

ME 486C Capstone Project

Fall 2025

100% Hardware Update

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SolidWorks Assembly

- 2 cold air inlets (1 in big room and 1 in smaller room)
- 3 heated outlets (2 in big room and 1 in smaller room)

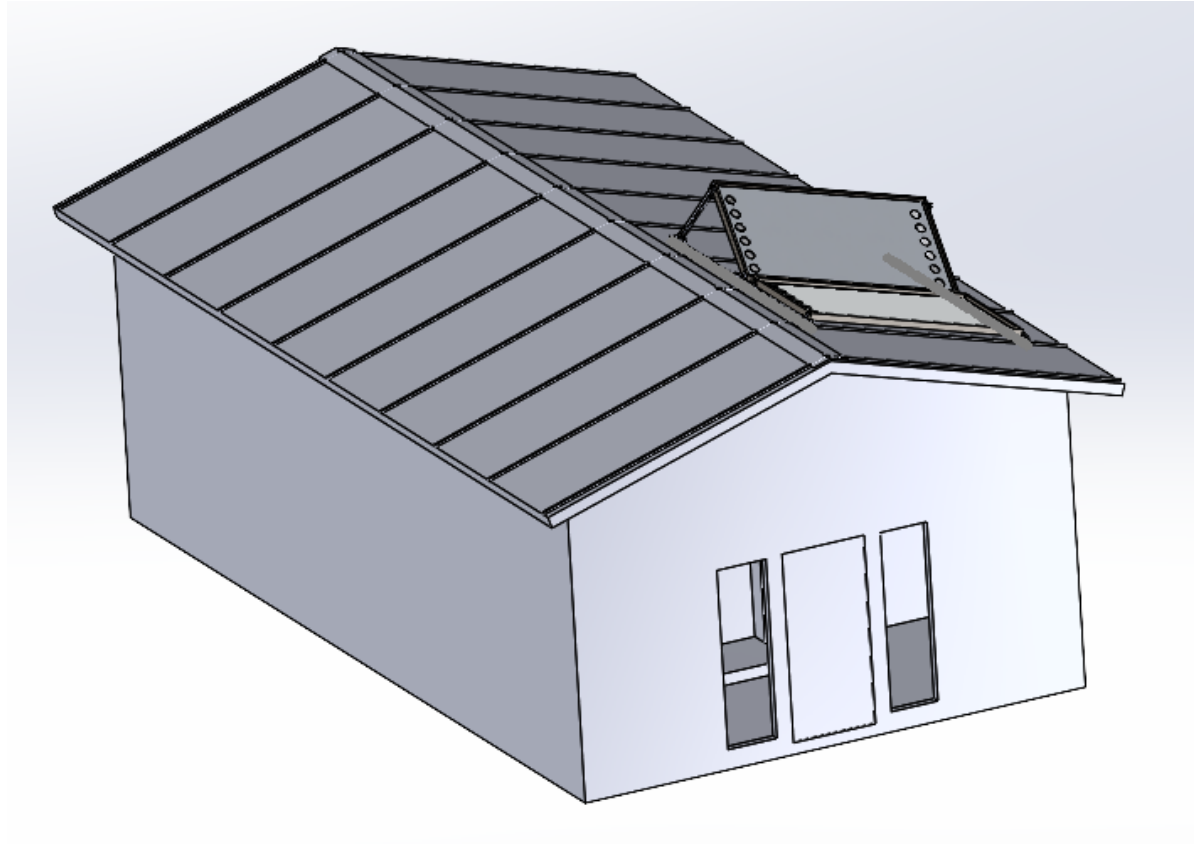


Figure 1: CAD Model of System

SolidWorks Assembly

Mounting Materials

- 14-gauge Unistrut
- Nylon Unistrut Cone Nuts
- 5-inch Lag Screws
- Unistrut Pivot Bracket
- 1.5-inch Square Washers
- 0.5-inch Locking Washers

