

## Meeting Minutes

Meeting 1: 9/15/2016

### Goals:

1. Meet with Dev to collect client information, discuss possible client meeting times, and discuss what specifically the client is asking for.

### Points of Discussion:

The client's name is Don Tolmie, with Treasure Valley Seed. His e-mail is don@tvseed.com.

The client is looking for a vacuum sealed tube in which a family in a hot and humid climate could store seeds from one year's harvest to be planted in the following growing season. The client envisions a vacuum sealed PVC tube about 1 foot in diameter and 6 feet long. The tubes should cost at most \$100 each to produce.

Likely client meeting times are Monday and Friday afternoons, since Dev Shrestha will be out of town between Tuesday and Thursday.

We discussed the possibility of other types of seed preservation possibilities including modified atmosphere storage to prevent spoiling, freezing to kill insects that may have been stored in the seeds, and the feasibility of a nitrogen gas generator or freezing the seeds in the third world.

We discussed possible questions to ask the client.

### Action Items:

1. Do preliminary research into how seeds are currently stored and transported. (All)
2. Compile a list of questions to ask the client. (All)

Next meeting will take place at 4:30 pm in the Gauss Johnson Lab in room 108.

## Meeting Minutes

Meeting 2: 9/24/2016

### Goals:

1. Speak with Don Tolmie over the phone to discuss what specifically he wants for this project as well as to address questions we had regarding the project.

### Points of Discussion:

We discussed the problems we had hoped to solve. This included maintaining a vacuum inside the tube, keeping insects from damaging the seeds, keeping moisture low, as well as acquiring the parts while staying under budget.

The target customers are rural small farm owners in third world countries primarily in hot and humid climates. The product would be assembled by the customer, and so should not be overly complicated to assemble and should include picture based assembly instructions. The seed storage tube will likely be stored outdoors or with little shelter from the weather, so it should be able to withstand long periods of exposure to direct sunlight and water. The seed storage tube will likely be transported by hand to its destination, so it should be light enough for two people to carry a long distance. The ideal cost per unit is under \$100, but a cost per unit of up to \$300. The seed storage tube should ideally be able to contain a pallet of 50 lb bags of seed.

Don Tolmie said he would be coming to Moscow in the fall between the 3rd week of October and the 1st week of November. We will plan on a meeting when he arrives.

#### Action Items:

1. Thoroughly investigate the costs of PVC pipe, valves, and vacuum pumps. (Joel and Josh)
2. Create a solidworks model of the seed storage tube. (David and Peter)

Next meeting will take place at 2:00 pm in the library.

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#### Meeting Minutes

Meeting 3: 9/29/2016

#### Goals:

1. Discuss our progress in finding a price for the materials and our progress in making a solidworks model.
2. Establish quantifiable specifications to present to Don Tolmie.

#### Points of Discussion:

We discussed our progress with finding prices and found that large sizes of PVC pipe are extremely expensive. We may have trouble finding parts for a large seed tube while remaining under budget. We considered smaller tube sizes to cut down on cost. We also discussed the difficulty in creating a standard connection for a vacuum pump. We have so far been unable to find examples of what kind of vacuum pumps are available in countries like Tanzania. We will continue to look into possible pipe vendors and available pumps.

We also discussed what specifications to send to the client. We based these specifications on what we had discussed with Don Tolmie during the initial client meeting. What we decided on are the following:

1. Moisture must remain under 12% after being sealed.
2. The seed must be able to be stored for up to 2 years without deterioration in quality.
3. The cost per unit should not exceed \$250.
4. The unit should be easy to assemble, and assembly should take no more than 1 hour.
5. The unit should weigh less than 200 lbs, to allow a two person lift.
6. Must have a pump connection. The pump will have a pressure gage.

7. There will be an instruction booklet with photographic step by step instructions at least 10 pages long.

Action Items:

1. Prepare a design including pipe sizes, costs per part and vendor. (All)

Next meeting will take place on 10/4/2016 at 2:00 pm in the library.

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Meeting Minutes

Meeting 4: 10/6/2016

Goals:

1. Discuss what needs to be done for the Snapshot day on Tuesday the 11th.
2. Discuss alternatives to the PVC system.

Points of Discussion:

We discussed changes we need to make to our specifications. These changes included making the specifications more quantifiable and adding some categories (see updated specification sheet for details). We also discussed possible alternatives to the PVC tube including using a plastic 55 gallon drum with a custom made cap that would allow for the filling and emptying of the drum as well as removal of air from the sealed drum.

