



# 17959 - Balloon Payload Enclosure Design

NEBP team of the Undergraduate Student Instrument Project, University of Houston

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## Abstract

High-altitude balloon payloads require enclosures that combine low weight, significant insulation performance, high levels of protection from landing impacts, and a rigging design that is inherently redundant and intrinsically safe.

## Design

- 3D model of each payload enclosure was modeled
- 2-inch (50mm) thick expanded polystyrene foam
- Carbon fiber tubes embedded in the sides of the enclosures
- .06x1<sup>3</sup>/<sub>4</sub> inch Safety Pins

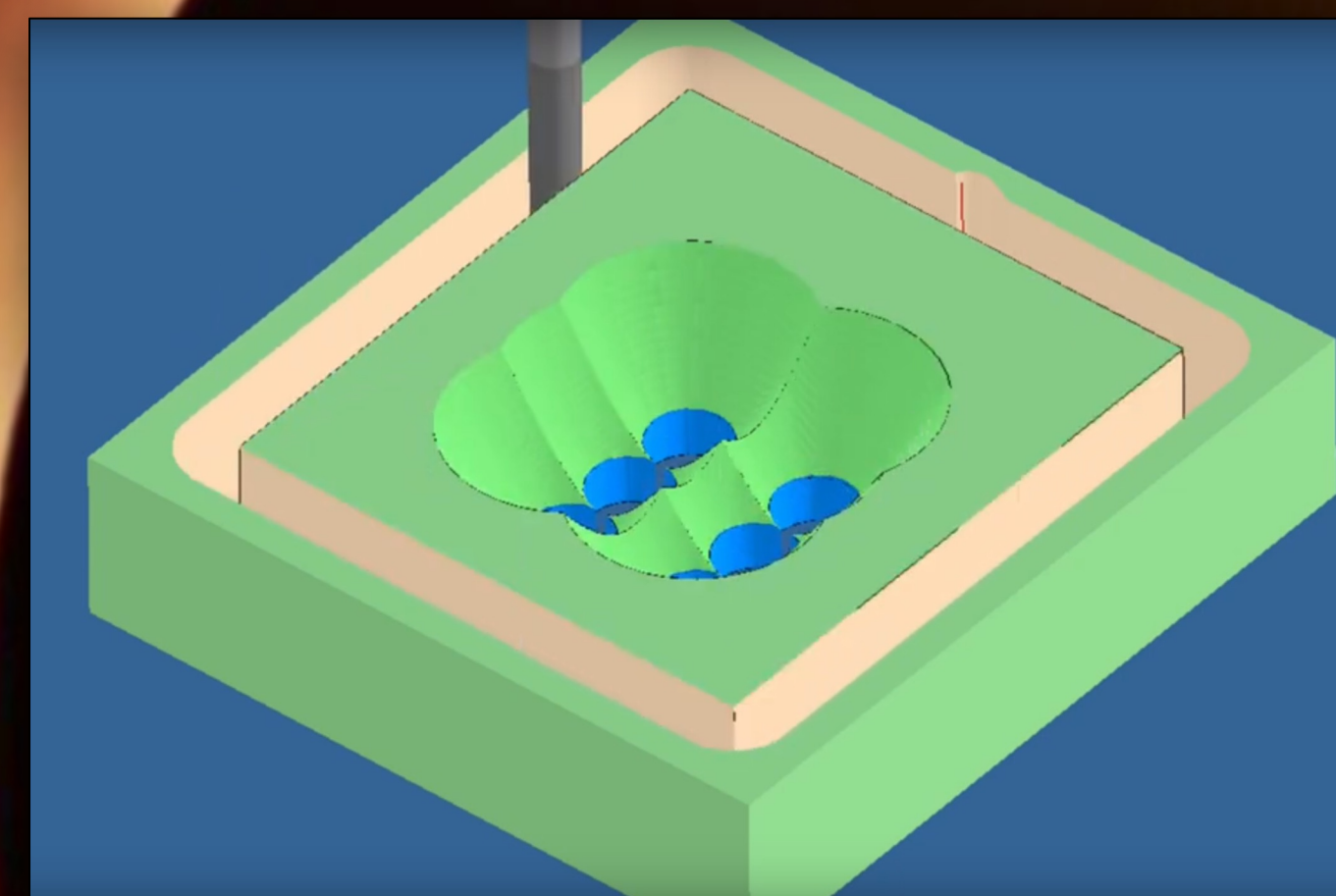
## Expenses

- Total material cost: \$159
- Carbon fiber tubes: \$24 per meter  
(Used 3 meters)
  - Polystyrene foam: \$20 4ftx8ft sheet  
(Used 1 sheet)
  - 1-<sup>3</sup>/<sub>4</sub> inch Safety pins: \$2.75 2 pins  
(Used aprox. 20 pins)
  - Gorilla Glue: \$12 per bottle  
(Used 1 Bottle)
  - Epoxy: \$6.98 per bottle  
(Used 1 Bottle)

After 2023 Eclipse



3D CAD modeled model



Payload Box



After 2024 Eclipse



## Introduction

We have developed a box construction method with desirable performance characteristics, low cost, and ease of manufacture. Payloads built with these new boxes were flown during the Nationwide Ballooning Eclipse Project (NEBP) in conjunction with the Undergraduate Student Instrumentation Project (USIP) at the University of Houston.

## Methods

- Manufactured with a simple 3-axis CNC router
- Each layer created by the CNC router is merged with glue
- Redundant rigging method with use of rope placed inside the tubing with safety pins
- Short plugs for quick connect of on-boards electronics
- Carbon tubes to act as both hanging points and guide sleeves for the suspension lines

## Results

This full-flight train flew during both the 2023 and 2024 eclipses. In all flights, the payload electronics suffered no damage. The construction methods allowed for rapidly producing replacement enclosure components when required. These methods are also easy to replicate and modify to suit various payloads.