TAKEOFF FLAP SELECTION AND THE MU-2

By Rick Wheldon

By now, a good number of PROP attendees have heard my presentations dealing with takeoff and single engine performance. In the presentations, I described the climb performance advantages of flaps 5 takeoffs. Unfortunately, some of the feedback indicated that many of you thought that I was advocating flaps 5 takeoffs exclusively. That was an impression that I did not want to create. Let's look at some of the factors that you should consider when selecting your takeoff flap setting.

First, bear in mind that there is no one flap setting that is best for all circumstances. I learned that lesson in the heavy transport business. Each transport airplane that I flew had multiple takeoff flap selections available, and we used them all, depending on the conditions. To understand why, let's look at FAR Part 25 takeoff certification. The maximum weight for any given takeoff is limited by the most restrictive of the structural limit, the climb limit, the tire speed limit, the brake energy limit, the takeoff field length limit, and the obstacle clearance limit. While the MU-2 certification basis does not require the analysis of each of these factors, a prudent pilot should consider them when planning his takeoff.

Structural limit – This one is easy – it's in the limitations section of your AFM. For most of the MU-2 fleet, the structural limit is a single maximum takeoff weight. For those of you flying "F" or "G" models or anything earlier, the maximum takeoff weight limit is reduced at high temperatures. Is there any structural difference based on temperature? Not really, but the early model takeoff weight limits are based on a combination of structural and single-engine performance considerations.

Climb limit –The MU-2 AFM previously did not have single engine climb data for either of the two takeoff flap settings. Remember, the MU-2 was certified under CAR 3, and this regulation did not require that an airplane be able to climb with flaps at takeoff in the event of an engine failure. However, in 2006, Mitsubishi provided single engine climb charts in the POM for both flap positions, as an additional safety tool for the pilot. Even so, if you want, you can legally takeoff in your MU-2 at a heavy weight where single engine climb is impossible. Not wise, but legal!

With the new charts you will find that single engine climb capability is generally better at flaps 5. With a marginal single engine climb capability, you could select flaps 5 to get the best climb capability, assuming you have adequate runway length at an airport such as Denver Centennial. I have decided that I will not takeoff unless the single engine climb rate for my flap configuration is at least 250 feet per minute. This is a personal standard only. It is important to note that the operating engine must be producing rated power (see power assurance chart in the AFM), the failed engine must be feathered, and the landing gear must be retracted. Likewise, the transition to the recommended climb speed must be accomplished as quickly as possible to achieve best climb.

Tire speed limit – This data is provided in your AFM. Less powerful, lighter early models have no restrictions, most models have data for flaps 5 only, and the Marquise presents data for flaps 5 and 20. If you look at the charts, tire speed is only a factor if taking off downwind at high density altitudes, so you generally are not limited by maximum tire speeds.

Brake energy limit – The transports have to demonstrate an aborted takeoff without using thrust reversers. In the MU-2, reverse thrust is very effective and can be used during an abort within the limits of asymmetric control. Little braking is normally required. Be aware that aborts from higher than normal speeds, using heavy braking, can result in high temperatures for the wheels, tires and brakes. The tires are equipped with weep holes to prevent bursting under high heat conditions. However, it is possible to overheat your tires and brakes, but not likely.

Takeoff field length limit – This can be a big consideration, and data is readily available in the MU-2 AFM for both takeoff flap settings. It is interesting to note that takeoff distances vary little between flaps 5 and flaps 20. If you go to your AFM, you'll see that flaps 20 takeoff distances are typically 200 to 300 feet less than flaps 5 takeoff distances for late model airplanes and no more than 1000 feet less for older models under the most extreme high, hot conditions. Check the AFM and see what the required distances are and the distance margins available for each runway. On a 7000-foot runway at sea level, takeoff distance requirements will provide large margins for abort if it becomes necessary. If you're on a short runway, you had better look closely at these margins, especially before conducting a flaps 5 takeoff.

Obstacle clearance limit – This may be a factor, especially in marginal climb conditions (single engine) with low visibility. I have refused to takeoff at night in the mountains based on an inability to meet single engine climb gradients. During daylight hours with a marginal climb gradient, it would have been an easy matter to avoid obstacles by following the river. Not so at night.

Looking at these 6 restrictions, the ones that come into play most often are climb limits, takeoff field length limits, and, less frequently, obstacle clearance limits. The variables include flap selection. All other factors being equal, takeoff distance is reduced at 20 degrees of flaps, while climb rates are improved by selecting 5 degrees. Which is better? It depends. Are you taking off from a very short runway? Are you operating out of Denver in the summer time? In either of these cases, the answers are obvious. However, the vast majority of your takeoffs will not be at either of these extremes, and therefore either flap position will work. Just ensure that you can climb adequately, you can avoid obstacles, and the runway is long enough. DO THIS BEFORE YOU START YOUR TAKEOFF ROLL. Set your own personal limits before you go to the airport, and adhere to them.