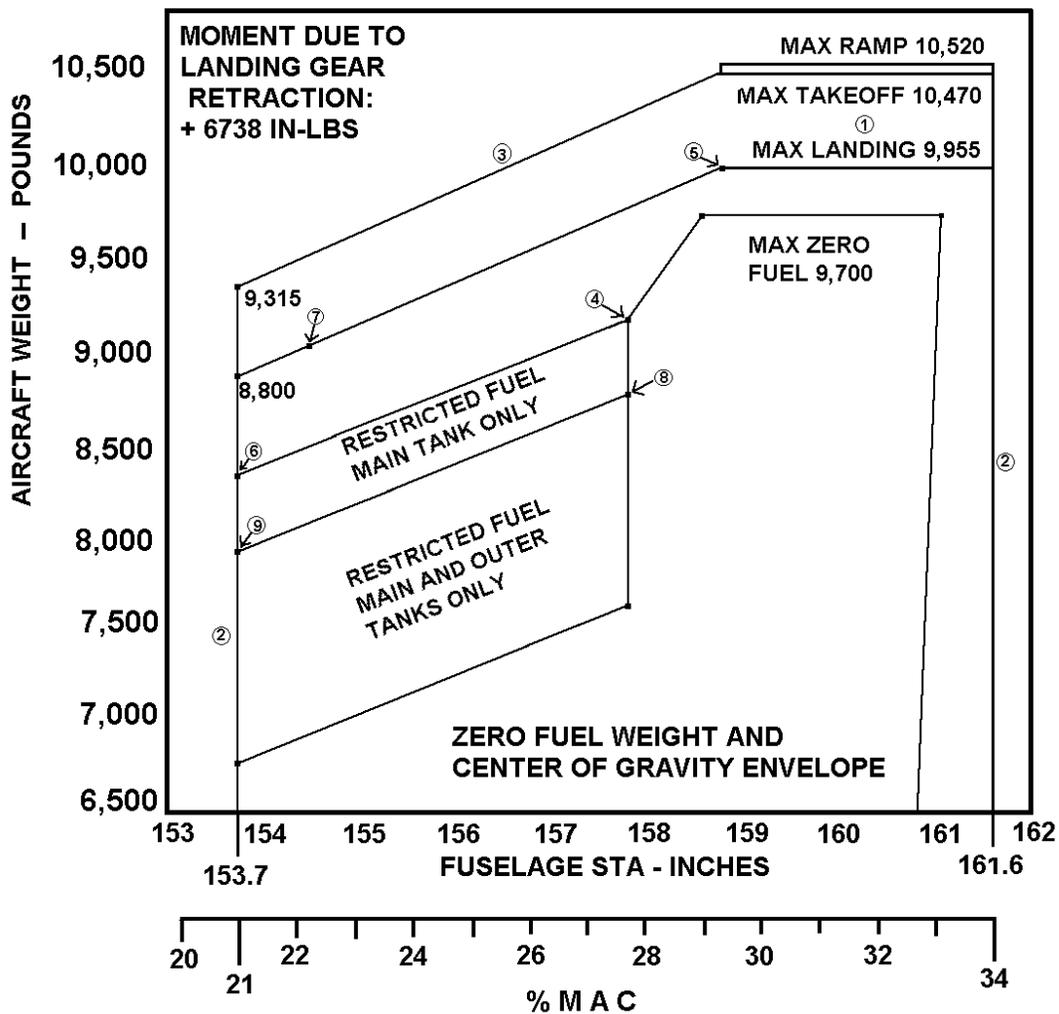


MU-2 Center of Gravity and Fueling Restrictions

By Rick Wheldon

We all have looked at the Center of Gravity envelope in our Flight Manuals and seen the fueling restrictions at forward Centers of Gravity. Essentially, each MU-2 CG envelope has an area labeled “RESTRICTED FUEL MAIN TANK ONLY” and another labeled “RESTRICTED FUEL MAIN AND OUTER TANKS ONLY.” For years, I have been flying various models of MU-2 aircraft and not understood the rationale for these restrictions. Last year we received an inquiry from one of our long time operators asking for an explanation, and I checked with Mitsubishi. Their reply forms the basis for this article.

AIRCRAFT WEIGHT/ZERO FUEL WEIGHT AND C.G. ENVELOPES (LANDING GEAR EXTENDED)



This is the CG envelope for the Solitaire. As you can see, this diagram limits the maximum takeoff and landing weights “1”, which are determined by a structural analysis. In the Solitaire the maximum landing weight is 9,955 pounds and the maximum takeoff weight is 10,470 pounds. The diagram also establishes a forward and a rear CG limit “2” for the airplane. The forward and rear CG limits are aerodynamic limits determined during the original certification. There is another sloped area to this chart, reducing takeoff and landing weights at forward CG’s “3”. In this area, the maximum takeoff and landing weight varies with the CG. The further forward the CG, the less weight is allowed. This is because the elevator must be able to provide sufficient pitch control.

Let’s look at what happens when we load fuel within the Flight Manual restrictions. Assume the zero fuel weight is at point “4”. In this area, fuel is restricted to the main tank only. If we now fill the main tank, the new CG is at point “5”. Similarly, if the zero fuel weight is at point “6”, the CG with a full main tank is at “7”. Connecting points “4” and “6” defines a line where, with full fuel in the main tank, the pilot never exceeds the variable maximum landing weight. The airplane cannot be taken off or landed outside of the CG envelope, and the pilot does not have to calculate his variable landing weight once he has determined his zero fuel weight and filled the airplane according to the restrictions.

Now let’s look at the other area, where only the main and outer tanks can be filled up. Suppose your zero fuel CG is at point “8”. Now, with full fuel in the main and outer tanks, the CG is again plotted at point “5”. Next, suppose that the zero fuel CG is at point “9”. Again, full fuel in the mains and outers will result in a CG plotted at point “7”. Similar to the previous example, connecting points “8” and “9” defines a line where, with full fuel in the main and outer tanks, the pilot never exceeds the variable maximum landing weight.

The answer to our initial question, then, is that fueling is restricted to ensure that the airplane will never be operated above maximum landing weight. If fuel in excess of the restricted amount is added, it would be possible to takeoff within the takeoff envelope, burn some small amount of fuel, but land over maximum landing weight, which could result in an overweight landing inspection and possible structural damage. By operating within the limitations imposed by the AFM chart entitled “Aircraft Weight / Zero Fuel Weight & CG Envelopes”, this will never happen.