Temperature-Sensitive Medication Storage for Natural Disasters

10-OCT-19

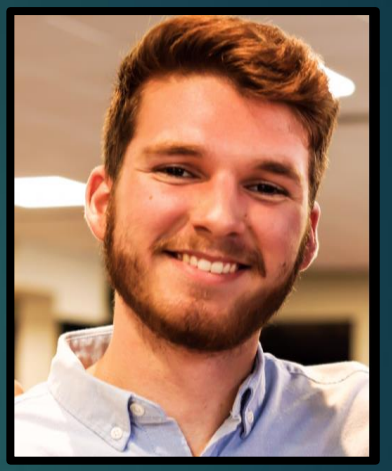
Meet the Team

Jesse Arrington
Design Engineer

Christian Torpey
Technical Engineer

Matthew Israel
Thermal Process Engineer

Tyler White
Energy Systems Engineer



Timothy Willms
Production Engineer

Sponsor

Tom Derzypolski

President: BowStern Marketing

- Florida State University graduate
- Bachelor's in Communications with an emphasis on Public Relations
- Decorated veteran of the U.S. Navy
- Member of:
  - Florida Public Relations Association
  - American Advertising Federation
  - Veterans of Foreign Wars

Design Review 1

This presentation will briefly discuss the following:

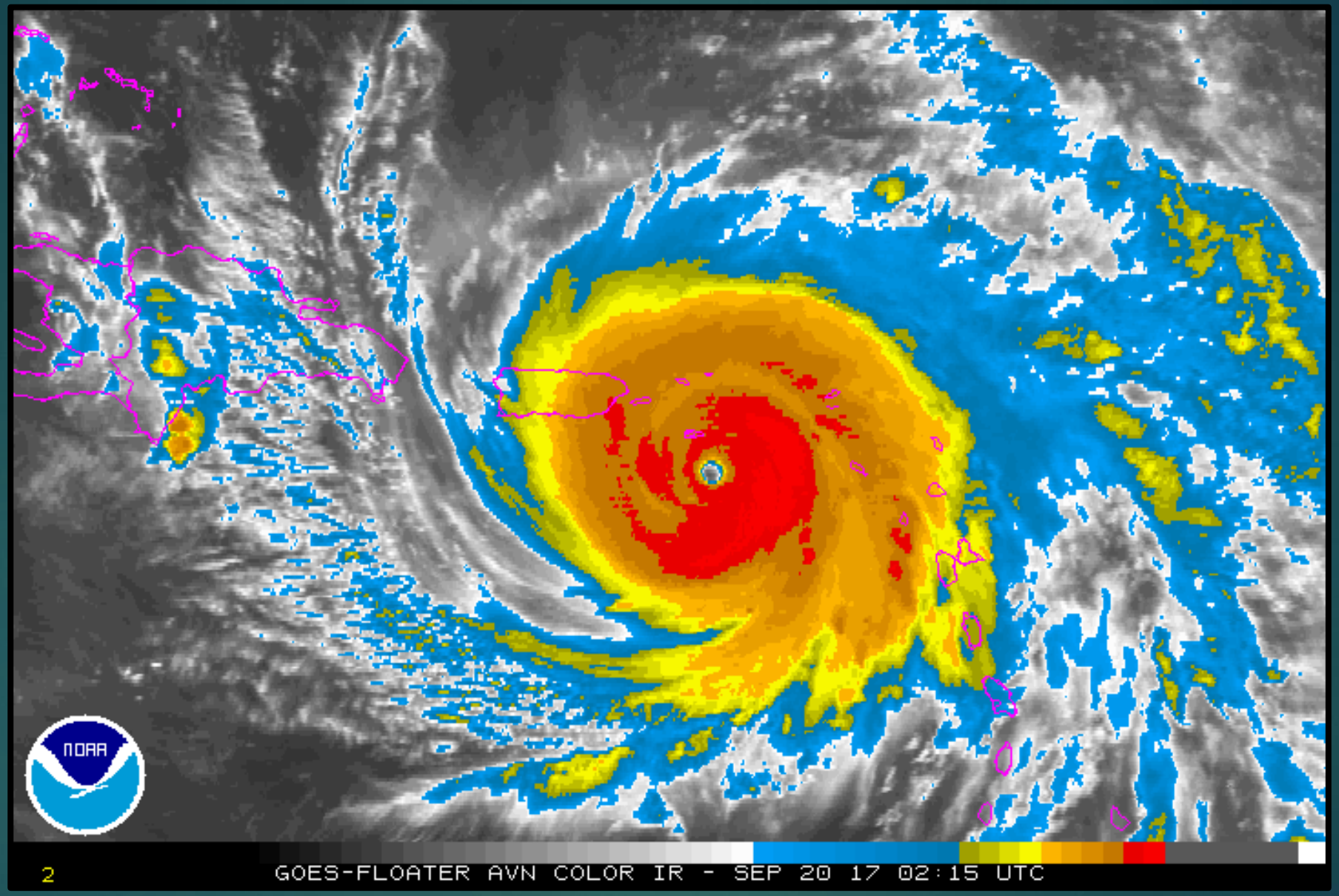
- Background Information
- Project Brief
- Project Scope
- Customer Needs
- Functional Decomposition