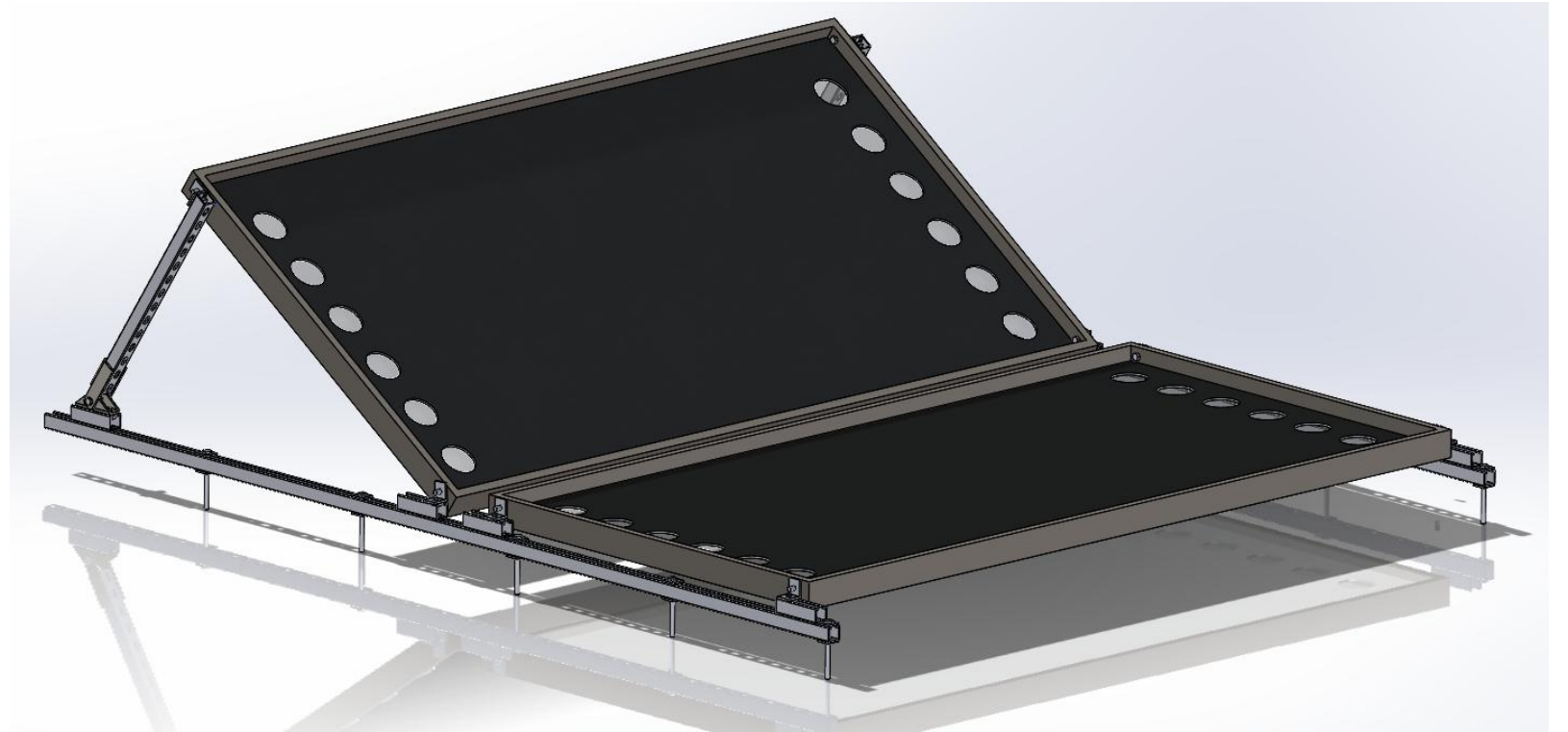
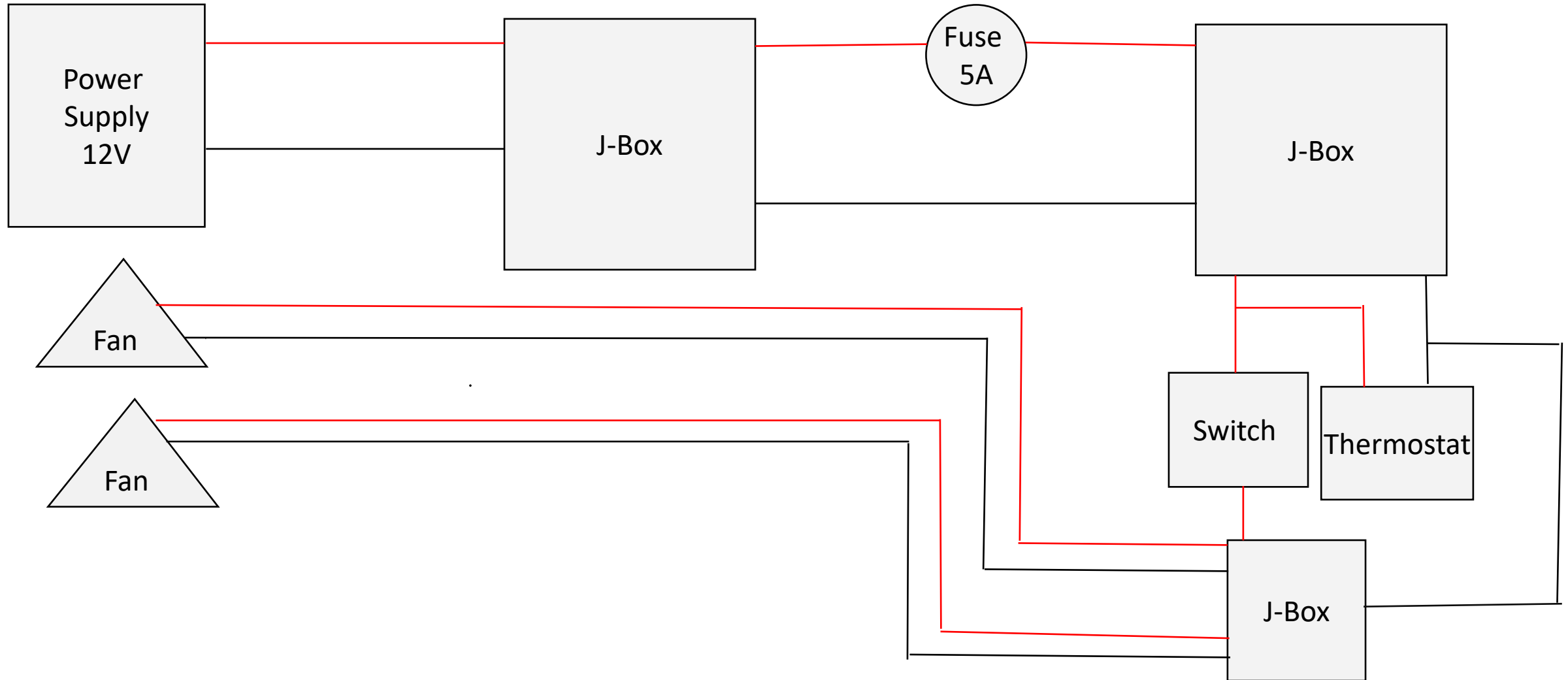


