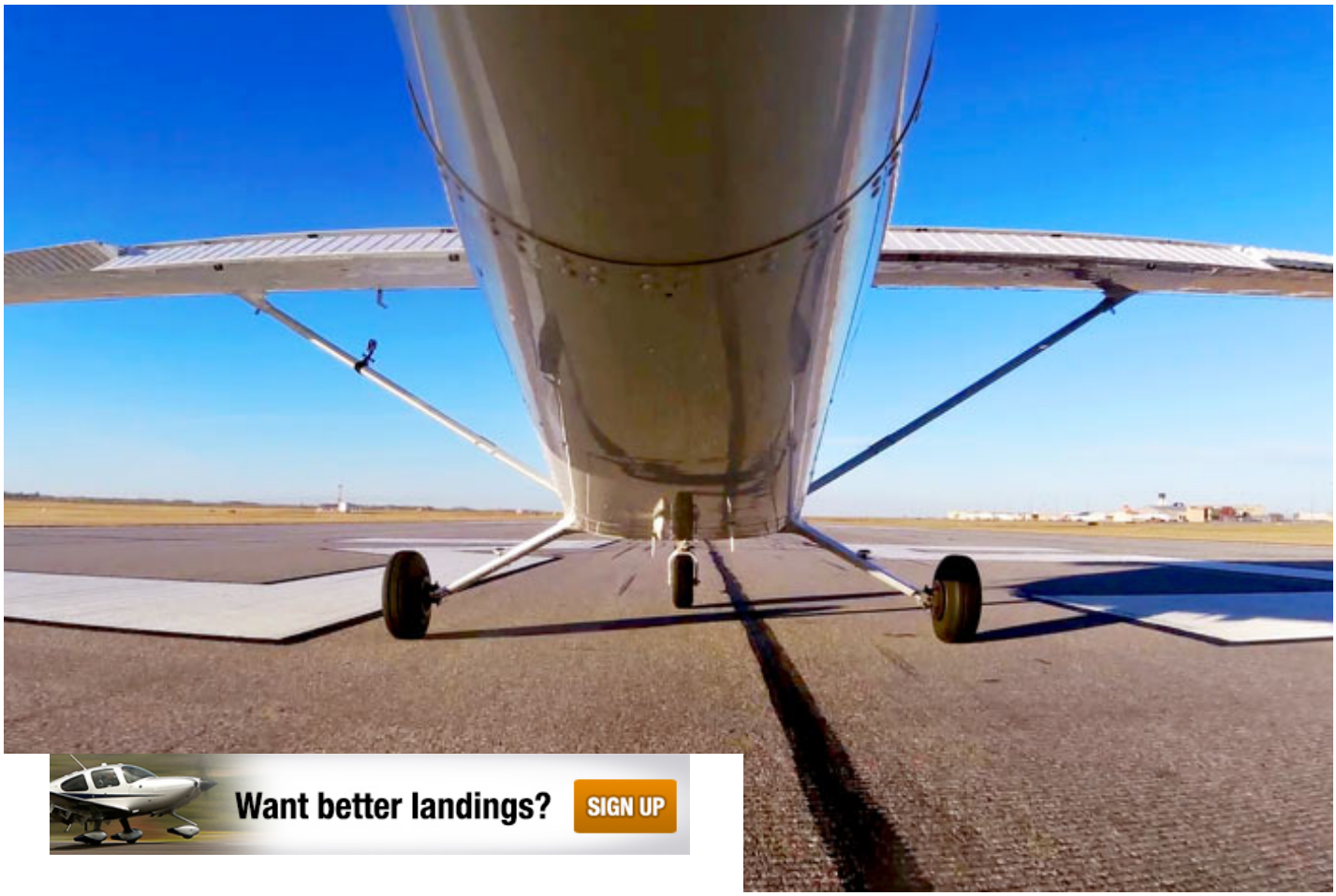
Density Altitude: What It Is, And How It Affects Your Performance

By Colin Cutler | 05/16/2024 | Previous | Next



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Density altitude is a measure of how 'thick' the air is, and it's based on three factors: **atmospheric pressure, temperature, and humidity**.

