



embr labs

One person's experience creating a wearable

What we'll talk about

Selecting a problem:

Concept generation and ideation

You have a problem, so solve it:

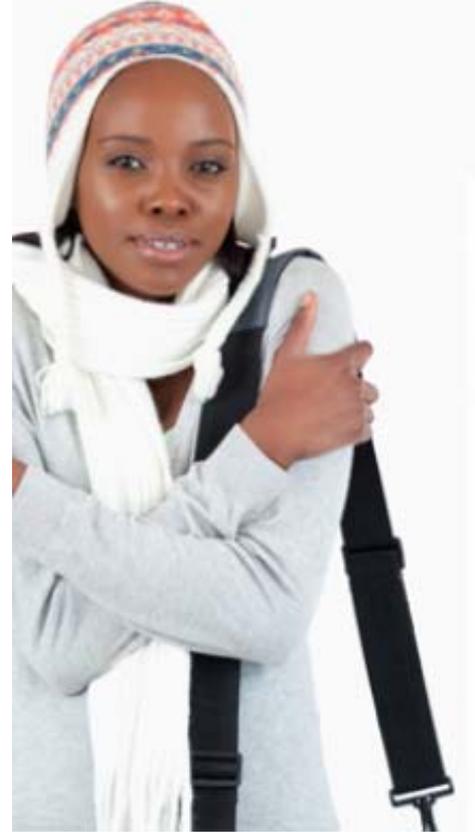
Applying technical know-how to solve problems

Making a solution into a product:

The iterative, engineering process

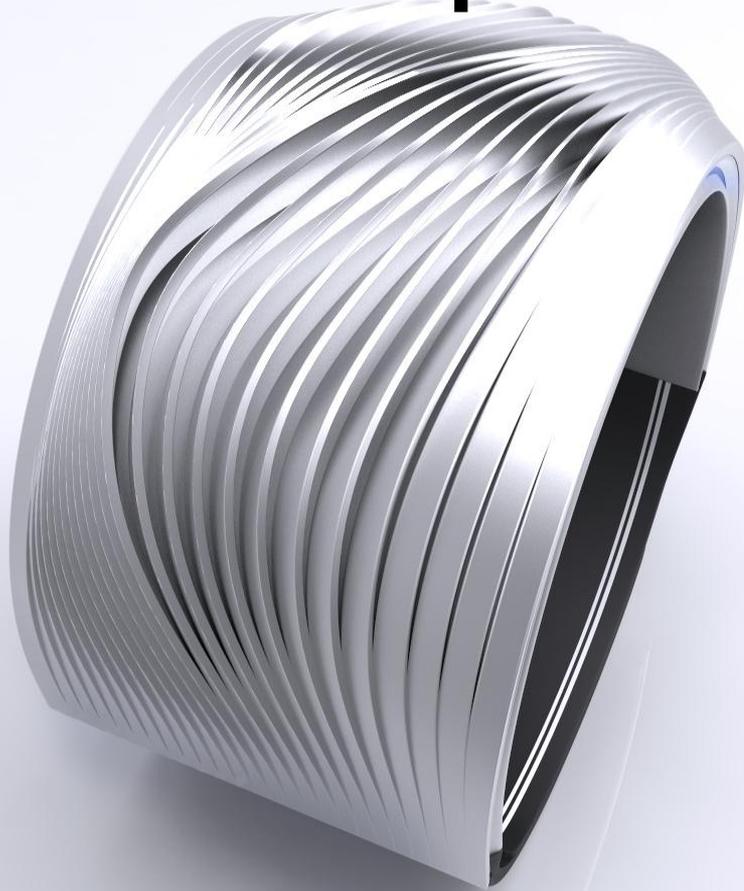
The journey of starting a small company

the problem: thermal is personal



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the solution: a **personal thermal** wearable



Our wristband is an
intelligent,
connected
and **personal**
heating and cooling
solution.

