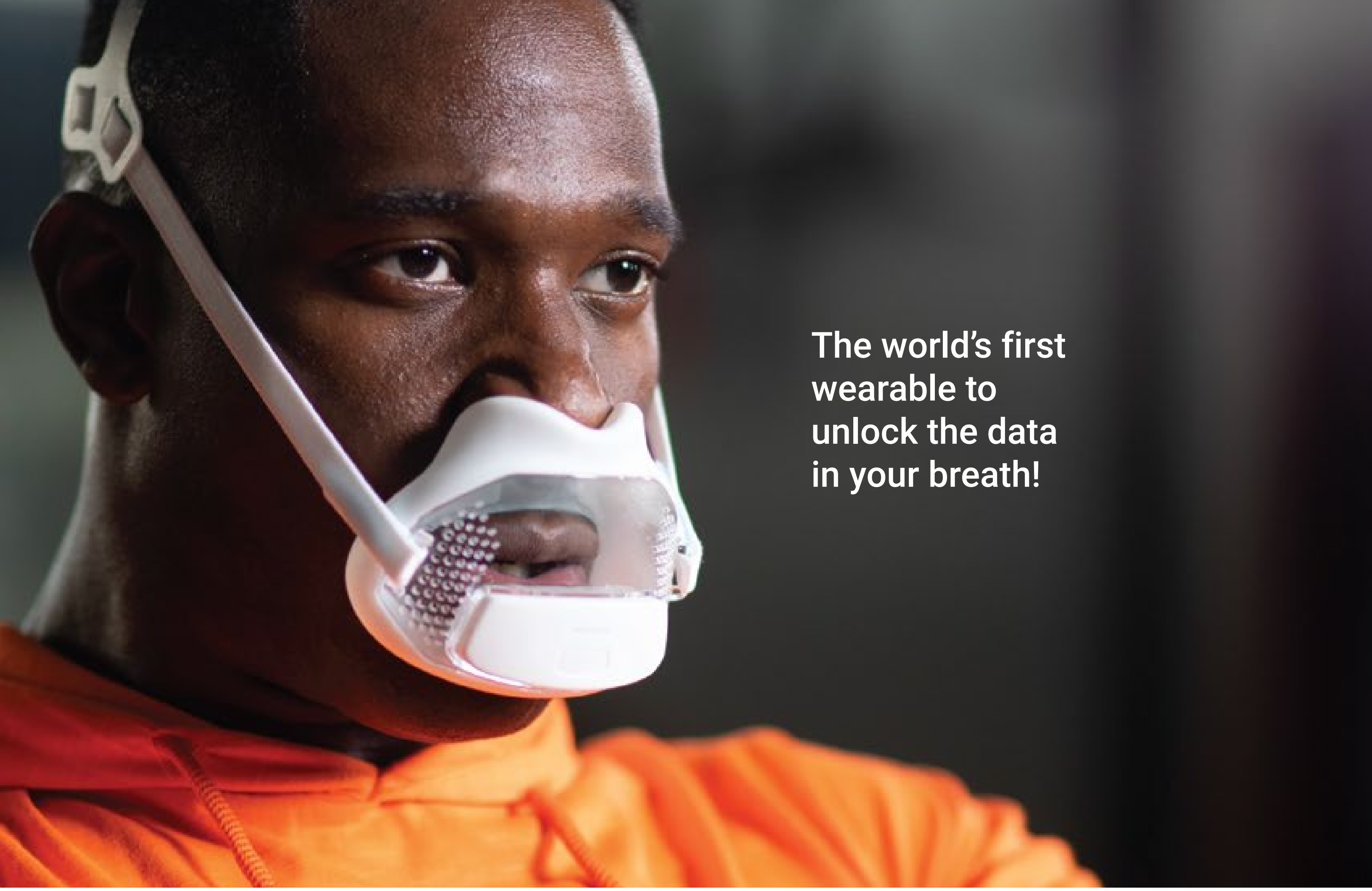


CASE STUDY

Calibre Breath Metabolic Tracker

A real-time wearable fitness metabolic performance tracker that helps you perform better and live smarter. Calibre™ measures breath flow and composition for tracking calories, fat burn and oxygen consumption that can be worn anywhere and anytime, allowing users to monitor how daily activities and exercise affect the body and respiratory system.

