Weight And Balance

GENERAL

Weighing and balancing your aircraft is a most important step in preparing for testing. The process discussed here is not just a government requirement. It is a critical step in assuring the safety of flight. During this process the builder establishes estimated safe loads that are to be verified or modified during the flight test operations.

You must know exactly where the centre of gravity is when operating your aircraft. Operation of the aircraft beyond the established forward or aft limits may result in a crash, injury, and possible death.

LIMITATIONS

The designer's original unproven limits were used as guidelines during testing of the prototype. After tests the design limits were modified to reflect test results. The revised design limits are shown below.

Design Forward Limit	Station 61.5
Design Aft Limit	Station 65.6
Design Max Gross Weight	
Limbach	1200#
Continental 0-200	1300#
Lycoming 0-235	1400#

WARNING: NEVER OPERATE YOUR AIRCRAFT OUTSIDE THE DESIGN LIMITS.

During the flight test phase always move the CG aft or forward in small increments. Your aircraft may act differently than the prototype and require more restrictive weight and balance limitations than the above.

WEIGHING

Prior to this operation you should read a text on the subject. Toy Bingelis' "Weighing Homebuilts" in July 1991 Sport Aviation is recommended.

It is best to use approved aircraft scales or commercial balance platform scales. Bathroom scales are usually unacceptable.

Prepare the aircraft for weighing. It should be ready to fly but with no fuel in the tanks. Have the upholstery and everything else in place. If there is any permanent equipment missing such as an ELT radio or fire extinguisher make notes on the data sheet as to the weight and station where the item will be added. Keep the data sheet neat and complete. Trust nothing to memory. Define all the conditions.

When the aeroplane is lifted prior to placing it on a scale the main gear legs will spring together. When again supporting weight the gear will spread. This may cause extreme side loads and inaccuracies of the scale readings. Strapping the gear or using a solid plank or other object across the main gear scales can prevent this. Another way is the roll-up ramp technique described by Bingelis.

Use shims of wood to level the aircraft. The fuselage water line must be level. A level of almost any kind placed on the window sill will determine when the fuselage is level.

Take tare readings (zero weight readings) before and after placing the aircraft on the scales. Record the weight on the right, left, and nose (or tail) wheels.

GEOMETRIC MESUREMENTS

The exact stations of the wheels must be determined. This can be done on the scales or can be done as a separate operation before or after the weighing. The fuselage however must again be level. A plumb-bob, string line, and some masking tape will be required. Establish the wheel (axle) locations relative to a known fixed location. The joggle where the cowl fairs with the fuselage, Station 32, is a good known location.

CALCULATING THE CENTER OF GRAVITY

If you are unfamiliar with this process get some help or refer to a good text. All calculations can be done with high school mathematics. Or if you have a personal computer then set up a spreadsheet as shown on the next pages. Typical Weight and Balance spreadsheets are included as examples. Don't be tempted to "hang your hat" on the typical Weight and Balance calculations. The exercise must be repeated for your aircraft.

Calculations may show that your aircraft will require reduced service loads or the addition of ballast to stay within the established limits. Note that the Limbach powered prototype required ten pounds of ballast at Station 7.5 and seat weight was limited to 360 pounds unless additional ballast was added.

Each builder may desire to prepare a chart of allowable baggage versus occupant weight. See the example included in the following pages.