the challenge

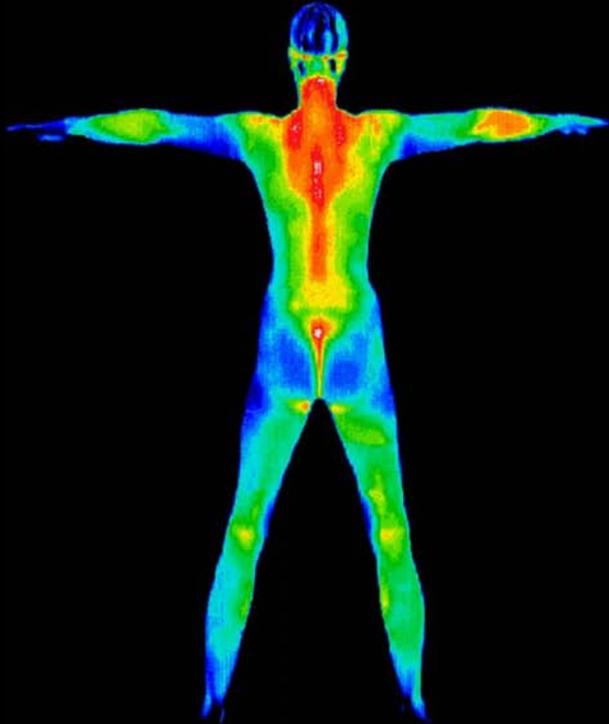


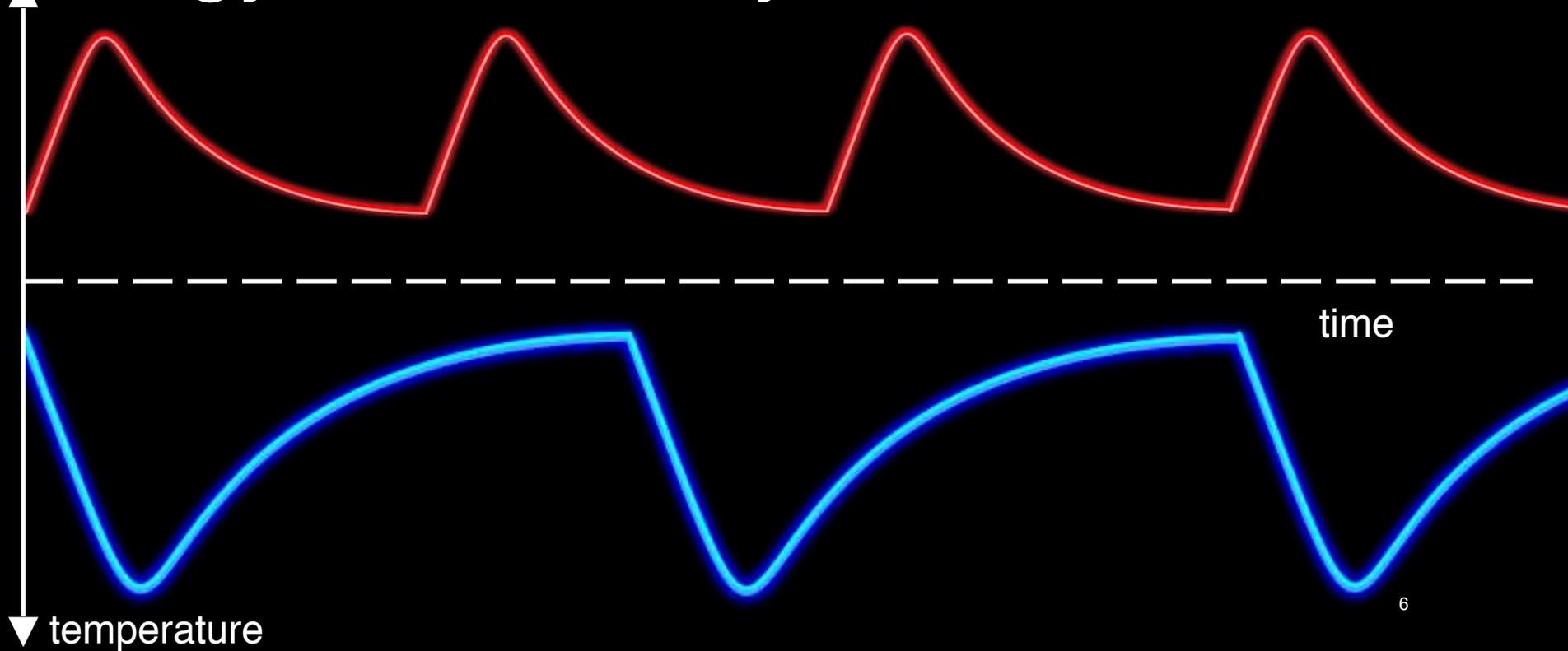
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the opportunity:
our skin

comfort
depends on
both core and
skin
temperature

our skin responds
strongly to
temperature
changes

Pulsed heating and cooling uses less energy to efficiently stimulate the skin



Technology selection: how to generate pulsed heating and cooling in a small form factor?

	Fan	Pumped water	Phase change	Evap. water	Peltier cooling
Tunable ΔT	✓	✓	✗	✗	✓
ΔT rapid and reversible	✗	✗	✗	✗	✓
Quiet	✗	✗	✓	✓	✓
No moving parts	✗	✗	✓	✗	✓
Lifetime	?	?	✗	✗	?