The preparations for Snapshot day we need to do include a table of our specifications, our problem statement, project schedule, description of our design goals and deliverables, and a description of the results our learning so far.

Action Items:

1. The following slides must be created prior to our next meeting:
  - a. Title (Peter)
  - b. Problem statement (Peter)
  - c. Designs thus far
    - i. PVC design (David)
    - ii. Drum design (Joel)
    - iii. Alternative 3 (Peter)
  - d. Design goals and deliverables (Joel)
  - e. Project plan schedule (Joel)
  - f. Results of learning so far (Josh)

Next meeting will take place on 10/10/2016 at 11:00 am in the library.

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Meeting Minutes

Meeting 5: 10/13/2016

Goals:

1. Investigate prices for each part of both the PVC design and the drum design.

2. Answer questions raised during Snapshot Day including:
  - a. At what rate will air leak back into the container? How often will it need to be re-pumped?
  - b. How can we protect the unit from damage caused by exposure to direct sunlight?
  - c. How low does the pressure need to be to kill insects?
  - d. What kind of access to electricity can we count on the customer having?

#### Points of Discussion:

We discussed possible experiments do find the rate at which both moisture and air would leak back into the unit. Our plan is to build small-scale prototypes of the chosen design, pump out the air until the target vacuum pressure has been reached, then submerging the unit in water, then checking in a few weeks whether or not water has entered the unit. A similar experiment would be done to test the rate at which air leaks into the unit. We would pump the unit down to the target vacuum pressure and observe the pressure reading after a few weeks.

We found that according to a study done by Kansas State University, an absolute pressure of 50mm of Hg is needed for a 99% mortality rate of insects over 3 days. We also discussed the possibility that once the absolute pressure of 50mm of Hg was reached, as long as it held this pressure for longer than 3 days and the unit was not opened, there should be no way for new insects or moisture to get into the unit. That would mean that it would not be vital for the unit to hold the pressure for any longer than until the seed was to be used.

A coat of paint would help reduce damage from direct sunlight. A tarp included with the unit would also help reduce damage from direct sunlight as well as keep moisture from rain away from the unit.

We discussed the likelihood that the customer would have access to a 12v battery at least a few times per year, so the use of an electric pump would not be unreasonable.

#### Action Items:

1. Make a price list of each part for both designs (Joel)
2. Make a solidworks model of the drum design (Peter)
3. Arrange meeting with client and prepare proposal for each design (Check with Dev)
4. Investigate pumps (after meeting with client)

Next meeting will take place on 10/20/2016 at 3:30 pm in GJ 108.

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#### Meeting Minutes

Meeting 6: 10/20/2016

#### Goals:

1. Discuss problems and solutions for experiments including:
  - a. Who do we talk to get access to our budget?
  - b. Can we use something cheaper than seed as a placeholder for the structural integrity test?
  - c. Will the unit need a brace if it is not going to be filled all the way?
2. Begin working on Wikipage

## Points of Discussion:

We have some parts for the PVC unit including 2 feet of 2" sch40 pipe, a ball valve, primer, glue, end cap, and a threaded coupler. We have no parts for the drum unit. Once we have access to our budget, we can get the remaining parts needed. According to Dev, the chemstore on campus has 55 gallon drums for about \$13. According to Dev, Debbie Foster is the person we need to contact to find out about our budget.

We decided to meet up on Tuesday the 25th to begin working on the wikipage at the wiki workshop session, rather than having just one of us show up. That way we can all contribute to the wikipage.

## Action Items:

1. Talk to Debbie Foster about spending card (Josh)
2. Email client to set up meeting time (Peter)

Next meeting will take place on 10/25/2016 at 3:30 pm in GJ 114.

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## Meeting Minutes

Meeting 7: 10/27/2016

### Goals:

1. Discuss progress of acquiring parts for experiments
2. Discuss plan for the completion of the wikipage rough draft
3. Discuss client meeting schedule
4. Write out our plan for our airtight/watertight and structural integrity experiments

## Points of Discussion:

According to Debbie Foster, we do not have access to our budget yet because funds have not yet been sent. Since we do not have access to funds, we have not yet purchased any new parts. This week, we will purchase parts with our own money and be reimbursed later.

