The fun world of the gyrocopter…

Chris Gilbert kicks off with his thoughts, followed by **Paul Chaplin** and **Nick Wright**, as they talk about their passion and praise of the modern gyrocopter…

Owners and their machines, left Chris Gilbert with his Cavalon, and Paul Chapin with his Calidus.

To many, gyrocopters and the people who fly them are very strange! How do they fly, why would anyone fly them, and are they safe? I fly and own a Cavalon gyrocopter, G-YROL. I was in the Army and flew as a passenger in many military helicopters, and perhaps it was this that set me off down the gyrocopter path when I started to fly myself, four years ago. I have never flown fixed-wing so cannot really compare the experience but personally, I find the gyrocopter as much a thrilling experience 450 hours later as it was on the first day.

History

The gyrocopter was invented in 1923 by Juan de la Cierva, a Spanish engineer. Having witnessed the stall and subsequent crash of a fixed-wing bomber he had designed, he decided to invent an aircraft which could operate safely at much slower speeds.

The early gyrocopters had a fixed-wing fuselage with the wings removed and a free-wheeling rotor attached on top.

Over the years, many different experimental designs were dreamed up for the amateur builder and, unfortunately, there were too many accidents – pitch instability, under-powered engines and non-availability of two-seat training aircraft all combined to give gyrocopters a bad safety record such that the CAA intervened and came up with a Section T regulatory design requirement.

The modern gyrocopter is a completely different beast. Perhaps the biggest change affecting safety was the addition of the much longer empennage (tailplane) we now have. The horizontal and vertical aerofoils of the empennage at the end of a longer lever provide tremendous stability to the airframe.

Modern engines, better structural design, type certification and a significantly improved dual training regime, have all helped the latest generation of gyrocopters achieve excellent safety records, every bit as good as fixed-wings. The increased useful loads also mean that many also have impressive avionics fits too.

Key characteristics

1. They cannot stall, therefore cannot spin.
2. They can fly at 10kt IAS or less – almost vertical descents being possible.
3. They are short take-off – 30 to 100 metres.
4. They can land short – 0 to 10 metres.
5. They are always in autorotation so an engine failure is not dramatic.
6. They have modern avionics, heaters – even seat heating and electric lumbar cushions!
7. They are reasonably cheap to run – 15 litres of Mogas/UL91 per hour.
8. They have good ranges – five to six hours at 80-90kt cruise.
9. They are low maintenance – 12 months/100 hours servicing.
10. They are far less complicated than helicopters.
11. They are far less susceptible to turbulence or crosswinds than fixed-wings.
12. Their glide ratio is poor compared with fixed-wing machines.
13. They do not have autopilots.
14. Their VNEs are 110kt at best.
15. They look really cool!

How do they work?

In flight, the rotor is not powered. The blades are angled so that air moving upwards through the rotor will spin it, which produces lift. The propeller pushes (or pulls) the aircraft forward which, with the rotor tilted backwards, forces the airflow upwards through the rotor. The empennage is only effective in yaw with air flowing over it – this is generated at slow speeds with the propeller pushing air over it, or at higher speeds, by the forward motion of the aircraft. Without any speed or propeller push, the gyroplane could lose rudder authority, so we keep a minimum of 10kt airspeed to be able to maintain your control.

The main controls are the control stick, the rudder and the throttle. The pilot thinks of the throttle in a similar way to the helicopter pilots collective – more power equals climb, less equals descent.

Flying a gyrocopter

In normal flight, the gyrocopter 'feels' very similar to a fixed-wing. The two phases of flight which are quite different are the take-off and landing – let's examine them both in a little more detail.

Take-off

Without the rotor-tie fitted, the rotor is floppy and could potentially hit the empennage. The stick is therefore held fully forward and to the right and the rotor-brake, which keeps the rotor parked in a fore/aft position for taxiing, is released. The pre-rotator is engaged, and the rotor clutch engages to start the rotor spinning. Power is applied to speed the rotor to 100rpm, at which point the rotor is 'rigid' so that the stick can be moved to the central forward position. Further power is provided until the rotor speed reaches 200rpm, holding the aircraft on the brakes (the propeller is beginning to really push now).