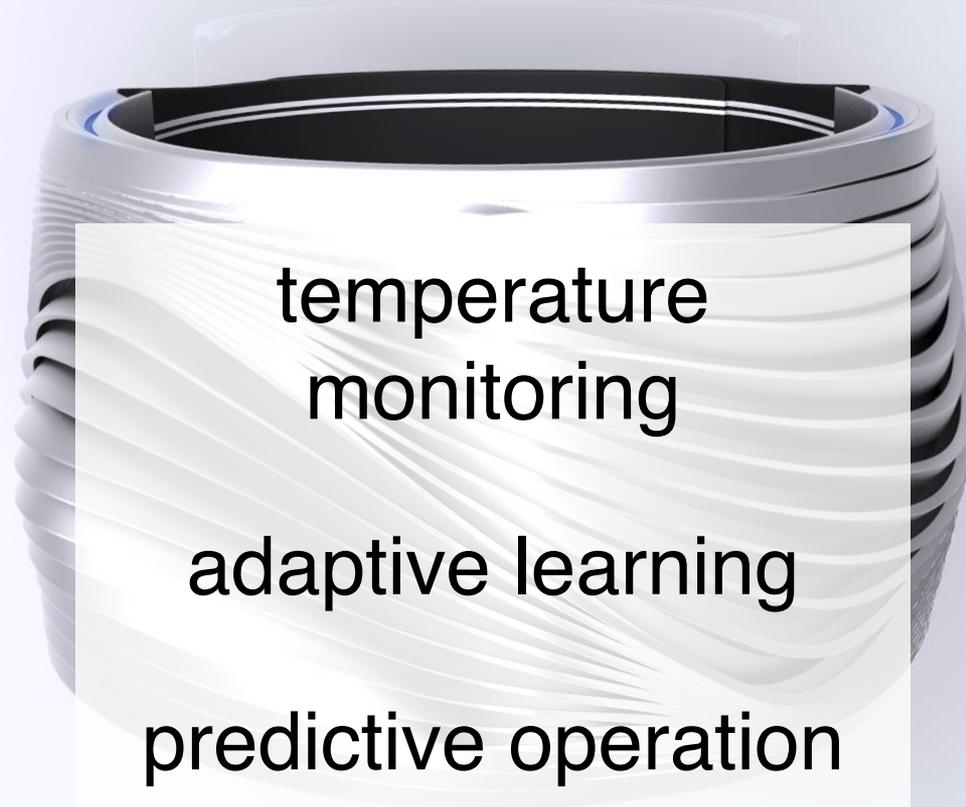
Technology selection: how to generate pulsed heating and cooling in a small form factor?

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Quiet	✗	✗	✓	✓	✓
No moving parts	✗	✗	✓	✗	✓
Lifetime	?	?	✗	✗	?

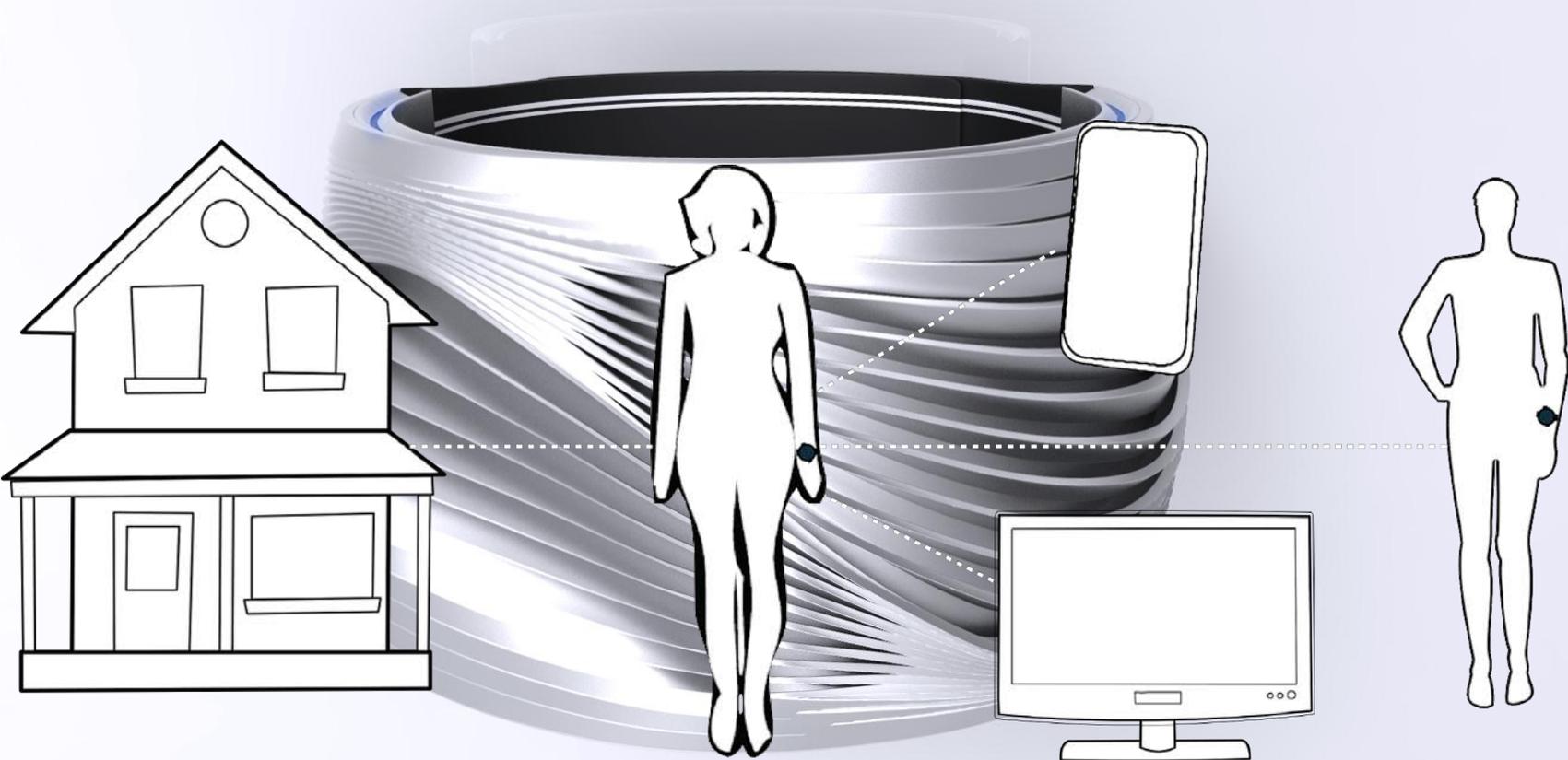
an energy-efficient personal thermal solution



