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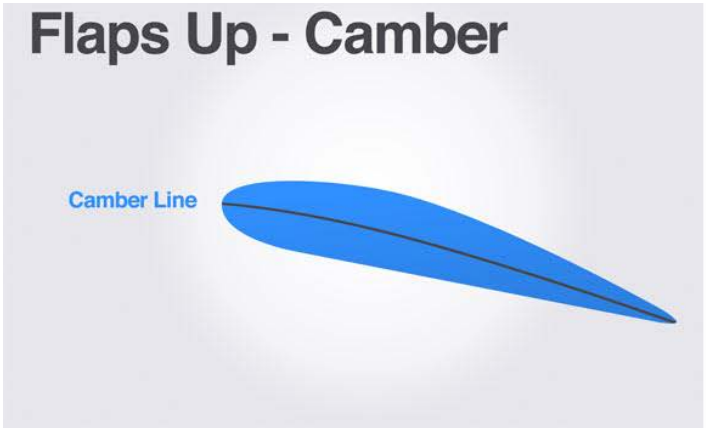
How Flaps Work

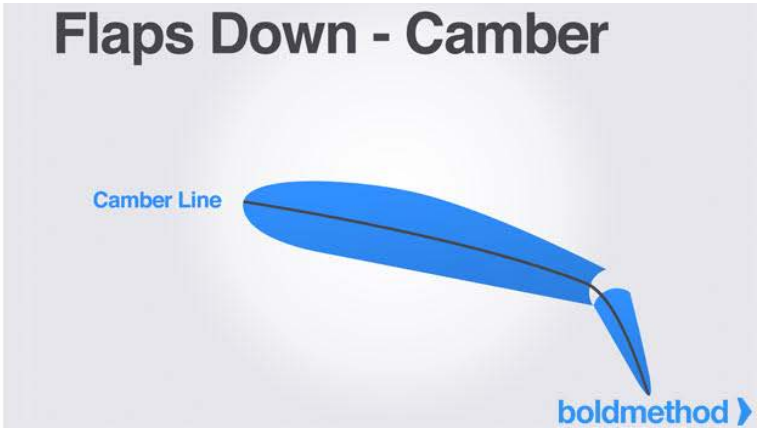
By Colin Cutler | 02/19/2015

Flaps. Most large aircraft couldn't leave the ground without them, and even a Cessna 172 needs them. But how exactly do they work? Let's take a look.

Stall Speed And Drag

When you extend the flaps on your plane, you lower your aircraft's stall speed, and at the same time, increase drag.

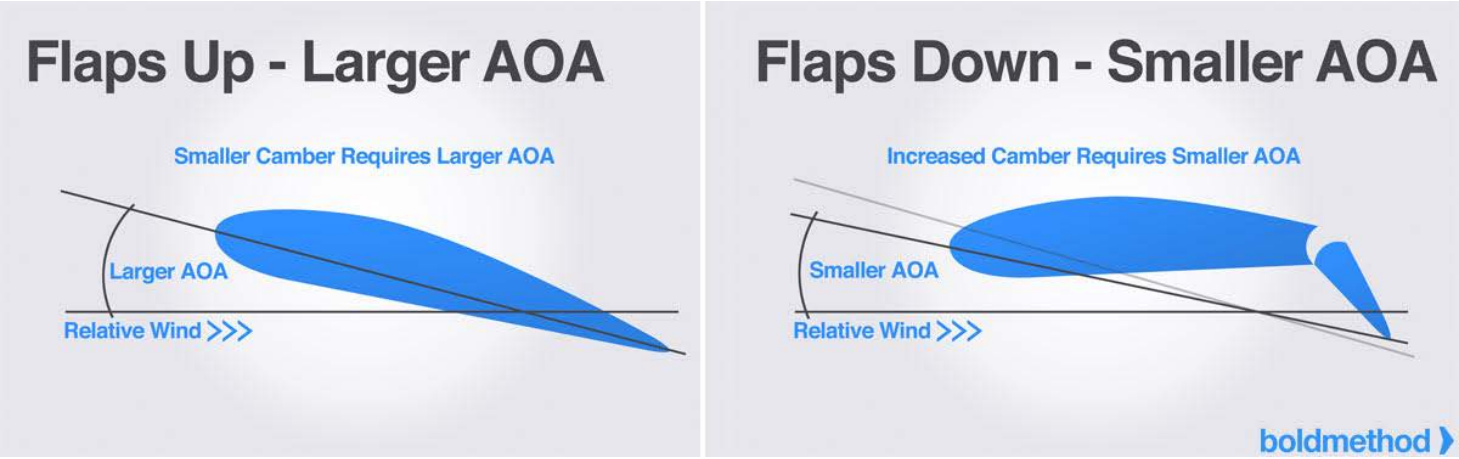




This all happens because extending flaps *increases the camber*, or curvature, of your wing. When your wing has a higher camber, it also has a higher *lift coefficient*, meaning it can produce more lift at a given angle-of-attack.

