

Handwritten signature in white ink on a green background. The signature is stylized and appears to be the name "K. P.". A small white dot is positioned above the letter "P".

My name is Eric.

This is my design portfolio. The projects inside reflect my academic curriculum.
Part environmental scientist; part industrial designer.



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Oxygen Concentrator Re-design

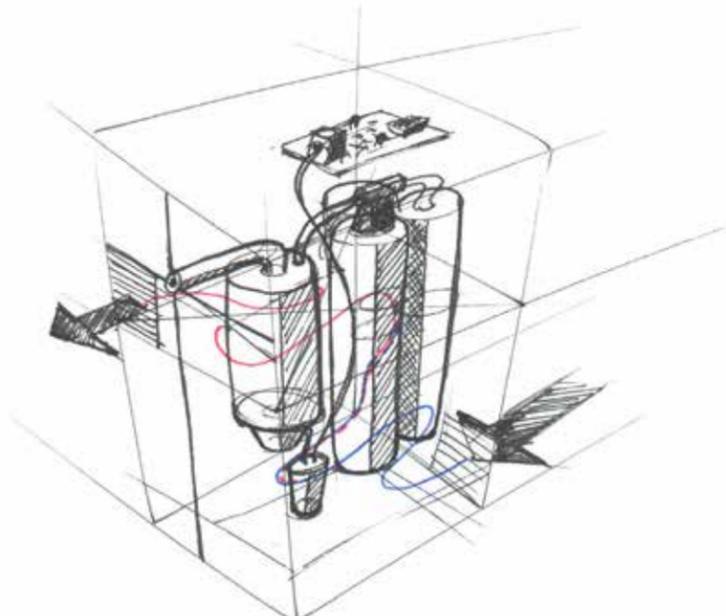
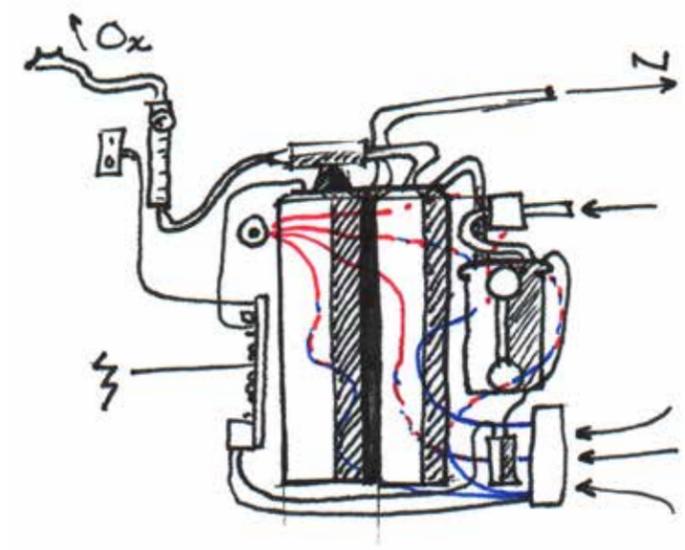
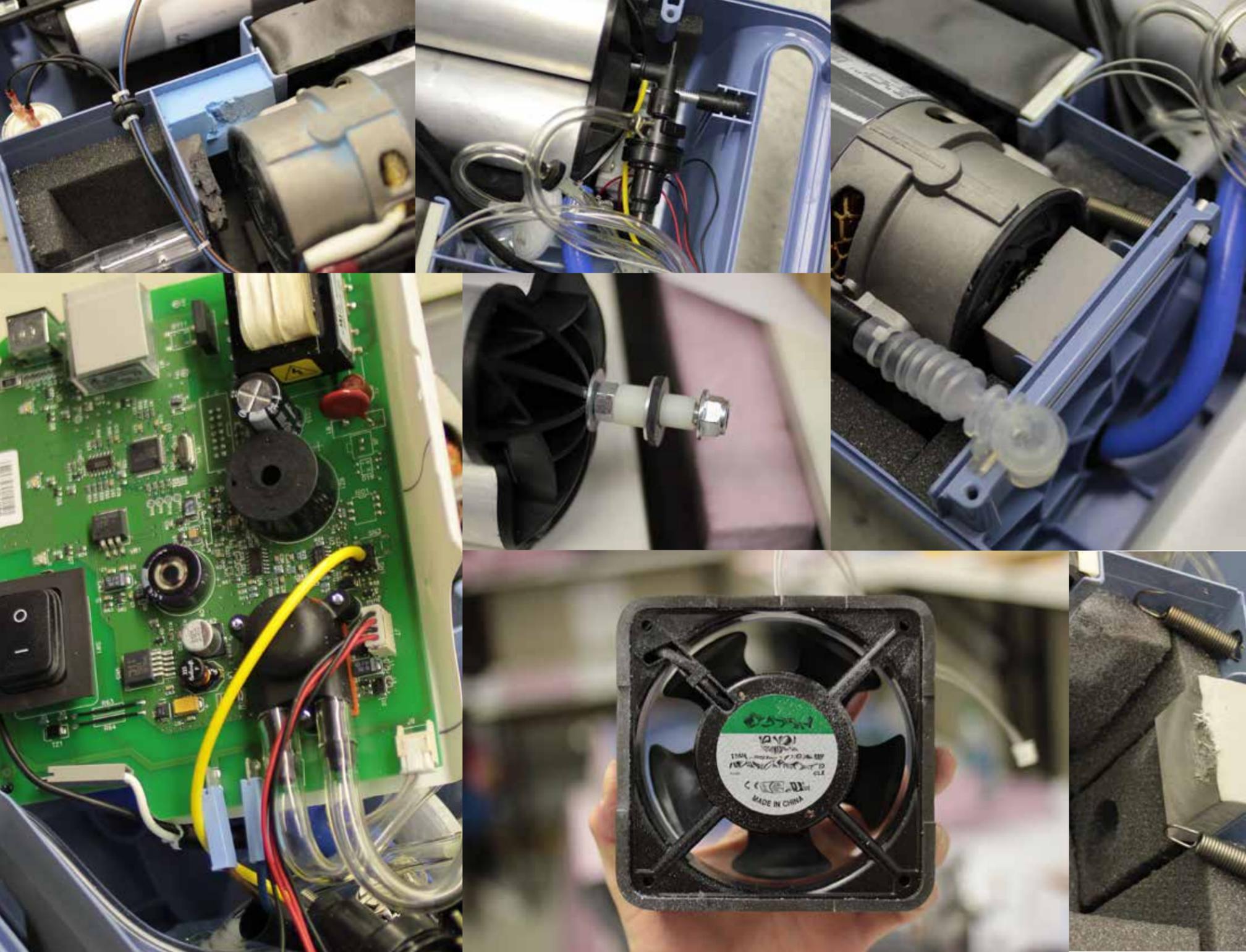
2013.

*A collaboration with Philips Respironics
and Georgia Tech Industrial Design.*



Oxygen concentrators are ergonomically disastrous and rarely are designed with consideration to sustainable material choices.

For this project, an Everflo Q was donated by Philips Respironics to be disassembled and re-purposed into a fully functional prototype. Disassembly led to a deeper understanding of the system.



Final design must incorporate lightweight [expanded polypropylene \(EPP\)](#).

Design must comply with [existing safety codes](#) (machine ventilation, etc.).

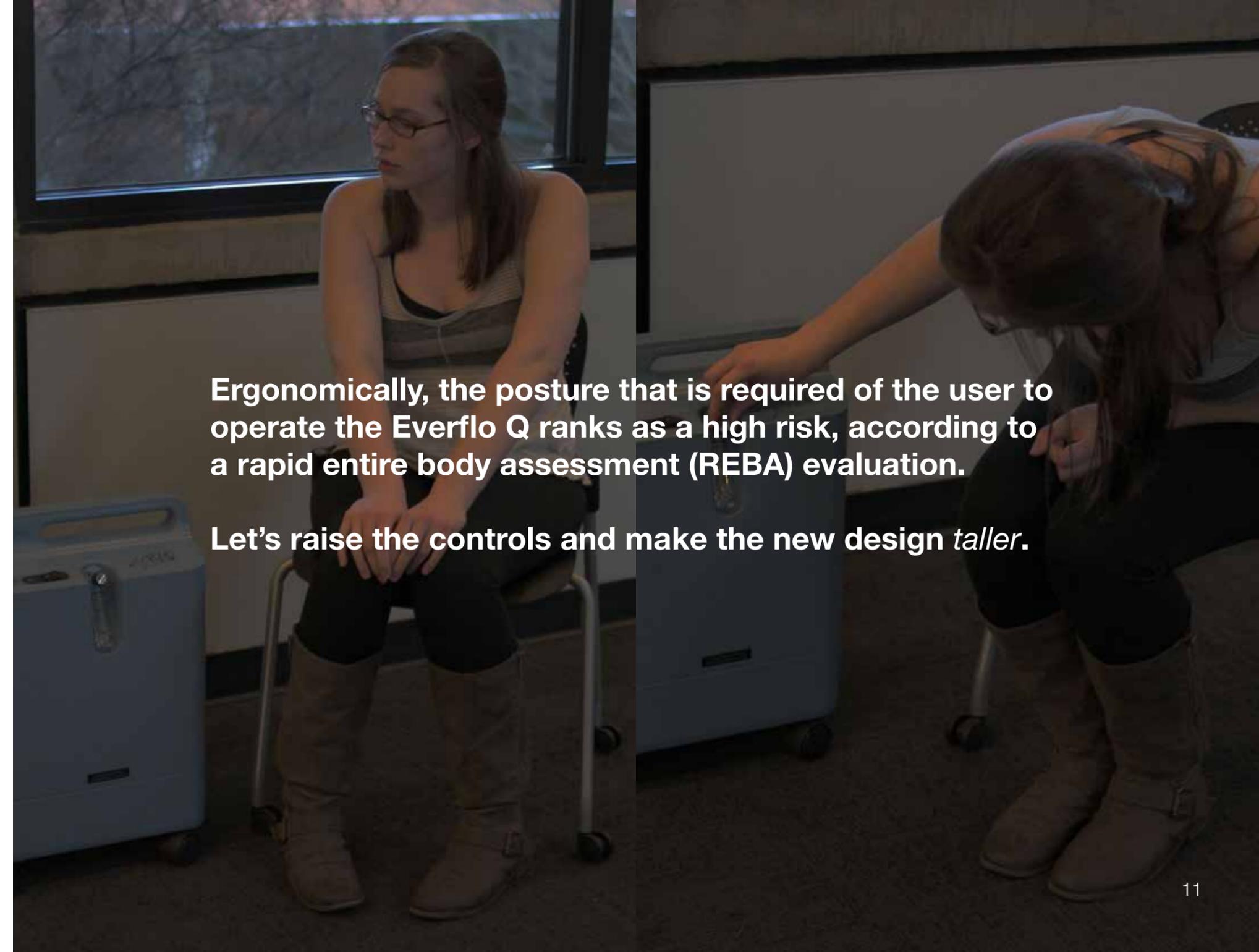
Must be [visually appealing](#) while fitting into a [specified cubic area](#) which is designated by Philips Respironics.



