

The VesprSolar V-Clip: Technical Assistance Request

1. Select final material type for mass-production

- **Unique Challenge:** During the Ready phase, VesprSolar discussed with Underwriters Laboratory (UL) to discuss a list of materials to use for mass-scale production of the V-Clip. Based on their manufacturability and performance under stressed conditions, we initially identified the following material types: Stainless Steel 410, 17-4 PH, and AISI 1070 with galvanization, and others. Based on this short list of materials, we need advice on selecting a final material type.
- **Technical resources needed:** As part of our voucher testing, Sandia National Labs will help us select the best steel alloys to be used for clip fabrication.

2. Complete fatigue testing

- **Unique Challenge:** Fasteners relying on spring-based mechanisms may be subject to metal fatigue over time due to cycling loading. However, our design is unique in the way that the spring mechanism works. Therefore, more specific experimental models are required to better understand and avoid failure modes associated with this phenomenon.
- **Technical Resources Needed:** Sandia National Labs will conduct rigorous failure stress and fatigue testing of prototype clips in accordance with the UL 2703 standard. As a first step, we need to determine bounding conditions that are representative for deployment, peak loads, and number of cycles. The goal of the fatigue test is to understand aspects of the V-Clip geometry and material type that will lead to long-term performance.

3. Complete dynamic, multi-axial load testing under severe weather conditions

- **Unique Challenge:** Structural performance for PV module clamps and connections may be compromised under severe wind conditions, particularly turbulent wind gusts. Combinations of uplift and vibration may lead to displacement of clamps and modules, and eventually structural failure.

After meeting with 20+ industry leaders while conducting our customer discovery, we confirmed that there is strong demand for a faster, more reliable attachment solution. However, there is some skepticism surrounding attachment clips because of product failures from other companies. In our work with Sandia National Lab and other partners, we need to determine how we can conduct thorough, comprehensive, in-depth testing that will convince the industry that our product will work under severe weather conditions. So far, there seems to be no straight-forward way to assess the performance of the clip at a system level under severe weather conditions (dynamic, multi-axial forces).

- **Technical Resources Needed:** Sandia National Lab and other partners will conduct a literature review to understand the bounding conditions and experiment approaches. We will investigate not only the behavior and performance of the clip itself, but also the entire assembly with the PV module and the mounting rail. This will lead to functional improvements in the product design of the mounting rail interface that connects with the clip.

Using the testing plan designed by Sandia National Labs, we will conduct multi-axial load testing, collaborating with Dr. Russell Gentry at Georgia Tech and the University of Oklahoma. Dr. Gentry is working to develop a full-module testing rig at Georgia Tech that will be able to assist with this assessment.

4. Complete corrosion and electrical bonding testing

- **Unique Challenge:** As a module connector, the UL 2703 standards have strict requirements surrounding corrosion and electrical bonding.

- **Technical Resources Needed:** We need to ensure that electrical bonding is maintained and that corrosion does not occur. UL will be evaluating our product as a recognized component, with a list of “Conditions of Acceptability” that will need to be evaluated. This testing will investigate the relationship with galvanization that might be damaged as a result of buffeting impact and cracks that are produced in fatigue. The goal is to determine the best coating and material type.

VesprSolar has assembled a team of partners who will be critical in meeting goals of the Set! Competition

Using connections from the American-made Network and personal networks, we have assembled a team of partners that have helped us clearly define our path forward. These partners and their capabilities that will be critical to bring our product to market are listed below:

- **The University of Oklahoma:** Access to first class prototyping and testing facilities to perform many of our R&D activities, including structural performance under severe weather conditions.

- **Sandia National Labs:** Dr. Laurie Burnham is one of the leading experts on PV module connections globally. Her team’s experience will be an invaluable asset to our team.

- **Georgia Tech:** Dr. Russell Gentry has extensive experience designing and testing PV mounting solutions. He is working to develop a full-module testing rig at Georgia Tech that will be able to assist with the assessment of multi-axial load testing.

- **Laridium Design & Manufacturing:** Connor Bacon is a manufacturing expert with significant experience leading complex manufacturing process. He will guide us through the process of designing a lean and optimized supply chain.

- **Underwriters Laboratory (UL):** As our product will be subject to UL 2703, we have already engaged UL. We have already obtained quotes to complete their “Recognized Component” certification process.

- **Quest Renewables and ReVision Energy:** As our initial pilot partners, they will provide insight on customer problems faced today and give us the credibility we need to commercialize globally.

- **Dartmouth College:** Through the Tuck Startup Incubator and Academic Venture Lab, VesprSolar will have access to a network of experienced start-up CEOs and venture capitalists to support business model development and customer outreach.