On reaching 200rpm, the pre-rotator is disengaged (it will not be used again until after landing), the stick is moved to a fully aft position and the main brakes are released. Power is increased to full and the aircraft moves down the runway. The increased airflow through the rotor increases its rotational speed and the front wheel lifts from the runway. The pilot quickly eases the stick forward so that the front wheel remains six inches (150mm) off the ground and the aircraft is then balanced on the mains as the aircraft continues to accelerate down the runway. This 'wheel-balancing' technique is perhaps the hardest skill a gyro pilot has to learn, it is particularly difficult on bumpy grass airstrips.

At about 25-30kt IAS, the aircraft mains lift off the runway and the pilot applies slight left stick to counter the torque generated from the engine at maximum power. The aircraft is held at about two feet (60cm) from the runway until 60kt (best climb speed) is reached before the stick is moved back for

Above The Magni M24 Plus is the Italian company's latest competitor in the enclosed side-by-side market. It features the 141hp Rotax 915iS..

Left Magni's M16, their open cockpit tandem two-seater which James Ketchell flew around the world.

Below The larger and longer moment arm of modern gyroplanes has made them considerably more stable. Only the rudder moves, controlling yaw.

the climb. With a bit of headwind, this whole process can take as little as 20 seconds!

Landing

The key to landing is making sure you have enough rotor energy to stop the descent before the float. In practise, this means maintaining a reasonable approach descent speed of 50-55kt with a significantly steeper angle of descent than a fixed-wing.

Let's assume a 15kt crosswind and a standard approach. On turning onto final, the pilot reduces power significantly to allow the descent. The crosswind technique used for gyroplanes is the 'wing down' or 'crossed control' method; the 'kick it straight' method simply isn't accurate enough. So, the aircraft is pointed down the runway with the rudder and the stick 'leaned' into the crosswind to stop the aircraft moving sideways. About 20ft off the ground, the stick is retarded (still maintaining the 'lean' into the wind) to reduce the rate of descent. This is repeated two or three times until the aircraft is around 6ins to 1ft (150-300mm) from the ground, in the float, in a nose-up attitude (the same 'wheel balance' attitude mentioned for take-off). Then, you try to keep the gyro flying as the increased rotor drag slowly allows the plane to descend and touch down on the mains.

The gyro is kept in this balanced position until it comes to a complete stop and finally the front wheel touches the ground, the stick being kept fully back until the gyroplane has stopped. Wheel brakes are not used at all in a normal landing.

Once stopped, the stick is moved fully forward and into wind, this being the correct stick position for taxying. After leaving the active runway, the rotor brake is applied to stop the rotor and the pre-rotator can be briefly re-applied to return the rotor to its fore/aft position.

If the crosswind is over 15kt, it is perfectly possible to land the gyrocopter across the runway – the POH says the gyro can fly in winds up to 40kt, not that I would!

Below The very nicely appointed cockpit of the Cavalon. Note adjustable rudder pedals.