an **intelligent** personal thermal solution



a **connected** personal thermal solution



The iterative engineering process



Keep in mind: never try to do everything at once! It's too hard.

Engineers break projects into **steps**, representing testable **hypotheses**.

The iterative engineering process



Hypothesis 1: People will like pulsed heating and cooling

Step 1: Building something that pulses heating and cooling.

So... we made a heating and cooling box!

The iterative engineering process

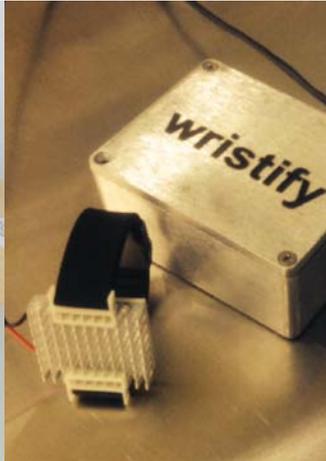
Hypothesis 2: People want wearable heating and cooling

Step(s) 2: Building something wearable. (Note: many steps)

Making it more wearable with each iteration



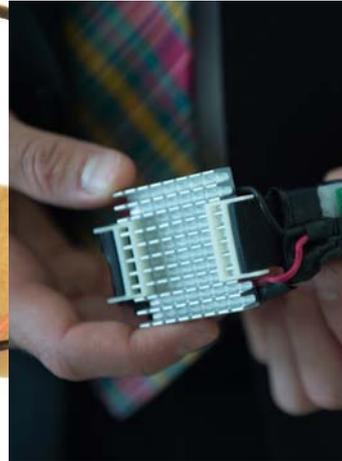
Not wearable.
Is a box...



Not wearable.
Has a cord.



Hacked together
wearable (gross)



