Design of an Aeroponic System for Burkina Faso

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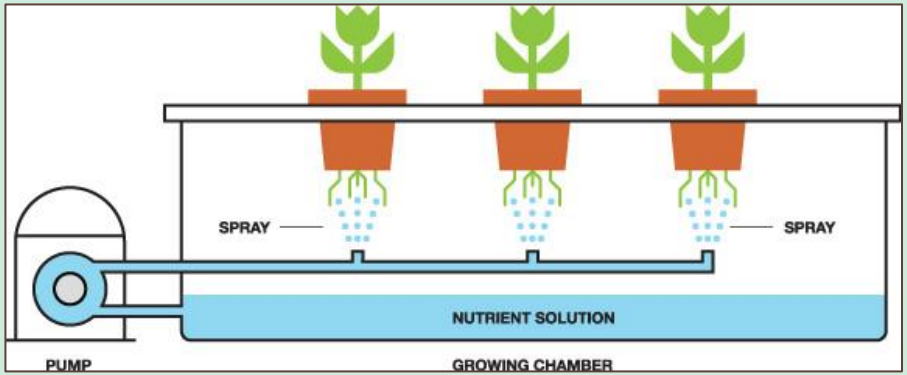
1:00 PM

Mission Statement

We believe that all people deserve access to fresh foods and proper nutrition, and that sustainable agriculture is the best way to improve food access world-wide.

What is Aeroponics?

- Aeroponic systems use less than 10% of the water and footprint used in traditional growing.
- Aeroponics allows for an extended growing season.



AER
rethinking growth

Client

Open Door Development
Matt Walsh
Mahadaga, Burkina Faso

Although Burkina Faso has good soil, lack of access to water during drought seasons creates a need for alternative growing methods.

Specifications

May 2017 Implementation:

- $500 System Budget
- Solar Powered
- (Mostly) Manufacturable in-country

Future Implementations:

- Minimize Overall Cost
- Electricity-free
- Manufacturable in-country

H.D.D.
Open Door Development

History of the Aeroponics Project

- Commercial Systems → Developing Contexts
- Individual Systems → Small Business Systems

Concept

Tower Body:

A - Tower

B - Trough and Cap Assembly

C - Tower End Cap

Pumping System:

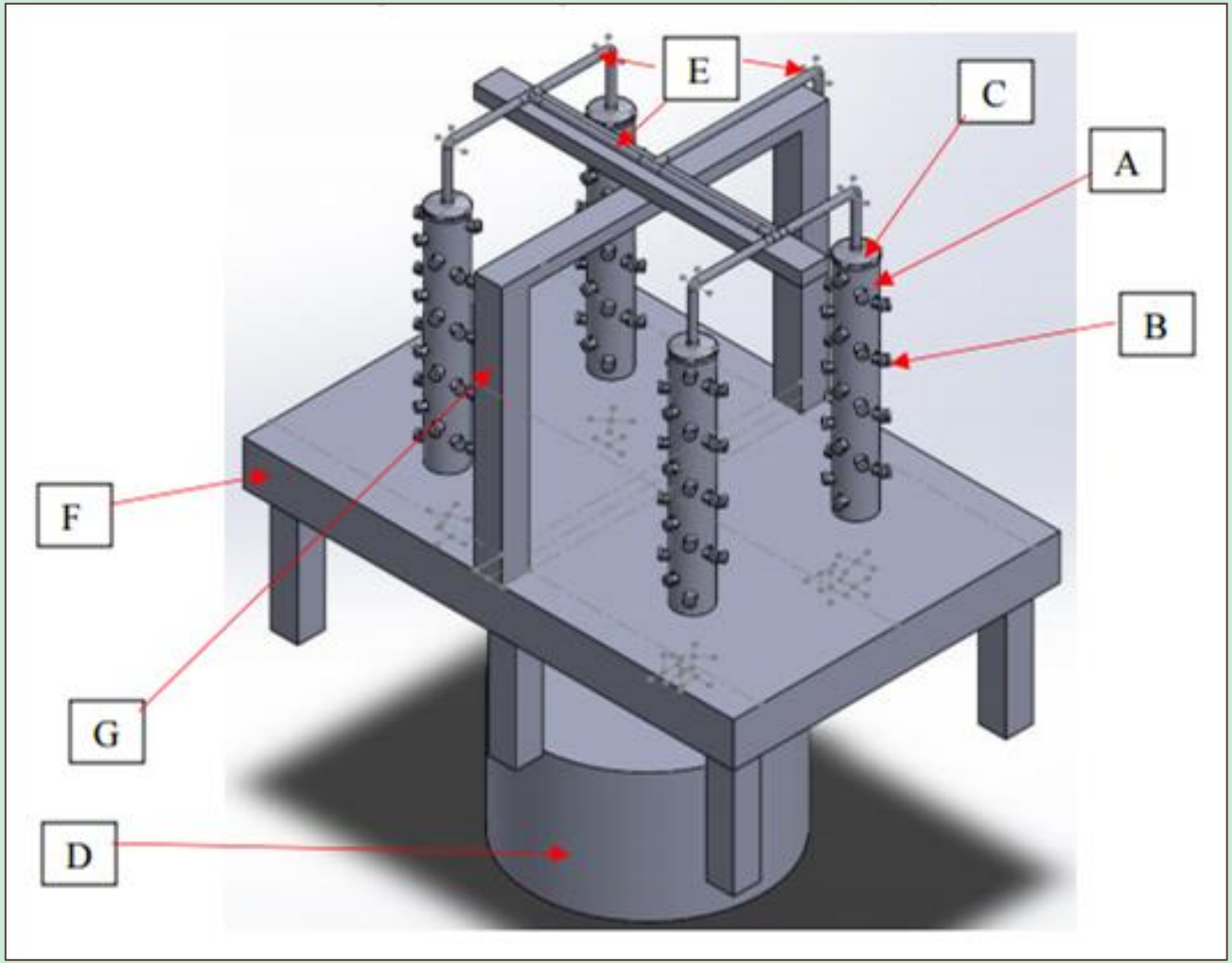
D - Reservoir (contains pump)