The technical definition of density altitude is "pressure altitude, adjusted for non-standard temperature." What that really means is on hot days, the air is much 'thinner', or less dense, than it is on cold days.

Why does that matter? It's a big factor in your airplane's performance, because when the

air surrounding your plane is less dense, it means your wings, propeller, and engine will have a lot less performance, and it will take you more time to get airborne during takeoff.

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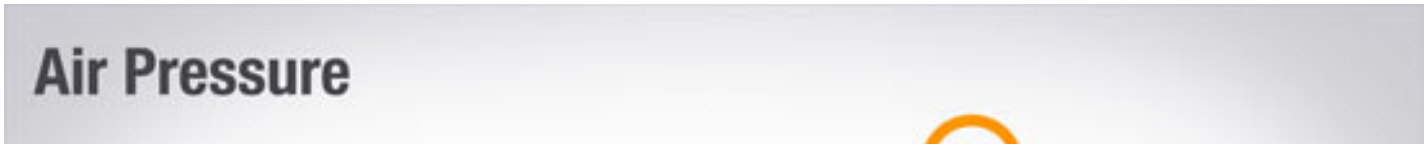
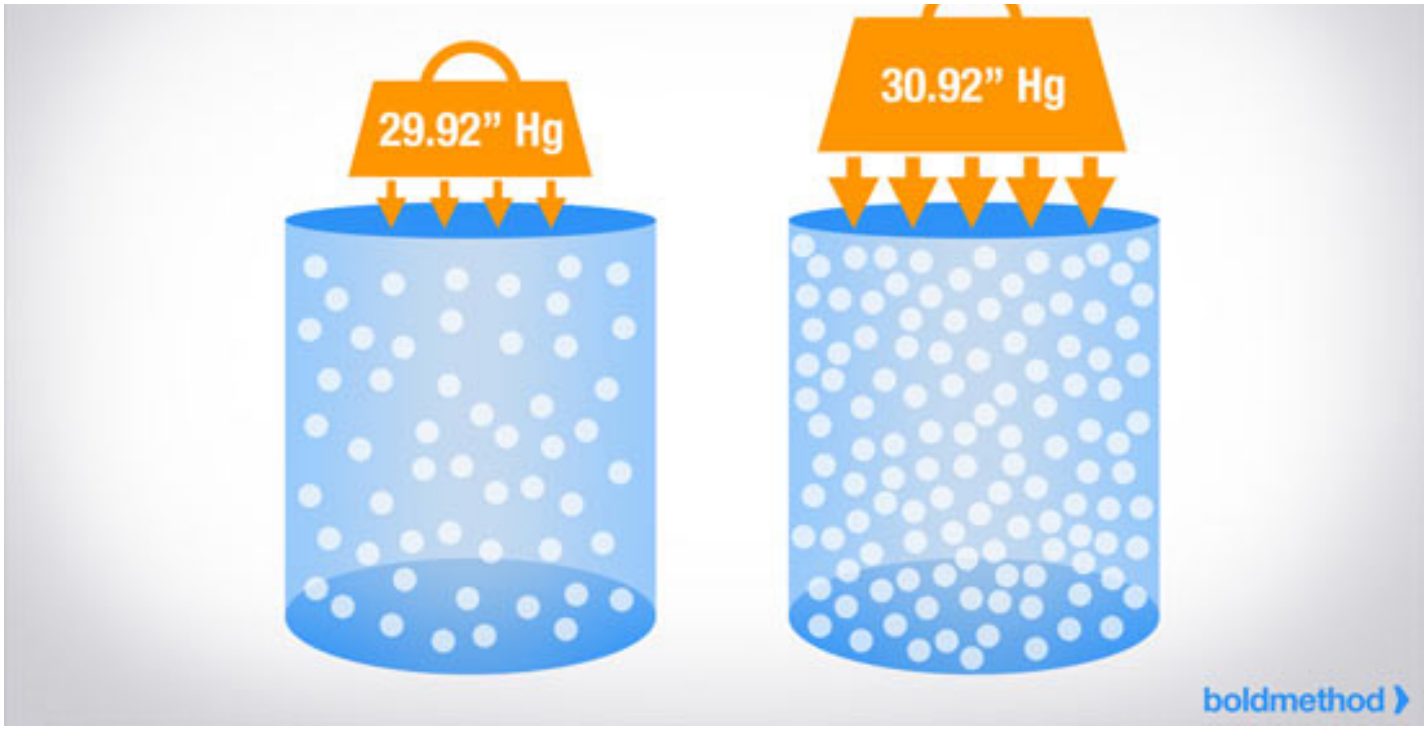
1) It starts with pressure.