The Challenge

Calibre™ was inspired by a belief that access to meaningful, reliable data can improve everyday health and performance. The company selected Design 1st in early 2020 for initial project concept design work, human behavior testing, and market research. Following the market research, the Design 1st team undertook other stages of the product design cycle, including R&D testing, detailed design, prototype testing, and critical individual parts specification that continues today.

Calibre™ needed to fit lab and medical-grade equipment into a wireless wearable mask while maintaining high accuracy.

Concept Requirements

- Aesthetically Appealing
- Light Weight
- Accurate Metrics
- Comfortable
- Long Battery Life

Access to this level of data was previously only available at medical or lab facilities. A large challenge was developing custom testing verification equipment and methods that were integral to calibrate sensors for accurate data metrics. Multiple sensors – previously performed by different pieces of larger medical or lab machinery, needed to be fit into a much smaller, fully-integrated package, that could comfortably fit on most faces to measure the user's breath with high accuracy.

The device needed to be an aesthetically appealing, light weight and functional wearable tracking device that gave users access to real time data to monitor metabolic burn and performance improvements.

The Solution

A wearable, real-time fitness metabolic tracker that measures breath flow and caloric burn of carbohydrates versus fats, as well as oxygen uptake and many other respiratory parameters. The device gives users access to data that influences how their daily routines and exercise affect body health and respiratory system function. Aesthetically pleasing, lightweight, and functional, Calibre packs a suite of gas, pressure, temperature, and humidity sensors into a tiny, portable, wireless electronics module that clips to a comfortable breath sampling face piece. Activity agnostic with 14 hours of battery life, users can go anywhere they feel comfortable with the mask on. Calibre tracks and stores dozens of real-time metabolic and respiratory biometrics through an app (measured up to fifty times per second), collecting real-time data on airflow composition, monitoring and reporting the effect of daily activity on the body.

