

**Murphy Aircraft Mfg. Ltd.**

Unit 1, 8155 Aitken Road,  
Chilliwack, British Columbia, Canada  
V2R 4H5

Tel: (604) 792-5855

Fax: (604) 792-7006

**Technical Bulletin 041096rb**

**April 10, 1996**

**Chilliwack, British Columbia**

**Attention: Rebel Builders and Pilots**

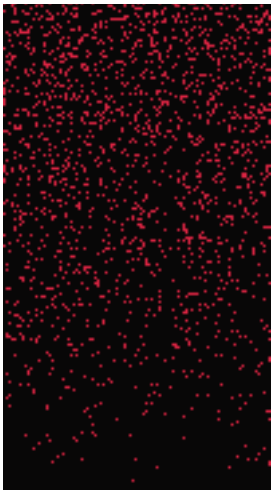
**Subject: Murphy Rebel Center Of Gravity Calculations**

**Contact:            Technical Services**  
**Murphy Aircraft Mfg. Ltd.**  
**Ph. 604-792-5855**  
**Fax. 604-792-7006**  
**e-mail [murtech@murphyair.com](mailto:murtech@murphyair.com)**

Recently there has been some concern among builders who apparently did not receive Bulletin #071095RB or the attached Rebel Weight and Balance information. The bulletin refers to the increase in allowable gross weight when operating on floats. This limit was raised by 5%, resulting in a limit of 1520 lb. for the 1450 lb Rebels and 1730 lb. for the 1650 lb models.

At the same time, after extended testing of the Rebel in a number of different configurations, there was a change in the recommended forward CG limit. The theoretical limits for the 4415 airfoil are between 12 and 30% of the Mean Aerodynamic Chord (MAC), however the recommendation for the forward limits has been changed to 20% (approx. +10.85" from datum).

The forward limit on the other hand, according to theory is 12%. In practice however it has been found that 20% is the more desirable forward limit for a number of reasons. This recommendation is based on hundreds of flight hours and feedback from Rebel builders. It has been found that in most cases, airplanes flying forward of 20% tend to be somewhat nose-heavy or at least lacking slightly in up elevator authority. In addition to this, the airplane simply performs better, the closer the CG is to aft. This results in better cruise, better climb and generally a more enjoyable airplane to fly. Although some airplanes are flying at CG locations forward of 20% without problem or complaint and are considered safe, it was decided to make 20% the recommended forward limit.



The aft limit has been tested to 33% and 32% was therefore selected as the aft limit. The recommended limits therefore are as follows:

Forward: 20% MAC (+10.85")

Aft: 32% MAC (+18.10")

Important: although the empty weight CG location may be outside of the limit, the important thing is that the CG location for different loading cases does not violate the limits. The reason for doing an empty weight center of gravity measurement as you do when you perform the weight and balance is so that you can accurately calculate the CG location for any loading case. Usually the most critical loading cases are usually the most likely forward and aft CG locations when loaded.

**Forward Case:** The most forward case (in the Rebel) would in most cases occur with a single pilot, minimal fuel and no baggage. By following the steps shown in the Rebel weight and balance calculations, you can easily calculate the CG location knowing the pilot weight and seat location relative to datum.

**Aft Case:** The most critical aft loading case will usually occur with full fuel, pilot, passenger and a generous baggage load behind the seats. Note however that the baggage weight has the most profound effect on the location because of its longer moment arm from the datum line, therefore there could be cases with a single pilot, full fuel and even more baggage which are critical. For this reason, you should always try to distribute your baggage load whenever possible. In any case, based on the majority of Rebels which are flying, it is rare to load one to the aft limit.

**Please Note:** The forward CG limitations are the primary reason that we recommend cutting the firewall back on airplanes which will be mounting heavier than Lycoming O-235 engines. The procedure for doing so is outlined in the assembly manual. Most airplanes which are flying at or near the forward limit have had heavy engines installed with no adjustment to the firewall location.

**CG Adjustments:** It is important to have all equipment installed when doing the empty weight CG measurement. Keep in mind that any permanent equipment added later will affect the CG location. Location of heavy items such as batteries, ELT s etc. have a significant effect. As a result, it is often advantageous to mount them in the rear of the airplane to counteract the weight of larger engines, therefore keeping the CG in an acceptable range.

[Home](#) | [Aircraft](#) | [Airshows](#) | [Our Story](#) | [Contact Us](#) | [Shipping](#) | [Technical Support](#)  
[Education](#) | [Builder Directory](#) | [Builder Projects](#) | [Builder Completions](#) | [Links](#)

© Copyright 2004 Murphy Aircraft Mfg. Ltd.