Project Background

OBJECTIVE, MOTIVATION & BACKGROUND INFORMATION

Objective

The objective of this project is to provide a relatively cheap and accessible means to keep temperature sensitive medications cool during natural disasters and the days following.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Mortality After Landfall

Causes of death	Sept./ Oct. 2015	Sept./ Oct. 2016	Sept./ Oct. 2017	Pct. change
Essential hypertension and hypertensive renal disease	88	84	134	**+56**
Sepsis	138	117	197	**+55**
Suicide	31	35	49	**+48**
Alzheimer's and Parkinson's Diseases	370	343	524	**+47**
Diabetes	441	473	666	**+46**
Chronic Lower Respiratory Diseases	143	175	225	**+42**

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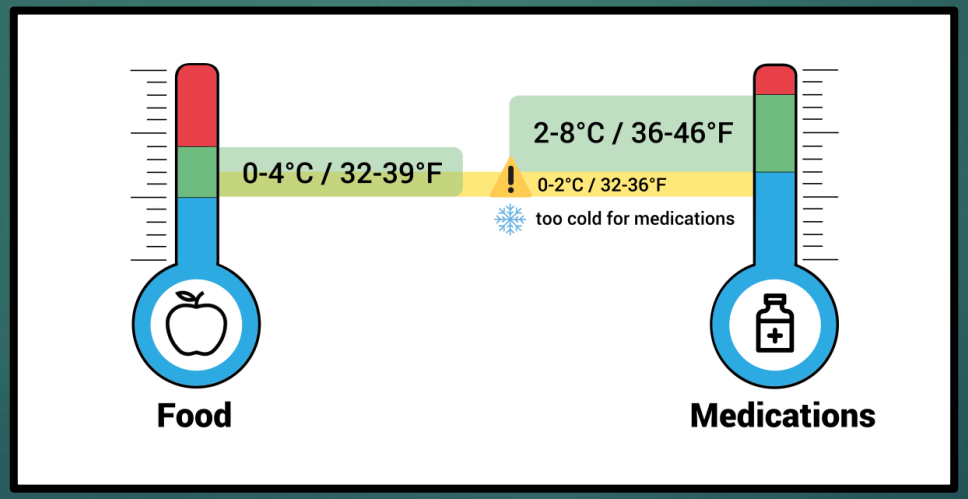
Motivation

- Puerto Ricans were out of power for an average of 84 days
- 46% spike in diabetes related deaths
- Inability to keep insulin medication chilled is blamed for loss of life

Background Information

- Medications such as insulin and penicillin are temperature sensitive and must be kept within a certain temperature range to remain viable
- When medications deviate from designated temperature storage ranges, they become unusable and, in some cases, may be dangerous to patients



Background Information

Medication	Unopened Storage Temperature Range (°C)
Insulin	3-15
Penicillin	3-15
Byetta	3-15
Victoza	3-15
Pulmozyme Nebuliser	2-8

Project Brief

- "Develop a way to keep temperature-sensitive medication cool during power outages"
- "A storage method that could be used during disasters and in the days/weeks/months afterwards would be very helpful"

Project Scope

KEY GOALS, MARKETS, ASSUMPTIONS, AND STAKEHOLDERS

Project Scope

Temperature Control

Energy Levels

Controlled Storage

Out of Scope

Freezer Medications

Grid Access

Key Goals

- Conserve Energy
- Optimize Heat Transfer
- Reduce Resource Consumption
- Environmentally Sustainable
- Cost Efficiency
- Reliability
- Portability
- Durability
- Ease of Operation

Markets

- Primary Market
  - Users of temperature-sensitive medicine
- Secondary Markets
  - Federal Emergency Management Agency - FEMA
  - Red Cross
  - People of Impoverished Countries
  - Military
  - Camping Industry
  - High Performance Cooler Industry

Assumptions

- Device will be easily accessible in terms of cost and supply
- Grid power is not available to power the device
- Design components can either be machined or purchased

Stakeholders

- Dr. Shayne McConomy
- Dr. Yousuf Ali
- Mr. Tom Derzypolski
- FAMU-FSU College of Engineering Dean's Office
  - Ms. Tisha Keller – Director of Marketing

Customer Needs

Customer Needs

Questions:

- Can you describe the intended user of this device?
- What do you like about existing products?
- What do you dislike about existing products?
- Should the device be specialized for a certain medication type?
- What would you see as the device's main functions and features?
- What type of disasters would you envision this device operating in?
- What time duration do you envision the device operating within?