Persona: Marilyn

Growing up in an upper-middle class family in the San Francisco bay area, Marilyn has always had a good sense of what is hot on today's growing technology market. Recently, she has developed an increasingly severe case of COPD, but she is [not ready or willing to give up her tasteful style](#) in her home by disrupting the feng shui with a medical device.

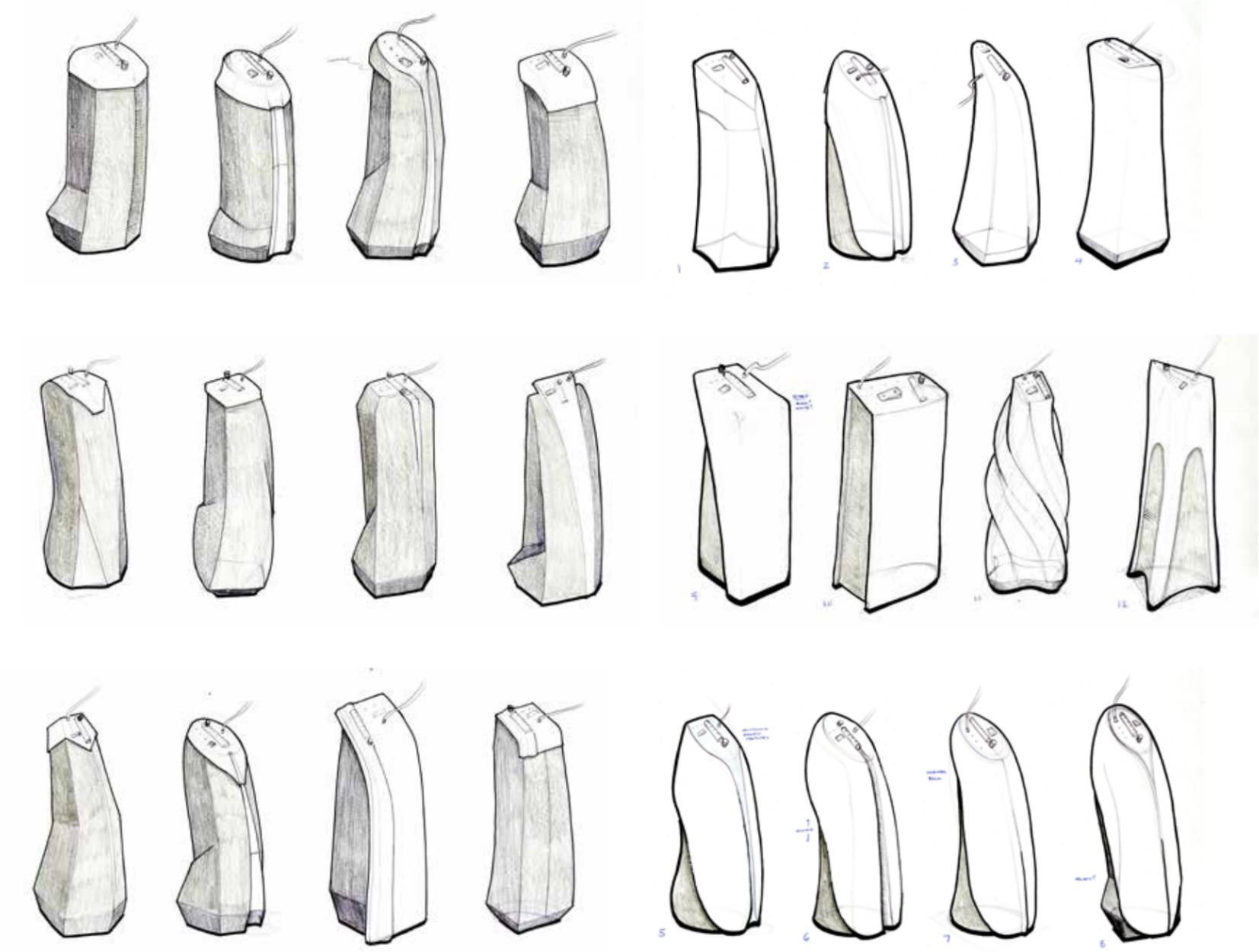
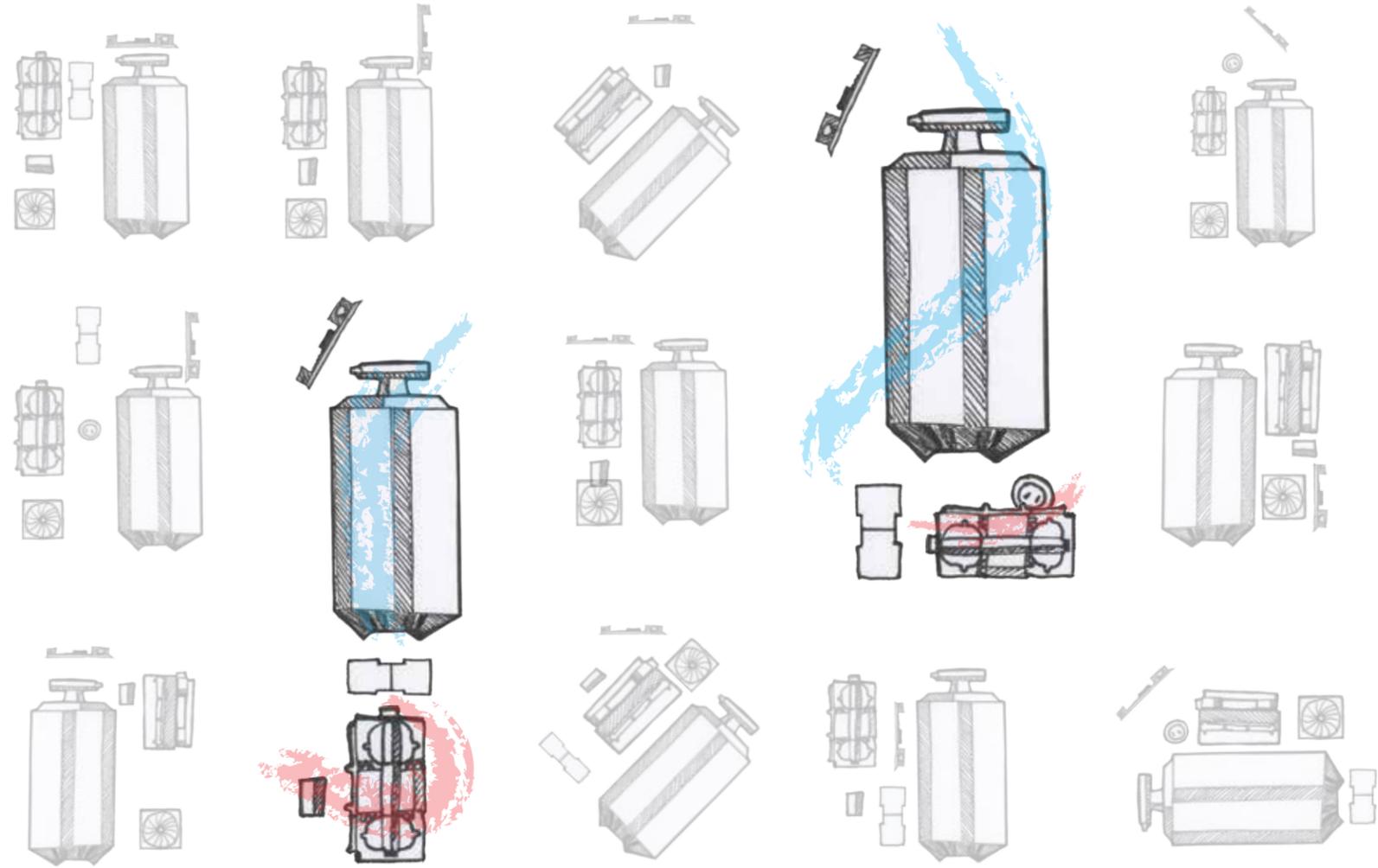
Almost everything she owns comes from a luxury market segment. However, she understands that the growing environmental concerns around product development are important to sustainable living. She [seeks products that can be recycled](#) in order to avoid feeling guilty about being a consumer.

