

# *AirBalance* HVAC systems

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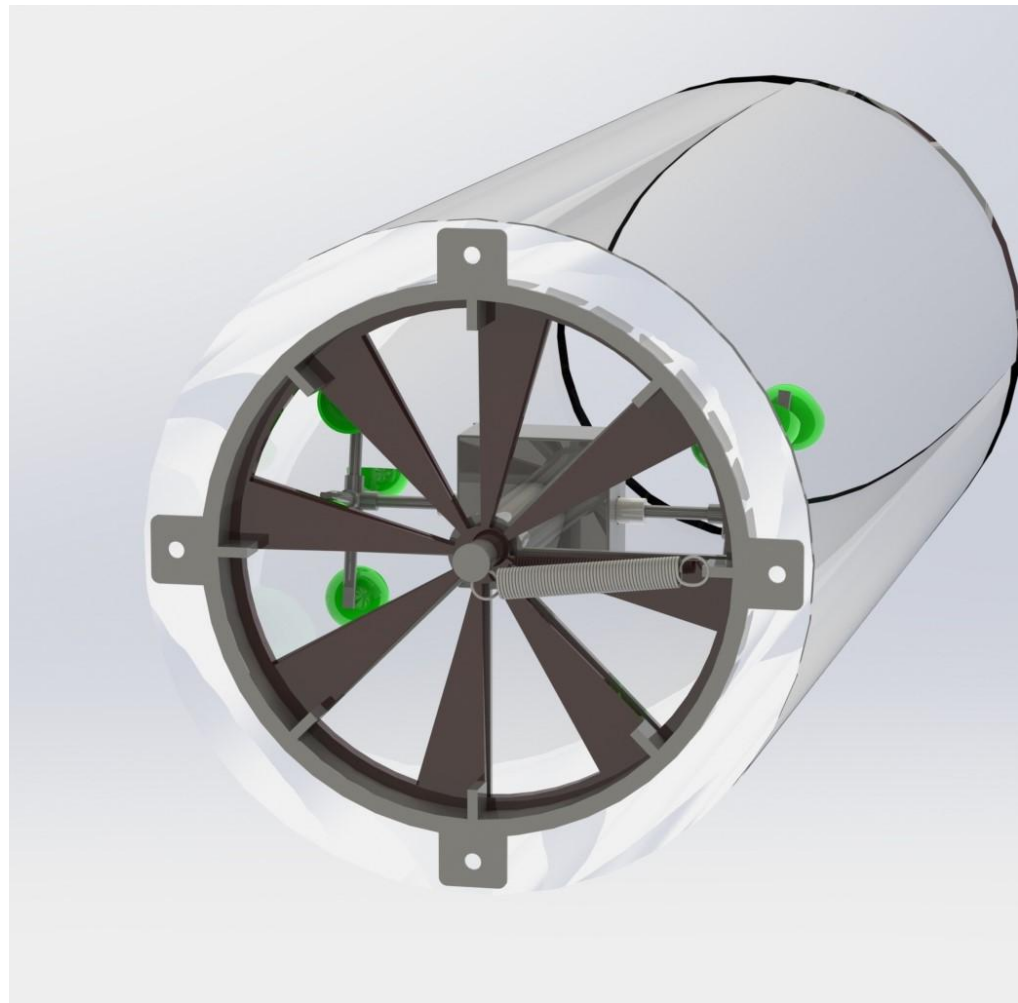