Figure 2: Solar air heater mounting

Circuit Diagram



Purchasing Plan

| Bill of Materials | | | | | | | | | |
|--------------------------|--|----------|-------|----------|----------------|-----------------|-------------|------------|--|
| Name | Part Number | Quantity | Cost | Make/Buy | Primary Vendor | Manufacturer | Part Status | Total Cost | |
| 8x6x6 Wye | 643092 | 1 | 17.98 | Buy | The Home Depot | Master Flow | Acquired | 17.98 | |
| 8 inch 90 | 148768 | 10 | 9.98 | Buy | The Home Depot | Master Flow | Acquired | 99.8 | |
| 6 inch 90 | 148733 | 2 | 8.68 | Buy | The Home Depot | Master Flow | Acquired | 17.36 | |
| 8 x 6 adapter | 148857 | 4 | 14.28 | Buy | The Home Depot | Master Flow | Acquired | 57.12 | |
| 6 inch duct | 1013032134 | 1 | 59.98 | Buy | The Home Depot | Master Flow | Acquired | 59.98 | |
| 8 inch duct | 1013032129 | 1 | 67.98 | Buy | The Home Depot | Master Flow | Acquired | 67.98 | |
| Duct Insulation | 1002502317 | 1 | 27.98 | N/A | The Home Depot | Master Flow | Donated | 0 | |
| 10 x 4 to 6 register box | 148962 | 2 | 12.49 | Buy | The Home Depot | Master Flow | Acquired | 24.98 | |
| 14 x 6 to 8 register box | 351407 | 1 | 14.98 | Buy | The Home Depot | Master Flow | Acquired | 14.98 | |
| 10 x 4 vent | 324411 | 2 | 13.98 | Buy | The Home Depot | Master Flow | Acquired | 27.96 | |
| 14 x 6 vent | 497808 | 1 | 14.98 | Buy | The Home Depot | Master Flow | Acquired | 14.98 | |
| Super Strut | 863322 | 3 | 0 | Buy | The Home Depot | Superstrut | Acquired | 0 | |
| 16 AWG Wire | B0CP1SGHK7 | 1 | 17.99 | Buy | The Home Depot | NAOEVO | Acquired | 17.99 | |
| Henry Roof Sealant | 111806 | 1 | 10.98 | Buy | The Home Depot | Henry | Acquired | 10.98 | |
| 8x8x4 Junction Box | 1007810624 | 1 | 40.55 | Buy | The Home Depot | Cantex | Acquired | 40.55 | |
| 4x8 1 inch insulation | 624637 | 1 | 16.98 | Buy | The Home Depot | R-Tech | Acquired | 16.98 | |
| Duct Tape | 1010742507 | 1 | 13.98 | Buy | The Home Depot | Everbilt | Acquired | 13.98 | |
| Roll Insulation | 1003829264 | 1 | 11.97 | Buy | The Home Depot | Everbilt | Acquired | 11.97 | |
| Caulk | 362622 | 1 | 11.58 | Buy | The Home Depot | GE | Acquired | 11.58 | |
| PVT panel | NA | 1 | 0 | Buy | RE Lab | NA | Donated | 0 | |
| Solar air panel | NA | 2 | 0 | Buy | RE Lab | Thermix | Donated | 0 | |
| Thermostat | 200417 | 1 | 23.15 | Buy | The Home Depot | Honeywell | 3-Nov | 21.53 | |
| Conduit | B0B6VGJCNJ | 1 | 47.48 | Buy | Amazon | Ansgery | Acquired | 47.48 | |
| Fuse | B07K4DV8PV | 1 | 0.5 | Buy | Amazon | SIXQJZML | Acquired | 0.5 | |
| Fan | 863322 | 2 | 0 | Buy | DigiKey | SUNON | Acquired | 79.51 | |
| On/Off Switch | Heavy Duty Toggle Switch On-Off 12V DC 30A 2 Pin 2 Position SPST Waterproof Mari | 1 | 12.81 | Buy | Ebay | Multiservices10 | Acquired | 12.81 | |

