

GlaStar Service Letter 6

Subject: WEIGHT CONSCIOUS GLASTAR ASSEMBLY

Applicability: All GlaStar kits

Discussion: In the beginning stages of developing the glastar, we set goals for performance, weight, build time, cost, quality and other desirable features. If we miss the mark on a particular category, we can sometimes make changes to achieve the goal, but it takes determination and perseverance. As with our human bodies, when the airframe weight comes in heavier than desired, it is a very difficult task to go back and find ways to lose weight. Some decisions can result in saving pounds, but there are a lot of areas to save many ounces which add up to pounds.

Building your own kit aircraft is similar to designing a prototype because there are no two glastars built the same. Sure, there are many standard parts which makes all glastars look the same, but why do some finished products weigh anywhere from 1150 lbs to over 1400? The answer is in the choice of engine, prop, instruments, options, paint and upholstery. The problem is that most builders do not have much of an idea what the final product is going to weigh when they are finished. Maybe there is wishful thinking and hope that it doesn't come in too heavy when weighed, but not much in the way of goal setting and careful calculation for each option added.

Here are some suggestions we hope you find helpful to achieve the desired weight and performance with your own finished 'Star'.

DEFINE YOUR MOTIVATION AND MISSION.

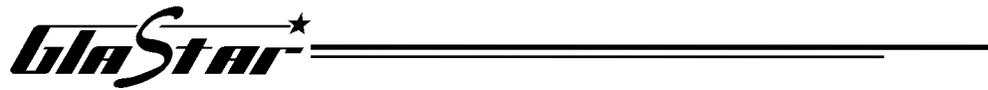
Some people plan a vacation far enough in advance so that they can get in physical shape by the time they go, especially if they are going to be seen in a bathing suit. Use the same psychology before starting the assembly your plane. Set in your mind the kind of mission and performance you wish to achieve and let that be the motivation for the target weight. In some cases, builders have been bitten by the bug to go on back country, short-strip safaris and since some GlaStars will be periodically on floats, you'll want your plane to be as light as it can be.

Everyone's mission won't be the same, but to get maximum performance, weight should be high on everyone's priority list.

Maybe you live in the Midwest and your mission is to fly IFR and you want long range and an autopilot. Well, you will be packing extra weight with a heavy panel, aux. tanks and autopilot installation, but don't need 180 h.p. because your typical flight won't involve climbing mountains. In this case an 1150 or 1200 lb. empty weight may be unrealistic, but with a 160 h.p. engine with light weight starter and alternator and light weight interior, you could still shoot for 1230 to 1250 lbs.

Define the variables and add up the weights.

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Variables are the things (options) you add to the project. Once you define the mission in step 1, make a list of the options you *need* and another list of the options you *desire* and keep a scale handy in the shop.

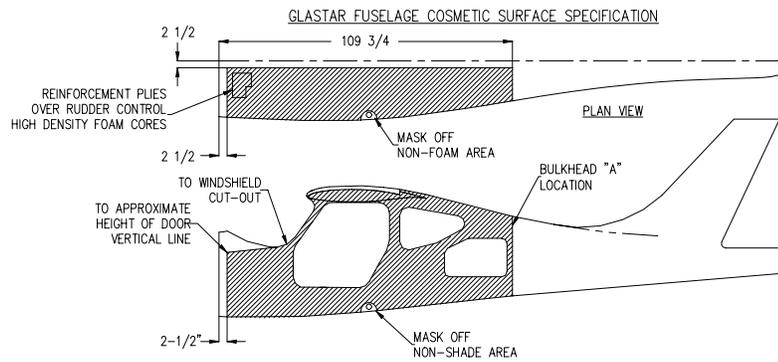
| Sample lists: | <u>Needs</u> | <u>Desires</u> |
|---------------|----------------------|----------------------|
| | Engine, 160h.p. | 180 h.p. |
| | Prop, fixed pitch | Hartzell C.S. |
| | 30 gal fuel | 50 gal fuel |
| | Upholstery, light | Leather |
| | Flight instruments | IFR instrumentation |
| | Avionics, (GPS com.) | IFR avionics |
| | Rudder pedals | Cast aluminum type |
| | Single brakes | Dual brakes |
| | Exterior paint | Paint inside and out |

After making a list like this one, but more detailed, calculate the weight difference between the needed items and the desired ones. If the total calculated weight exceeds your target weight, start dropping some of the desired options or get creative on where to save weight in other areas.

