Venus Mission Design Competition 

**Welcome to the Space Careers Show Mission Design Competition!**

We are pleased to announce that you have been selected to run our impending Venus reconnaissance mission. A team of five astronauts will be travelling to the surface for the 42 month mission. You must provide us with plans for this mission, including the reconnaissance vehicle. It is essential that the mission come in under budget. **You have $1250 to spend**.

 There are several applicants for this role, so the reasoning behind your choices must be given.We have provided a price list to help you determine the cost of materials, and a workbook where you can fill out your choices and reasonings. Please submit a scanned copy or photograph of your work to **mission.design@spacecareers.uk**(Alternatively please feel free to edit this document in word and submit an electronic copy)

We will be judging your mission based on the following criteria

* Total price
* Practicality of the base
* Practicality of the reconnaissance vehicle
* Comfort of the astronauts
* Safety of the base
* Creativity of your mission
* Science objective of reconnaissance vehicle

Please ensure the copies sent through are legible, or we will not be able to judge them. Submissions must be received by 4pm on 7th of November the winning design will be announced at the end of the show at 5pm . We would also like to share your work on social media and will be contacting the winner by email, so if you are under 16 years of age, please ensure we have the contact details of your parents/guardian.

 **There are also exciting prizes available for 1st and 2nd place winners so be sure to try your hardest! (One of the prizes will be a star projector!) (The prize will be posted out after the event has finished so make sure to fill in the submission form fully!)**

Workbook

**Name:**

**Email:**

1. **Base layout**, will you have multiple rooms in your base? If so what will these rooms be?

*Choice:*

*Reasoning:*

1. **Base flooring**, the surface of venus is approximately 400ºC so the floor of your base must be able to withstand very high temperatures. Don’t forget that humans can’t survive in high temperatures so try not to let your astronauts overheat:

*Choice:*

*Reasoning:*

1. **Base dome**, as well as being a very hot planet, the air pressure on Venus is 100 times as high as on Earth. The base dome will need to protect your astronauts from these harsh conditions:

*Choice:*

*Reasoning:*

1. **Oxygen**, we can’t take enough oxygen to keep a team of astronauts alive for years on our mission, how will you make sure they can breath when they’re inside their base?:

*Choice:*

*Reasoning:*

1. **Food**, there are lots of ways to feed an astronaut but a link between the food they eat and their mental health has been discovered. How will you keep your astronauts fed? Do you want a cheap mission or a happy crew?

*Choice:*

*Reasoning:*

1. **Water**, as missions increase in length methods of generating and recycling water improve. How much water will you need for your mission? Don’t forget that food production and other operational functions of your mission may need large quantities of water too.

*Choice:*

*Reasoning:*

1. **Weathering**, we know that Venus is a hostile landscape and have built a base to withstand that, but will your base need to be repaired during the mission? Will you need extra methods of keeping your astronauts comfortable and healthy when within their base? Extra methods to protect against the extreme landscape will be needed, so list any you will chose to utilise here:

*Choice 1:*

*Choice 2:*

*Reasoning 1:*

*Reasoning 2:*

**Total Price:**

1. **Reconnaissance vehicle**: To accompany your mission a reconnaissance vehicle will be taken to venus. You should use this space below, or another sheet of paper to provide us with the details of this vehicle. We will need a brief description of the vehicle’s design, you may include a sketch image if you like, and a description of the science you would like to conduct using the vehicle. When describing the science you will be conducting, you should note any design features that will be required to complete the work. Costings will not be required, but you should explain any choices you make, such as vehicle type and material choices. Be as creative as you want!

Pricing Information

Below you will find the pricing and cost details for different areas of your base. In order to successfully complete your mission you will need to select one of the pricing options from each section of the pricing sheet below. The quality and functionality of the items you choose will play a big role in your mission, so be careful! Spending too much or too little could have a huge impact on your mission success!

**You will need to justify your decisions for each choice in the worksheet section so be sure to make sensible and thoughtful decisions.**

Base Flooring/Walls

1. **Titanium -- Cost: $150**

A low density, high strength metal with a melting point of 1941K. It is resistant to many forms of erosion.

1. **Chromium -- Cost: $200**

A hard and brittle metal with a melting point of 2180K. It is resistant to corrosion and tarnishing.