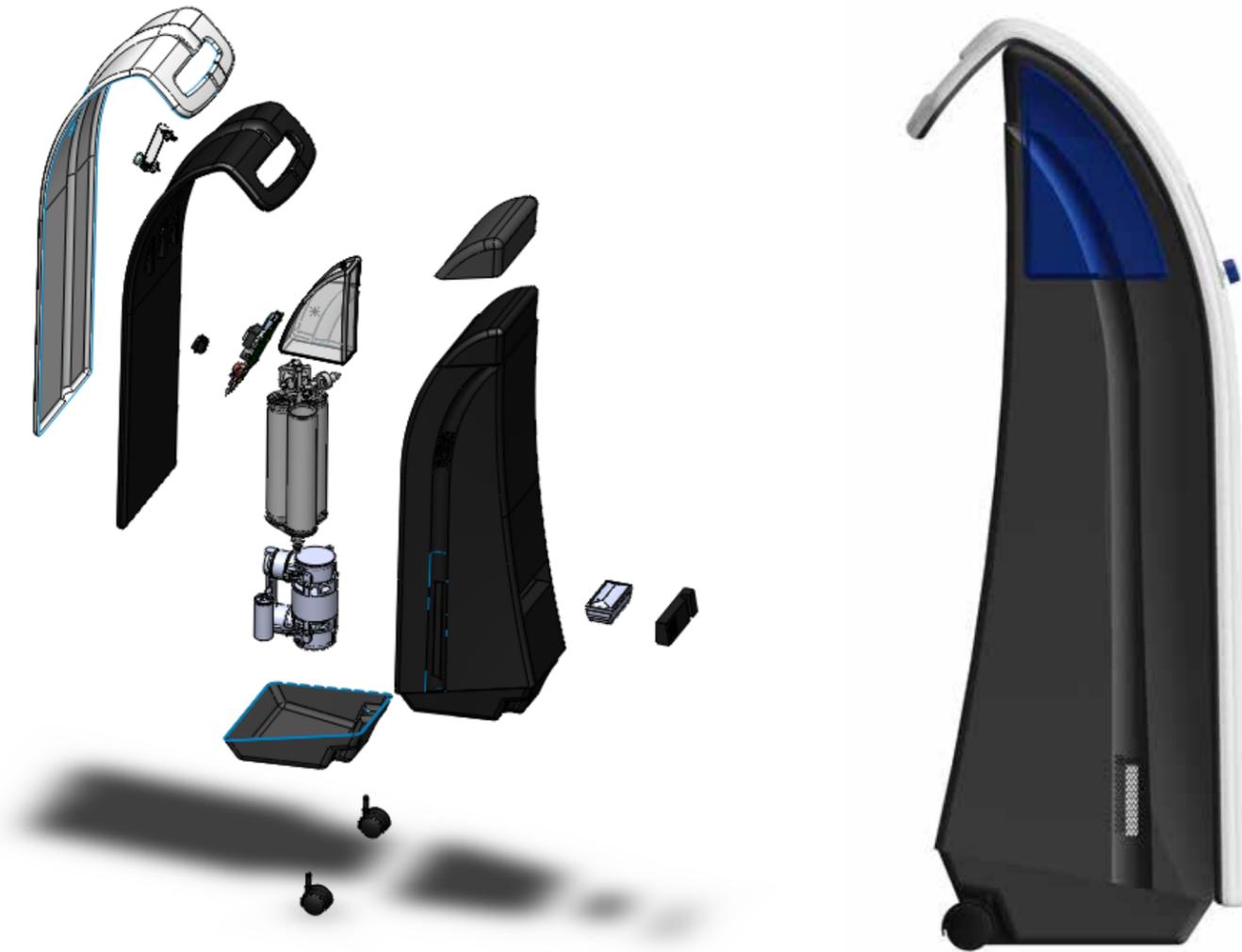
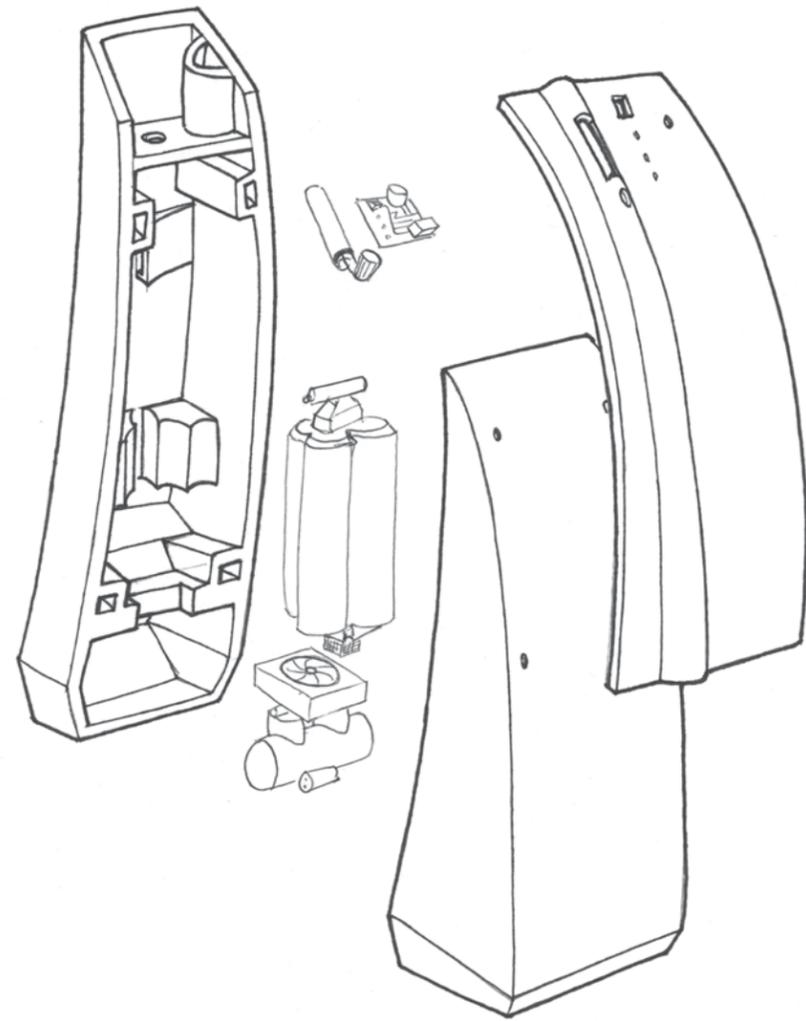
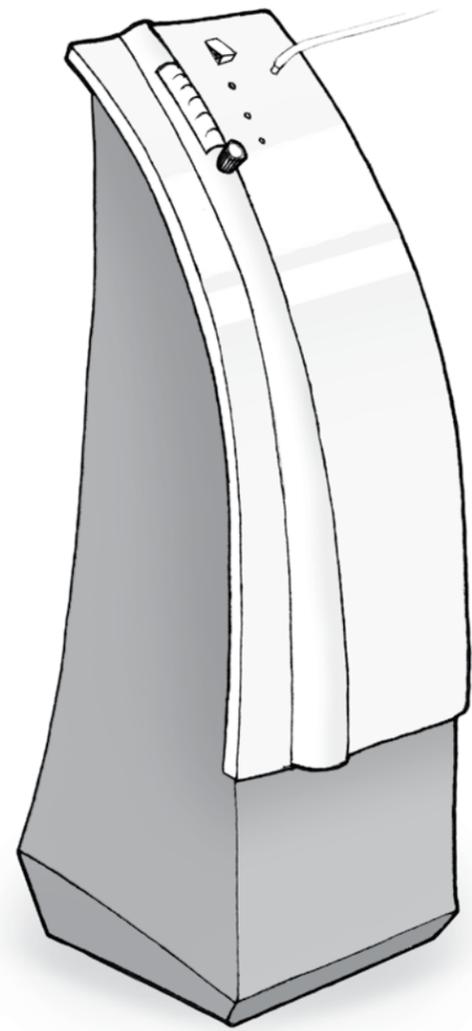


Ergonomically, the posture that is required of the user to operate the Everflo Q ranks as a high risk, according to a rapid entire body assessment (REBA) evaluation.

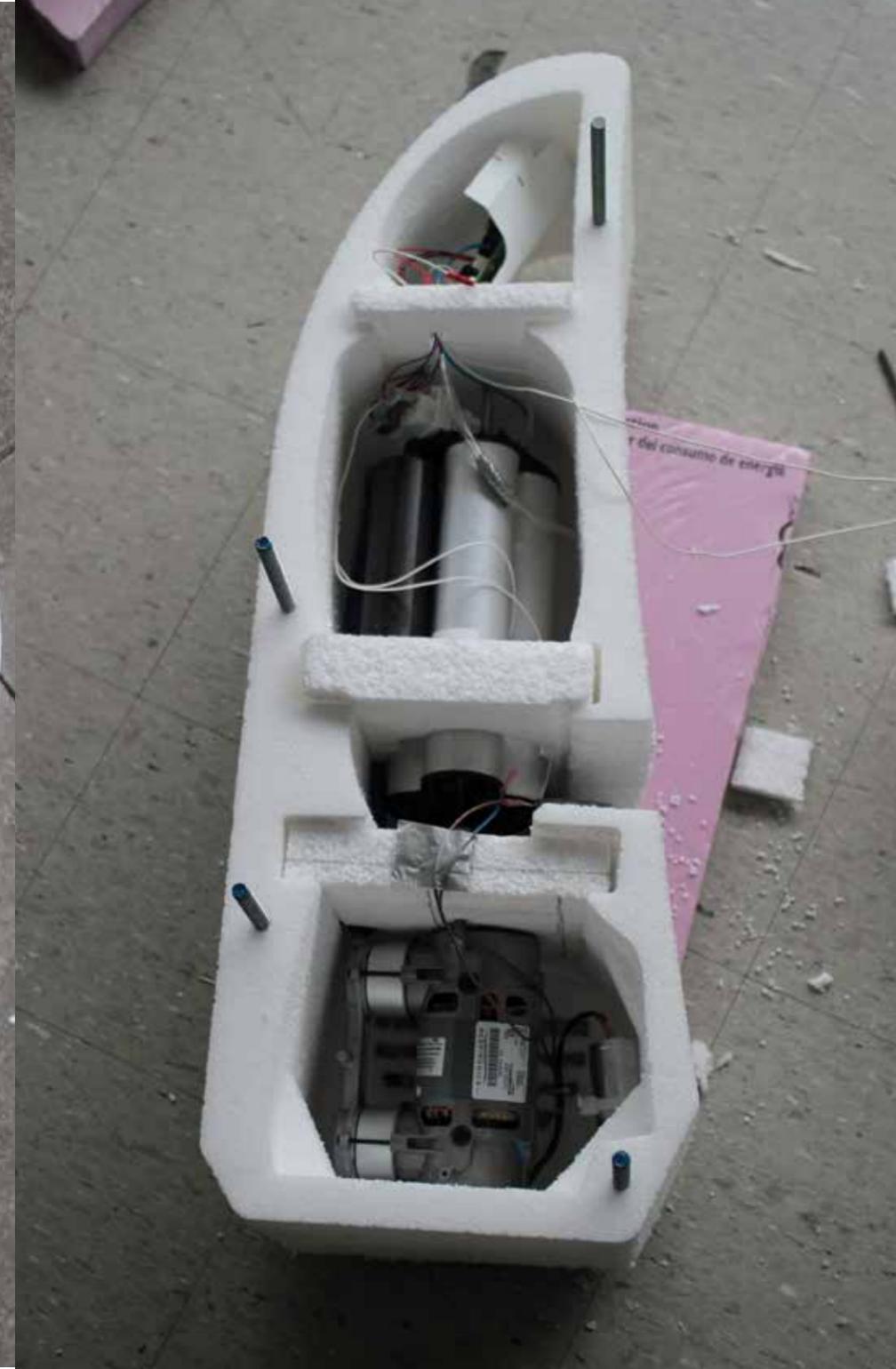
Let's raise the controls and make the new design *taller*.