Cleaner wearable,
circuit is exposed



Circuit is enclosed,
has buttons, but ugly

The iterative engineering process

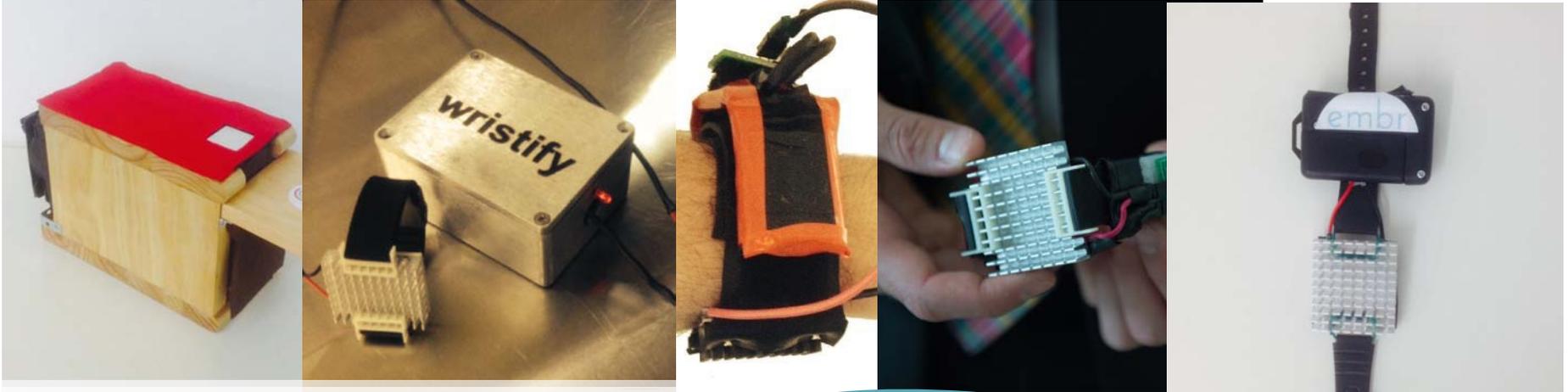


Hypothesis 3:
It can't be ugly.

Step 3: Make it prettier.



The iterative engineering process



Make concept renders (sketch, CAD)



Make prototypes



Making prototypes informs new concepts

personalized for comfort

user interface



heat sink



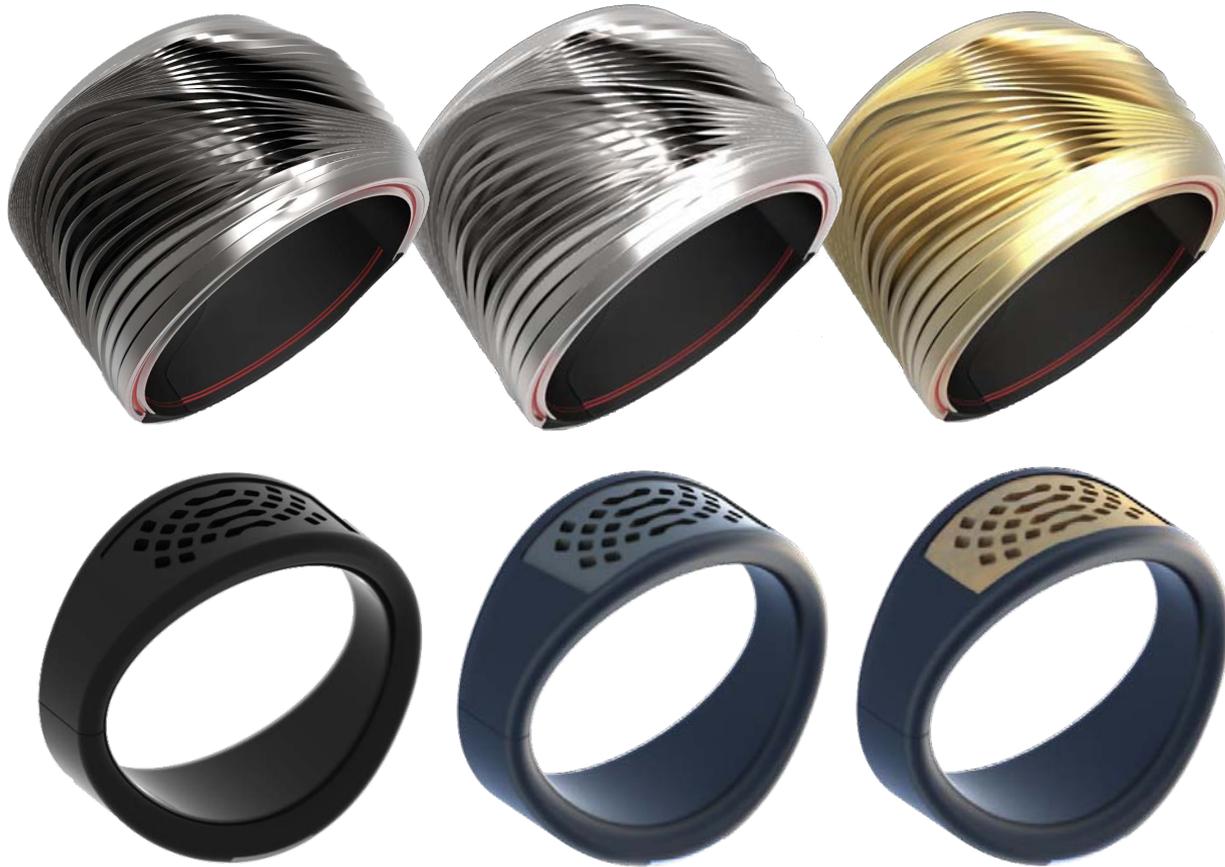
heat pumps



power + electronics



Why CAD is fun: It lets you make art, fast.





