

A Canopy for my Starduster Too C-FUMY

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First, some background. In 2000 I bought a Starduster Too (C-FMHW) in Nova Scotia and flew it home to Calgary, Alberta. It had a canopy which I believe was from the Starduster



company. It was a great aircraft and the canopy worked well except that there was considerable air intake from the back where it wasn't tight around the head and shoulders turtle deck. I had great fun flying that Starduster but I sold it in 2006 to buy a 1947 PA12. What can I say, I had a hankering for a vintage aircraft.

I missed the Starduster, so in 2017 I started looking for another and found a good one in Gage, Oklahoma. It was really nice but open cockpit only. In late May 2017 I flew the 1300 nm flight home, which had a few very cold moments, and I promised myself to install a canopy sooner than later.

I spent a lot of time searching for places to buy or have the canopy made and determined the best choice was a company call Airplane Plastics in Tipp City, Ohio, just north of Dayton. I contacted the owner, Jeff Rogers, and he told me he had made one canopy for a Starduster a few years earlier. He sent me a copy of the drawing and a photo of that one and ask me to provide similar drawings to fit my Starduster. And so the process began.

Making the drawings

First, I should mention that I puzzled over ways to make a completely sliding canopy, but for a 2-holer with a tapering fuselage this is extremely difficult to do. So I decided instead to copy the basic design from my previous Starduster and build a tip-up canopy, which still has to slide back about 8 inches in order to clear the upper wing sufficiently.

The drawings Jeff needed where a horizontal view and a vertical view. After studying the drawings he had sent it was clear I needed to do my own. As you know there are a lot of differences in the final finishing between plans-built airplanes like the Starduster. People finish the rear turtle deck differently, the curvature of the front turtle deck can be different and the method of supporting a canopy may vary depending on how the sides are finished and the

holes are cut. But in order to produce drawings I had to establish a base line. In other words, I had to build the ledges that the canopy would sit on and take all the measurements from there.

The ledges start at the rear cabane struts and go back to just behind the rear seat. In my case the sides from the firewall to the back of the rear seat are aluminum panels whereas most Stardusters have fabric covered sides from the firewall back. The longerons have tabs welded on the bottoms for attaching the side panels and the overlapping edge of the turtle deck (see photo 10). This shows the left ledge attached with the side panel mounting screws on the bottom and additional mounting screws with nuts on the top. This worked out well. I had to make the ledges in two sections – one for the parallel part to the back of the front seat and the second for the tapering part. I made them out of 6061-T6 .030" aluminum. I have a 30" break which was just long enough. Once they were made, and temporarily attached, I made meticulous measurements and produced the drawings. I have included the full-size drawings in PDF. You will have to zoom in on them.

I should mention Jeff offered a choice of several different tints and thicknesses of acrylic. I chose to go with no tint (clear) and the largest thickness of 1/8". With such a large canopy I wanted the extra strength vs the weight savings. (Total weight discussed at end). Also the canopy has perfect optics – no distortions anywhere.

Designing the frame

Once I had the bubble I set up a plywood work table and drew the ledges onto the plywood precisely as they are on the fuse. I then placed the canopy in place and screwed on small wood block to hold it in place exactly where I wanted it to sit on the ledges (photo 9). I trimmed the acrylic to fit the front and back decks (put it on and off a dozen times trimming off a little at a time). Once that was done it was time for the frame.

I used square chromoly tubing (5/8 x 5/8 x .049) for the two sides and 1/2" x .035 round tubing for the hoops. One where the canopy would meet the windshield section and one at the rear seat headrest. I also made two hoops to go across 1" above the deck between the cockpits for structural strength and something to grab to close and open the canopy from inside. These can be seen in photos 9 and 10.

To make the hoops I inverted the bubble and made two braces from 1" x 1/4" wood to go across the bubble opening at the two large hoop positions to hold the sides in the correct place to match where they sat on the ledges. With the canopy inverted I then used light corrugated cardboard to cut out a semicircular pattern for each hoop. This took several tries but once done I used them to make 1/4" plywood patterns. I did the same but in reverse for the two hoops that go across in the middle. Once they were done I attached them all together, as the final frame would be, with 1/2" wood dowels. So now I had a wooden pattern matching the metal frame so I

simply turned everything right-side up on the work table and made final adjustments. Photo 22 shows the canopy sitting on the plywood mockup of the frame.

With this done I could now take it apart and use the plywood pattern pieces to bend the ½ tubing to match. I also had to put a bend in the square tubing base pieces at the point where the fuselage starts to taper. I added two small bracing pieces of tubing in between the mid-section hoops as well as a square plate and a piece of 3/16" tube to mount the latch on. This can all be seen in the final welded-up version in photo 10.

