Active Roof System

Midpoint Review

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March 3rd, 2014

Overview

- Brief Project Description
- Finalized Testing Methods
- Team Job Assignments
- Temperature Measurement System
- Prototype Building Construction
- Simulated Sun
- A/C System
- Active Roof System
- Current Budget Spent
- Current Spring Timeline
- Conclusions

Brief Project Description

- Amount of power consumption due to cooling and heating of large warehouse buildings it too high
  - Project will investigate roof designs that will lower this power consumption
    - Control, Passive & Active Roofs

Finalized Testing Methods

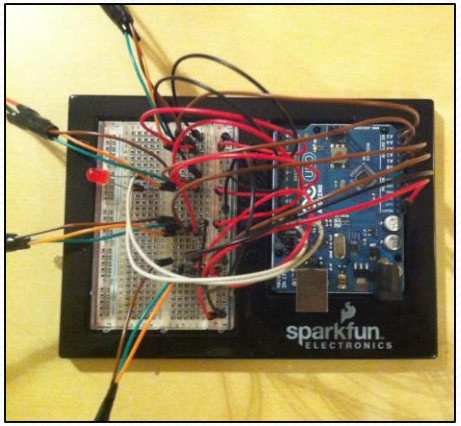
- Ideally testing in simulated, controlled environment
  - Indoors using a simulated sun
  - Testing one prototype roof at a time, 3 times
    - Total of 9 tests
- Testing will represent an expedited day
  - Only 2 hours long
  - Manually move “sun” into new position every 5 minutes
    - Each move is appox. 6 inches

Team Job Assignments

Team Member	Job Assignment 1	Job Assignment 2
Mohammed	Temperature Measurement System	Power Usage Programming (Audriuno Board)
Coy	Construction of Prototype Building	Construction of Simulated Sun
Donovan	Construction of Prototype Building	A/C System Design & Construction
Marissa	Construction of Prototype Building	Construction of Roof Panels
Krysten	Active Roof Rotation Design & Construction	Forming a Hypothesis (Heat Transfer Analysis)

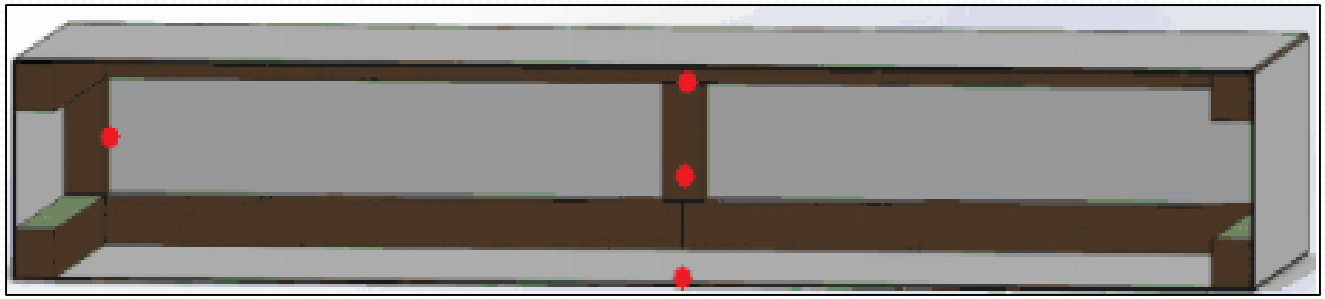
Temperature Measurement System

- UNO Arduino
- 4 TMP36 Thermoisters
  - 2 are 5 ft long
  - 2 are 7 ft long
- Arduino programmed to
  - Read temperatures
  - Send signals to the A/C
  - Calculate the time when the A/C is running



Temperature Measurement System Cont.

- Location of sensors
  - One at the corner
  - One at the middle attached to the roof
  - One at the middle between the roof and the ground
  - One at the middle attached to the ground



Temperature Measurement System Cont.