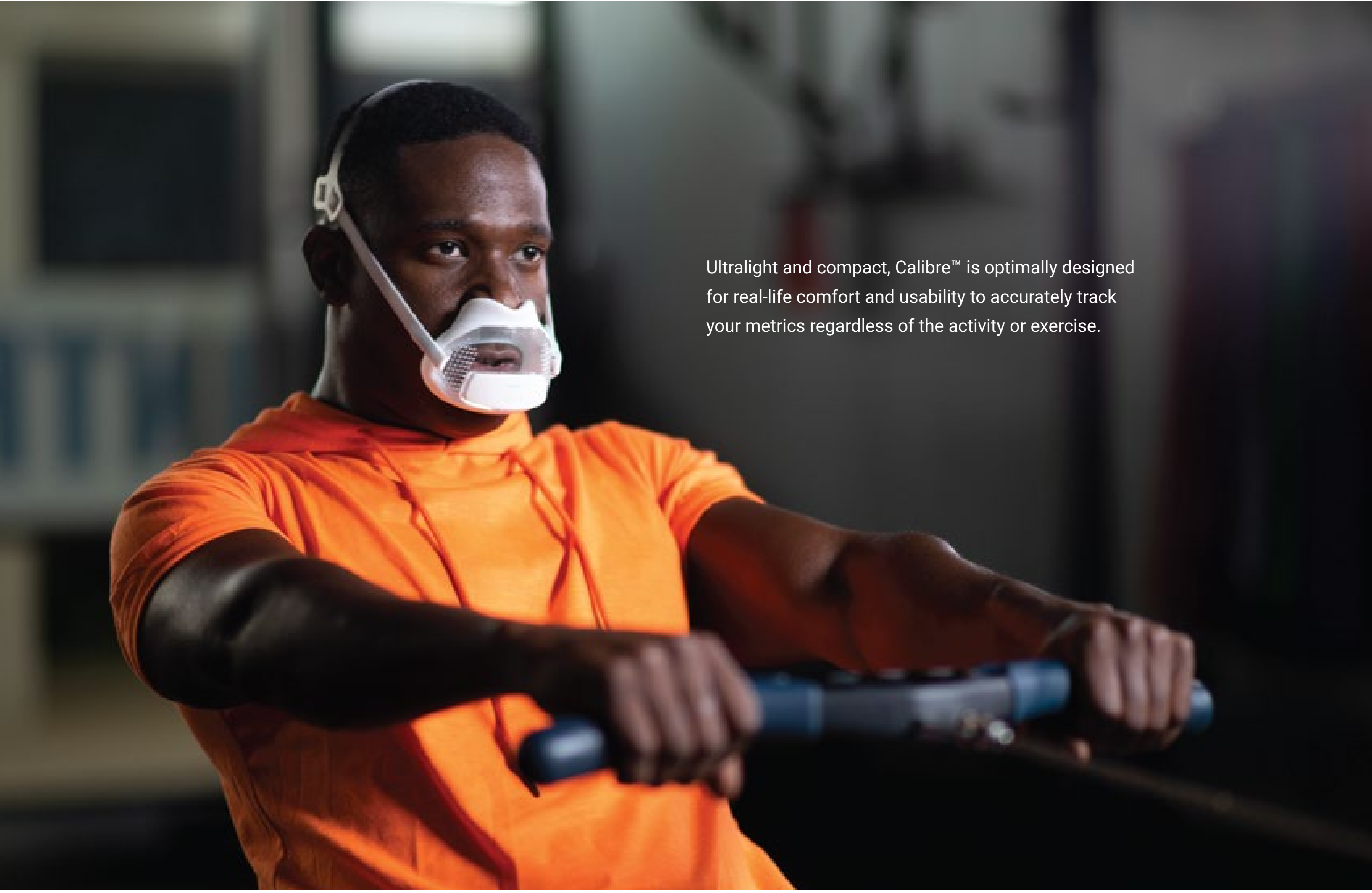
Calibre™ was inspired by a belief that access to meaningful, reliable data can improve everyday health and performance.

Design Project Overview

Calibre Biometrics was founded with a vision of bringing the richness of breath measurement and calorimetry to consumers. The company believes that meaningful, reliable data can facilitate improved everyday health and performance, and is on a mission to provide people access to the wealth of information carried in their own breath. Breath measurement is the most accurate way to measure metabolic activity and access to these tools were previously only available in labs and hospitals.

"Design 1st's creative, product design, and mechanical engineering services really stand out. They are a smart, experienced team and their rapid prototyping and test capabilities really played a major role in shaping our innovative device"
-Udi Meirav

The company sought a design partner that could conduct extensive sensors and ergonomics R&D to determine human acceptance of a wearable fitness tracker and successfully develop a technologically challenging product design that could be manufactured in high volume. Calibre Biometrics evaluated a couple of design firms before bringing on Design 1st. The other design firms found the design too challenging considering the multiple sensor requirements. Design 1st was chosen as the preferred design partner who could tackle the challenge with their large multi-disciplinary team of people with expertise in air and fluid flow, as well as integrated circuitry, firmware programming, and industrial design, all required skills to meet the business goals of the product. Calibre began engaging with Design 1st in 2020 to conduct extensive user and market research to help identify the target customer and the market opportunity for a wearable measurement device that would be used by individuals that are most likely to exercise and adopt new technology. Survey results would help guide initial project concept design work. For the product design to be impactful and successful in market, survey results needed to uncover insight into five key areas: the target customer, individual's relationship with exercise, comfort level with technology, individual behavior habits with this type of product and preferred design.



Ultralight and compact, Calibre™ is optimally designed for real-life comfort and usability to accurately track your metrics regardless of the activity or exercise.