Internal Component Thermodynamics





*Renderings co-created with Leslie Bush and Sarah Brand,
project group members. Solidworks.*



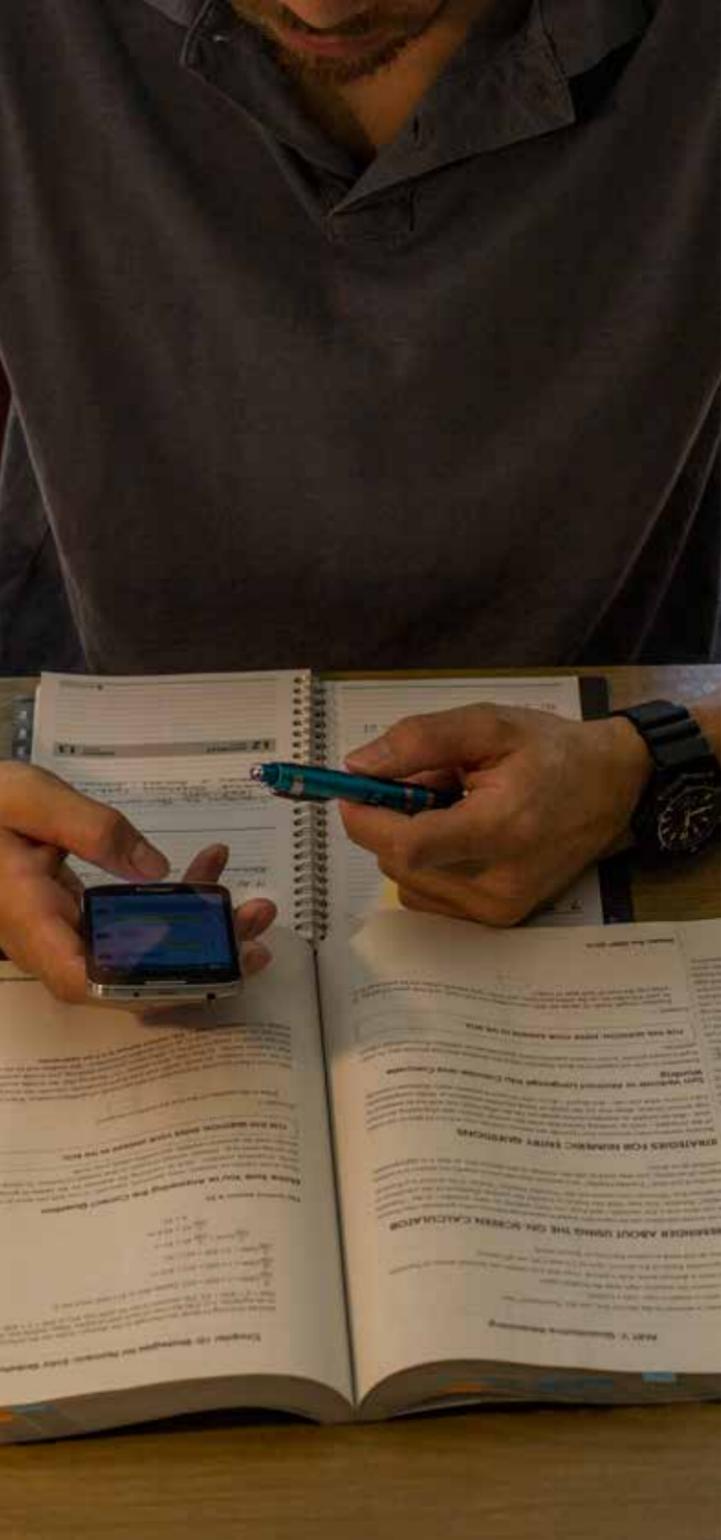
RFID Shopping System

2012.



Current self-scanning shopping systems rely on antiquated bar codes and shopper moral integrity to maintain order. While individuals can be reliable, a new system that could double-check the customer and provide a faster check-out time would allow for more positive experiences.

Radio frequency identification (RFID) technology can help speed things up.



Persona: Michael

Always on his work phone, rushing between meetings, and dropping his daughter day care every morning does not afford Michael much time in a day. He's the type that waits in line for the next iPhone and would rather use the EasyPass than wait in the "four outside" lanes like the majority of commuters. [Time is extremely valuable to him](#) and he often thinks things can be run better.

The majority of his grocery shopping is done at large-scale stores, such as Costco or Sam's Club. Despite the fact that there are a seemingly endless number of cashiers, [he still finds himself waiting in line](#).

Design Considerations



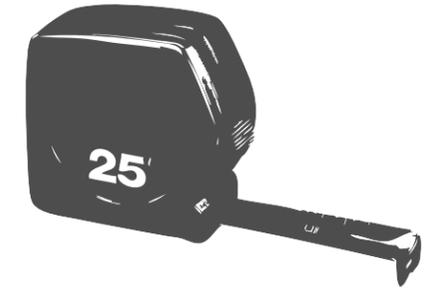
Theft

Relying on the customer to take the system into his or her own hands carries risk with the integrity of the purchase.



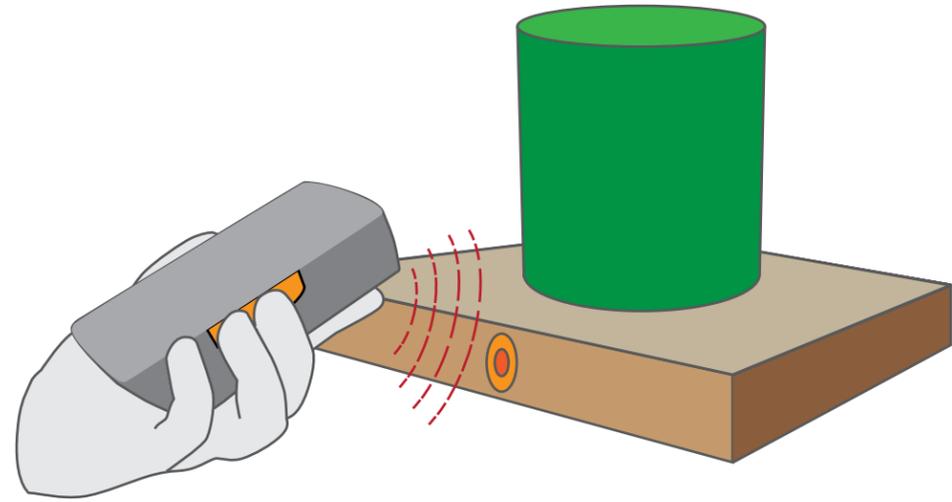
Mixing RFID

Signals overlap due to the inherent behavior of radio frequency. The system should aim to isolate and distinguish intended signals.



Device Size

Since the customer will be carrying the device throughout the store, weight and scale must be appropriate for all.



Gather inventory data...

Dual-button interaction prevents accidental activation.

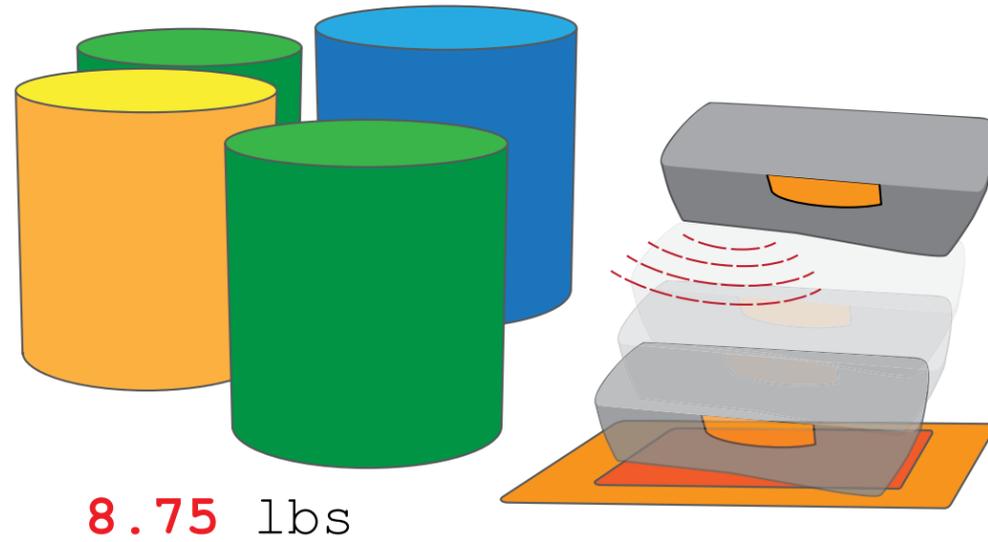
RFID system *times out* for 0.1 sec in order to prevent overlapping signal processing.

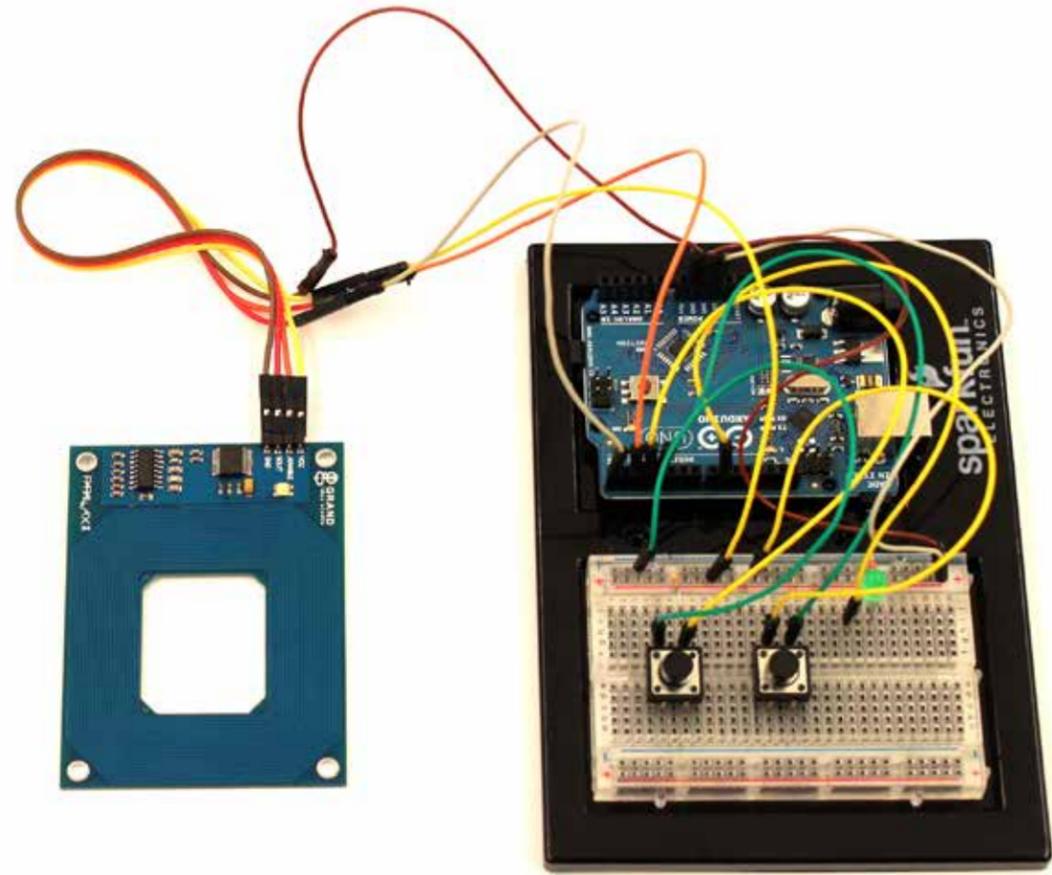


... Verify at check-out.

Uses NFC to beam data set into inventory database.

Compares collected inventory data sets with weight on scale within a close tolerance to ensure honesty.

