

S1 E7 What is it like to fly an eVTOL?

By Jaap Rademaker – Chief Commercial Officer

We hear a lot at the moment about eVTOLS: Electric Vertical Take Off and Landing vehicles. This video is about what it is like to **fly them yourself**. We'll be answering, in practical terms for non-pilots, questions such as: are they difficult to fly? and are they safe?



Spoiler alert: **yes!** They are safe to fly, and they are so easy to fly that everyone can fly them. You don't have to fly all the time, as the autopilot will do most of the work, while you sit back, relax, and enjoy the stunning views. But not for long, because they are fast and they fly as the proverbial crow flies, so you'll reach your destination much quicker than in a car. An hour's stressful drive to the beach with a friend, getting stuck in traffic, bumping around uncomfortably, and being forced to always keep your eyes on the road on penalty of serious injury or death, becomes fifteen minutes of relaxation whilst enjoying views from above.

The main reason for that is that you're not travelling in two dimensions, but in three dimensions. That means that there's a huge amount of empty space, no traffic jams, and you can nearly always use your autopilot. This video is not like all the other videos that you see about eVTOLS. They just describe the eVTOL as an object and describe range/horsepower etc; this video is more about what it does, and what it means for you in practical terms in your life. It's about the **freedom** it gives you, the **time it saves** you, and the real **glorious beauty of rising above it all:**

enjoying the journey and getting where you want to go so much faster, more importantly. This is about the ultimate luxury that you thought you couldn't buy.



But let's start at the beginning. eVTOLs work in the same way as drones – the only difference is that drones don't carry people, and they're uncrewed. eVTOLs carry people but the designs are roughly the same. eVTOLs are the next step in the evolution of our mobility – we're going from the car into eVTOLs – we're not going to drive on roads, we're going to fly through the air. That's good for the environment because we won't need those roads anymore, so we won't need to build more of them, and we can leave existing roads for heavy goods vehicles and trucks.

You will have heard first about the bigger commercial flying taxis, which will hopefully liberate us from long tedious journeys to city centres, that are now only a couple of years away. But with battery technology improving rapidly, and thanks to growth of the market more and more suppliers are entering, which has pushed costs down, you can now also see the possibility of having a smaller, private EVTOL, that carries two people. This is what the Axe eVTOL by Skyfly is all about. It's even likely that a product like the private Axe eVTOL comes to market quicker than commercial EVTOLs can. The Axe is a **small, light, private aircraft** (600kilos take-off weight), so it has a much less onerous certification process than commercial aircraft.



Now to the exciting part – what is it like to fly a private eVTOL? When you drive your car just inches away from opposing traffic, the world flashes past at great speed, even if you're only doing 50 miles per hour. If you've never flown in a light aircraft before, the most striking difference from driving your car is how slow everything feels, but when you look down at your instruments to check your speed, they tell you that you're doing 100 miles per hour. If you go higher, the greater the illusion of everything being slower becomes. Commercial airlines cruise at 30,000–40,000 feet, where the air is thin (that's why they're up there, they can operate much more fuel efficiently and they have much less resistance because the air is thinner). That's good for us eVTOL flyers, because we're operating at a very low level, and we're never really in the way of those commercial airliners – except for the limited areas around London Gatwick, New York JFK airport, the approach areas where they land. That's where we can't go as eVTOL flyers, but only 15km beyond there, an eVTOL can operate very easily at low altitudes: just a couple of hundred metres, or a couple of thousand feet.

And in your eVTOL when you're flying, usually at a couple of thousand feet, **you will enjoy amazing views.** The first big implication of this is that you have ample time to steer and pilot your eVTOL around the sky very calmly. You're operating in 3D, not on a road with opposing traffic. Now combine this with an autopilot, which in the Axe by Skyfly comes as standard, and things become very calm and very simple. Also, contrary to what people often think, flying a small aircraft or your eVTOL does not normally require permission from air traffic authorities, or any other complicated flight plans that you might have thought you'd need to file. Just take off from your back garden, if you don't live right next to a big

commercial airport, and you don't need to do anything or talk to anyone in particular.