Figure 4: Bill of Materials



Figure 5: GoFundMe

Purchasing Plan

| | | | | | | | | |
|------------------------|-----------------|----|-------|-----|----------------|-------------|----------|---------|
| Drip Edge Flashing | 894788 | 8 | 8.729 | Buy | | | Acquired | 69.83 |
| GAF Roll Roofing | 561381 | 9 | 133.4 | Buy | | | Acquired | 1200.31 |
| Gutter Screws | 9837688 | 1 | 4.9 | Buy | | | Acquired | 4.9 |
| Roofing Nails | 7668421 | 1 | 6.1 | Buy | | | Acquired | 6.1 |
| SKYSHALO Pipe Flashing | 335478041 | 4 | 38.97 | Buy | | | Acquired | 155.86 |
| Gold Galv Superstrut | 863322 | 2 | 41 | Buy | Home Depot | Superstrut | Acquired | 82 |
| Gold Galv L Bracket | 410246 | 8 | 3.764 | Buy | Home Depot | Everbilt | Acquired | 30.11 |
| Gold Galv Sqr Wshr | 410247 | 4 | 10.59 | Buy | Home Depot | SuperMag | Acquired | 42.36 |
| 1/2 x 5 Lag Screw | 473052 | 10 | 9.211 | Buy | Home Depot | Everbilt | Acquired | 92.11 |
| 1/2 nylon cone nuts | 215101 | 4 | 7.145 | Buy | Home Depot | Superstrut | Acquired | 28.58 |
| 1/2 lock wshr 50 pk | 352937 | 1 | 25.79 | Buy | Home Depot | Everbilt | Acquired | 25.79 |
| 1/2 galv wshr | 339843 | 1 | 24.56 | Buy | Home Depot | Everbilt | Acquired | 24.56 |
| 1/2 x 5/16 galv bolt | 356297 | 4 | 9.048 | Buy | Home Depot | Superstrut | Acquired | 36.19 |
| 1/2 x 1-1/2 galv bolt | 202997 | 8 | 1.303 | Buy | Home Depot | Everbilt | Acquired | 10.42 |
| 1/2 x 13 tpi galv bolt | 538892 | 8 | 0.603 | Buy | Home Depot | Everbilt | Acquired | 4.82 |
| Pivoting Strut Brkt | S-5481-E/E-Galv | 2 | 55.97 | Buy | Flastners Plus | Flex-Strut | Shipping | 111.94 |
| Sunon 12v DC Fan | 863322 | 2 | 79.51 | Buy | Sunon | Sunon | Acquired | 79.51 |
| 8x6x6 Wye | 643092 | 1 | 19.67 | Buy | The Home Depot | Master Flow | Acquired | 19.67 |
| 10x4 to 6 Register Box | 148962 | 2 | 26.19 | Buy | The Home Depot | Master Flow | Acquired | 26.19 |
| 14x6 to 8 Register Box | 351407 | 1 | 32.78 | Buy | The Home Depot | Master Flow | Acquired | 32.78 |
| Thermostat + SSR | y-Stretch | 1 | 13.12 | Buy | Amazon | | Acquired | 13.12 |
| Conduit + Connectors | 6514520 | 1 | 28.43 | Buy | Amazon | | Acquired | 28.43 |
| Vent Covers | D59XWYY | 2 | 39.36 | Buy | Amazon | | Acquired | 39.36 |
| Fuses + Connectors | CS011 | 1 | 5.46 | Buy | Amazon | | Acquired | 5.46 |
| Master Switch | DC 30A | 1 | 14.02 | Buy | Ebay | | Acquired | 14.02 |
| Total | | | | | | | | 2873.4 |
| Total Budget Left | | | | | | | | 126.6 |