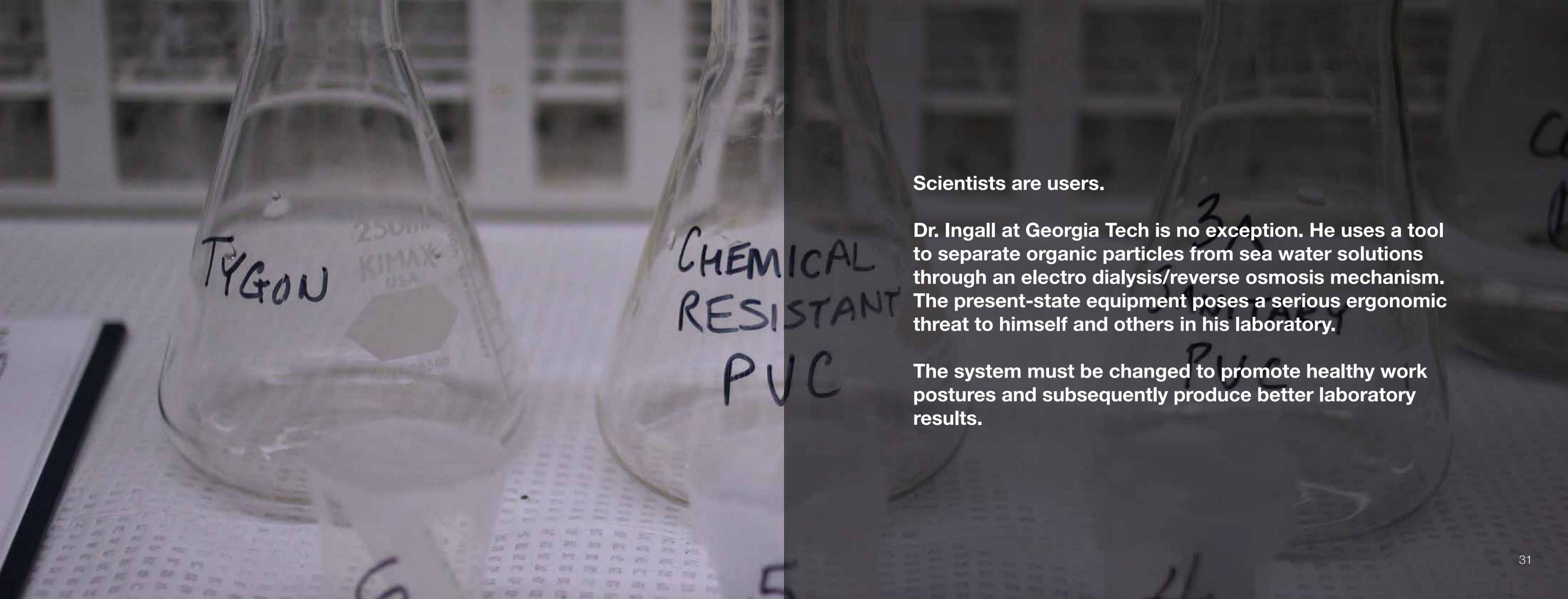




Laboratory Equipment Ergonomic Re-design

2012.

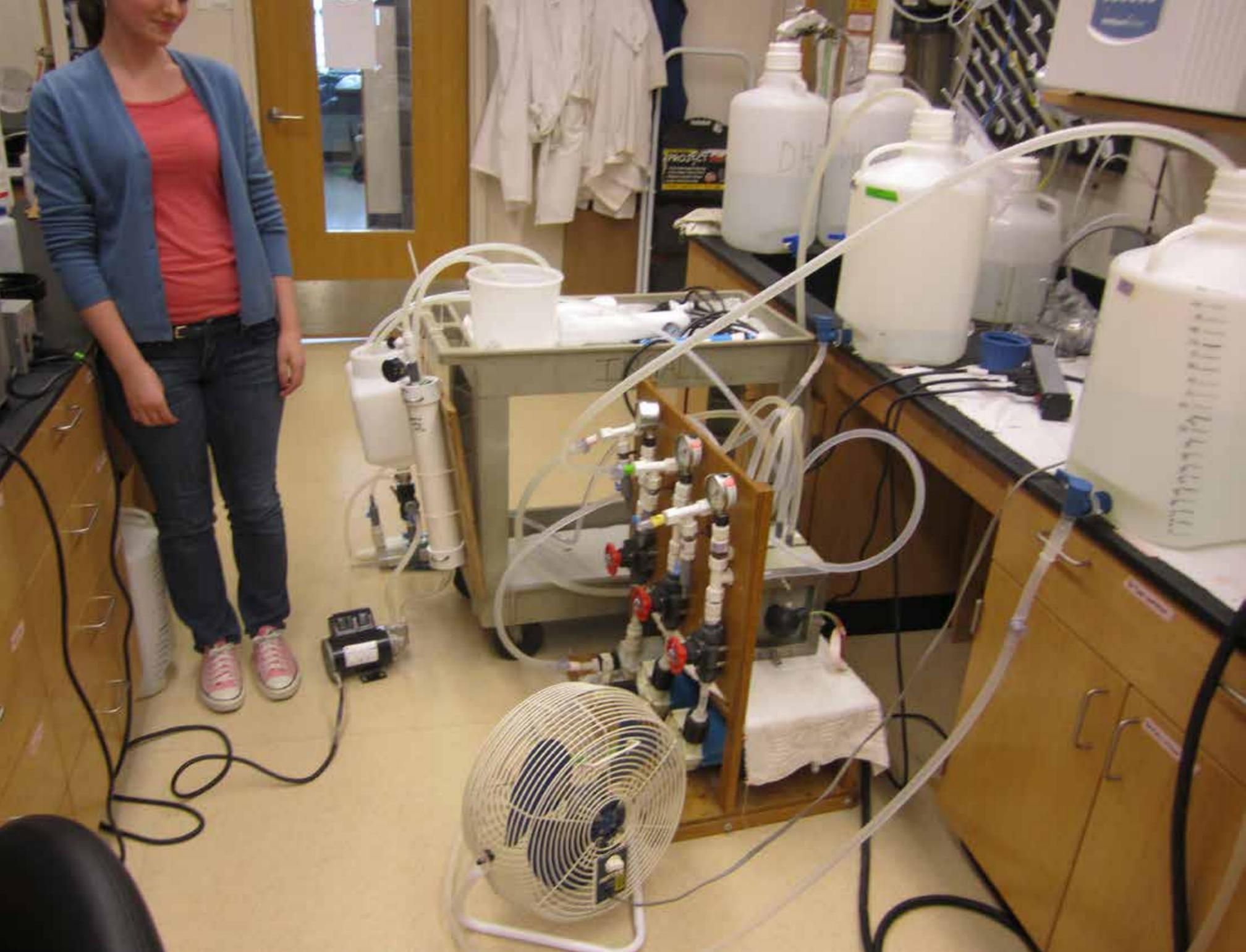
*Independent research for Dr. Ellery Ingall in
the College of Earth & Atmospheric Sciences
at Georgia Tech.*



Scientists are users.

Dr. Ingall at Georgia Tech is no exception. He uses a tool to separate organic particles from sea water solutions through an electro dialysis/reverse osmosis mechanism. The present-state equipment poses a serious ergonomic threat to himself and others in his laboratory.

The system must be changed to promote healthy work postures and subsequently produce better laboratory results.