The first factor in density altitude is pressure, or more specifically, atmospheric pressure. The lower the pressure, the fewer air molecules surround your airplane.

In fact, decreasing atmospheric pressure by one inch of Mercury (inches Hg) increases your pressure and density altitudes by 1,000 feet. Your airplane performs like it's 1,000 feet higher than the field elevation. So if your airport's field elevation is 1,500' MSL, your plane is going to perform like it's actually at 2,500' MSL.





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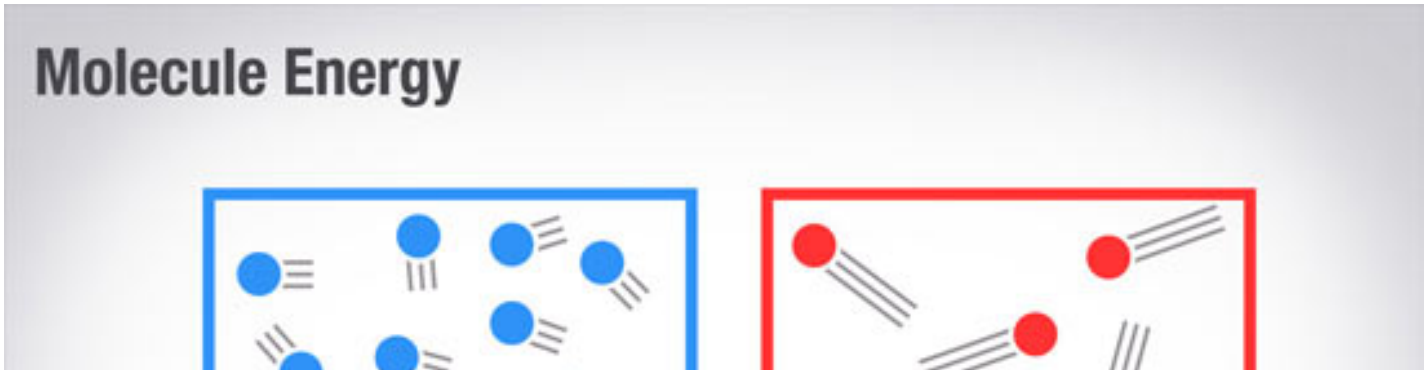
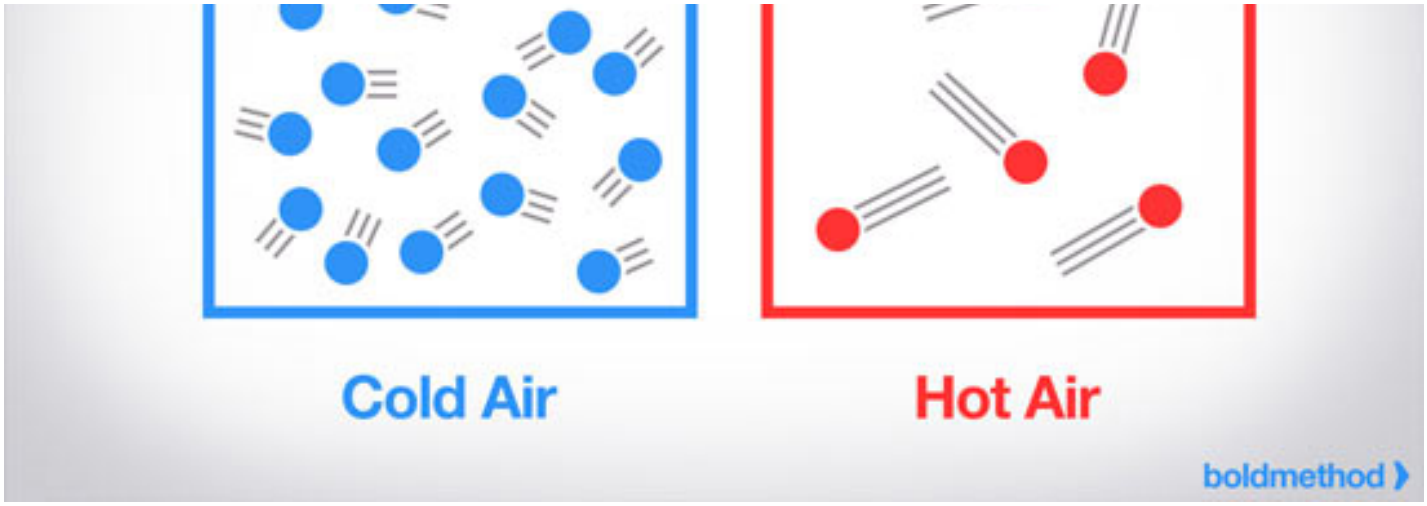
2) Next, add temperature.

