



Payload Construction Guide

Your payload construction can take on just about any form, but there are some safety and regulation requirements as well as best practices for materials to use and how to properly construct your payload. Below are a list of guidelines we recommend following.

FAA Regulation Requirements

- Your entire payload including all batteries, cameras, sensors, mascots, mounting harnesses, etc. must weigh less than 4 lbs. (1800g). The lighter, the better!
- Any string used on your payload, particularly for your mounting harness, must be no stronger than 50 lb. test line (50#). We recommend using 50# test kite string.
- Cellular phone usage is not permitted during flight.
- Objects may not be dropped from your payload during flight
- Your payload must be constructed so that persons or property would not be damaged or injured at a vertical landing speed of 10 to 15 mph.

Payload Container & Supports

- Styrofoam cooler/box, ping pong balls, tennis balls are recommended containers.
- Small wooden dowels make good supports for exterior items (like products or mascots)
- Only add items that are essential. Keep weight as low as possible. Don't use extra materials that aren't absolutely necessary. Everything you add is more weight!
- Limit sharp objects and edges outside your payload. Any sharp objects or edges should have extra security to ensure they cannot come in contact with the balloon or any of the support lines during ascent, burst or descent.
- A "harness" must be added that will allow your payload to attach to our balloon train. Our balloon train provides a swivel hook (like a fishing pole swivel hook) and will clip to your payload either above or below your payload. You must provide 2 attachment points. One above your payload and one below your payload. A small key ring works well as a final attachment point.
- Your harness (usually kite string) must have at least 6 support lines that attach to your payload in 6 different locations and should be extremely well secured to your payload (packaging tape works well). The harness must be able to continue to support the payload even if 2 of the support lines break. At balloon burst, your payload will be violently thrown, flipped, tossed, and experience a wild ride. Your harness must be able to contain and hold the payload throughout without the payload slipping out, becoming dislodged or breaking the support lines.
- Your harness connection points should be as short as possible & should not extend out vertically from your payload by more than a few inches. Unnecessarily long harnesses will be shortened.
- Strong rope or parachute cord is not permitted by FAA regulation.
- Any knots you tie in your string, especially kite string, should have super glue applied directly to the knots to ensure they do not slip or come loose.
- Label the outside of your payload with your name and organization name. You can add your contact phone or use ours: 585-270-7074 so if it is lost and someone finds it, they call us! It's also best to indicate that the box is a harmless science experiment. Some people are afraid of mysterious falling boxes from the sky! Make the label as weatherproof as possible.

Exterior Items

- All items not contained within a payload container/box must be secured to your payload container and/or harness with at least 2 redundant and separate methods. We recommend 3 methods of attachment for extra support (Example: double sided foam tape, packaging tape & safety string).
- Items may not extend horizontally or vertically more than 3 ft. from the center of your payload on any side.
- Items or antenna that extend vertically must be soft, not sharp, and lightweight.
- Clear packaging/shipping tape is a great method of securing items outside your payload
- Double sided foam permanent mounting tape (Scotch 3M brand) is a great securing method for smaller exterior items or as a second securing method.
- Zip-ties also work well as a securing method, provided they are zip-tied to your payload container and/or harness.
- 50 lb. test (50#) kite string is a great method to add a safety line for your final fail-safe securing method.
- Lightweight wooden dowels work well for supporting products or mascots that extend horizontally from the payload container. Wooden dowels should be well secured with at least 3 methods to ensure they cannot separate during flight.
- Do not use scotch tape or electrical tape. Duct tape is functional, but has a lot of weight. Avoid it if you can.
- We prefer that you do not use paints on the exterior of your payload. If you want to decorate the exterior, colored markers are usually best. If you feel you must use paint to achieve a unique design, contact us first with details about what you're doing.

Interior Items

- All items inside your payload container must be secured to the bottom or sidewalls of your container. We recommend double sided foam mounting tape (Scotch 3M brand), industrial strength Velcro and/or clear packaging/shipping tape.
- Do not include bubble wrap or bubble padding as a protection method. The bubbles will burst well before they reach maximum altitude.
- Do not include hand warmers as a heat source. They aren't necessary and won't work in the thin upper atmosphere.

