



Technical Article – Sonex Gross Weight Testing

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As part of your 40 hour Phase I flight test activities, the builder is expected to slowly add weight in order to demonstrate the aircraft remains safe and flyable throughout its weight and balance envelope.

AC 90-89A is the Flight Testing Handbook. Read it and become familiar with it. Unfortunately, there is not a lot of advice contained within, and, of course, no Sonex-unique advice.

The content of this paper reflects what I did to support the flight test activities of my airplane, Sonex 1170. These steps should not be repeated by other builders, since each plane varies in its empty weight, the weight of the pilot, local weather, and CG calculations. If any doubts exist, discuss them with your local EAA Chapter Flight Advisor.

First of all, you must decide what material you will use to simulate a passenger load. Do not use a live human being, as that would violate your contract with the US Government (your Phase I Operating Limitations). I used 40 lb bags of cement. These are smaller in size than the traditional 80 lb bags, and are easier to handle. I wrapped mine in the plastic sheeting provided by Lowes to protect your car's trunk from, well, cement dust. I securely taped up all seams to prevent any cement dust messing up my plane.

Next, ensure that your ballast is securely restrained in the seat (or baggage area if you are testing that area). I used a secure net, tied at the bottom thru the center seatbelt hole, around the back of the seat, to the outer fuselage. I then tied the top corners of the net to the bottom cross-threaded rope. To that, I fastened the seatbelt. It's just sitting there, after all. Do not rely on the seatbelt alone. The last thing you want to happen is to have a 40 lb bag of cement suddenly wedge itself between the other bags and the control stick.

Naturally, you should gradually increase the weight of the bags. I started out with 80 lbs, then 120 lbs, then 160 lbs, which brought me to my gross weight. It is important to re-calculate the weight and balance for each weight increment as well as fuel quantity. Speaking of which, **DO NOT FLY YOUR AIRPLANE IF YOUR AFT CG EXCEEDS THE ALLOWABLE MEAN AERODYNAMIC CHORD CG LIMITS.** Severe aft CG can result in a dangerously unstable aircraft of any make or model.

The first test of each new weight addition should begin with as much fuel loaded as practical. This will help ensure there is some distribution of the weight between forward and aft CG. Make sure that in addition to your stall tests and other inflight stability tests with each increment, you should also execute some landings at different fuel loadings. That "just fine" W&B that you started with could get closer to adverse aft CG as the tank empties.



The Sonex flies just fine at its gross weight, but it does fly differently. Most notable is that if you have a conventional (i.e., tailwheel) airplane, you will immediately notice that it takes more forward stick pressure to raise the tail on your takeoff roll. Mine was a bit heavier at the 80 lb setting, but when I upped it to 120 lbs, it caught me unprepared. I approached the "normal" speed at which I normally start to apply forward stick pressure, and....nothing. Hmmmm... speed continuing to build....I push some more. Nothing. Finally I added even more pressure, and the tail came up. There was nothing uncomfortable or unsafe about what happened, but it was different than what I had experienced in solo flight. So, as your weight increases, you may need to adjust your takeoff trim setting from a neutral setting to one with greater nose-down trim.

The second unfamiliar characteristic was one I had also felt in my C-172 at higher weights. That is, you will need to have higher airspeed at the time of rotation than that with which you've been familiar. Once I had the tail up at 120 lbs (second flight, with trim set properly) I rotated at my normal speed. Up we go...a few inches, then settled back on the runway. After a few more MPH were added to the airspeed, a normal rotation and climb-out ensued.

When I added my last bag of cement (160 lbs total), I thought (incorrectly) that it wouldn't be all that different. My CG was a bit more aft than previously tested, but I was still well within limits. Taxiing out, I double-checked my trim setting, just to be sure. As I started my takeoff roll, it took a bit longer than with 120 lbs to get up to a decent airspeed for takeoff, and rotation and climbout were quite normal. A bit more sluggish than when at solo weight, but at 80+ F degrees OAT, I was still observing greater than 400 fpm climb - not bad on an 80 hp AeroVee at full gross weight.

The real "fun" however, came back to bite me on my landing attempt. USE FULL FLAPS! Due to distractions on my base-to-final turn in the form of unexpected crosswinds at pattern altitude, I had neglected to provide additional nose-down trim. As a result, I crossed the numbers and started to settle-in, but noticed I was a bit too fast. I eased back on the stick, but due to the severe aft CG, the nose came up more than I needed, and the tailwheel struck first, which then slammed the mains on, which then provided a sporty bounce. I applied full power for a go-around, but since I still had about 5,000 ft of runway remaining, was able to re-establish a landing profile and get her on the ground. It wasn't pretty, and bounced a bit more than I'd like people to see, but no parts were left on the runway and the gear legs remain straight.

Folks, the Sonex is a great, solid airplane, but it can't completely save you from stupid mistakes. Make sure you familiarize yourself with available flight test aids such as AC 90-89A and talk things over with your Flight Advisor. Know what to expect, expect the worst, and be pleasantly surprised at the forgiving nature of our great aircraft.