1. **Fiberglass Cost: $100**

A cheap and flexible material that is stronger than many metals, non-conductive and transparent to radiation (EM). Fiberglass begins to degrade at 1500K

1. **Ceramic -- Cost: $50**

Any of a variety of hard, brittle, heat and corrosion resistant, non-metal minerals. The melting points for ceramics are over 2300K

Base Dome

1. **Basalt Fibres -- Cost: $75**

A cheap fireproof material, with similar properties to fiberglass, it is very fire and difficult to shape. The melting point is 1500K

1. **S-glass -- Cost: $100**

Strong, brittle glass fibres that can be woven into a highly insulating fabric. Melting point 1800K.

1. **Aluminium -- Cost: $150**

A flexible and strong metal, aluminium has a melting point of 900K

**4. Plastic -- Cost: $50**

A versatile material, with a wide range of properties. Plastic is often highly moldable, but brittle once shaped and with low melting points.

Oxygen

1. **Extract from Veneitan atmosphere -- Cost: $150**

Requires less equipment bringing on the journey, but could take time to generate enough of an atmosphere within the dwelling to be able to survive outside of a spacesuit

1. **Recycle from suits and ship -- Cost: $100**

Technology already exists, but there would be no way to add more oxygen if levels began to run low

1. **Collect from vegetable farm -- Cost: $50**

Would require very little equipment and would provide large amounts of oxygen, but would take a very long time to be generating enough oxygen to survive outside of a spacesuit in the dwelling

1. **Bring large quantities of oxygen on the journey -- Cost: $300**

Would ensure the astronauts are able to survive outside of their suits very quickly, but is expensive and heavy, so would have to sacrifice other items.

Food

1. **Bring basic supplies -- Cost: $50**

A cheap and lightweight option that will keep your astronauts alive, but it could get boring after several years

1. **Bring a variety of long lasting food supplies -- Cost: $100**

A slightly more expensive, but still lightweight option. Your astronauts will be well fed and have some variety in their diet.

1. **Conduct arable farming only -- Cost: $150**

A more expensive option that will provide your astronauts with an extra activity to complete, an oxygen supply and a chance to study the growth of plants in space. However it will mean more water is required on the base and if the harvest fails, your astronauts could go hungry.

1. **Conduct animal farming only -- Cost: $250**

An expensive option, requiring more food, water and oxygen bringing at the start of the mission. There is a small risk of disease outbreak between humans and animals, and the carbon dioxide levels in the dwelling will be increased. However it will bring a more varied diet, activity for the astronauts, pets and a chance to study how other species survive in space.

1. **Conduct mixed farming, animals and fruit/vegetables- $200**

A moderately expensive method of feeding astronauts, it will put strain on other resources like water and space. However the two productions could be managed in a cohesive way to ease the strain on food and oxygen supplies, it will provide large benefits to quality of life and help advance many research topics greatly.

Water

1. **Bring a full water supply-$250**

Expensive and heavy, bringing enough water to survive for years is nearly impossible. This method will guarantee an adequate water supply for the full duration of the mission

1. **Recycle waste water-$50**

An unpleasant thought, but a very cost effective method of gathering water. Over time the amount of water that can be retrieved through recycling will decrease, so it won’t guarantee an adequate supply, especially if food production etc requires extra water.

1. **Generate from atmospheric gases-$100**

A potentially explosive process, but the atmosphere of Venus contains both oxygen and hydrogen, so water could be created in situ. Dealing with the potentially toxic waste products would be difficult but if an efficient process could be set up, a nearly unlimited water supply could be generated for a low cost.

Weathering, choose up to two options

1. **Air conditioning-$500**

Air conditioning is expensive but effective. Removing the excess heat could be tricky on Venus and it would be an strain on water supplies

1. **Underground living-$300**

An effective way of keeping heat levels down and the base protected from any surface impacts. It would make communication with Earth very difficult and could have a negative impact on physical and mental health living underground for years.

1. **Base shading-$200**

Adding a layer of shade around the base would help reduce the temperature somewhat, but the air and surface temperature are still very high so it would take a long time for it to have a large impact. This method would put the least strain on resources

1. **Extra insulation layers-$400**

 Building the base out of insulating materials is a must, adding extra layers to the buildings would help reduce temperature inside, and add extra protection. Taking more material with you will add to the cost and take away space from bringing other items, but this method would have a low impact on the quality of life on the surface.