EEL 4911C Senior Design: Solar Sausage Project ‘B’

By: Jimmy Smith, Jr., Aileen Ulm, Xiaoxiang Gao, Jonathan Melton, Morgan Bublitz, James Harrell, and Madanha Chibudu

The Design Team

- Jimmy Smith, Jr. – Project Manager/Team Leader
  - Manages/coordinates the tasks of the group.
  - Measures performance
  - Delegates roles
  - Oversees all operations and manages the budget
  - *Technical Area: Circuit design, power, C++ programming*
- Aileen Ulm – Lead Electrical Engineer/Secretary
  - In charge of all EE and CE designs.
  - Keeps in close contact with the lead ME.
  - Keeps all records.
  - *Technical Area: Power, Energy*

Speakers: Jimmy Smith, Jr. & Aileen Ulm

Continued….

- Morgan Bublitz – Lead Mechanical Engineer
  - In charge of all mechanical designs
  - Keeps in close contact with the Lead ECE
  - Provides valid design specifications for the team to decide on
  - Keeps all design documents
  - *Technical Area: Energy Research, Experimentation 32*

- Jonathan Melton & Xiaoxiang Gao – Electrical Test Engineers
  - Insures all components in a synchronized environment and do not violate engineering standards.
  - Test all prototypes
  - *Technical Area: Power, Photo Voltaic, Energy*

Speakers: Morgan Bublitz, Jonathan Melton, Xiaoxiang Gao

Continued….

- James Harrell & Madanha Chibudu – Mechanical Test Engineers
  - Insures all design specifications are valid and do not violate engineering standards.
  - Test all structure prototypes
  - *Technical Area: Pressure Systems, Water Pump Design/ Thermo Fluid Design*

Speakers: James Harrell & Madanha Chibudu

Code of Conduct

- Weekly meetings
- Team Dynamics
- Dress Code
- Conflict Resolution

Speaker: Jimmy Smith, Jr.

Needs Assessment

- Problem Statement
  - The team will address the inefficiencies present in the current Solar Sausage development, and design a complete and working system.
- Background Information
  - “Inflatable Solar Energy Collector”
  - Applications requiring heat generation can benefit from the Solar Sausage

Speaker: Aileen Ulm

Statement of Needs

- Structural System for the Solar Sausage
- Tracking Mechanism
- Balloon pressure controls
- Power Utilization System
- Photovoltaic (PV) Cooling system
- Water Supply and Purification system
- Waste Disposal System
- Low Cost overall design and maintenance

Speakers: Jonathan Melton

Statement of Wants

- Avoid water cooling system
- Use of 2 or 3 Sausages to catch sunlight
- Optimize all sunlight captured by the Sausages
- Independently supported tube for water purification

Speaker: Jonathan Melton

Operational Description

- Harness Solar Energy
  - Lost Rays
- Pressure Levels
  - MUST be accurate
  - Microcontroller
- Cool Water Pump
  - Cool PV Panels
  - Pasteurization Process
- Weather

Speakers: Aileen Ulm

Performance Requirements

- Water Pump
  - Negligible energy draw (if any)
  - Pump water from ground
    - ~100 psi required for 200 ft well
- Filtration System
  - Filters large particulates
  - Change filtering material with minimal resources
- PV Panel Heat Exchanger
  - Water cooled
  - Maintain low temp for PV panel
  - Preheat drinking water

Speakers: James Harrell

Performance Requirements

- Pasteurization
  - Temp at time
  - Ideal Diameter vs wall thickness
    - High Reynolds number
  - Material constraints
    - Temperature, pressure, etc.
- Pressure Gauge
  - Reliable and cost effective
  - Use existing pressure sensing ports
  - Regulatory inflation/deflation rate

Speakers: Morgan Bublitz

Constraints

- CONS1:Time – This projected has to be completed by the end of spring 2015.
- CONS2: Money – $5000 budget was allocated for this project.
- CONS3: Size – The prototype has to be approximately equal to 10ft.
- CONS4: Temperature – Potable water has to be pasteurized with temperatures ranging from 65˚C - 90˚C.
- CONS5: Pressure – The top and bottom halves of the prototype have to maintain a pressure of 0.5psi and 0.492psi respectively.
- CONS6: Weather – Solar sausages work best in dry climates.

Speaker: Madanha Chibudu

Interface Requirements

- Increase in temperature during the day would increase the internal pressure of the sausages and vice verse.
- “Index of Refraction”
- Trivial interface for the user… Sensors, filtration, and reflective film.
- Other systems: Valve, Cooling, and Waste System; Pump control, pasteurization, and pressure.