Reduced Stall Speed With Flaps

Extending flaps reduces your aircraft's stall speed for a fairly simple reason. Because your wing creates more lift with the flaps down, you don't need to as much angle-of-attack to balance the four forces of flight.



And because you can fly at a lower angle-of-attack with flaps extended, your stall speed will be lower as well.

More Lift = More Drag

Extending flaps increases drag as well, which, for the most part, is a good thing.

As they say, "nothing in life is free", and the same goes for lift. When you produce more lift, you produce more induced drag. But that increase in drag can be very useful, especially when you're landing, which we'll get to in a bit.

Takeoff Flap Settings

Many aircraft, especially the big ones, use flaps for takeoff. Without the increase in lift that flaps provide, most large aircraft would simply not be able to go fast enough, or have enough runway, to get off the ground.

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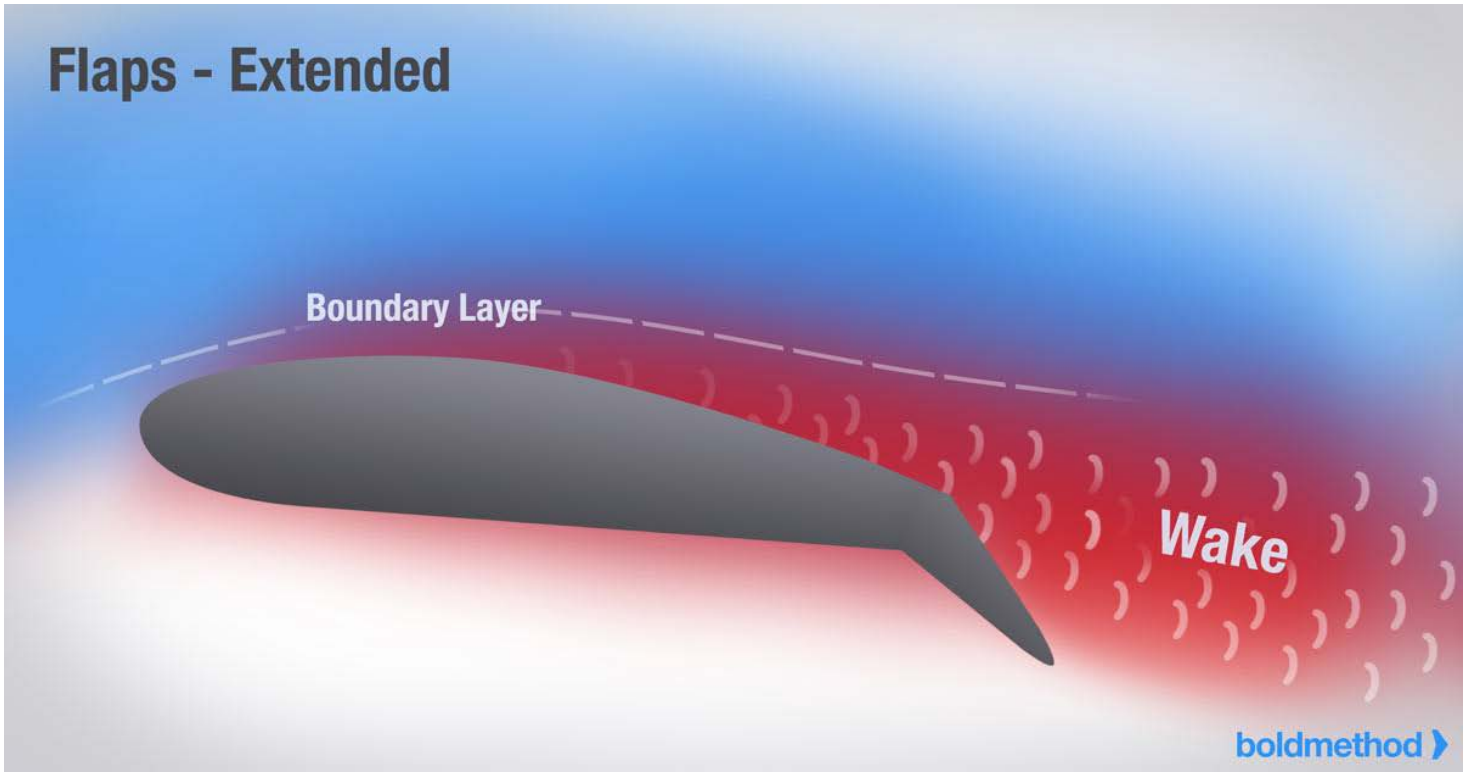
Aircraft use takeoff flap settings that are roughly between 5-15 degrees (most jets use leading edge slats as well). That's quite a bit different than landing, when aircraft typically use 25-40 degrees of flaps.