Just to illustrate this, I'm speaking to you with 25 years of practical experience – I fly my little two-seat airplanes all around Europe and the UK. I used to be very lucky and live right next to a farm with a big grass field, big enough to fly my little plane from, allowing me to fly direct from my front door to any friends who had a field big enough to land in too. A few years ago, I had to move back to a town with a school nearby for my daughter, but having had such amazing mobility, having had my aircraft and the ability to fly to my friends in minutes, I missed not having my plane outside my front door anymore. And this is exactly what the Axe by Skyfly will give you: because of its vertical take off and landing ability, you can literally fly from your own garden to your friend's garden, and go completely direct in between.

The big constraint of flying a small aircraft is that I could only fly to very specific places. A helicopter partly solves that problem, but I found them very difficult to fly: if you don't fly them every day it can become quite dangerous. They're also very expensive, very noisy, very inefficient, and not very sustainable at all. Like a helicopter, the Axe will give me the **freedom to land anywhere**, but without all the problems that a helicopter brings.

For starters, **the Axe is much easier to fly than a helicopter**. With its auto-stabilisation, it's even easier than flying a fixed wing aircraft, as you can just land with the press of a button, or input GPS coordinates and it will land on that spot. The Axe is both a fly-by-wire aircraft, with 8 motors driving 4 propellers for

the vertical take-off and landing aspects (much like a consumer drone) and also has conventional mechanical control linkages to your control surfaces. If you're flying low and slow and you let go of the controls, it will just sit right there; it will stabilise itself, not move, and sit very safely in a hover. If you let go of the controls while cruising, the aircraft will continue to fly itself in a straight and level course: the autopilot will effectively take over. You will have already put in the destination on your screen, and it will continue on that course until it arrives at your chosen landing site.

There will be systems in the cockpit helping you too, not just the easy-to-use autopilot, but also a navigation display with a 'Google Maps'-style picture, that shows you your destination and your flight path. It will also display the location and height of any aircraft around you, and if there is a risk of collision they will be highlighted and flash prominently on your screen. It's quite likely, that with software assisting pilots more and more, soon these aircraft will be talking to each other and taking avoiding action autonomously.



Again, to put this into context there is so much space, and things go so slowly up there, even if you're flying quite fast through the air. In my 25 years of flying, I've only had to take avoiding action twice, and that was before computer systems reduced this risk. These days, say in the last 10 years, great new computer systems have been created that show other aircraft on your screen. The computer sees them before you see them, and you can quite easily stay far away and have no risk at all of collision.

Now, **taking off is the awesome bit**. It's very easy, and majestic in every sense of the word. You see the Earth, the houses, and the objects around you, become

smaller quite quickly as you gain height and climb away to your cruising height. The important difference is, compared with an old-fashioned helicopter, the Axe is very quiet with its electric motors. Secondly, it's very stable as you are surrounded by 4 rotors, rather than dangling on a single rotor like a helicopter does. The flight computers will automatically manage the rotors and stabilise the aircraft, unlike in a helicopter where the rotor blades must be continuously adjusted by hand. Helicopters were invented in the 1940s, and they haven't changed in design or control: you still need to do that all by hand.

