Preliminary Design Review

The Mann 2 - Smart Vent Team

Project and Team

- Smart Vent Team

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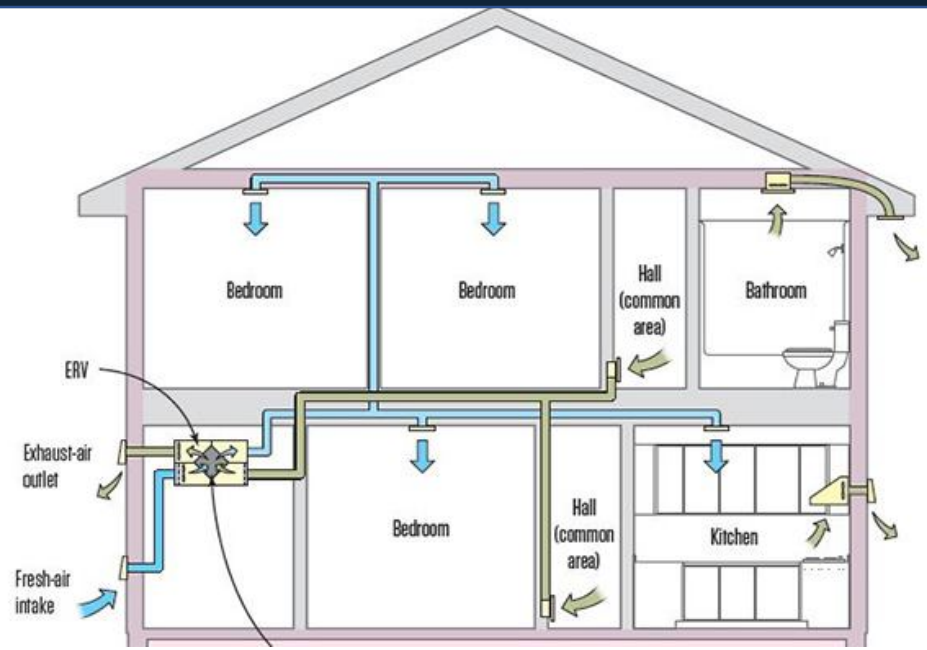
Project and Team

- Purpose of the Project
  - Improve the user's control of today's HVAC (heating/ventilation/air conditioning) systems.
    I. Do not accurately regulate temperature in each room;
    II. Do not move air between rooms;
    III. Air is much warmer on the second floor and much cooler in the basement;
    IV. Moving air through the supply ducts when the main blower is off.



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Project and Team

- Purpose of the Project
  - Gain more air controls in the HVAC systems by developing a standard for better dampers and in-line fans
- Current Systems (Dampers and in-line fans)
  - Restricts air flow when off;
  - High retrofit cost;
  - Labor intensive.

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Customer's Requirements

Fans	Move air between rooms
	Maximize airflow through the duct when existing HVAC is in use
	Low noise
Dampers	Restricts air flow when closed
	Maximize air flow when open
	Low noise
Communication System	Compatible with the Manhattan 2's BuildingBus system
Installation and Maintenance	Compatible with current HVAC systems
	Easy access to location through vent opening
	Long life cycle
	Parts are easy to replace

Fan Engineering Specifications

	Target	Threshold
The rate of air flow of the duct fan shall be high	200 CFM	100 CFM
The percent reduction of air flow through the system shall be low	5 % (CFM/CFM)	20 % (CFM/CFM)
The noise of the fan at full power shall be small	25 dB	40 dB

Damper Engineering Specifications

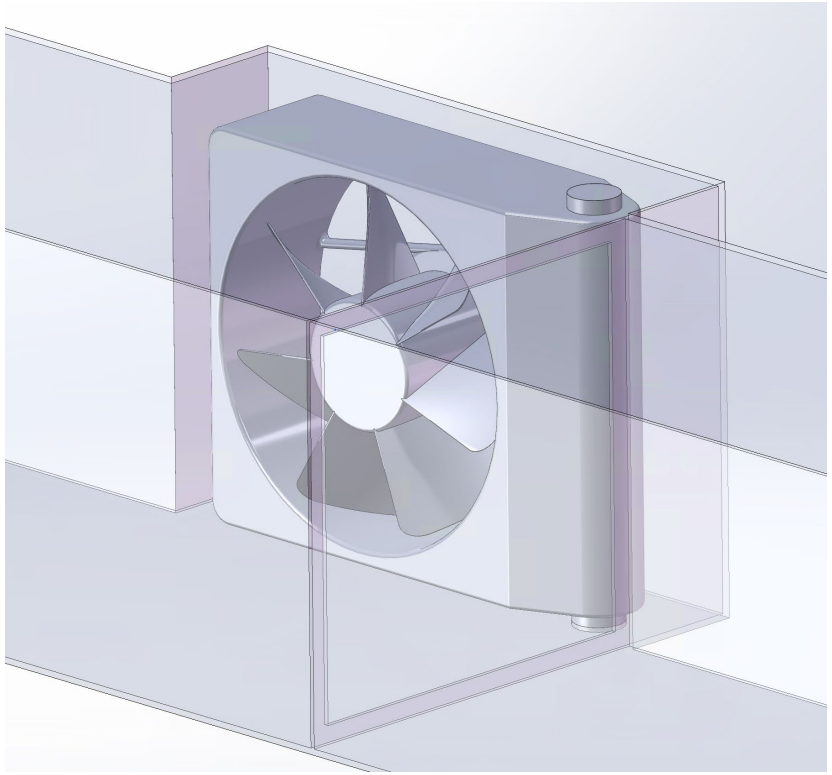
	Target	Threshold
The rate of air through the duct shall be reduced to zero when the damper is closed	0 CFM	10 CFM
The damper shall not obstruct the air flow when fully open	95 % (CFM/ Max CFM)	80 % (CFM/ Max CFM)
The noise of the damper when moving shall be small	30 dB	45 dB
The noise of the air though the damper shall be small	5 dB	10 dB