Why the lower flap setting? By extending the flaps a little bit, your plane benefits from the increase in lift (due to camber), but it doesn't pay the high form drag penalty caused by fully extended flaps.



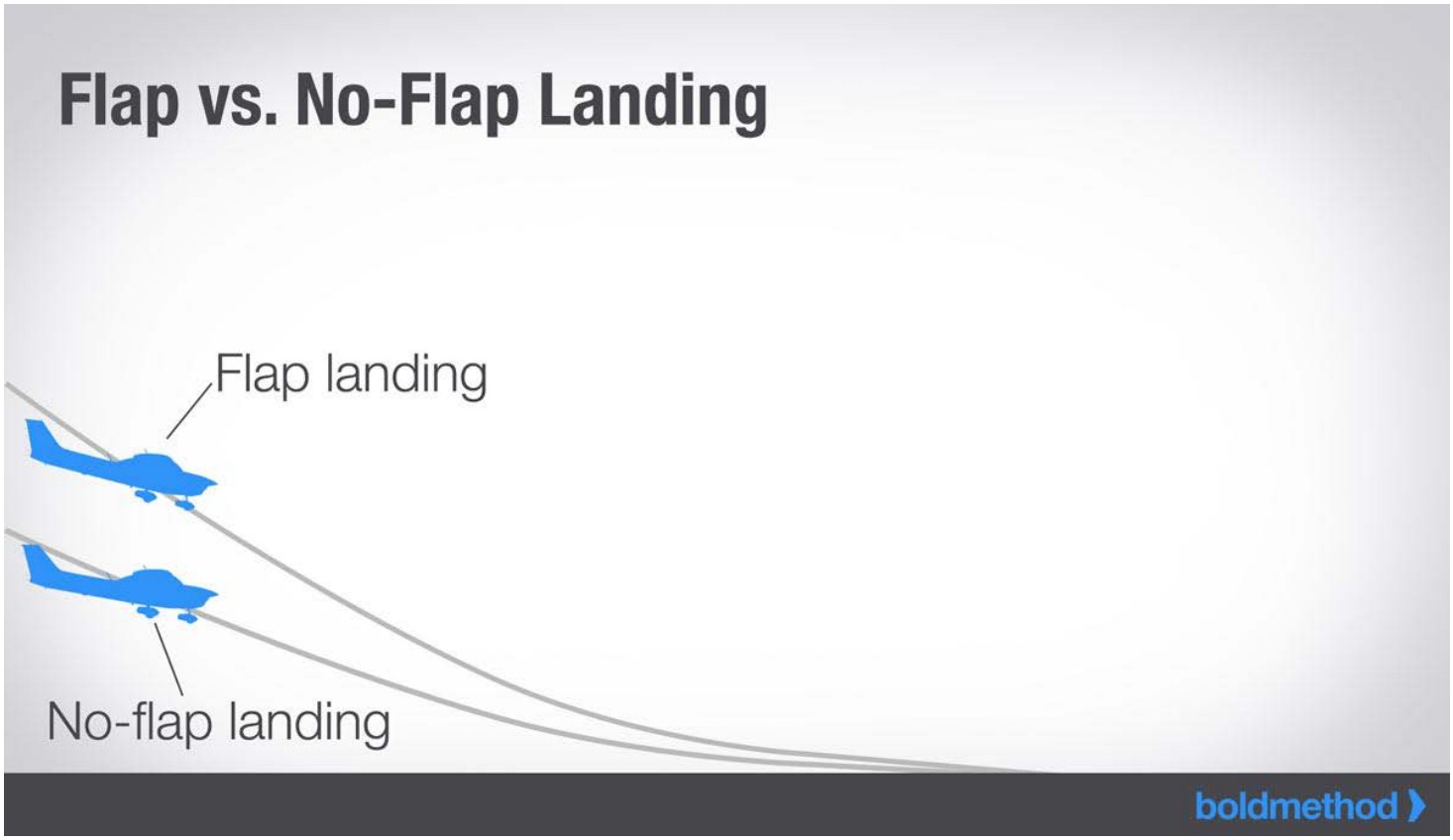
This is true for both large and small planes. Even for a Cessna 172S, 10 degrees of flaps are recommended for takeoff.

Once the plane is off the ground, the flaps are retracted, the camber is reduced, and the aircraft accelerates to cruise speed.

Landing Flap Settings

When you're landing, you typically extend your flaps to their maximum setting. By putting the flaps out all the way, you maximize the lift and drag that your wing produces.

This gives you two distinct advantages: 1) you have a slower stall speed, which means you can land slower, and 2) you produce more drag, which allows you to fly a steeper descent angle to the runway.



Putting It All Together

There you have it. The next time you're on a flight, not only can you tell your passengers what flaps are, you can tell them exactly how they work as well.