To attach the bubble to the frame I decided on #8 AN525 washer head screws. I thought of blind rivets but wanted to be able to easily take it apart if necessary. With the canopy clamped to the bottom square tubing I drilled all the holes (3" spacing) through the acrylic with an acrylic bit. This is very pointed so it conveniently left a tiny mark in the tubing which served for centering the steel drill bit I used to drill the matching holes in the tubing. With the bubble removed I finished drilling and tapped each hole in the tubing.

After painting I did the final assembly with a star lock washer against the screw head and thin flat washer against the acrylic. I think this should be good but if screws start to work their way loose I can reattach them with locktight.

Hold-downs

To hold the canopy down when closed I made and attached a short piece of ½" steel rod with one end tapered to the front end of the left ledge. When the canopy slides forward the square tubing slides over this pin and is secure (photo 11). The right side doesn't need one since it is held down by the hinge pin. I also made a hook type attachment for the back ends of the square tubing which hook under the ledge when the canopy slides forward and hold it down there – one on each side (photo 12).

The latch is something I copied from the canopy latch on the RV's. It is an over-center type that pulls the canopy forward so it locks under the windshield fairing. It does not hold down the canopy just locks it in the forward position. I bought some of the parts from Rans but they could easily be fabricated if desired. I have attached a drawing of this as well as photos 15 and 16.

Front windshield

Once the bubble was attached to the frame I put the canopy on the ledges and clamped it in place. I then laid up the fiberglass front fairing that would attach it to the turtle desk and the hoop fairing across the top which would be attached to the windshield and provide for the canopy to slide under the overlap and hold the position plus prevent wind from getting under the top of the canopy. The overlap is 1/2".

Once the fiberglass was done and trimmed I attached it to the deck with #6 screws and nylocks (had to remove the front panel for access). I then removed the canopy and made the make or break cut that separated the windshield and canopy. Fortunately it went well.

Hinges

The hinging of the right side of the canopy so that it would tip up was planned and worked on at several different points. Early in the process I sat in the front seat several times to determine how far the canopy would have to slide back before tipping up to both provide reasonably easy access and to miss enough of the top wing to permit the canopy to tip far enough so that the center of gravity of the canopy would hold it open by its own weight. I used the front hoop plywood pattern for this exercise. The answer is 8".

For hinges I just bought some heavy-duty door hinges from a local builder's supply. I picked ones that would fit a 1/4" hinge pin and were large enough that I could cut them into smaller lengths and be able to drill mounting holes where I wanted. I bought a length of 1/4" OD x .065" wall chromoly tubing and this seems to be ridged enough for the job. Two hinge pieces are welded to the bottom of the 5/8" square tube on the right side at the appropriate spots. I had to be really careful to align these hinges with the tubing while welding. Three hinge pieces are mounted to the ledge (photos 13, 8, 20). I used floating anchor nuts on the inside of the ledges to provide a little adjustability. The first and second hinges from the front are spaced to provide the front and rear stops.

To secure the hinge pin I simply drilled small holes in the front and back and used a cotter pin and washer at each end.

Sliders

One last thing. To get the canopy to slide easily without scratching metal I bought some 1/8" x 3/4" strips of UHMW (Ultra High Molecular Weight) plastic and glued these to the bottom of the square tubing before painting. I just used a 2-part epoxy glue. The 3/4" width covers the 5/8" tubing plus the edge of the 1/8" acrylic. (A local supplier of the UHMW happily cut the strips for me for a total cost of only \$20).

After painting I stuck some self-adhesive Teflon anti-chafing tape from Aircraft Spruce to the top of the ledges. This provides a very low friction contact between the canopy frame and the ledges and also accommodates the welded-on hinges on the right side with simple cutouts in the UHMW. In fact, the only friction is on the hinge pin and without that the canopy slides back by itself due to the slop of the fuselage when stationary. (Photos 17, 19)

A few more tidbits

I weighed the finished canopy before cutting the windshield off at slightly under 20 lbs. without the ledges, which were already mounted. There was a slight reduction from the rear windshield that was removed so I just used 20 lbs to adjust by W & B. The center of weight on the canopy was exactly at the point where the fuselage taper starts – behind the front seat.

To cut the acrylic I used a Dremel tool with a 2" cutting blade at high speed. I did three passes, the first is a slow, precision cut just deep enough to score it, the second going back over it a little deeper and smoother, then the third going all the way through. This worked well for me on all the cuts. Then a final pass with a fine sanding block to smooth the edges.

To fly open cockpit it takes about 5 minutes to remove the canopy, leaving the front windshield, and about 30 minutes to reattach the rear windshield (which is secured with many bolts and nuts). It would take even less time if I installed anchor nuts. Frankly I like the canopy so much I doubt I will ever do this. In my neck of the woods summer temps rarely get above 25C (77F). I have flown it with the old windshields and the support ledges attached with no noticeable affect.

You can take the full-size drawings I included to Staples and get them printed full size on paper if needed. This is how Airplane Plastics wants to receive the drawings, if you go to them.

You are welcome to contact me if I can be of assistance in any way:

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