Customer Needs

Responses	Interpreted Need
Chilled medication users in disaster-prone areas.	The device is intended to store and maintain chilled medication.
Existing products keep ice cold, but don't hold the temperature well without ice.	The device sustains a desired temperature without the use of ice.
Most products require a charger, and don't last long enough in the case of a power outage.	The device generates and uses minimal power to keep the medication refrigerated.
The medication types that result in the highest death toll.	The device maintains a temperature range suitable for refrigerated medicines.
The device should last up to three months without access to the grid.	The device controls the temperature of the system for three months without being plugged into external power.

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Functional Decomposition

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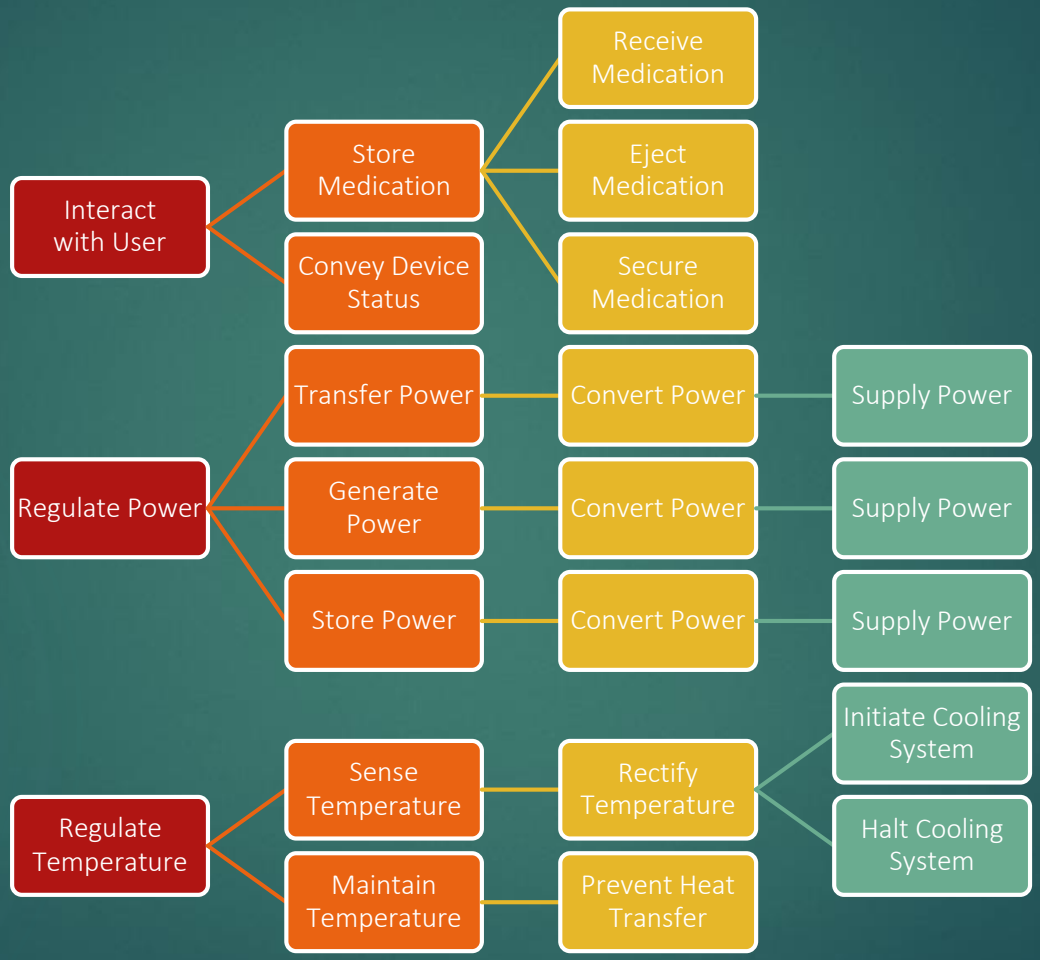

Functional Decomposition

- Three main functions:
  - Interact with User
  - Regulate Power
  - Regulate Temperature
- Overall outcomes:
  - Maintain temperature
  - Store medicine
  - Protect medicine

Next Steps

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Questions?

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