On Tuesday, we got the wikipage started, but did not begin filling it out. We will meet at the library on Tuesday the 1st to fill out the information. We can use some of the information from our snapshot day poster.

The client still has not responded to emails, and so we have not yet scheduled a meeting with him. We will continue to attempt to contact him.

Our experiments are planned as follows:

### Experiment Airtight Watertight Structural Integrity

Hypothesis A sealed unit will remain below an absolute pressure of 75mm of Hg for at least 12 weeks. A sealed unit will remain watertight indefinitely. A sealed, empty unit will, when brought to 50mm of Hg absolute, will not collapse, and will not deform more than 2cm in radius.

Procedure 1. Construct and seal a unit at an absolute pressure of 50mm of Hg. 2. Place unit in an area where it will not be moved for 1 week. 3. Note rate at which air 1. Construct and seal a unit at an absolute pressure of 50mm of Hg with a humidity sensor inside 2. Submerge the unit underwater for 1 week. 1. Measure outside circumference of the unit at half of the height of the unit. Calculate radius. 2. Vacuum air from the unit 50mm of Hg at a time

leaked into the unit. Extrapolate to 12 weeks. 4. Compare that loss in pressure to 75mm of Hg and review design. 3. Note the change in humidity inside the unit. Extrapolate to 12 weeks. 4. Compare that to the initial humidity and review design. until the unit visibly deforms or reaches 50mm of absolute pressure 3. Note the circumference of the unit and review the design.

Action Items:

1. Check chemstore for drum (David)
2. Investigate vacuum pumps in the JML with Dev at 9 am on Tuesday the 1st (Joel)
3. Acquire remaining parts for tests (After David checks on drum prices)
4. Meet up on Tuesday the 1st at 3:30 pm in the library to fill out our wikipage

Next meeting will take place on 11/4/2016 at 3:30 pm in GJ 114.

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Meeting Minutes

Meeting 8: 11/3/2016

Goals:

1. Discuss pros and cons of each design for client meeting
2. Discuss plan for when and where to conduct the client meeting
3. Continue work on the wiki page.

Points of Discussion:

We bought a drum from the chemstore for \$13. It is the type with two small caps on the lid rather than the whole lid coming off, so this is not totally representative of the final product and for prototyping only. We also bought the brass fittings from Tri-State for about \$12, but they didn't all fit together. We will return them and try Moscow Building Supply.

The wikipage is ready for the rough draft review. We will add more content as we progress.

Joel met with Dev to see what vacuum pumps were available to us for experimenting. There were two pumps that looked well suited to our needs in the JML diesel lab.

Pros and cons of both designs to present to the client:

Pros Cons

Drum 1. Cheap- best value per ft<sup>3</sup> 2. Easy to assemble 3. Should be easy to get parts 4. Easy to fill/empty (depending on lid type) 1. Could be hard to empty depending on lid type 2. Likely to take a long time to get to 50 mmHg

Pipe 1. Materials may be more readily available in target areas 2. Large storage capacity 3. What client proposed 4. Easy to empty 5. Stackable 1. Extreme per unit cost 2. PVC glue and fittings may be harder to get

Action Items:

1. Get correct fittings from Moscow Building Supply (Joel)
2. Call Client to schedule meeting (Peter)
3. Check drum label for thickness of drum wall (David)

Next meeting will take place on 11/7/2016 at 3:30 pm in GJ 114.

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Meeting Minutes

Meeting 9: 11/10/2016

Goals:

1. Prepare powerpoint for preliminary design review
2. Practice sales pitch for pitch competition Tuesday

Points of Discussion:

Reusing some slides from our snapshot day powerpoint, we prepared our presentation to send to Don Tolmie for the design review.

Pitch points:

- \* Easy to assemble
- \* Parts are common
- \* Simple solution to an expensive problem
- \* Farmers can sell at higher prices outside harvest season; our product would allow customers to do that
- \* Governments and charities are the target buyers, since they'd have an easier time buying units and giving them to farmers
- \* Herbivorous insects destroy 1/5 of global crops annually
- \* Insect infestations are carried from field to container and from container to container. Our container kills insects, eliminating infestations
- \* *Prostephanus Truncatus* can destroy 35% of maize and cassava crops in 6 months if not properly stored and 60% in 9 months
- \* Spotted Stem Borer can destroy 20-40% of potential maize and sorghum crop

Action Items:

1. Practice pitch for Tuesday (All)
2. Preliminary design review on Thursday (All)

Next meeting will take place on 11/17/2016 at 3:30 pm in EP 4th floor conference room.

