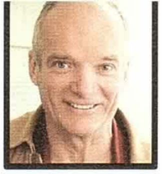


L/D Max

Maximizing your chances in engine-out glides

BY CHARLIE PRECOURT

I RECENTLY WATCHED the movie *Sully*, and it brought to mind some critical concepts regarding engine-out scenarios. I'm not talking about the Hollywood "drama," which depicted the NTSB in an adversarial role during the investigation, but rather the actual thought process Sully and Jeff exercised as they dealt with the situation. Suffice it to say the NTSB has set the world standard for impartiality in accident investigations, and it focuses on recommendations with safety benefits without having the regulatory authority to implement them. Only the FAA, and we pilots, can implement those recommendations. For those of us who fly, I think Sully's lessons in pilot judgment are more important than the drama.

The cards Sully and Jeff were dealt were pretty awful: bird strike two minutes after takeoff from LaGuardia at 2,800 feet, 4.5 miles from the airport on an outbound heading to the northwest. Densely populated areas all around, and both engines producing no thrust. The crew assessed all landing options, attempted engine restarts, maintained optimum glide conditions, and were in the river only 208 seconds after the bird strike. The decisions they had to make were reliant on tremendous experience and feel for the capabilities of their machine, and their ability to consider and select from multiple options quickly. The options they had were to reverse back to LaGuardia, stretch to the west into Teterboro, or choose the Hudson. Attempts to reach the runway given even their trained reaction times would have resulted in falling short into densely populated areas.