System Engineering Specifications

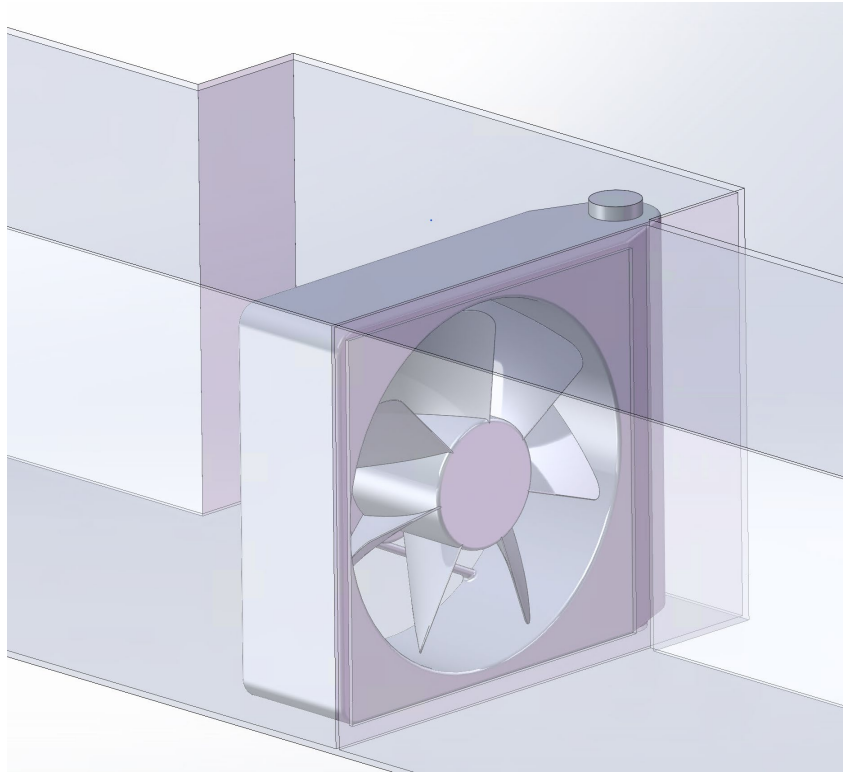
	Target	Threshold
The RULA (rapid upper limb assessment) score shall be low	2	3
Time to install shall be low	0.5 h	1.5 h
Steps to assemble the system in duct should be low	10	20
Years of operation shall be high	15 years	10 years

