***No Heat Shield:***

Do we have any wiggle room for the frequency (437 MHz)? Because most small transmitters that we have seen are only capable of reaching 433 MHZ

My ham radio specialist who gave the frequency and was aiming at a frequency that was for general use.  You may use any frequency that works for you and will not mess with other ham radio operations.

Regarding the antenna length, does it have to be 6.42 inches long? is it possible for the antenna to be shorter or to just not have one entirely? You will need an antenna.  The length of the antenna is determined by the frequency of your transmitter.

We also wanted to reconfirm if the final product could be made out of any material because we have recently talked about using 3D printers to make the glider.  I’m ok with 3D printing of a glider especially for testing.  Be aware of the melting point of your plastic

Are there any websites that also sell transmitters that you could recommend, if possible?

I did a google search for pico balloon transmitters and found some websites and videos

I did an update to the presentation last week.  Make sure you check it out.

***Simulated Gravity:***

Would a gyroscope be able to help out in space?

We have gyroscopes on the space station now to help keep it pointed in the right direction or to rotate it for docking to approaching vehicles.  The rotating space craft would have its own gyroscopes as well but it would also have gyroscopic properties because it is rotating.

Simulated Gravity AR/VR? What is your ideal shape for this space station or we do have free will with size and shape?

I believe I gave dimensions of 15m in diameter and it needs to have some spokes or tunnels to get to the central hub.  The people need to be able to walk around and have some head space so make the area at least  1.7 m tall.  You can make it as wide as you like but try to not go over 3 or 4 m so it is fairly realistic for what we could launch.

* + Is the 15 meter station diameter to the interior or exterior of the station

See page 12 of the updated presentation.

<http://www.hunchdesign.com/project-information-and-supporting-documents.html>

* + Can we split the station into 2 levels and then show people “teleporting” from the core to main level or do they have to show people traveling from one area to another

No teleporting—we are trying to demonstrate rotational effects in the first rotating space craft

* + Is there a set layout of what each room should contain? **(I had said to look at ISS and use that as a guide of the different areas –**

Page 12 and 13

* + Should there be a window (I said yes and used the example of the cupola)

Not required but a Nice touch.

* + Are programs like Kerbal Space Program available?

If Kerbal space program allows for this you may use it. I don’t think so. Some teams are using Unity.

***Mars Trash Ejector-***

If we were planning on using a spring as part of our ejection method it would be problematic since the spring would be subject to extreme cold in the chamber. A spring loses elasticity in the cold and depending on the material if it were metal it can become brittle and develop cracks. Is there a way to navigate this issue or are springs ruled out like hydraulics? Also would pneumatics be ruled to conserve air?

Great thinking!  You are correct in considering the cold effecting the spring.  If the spring were left in the cold of space over long periods of time, it would change its elasticity and would be less effective.  Depending on the spring material, it may not be a spring anymore.  I’m sure there are some materials that could be used for very low temperatures but they would be very specialized for the application.    However, this spring will be inside most of the time and be at room temperature (around 69 to 72 degrees F).  Most of the time the outside hatch would be kept closed and there would be air in the chamber.  Although the majority of the chamber could be outside, it would still retain a lot of the heat from the inside of the vehicle through conduction of the metal.  On the ISS, the internal walls have electric heaters to keep the temperatures a consistant temperature.  I think this would be similar.

It is possible to have a pneumatic system to push the trash out but you would want to make it so a piston pushed the trash out without throwing away air each time.

How large would the trash containers be?

The containers on the final flight unit would probably be around 4 gallon size because that what works well now.  Your trash ejector only has to shoot out a soup can but I think most of the mechanics would be very similar.

What are some of the waste products? What are some of the products that are recycled, and how are they reused?

There is discussion of melting some of the plastic bags and components and making radiation bricks to protect the crew.  Water from food and waste products need to be removed so the water can be cleaned and re-used.  I don’t think aluminum or other metal parts will be able to be recycled because melting them would be very difficult.  I expect that some clothing and cleaning materials will be thrown away with solid waste (poop), damaged parts, filled vacuum cleaner bags….

How can we be sure that the trash won't orbit somewhere off to space? How could we improve the trajectory of the waste products to Mars atmosphere?

The hope as we develop this project is that we would be able to aim the trash to hit Mars.  although space is very big and it is unlikely that we would run into our trash for a very long time, we use to think that about the space around Earth and we are now having to avoid trash in space.