Temperature is the single biggest factor in density altitude. That's because when you heat air, the air molecules have more energy, and they spread further apart, making the air less dense.

The effects of temperature are eye-opening. Take Denver, CO (5,434' field elevation) for example, where the average July temperature is 31 degrees C. That temp increases Denver's density altitude by 3,012', to a total of 8,446' density altitude.

How well does your plane perform at 8,446' MSL? How much runway do you think you'd need for takeoff at 8,446'?





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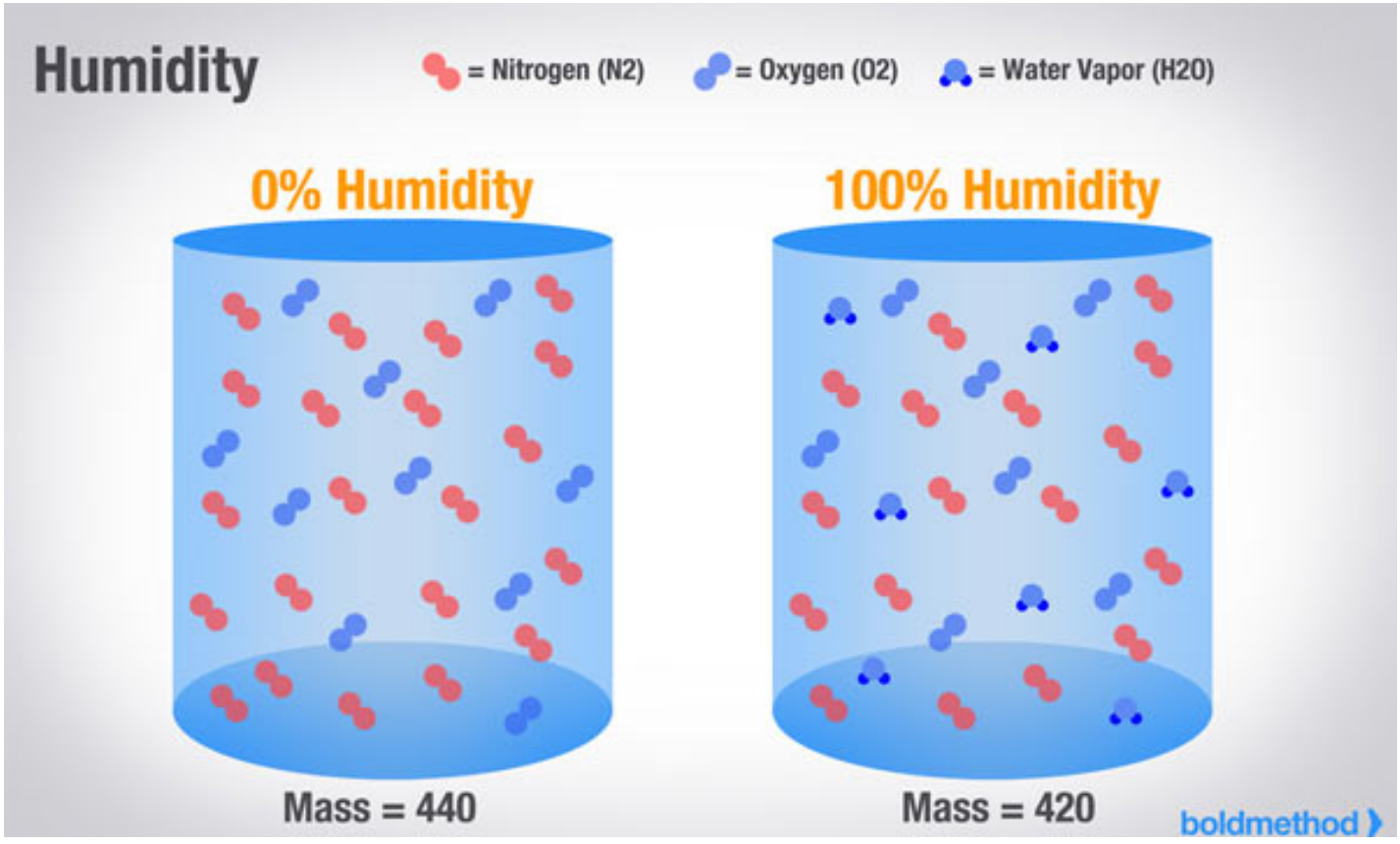
3) Finally, add in humidity.