- PLX-DAQ (Data acquisition)
  - Write data in separate columns to Excel
  - Record data instantly

	A	B	C	D	E	F
1	Time	Temperature-1 (F)	Temperature-2 (F)	Temperature-3 (F)	Temperature-4 (F)	elapsedTime (milis)
2	18:47:44	71.20	72.08	72.08	72.08	214340
3	18:47:54	71.20	71.2	72.08	72.08	224543
4	18:48:04	71.20	71.2	72.08	71.2	234746
5	18:48:14	71.20	72.08	72.08	72.08	244950
6	18:48:24	71.20	71.2	72.08	72.08	255153
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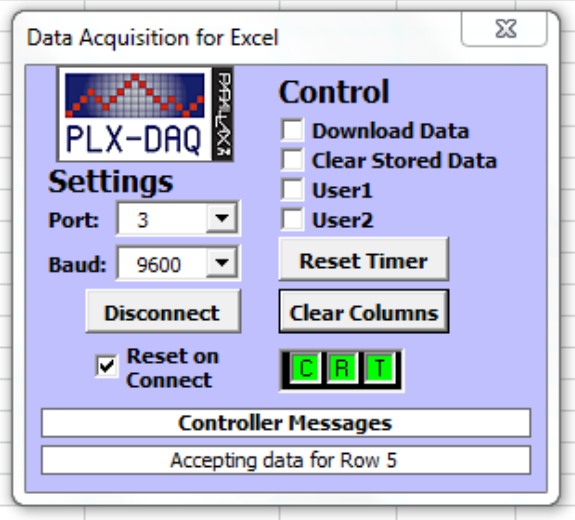
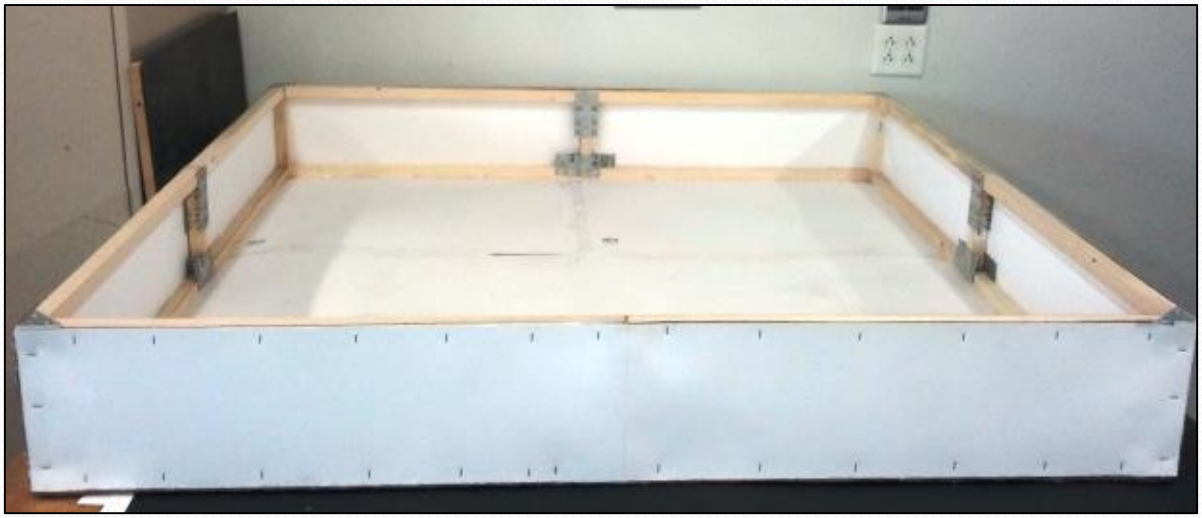


Prototype Building Construction

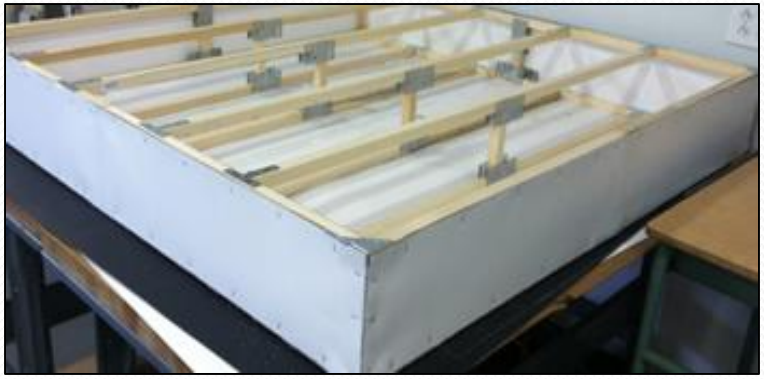
- Beginning framework and walls (everyone's job)



Prototype Building Construction Cont.