What is the minimum speed and velocity the trash needs to be shot out at?

Each canister will have a different mass so each container may be shot out at a different speed.  I think that means that there will have to be some adjustment in the ejection system.  If you use a spring, you should make it so you can push the can harder or softer depending on how much stuff you have in the can.  If you use an electric motor to push the can, make it adjustable also

What happens to the waste once ejected? Does it just float around space? Can it have any negative effects?

Hopefully we will be able to aim it to the atmosphere of Mars so it burns up.  The martian atmosphere is less dense than ours and it is mostly CO2 so we need to be smarter about how to make it burn up.  We have to choose container materials that will help the contents burn up or at least kill off any Earth bacteria.  We don’t want to contaminate Mars before we have a chance to study Mars.

How much trash can be ejected at one time?

I was only expecting to eject on soup can at a time.

How fast does the trash need to be ejected?

The goal is to eject at 1 m/s.  The mass of the can could vary some so it would be good if there were a few different settings to the springs, motors or whatever mechanism to account for the different mass.

Which direction would the ejector have to face for the trash to be launched in the appropriate direction?

I am envisioning it on the forward side of the ship so the ship would not have to reorient itself to shoot it toward Mars.

How often will trash be ejected from the ship?

Maybe once a day but more likely to be every couple of days.

Is there a limit to the number of weight added when there's trash on the ship?

I don’t understand this question.

Is the ejector functioning manually or electronically?

You can decide that.   I don’t see a reason that drives it to be electronic but it is possible.

Have there been any past waste disposal systems which had their doors open manually instead of automatically?

I believe the trash ejector on the Mir Space station would have been manually operated.  There have not been many disposal systems in the past.  Remember, until recently only the US and Russia have has manned space programs.  China has started a manned program in the last few years but they have not made many advancements yet.

can we wrap cannister in teflon film?

I’m not opposed to that but we would not want to do that with the flight materials.

do we need to account for electronics in vacuum? **(I said yes and all you need to do is state electronics is sealed to protect from vacuum). Agreed. Since the electronics would be mostly in contact with the shell of the airlock it would be pretty close to the inside temperature of the module.**

***Food Bite Dispenser***:

Would you need to eat more food in space than you would on earth in order to have the amount of energy necessary to function properly?

Astronauts typically eat less food in space since they are not using as much energy fighting gravity.

What Superfoods do we have available?

You can choose any kinds of foods you would like to put into your dispenser.  I was thinking about jerky, energy bars, gum, candy but you can do what you like.  The main idea is that you need to find things that your dispenser and work with.

Which side of the astronaut head is the best fit to put the dispenser?

I think you can work with either side of the head.  We have both left and right handed astronauts so it might be valuable to make it for either side.    Choose one side and be able to talk about how you could alter it to put it on the other side.

I know you're kind of confined in the space suit due to all of the layers but how much will you be able to move your head in the helmet either forwards towards the visor and/or towards the sides of the helmet?

If you look at the pictures of the new suit, there looks like quite a bit of room.  It may be difficult to put your nose on the inside of the glass.  Some of that room is important so you have good air flow but they may also have a ‘heads up display’ for projecting procedures and information onto the inside of the helmet.

How much food can fit in the suit?

I don’t know yet.  I was suggesting something on the order of like a 1 ½ candy bar size.  Its hard to judge but that is why I was suggesting something like 8 to 10 energy bites.  It might be there is room for two but this would give us something to start with.

How would you develop a pellet with enough calories and nutrients to sustain the astronaut for hours?

Assume the astronaut already had a good breakfast and they will have a big dinner.  This is the snack that will keep them focused for the hours they are outside doing their work.  The food lab, nutritionists and chefs will have the final say about what will be available.  I think energy bars will be a good start and there will be many other options.

Is it possible to redesign the space suit so that you could work inside and outside of the suit

They are not going to let us redesign the suit or helmet for giving the crew snacks.  We need to come up with ways to work within the existing equipment.  If we are lucky with a good design they might let us make very minor changes.

I know this is far fetched but could they use some type of AI system that they could talked to to get them the food they want kind of like ironman

I think the AI systems are getting smaller and that may be possible.  How much space will you need to have for the motor and battery to push the food pellet out as well as the controller?  Good idea.  Keep in mind the space you need.  Very possible

***FOOD BITE Cont’d***

Could you make a custom helmet design with a nozzle for your mouth and the pellet dispenser be injected into the helmet?