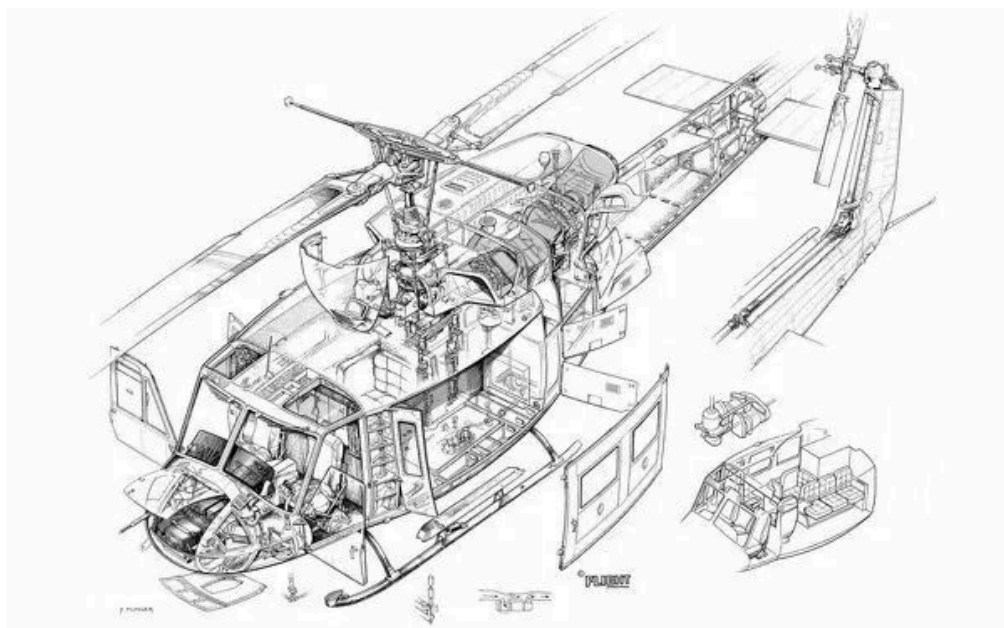
After the take off, you start moving forward. Steering is quite simple: just move the control stick left or right, and you go left or right! The throttle lever moves you up and down: let's just call that the houses lever; pull the lever down and the houses you see get bigger, push the lever up and the houses become smaller.



Landing is very difficult in a helicopter, manually steering that one huge rotor above, and moving the tail rotor at the back to keep it in check. There might be gusty winds, or winds around buildings and objects – it's quite hard and quite unsafe, and is best left to the professionals who do it day-in-day-out, rather than flying that helicopter yourself. Your private Axe eVTOL on the other hand, will **land automatically, assisted by satellite GPS guiding you to your destination**, combined with instruments that measure your height with a radar altimeter, which reflects a radar signal downwards to the surface of the Earth beneath you. The aircraft will even compensate for any wind gusting around any objects, or at different heights, and it will make sure that you descend exactly in the right way, to the right space. You can also choose to do a manual landing as well, but the systems will ensure that you descend slowly enough to land comfortably, and

safely. To help you further, the navigation map that we talked about earlier, will be replaced by a live camera feed that shows what's going on underneath you. You can also look around you, and rotate around your axis using your rudder pedals, to check to see that you're comfortable, and make your landing.

I hope that this has given you a good picture of what it's like to fly your eVTOL. You are excited I imagine, and rightly so! But you're thinking: how safe is it? The Axe EVTOL aircraft is much **safer than an airplane**, and **very much safer than a helicopter**. Let me explain that: it has many more safety levels than a conventional aircraft or a helicopter, and even more safety levels than a typical eVTOL.



- 1) Let's first start with a helicopter: if the engine, gearbox, linkages to the rotor, fail on a single engine helicopter, there really is no back up. eVTOLs on the other hand have **multiple electric motors**, which work independently and are governed by, in the case of the Axe by Skyfly, a quadruple-redundant **Veronte controller**, built by [Embention](#), and this means that one or even two engines can fail, and the eVTOL will continue to be able to fly, **automatically adjusting the power** settings for the motors that are still working to keep the aircraft stable and do a normal landing.
- 2) Also, like some other eVTOLs, the Axe can be equipped with a **ballistic parachute** – that's a fancy word for a parachute that can carry the plane and passengers, down to safety. After deployment, it simply floats you and the aircraft down at a speed that won't injure the occupants. Some small fixed-wing aircraft have these too, and in the last decade or two they have been proven to work well, when they've been used, and they've saved many lives.

But now the interesting thing. **The Axe by Skyfly is unique** in that it has yet another layer of redundancy that no other eVTOLs have.