E - Assorted Piping

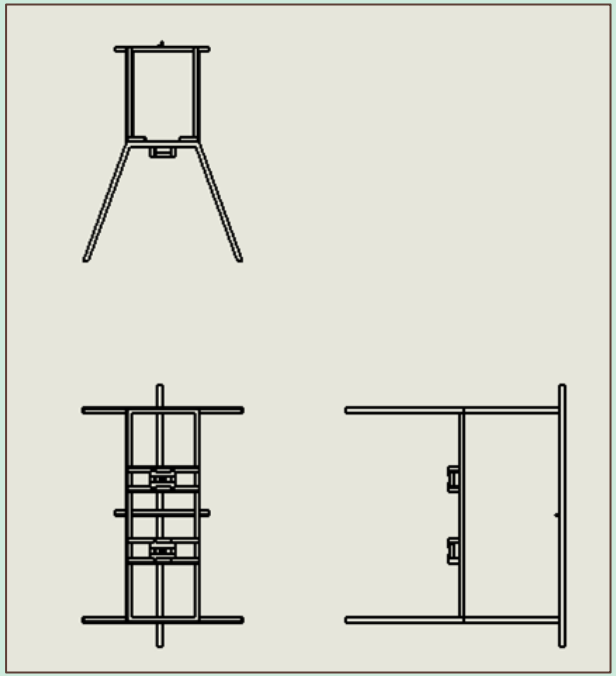
Superstructure:

F - Primary Portion of Superstructure

G - Secondary Portion of Superstructure



Concept Adjustment



Goals of Project in 2017

Implement a two tower system in Burkina Faso during **May 2017**

- Fabricate one complete prototype
- Finish a pattern template to assist in drilling
- Create a quantitative testing procedure for the nutrient source
- Prepare for site team visit

Answer the following questions:

- Is the cost of the total system feasible for our current clients?
- Is it possible to provide all nutrients through a non-chemical source?

Analysis of a Growth Cycle

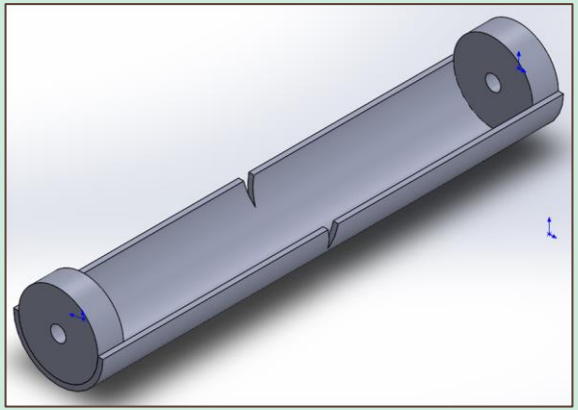
Commercial versus Modified Aeroponic Tower Growth:

