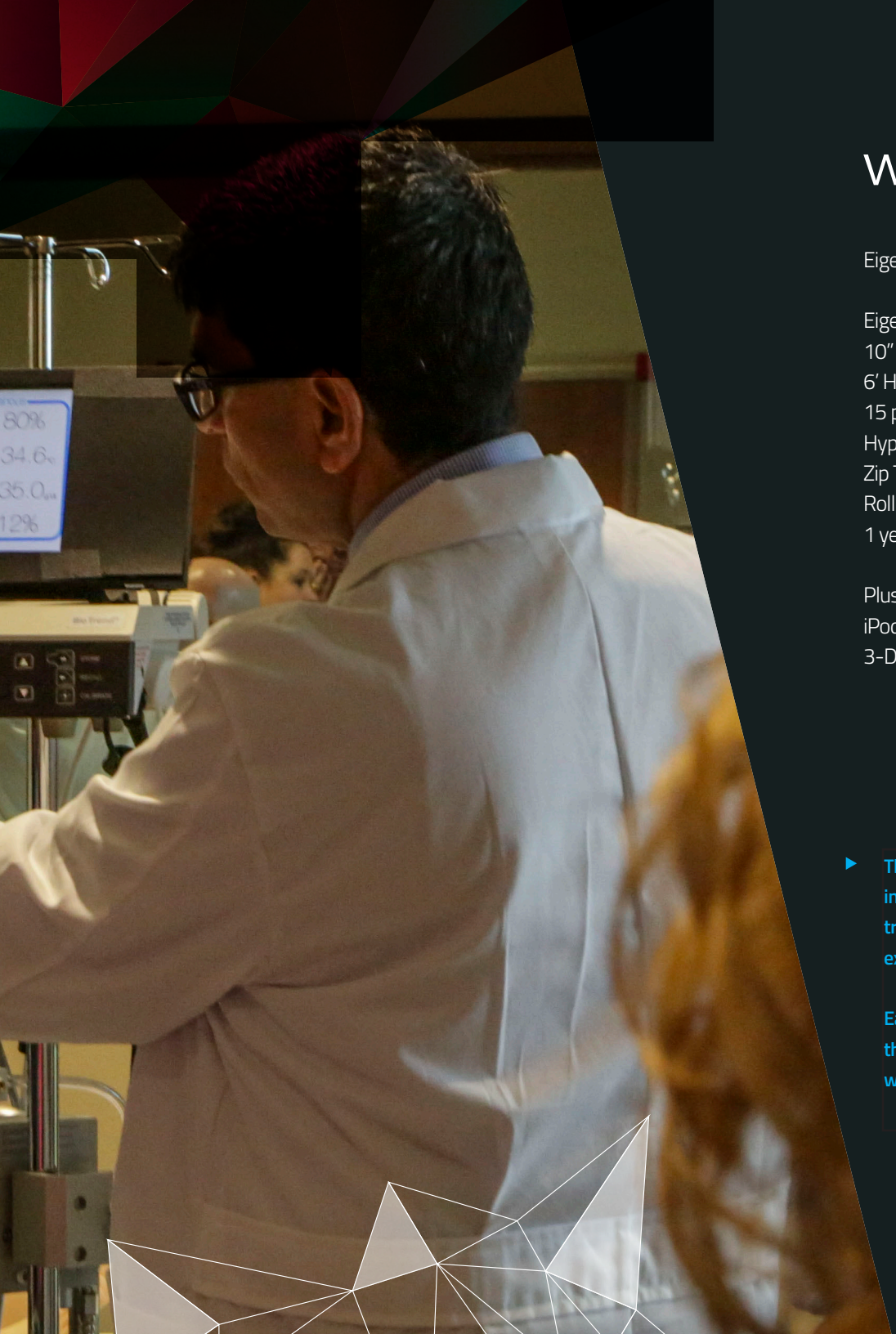
EigenFlow comes with 12 pre-written adult and 7 pre-written pediatric scenarios that can be used by your ECMO team to formalize your training. Each scenario comes with a background history of each patient as well as a state diagram detailing a scenario progression. Here is a list of the following scenarios:

Adult

1. Cardiac Tamponade
2. Cardiogenic Shock
3. Differential Hypoxia
4. High Post-Oxygenator Pressure
5. High Pre-Oxygenator Pressure
6. Hypovolemia
7. Kinked Tubing
8. Oxygenator Failure
9. Pump Chatter
10. Venous Air Entrainment
11. Arterial Air Entrainment
12. VV ECMO Preparation

Pediatric

1. High Post-Oxygenator Pressure
2. High Pre-Oxygenator Pressure
3. High Better Bladder Pressure
4. Hypovolemia
5. Venous Air Entrainment
6. Arterial Air Entrainment
7. Oxygenator Failure



WHAT'S IN THE BOX?