Pivot Fan

Maximize airflow through the duct when the fan is off



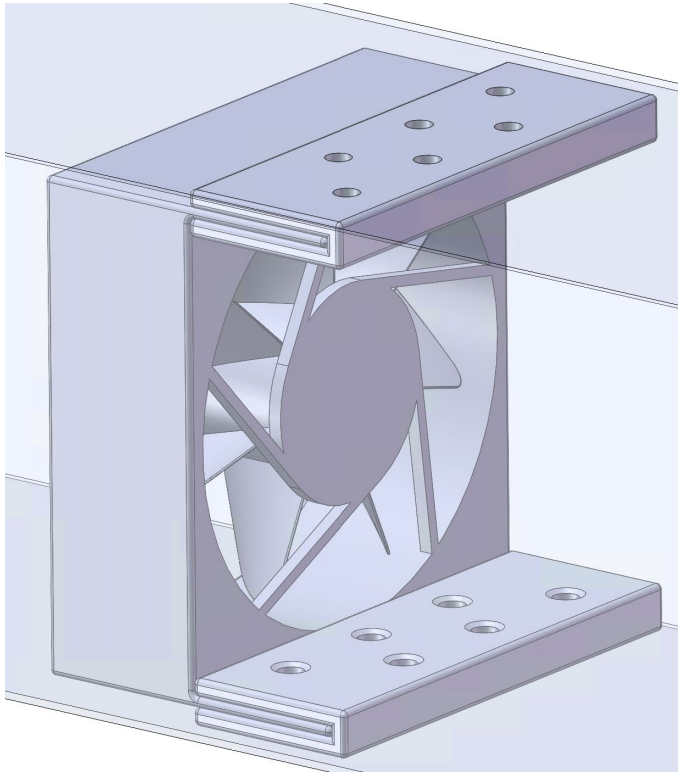
Pivot Fan in the off position



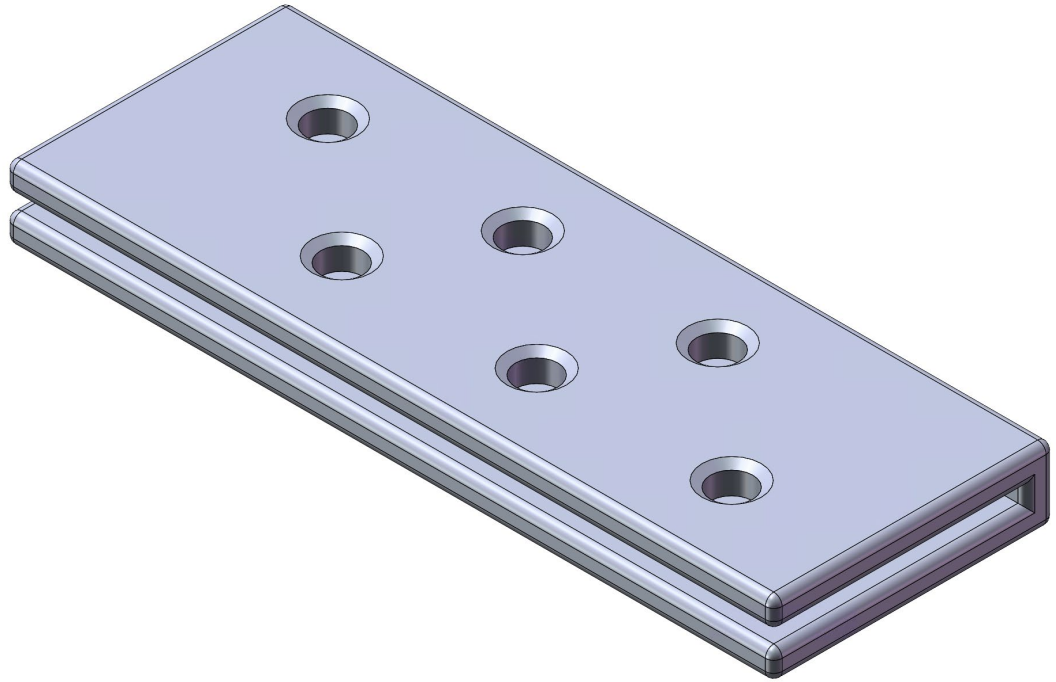
Pivot Fan in the on position

Mounted In-Line Fan

Simple mounting system for existing duct structures



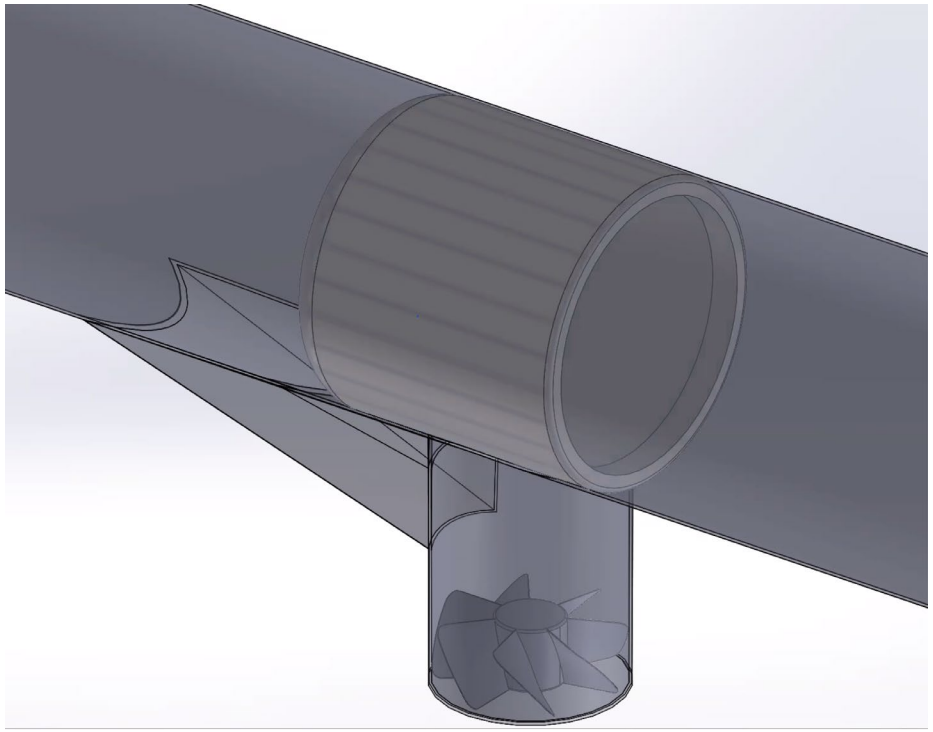
Fully assembled fan system



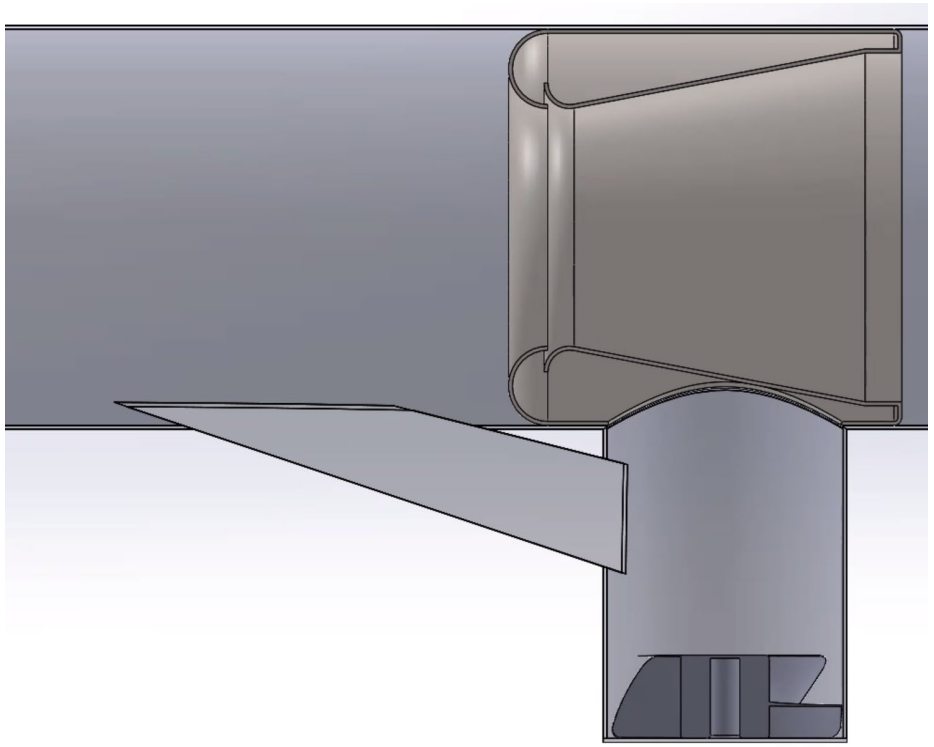
Mounting Bracket for the fan

Air Multiplier

Minimizing restriction of airflow through circular ducts

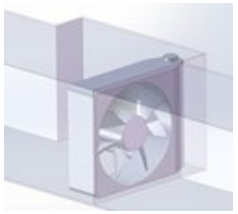
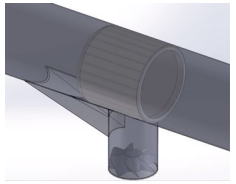


Fully assembled Air Multiplier system



Section View of Air Multiplier system

In-Line Fan

Concepts		Moving Parts (2)	Obstruction of Airflow (5)	Effectiveness (5)	Size Taken Up Outside of Duct (1)	Total
Pivot Fan		4	25	25	3	57
Mounted In-Line Fan		10	0	25	5	40
Air Multiplier		8	10	0	2	8