Prototype Building

- Simpson Strong - Tie
  2 x 4 in Steel mending
  plate.
- 8 - Everbilt 2 in. Zinc
  Plated Heavy Duty Corner Braces.
- 16 - Hillman Group 4 x 4 in Zinc
  Plated T-plates.



Simulated Sun

Lighting System

- 16 - 200W Incandescent light bulbs
- 16 - Leviton Black Weatherproof Sockets

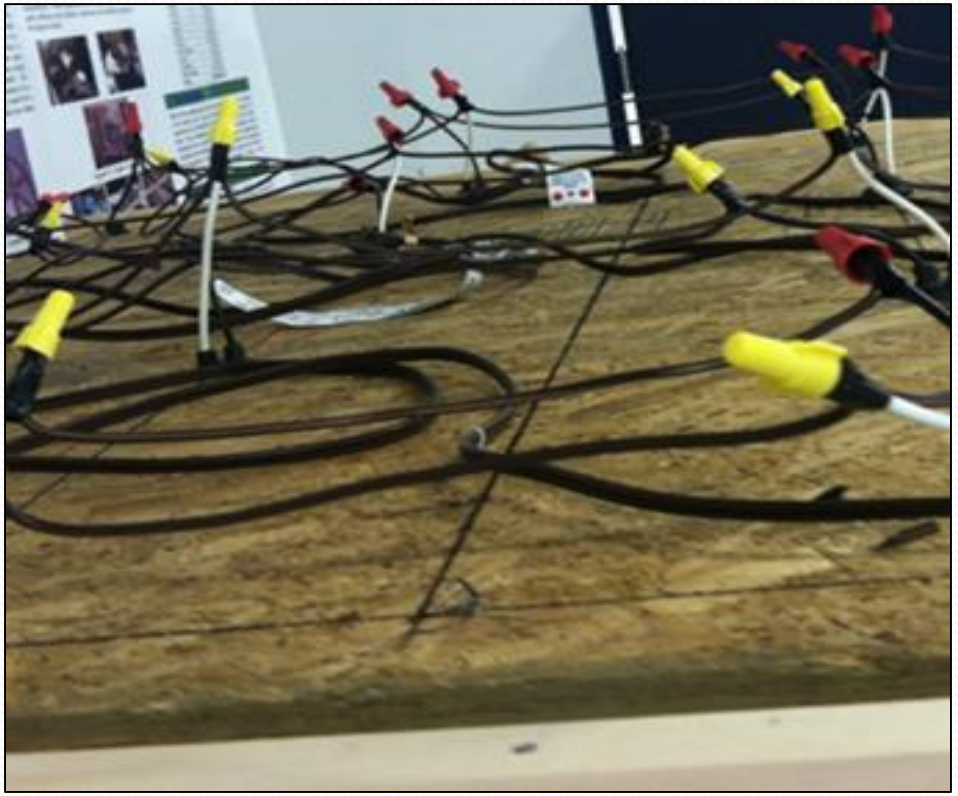
Simulated Sun Cont.