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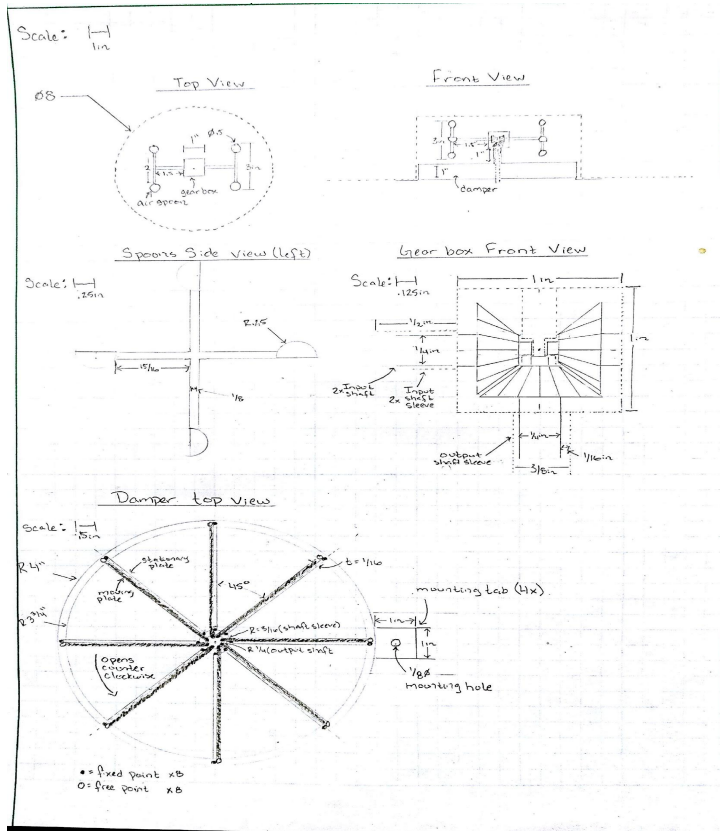
Rebecca Gladden