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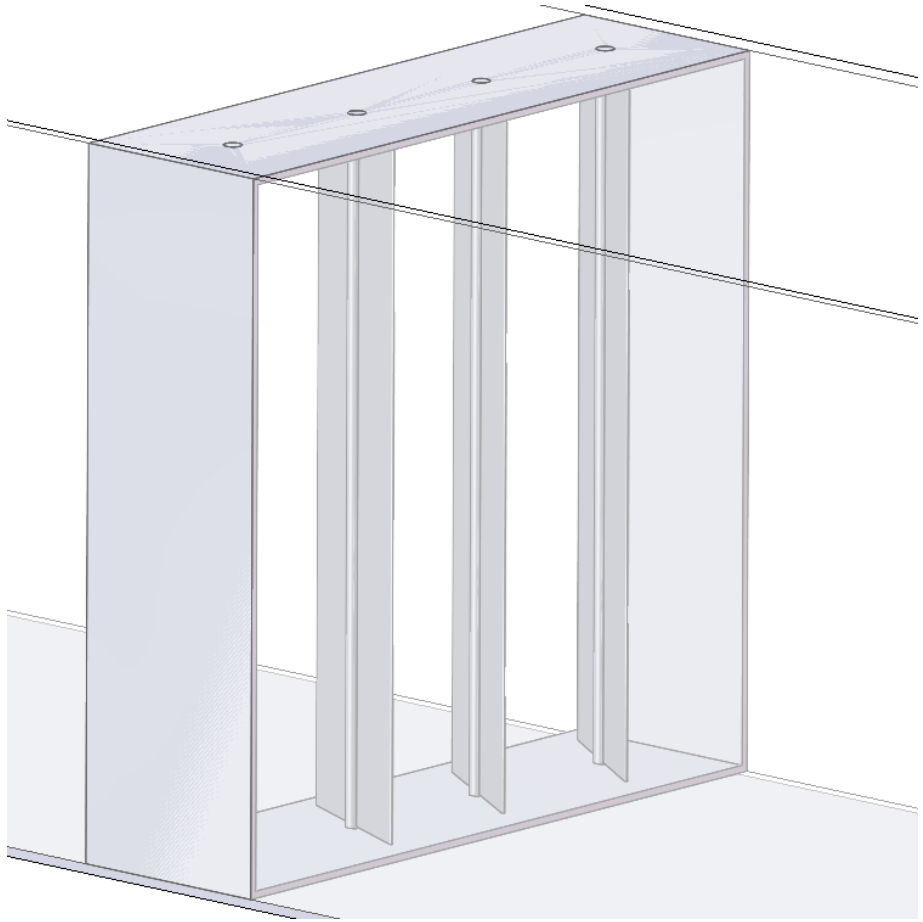
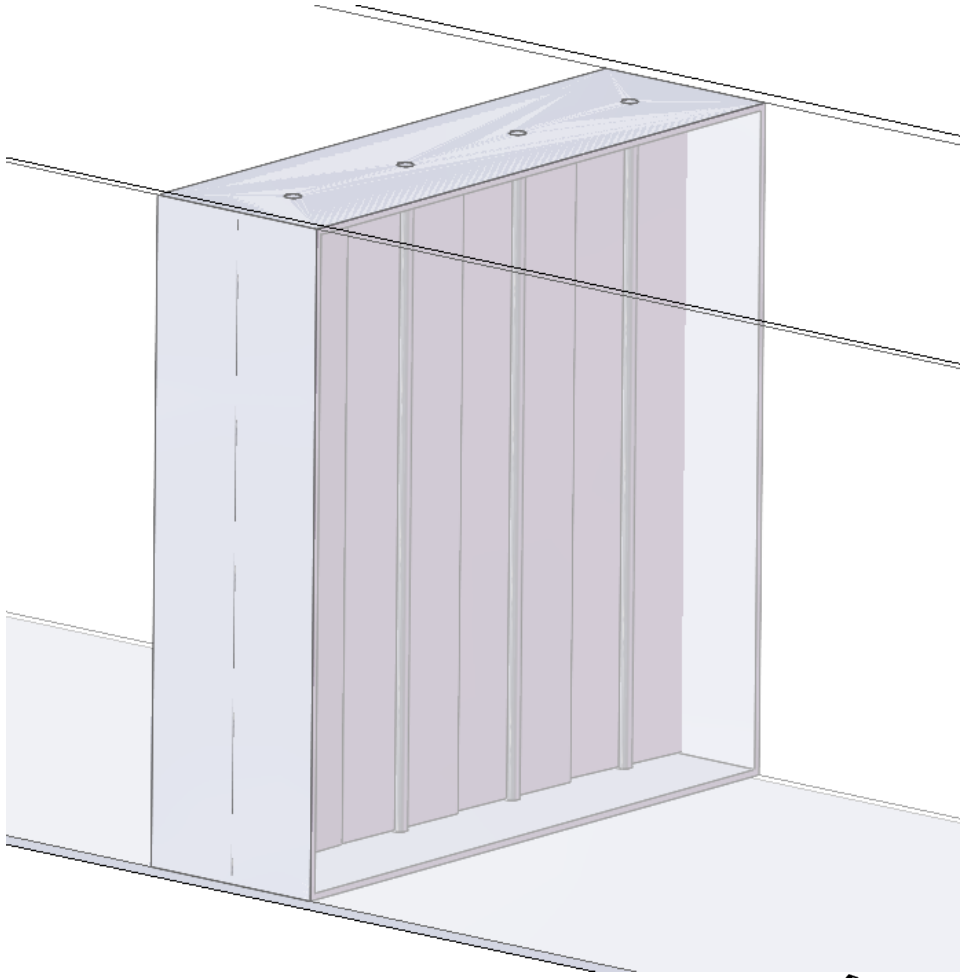