Custom helmet will be very expensive.  The helmet is already a very specialize piece of equipment.  Try to keep it simple.

How far out are we from having advanced UI

How far are we from AI?

I think it is within range for it to be in the suit.  The AI can activate a motor to eject the food but you will need a battery and a controller to receive the command too.  Just be aware of your volume in the helmet.

A UI is a Computer system that has to be given a command to operate unlike AI, which can learn and act on its own

Thanks for the clarification.  I think UI would be better for this system.  I don’t want an AI to be spitting out food because it thinks I want food.  I would like to choose when I get the food.

* how would they get the food? (I think the team want to confirm that the food is inside the spacesuit);

the food would be installed into the dispenser before they go on their space walk, installed into the helmet area and the crew has to be able to dispense it into their mouth without their hands getting into the helmet.

* material?

I expect it will be made of either plastic or aluminum but that is up to you.

* + Do we make the food?
		- Told them I don’t think so and to focus on something already made

I would suggest they make the food bites out of something that is easy to work with—plastic, wood,….. The main idea is to choose a shape and size of food pellet that works with your dispenser so it doesn’t clog or jam.

***Lunar Supply Pod Mover-***

Can we use an electromagnetic to lift the spherical pod? Additionally if there are electronics and the pod can make the lifting system interchangeable for different situations?

Electromagnets would be a good idea if we use steel for the supply pod but it wouldn’t work if it is titanium.  You can help determine the materials.  Make sure your supplies don’t include any electronics that could be damaged by the electromagnet.

The more versatile the pod mover, the more likely NASA would like it.

Can rubber withstand a hit from the outer atmosphere to landing on the moons surface? Would y’all consider using rubber?

Good thinking.  I don’t know.  I’m thinking of like a rubber ball or rubber tires lined up to make a cylinder.  They seem to be able to handle a beating on earth but I’m worried about the -250 F of space.  I think it would shatter if it is allowed to get too cold.  Explore the idea more.

Also for the model size on the powerpoint on website it states to design and build a 1/3 scale , however you stated an desktop model which one is best?

Make it a size that you can transport easily and not spend a lot of money on.  I want to see your idea more than I need to see it pick up a heavy load.

How heavy would the pods be?

Expect the pods to be at least 5000 lbs on Earth.

How big is the “small” and “large” dimensions/scale model?

The ones that land on the moon will be at least 2m in diameter.  They could be spherical or cylindrical.  Your prototype should be scaled so that it will fit on a desk.  Since this is pretty small, you will need to do the math to show the gearing and motors and structure you are suggesting for the mover is appropriate for the full scale mover.

Would there be any wheel and tire blueprints I could access so I can add them to my design?

I don’t have any blue prints for wheels.  We did put the requirements of the Lunar wagon wheels from last year on the website and there were some excellent wheel designs from last year.  You can look at pictures of the student teams from last year for ideas or talk/work with any of them you might know.

What kind of attachments for a trailer exist on the rover?

You can determine what kind of attachment is appropriate for your design.

Would I be loading the pod onto the rover or making housing for the pods on my design?

You can decide that.

Are there any restrictions on the materials that I'm allowed to use?

Not really.  Aluminum is often used because it is lighter weight than steel but there are times you need the strength of steel or titanium.

How many pods would be transferred at once?

I would expect one at a time but if you see a way to transport more than one, I’m ok with that.

These questions in the process of being answered

* How much will the contents differ, and will it affect the shape and weight much?
* Are there any concerns about temperature?
* Will the shapes be uniform?
* How extreme would the deformation caused by the landing on the moon be on the shape?
* Are there restrictions on how the device would be attached to the rover?
* Are there restrictions on the dimensions of the mover?
* How will the weight of the pods be distributed?
* Are the contents of the pod susceptible to strong magnets? (ESD)
* Can we modify the SEV in any way?
* What do the attachment ports on the SEV look like?
* The design is asked to be built at ⅓ scale, could we build this on a smaller scale to account for financial constraints?

***Plant Growth Chamber:***

 wouldn't the soil float away? or is it held in by other mans.