Kyle Schwartz

# Presentation Contents:

1. Recap of previous presentation
2. Material selection
3. Manufacturing process
4. Cost analysis
5. Final drawings and models
6. FTA/FMEA





## Reviewing the *AirBalance*...

-Consumer demand

-Purpose & basic functionality

-Unique compared to competitors

# Design Emphasis

- Consolidation/ Less Parts
- Ease of Manufacturability
- Low Cost
- USER FRIENDLY
- Installation/ Assembly
- Easy to Support/ Maintain



## Where We Left Off...

- Material selection
- Cost Analysis
- Manufacturing



# Materials & Cost

## Parts:

1)	Gearbox Upper.....	\$1.40
2)	Air Mill & Gear (2).....	\$0.50
3)	Damper Body.....	\$1.40
4)	Shaft & Gear.....	\$8.00
5)	Spring & Locking Mechanism.....	\$1.20
6)	Fan Dampers.....	\$2.00
7)	Damper Arms.....	\$3.00

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Total \$17.50

## Material:

Acrylic: { 1,3 }

PVC: { 2,4 }  
(Polyvinyl Chloride)

Steel: { 5,6,7 }

## Properties:

- Injection Moldable, Rigid, Weatherability, Clear (inspectability)
- Strong, Durable, Chemically stable and Mechanically Strong
- Ductile, Long Life Cycle, Purchasable

# Market

- 8 in Air Balance \$79.99
- 6 in Air Balance \$69.99
- 4 in Air Balance \$59.99

## Car-II



\$45.99

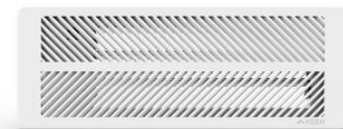


\$39.99

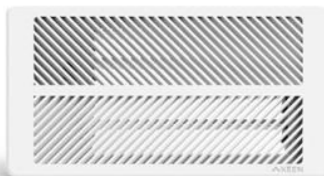
# Keen Home



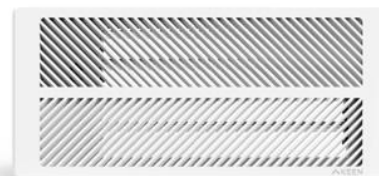
4x6  
\$84.99



4x12  
\$94.99



6x10  
\$99.99

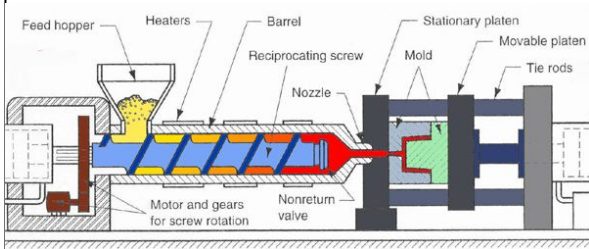


6x12  
\$105.99

# Manufacturability

## Injection Molding:

Easy to mass manufacture and make moderately complex shapes. Using this method, all plastic components can be produced inexpensively, quickly and efficiently.