After a design concept was chosen, Design 1st developed 3D CAD prototypes for user testing. A test bed was created to verify sensor accuracy with the ability to conduct live, ongoing testing to help verify necessary programming and data processing changes. This resulted in the ability to test and address risks, including air moisture condensation challenges, and ultimately to design a device that was both aesthetically appealing and engineered for precision and long-term use.

The result is an accurate wearable tracking device that is functional, aesthetically pleasing, and lightweight. Calibre packs a suite of gas and pressure sensors into a tiny, portable, wireless electronics module that clips to a comfortable face piece. Users can go anywhere and do anything, tracking dozens of real-time metabolic & respiratory biometrics, measured up to fifty times per second. Activity agnostic with 14 hours of battery life, it features a tracking app to collect real-time data on airflow composition and to monitor daily activity effects on the body.

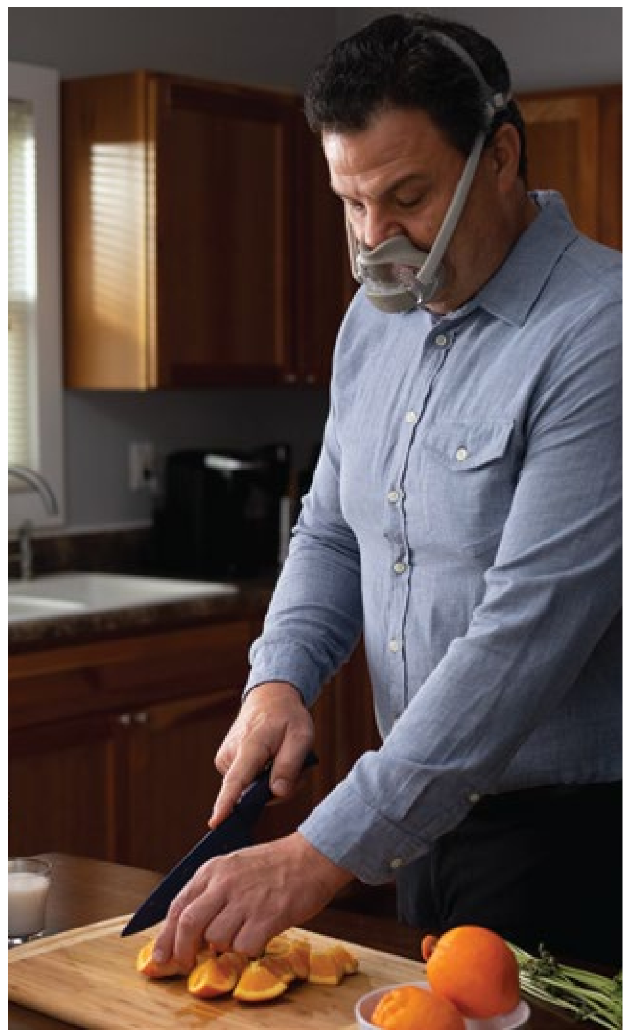
Reducing Risk & Cost

Design 1st addressed design and component supply risks up front. Extensive surveys and ongoing testing fueled the modifications of the product. A test bed helped the team successfully identify and overcome engineering challenges, refine sensor characterizations, and validate product performance for repeatable and accurate function.

"Design 1st is a one-stop-shop, including supply chain access. This latter part is very complicated, but they're well connected to a system of manufacturers for prototyping and mass production and their ability to bring all of this to the table really helped deliver the product we envisioned to market"

-Udi Meirav

Extensive early market and consumer research which helped the Design 1st team successfully pivot from possible design challenges down the road. The research involved human factors analysis of things like the average distance between nostril and mouth, head and face sizes and bench model prototypes to gain an understanding of user reactions and achievable measurement accuracy of sensor data. The outputs of this research shaped the design helping to achieve the final device geometry including the placement of sensors on the custom device.