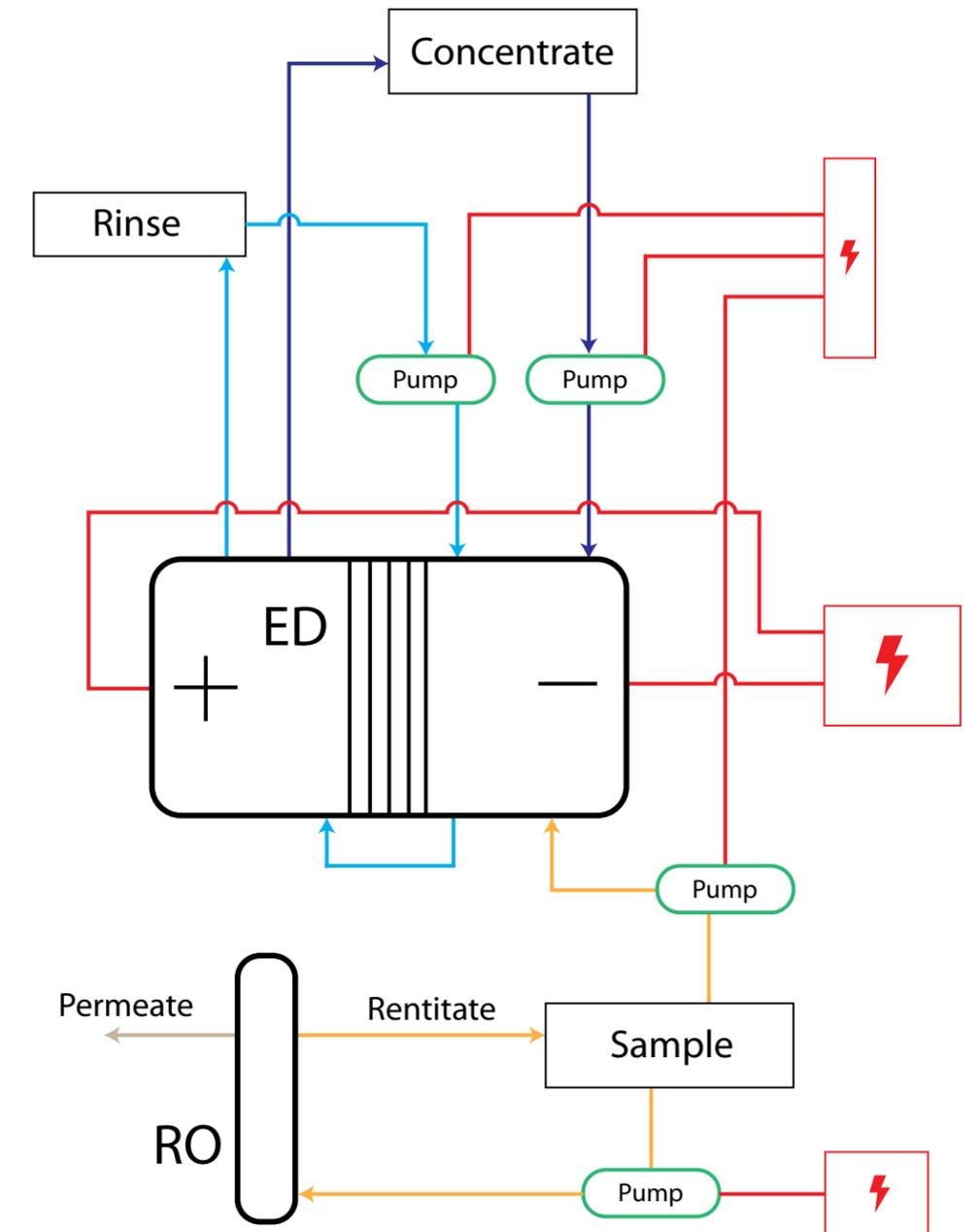


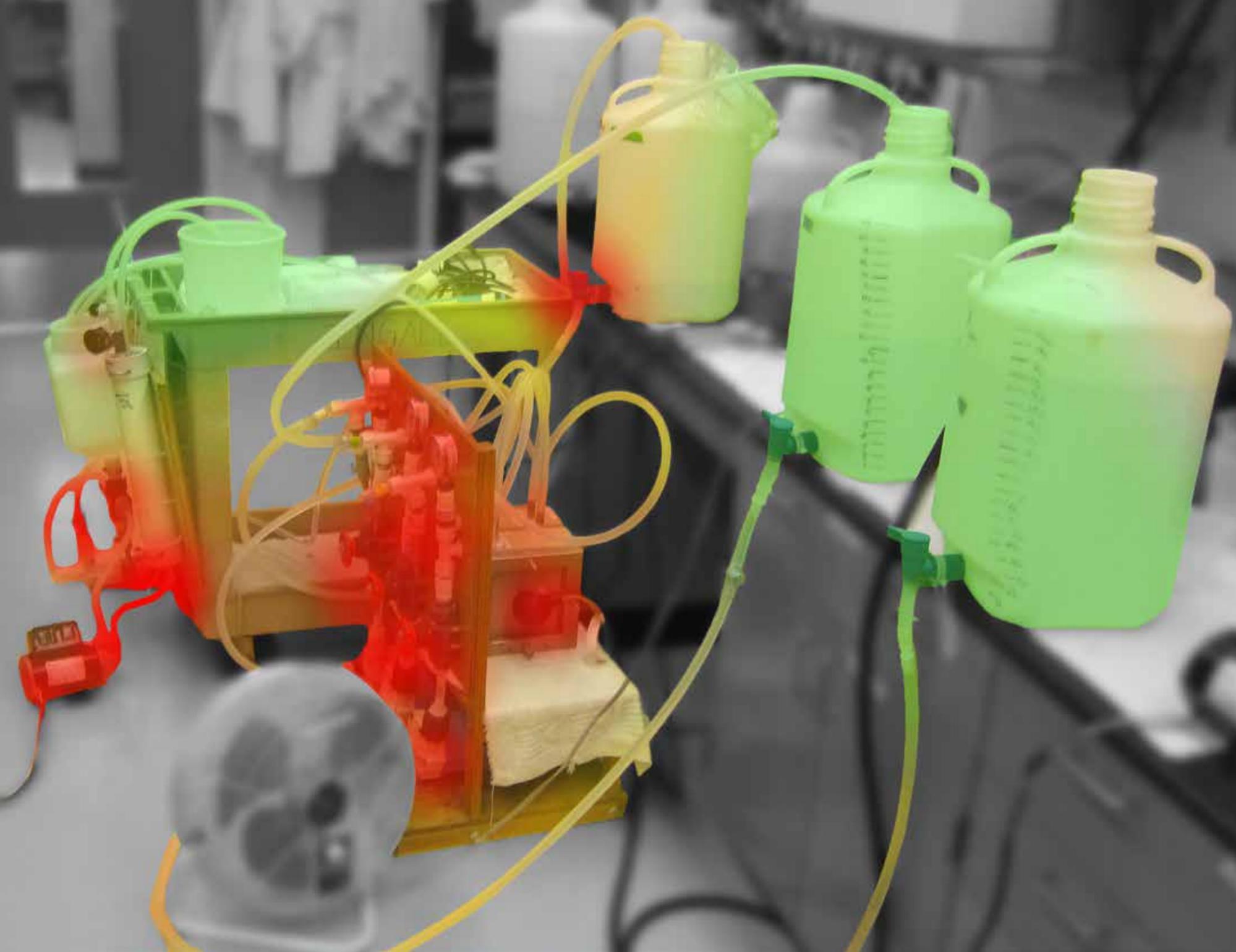
Tube Length

Tube length throughout the system retains excess volume before and after each time the system is run. This creates less accurate results when acquiring crucial conductivity tests during the run.

“Organic” Structure

Since there wasn't a defined plan of the mechanism in this space, a lack of order makes the system hard to use. This became even more apparent through a task analysis and test run.





Ergonomic Evaluation



This heat map highlights opportunity areas for improvement in a redesign. Since Dr. Ingall has a lab assistant, I was able to observe two different people of different age, sex, and stature with similar knowledge about the system. Using the system myself verified the problems that I noticed in my observations. Evaluations based on rapid entire body assessment (REBA) and key indicator methods.

- + *Bad working posture*: crouching, kneeling, lying on back, lying on elbows
- + *Visibility issues of dials*: angle of gauges, wrist angle, grip and torque
- + *Compromised disassembly*: must be able to be transported to Antarctica

Notes about fittings and configurations

Notes about fittings and configurations:

- Top Left:** Diagram of a pump assembly with labels: HEX NUT, 1/4" FEMALE TEE, ADAPTER 1/4" x 3/8" OD, TUBING, ADAPTER, PUMP. Includes note: "NEED SAMPLE LID (5/8" I.D. TUB)".
- Top Middle:** Diagram of a vertical assembly with labels: (C.F. = COMPRESSION FITTINGS), 1/4" WIRE PUMP, OP FOR NUTS USE = 1/2", 3/8". Includes note: "* CURRENTLY, THE FERTILITY HAS ABOUT 2" FROM PUMP".
- Bottom Left:** Notes on fittings: "FITTING THAT DOESN'T LEAK", "FIX POINT IN MECHANISM?", "NON-BARRERED 1/4" FITS??", "FIX PLATE TANK", "MIN HEIGHT = 4 1/4". Includes diagrams of fittings and a tank.
- Bottom Middle:** Diagram of a structural frame with labels: "STEEL TUBING", "CON", "GRINDER 1/2" x 1/2". Includes notes: "WILL FIT METAL CL.", "CAN'T SEE DENTENTS.", "CAN'T SHIP (RIGID)".
- Bottom Right:** Notes on tubing and tanks: "WPE (WATER PUMP - ED)", "NEED FLEXIBLE TUBING OR E.D.", "ELEVATOR 3/4" MPT", "CONCENTRATE RELATIVELY SIMILAR TO SAMPLE.", "SAMPLE TANK ABOVE GAUGES?", "SO THEY CAN REMOVE A SAMPLE FROM THE BOTTOM".

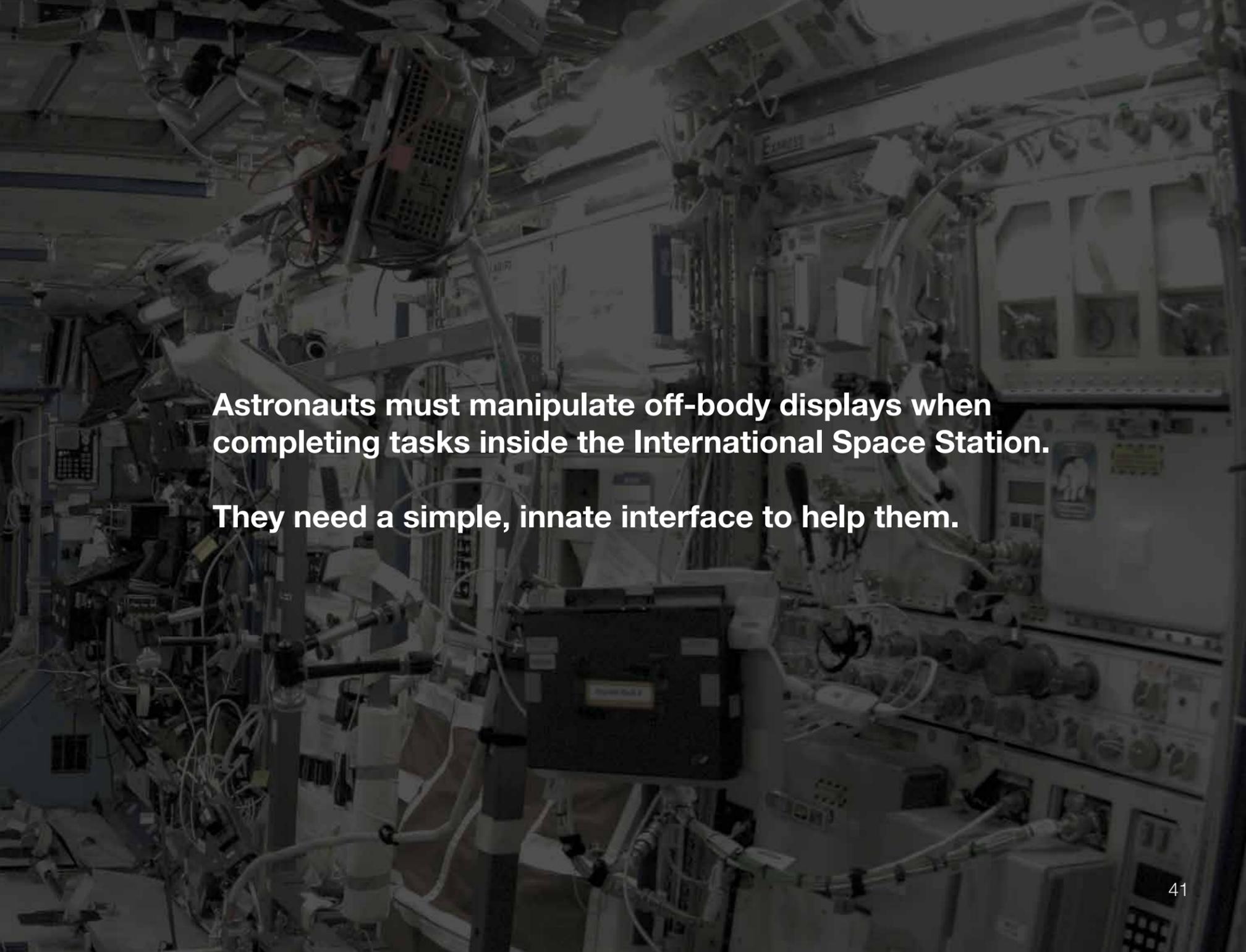
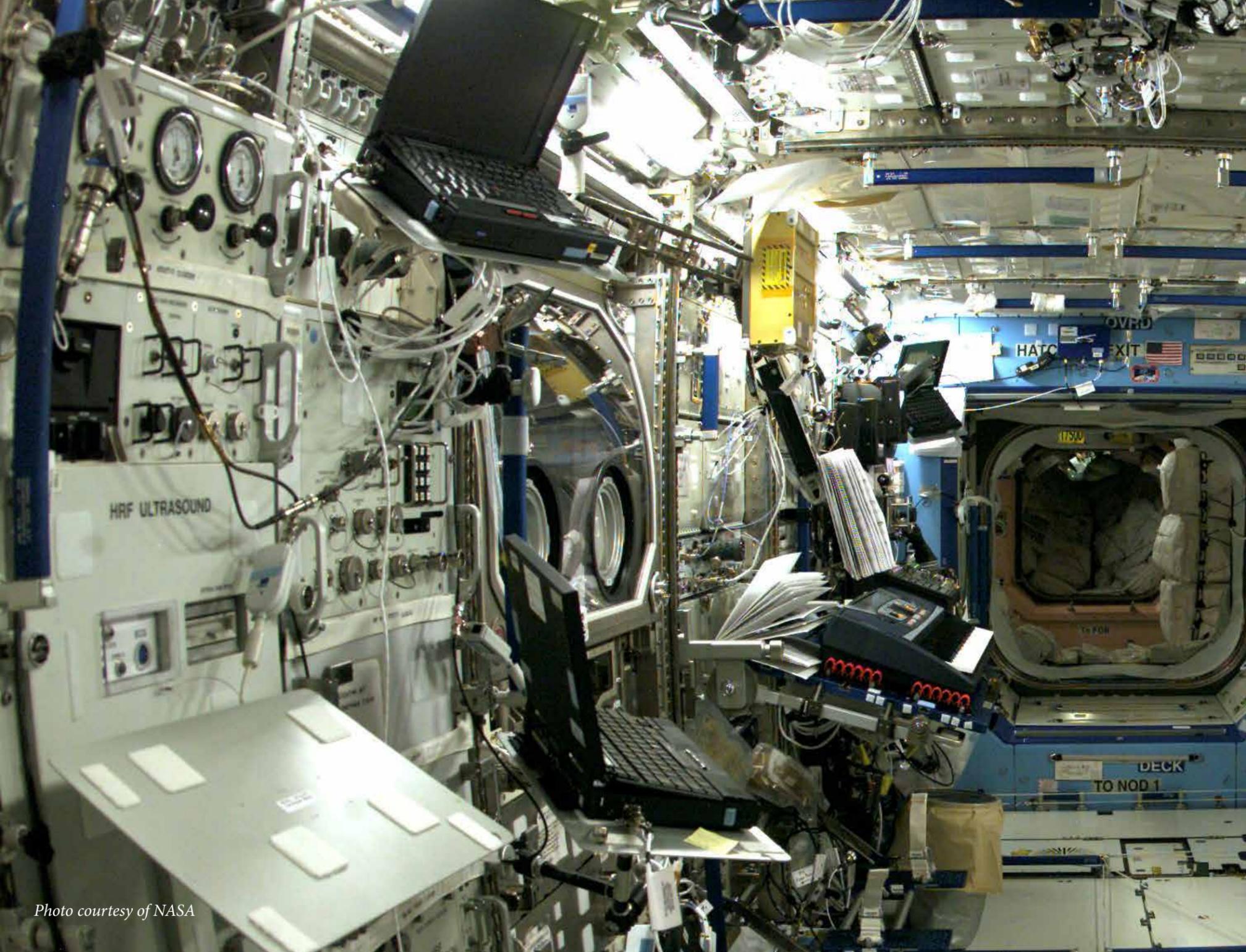
Final Design