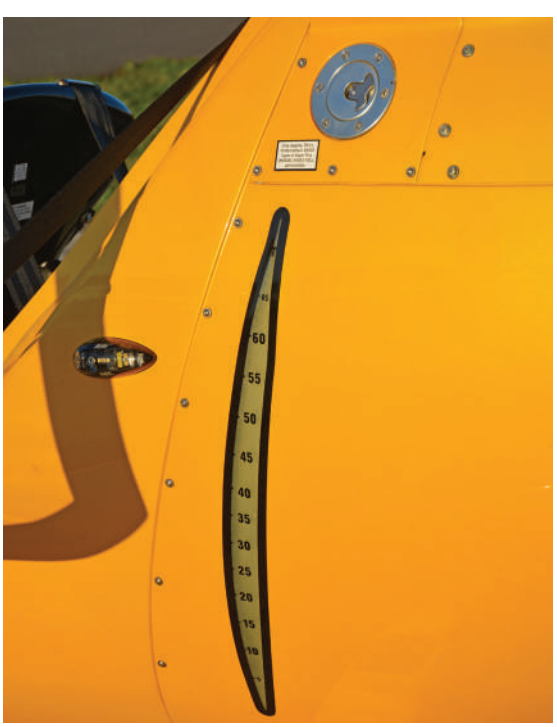
Loss of engine power

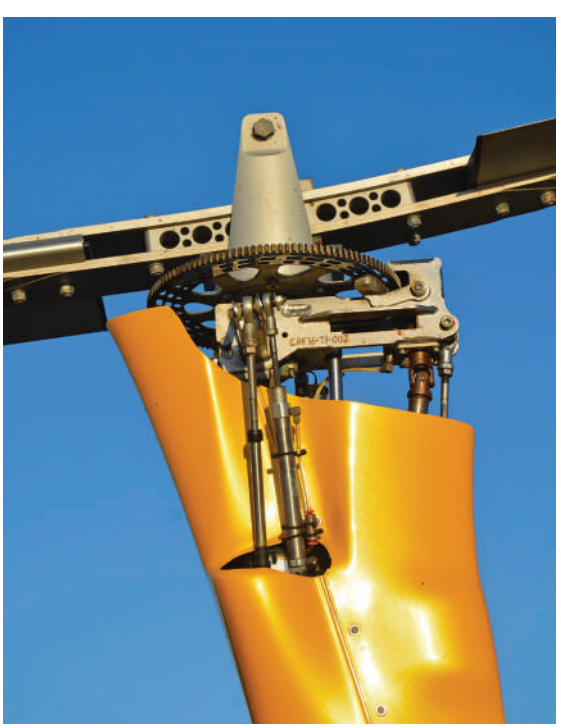
In a helicopter, loss of engine power can be pretty dramatic. The helicopter pilot has to disengage the engine from the rotor very quickly, and the airflow has to change from top-to-bottom to bottom-to-top. The helicopter then moves into autorotate – gyrocopter-mode – and then has to land as a gyrocopter. If it happens at low heights or low speeds, the aircraft does not have sufficient energy to land safely.

The gyrocopter, on the other hand, is always moving forward and is always in autorotate. If the engine suddenly stops, there is plenty of time to choose the landing point and execute a near-normal approach and landing. If the pilot is doing his job properly, he will be constantly checking the terrain for possible landing spots in the event of engine failure. I often demonstrate a simulated engine failure to my passengers by doing it first (so as not to alarm them) and tell them what we had just done! They are always amazed at the lack of drama!

Gyrocopter manufacturers and models

The best-known companies who produce type certified,





Far left Nice idea of the easily visible fuel contents when pre-flighting or filling up.

Left The relatively simple rotor head – compared to a helicopter. Pre-rotation is only ever engaged when on the ground.

Left The more rudimentary seating in the Calidus, but all-round performance is better than its side by side stablemate.

Below Glassfibre and transparency work is beautifully done. The wide doors and low sills of the Cavalon make for easy entry and egress.

Autogyro	Magni	
Open cockpit	MT03	M16C/M22C/M26
Enclosed cockpit: inline	Calidus	N/A
Enclosed cockpit: tandem	Cavalon	M24C

modern gyrocopters are Autogyro and Magni. Both companies have similar ranges.

The open cockpit aircraft are beautiful to fly – the visibility is fantastic and you really are flying in the elements. On the other hand, my Army time taught me to enjoy being enclosed and to have a heater! I also think it is more companionable when your passenger is seated right next to you rather than behind. However, tandem (side-by side enclosed) models are significantly more expensive than the open cockpit aircraft and are usually 10-15kt slower than their inline brethren.

Both companies have recently introduced the 142hp Rotax 915iS engines into their ranges. I am in the process of buying a new Cavalon 915, which has a claimed maximum climb rate of over 2000fpm.

So, why fly gyrocopters?

In short – fun, fun, fun! The aforementioned characteristics mean that we can safely fly gyrocopters at much lower heights than fixed-wings. We tend to fly at heights of 800-1,000ft max, which means we are flying in the contours of the terrain. Hills, woods, lakes, fields etc - all look better at these levels rather than at 2,000+ feet.

The comfortable VFR envelope for flying because of the gyrocopter's lower susceptibility to wind means we are often the only people flying on windy days. I regularly fly with a 90° crosswind of 15kt. On the other hand, gyros are rarely used for long-distance flying, although there have been a (very) small number of inter-continental/global trips by the hardy. I'm pretty drained after a three-hour flight!

Paul Chaplin, pilot/owner of G-CICM, AutoGyro Calidus

It was in 2009 when I read the article in *LA* magazine on the new wave of two-seat autogyros available for training. Like most of us, I had recollections of Ken Wallis flying *Little Nellie* in *You Only Live Twice* and of thinking that looks like fun. At the time, I was completing the build of my RV-7. My background is fixed-wing RN, followed by airline and corporate, with a fair smattering of GA and vintage display and paramotoring. However, the article was enough for me to make my way to Rufforth to visit Phil Harwood's Gyrocopter Experience flying school for a quick look-see.

