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## Customer Background

Dr. Dietz is a director at the Purdue Homeland Security Institute. His research interests include optimization of emergency response, homeland security and defense, energy security, and engaging veterans in higher education.

## Problem Statement / Scope of Work

Improve safety and efficiency of emergency pedestrian traffic in large outdoor event evacuation settings.

## Requirements

- Height (>8')
- Interacts with existing alarm system (deployable)
- Must be waterproof (IP67)
- Visibility/Lighting (>80 LMN)
- Deploys in 5 seconds
- Size (<55 Gallon Volume)
- Safety (OSHA Compliant)
- Power (<500 Watts)
- Cost (\$300/unit)

## Experimentation, Concepts & Final Design



### Final Design Components:

- Solenoid (1)
- Air Column (2)
- Blower (3)
- Hinges (4)
- Container, wheels, and lid (5,6)
- Electronics box (7):
  - Alarms (8)
  - Power relay (9)
  - Arduino (10)
  - Lights (11)

### How it works:

Once the system is activated, solenoid retracts, lid opens and stops at a 90°; blower, alarms, and lights turn on simultaneously as the air column rises

## FMEA

FMEA			
Failure Mode	Failure Effect	RPN	Action Taken To Resolve
Failure to deploy via logic control	Failure to deploy prototype	168	Coding Tested Thoroughly
Lights underneath restrict airflow	column droops or is not rigid enough to maintain straightness	108	Airflow Holes added
prototype is not IP67 waterproof	Components in prototype damaged by water	384	All non-cots IP67 parts packaged inside waterproof box
alarm system is < 95 dB in volume	Will not be heard by attendees in an emergency	126	Supply full 5V to alarm, rated to 100dB when receiving max power

## Testing

Initial Testing					
Step	Test	Details	Outcome	Changes Made	Resolved?
1	Column Stability Testing	Turn on blower, test stability in wind conditions	Low stability both indoors and out, needed	Height of column Decreased,	Yes
2	Light Testing	Turn on lighting while prototype deployed, test luminosity	Luminosity reached 50 lux, but current draw made system	One light fixture removed to reduce	Yes
3	Lid Deployment Testing	Turn on system, test if lid deploys with spring loading and column uplift	Spring-loaded hinges were too weak to lift lid, stronger springs	Stronger spring-loaded hinges added	Yes
4	Alarm Buzzer Testing	Turn on alarm buzzers, determine whether loud enough	Buzzers located inside waterproof box not loud enough	Alarms moved to inside of containment	Yes