The ‘soil’ on the space station now is held in a cloth ‘pillow’ and the plant grows out of a hole in the pillow.  You might make your grow chamber hold a pillow or you make make a chamber that holds a gel that the seed grows out of.  Give the experimentor options when you can.

How many planted needed for AgLab?

* + What type of USB interface should they use? 2.0 or C? (AgLab)

Page 9 has the links for the Nano Racks requirement

* + What kind of interface to the plants? Wi-Fi? After the fact? SD card? (AgLab)

The USB connection provides data and power. Expect to down load at least once per day.

* + Is there an orientation the plants need to grow? (AgLab)
		- Told them don’t think so. Agreed.
	+ Is there a specific seed they need to use? (AgLab)

Each experimenter that uses your AgLab will probably have a different seed and plan. Make your design so that anyone can make small changes to your design to make it fit their need. Versatility is the key to this project.

* + Is there a budget from us to order AgLab kit or other supplies? Students can spend what every they like on this. I would encourage you to keep it cheaper when possible and show what other options could be used if more money is spent. Engineers are able to extrapolate from a good idea.

**(All the ones below came from Matt Leuchtmann and I haven’t had a chance to respond so adding it here).**

* Will the 1U box contain everything, including lights, grow space, etc?

HUNCH will be sending the supplies that are in the Sparkfun link on page 10. Nano Racks will be supplying only the exterior aluminum box. The students are arranging the components inside to maximize the versatility of experiments that can be done in the box.

* Will lights be able to be placed outside the box along with plants if the grow space extends beyond the box?

Everything is limited to inside the box. At no time will there be anything coming out of the box or the box being opened.

* What interface is there between the box and the ISS for getting water into the system?

The water source has to be included when launched. This is only a 30 experiment.

* Should we design the box for a specific type of experiment, or try to be as broad and general as possible?

Broad and general

* The criteria said delivery of water OR other media such as gel or agar. Does this mean we choose one and make it so it would be easy to change when people specify experiments?

Yes. The experimenters that choose your box will want to make some choices that may include the growing media.

* What sort of things should individuals change before experimentation and what sort of things should be adjustable during the experiments.

I will leave that up to the students.

* What sort of software interface should we have?  Should variables be changed in the code, or should we use buttons/switches/etc. to allow those to be changed.

The easier it is for the user to make adjustments for their experiment, the better.

* What needs to be adjustable?  To what extent?

That is up to the students.

* May we use a Raspberry Pi?  For the camera most likely.

The raspberry Pi is what we are providing but you are welcome to use something else if you like.

* Will we need to worry about an air filter to remove chemicals such as ethylene?

I don’t expect the ethylene to be an issue in the early stages of the plant growth.

***Lunar Dust Blower and Waffle Baffle***

Are there and dimensions for the dust blower?

I do not have specific dimensions for the snow blower.  You may work with any size snow blower you have available. The modifications you make will be the most important thing we are looking for.

General info: These habitats have not been built yet.  I know we will be using inflatables since they are quick to set up and they are the plan for most of the discussions.  Because of that, I don’t know specifics but I can give you some rough estimates.

Expect they will be around 15 ft tall and at least 30 ft in diameter.  They will probably get bigger as the base gains experience and years.

There will most likely be a door to an airlock  (might be a rigid structure)  and there could be a connecting hall way to another inflatable.

You do not need to build for this size and dimension.  The mock up you make needs to fit on a table top so you can show the idea.  The most important components to show is that the baffles are able hold the soil even when the surface material of the inflatable is very smooth.  Not all the baffles have to be the same.  The ones on the top may look very different from the ones on the sides.

How much soil and how fast?

The goal is to hold around 5 ft of dirt on top. This may not happen fast. This is 1/6 earth gravity so it won’t be as heavy.

Do we need to account for vibrations?

Yes.

Thickness – limit?

How tall does the baffle need to be to hold the dirt? It may only need to hold the bottom layer of soil but it may need to extend up into the dirt to hold it.

Is there a weight limit? **(Lighter is better)**

Using less material to make the baffles is better but we don’t want them to rip while being filled.

Waffle/baffles - temp of material or weight of material

Will need to handle the temperatures of the moon—250F to -250F

Lunar Supply pod – material?

I will leave that up to you. There may be several materials sandwiched together to get the desired durability.

* + Is the inflatable already radiatively protected?

Yes. The outer cover will probably be Kevlar or something similar but we still don’t want to throw sharp rocks at it.