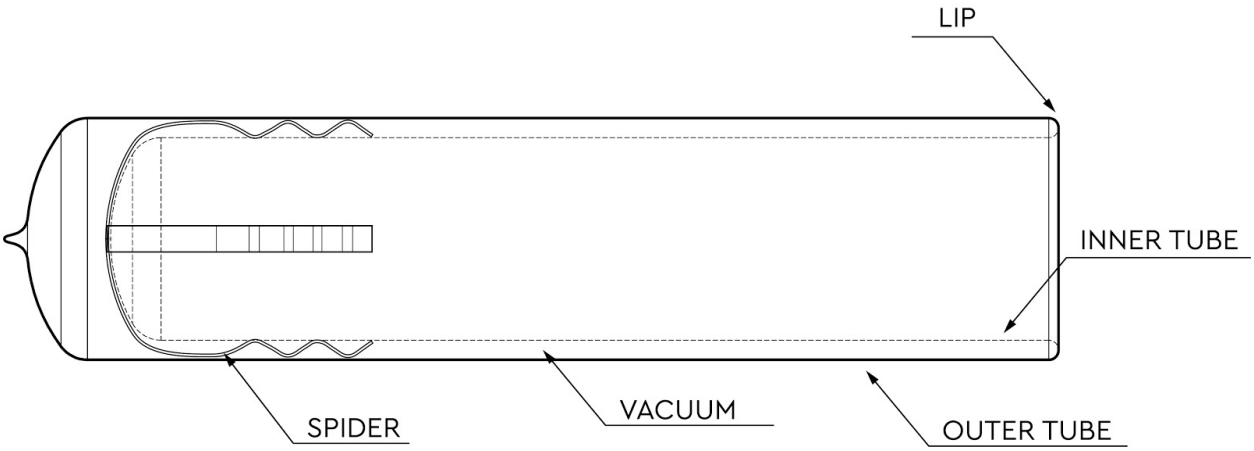
Technical Assistance Request: GoSun Relief Trailer

The GoSun Relief Trailer combines several technology types, and therefore has several uniques design and engineering challenges to overcome.

Vacuum Tube Integrity:

The heart of the trailer is the array of GoSun Fusion solar ovens that will be mounted in an adjustable chassis at the top of the trailer. Because the efficiency of the cooking process relies so heavily on the quality of the vacuum in the evacuated tube, we would want to develop a method of quickly and reliably inspecting the status of the vacuum within the tube. We would like assistance in developing a relatively quick method of testing the quality of the vacuum. The current method involves placing a fixed heat source within the evacuated tubes, and measuring either the rate of change of the internal temperature in the tube, or the rate of change of the external temperature of the tube. Either method requires more than an hour to reliably determine if the vacuum is intact or not.



One potential method we could use assistance on is to use acoustical analysis to determine if the vacuum is intact. The theory being; for a given tube geometry, the way a sound wave travels from the inner tube to the outer tube will vary significantly based on the quality of the vacuum present in the tube. With a perfect vacuum, the sound would travel only through the glass rim that joins the inner and outer glass tubes, and through the stainless steel “spider” that supports the free end of the inner tube. If the vacuum is compromised, sound can also travel through the limited atmosphere within the evacuated tube, causing the received signal on the outer tube to be significantly different. We would need assistance in developing the right tools to send, receive, and analytically compare the signals with various levels of vacuum in the tubes to determine a reliable methodology and tooling.

Vacuum Tube Durability:

As the evacuated tubes will be mounted to a trailer, and trailers typically have inferior suspension systems compared to most modern vehicles, the evacuated tubes will be subject to more severe and consistent levels of vibration during transport between sites. The tubes are designed to withstand some vibration given their construction, and the tubes are already planned on being suspended in a set of custom molded silicone rings to help isolate them from more severe vibrations. We would like assistance with two aspects of this research.

Firstly, to determine what types of vibrations are beyond the limits of the evacuated tubes. We believe the acceleration, frequency, and maximum displacement of the vibrations would all be contributors to tube failures. We would desire assistance with determining; the right type of sensors, the correct placement of sensors, how to consistently create vibrations to form a solid foundation of baseline data.

Secondly, we would need to determine how the tubes behave when mounted to the trailer when in motion. We would need assistance sourcing and placing sensors on the trailer and the tubes mounted in the trailer, then analyze the results to determine if the tubes are at risk and need further protection.

Trailer Stability:

Older mobile solar energy stations would use lead acid battery technology to store any needed solar electricity. Due to the extreme weight of these batteries, it was common to place them over the axles of the trailer near the wheels to minimize the stress on the trailer and maximize stability both on the road and when deployed. With the advent of Lithium based batteries, the weight requirements for a given amount of usable energy are less than 25% of what they were using lead based batteries. This is a benefit in terms of lowering the gross vehicle weight, allowing smaller vehicles to be able to tow the trailer, and reducing fuel usage while transporting (along with the other obvious electrical benefits lithium provides to an off grid system). But this comes at the disadvantage that the center of gravity of the trailer will have been raised significantly without such a large mass down by the axles. Given the intention of raising the array of solar ovens to track the sun, the trailer will often have a significant cross sectional area exposed to the wind when in operation. We could benefit from the ability to test either full scale or small scale prototypes of the trailer in a wind tunnel to determine if additional measures must be taken to ensure stability of the trailer when deployed.

Dispatchable Solar PV Array Grounding:

Given the unique requirements of the dispatchable PV array, that it easily and quickly fold up into a compact form that can be secured to a trailer chassis. The ability to securely and reliably ground the array framework will require careful attention. Once a method has been devices, assistance from one of the national testing labs associated with UL would be desired to help test the array framework to the standards of UL2703, which addresses solar PV racking system grounding.