## Purchasable:

Some parts are more cost effective to design for standard sizes and materials to be able to be purchased. The steel components have generic shapes and could be purchased at a lower price than being manufactured.



## Effects:

- Standardization
- Simplification
- High Quality- Low risk manufacturing methods
- Replaceability
- Low number of Vendors
- Increased Serviceability
- Product Performance

# DFA, Serviceability, and Life Cycle

## DFA

- Snap fixtures, No nuts and Bolts!
- Assembled by Customer, cuts down on manufacturing costs!
- Unit is self calibrating, no adjustments needed!



## Serviceability

- Mass produced parts, easy to send replacements!
- Units can be dismantled and reassembled easily with the help of snap fittings.
- Low cost materials make replacement and repairs inexpensive for us and the customer!



## Life Cycle

- Use of plastics and steel make the parts recyclable!
- Strong, durable materials make for a high performance, hardy and wear-resistant assembly.
- Replaceable parts extend the life of *Airbalance*.

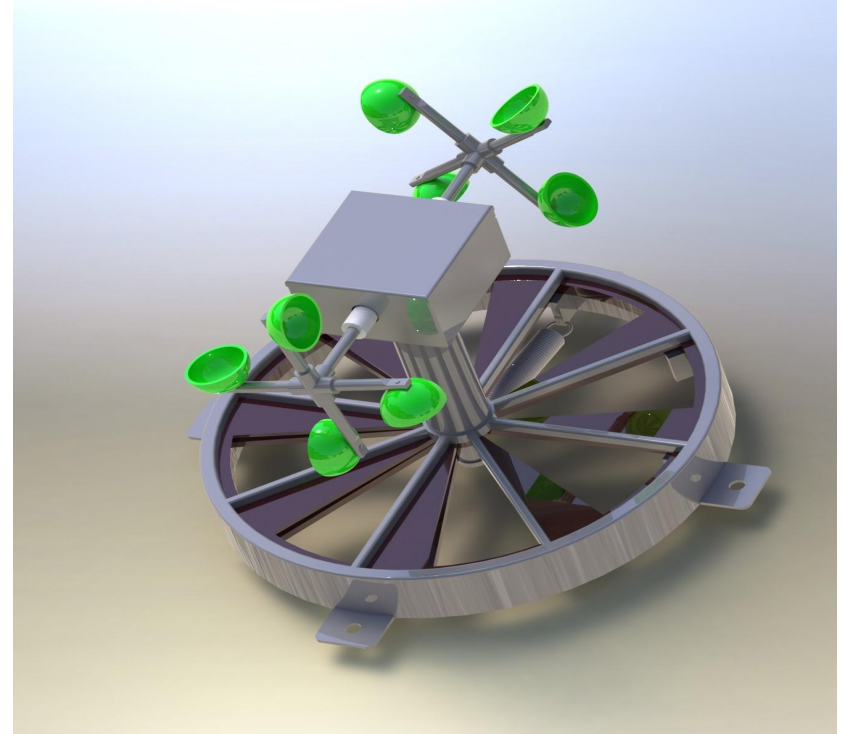
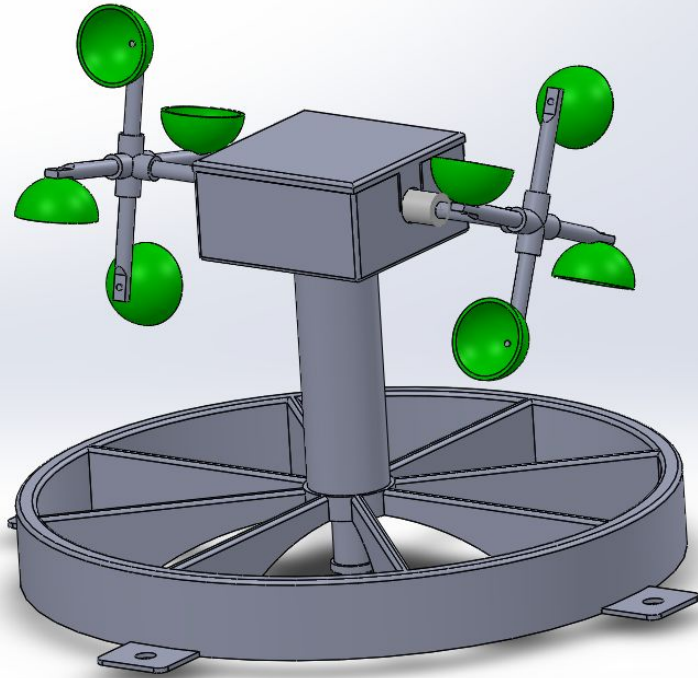