4-Wing Design



- 3) The Axe has not just 2 but 4 wings, in two pairs: one at the front, one at the back. Most eVTOLs just use the rotors driven by the motors to stay in the air; the Axe meanwhile, uses lift from its wings like a traditional airplane, meaning it has **much lower energy use than eVTOLs without wings**. If the motors were to stop working, the wings also enable the Axe to glide gently down to Earth, still under the control of the pilot and mechanical linkages, even with a complete electrical failure. You can still just operate your stick, look left and right, and find yourself a suitable field to land in – even without any power. The Axe by Skyfly has a **glide ratio of 9:1**; that means for every 1 metre it descends, it goes forward 9 metres. This is the same glide ratio as most popular small aircraft, like the Cessna or Cirrus.
- 4) Without getting too technical, another feature of the Axe's double set of wings is that unlike a normal aircraft, the Axe **cannot stall**. In a normal aircraft with one set of wings, a stall happens if you go too slow. There is no longer enough airflow over the wings for them to create lift, and suddenly you're not in an aircraft but falling like a brick. The double wings on an Axe cannot stall; if you get too slow, the aircraft gently pitches forward, finds its own glide ratio, and descends at a constant speed.
- 5) Now, those unique wings that Axe has don't just provide a safety benefit. Having 4 short wings instead of 2 long ones, means that the Axe has a very small footprint, and that allows you to land in your own garden and park the Axe in your garage. Finally, these wings make the Axe by Skyfly the best-in-class in terms of the no-nonsense criteria of kilowatt hours per passenger per mile: the Axe is more frugal with energy than a Tesla!



One more thing about those wings on the Axe eVTOL, is that they allow the Axe to take off and land on a runway like a conventional aircraft, so the Axe **can fly like a helicopter as well as like an airplane**. Interestingly, if you have a runway to take off in your Axe like an existing small aircraft, you can save a great deal of energy and battery power thanks to the lift from the wings. You don't just rely on the rotors: some $\frac{2}{3}$ of energy is saved by taking off and landing horizontally; that increases the already-impressive range of 100 miles to even more. Those unique 4 wings that the Axe has is also very important, as currently there are no pilot licenses for eVTOL aircraft. Because you can fly the Axe like a normal airplane, you can fly it right now with a normal pilot license, and that's **the only eVTOL that you as a private pilot can fly right now**.

In terms of safety, compared to a helicopter, there is not only more safety redundancies but there are also fewer things to go wrong. A helicopter has a complex engine with many moving parts: gearboxes, pistons, driveshafts, all the linkages to convert that motion and power to the main rotor and to the tail rotor, which is not very strong and very light. All of these can go wrong, and if they do, you can't fire a ballistic parachute because the rotors would chop off the guidelines to the parachute.

The last thing you'll want to know when flying your eVTOL is where can I use it? Because the Axe is a private aircraft, in countries like the United Kingdom and the United States, you're usually allowed to land your aircraft where the owner of the land gives you permission. This means any landowners can, using a public

database, say that they're happy for eVTOL owners to land in their field, and in this context the hybrid option where your Axe can have a range-extending, lightweight rotary petrol engine to recharge your batteries is quite relevant as well. If you land on a beach, or in a beautiful field in nature, or in a farmer's field where there's no charger, you can use that charger to recharge the batteries and it will switch itself off the moment that the batteries are full. That means that you really can land anywhere, not just where there is a charger.

You will probably not be allowed to land near large international airports or city centres, until regulations and infrastructure surrounding traffic management have matured. Although, over time it is likely that these destinations will become automated, and that you'll be able to land if you leave the computer to do it for you. But even before then, it is quite likely that around cities you'll see urban airports or eVTOL parking lots starting to pop up: kind of like driving to the car park of a train station, and hopping onto a train to take you to the city centre. You'll have an aerial park and ride system – you'll park your private Axe eVTOL and walk over to the larger terminal, where a commercial air taxi takes you quickly to the city centre.

The further benefit is that because distances become so much less relevant, these park and ride areas can be in places where there is much more space, and where land values are much more modest.

The eVTOL experience is within your reach, and affordable at \$180,000 for the Axe by Skyfly. Order yours today at www.skyfly.aero.

More time, more joy, amazing views

Rise above it all, in your Axe eVTOL



Jaap Rademaker

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