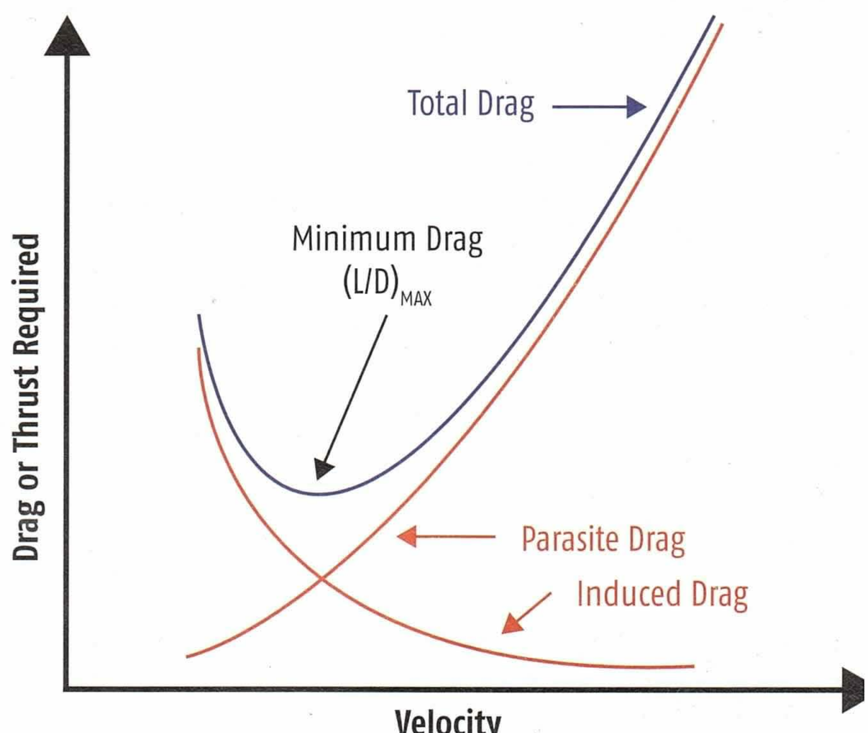
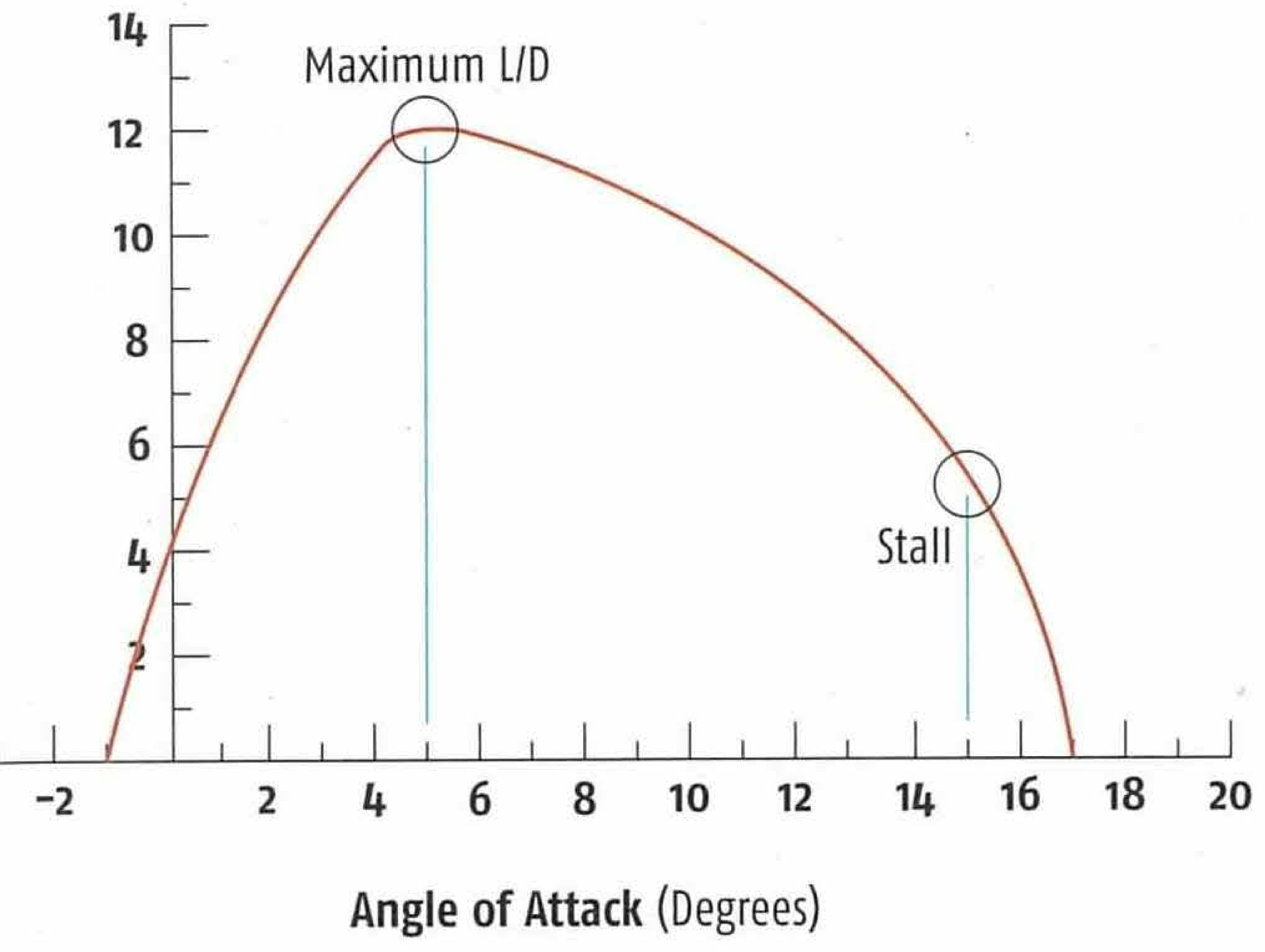


Figure 1

You can break the scenario and decision process into three phases: initial response, select best option, and execute the selected option. In the initial respons we recognize the loss of thrust and make prompt maneuver to set maximum glide speed. This ensures we have the best possible range available. In the engine-out scenario, L/D_{MAX} is king. L/D_{MAX}, or the speed where the ratio of lift to drag is maximized, provides best glide distance i the event thrust cannot be recovered. Thi point is achieved at a specific angle of attack in wings-level gliding flight for eac



gure 2

rcraft design. It can be determined by plotting the aircraft's tal drag as a function of speed as in Figure 1, total drag eing the sum of induced drag and parasitic drag. These can en be mathematically converted as in Figure 2, showing the /D ratio as a function of angle of attack. You can see there is ly one angle of attack where this ratio is maximized. It can so be shown mathematically that this ratio of maximum lift drag also gives the maximum horizontal distance you can avel for each foot of altitude loss. Knowing that ratio for our aircraft can help you make good judgment calls in an ngine-out scenario.