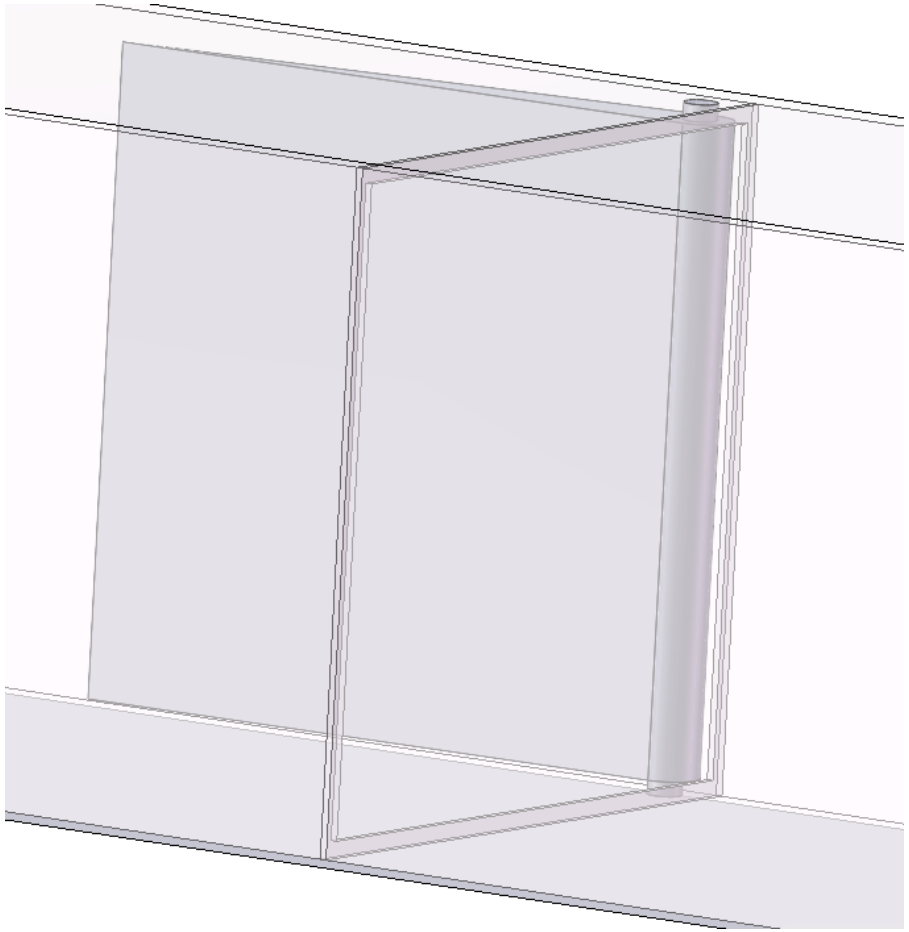
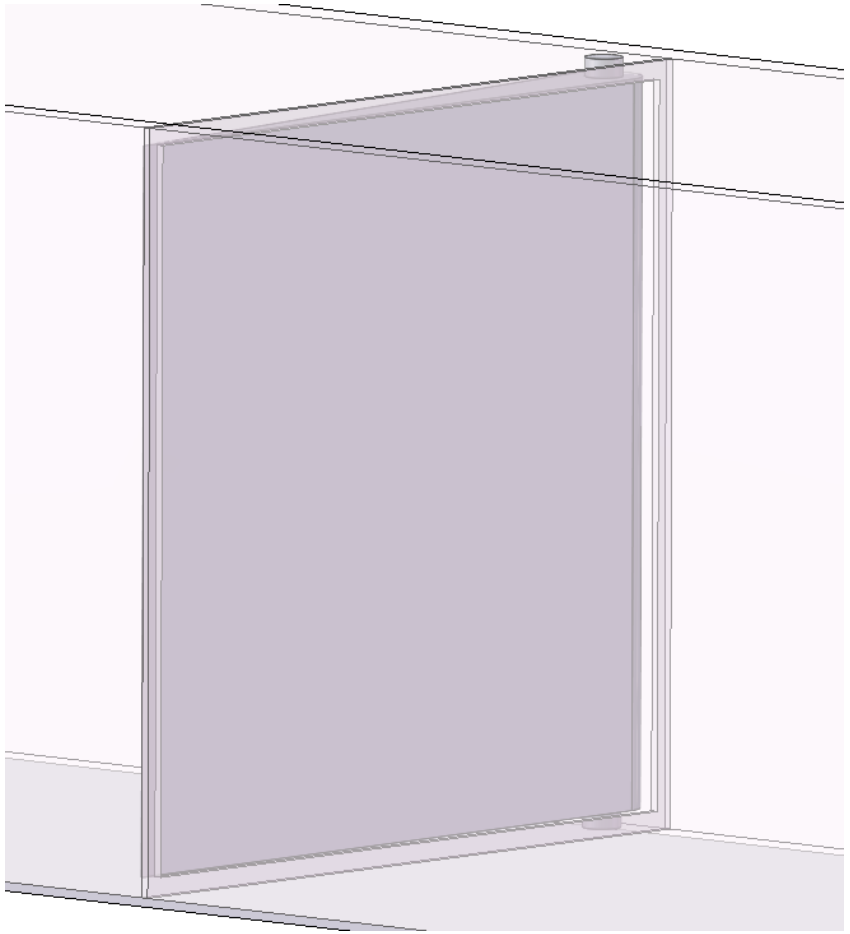
Self-enclosed In-Line Damper