# Up Next...

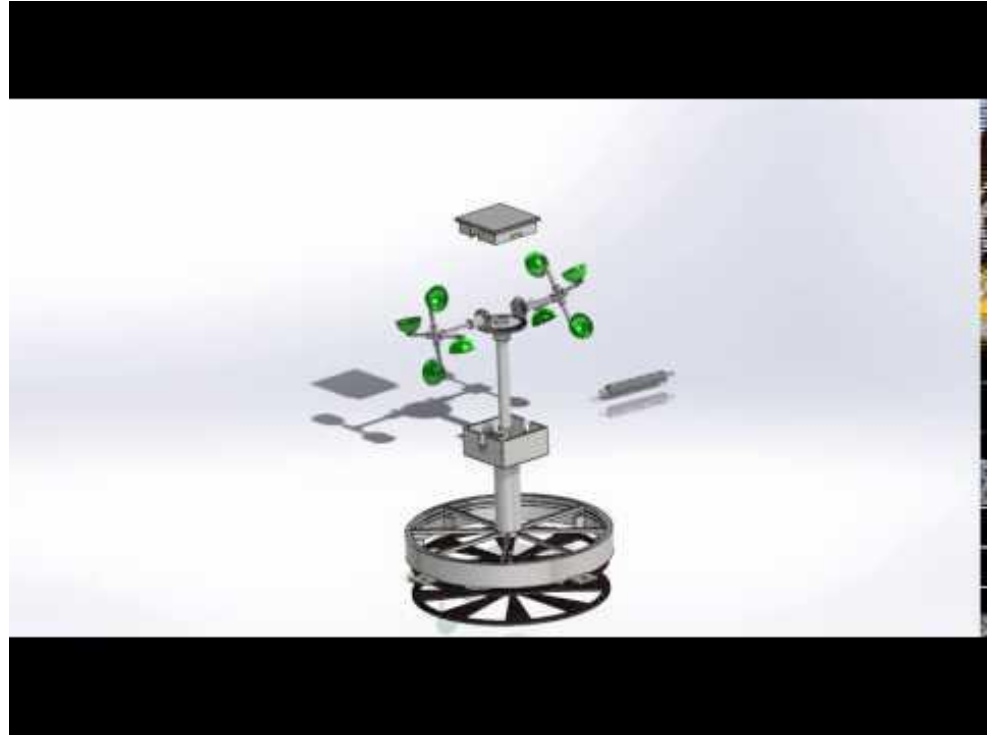
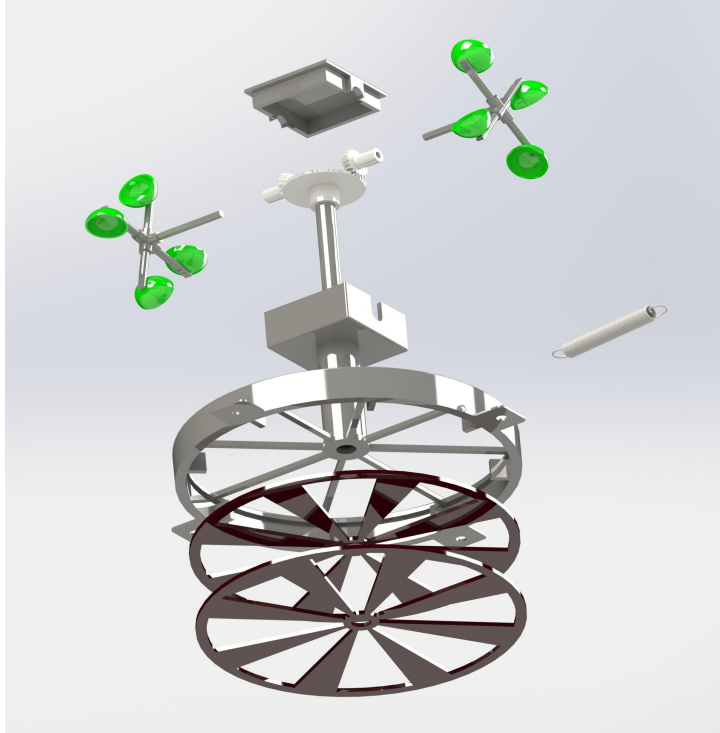
- Final Drawing/ Designs
- FTA/ FMEA