EigenFlow contains everything you'll need to run your own in situ ECMO Simulations:

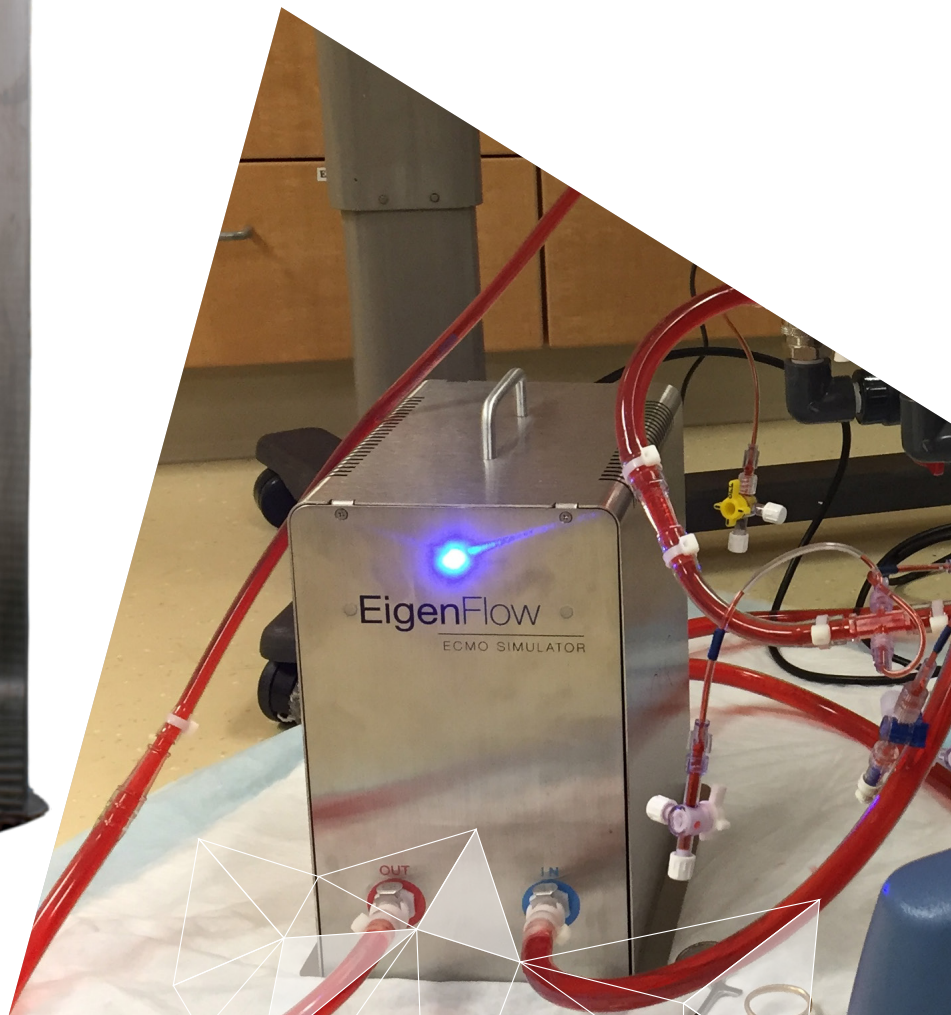
EigenFlow 2 ECMO Simulator
10" LCD monitor
6' HDMI Cable
15 pediatric/adult circuit acetal connectors 4 acetal couplers
Hypovolemia module
Zip Ties
Rolling Pelican Case EigenFlow Manual
1 year limited warranty

Plus:
iPod Touch preloaded with the EigenFlow app
3-Dmed® Pediatric ECMO Cannulation Kit plus 3 replacement neck pads

- **The 3-Dmed® Pediatric ECMO Cannulation Kit plus 3 replacement neck pads takes your training to a new level. Using the 3-Dmed® ECMO neck pad provides a realistic experience when training for ECMO cannulation. Now the surgeon is an active participant in the simulation experience.**