Electrical Connections

- 32 - winged wire assortment
- 4 - extension cords

Approx. Dimensions

- 4’ wide x 6’ long
- 6’ tall



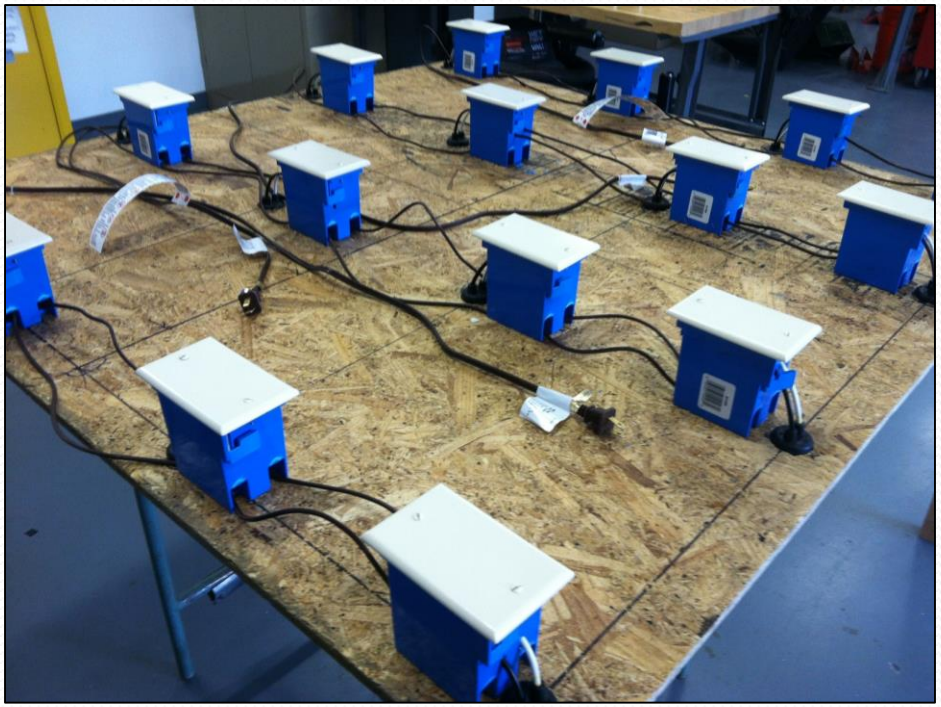
Simulated Sun Cont.

Electrical Boxes

- Added for safety

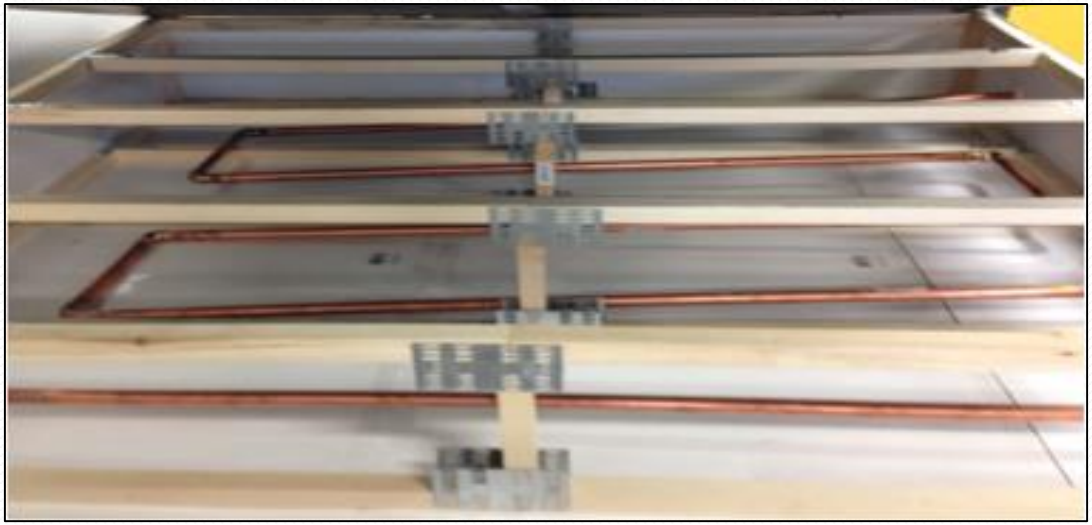
Power Source

- Mobile generator (from ASME)



A/C System

- Serpentine layout
- 1/2in Copper piping
- Centralized location for even cooling

