PEAK OF FLIGHT

NEWSLETTER

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Convert an Umbrella into a Rocket Parachute

By David T. Flanagan

Introduction

Occasionally an umbrella will lose its battle with the elements. High wind may rip the fabric from the frame or turn the frame into a pretzel. So you have lost an umbrella, but if the fabric is not torn you have gained the main part of a mid-power or maybe even a high power parachute! Yes it takes a little patience and some modeling skill, and it is true the resulting parachute can be a little bulkier and heavier than commercial chutes, but maybe you can save a buck or two. We'll look at two ways to turn the salvaged fabric of an old umbrella into a parachute.

Figure 1: A damaged umbrella ready for salvage.

Disassembly

The first step is to remove the fabric from the metal frame. It is a very good idea to wear safety glasses during this phase. There are a lot of long, sharp metal parts involved here, some of them spring loaded, and you are not exactly sure just how they go together. So wear safety glasses. I mean, they are right there on your hobby bench where they belong, right? Put them on!

A hobby knife works, but the best tool to dis-articulate the fabric of an umbrella from the frame is a seam ripper. Carefully cut all the various threads and bindings connecting the fabric to the frame, being sure not to poke holes in the fabric. Some umbrellas are difficult to remove at the center (which will become the apex of the parachute) but most are pretty easy. The last umbrella the author disassembled had a simple plastic screw cap holding the apex to the umbrella frame. When the cap was removed the fabric material popped right off the metal frame. It even had reinforcement sewn around the very small hole so already the canopy had a nice strong apex with a very tiny vent.

Once the metal frame is free, wrap it up with duct tape or otherwise get it under control so it can't hurt anyone. Then get rid of it.

Figure 2: The fabric is completely removed from the frame. Note that the canopy does not lay flat – it has a three dimensional shape. This is true of most umbrellas. It is not an issue.

Mid Power Parachute

The umbrella dissected in **Figure 2** is about 39" point to point (circumscribed diameter). Making this canopy into a parachute will not require a sewing machine or any unusual tools. The approach is the similar to that used to make a "gathered parasheet" with some modifications for additional strength.

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The first step is to select suitable suspension line material. Unless it is very heavy, string should be avoided. Very light line can be used. Form an "ear" of fabric where two of the umbrella gores join and tie the suspension line into place (**Figure 3**). The synthetic fabric of most umbrellas is very slippery as are synthetic lines, so this joint would not likely survive a healthy opening shock. It is necessary to tuck the ear under the canopy and lash it in place with a separate short piece of line (**Figure 4**). The author used some waxed twine that was available, but nearly any type of line may be used.

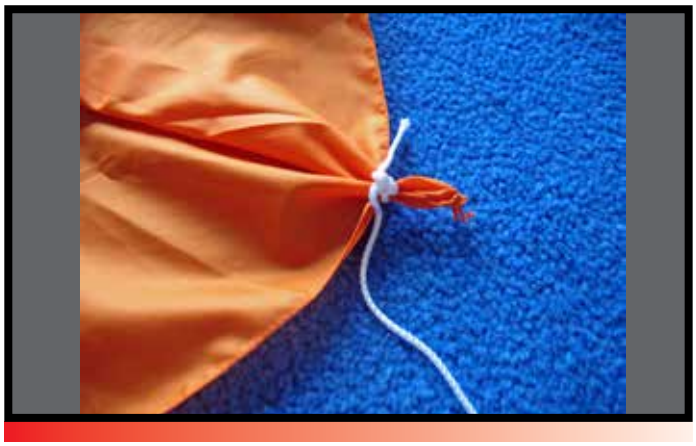

Figure 3: The "ear" is formed and the suspension line tied around it.

Securing the ear to the underside of the canopy can also be done by "tacking" it in place (hand sewing) or even whipping it in place with light thread.

Figure 4: The "ear" is tucked under the canopy and tightly lashed in place.

Regardless of how the ear is attached to the underside of the canopy, the whole purpose is to create a secure "loop" of sorts at the edge of the canopy through which the suspension line is routed and tied. There are probably other options.

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A drop of glue worked into each knot will help prevent unraveling (**Figure 5**). Even better, believe it or not, is silicone caulk – it will not dissolve in damp or wet conditions such as dewy grass, humidity. etc. (The author routinely uses silicone caulk to secure various knots on scuba gear.)

Figure 5: The complete line attachment.

The rest is straightforward. Gather the line attachment points on the canopy together and collect all the lines. Measure and mark the lines. Line length should be about 90% of the canopy diameter (about 35" in this case). An overhand knot will secure the lines and create a confluence point (payload attachment point).

High Power Parachute

The above techniques are probably not adequate when larger umbrellas are involved. Actual parachute manufacturing and rigging techniques should be employed. A sewing machine is extremely handy for this, but if one is not available all the sewing here can be done by hand, although it will be tedious.

Selection of the suspension line material is important. The author used a flat, hollow braided line much stronger than necessary. Similar line, sometimes called "550 cord" or "survival cord", can be found at almost any hardware or sporting goods store. This line will also be way "over spec." The main feature is that the line is hollow (or can be made hollow by pulling out the internal filaments). This allows flattening the line so it can be easily sewn to the canopy, and also allows for "fingertrapping" or sewing loops into the ends of lines where they are installed on the connector link.

Figure 6: Toss testing the 39" chute with a 2.2 lbm (1 kg) payload.