Humidity has the smallest effect on density altitude, but it can make a difference of several hundred feet. Water vapor weighs less than the nitrogen and oxygen that make up most of the atmosphere. When the humidity is high, the air is less dense.

Humidity is complex to compute, but there's a great calculator for it here.



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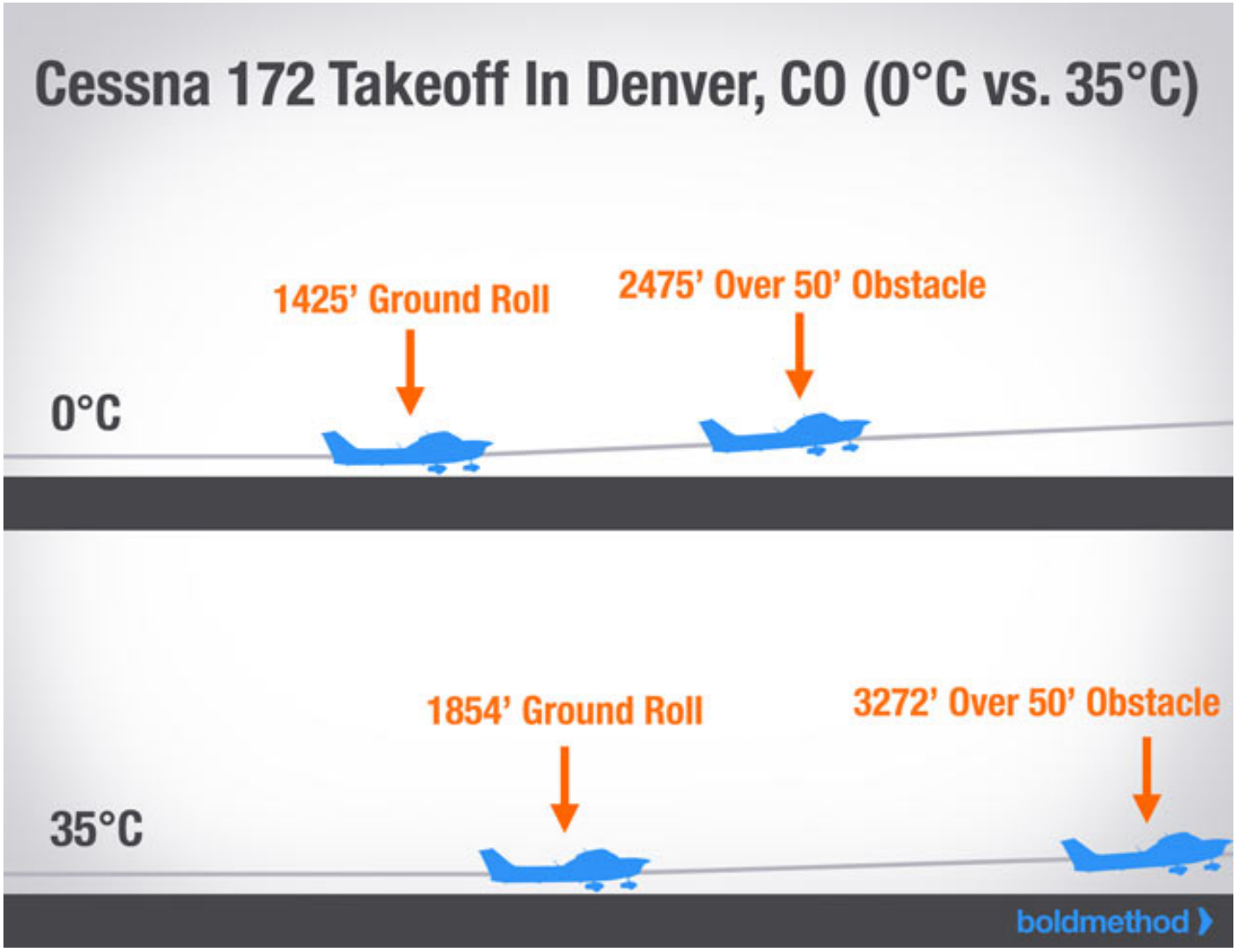
4) The result? A major performance penalty.

What this all comes down to is a major performance penalty for your plane on hot days, and when the atmospheric pressure is low.

Look at the difference in takeoff distance on a hot day in Denver versus a cold one; **takeoff roll is increased by 30%. And clearing a 50' obstacle? It's an increase of 32%** Those numbers can make a big difference, especially on a short runway.



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What Does It Mean For You?

Density altitude is something you always need to consider, especially when your airplane is heavy, you're at high altitude, and it's warm outside. Use your POH to calculate your takeoff distance, and make sure you have enough runway for a safe takeoff.

How much extra runway should you have for takeoff? It's often recommended to add 50% to your takeoff performance calculations. That gives you plenty of extra room for takeoff, no matter what the weather is doing.