Figure 6: Bill of Materials

Manufacturing Plan

Table 1: Tentative Installation Schedule

| Task | Task Lead | Status | Scheduled Date |
|-------------------------------------|-----------|--------------------|----------------|
| PVT Panel Removal | Brendan | Completed on 9/14 | 9/22/2025 |
| Refurbish Solar Panels | Jacob | Completed on 10/13 | 10/13/2025 |
| Mounting System Assembly | Calvin | Completed on 10/26 | 10/19/2025 |
| Install New Roof | Calvin | Completed on 10/7 | 10/7/2025 |
| Building Modifications for Mounting | Brendan | Completed on 10/25 | 10/27/2025 |
| Install Solar Panels to Mounting | Brendan | Completed on 10/24 | 10/26/2025 |
| Electrical Installation | Jacob | Completed on 11/03 | 11/03/2025 |
| Building Modifications for Ducts | Calvin | Completed on 11/02 | 11/03/2025 |
| Ductwork Installation | Joseph | Completed on 11/03 | 11/03/2025 |
| Conduit Routing and Installation | Tyler | Completed on 11/02 | 10/30/2025 |

Demonstration



Figure 7: Mounting Unistrut



Figure 8: Making Adjustment to Unistrut



Figure 9: Mounting Installation

Demonstration

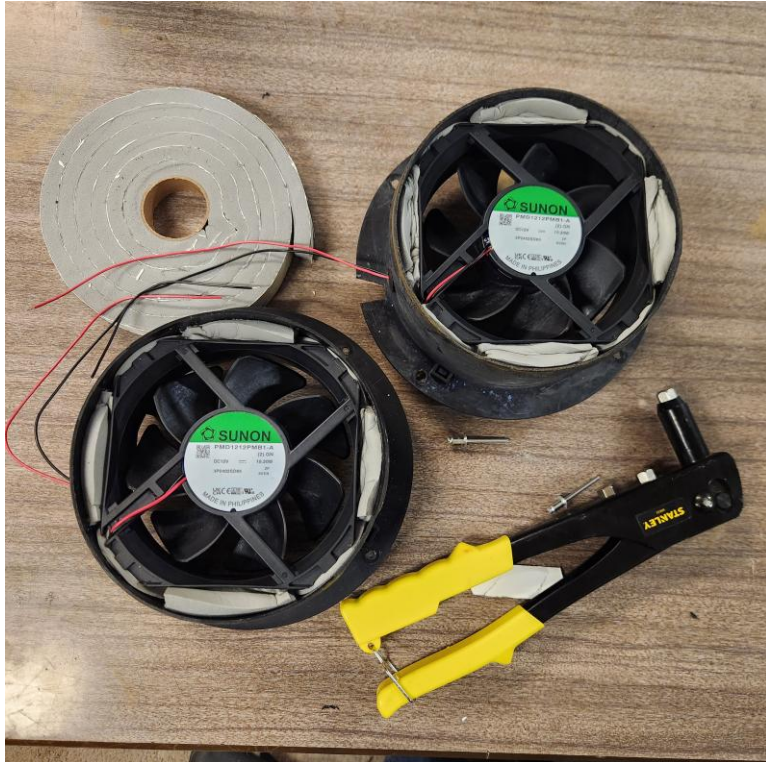


Figure 10: DC Fans

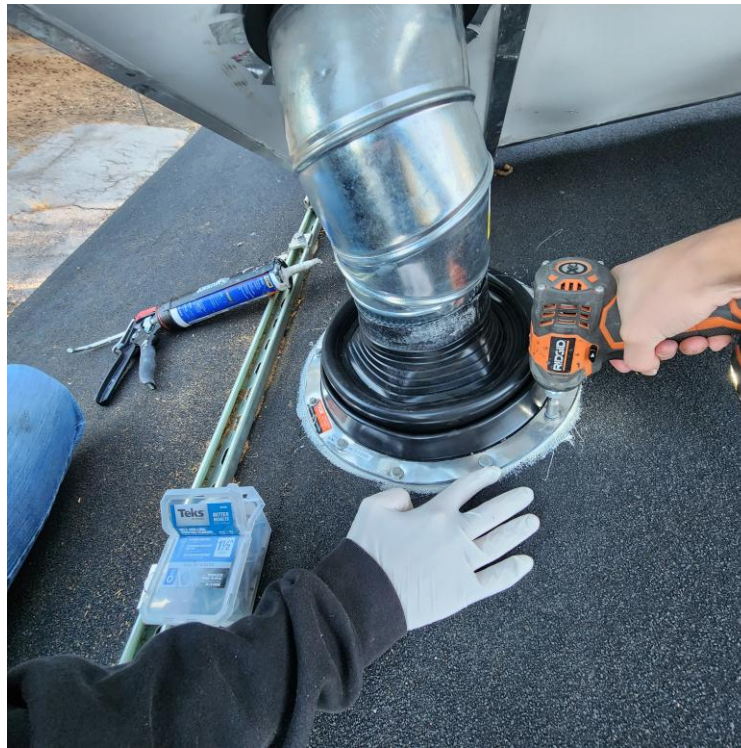


Figure 11: Duct Work Through Ceiling

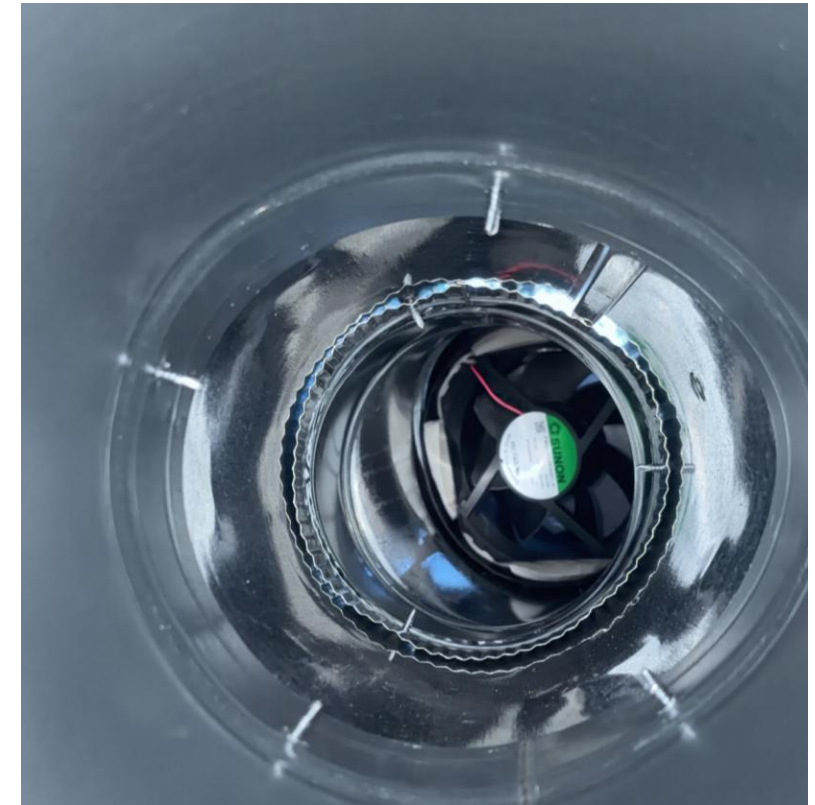


Figure 12: Fans Installed in Solar Panels

Demonstration



Figure 13: Load Box Wiring

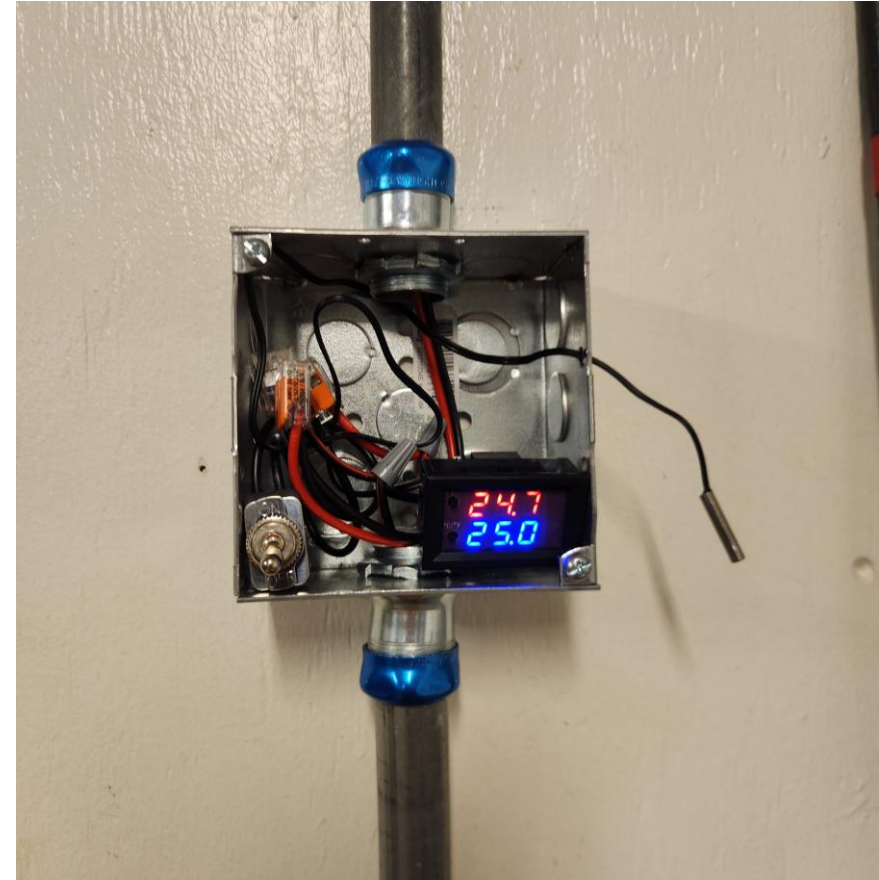


Figure 14: Master Switch

Demonstration



Figure 15: Conduit to Flat Solar Panel



Figure 16: Splitting Wires for Fans



Figure 17: Conduit to Inclined Solar Panel

Demonstration



Figure 18: Hot Air into Attic



Figure 19: Hot Air into Main Room

Demonstration



Figure 20: Inlet in Small Room



Figure 21: Mesh Covering

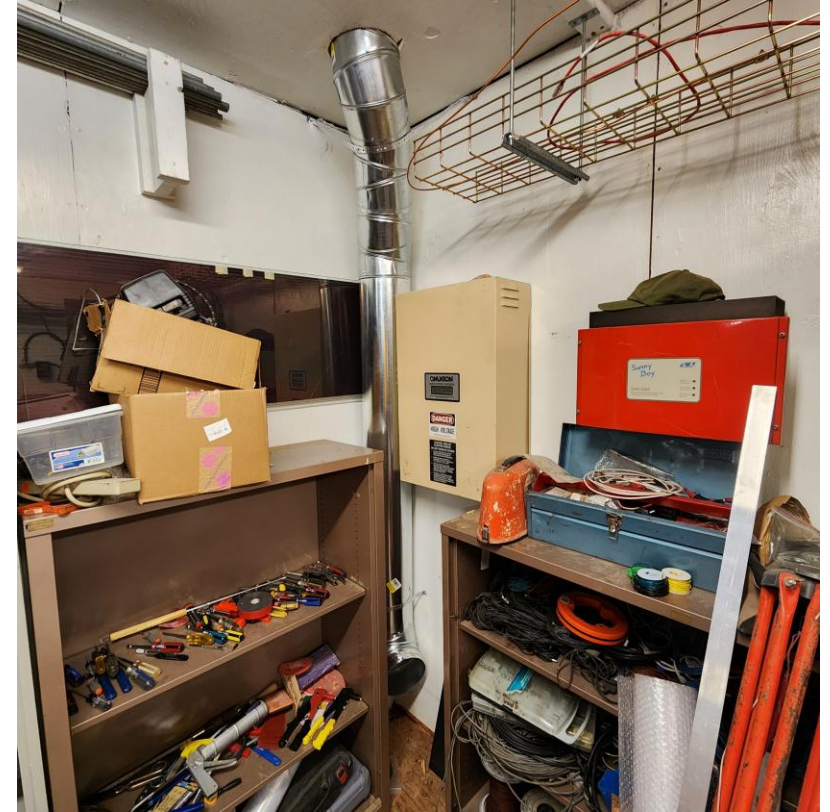


Figure 22: Inlet in Big Room

Demonstration



Gantt Chart

RE LAB Solar Heater

NAU Capstone Project FALL 2025

| Role and Tasks | ASSIGNED TO | PROGRESS | START | END |
|---|-----------------------|----------|----------|----------|
| | | | 8/25/25 | 12/12/25 |