Intra-vehicular Activities Device

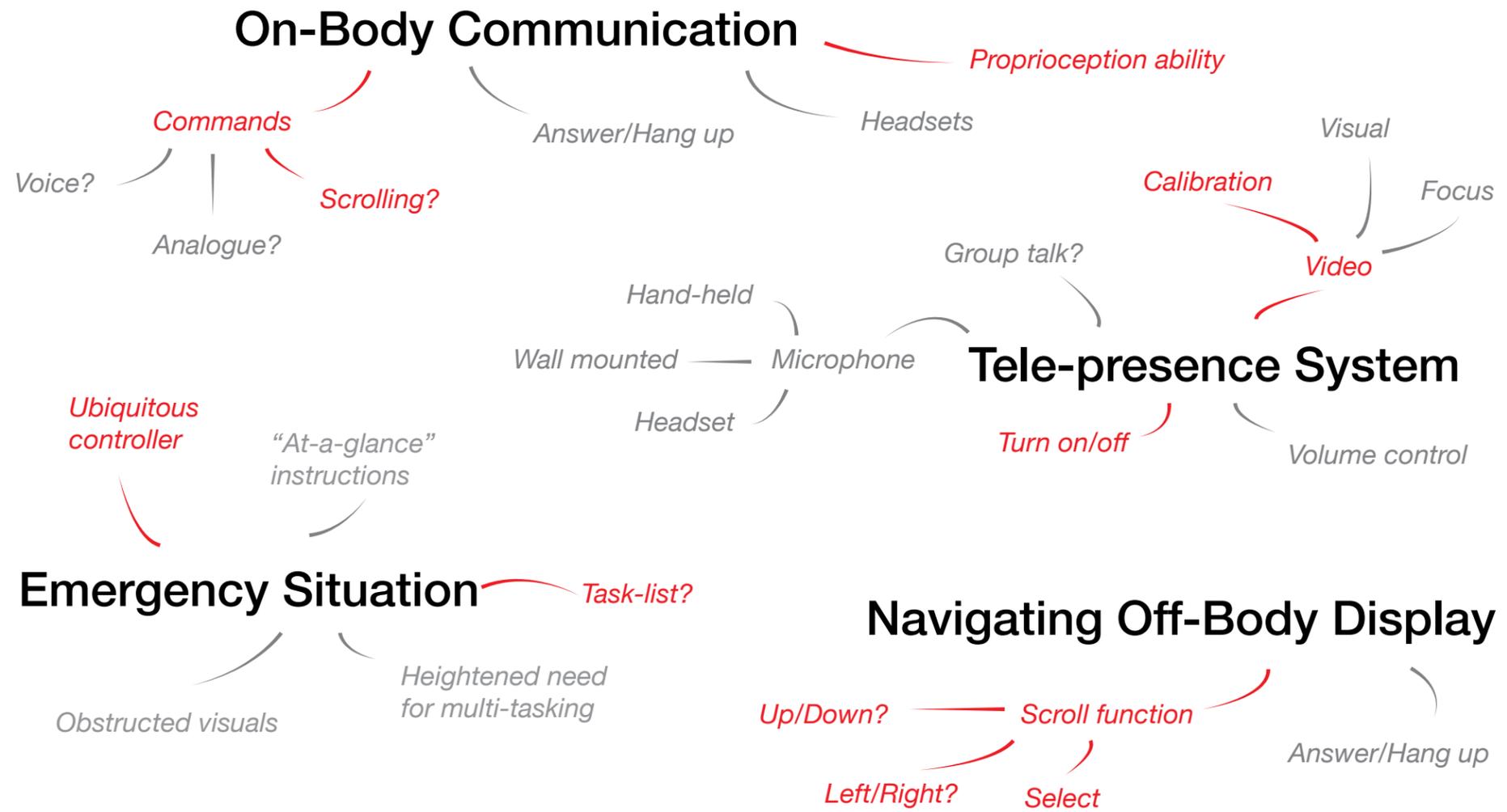
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*Presented at the 2013 NASA Wearable
Technology Symposium in Houston, TX.*

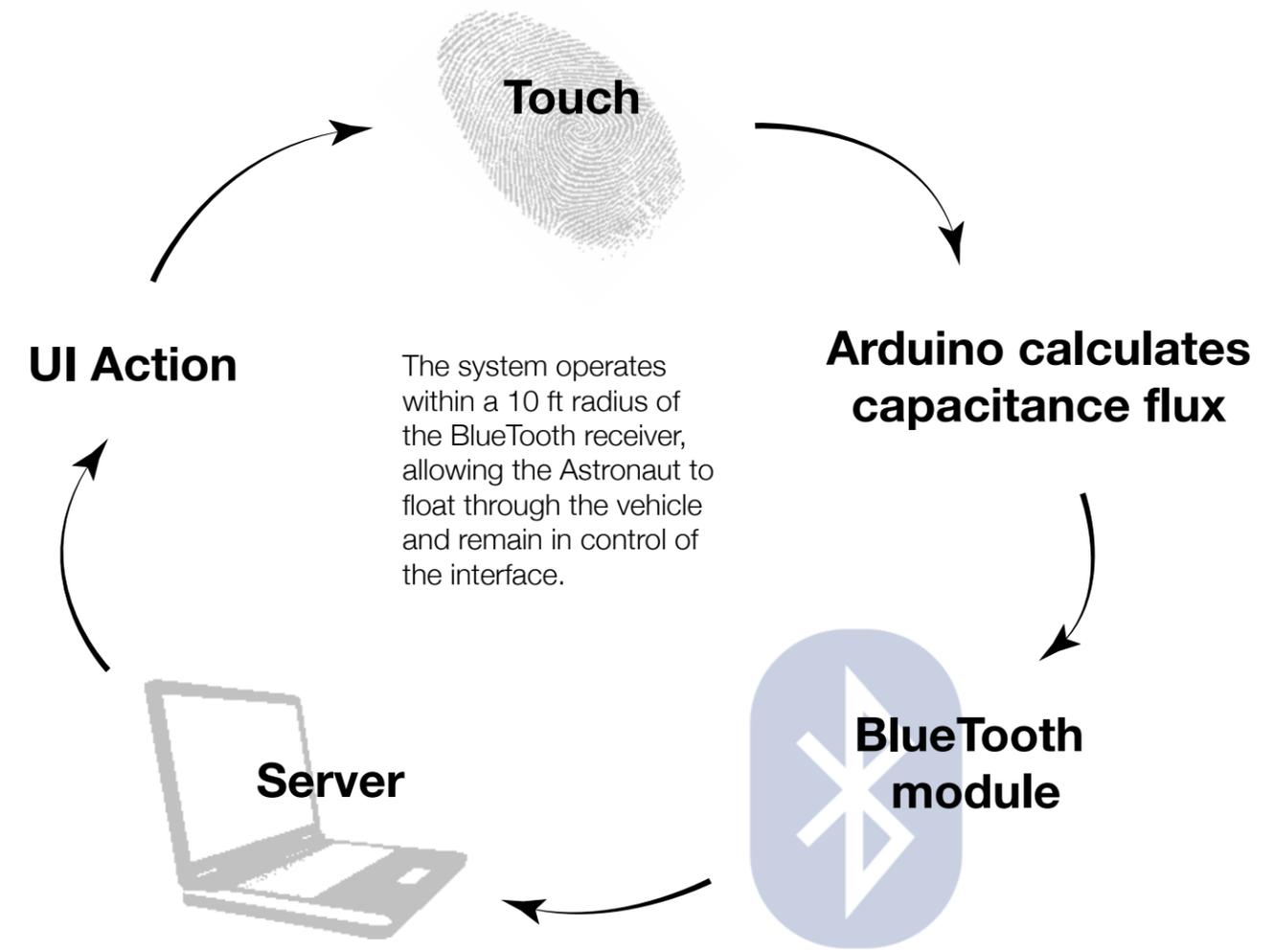
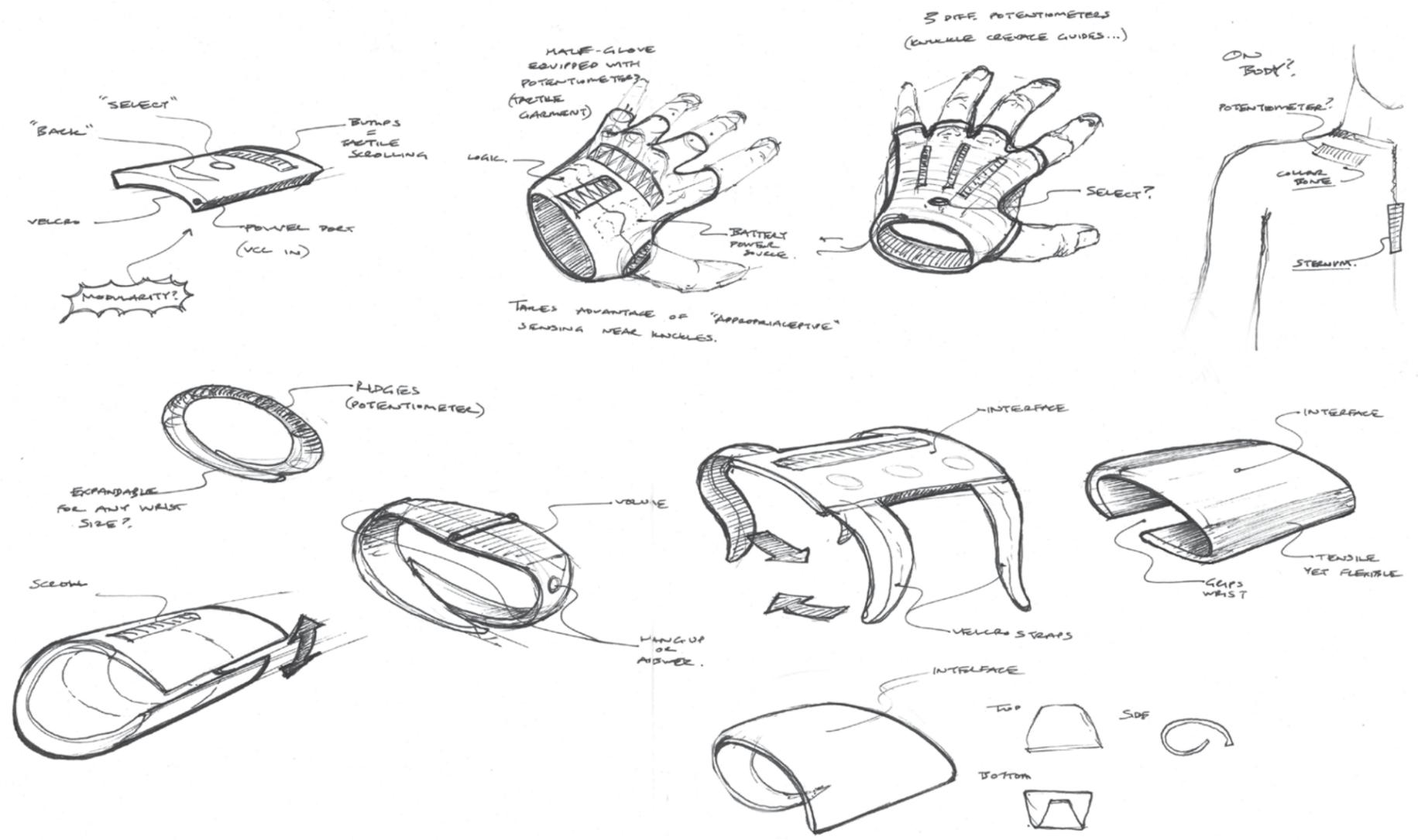