# Solidworks Assembly

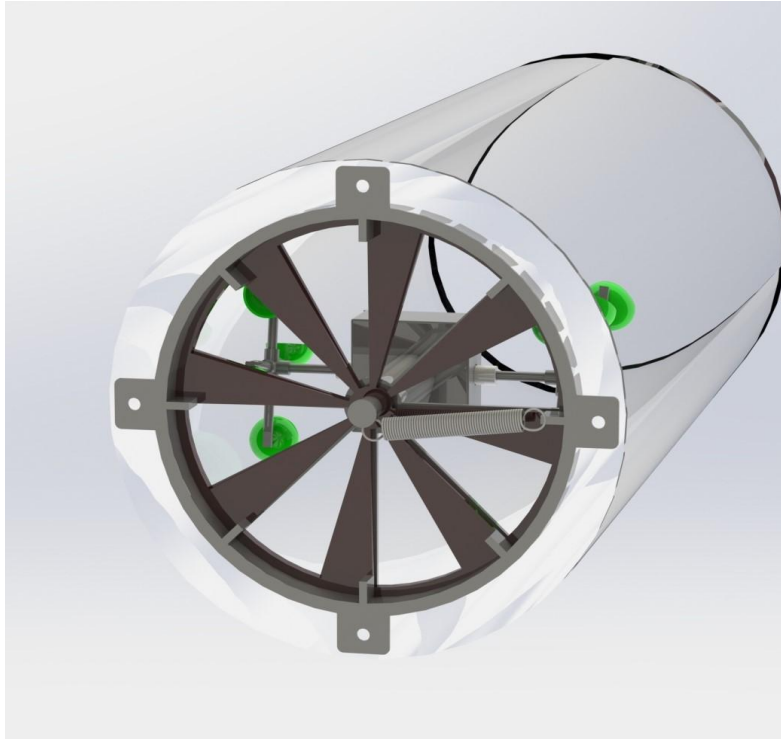


# Solidworks Exploded View

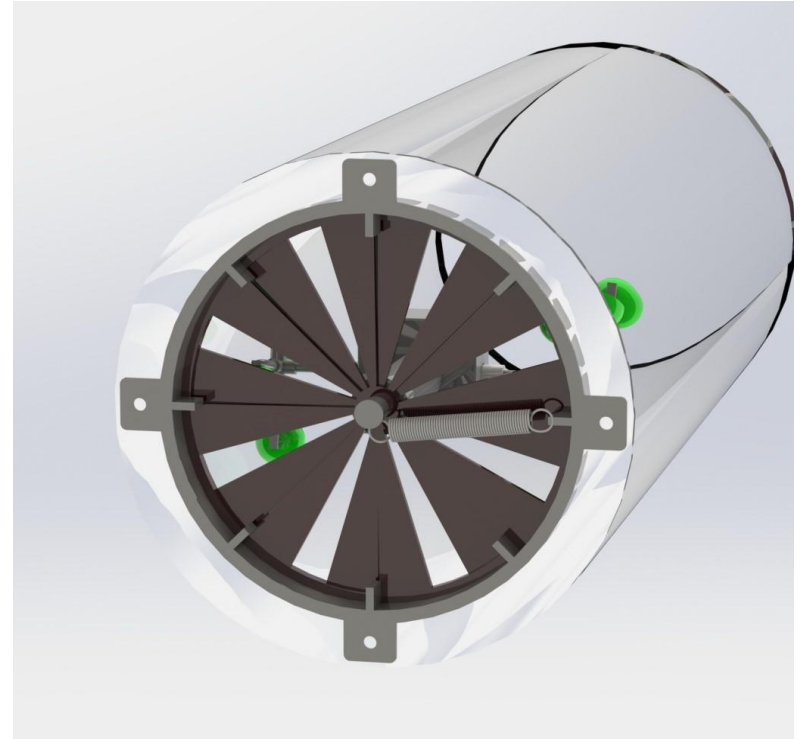


# Open Vs. Closed System

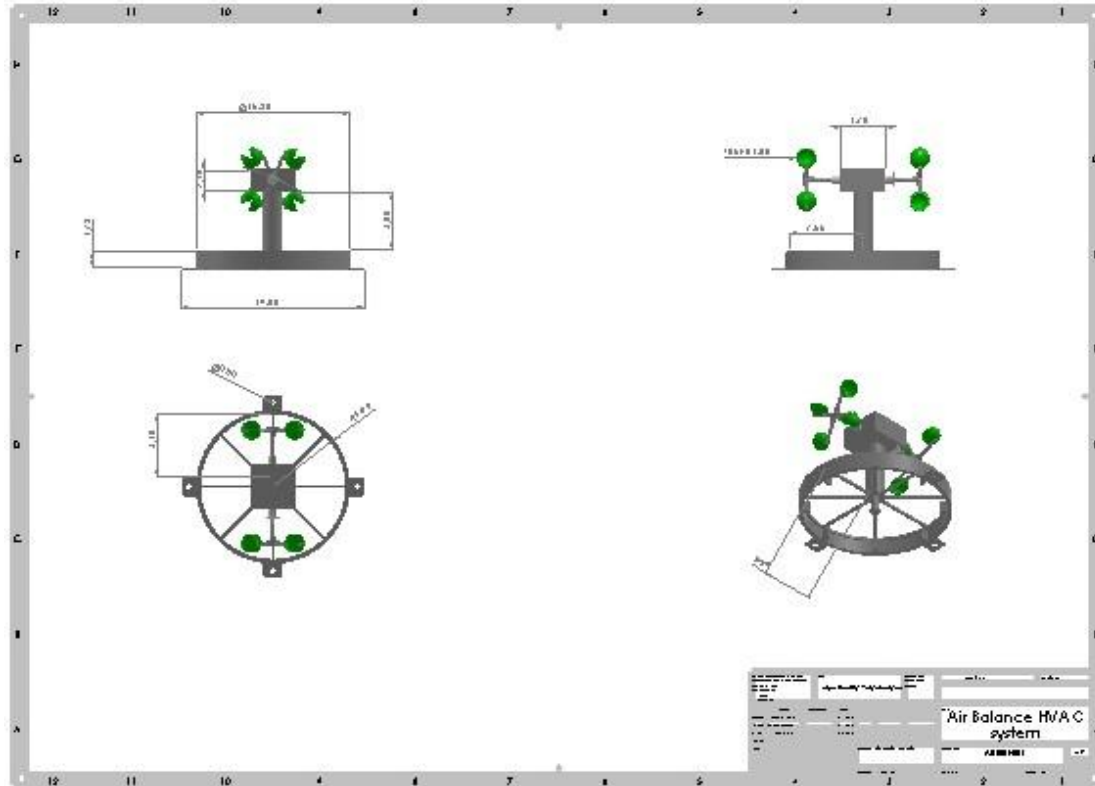