Figure 7: A 58" (circumscribed diameter) umbrella salvaged from its frame. It has 16 gores and will need 16 suspension lines.

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Fingertrapping sounds complicated but it is not. It is simply using a tool to pull the bitter end of a line back into the body of the line (see **Figure 8**.) It does however take practice.

Figure 8: Fingertrapping.

The tool in **Figure 8** is homemade and its main feature is a thin wire loop. The wire loop in inserted into the hollow body of the line and after travelling a couple inches towards the bitter end it is forced out thru the wall of line material. The bitter end of the line is then wrapped around a temporary "spacer" (a pencil in this case) and hooked into the wire loop. Withdrawing the wire loop from the line drags the bitter end of the line into the body of the line with it. A couple of hand stitches (or zig zag stitches if using a machine) will stabilize the trap. Excess line may be trimmed off.

If fingertrapping seems too difficult, simply sew a loop in the end of the line either by hand or with a sewing machine. Tying each line individually to the connector link (or around the spacer) is also possible but knots must be secured after tying. In full scale parachutes the bitter end of the line is sewn to the standing part of the line above the knots, but perhaps glue or silicone as discussed above will also work.

Figure 9: The "line set" of sixteen lines each with a finger-trapped loop stabilized by a few zig zag stitches.

Lines must be marked and cut to length before sewing to the canopy. It is best to do all the lines as a set.

Figure 10: Marking the suspension line set.

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Figure 11: The completed line set ready for installation.

Note that two marks are made on each line. The red mark indicates where the line is trimmed to length. The grey one must be even with the edge of the canopy when the line is sewn in place.

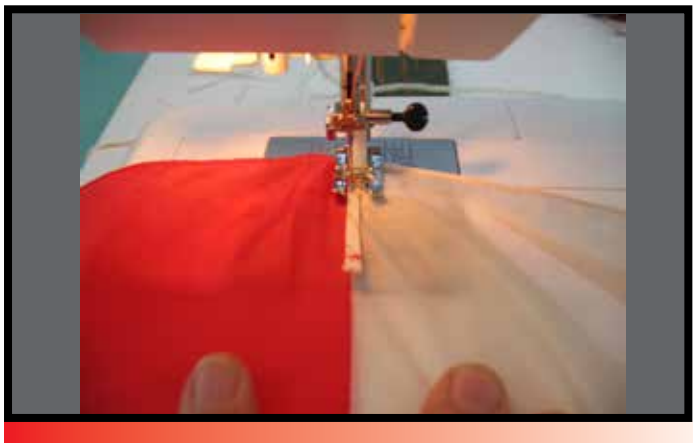

Figure 12: Sewing the line in place with a zig zag stitch. Lines may also be sewn to the canopy by hand.

Once sewn to the canopy the lines are installed on a connector link.

A Note About Parachute Riggers

If you would like to know more about parachute construction techniques it would be good to talk to an FAA certified parachute rigger. Many parachute riggers are also skydivers, so usually one or more riggers can be found at your local skydiving drop zone (DZ) on most any weekend. (The DZ nearest you can be found at https://uspa.org/DZlocator.) Generally riggers are pretty nice people. They like to help people or they wouldn't be constantly accepting all the legal risks involved in routinely servicing their fellow skydivers' main and reserve parachutes. If you were to visit your local DZ, especially on a rainy or overcast weekend when there is little or no jumping, you might find a rigger willing to spend some time briefing you on fingertrapping, rigging tools and techniques, parachute materials, and maybe even sewing. A rigger can also show you the basics of deployment bags, pilot chutes, and similar items that might apply to your recovery system. It never hurts to ask. Have fun!

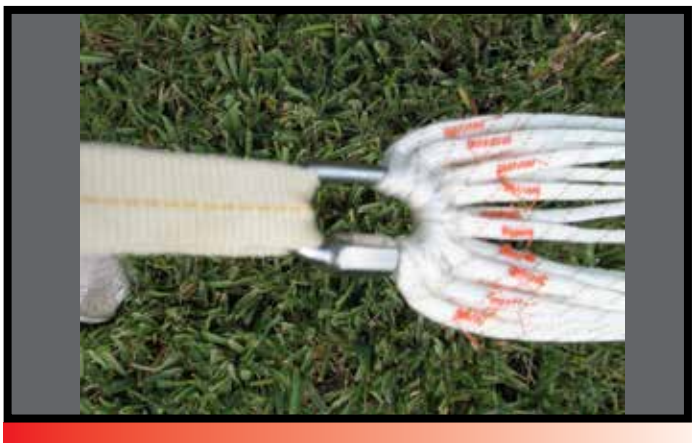

Figure 13: The payload end of the suspension lines (confluence point). The #5 connector link shown here is too small. A #6 link would let the lines be loaded more evenly.

Figure 14: The completed 58" parachute.

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About the Author

Dave is a registered professional engineer with well over twenty years of aerospace experience at NASA's JSC and MSFC. He holds bachelors and masters degrees in engineering and a bachelors degree in science, and while at MSFC supported NASA's University Student Launch Initiative. Although no longer actively jumping, he is a former Army paratrooper and holds an expert skydiver rating. Dave is a master parachute rigger and has completed the AIAA Parachute Systems Technology Short Course. He is a licensed private pilot and a certified ultralight pilot. Dave is retired and spends most of his time scuba diving and kayaking but does occasionally fly with the Northeast Florida Association of Rocketry (NEFAR, NAR #563, TRA #35).