| Hardware Status Update (100% Build) | Everyone | 95% | 10/6/25 | 11/3/25 |
| >Electrical Installation (Circuitry) | Jacob Apodaca | 100% | 10/13/25 | 10/30/25 |
| >Soldering Connections (Wire nuts / lever nuts) | Jacob Apodaca | 100% | 10/14/25 | 10/30/25 |
| >Fuse work | Jacob Apodaca | 100% | 10/14/25 | 10/30/25 |
| > Mounting Conduit | Tyler Hedgecock | 100% | 10/14/25 | 10/30/25 |
| >Install Pipe Halo Flashing | Calvin Schenkenberger | 100% | 10/14/25 | 10/21/25 |
| >Install unistrut guides cut and attach supporting unistrut | Calvin Schenkenberger | 100% | 10/14/25 | 10/26/25 |
| >Install solar panels to mounting assembly | Brendan Frazier | 100% | 10/14/25 | 10/26/25 |
| >Ductwork Installation | Joseph Meza | 100% | 10/14/25 | 10/26/25 |
| Peer Evaluation 3 | Everyone | 0% | 10/31/25 | 11/10/25 |

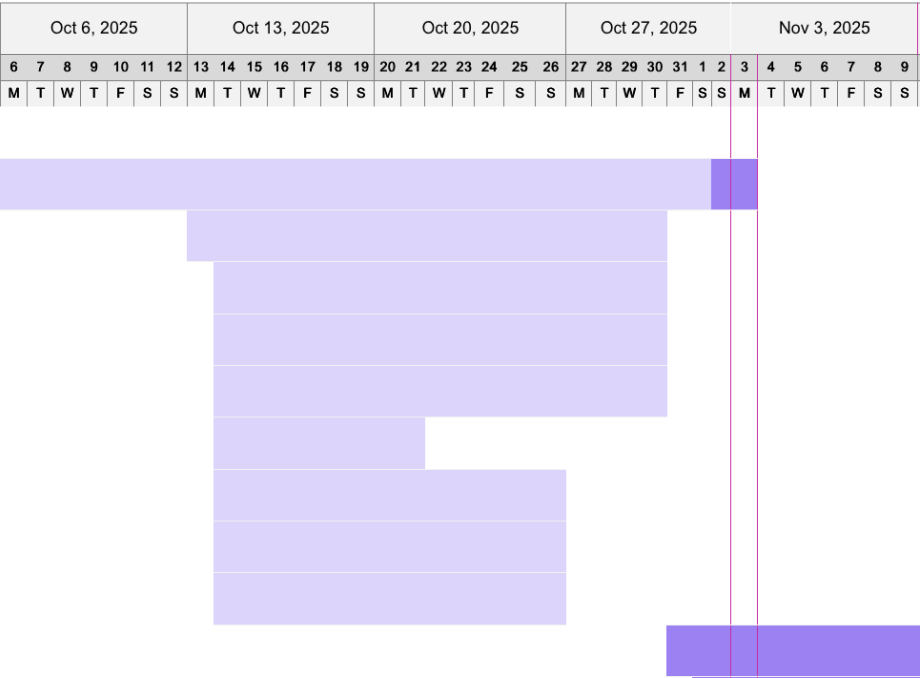


Figure 23: Up to Date Gantt Chart

Testing Plan

Table 2: Testing Plan

| Experiment | Summary | Deadlines |
|--------------------------|--|------------|
| EX1 – Output Temperature | Measuring output temperature using Type-T Thermocouple and RTD | 11/17/2025 |
| EX2 – Output Flow Rate | Measuring Output flow rate using anemometer | 11/17/2025 |
| EX3 – Wind Loading | Use Weather Stations' anemometer to measure maximum wind speeds. | 11/17/2025 |
| EX4 – Circuit Test | Ensuring circuits are pulling the correct amount of amps | 11/17/2025 |
| EX5 – Air Leak Test | Determine if air leaks are present | 11/17/2025 |
| EX6 – Water Leak Test | Determine if water will leak through the ceiling | 11/17/2025 |
| EX7 – Data Collection | Collect data for solar irradiance, wind speed, etc. | 11/17/2025 |
| EX8 – Performance Test | Establish energy input of RE building | 11/17/2025 |

Moving Forward

Testing

- Begin testing and gathering initial testing data
- Optimize system (indicated through testing)

Project Deliverables

- Final poster and presentation
- Final CAD packet
- Operations and assembly manual
- Final report



Figure 24: RE Lab Solar Panels

**Thank You
Questions?**