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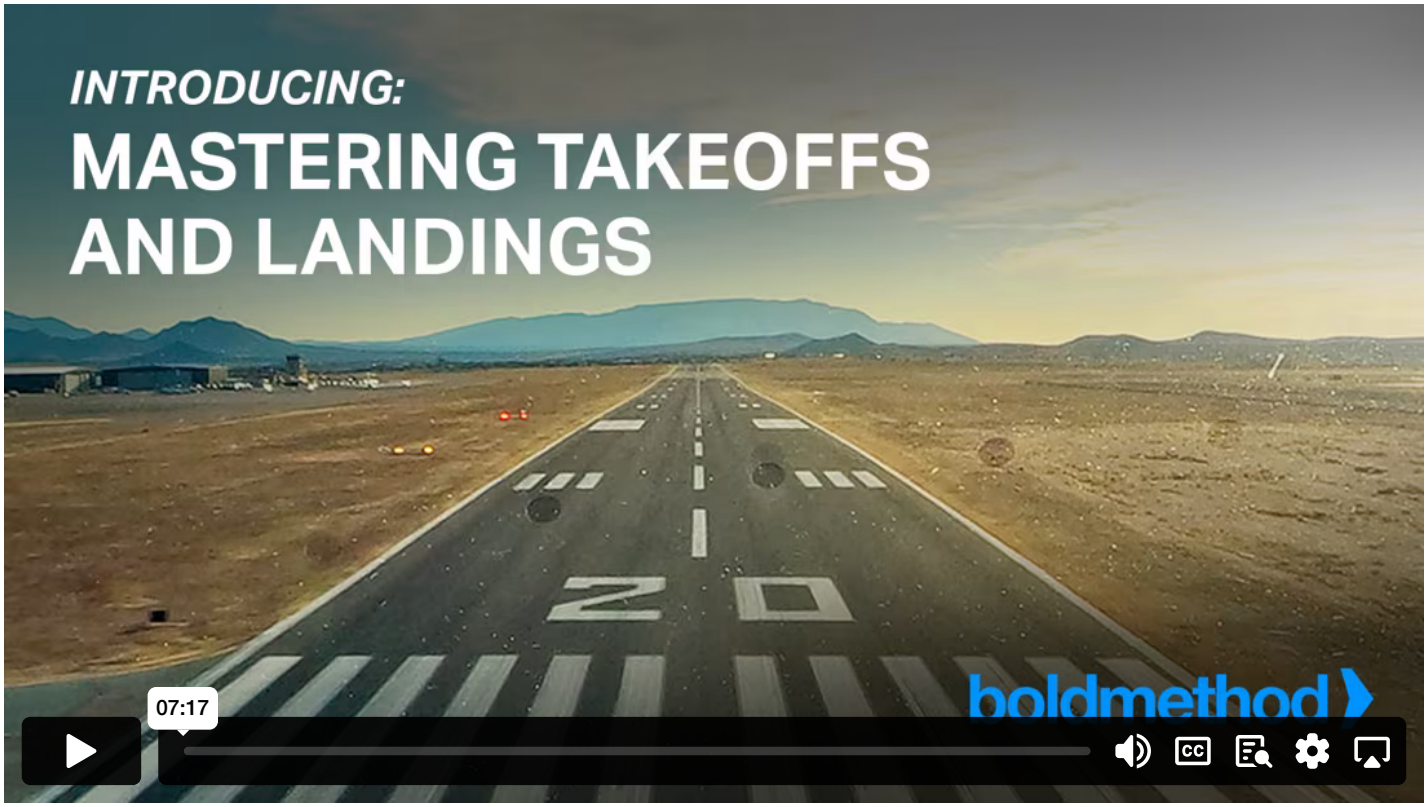

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the worst thing about density altitude is having to answer test questions about it.

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Colin Cutler

Colin is a Boldmethod co-founder and lifelong pilot. He's been a flight instructor at the University of North