Open System = More Flow



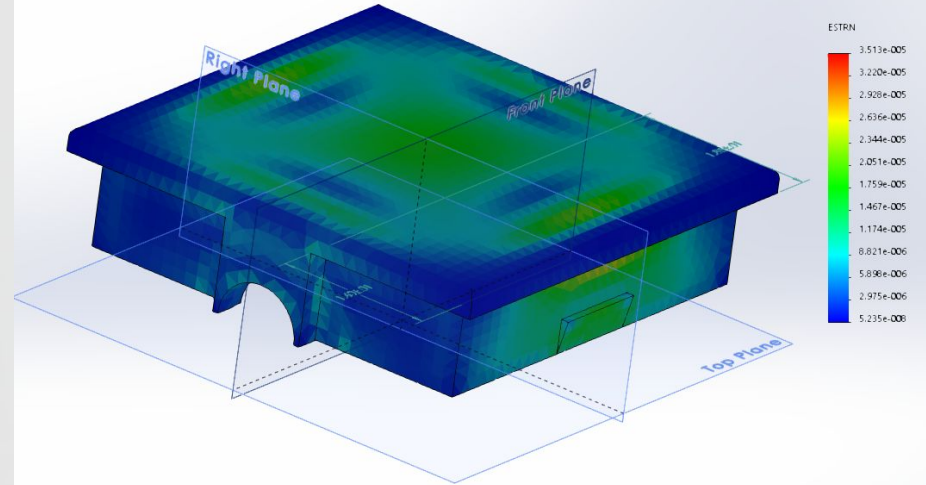
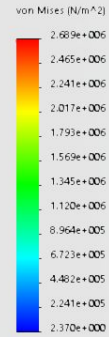
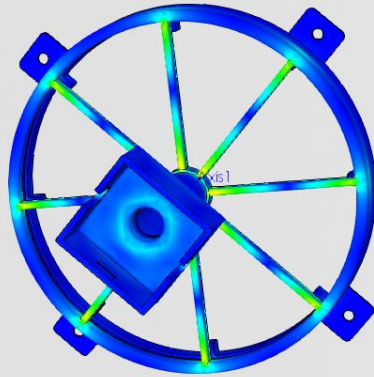
Closed Off System = Restricted Flow