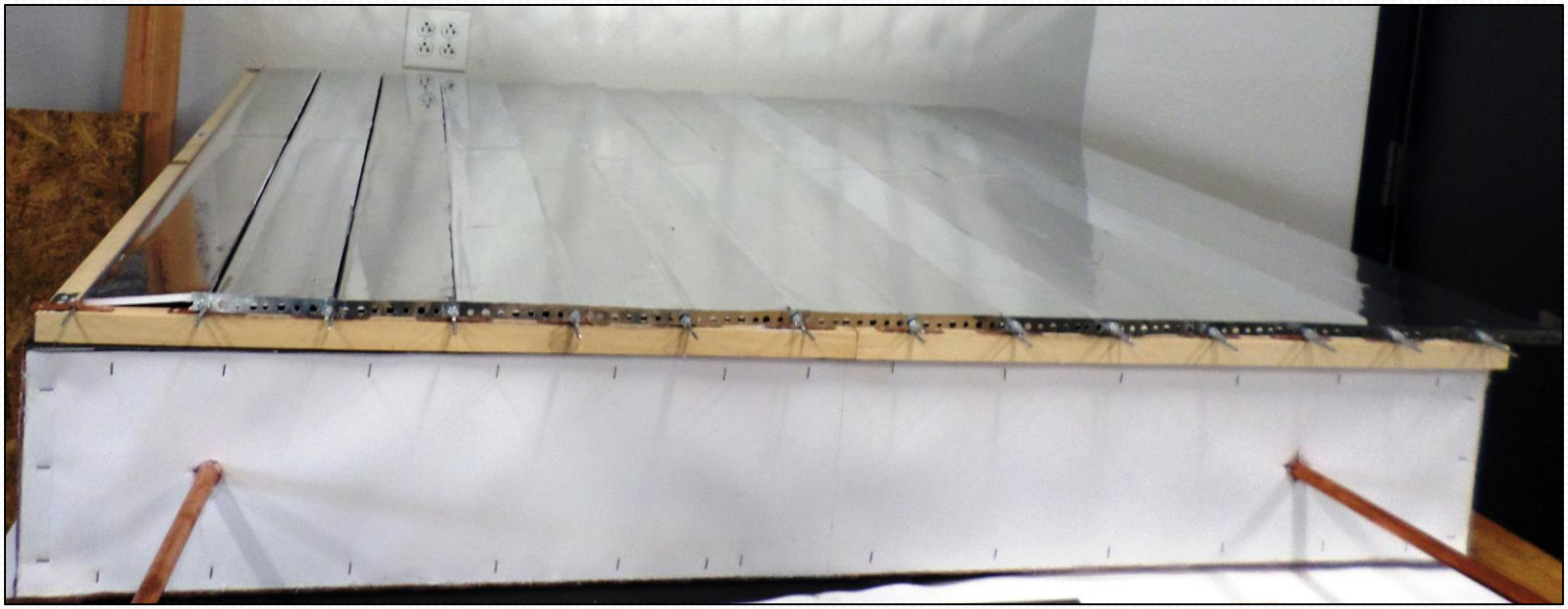


A/C System Cont.

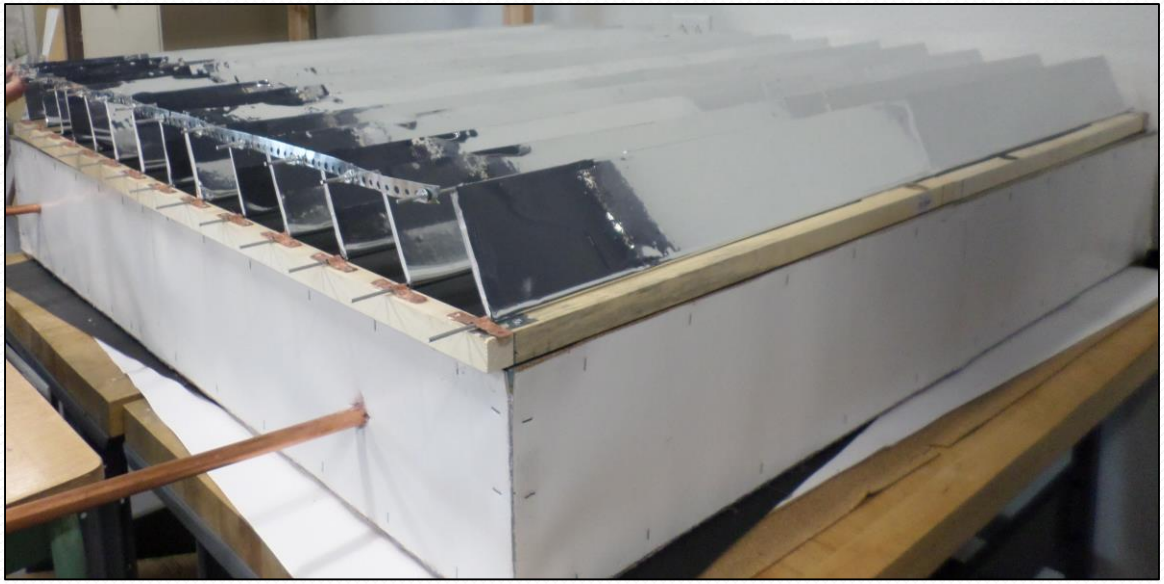
- Radiant Cooling
- ~32^{o}F (ice) water pumped through the piping
- Fans may be used to improve cooling power
- Connected to arduino to control on/off