wristify &



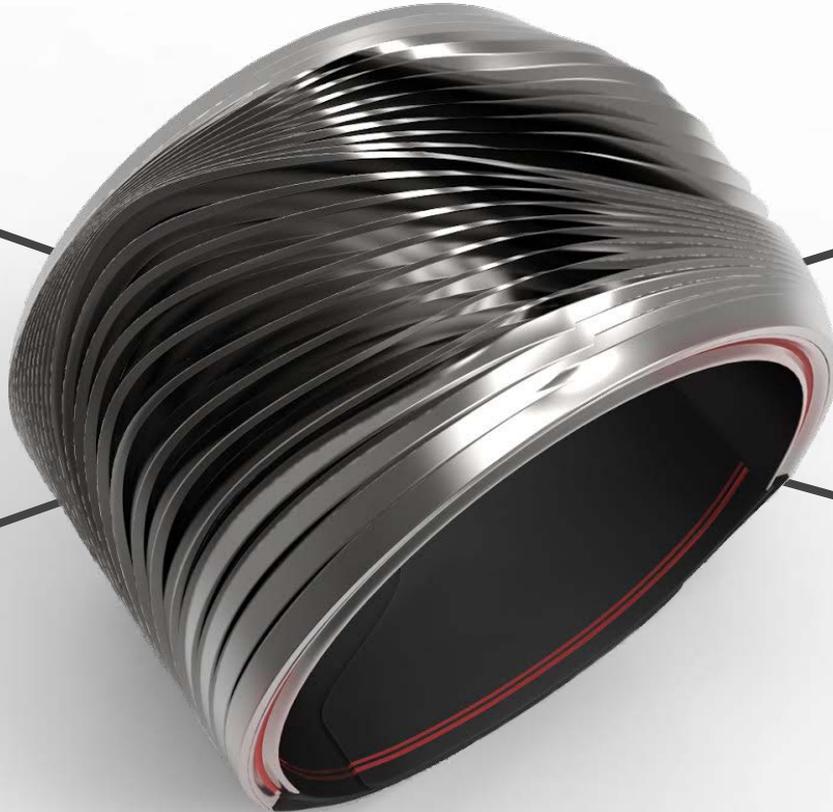
Edison

comfort on
demand

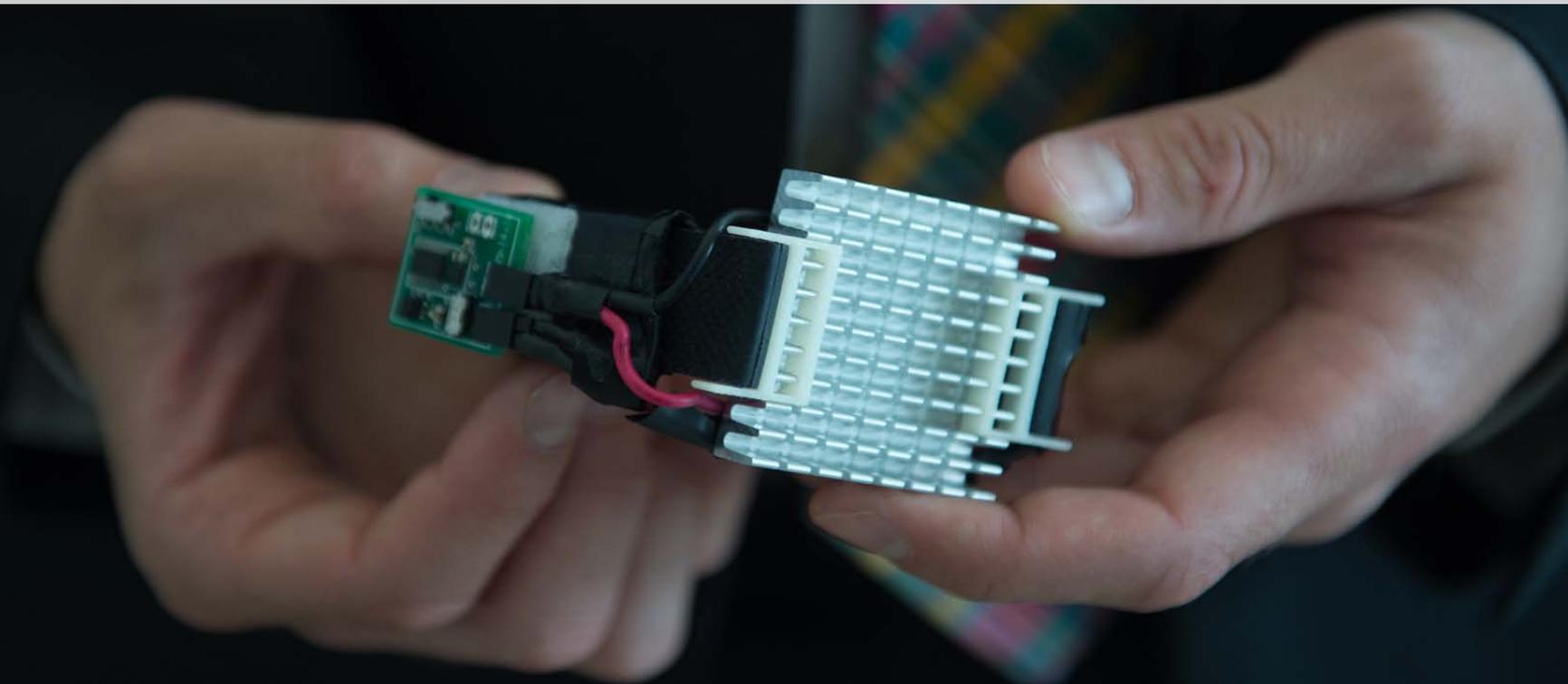
personal &
environmental
sensing

predictive &
adaptive

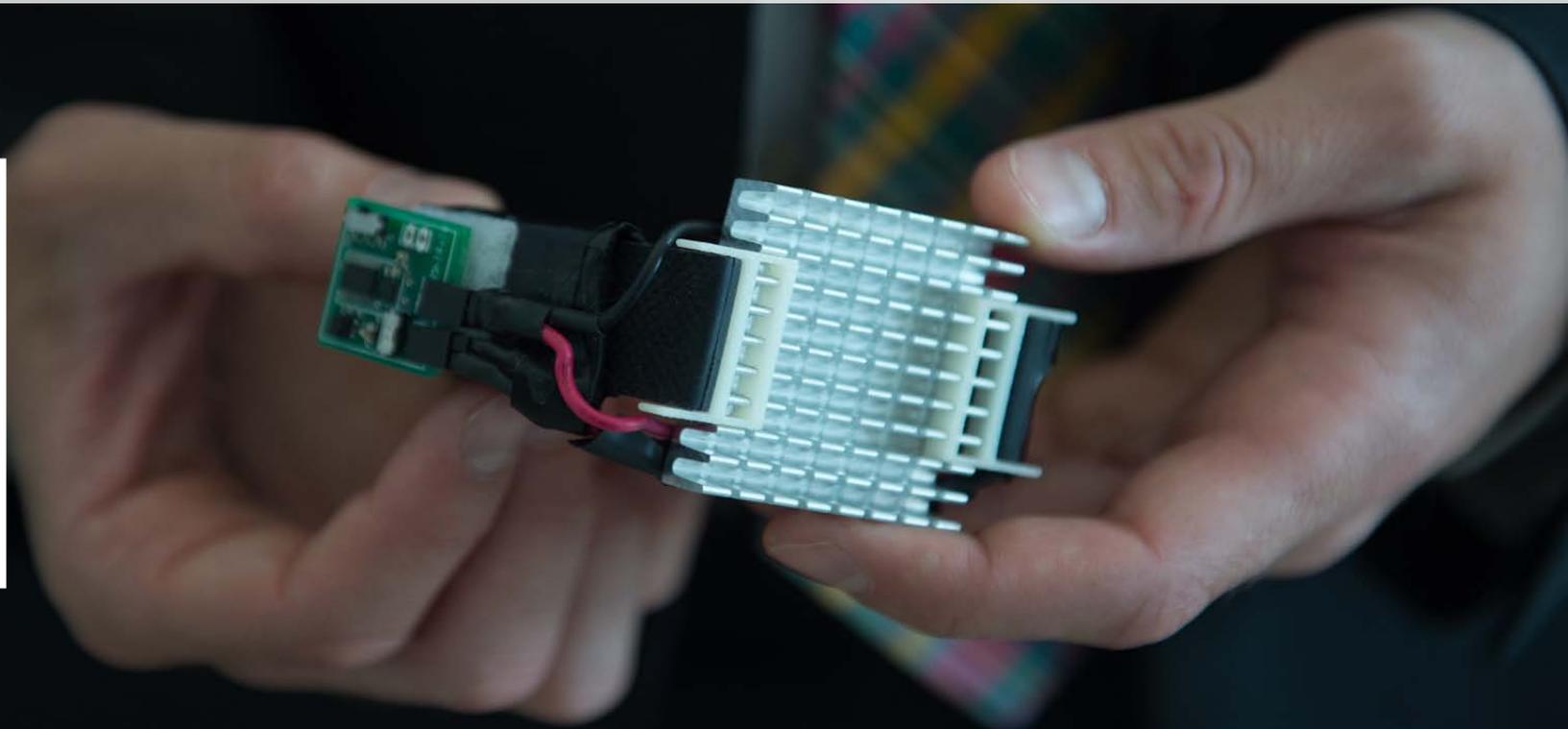
a connected &
efficient world



our journey so far



our journey so far

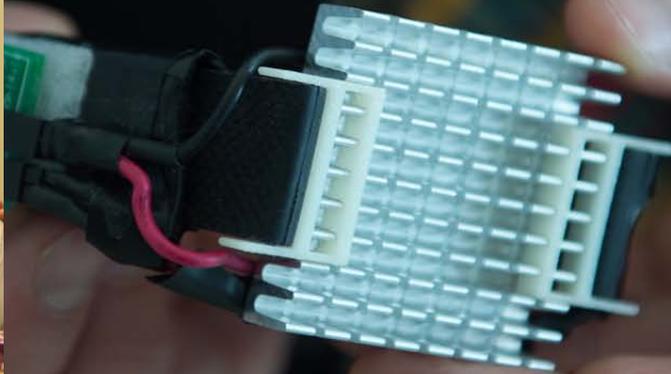
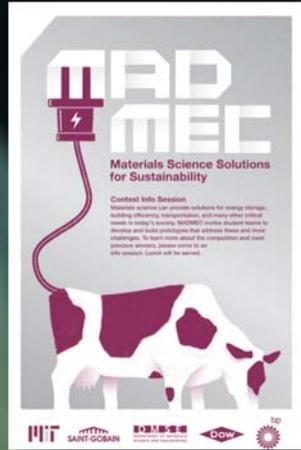


MAD MEC
Materials Science Solutions
for Sustainability

Contest Info Session
Materials science can provide solutions for energy storage, building efficiency, transportation, and many other critical