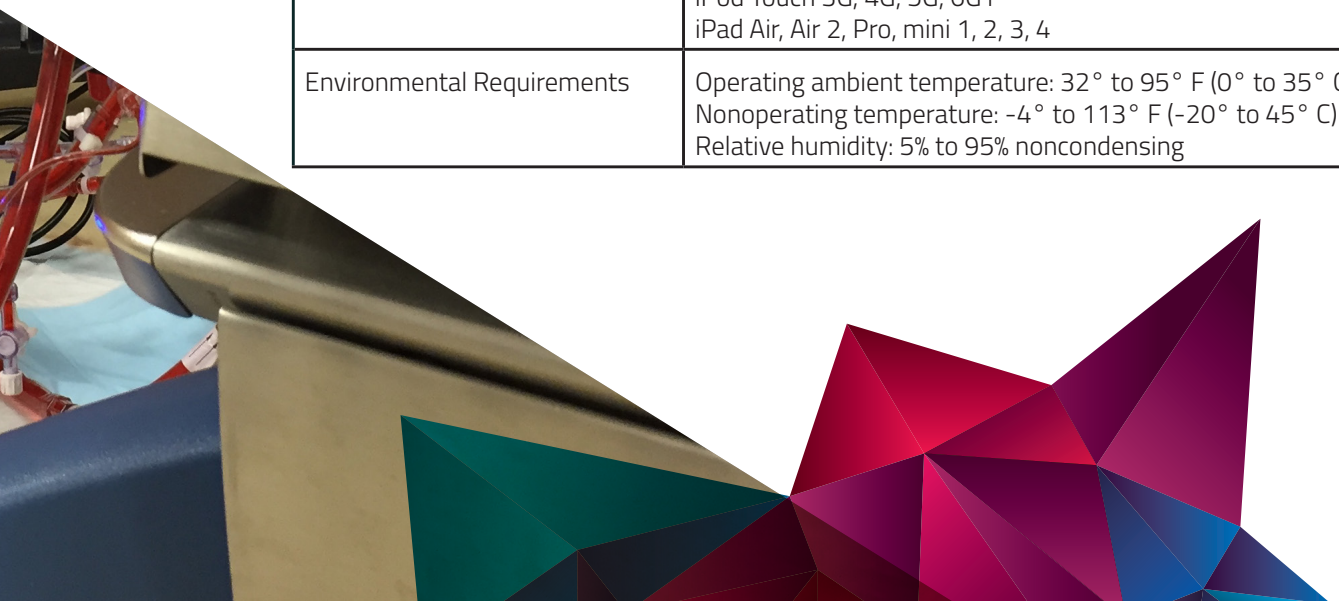
  Each ECMO neck pad allows for a surgical incision, cannulation of vessels and connection to the ECMO machine for artificial blood transference through the machine. Use in conjunction with the EigenFlow for a comprehensive simulation experience.


EigenFlow
ECMO SIMULATOR
OUT
IN


EigenFlow
ECMO SIMULATOR

TECHNICAL SPECS

Finish	316 Stainless Steel
Capacity	8GB SD Card
Weight and Dimensions	Height: 6 1/8” Width: 8 1/2” Depth: 10 1/8” Weight: 33 lbs
Display	Panel Size: 10.1” TFT LCD (16:9) Resolution: 1024×600, support up to 1920×1080 Brightness: 450cd Contrast: 500:1 Input Signal: HDMI, YPbPr, AV1/AV2
Processors	700 MHz single-core ARM1176JZF-S, 16MHz Atmel ATmega32U4
Wireless	Bluetooth 4.2 technology
Power & Output	EigenFlow is powered by 12VDC 6A Output: HDMI out
EigenFlow iOS App	iOS 7, 8, 9, 10 Compatible only iPhone 4S, 5, 5S, 6, 6+, 6S, 6S+, 7, 7+ iPod Touch 3G, 4G, 5G, 6G i iPad Air, Air 2, Pro, mini 1, 2, 3, 4
Environmental Requirements	Operating ambient temperature: 32° to 95° F (0° to 35° C) Nonoperating temperature: -4° to 113° F (-20° to 45° C) Relative humidity: 5% to 95% noncondensing



OUR CLIENTS

- EigenFlow is used in over 11 hospitals nationwide

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THE UNIVERSITY OF
ALABAMA AT BIRMINGHAM

OSF
HEALTHCARE

Children's
MINNESOTA


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CookChildren's
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