Speaker: Jimmy Smith, Jr.

Preliminary Test Plan

- Objective
  - The objective of testing is to ensure that each parts of design is working to its capability without endangering the environment and user
- Features to be tested
  1. Interface
  2. Pressure Sensor
  3. PV Cooling System
  4. Votlage and Current Output
  5. Water Purifying
  6. Sun Tracking

Speaker: Xiaoxiang Gao

Preliminary Test Plan

- 1.Conversion Test
  - make sure convert DC to AC properly
  - The optimal power converted by PV panels is 900 W/m^2

2.Interface Test

- ensure the sausage can work during the extreme weather condition
- no major meltdown happen while maintaining

Speaker: Xiaoxiang Gao

Preliminary Test Plan

- 3.Water Purifying Test
  - make sure the water can pass the Red Cross Standards for consumable water after the pasteurization

4.Pressure Sensor Test
  - using the pressure regulator to keep the balance between the top and bottom of the sausage

Speakers: Xiaoxiang Gao

Preliminary Test Plan

5. Performance Test
   - ensure all pieces of sausage are working in harmony

6. Sun Tracking Test
   - guarantee the PV panels can track sunlight precisely so that it will be in good utilization all the time

Speaker: Xiaoxiang Gao

Preliminary Test Plan

7.PV Cooling Test

- make sure that solar panels are at an operable temperature

Speaker: Xiaoxiang Gao

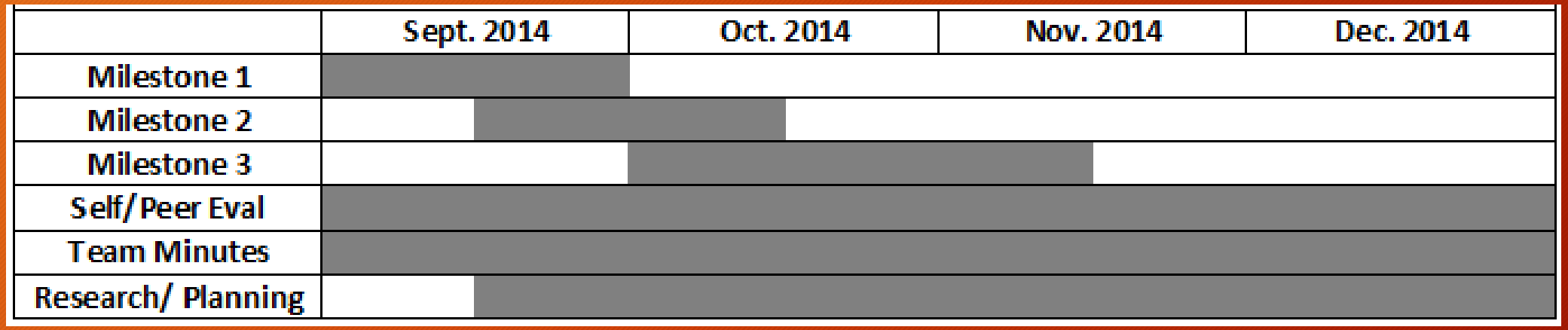
Comparison Matrix

	Low Cost	High Energy	High Efficiency	Clean Water	Low Maintainence	High Safety	Small Size	Geo Mean	Norm Weight
Low Cost	1/1	1/1	3/1	1/3	2/3	1/5	2/1	1.17	0.10
High Energy	1/1	1/1	1/3	1/2	1/2	1/5	1/1	0.65	0.06
High Efficiency	1/3	3/1	1/1	1/4	1/2	1/5	1/3	0.80	0.07
Clean Water	3/1	2/1	4/1	1/1	4/1	1/1	4/1	2.71	0.24
Low Maintainence	3/2	2/1	2/1	1/4	1/1	1/5	1/2	1.06	0.09
High Safety	5/1	5/1	5/1	1/1	5/1	1/1	5/1	3.86	0.34
Small Size	1/2	1/1	3/1	1/4	2/1	1/5	1/1	1.14	0.10

Rank	Needs	Weight
#1	High Safety	0.34
#2	Clean Water	0.24
#3	Low Cost	0.10
#4	Small Size	0.10
#5	Low Maintainence	0.09
#6	High Efficiency	0.07
#7	High Energy	0.06

Speaker: Jimmy Smith, Jr.

Fall 2014 Semester Gantt Chart



Speakers: Aileen Ulm

Overall…

- Many constraints
- Interface will be very strenuous
- Tested in stages
- Customer needs’ and wants pose valuable insight

Speakers: Jimmy Smith, Jr.