needs in today's world. MAD MEC invites student teams to discover and build prototypes that address these and more challenges. To learn more about the competition and meet previous winners, please come to an info session. Lunch will be served.

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our journey so far



our journey so far

MAD MEC
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Materials science can provide solutions for energy storage, building efficiency, transportation, and many other critical needs in today's exciting, high-tech world. MAD MEC invites students to design and build prototypes that address these and more challenges. To learn more about the competition and meet previous winners, please come to an info session. Lunch will be served.

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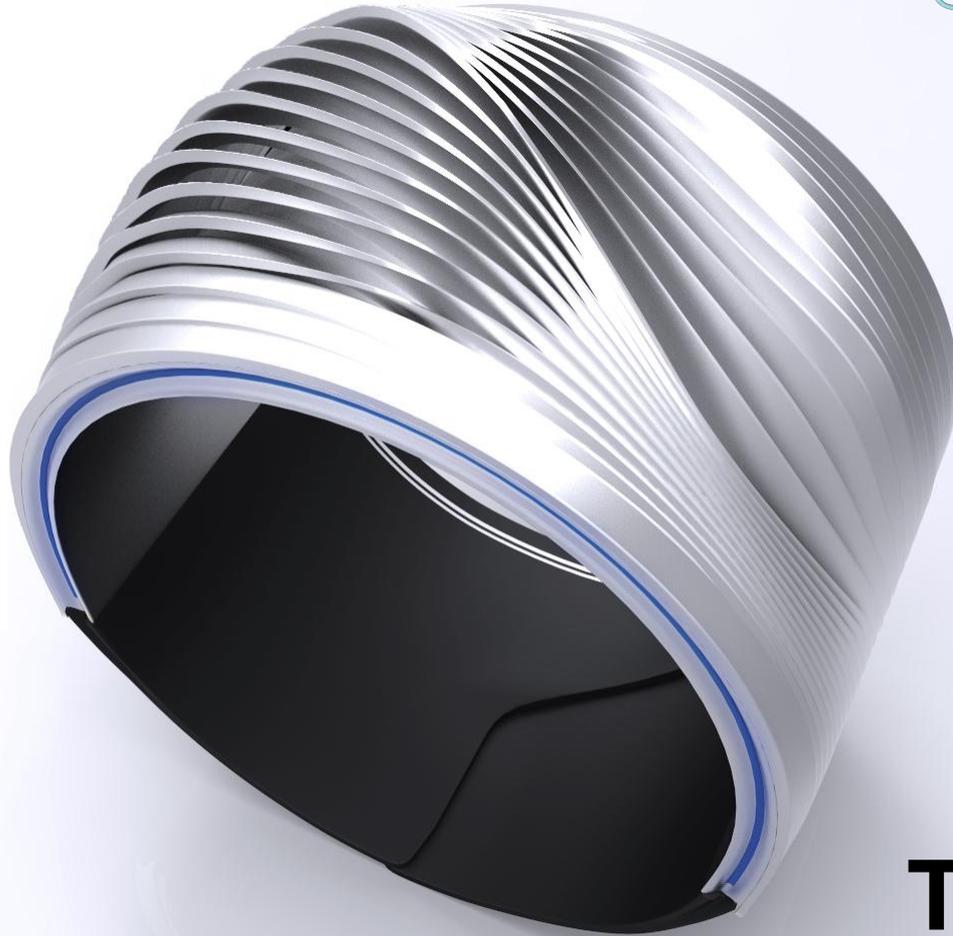
THE INDEPENDENT

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our journey so far





Thanks!

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RES.2-005 Girls Who Build: Make Your Own Wearables Workshop
Spring 2015

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