As examples, the Cessna 172 maximum glide ratio is about -to-1, a Cirrus SR20 is 10.9-to-1, while the SR22T is 8.1-to-1 both ith the prop windmilling. A Boeing 747 is more than 17-to-1. Iy Mirage JetProp is almost 15-to-1 but less than 10-to-1 if the rop isn't feathered. If you have a variable-pitch prop, engine ut, get it feathered or know the impact if you can't. The way I se these ratios is to look at how high I am AGL (in miles) and se the ratio to determine how many miles I can fly. For examle, at 12,000 feet above the ground, you have 2 nm of altitude, nd with a glide ratio of 12-to-1, you can glide 24 nm before you it the ground. These ratios are generally published in the POH, nd you ought to be familiar with how to use them correctly, as nere are several nuances to understanding the performance ou will achieve.

The first nuance to recognize is that L/D_{MAX} is achieved at specific angle of attack. That means the airspeed you see for $/D_{MAX}$ will vary with the gross weight. Many times the POH ill publish the max glide speed as a range based on weight. he glide *performance* of both the heavy and light weight airaft is the same, in other words the ratio doesn't change, nor oes the angle of attack, just the speed is higher for L/D_{MAX} if ne weight is higher. In some light aircraft the difference in peed is so small only one speed is published. For example, ny PA-46 publishes 90 knots without a range based on eight. The T-38 however was 230 knots with an additional

10 knots per 1,000 pounds of fuel on board. The interesting reality is, since the glide ratio is the same, a light aircraft and a heavy aircraft, if flown side by side in the same engine-out scenario, will both reach the same spot on the ground, but the heavier aircraft will get there first because it has to be at a higher indicated speed to hold L/D_{MAX}.

The maximum glide ratio is not the same as speed for minimum sink rate. If you have several good landing choices and are at high altitude, you might actually want to begin the troubleshooting by flying at the speed for minimum sink, which is always a speed somewhat slower than L/D_{MAX}. This gives you more *time* before you hit the ground, but it will result in less total distance flown. Many pilots I've flown with mistakenly equate L/D_{MAX} with minimum achievable sink rate. At the indicated airspeed for L/D_{MAX}, because we are descending from higher altitudes, the true speed will be decreasing and have an effect on the vertical speed that we see as we descend.

Another point to remember is that L/D_{MAX} assumes a wings-level glide. If you are in a turn, the distance will be along an arc, and more importantly, the higher the bank angle the more your lift goes into turning rather than gliding, impacting distance achieved. For this reason, the initial response to an engine out can have a big impact if you continuously assess where to go if you lose all thrust. Most of the time we are cruising above speed for L/D_{MAX}, so we should use that extra speed to both climb and turn to the desired best heading. Then once we are at L/D_{MAX}, roll out in a wings-level glide to begin troubleshooting.

When I instruct an engine-out in the L-39, the most common error I see in the pilot's initial reaction is too much time flying straight ahead (often away from a field) at speeds much above L/D_{MAX}. Remember that every knot above or below L/D_{MAX} will cost you in distance achieved, and could mean the difference between making a runway or not.

Lastly, don't forget to consider the winds. When I take my JetPROP across Lake Michigan at FL 270, it is with the knowledge that I can reach a landing even if I lose the engine halfway across. But my *real* halfway point considers the winds. I know from my glide ratio and altitude the distance I can fly, and that my glide will take a good 30 minutes. Translate a half an hour of wind speed into distance — I can then adjust where I'm going to turn around or continue across the lake accordingly. In other aircraft, or at lower altitudes, the numbers tell me to fly around the lake! EAA

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