To Predict ▶ To Design ▶ To Perform

College of Engineering
Department of Mechanical & Industrial Engineering

ME, ECE, BE Capstone Design Programs

TEAM #2: INSTANT AIR

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RK Baker Group

Background

Entering a hot car poses a health threat to children, the elderly, and pets.

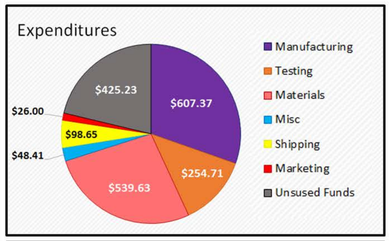
Objective: Design an easy to use handheld system that rapidly cools localized surfaces of an automobile prior to entry.

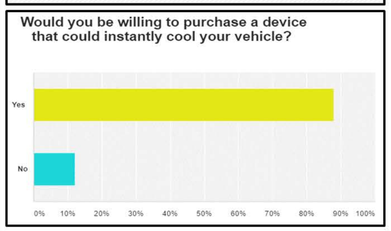
Potential Customers

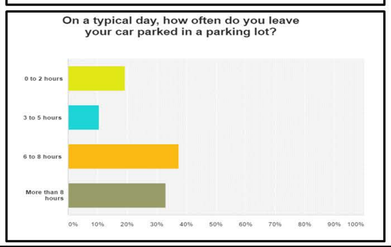
- Elderly
- Parents
- Pet owners
- Construction workers

Budget and Market Research

- Total Budget: $5000.00
- Funds Allocated: $2000.00
- Total Expenditures: $1574.77





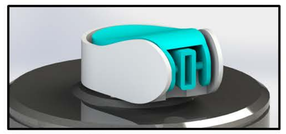


Market Analysis	
Participants living in SW Central US (Arkansas, Louisiana, Oklahoma, Texas)	80.17%
Car Owners	98.28%
Remote Start Car Owners	22.41%
Average Time Car in Parking Lot	6.87 hours
Participants Experiencing Hot Summers	99.14%
Participants Returning to Unbearably Hot Cars	95.65%
Participants Interested in Purchasing Instant Air	87.93%
Average Number of Uses per Week	6 uses
Desired Cost Per Unit	$46.47
Desired Cost Per Refill	$8.00
Participants Currently Employed	75.86%
Average Income	$77,250
Average Age	37 years
Total Participants	120

SolidWorks Models

Exploded Rendering of Instant Air

Full view of Instant Air



Close up of Nozzle

Section view of Instant Air

Functional Requirements

- Coolant (1.1.1.2-Tetrafluoroethane)
- Environmentally friendly
  - Fast acting
- Cool surfaces to comfortable temperature
  - At least cool 60 ^{0}F
- Safety
  - Non – Toxic fluid and Non – Flammable fluid
  - Safety cap to protect against accidental usage
- Ability to refill (reusability of vessel)
- Storage in Automobile
  - Vacuum Casing protects against highly pressurized vessel
  - Outer silicone layer to protect against high device surface temperatures

Safety and Testing

- Pressure Vessel
  - Maintain factor of safety of 5
- Fluid Containment
  - Push-button nozzle and indented profile to collect leaks
- Surface Integrity
  - Product does not damage leather or cloth interiors
- Effectiveness: Cools surfaces significantly (To -30 ^{0}F)

Engineering Specifications and Analysis

Specification	Measurement
Change in temperature	20°-30°F
Max system temperature	170^{0}F
Cost of 1 unit	< $50
Cost of each refill unit	< $20
Max can diameter	2.5 inches
Max can height	10 inches
Max time to cool car	10-20 seconds
Fluid boiling point	< 80°F
Uses per vessel	Min of 3-5 uses
Flammability Limit	Must not exceed lower flammability limit*

- Vacuum Seal Technology
  - Used in cryogenics
  - Eliminates conductive and convective heat transfer
  - Provides barrier between user and pressure vessel