

Once you know your best endurance and range speeds, you can then determine your fuel flow for each condition. If you have a fuel-flow indicator and you already collected the data during your tests, you can simply refer back to those fuel flows. If you don't have a fuel-flow indicator, you will need to do a little more work.

Using fuel-flow instruments makes this test easier, but you can perform accurate tests without them if your airplane has two fuel tanks. Starting with full tanks, take off and climb to the test altitude on tank A, switch to tank B for the test period of no less than 30 minutes, and then return to tank A for landing. The fuel used from tank B, divided by test time, reveals the rate of flow. (Performing the test in this manner also confirms the accuracy of the gauges that measure fuel quantity and flow.)

If your airplane only has one fuel tank, you need to add a step. Starting with a full tank, take off, climb to your test altitude, set the power for the test, and immediately return to the airport to top off the tank. Record this fuel top-off quantity, and then subtract it from the fuel used on your subsequent flights to test power and speed combinations. For this to work, you must fly the same takeoff and landing profiles as your pretest flight. Climbing to a higher or lower altitude will reduce the accuracy of your results.

Calculating true airspeed is important for accuracy. Remember to record the pressure altitude and outside air temperature on every test flight. Before performing these tests, check that the wings are free of bugs and other contamination.

Before every takeoff, check that:

- Engine temperatures and pressures are okay.
- You have selected a tank with plenty of fuel.
- Before takeoff, fuel is actually flowing from that tank to the engine.

Consistent technique is the key to obtaining repeatable results. Perform the test the same way every time. If the data you collect on any particular flight appears to be significantly different from your expectation, repeat the test.

After compiling the data on speeds, power settings, and fuel flows, make a chart or table and add it to your airplane's POH. See the References & Resources section for articles that provide more details on this test and others.

Test Card 10 — Takeoff Performance

Knowing your airplane's takeoff performance is key to planning safe departures, especially on short runways and on different surfaces. This test provides that information. You'll record some of the needed data in the cockpit, but to measure the takeoff roll you'll need a ground observer who can see exactly when the wheels leave the runway.



For data on different runway surfaces — grass, gravel, dirt, and pavement — you'll need to perform the test on each of them. Note everything that affects takeoff performance: wind direction and speed, surface type, texture, and slope. You can find the exact runway slope in the FAA's *Chart Supplement*, previously named the *Airport/Facility Directory*. On unpaved surfaces, note the softness, length of the grass, and other appropriate factors.

If possible, use an airport where the observer can parallel the runway and can stick a marker in the ground at the point you take off. With a marker at your starting point, you can measure the takeoff distance with tape measure or GPS. *Note: Only WAAS-enabled GPS will have the accuracy you need.* The pilot can also use runway lights and feet remaining markers to get a measure of the distances.

Repeat the tests at different configurations (as recommended by the designer) and gross weights, from light to maximum, ensuring that the CG is always within its fore and aft limits. To minimize data variations, perform at least two takeoffs in the same configuration and average the data. Before testing the next configuration, refuel to regain the original test weight and to let the airplane cool off if necessary.

The takeoff distances derived by these tests do not guarantee obstacle clearance after takeoff. To get this information, combine the takeoff data with your climb data to determine whether you can clear an obstacle. To account for performance variations caused by environmental factors, such as wind or density altitude, always add a margin of safety to the figures.

Before performing these tests, check that the wings are free of bugs and that the tires are at correct pressures. At high density altitudes, lean the mixture for best power as recommended by the manufacturer, and record the pressure altitude so you can apply the data to similar situations.

Before every takeoff, check that:

- Engine temperatures and pressures are okay.
- You have selected a tank with plenty of fuel.
- Before takeoff, fuel is actually flowing from that tank to the engine.

Consistent technique is the key to obtaining repeatable results. Perform the test the same way every time. To get the quickest acceleration, hold the brakes until the engine is developing full power. If the brakes won't hold that long, release them at the same power setting.

To reduce variation in test results, perform the tests in similar conditions and conduct a series of takeoffs one after the other. Be careful to not overheat the brakes; if you must use repeated or heavy braking, check the brake and wheel temperature and comply with the manufacturer's limits.

After compiling the data, add it to your airplane's POH.