Dakota, an airline pilot on the CRJ-200, and has directed the development of numerous commercial and military training systems. You can reach him

at colin@boldmethod.com.

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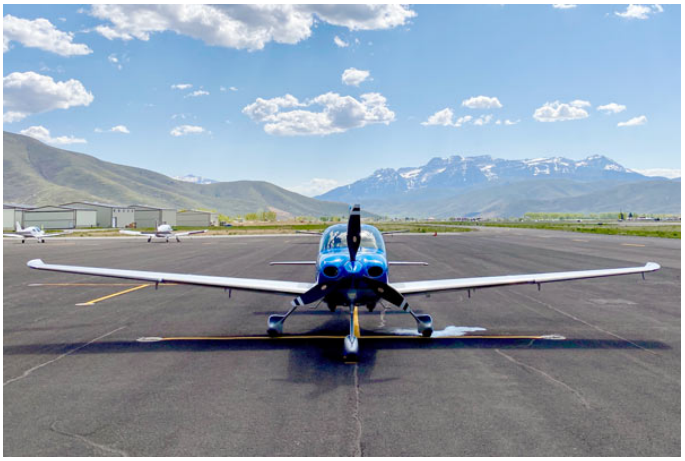

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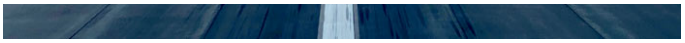

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