DON'T DISMISS THE OUNCES

It could be a disappointing mistake if you think you are doing a great job with saving 12 lbs. on engine choice, 15 lbs. without aux. tanks and ignore the myriad of little places weight gets added one or two ounces at a time. We've outlined some areas here that we believe account for the disappointment at the end of the project where you stand back just after the plane was weighed and ask yourself, "Where in the name of Pete did that extra 70 lbs come from? I figured my empty weight was going to be somewhere around 1265—not 1335 or 1400!"

- a) **Corrosion protection.** Even though you may plan on flying floats occasionally on salt water, you may want to only etch and alodine the internal skins and ribs inside the wings, flaps and ailerons but only spray a light coat of self-etching Marhyde primer on the rib flanges and skin rivet lines. The weight gain of spraying a healthy coat of primer on all inside surfaces may be 5-8 lbs. The exception to this rule is with the stabilizer, elevator and rudder. We suggest you will probably give these the full meal (etch, alodine and primer) deal on the inside since they get literally bathed in salt spray on takeoff and landings.
- b) **Interior and upholstery.** The weight savings in this category can be huge. Consider spraying an interior coat of gray Zolatone-- a speckled, textured paint--on all interior fuselage surfaces that will be visible behind the cage **before** the sides are seamed together.



SPRAY "ZOLATONE" (OR EQUIV.) IN SHADED AREA PRIOR TO FUSELAGE ASSEMBLY

NOTES:

PARTS PREPARATION:

1. SAND OFF ANY VACUUM BAG WRINKLES OR OTHER VISIBLE SURFACE IMPERFECTIONS PRIOR TO PAINT.
2. ADD REINFORCEMENT PLYS OVER RUDDER CONTROL HIGH DENSITY FOAM CORES.

TOP DECK:

1. SPRAY GRAY PRIMER UNDERCOAT AND "ZOLATONE" TOP COAT ON ALL INSIDE SURFACES, EXCEPT BOND AREAS.
2. USE PEEL PLY OVER LAMINATES
3. FOLLOWING TOP DECK INSTALLATION, SAND & DEBURR ALL ROUGH EDGES AND COVER LAMINATES WITH OVERLAP "ZOLATONE" SPRAY.

FUSELAGE:

1. MASK NON-SHADED AREAS AND FUSELAGE UPPER SEAM. MASK TO 1" OF WING ROOT FOR TOP DECK BONDING. (FIRST THREE SETS ONLY)
 2. FOLLOWING BULKHEAD "A" INSTALLATION, FINISH SPRAY BULKHEAD "A" WITH "ZOLATONE".
- TOLERANCES: ALL DIMENSIONS ±1/4"

Tape off all fiberglass seam areas, and sand and spray a touch up overlapping coat after the seams have been laminated and sanded. These areas include top deck laminates (wing roots and leading edge), door opening aft to baggage bulkhead, windshield/door post, and fuselage sidewalls forward of the doors to the firewall. After the top deck is laminated in place, the fiberglass seams also will need a touch up coat of texture paint. Advanced cosmetic planning like this will mean you can dismiss any temptation to add weight with contact cement and upholstery fabric in all these areas, not to mention all the upholstery panels seen in some GlaStars to cover the cage. The powder coat finish of the cage looks great, and it makes sense to have it open for inspection—all the time. There are many brands of rattle-can speckle paint similar to Zolatone available at most hardware stores.

In the baggage compartment, we suggest covering the floor and control cable tunnel with a thin, lightweight carpet, but only a short way up the fuselage sides. From there upward, spray texture paint all the way up and around the aft windows.

The doors would be sprayed with the same treatment around the edges and window frame (after the dogs are bonded in and laminates filled and sanded) and a lightweight panel upholstered and screwed in place. Elbow rest plastic door handles from mid to late 80's Honda cars from local wrecking yards weigh only ounces and if you search hard enough, you will find a set to match your interior colors. Our local yard charges \$15-\$20 per set.