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## Meeting Minutes

Meeting 10: 11/17/2016

### Goals:

1. Meet with the client

### Points of Discussion:

We conducted a phone meeting with the client Don Tolmie. We discussed the points presented in our prepared PowerPoint, which we emailed to him. He agreed with our conclusions and suggested, in the interest of groups like the Idaho Bean Commission, we should focus on making the unit to preserve crops after harvest until sale or consumption rather than for replanting. He said that we could contact him and request beans for our tests. He also suggested that we contact his colleague Dr. Jim Beaver. Dr. Beaver works in Puerto Rico with farmers in the exact situation we are trying to help, and by sending him our final product, he may be able to help us get valuable data about the real applicability of our product. We took notes on these things and reviewed our plan accordingly.

### Action Items:

1. Review the client meeting.

Next meeting will take place on 12/1/2016 at 3:30 pm in GJ 114.

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## Meeting Minutes

Meeting 12: 12/1/2016

### Goals:

1. Prepare for snapshot day

### Points of Discussion:

We prepared for the upcoming snapshot day by updating our slides from the previous snapshot day. These updates included changing the slides about our proposed designs to reflect our decision and the input of our client to focus on the drum design, the research about the benefits of our product that we did for the pitch competition, and the improvements to the designs that we've made since the last snapshot day. We also reviewed our experiments so that we can discuss them.

### Action Items:

1. Do well at snapshot day (All)

Next meeting will take place on 12/8/2016 at 3:30 pm in GJ 114.

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## Meeting Minutes



Meeting 13: 12/8/2017

Goals:

1. Perform the structural integrity experiment

Points of Discussion:

We performed the structural integrity experiment. We connected our prototype drum up to a vacuum pump and turned on the pump. The vacuum gage showed the internal pressure dropping until the gage read about 3 inHg below atmospheric pressure, when the sides of the drum began to buckle inward. By the time the gage read 5 inHg below atmospheric pressure it mostly stopped changing as the drum deformed more and more. We removed the gage assembly and plugged the end that plugs into the barrel with a rubber stopper and ran the test again. The gage stopped increasing at 17.5 inHg below atmospheric pressure. We closed the valve and disconnected the vacuum pump. The gage assembly held this pressure. We treated the threads of the small cap with Teflon tape and the threads of the large cap with PVC glue and retried our experiment. We saw little improvement, getting to about 5 inHg below atmospheric before the pressure greatly decreased its rate of change. We closed the valve and observed the rate at which the gage reading indicated the increase in internal pressure as the drum leaked. We noted these results and discussed ways by which we might improve our design.

Because the drum collapsed, we realized that we will need an internal brace to keep the drum from collapsing. We also need to get something to fill the drum with so that we can test its integrity at  $\frac{1}{4}$  full,  $\frac{1}{2}$  full,  $\frac{3}{4}$  full, and full. To test the effectiveness of the brace, we'll need the drum with a removable lid. We should also test the viability of using a hand pump to bring the drum to the desired pressure.

We also discussed another future experiment where we would place live crickets in different jars at different negative pressures and noting how long it takes for them to die. This would be helpful because if we can achieve complete insect mortality at a smaller difference from atmospheric pressure, it would make the product easier to use, especially if pumping by hand.

Action Items:

1. Acquire and assemble hand pump as per the internet tutorial video linked below (Joel): a. <https://www.youtube.com/watch?v=UkPLu6mgdWA>
2. Research check valves for testing and leak finding (David)
3. Deliver shopping list to Dev (Josh)
4. Research humidity sensor specifications and vacuum tolerance (Josh)
5. Look for ways to reduce pieces in gage assembly (Peter)
6. Email Dr. Beaver about our project and obtain details of collaboration (Peter)

Next meeting will take place on 1/12/2017 at 3:30 pm in GJ 114.

