

**Aircraft Weight & Balance:**  
***Do we have to calculate it for every Flight?***

*By Al Russo, ATP, CFII, MEI*

It's surprising how often this debate comes up. Surprising because from day 1 we learn the acronym "ARROW" to describe the documents required to be in the airplane during flight. The "W" represents current Weight and Balance and Center of Gravity (CG) data.

Just this week, I was asked to conduct a check-out for a pilot in one of our training aircraft. For the sake of anonymity we'll call him "Pilot Bob". When Bob was ready to go, we discussed how the check-out would be conducted, where we were going, and who would be acting as PIC. Just prior to leaving, I asked Pilot Bob if he had completed a weight and balance for our flight today. To my surprise, his response was, and I quote: "We don't need one, it's in the Pilot's Operating Handbook (POH), and the FAA doesn't require one for every flight". Yikes! This was going to be an interesting day.

It's interesting to note that Pilot Bob has a log book filled with thousands of hours, flies jets for a living, and last but not least, he's a Flight Instructor.

I went over to the nearest PC and entered our passenger, fuel and baggage weights. Within 20 seconds, I had a current printout showing that we were under max gross weight and well within the CG range. Bob was not impressed.

So, are we required by the FARs to calculate a weight and CG for every flight? And, does the weight and balance information located in the Pilot's Operating Handbook satisfy the requirement for having a current weight and balance on-board? The answer to both questions is No. This seems to be a contradiction, but according to the FARs, these two documents serve different purposes.

While there are no specified requirements for the Pilot in Command (PIC) operating under 14 CFR Part 91 to conduct weight and balance calculations prior to each flight, 14 CFR 91.9 requires the PIC to comply with the operating limits prescribed by the manufacturer.

The FARs notwithstanding, let's agree that calculating an aircraft's weight and CG accurately makes good sense, and is essential for safety of flight. No different than checking the oil before each flight. Excessive weight and/or a CG out of range reduces the flight performance in almost every respect. To name a few of the more important factors, an overloaded aircraft will experience:

**Higher takeoff speed**

**Longer takeoff run**

**Reduced rate and angle of climb**

**Lower maximum altitude**

**Shorter range**

**Reduced cruising speed**

**Reduced maneuverability**

**Higher stalling speed**

**Higher approach and landing speed**

**Longer landing roll**

**Excessive weight on the nose or tail wheel**

Unless we "do the math", how else are we going to know we are complying with the certification and performance limits established for the aircraft? Limits such as CG ranges, Maximum Takeoff Weight, and required runway lengths are reduced to mere guess work if they were not calculated in advance of the flight.

While owning a V35 Bonanza for years, I performed the necessary calculations for my most common loading scenarios *in advance*, and I kept these in the airplane. Therefore, I didn't have to calculate a *new* weight and balance each time I stepped into the airplane. I knew, and more importantly, I could demonstrate that we were within the prescribed operating limitations ***on every flight***. If my "canned" weight and balance forms didn't cover the loading requirements for a particular trip, I would get out my trusty Sporty's calculator and come up with a unique weight and balance for that particular trip. I hated telling my mother-in-law she had to stay behind on that trip to North Carolina because she put us over max gross weight.

So, was Pilot Bob right about not being required to calculate a current weight and balance for our check-out flight? As the saying goes, he was "dead" right. Not knowing my weight, baggage weight, and the current fuel load, he had no way to be sure if we were within the operating limitations. To depart without knowing would have been a guess. We *may* have been in compliance with FAR 14 CFR 91.9. Who knows? And most importantly, safety of flight was in question. Not good, Bob.

By answering the first question, we now understand why the weight and balance information in the POH will not satisfy the requirement specified by 14 CFR 91.9. This data is used during the aircraft certification process, and provides us with a starting point to calculate our loading CG and weight scenarios. This Section of the POH tells us our Basic Empty Weight, initial CG and important Arm data. It is also referenced in 14 CFR Part 43, requiring our maintenance personnel to update this information after any major modifications take place to the aircraft. Advisory Circular 43.13-1 issued by the FAA requires that these initial weight and CG calculations be accurate to within one pound or less for an aircraft whose Basic Empty Weight is less than 5,000 pounds. That's 99.98%!.

So make it a habit, like sumping the tanks, or checking the oil prior to each and every flight. Know for certain that you're within operating limitations. If you own your own airplane, or fly the same aircraft on a regular basis, create canned weight and CG scenarios for your most common loading configurations. And if your mother-in-law decides she'd like to come along, just do the math.



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