Marshmallow Tower Challenge

Group 18: Northrop Grumman

Luke Baldwin

Josh Dennis

Kaylen Nollie

Desmond Pressey

Abstract

The group of four students was given a design problem to build a tower to suspend a marshmallow at the greatest height possible, while being constrained in time and materials. The team overcame many on-the-fly challenges, but due to the constraints, the structure ultimately failed.

Roles

Luke Baldwin: Once construction was complete, made many modifications to the structure to enhance the stability.

Josh Dennis: In charge of the design process. Came up with a handful of possible designs, and after proposing them to the group, one was chosen democratically.

Kaylen Nollie: Directed construction from start to finish.

Desmond Pressey: Personally handled the first stage of construction.

Design

In considering a design for the project, the main factor considered was the materials. Tape and Noodles are not ideal for construction, so it was decided that any design would have to include trusses to provide additional support. The marshmallow that had to be supported by the structure would translate into a large point force, so the design should be able to distribute that force to the table adequately. The thought process behind the design was taken from five minutes of brainstorming in which each member came up with an individual design. One member of the group was focused on making the tower as tall as possible in a tripod type shape. Another member wanted to model it after a radar or water towers and another member of the group wanted the tower to be in a square shape with square supports after each section using the rest of the noodles as height. After considering the ideas, a group member pointed out that a better support system is built with triangles. Ultimately, the template chosen was a triangular pyramid, with remaining noodles used as braces across all three of the sides. This was decided on based on the parameters of being structurally stable and sufficiently high.

Construction

In order to make the tower stand, tape was used as the support at the bottom of each tripod by wrapping the tape 360 degrees around each noodle. In order to make the tripod as high as possible, but still able to stand and support the marshmallow, it was decided to connect two noodles to each piece of the tripod with tape anything taller than that would have definitely failed. The tip of the tripod where all three pieces connected would also be connected with tape. The triangular supports were placed in the middle of the mechanism and taped 360 degrees around the noodles and stacked. After it was decided to place 3 noodles at the tip of the tripod to make it higher and stick the marshmallow on top of that. The rope was then used to try to add more support from the top of the tripod to the table to ensure that the tripod would stand. All of the material was used.

Modifications

After the main tripod was constructed, it became apparent that cross member supports needed to be attached. Under its own weight, thee one noodle thick legs would bend in on themselves. Initial reinforcement was adding small triangle of noodles about halfway up the tripod in order to reduce the inward bending. The cross noodle was joined to the leg with a half inch piece of tape wrapped around each other. In order to increase the height of the structure, a noodle was attached from the top of the tripod vertically with tape. This was to combat the height of other teams structures.

At this point, we put the marshmallow at the top of the structure to check for structural integrity and displacement. Before we even let go fully of the marshmallow, our team noticed that there was still significant bending in our structure. The rope was then utilized as another triangle cross support for the tripod between the noodle brace and the top. With the additional noodles and tape that we had left, our team attempted to secure each base of the tripod with another link to ground. During this last stage however, some of the modifications were rushed which resulted in the breaking of noodles in one of the legs tape joints. This was due to the approach of the time limit and pressures to make something work.

Conclusion

The conclusion of the process was a marshmallow, suspended at a height lower than the table base itself. It was more than clear that the attempted construction of a competing tower had failed, but the procedure of working as a team proved to be a viable lesson. Focusing on certain aspects of the design and considering other construction methods are just a couple of the many things that could have been done differently to improve the chances of succeeding.

Throughout the process of designing, constructing, and modifying the marshmallow tower a great deal of communication was needed. In the design process, each team member contributed his or her idea of how to go about creating the tower whether it was by drawing a visual, describing the idea verbally, or giving feedback to other team members’ thought processes. In constructing the tower, each team member communicated to support each other’s effort in putting pieces of the tower together, or doing things in conjunction such as holding up a piece while another was connected. The modification process added to the communication challenge when on-the-fly decisions had to be made in attempt to accomplish the challenge. Though the final result was a failing tower, the communication effort was commendable given the amount of time that was given, the lack of prior preparation, and the inadequacy of the materials provided.