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Meeting Minutes

Meeting 14: 1/12/2017

Goals:

1. Review progress on goals over winter break.
2. Discuss possible brace designs

#### Points of Discussion:

We achieved most of our goals over the winter break. Joel acquired the parts needed to assemble the hand pump we saw online and will assemble the pump before next week. David and Peter found a ball-check valve with a shut-off valve built in and a barbed needle for connecting hose, which solves our problem of needing a check valve and reducing the parts in the gauge assembly. Josh delivered our shopping list to Dev, and both the aforementioned check valve and the open top drum arrived. Peter contacted Dr. Beaver. Dr. Beaver said that he would be able to get us data on the effectiveness of our product. We would need to send him some prototypes of our product, and he would be able to tell us soon after how whether it had functioned properly.

We discussed possible brace designs including the following:

We decided to use the design shown on the right, which is a hybrid of the other two, using both a cross-shaped vertical brace with round braces every third of the height. David will pick up a sheet of plywood, or something cheaper that serves the same purpose.

#### Action Items:

1. Acquire the wood and assemble the brace (All)
2. Assemble hand pump (Joel)

Next meeting will take place on 1/19/2017 at 3:30 pm in GJ 114.

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#### Meeting Minutes

Meeting 15: 1/19/2017

#### Goals:

1. Further refine brace design

#### Points of Discussion:

Joel assembled the hand pump, but it did not function as intended. The o-rings were not thick enough to get a good seal, and the rubber flaps that were meant to act as check valves would not close. Re-doing parts of the assembly may resolve this issue.

We began by assembling the vertical cross-shaped part of the brace and testing that. There was an improvement from 5 inHg below atmospheric to 10 inHg below atmospheric pressure before the barrel deformed excessively. Our next plan is to cut out the wooden rings and attach them to the cross brace every 1/3 of the height.

When the barrel deformed, it created gaps between the barrel and the lid, allowing air to enter the barrel and preventing a vacuum from being drawn. For our project to be successful, we must find a way to seal

the inside of the container. Since the hand pump is not part of the minimum viable product (a vacuum sealed food safe container), getting the pump to work is postponed until the barrel works properly.

Action Items:

1. Assemble the updated brace (All)

Next meeting will take place on 1/26/2017 at 3:30 pm in GJ 114.

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Meeting Minutes

Meeting 16: 1/26/2017

Goals:

1. Further refine brace design

Points of Discussion:

We assembled the complete brace design, including the wooden rings every 1/3 of the height and tested it. There was another noticeable improvement, as we were able to draw down to about 14 inHg below atmospheric pressure. When this pressure was reached, however, loud cracking sounds were heard from inside the barrel. Upon investigating, we found that most of the sections of the wooden rings had collapsed.

Our plan is to cut the vertical cross brace into three sections and attach a solid round of wood to the bottom of each. We think that this will be much more stable. Dev informed us that we may use some of the mustard seed in room 72 of the JML to test our product while it is full. Having the container full of seed should help hold the sides out and prevent them from buckling. We hope that this reduction in buckling will prevent the barrel from deforming so much that it can not hold a seal.

Action Items:

1. Assemble the updated brace (All)

Next meeting will take place on 2/2/2017 at 3:30 pm in JML 82.

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Meeting Minutes

Meeting 17: 2/2/2017

Goals:

1. Further refine brace design

Points of Discussion:

We assembled the new brace design, including the wooden rounds at the bottom of every section and tested it. There was another noticeable improvement, as we were able to draw down to about 20 inHg below atmospheric pressure. The barrel buckled slightly, but for the most part, retained its shape. When we turned the pump off, we heard the hiss of air entering the barrel.

Dev proposed using a bag design. If we could find a way to seal a bag that the end user could do, then we may have an easier time making the container meet our goals. This would also greatly reduce the cost, since the bag could be kept in any rigid container, and a barrel would not be needed.

Our plan is to attach our gauge assembly to a small pvc pipe which is sealed at the other end and drill holes in the bottom of the pipe. The bottom half of the pipe would be sealed into the bag. Air would flow from the bag, through the holes, and out the gauge assembly. Our plan to seal the bag onto the pipe for now is just to tie it on with string and pour glue above the string where the bag and pipe meet to seal any gaps.

Action Items:

1. Assemble the bag and pipe(All)

Next meeting will take place on 2/9/2017 at 2:30 pm in JML 82.