Consider covering the seats with a durable, lightweight fabric. Leather wears very nice, but keep in mind it weighs more. If you install drain pans for wing fold weather protection, consider painting them with a gray finish or similar speckle paint. Behind the seats, you can cover the lower aileron and flap cable pulleys with a thin aluminum panel that extends vertically halfway up

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the cables. This is important in order to keep baggage compartment objects out of the control cables. In our opinion, they don't have to be protected any higher than that. (Look inside a Cub or similar tube and fabric plane. Many cables are visible). The forward tunnel between pilot and co-pilot legs needs a cover; easily fabricated from .016 or .020 aluminum and painted gray.

The dash panel can be purchased as an option or made from thin aluminum or fiberglass with a flat black painted finish supported with aluminum angles extending from the panel to the front edge of the windshield. Some may want to consider a gray, thin fabric glued down on the dash to reduce glare.

That's it for our suggestions for a spartan but cosmetically appealing interior finish. Guaranteed to save 20 or more lbs. over the cover-the-cage with panels and glue fabric everywhere method.

- c) **Exterior paint.** Unless you plan to sand off all the gelcoat weight, leave it as-is. Paint the wings, flaps, ailerons and tail surfaces with a matching white polyurethane. (The gel coat we use is actually a slight off-white). Bare aluminum is lighter, but too much maintenance for most. We'd guess the paint on all these surfaces to weigh 15-20 lbs.
- d) **Windshield.** Stay with the stock 1/8 thickness. The 3/16 windshield adds about 6 lbs. and adds nothing but *maybe* a little noise reduction. (Let the headsets do the job here). Some claims have been made toward extra bird-strike protection with the thicker windshield, but realistically you get nothing more than hummingbird protection if you've ever witnessed bird strike tests or studied the physics of bird mass, speed and impact point.
- e) **Bracket trimming.** Most brackets don't need square edges on the corners. A healthy 45-degree chamfer or corner can be nipped off most rib flange-ends, bracket corners, and aluminum angles. I know this seems trivial, but at the end of a project, a small can of these trimmings may weigh a full pound or more!
- f) **Laminates.** All too often, fiberglass laminates are too resin rich and wider than they need to be. When multiple laminates are called for, stagger the widths so the edges don't stack up. If the book says to lay up (3) two-inch wide lams, cut them at 1.5, 1.75 and 2.0 inches wide and start with the narrowest first. This is just as strong and a little lighter. Use peel ply to keep all laminates neat and tidy and don't be afraid to taper sand rough edges down after cure.
- g) **Instrument/avionics choice.** Money can save weight here! The latest developments in flat panel screens and digital instruments are getting lighter all the time. For the overall layout, keep the mission in mind here. Full panels look awesome, especially when they are lit up at night, but try to keep it to the minimum you'll need.
- h) **Engine accessories.** A lightweight starter and alternator can almost make up the weight difference between the 160 and 180 h.p. Lycoming. But these items on the 160 will save all the more weight!
- i) **Rudder pedals.** The original thinking on the GlaStar was to have very light pedals. Cast aluminum pedals weigh about three times as much. The flat, simple homemade pedals may be more difficult to actuate toe-brakes, but before giving up on them, try making them a little taller and riveting a light, half-round toe pad similar to the cast design and glue down some non-skid pad material. They may still weigh less than the weight of the cast aluminum ones. If you insist on using the cast pedals, drill them full of lightening holes.

- j) **Window installation.** We've had experience with both the assembly manual pigmented resin method and the GE Silpruf adhesive method recommended by Airlink. We like the Silpruf method better. It's easier to get a good cosmetic finish and has to be a little lighter.
- k) **Stick grips.** For the weight fanatics, consider slip over foam bicycle grips (tipping the scales at a whopping ounce each!) with some kind of cap on top with a push to talk switch, or the coolie hat trim switch on top with a small, push to talk switch taped to the side of the grip in the best ergonomic position. This may sound funky, but try to find a way to wrap a side switch mount with black electrical tape that would look and function fine. If this experiment fails, you can always settle with a plastic grip from our catalog.

By now you should have a feel for how to get in the mind-set of building a light GlaStar and reaping the benefits of the extra performance to be gained. Because you chose to build it as light as you could, you will 'feel' the difference, especially in take-off and climb performance.

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