Detailed Engineering

An adjustable head strap was designed with spandex and polyurethane foam and hypoallergenic silicone gasket for a gentle secure rest of the face piece below the nose. The housings are made of durable polycarbonate, with a clear Tritan plastic anti-fog facepiece, and over-molded LSR silicone gaskets. A custom flex PCBA was developed with pressure, O2, CO2, humidity, and temperature sensors to measure breath flow and composition to determine real-time metabolic and respiration metrics.

Protoyping began early on, and continued throughout the design process, continuously refining the product.

Prototype
& Testing:

Human anthropometrics analysis of facial structures and 3D prototype & user testing for face fit was conducted, as well as rigorous user testing and rapid prototyping/bench modeling to create minimal straps that are stable, comfortable, for adjustable seals that cater to different levels of activity.

Airflow dynamics testing was conducted for facepiece comfort at high breathing rates and detectable pressure at low breathing rates.

Sensor and physiological research and testing were conducted to create custom tuned device firmware for accurate auto sensor calibration, breath detection, gas mixing correction factors, and pressure to flow conversion.

A testbed with mannequin heads, bellows pumps and calibrated gas inputs was designed to verify breath measurement accuracy and repeatability.

Manufacturer & Supplier Selection

Design 1st researched, tested, and worked with manufacturers on getting the right materials with anti-fog and soft touch coatings applied to the lens and gasket of the face piece in production. Other critical components required access to robust supply chain management skill.

Do you need help with wearable product design?

Get in touch with our senior team:

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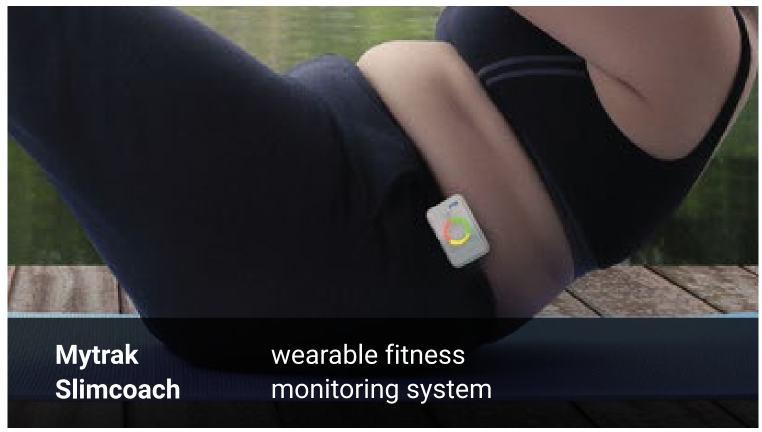
Design1st.com

See other wearable projects we have worked on:

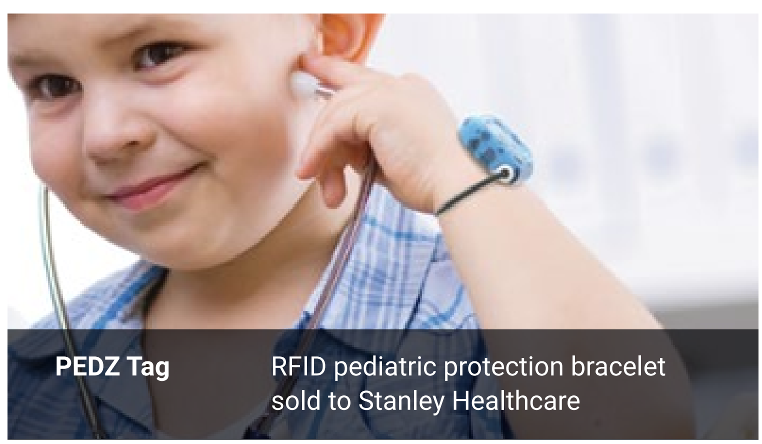
www.design1st.com/wearables

Breathe Connected Wearable Mindfulness Device



Mytrak Slimcoach wearable fitness monitoring system

ARC Lenovo Vital Sign Reader



PEDZ Tag RFID pediatric protection bracelet sold to Stanley Healthcare