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Meeting Minutes

Meeting 19: 2/16/2017

Goals:

1. Further refine bag design

Points of Discussion:

Last week, we met with some representatives from the Idaho Bean Commission and showed them what we had so far, including our updated powerpoint discussing our updated costs and designs.

We assembled the bag and pipe design. It leaked air in as soon as we turned off the pump, but it did not break. With a new method of sealing the bag, we should be able to prevent further leaks. We are considering using a rubber pipe coupling slid over the top of the bag and pipe and secured with hose clamps. Until we can consistently get a good seal, we can't make any progress. In order to eliminate possible leaks, we assembled a new pipe-and-gauge assembly, pulled it down to as far of a vacuum as we could, and left it over the weekend. It did not leak at all, so we can safely assume that all leaking is happening where the bag and pipe connect. The rubber coupling did not prevent leaks. David suggested simply wrapping the end of the bag tightly against the pipe with electrical tape, with the tape coming over the top of the bag. When we tried this we continued to get leaks in the bag itself. We decided to try again with thicker bags.

Action Items:

1. Assemble the bag and pipe(All)

Next meeting will take place on 2/23/2017 at 2:30 pm in JML 82.

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## Meeting Minutes

Meeting 20: 2/23/2017

### Goals:

1. Further refine bag design

### Points of Discussion:

Last week, we prepared materials for our logbook review. We also tried to improve the bag to pipe connection by pulling the bag between the rubber collar and applying hose clamps. When this failed to maintain a seal, we repeated the test with a layer of rubber cement applied at the interface between the pipe and bag. This also failed to maintain a seal. We listened for the sound of leaks and found a number of small holes. Upon patching the holes, we found more holes. We decided to use thicker bags. We purchased some 4 mil bags and will reattempt the experiment.

### Action Items:

1. Assemble the thick bag and pipe(All)

Next meeting will take place on 3/2/2017 at 2:30 pm in JML 82.

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## Meeting Minutes

Meeting 21: 3/2/2017

### Goals:

1. Further refine bag design

### Points of Discussion:

Last week, we used the thicker bags in an attempt to prevent holes. The seal still leaked air at an unacceptable rate. Rather than bunching up the bag around the pipe, we tried pulling the pipe to the far right side and folded the bag flat and wrapped it around the pipe. This greatly improved the leak rate. It still returned to atmospheric pressure within three hours. Next, we wrapped the bag, which was also wrapped around the bag, with electrical tape. This also improved the leak rate, adding another hour before the bag returned to atmospheric pressure. We think the air may be still be leaking through small holes caused by rough handling and rough surfaces. To make the bags easier to seal, we have decided to try using a foodsaver to melt the bag shut, leaving only enough room to insert the pipe.

We also reviewed our presentation material for snapshot day. We added new slides to show the progress made since the last snapshot day and rehearsed our presentations.

### Action Items:

1. Assemble the thick bag and pipe(All)

Next meeting will take place on 3/9/2017 at 2:30 pm in JML 82.

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Meeting Minutes

Meeting 22: 3/9/2017

Goals:

1. Further refine bag design

Points of Discussion:

Last week, we used the thicker bags and tape to get a better seal. Gently handling the bag and working on a covered surface, rather than the concrete floor or wood tabletops did not prevent all holes in the bag, but did improve the leak rate.

We used a food saver's "seal" function to melt a seam in the bag's opening, reducing the possible opening. This improved the leak rate, but at the observed leak rate, returned to atmospheric pressure in about 12 hours. We plan to work on our wikipage after spring break, since there is a review coming up. We will update the content to reflect the progress we've made since the last wikipage review.

Action Items:

1. Update wikipage (all)

Next meeting will take place on 3/23/2017 at 2:30 pm in JML 82.

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Meeting Minutes

Meeting 23: 3/23/2017

Goals:

1. Further refine bag design

Points of Discussion:

This week, after returning from spring break, we updated the content of our wikipage to reflect the progress that we have made since the last wikipage review. These updates included the designs we have tried and their results. We made a few attempts to get a better seal when heat-sealing the bag shut around the pipe, but were unable to improve the leak rate. The foodsaver's latch pokes holes in the bag. These holes are on the outside of the seal, but another tool may provide a better seal. We are considering something with a wider surface, like a hair straightener. We think that a thicker seal would leave less possibility for gaps in the seal.