Active Roof System

- Manually operated using lever arm system
  - Black roof with 14 rotating, reflective panels
  - Will be moved every 5 minutes to new angle



Active Roof System Cont.



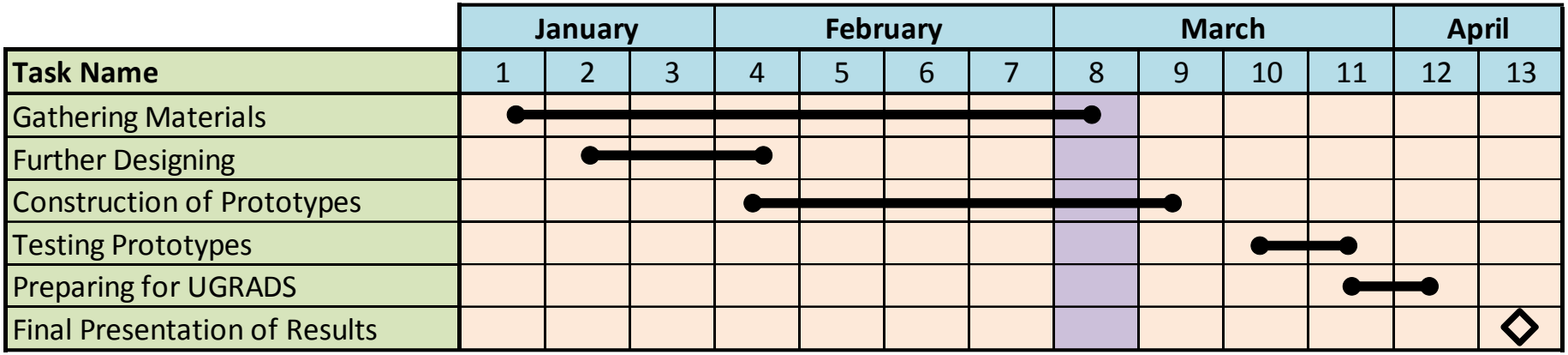
Current Budget Spent

Category	Cost
Wood	$262.04
Fasteners	$156.63
Cutting Tools	$19.75
Prototype Walls	$268.66
Active Roof	$135.36
Simulated Sun	$151.99
A/C System	$151.18

TOTAL (before tax): $1,145.61

Total after taxes: **$1,227.58**

Current Spring Timeline



Conclusions

- Testing each prototype 3 times
  - Each test is 2 hours long
  - Using simulated sun
- Temperature measurement system uses 4 thermocouples placed at strategic positions
  - Uses readings to control A/C system pump
- A/C system uses ice water flowing through copper tubing assembled in a serpentine design
  - Fans might be added depending on initial testing

Conclusions Cont.

- Prototype Building is complete and build to plan
  - Except extra internal support beams were added
- Simulated Sun consists of 16 200W light bulbs
  - Entire bulb set up will move every 5 minutes
- Active roof system will now be rotated manually every 5 minutes
- Current budget spent = $1,227.58