Cameras

- Action cameras must be wrapped in copper tape to contain electromagnetic interference that will disrupt our GPS systems. If you don't want to apply copper tape directly to the camera, you can attach the copper tape's sticky side to clear plastic wrap (Saran wrap) first, cut out a rectangle and then wrap the copper tape (with the plastic wrap) around the camera like birthday present. Make sure the plastic wrap side is touching the camera. Secure the loose edges with more copper tape on the outside of the wrap.
- External batteries are likely necessary. Most action camera batteries last about 45 minutes. Ascent will take about 2 hours and descent will take about 40 minutes. Your camera battery should be able to last for 4 hours to survive pre-flight, flight and post-flight. External camera batteries generally need to be thermally protected inside something like a Styrofoam cooler to protect against the -60° F temperatures.
- Housing (cases) for your action camera should be avoided, if possible. They are bulk and added unnecessary weight. They can also trap moisture and ruin footage. They can also break during the pressure drop. Most action cameras will survive with just the bare camera itself. Embedding the camera in the sidewall of a Styrofoam cooler with just the lens poking out is a great option.

Electronics

- Electronics must not interfere with our radio transmission positioning reports which occur on a frequency of 144.390 MHz
- Electronics must be tested for electromagnetic interference prior to sending to us. You can use a free Android application called GPS Toolbar to test if your electronics interferes with your phone's GPS satellite acquisition. Contact us if you need help verifying this.

Batteries

- Do not use Alkaline batteries, they won't make it.
- Lithium (Energizer) batteries are the best (**not** Lithium-Ion batteries! There is a difference!). These batteries generally survive throughout the flight even if completely exposed to the frigid temperatures.
- Lithium-Ion batteries can be used, but should be thermally protected inside your payload container.
- If you want your batteries charged by the flight team prior to flight day, you must include this on your pre-flight checklist and you must include a charging cable and plug for any device that needs to be charged.
- Ensure that all your batteries can last for at least 4 hours. Your payload will be tested prior to flight, turned on 30 minutes for prior to launch, fly for 3 hours and may be delayed for hours for recovery.

Operations

- If you are not expecting to pay for assembly labor then your payload should be fully ready to fly when sent to us. If we need to complete assembly procedures before flight day, those will be billed at \$50 per hour. If we find a safety or regulation issue, the payload will not be able to fly until resolved.
- On flight day our launch team will **(1)** power on electronics, **(2)** seal your payload container with packaging/shipping tape and **(3)** attach your harness to the balloon train. **Any other steps beyond those 3 items must be completed prior to flight day by you or by us (for a fee). We will not perform any other steps or assembly on flight day.** If your payload needs additional steps on flight day, it will not fly that day. Items cannot be added or removed from your payload after our flight team establishes a final weight. **You will not be able to make changes to your payload on flight day.**
- A **DETAILED** check list should be provided for anything that needs to be performed prior to flight day as well as what items must be powered on for flight. Provide very explicit details on any wires that need to be connected, buttons that need to be pressed, etc. Our flight team will not assume any steps and does not have time to learn how to operate device menus. For example, an action camera power on sequence would be: (1) press and hold power button for 3 seconds, (2) push front camera button 4 times for video mode, (3) press top button to start recording. A one-line item that says “turn on the camera” is not detailed enough.
- Payload construction is just as important as, if not more important than, the actual onboard equipment and experiments. Put some thought into how you can make the payload lighter, more aerodynamic, safer or even better looking (without adding weight). Bonus points for crazy and/or unique designs that don’t add extra weight!!





Flight Readiness Checklist

For your payload to be ready to fly and manifested to a flight, it must be fully prepared and ready to fly well in advance of your actual flight day. Flight day operations will be restricted to simply **power on, sealing the payload and attaching to the payload train**. Any other operations for assembly or preparation must be completed well in advance of your flight day. The checklist below will help you ensure you have included and prepared the essential items for flight, but should not be construed as a full list. It is your responsibility to ensure your payload is full ready to fly and prepared for flight day.

Your Name: _____ Organization Name: _____

Signature: _____ Today's Date: _____

	Completed
All items on the interior of your payload box have been secured to the sidewalls with industrial Velcro, double-sided foam tape or hot glue.	
All items on the exterior of your payload box have at least 2 methods of attachment for redundancy. Usually packaging tape & a safety line/string as a backup.	
A harness has been added and secured to your payload box with attachment points both above & below the payload box. String harnesses should be secured with packaging tape or duct tape.	
My harness has two attachment points to connect above or payload the payload	
Action cameras have been wrapped in copper or aluminum tape to contain electromagnetic interference.	
I have prepared a detailed pre-flight checklist AND a flight-day power on checklist.	
I have weighed ALL components and they are less than 4 lbs. in total combined weight.	
All string/rope used on or in my payload is no stronger than 50 lb. (50#) test line.	
I am certain that no items will become dislodged and fall from my payload during the flight.	
I have read through the entire Payload Construction Guide and believe that my payload conforms to these guidelines.	

Please return this completed checklist with your payload when sending it to us for flight operations.

Our shipping address:

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