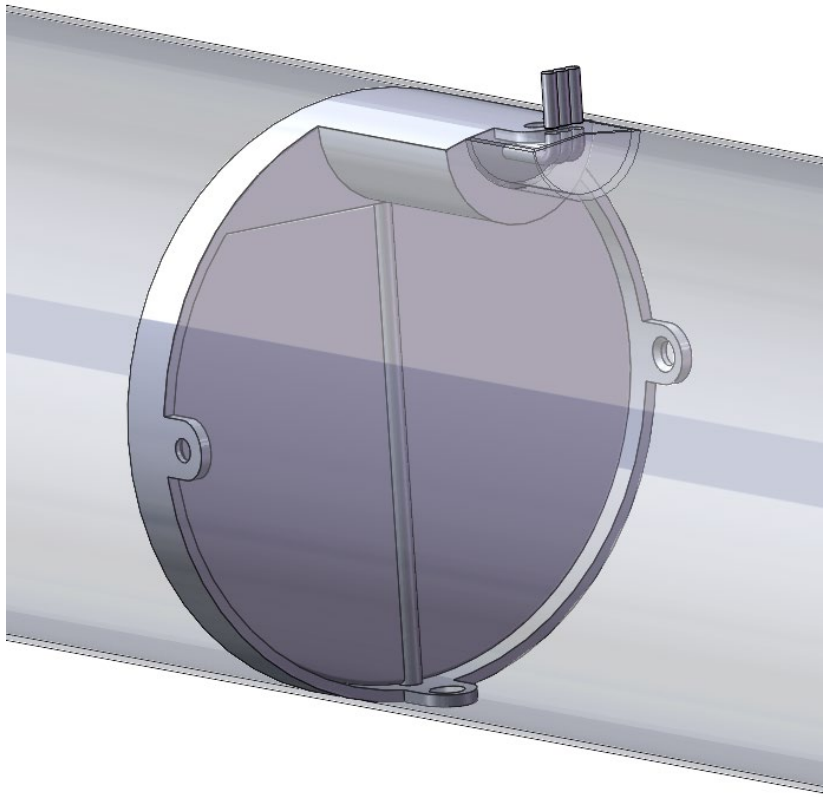
Pivot Damper

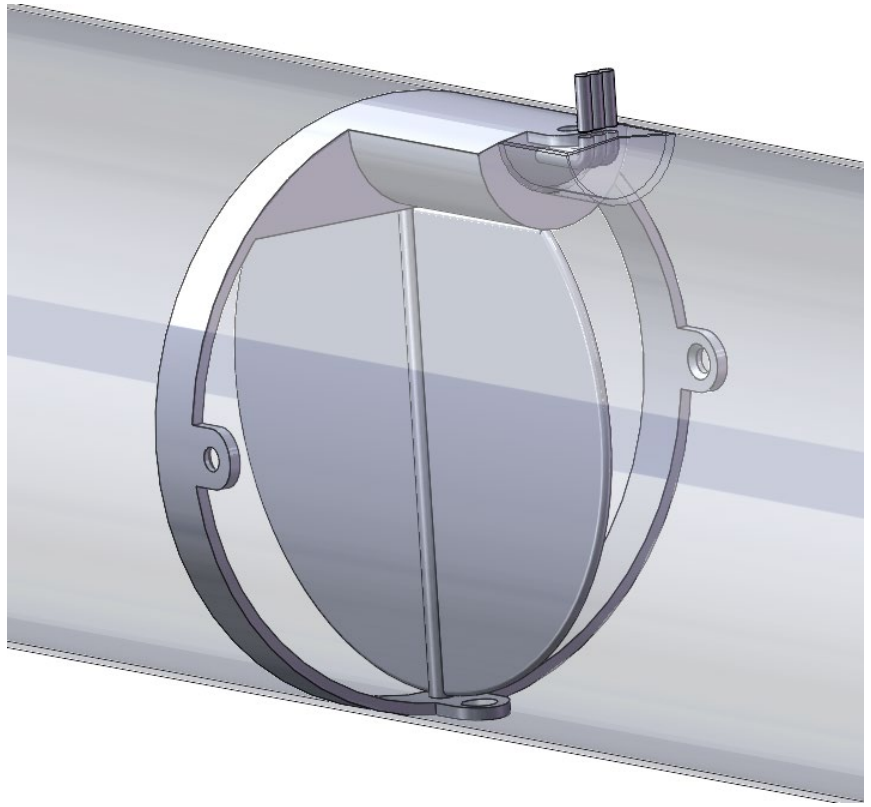




Butterfly Damper with an Internal Motor

Damping system installed within existing circular ducts

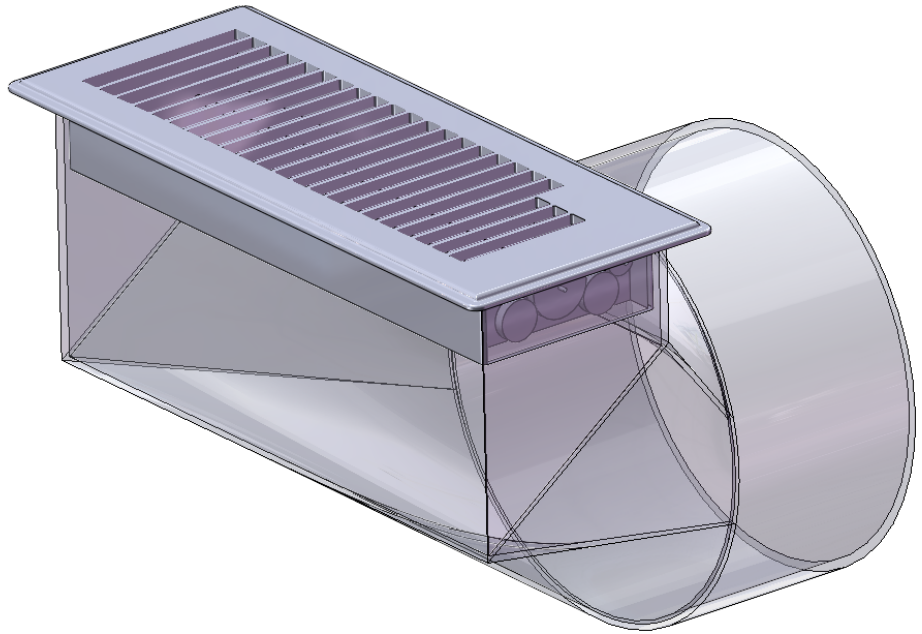


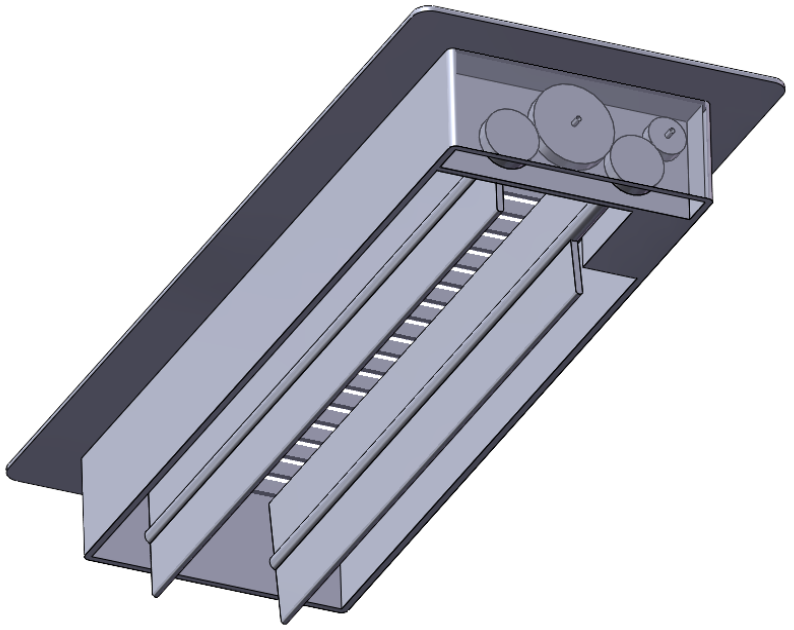


In-Line Damper

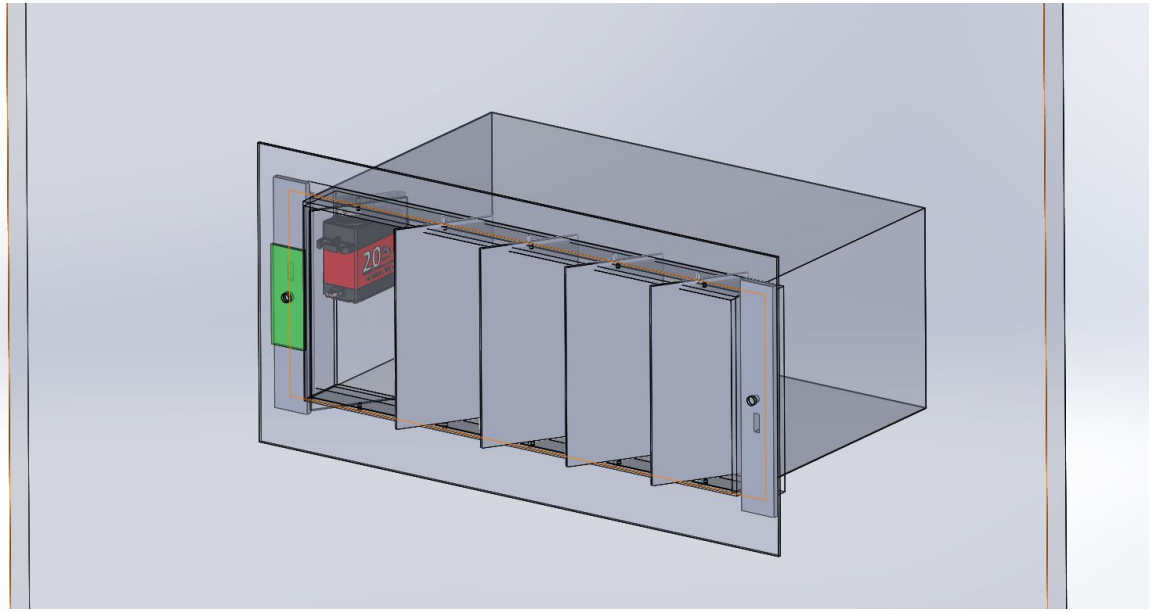
Concepts		Moving Parts (1)	Reduction of Airflow Open (5)	Reduction of Airflow Closed (5)	Torque Requirement (2)	Total
Pivot Damper		4	25	10	2	41
Self-enclosed In-Line Damper		3	15	25	8	51
Butterfly Damper with an internal motor		2	10	15	8	35

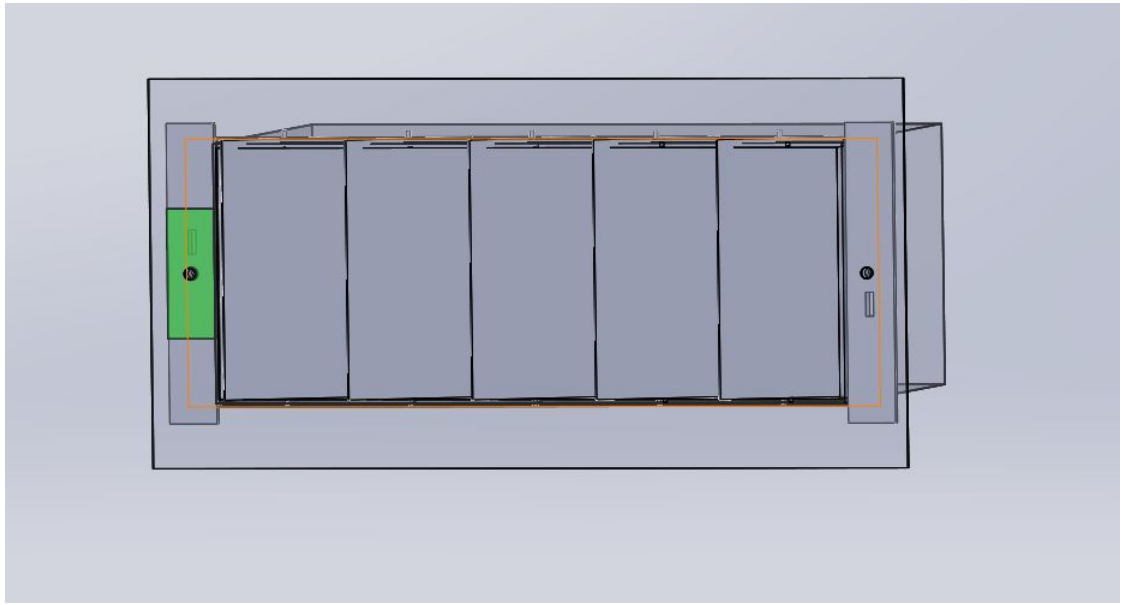
One Piece Motorized Vent Cover



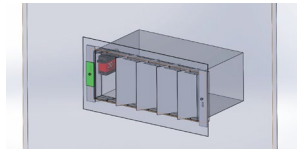
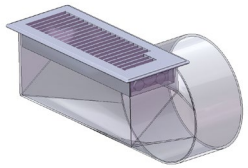


Vent Cover with Plastic Adapter

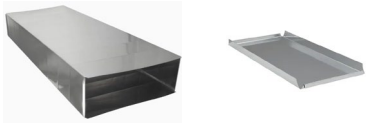




Motorized Vent Cover

Concept		Moving Parts (3)	Direction Of Airflow (1)	User Serviceability (4)	Susceptibility to Failure (5)	Total
Adapter		9	5	16	25	55
One Piece		9	2	20	15	46

Approximate Budget

Items		Cost
Low-Profile Fan		$100.00
Rectangular Duct and Duct Attachments		$100.00
Vent Covers		$40.00
Motors (3)		$120.00
Miscellaneous		$140.00
Total Estimated Cost		$500.00

Project Schedule

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Questions

References

- https://www.manhattan2.org/projects
- https://www.jlconline.com/how-to/hvac/choosing-a-whole-house-ventilation-strategy_o