- Same nutrient source
- No access to a greenhouse
- Poor growing environment
- Low success rate of plant growth

Current Trough Design

Revisit current trough design

- Pooling
- Too small for enclosement and security
- Design needs to retain moisture



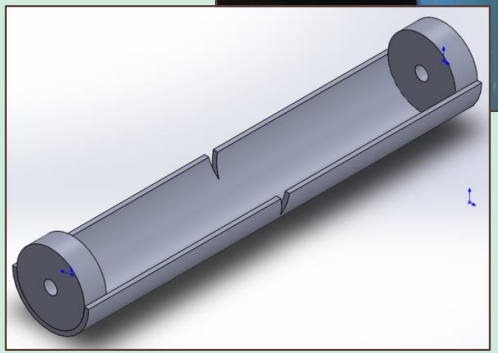
- Utilized 1 ⅜” outer diameter [OD] drain pipe and experienced failure

Design Alternatives

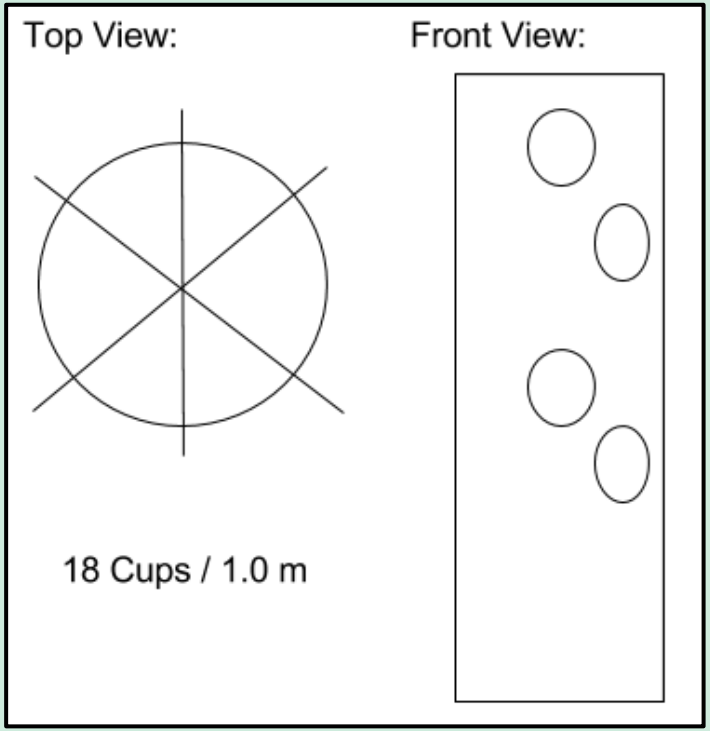
Larger Troughs versus Angled Cups

- Larger troughs (2 ⅜” od schedule 40 pipe)
- Angled cups (made from 2 ⅜” od schedule 40 pipe)
    - Cut at 45 degrees to maximize product per unit of material

After flow testing and experimentation, both designs seem feasible for future systems.



Tower Template Design



Six column spiral design allows for 18 plants per 1 meter tower.

The Nutrient Source

Macronutrients:

- Nitrogen (N)
- Phosphorus (P)
- Potassium (K)

Possible Sources:

- Compost Tea
- Manure Tea
- Worm Casings
- Powdered Supplements

Image: Team member straining compost tea

Quantitative Testing & Nutrient Sources

Procedure for On-Campus Testing

- Created with help from Dr. Shaeffer of the Chemistry Department
- Utilizes a Spectroscope to create calibration curves
- Studies metals: Iron, Magnesium, etc.

Procedure for Burkina "Testing Kit"

- Buret & titration based analysis
- Doesn't necessarily differentiate between nutrients available to plants and nutrients in solution.

Implementation in Burkina Faso - May 2017

- Meeting client and community
- Metal structure assembled pre-arrival
- Powdered nutrients used in first implementation
- Soil testing and analysis

Conclusion

- The spacing between plants has been finalized, and we have a template to use in Burkina Faso.
- After revisiting the trough design, we have a cup that both preserves water and does not overflow.
- We now have a nutrient testing method to be used on campus, and are in the process of working out a more portable test to bring to Burkina Faso.

The Future of Aeroponics

- Visit & implement in Burkina Faso
- Continue testing and refining the nutrient source
- Refine the system & components based on results in Burkina Faso

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Questions?