Action Items:

1. Assemble new bag/pipe (all)

Next meeting will take place on 3/30/2017 at 2:30 pm in JML 82.

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#### Meeting Minutes

Meeting 24: 3/30/2017

Goals:

1. Further refine bag design

Points of Discussion:

This week we continued to build new bags with different methods for sealing. We tried using the foodsaver, hair straightener, and plastic sheet welder. The foodsaver, as mentioned before, provides a thin seal and holes on the outside of the seal. In an attempt to get a wider seal without holes, we tried using a hair straightener. This did provide a wider seal, but the leak rate was still far too high to be acceptable. Dev suggested using a plastic sheet welder. This also proved difficult. The device was inconsistent in temperature, so it would usually either leave the plastic unaffected or melt the section it was in contact with off of the rest of the bag. David proposed using spacesaver bags to store the seed. Spacesaver bags have a built in vacuum valve and are made to be airtight. Modifying the bag so we can attach our gage assembly may be a good way to ensure a seal and reduce costs by removing the pipe. We will try it next week.

Action Items:

1. Assemble spacesaver bag (all)

Next meeting will take place on 4/6/2017 at 2:30 pm in JML 82.

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#### Meeting Minutes

Meeting 25: 4/6/2017

Goals:

1. Further refine bag design

Points of Discussion:

This week we continued to build new bags with different methods for sealing. We tried using the foodsaver, hair straightener, and plastic sheet welder. The foodsaver, as mentioned before, provides a thin seal and holes on the outside of the seal. In an attempt to get a wider seal without holes, we tried using a hair straightener. This did provide a wider seal, but the leak rate was still far too high to be acceptable. Dev suggested using a plastic sheet welder. This also proved difficult. The device was inconsistent in temperature, so it would usually either leave the plastic unaffected or melt the section it was in contact with off of the rest of the bag. David proposed using spacesaver bags to store the seed. Spacesaver bags have a built in vacuum valve and are made to be airtight. Modifying the bag so we can attach our gage

assembly may be a good way to ensure a seal and reduce costs by removing the pipe. We will try it next week.

#### Action Items:

1. Assemble spacesaver bag (all)

Next meeting will take place on 4/13/2017 at 2:30 pm in JML 82.

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#### Meeting Minutes

Meeting 26: 4/13/2017

#### Goals:

1. Further refine bag design

#### Points of Discussion:

This week, we tested the spacesaver bag. Using a pvc bulkhead glued with epoxy to the bag, we attached the gage assembly to the bag. This would not hold a seal. The epoxy was too rigid and did not stick to the bag after it dried. After the epoxy, we tried silicone caulk. This stuck to the bag and gave a better seal, but did not hold well enough to meet our specifications. After consulting Matthew Soden, who suggested using a device called a "frog", a pair of plates and rubber gaskets that screw together to create an airtight seal. We ordered one and used it to connect the bag and the gage assembly. This created by far the best seal that we've been able to achieve so far. While not quite meeting our specifications, this design is very close. With some improvement, we can hopefully reduce the leak rate even further. We will investigate ways to do this over the next week.

#### Action Items:

1. Improve spacesaver bag (all)

Next meeting will take place on 4/20/2017 at 2:30 pm in JML 82.

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#### Meeting Minutes

Meeting 27: 4/20/2017

#### Goals:

1. Further refine bag design

#### Points of Discussion:

This week we improved upon the bag design. Using the frog greatly reduced the leak rate, but David suggested placing the seed in a plastic bag, placing that bag in a second bag, and then placing them in the spacesaver bag. Where the frog is attached to the bag, holes are cut in the other two bags so that the inside of the frog is up against the seed, the top of the inside bags are rolled up, and the zip-top is sealed. Doing



this gave us an acceptable leak rate. Over seven days, the pressure only rose about 3 inHg. This keeps the vacuum low enough long enough that it should kill any insects mixed in with the seed. We will continue to monitor the pressure in the bag, and we are hopeful that it will hold. Next on our agenda is to prepare for EXPO. We need to create a poster as well as update our powerpoint and wikipage. This is what we plan on working on between now and EXPO.

Action Items:

1. Create poster (Peter)
2. Update Wikipage (Josh)
3. Update Powerpoint (Joel and David)

Next meeting will take place on 4/27/2017 at 2:30 pm in JML 82.