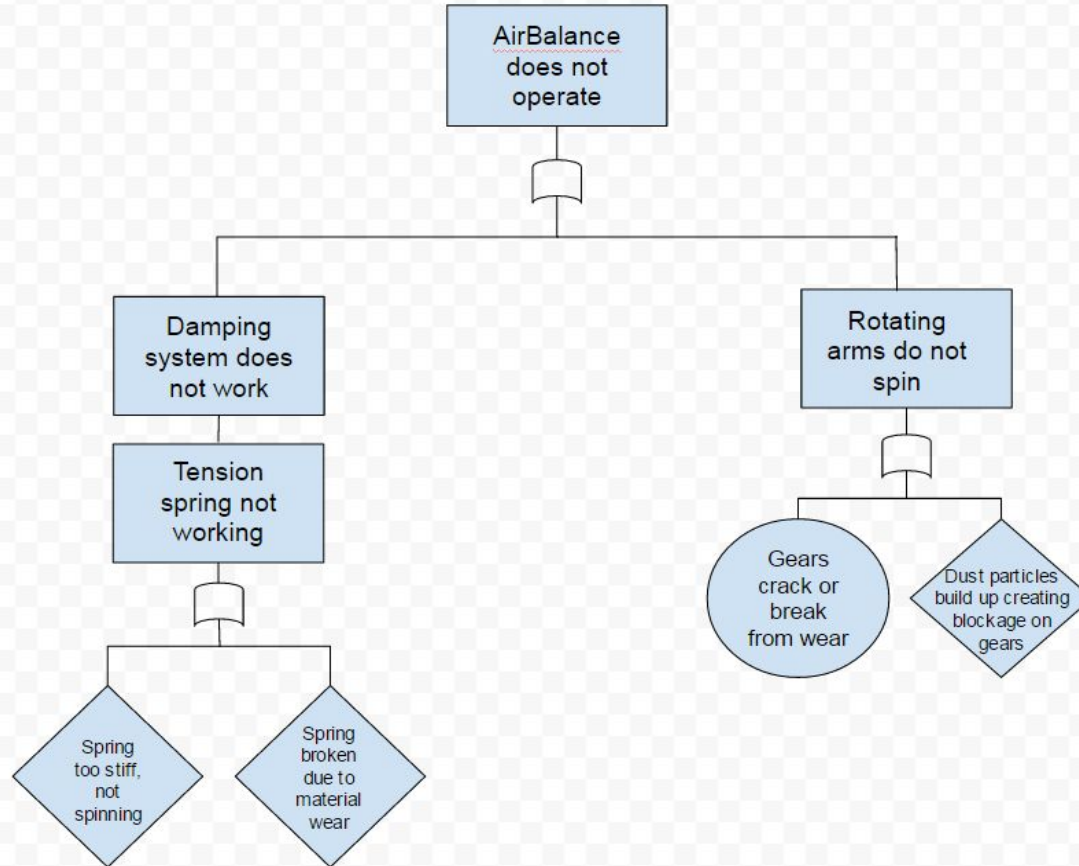
# Solidworks Assembly Drawings



# Basic FEA



# AirBalance FTA



# AirBalance FMEA

Failure Mode and Effect Analysis  
System: *AirBalance* HVAC  
Team: Brown, Cracraft, Drury, Gephart, Gladden, Schwartz

Item	Potential Failure Mode	Effects of Failure Mode	Action to Correct Failure	Scale of Failure Probability*
Silicone Dampers	Collaption	Loss of airflow control	Appropriate depth of damper groove	1
Silicone Dampers	Static induced failure of motion	Loss of calibration between spring and dampers and/or total loss of damper movement	Grounding of components, change neutrality of materials	2
Silicone Dampers	Dust accumulation on damper and within groove	Limited range of extension and loss of airflow control	Appropriate tolerance of damper groove and damper folding construction	3
Gears	Dust accumulation in gear teeth	Loss of calibration between air mill and system	Tighten tolerances of upper and lower gear box connection	9
Damper Arms	Dislocation from shaft slot	Complete loss of particular damper	Appropriate depth of shaft slot	5
Air mills	Fracture of air mill arm	Loss of balance between air mills	Correct alignment for evenly distributed air pressure on cups	8
Damper Arms	Deflection	Loss of airflow control	Correct type steel for necessary rigidity	7
Damper Frame	Fracture of damper connect	Loss of airflow control	Appropriate seal, or hardware for even connectivity	10
Shaft	Static induced failure of motion	Loss of calibration between spring and dampers and/or total loss of damper movement	Grounding of components, charge neutrality of PVC, limited contact of shaft and shroud	6
Damper Frame	Insecure attachment to duct entrance	Loss of airflow control, and/or complete detachment of system from duct	Appropriate grade of hardware, and distribution of hardware circumventing damper frame	4

\*Probability of failure is scaled 1-10, with 1 being of the highest priority due to the highest projected rate of failure, 10 being the lowest priority with the lowest projected rate of failure.