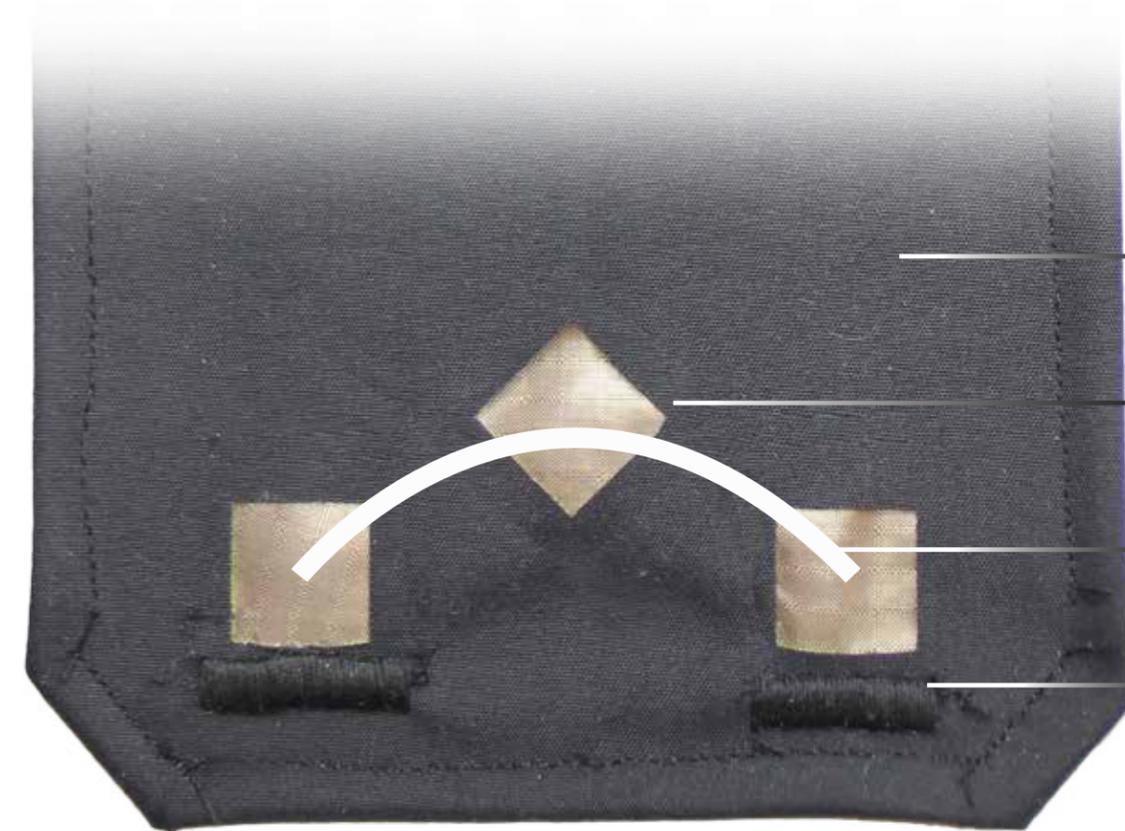
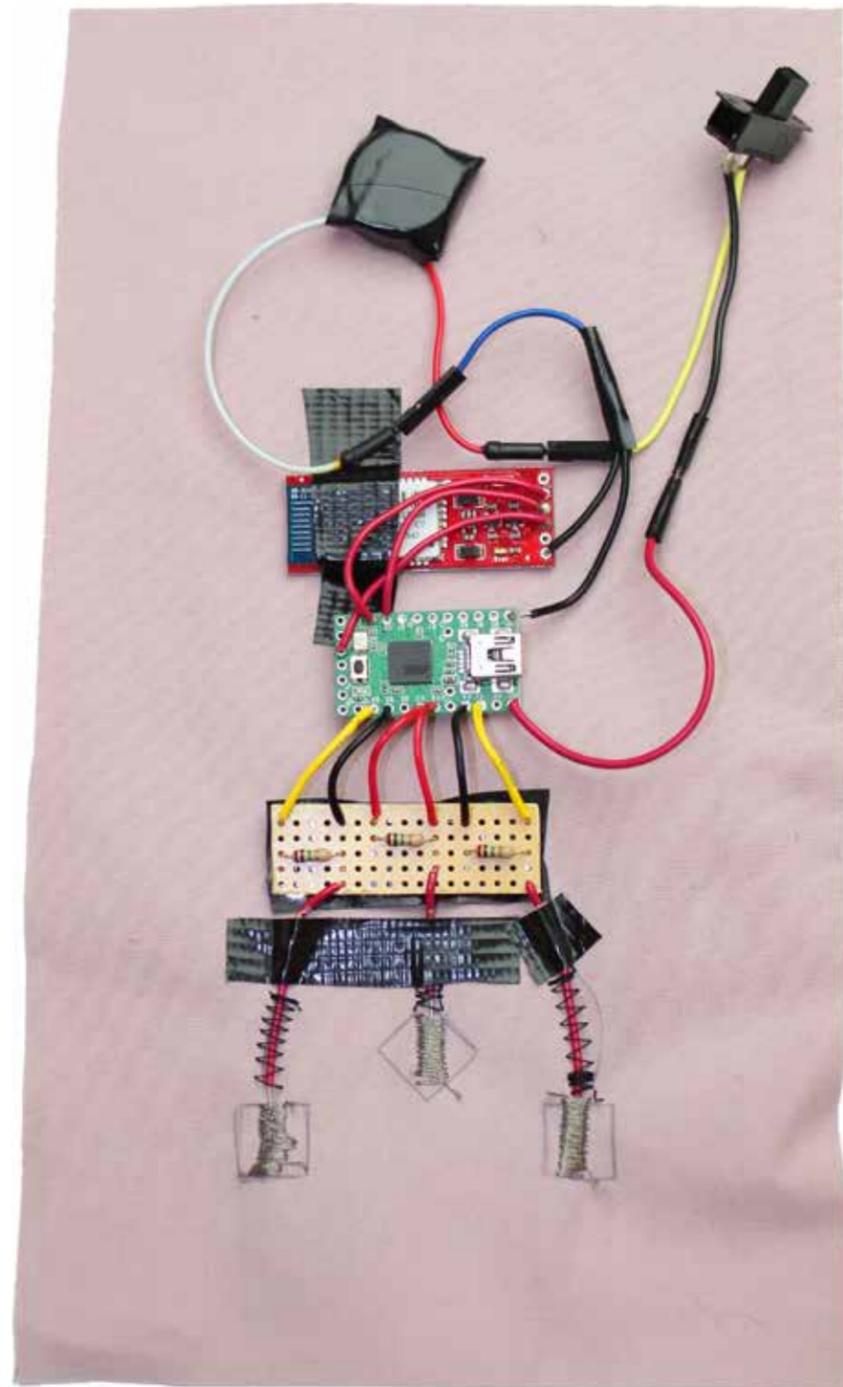
Astronauts must manipulate off-body displays when completing tasks inside the International Space Station.

They need a simple, innate interface to help them.



Taking advantage of *proprioception*, or the neurological ability to sense the placement of body parts, combined with a *physical indexing feature* minimizes the design and maximizes the effectiveness of the interaction.





Water-proof polyester

Conductive fabric shield

Accommodates finger length differences

Non-conductive index feature for user's cognitive mapping



Special thanks to GVU Labs at Georgia Tech, Cory Simmons from NASA, and the Georgia Tech College of Computing.

End.

Thank you