Financial Information

Part	Quote
Injection Molding Tooling	$36,692
Injection Molds	$82,900
Peltier Coolers	$79,200
Cost of Insulation	$5,533.88
Cost of Heat Sinks	$166,000
Cost of Hardware (screws)	$6,370
Cost of Fans	$322,000
Total Cost of 10,000 units	$698,696
Cost per Unit	~$70

Conclusion

From the numerical analysis of a general system and the results achieved, we can see that it is possible to achieve the desired rate of condensation. However, it is only possible under certain conditions, meaning that it would work much better in certain regions. Under these ideal conditions, the heat absorption required by the cooling devices seems to be in an achievable range. The power needed to run the device is also much greater than expected, so there are no "portable" options for batteries right now.

Future Work

1. Determine ways to make the device more lightweight when alternate power sources become available.
2. Add a food safe super-hydrophobic coating that would prevent the condensed water from sticking to the inner surfaces.
3. Add a filtration system to the funnel that removes pollutants to ensure the collected water would be safe to drink.

Contact Information

Daniela Cabrera: dcabre5@uic.edu
Ewa Konczewska: ekoncz2@uic.edu
Michael Orland: morlan4@uic.edu
Seth Sheppard: sshepp4@uic.edu
Michael Tegeler: mtegel2@uic.edu

MECHANICAL AND INDUSTRIAL ENGINEERING
COLLEGE OF ENGINEERING
UIC

Portable Water Condenser using Thermoelectric Cooling

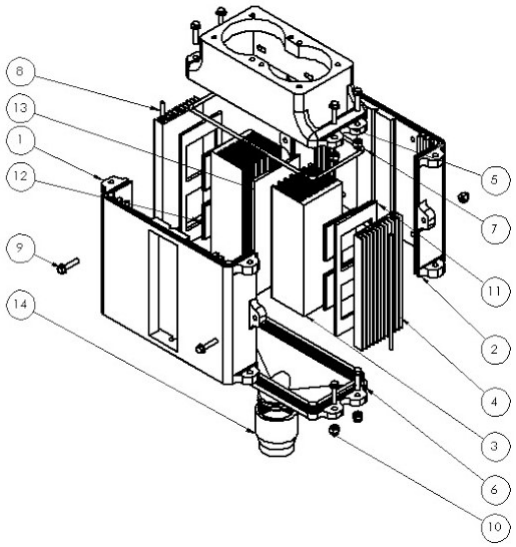
Daniela Cabrera
Ewa Konczewska
Michael Orland
Seth Sheppard
Michael Tegeler
Faculty Advisor: Jon Komperda
Technical Advisor: Sushant Anand

Problem Statement

The focus of this project is to design and construct a handheld device to fill a water bottle using condensation from the atmosphere.

- The bottle must collect half a liter of water within 5 hours
- It must also be portable, weighing at or below 2kg
- It must be capable of being powered by batteries
- The bottle must be cost effective and designed for manufacturability

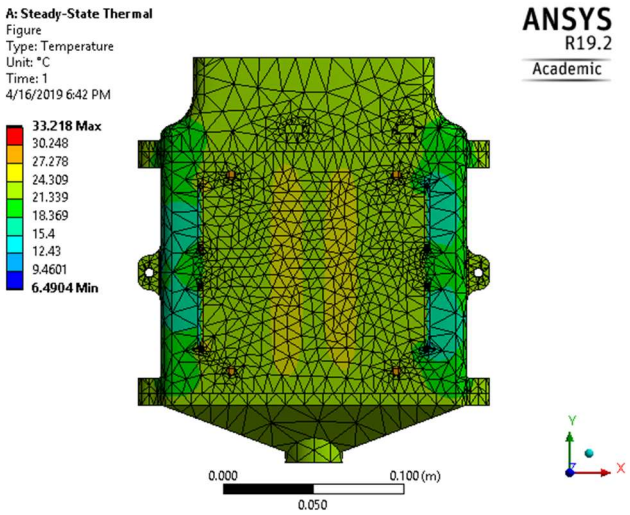
Final Design



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	MAINHOUSINGFRONT	CASING	1
2	MAINHOUSINGBACK	CASING	1
3	HSSERRATED	HEATSINK	2
4	C-HEATSINK	HEATSINK	2
5	FANHOUSING	CASING	1
6	BOTTOMHOUSING	CASING	1
7	CORDSTOCK_SEAL_(8TH IN)	SEAL	2
8	VERTICAL SEAL	SEAL	2
9	PL-HWMS 0.164-32X0.75X0.75-C	SCREW	10
10	ALCNUT 0.1640-32-N	NUT	10
11	INSULATION	INSULATION	2
12	TECOOLERS	COOLER	4
13	WEDGE	CASING	1
14	BOTTLETHREADING	CASING	1

This final design was the culmination of multiple types of analyses, including numerical methods, ANSYS analysis, and experimental testing. The optimal conditions for power supply to the Peltier coolers and fans were also found.

Heat Transfer



This simulation proved the best setup for the coldest temperatures possible for water collection. The amount of Peltier coolers required and their distance from each other were chosen from the ANSYS analyses. It also shows that the outside of the device will not become too hot to the touch.

Results

Test 1: 25.5mL @ 90% RH 26 °C for 2 hours
Test 2: 19mL @ 80% RH 26 °C for 2 hours
Test 3: negligible @ 70% 26 °C for 2 hours