Phil insisted on taking me up for a quick familiarity flight in an MT-03. This gave me such a feeling of being 'out there' in the elements as well as this being something different, yet some aspects of the handling were quite familiar. I felt I had to try it out properly. Coupled with Phil and Kati's enthusiasm, it did not take much persuasion for me to sign up for a PPL(G) course. Having the ATPL(A) and a PPL(H) meant this would not be too onerous on the hours requirement. Also, I was very much looking forward to flying from Rufforth in the Yorkshire skies again, 37 years after I had instructed from there on Chipmunks and Bulldogs with the RN Elementary Flight Training School.

There are aspects of gyrocopter handling which relate more closely to fixed-wing, mainly in forward cruise and manoeuvring flight – but without the adverse yaw on roll inputs. The main rotary wing similarities are the obvious ones

of having a 'fling wing' overhead, and the technique required on engine failure, but nothing else.

Whether your background is either, there are aspects of gyro flying which will be totally unique. Quite possibly not converting from any previous type would be an advantage!

The gyrocopter is a very safe way to be airborne, with more options when things go wrong. However, there are some very strict unique handling rules which must be followed.

Why do we fly? For me it continues to be leaving the familiarity of my surroundings on the ground, observing the world from above, and being reliant on myself and machine for returning safely again.

So, what is it about the autogyro? In light aviation I cannot think of a better way to receive more 'bangs for your buck'. There are an infinite number of approach angles and landing techniques to try out; reasonable cruise speed yet also a safe slower sightseeing one, as you're not always in a hurry; there are usually plenty of places to land in extremis; they're relatively cheap to operate; easy to park and hangar; it satisfies the pilot-thing of strict discipline at the right times; and it's still quite different, thrilling and fun.

Nick Wright, gyro instructor and examiner

As a child, I had always dreamed of learning to fly. So, in 1988 when I sold my house and, finally having the funds, I took that opportunity to gain my PPL(A) at Birmingham Airport in a Cessna 150 and 172. I then did the typical PPL(A) progression of adding a night rating, IMC, multi engine, and some aerobatic training. I bought different shares in a variety of fixed-wing aircraft; I started gliding at Husbands Bosworth, I even did a seaplane rating in the USA on the Colorado River, which was great fun!

I mention all this because, while I thoroughly enjoyed the challenge of flying fixed-wing, it didn't really match the dreams of flying I had as a child. At 2,000 or 3,000ft the ground just looked flat, there was little sense of speed. I'd fly 50 miles in a straight line, trimmed hands off; then a 30° banked turn and another 50 miles…

Then, in 2007, I read an article in *Pilot* magazine about the newly available Rotorsport MT03, I just had to have a go! So, I booked a lesson with Chris Jones at Kirkbride (he was the only full-time instructor back then) stayed the night before in a local B&B, waking up to a gale blowing! Off I went to the airfield anyway, might as well go and see what it looks like I thought. "I've come for a look and a chat, it's obviously not a flying day," I say to Chris. "On the contrary," replied Chris, "it's an ideal day to demonstrate a gyro". So, off we went.

My first flight in a gyro, my first in an open cockpit, in wind and weather conditions that, in 20 years of flying, I would never have considered suitable. Here I am strapped into the front (pilot's) seat. Chris had briefed me – push this, press that etc (although gyros have dual controls, there are certain things that can only be done from the front seat). It's noisy, it's shaking, Chris is telling me what to do, but it's all a blur, I'm totally overloaded! Because it's so windy there is virtually no ground roll, we just levitate into the air, and we're climbing at what seems like a frighteningly slow airspeed. My fixed wing brain is screaming at me that it's all wrong! Put me back on the ground! I've made a terrible mistake! This all takes just a few seconds, and at about 500ft Chris gives me control. I feel better, it feels just like a fixed-wing, I relax a bit.

We can't really go anywhere because the wind is so strong that if we fly downwind very far it will take us forever to get back to the airfield. We spend an hour flying around, getting a feel for this incredible aircraft. It's blowing a gale, yet it feels so solid, so planted. It's so accurate to fly, it responds to every little input that I make. The only aircraft that I've ever flown that responded with such accuracy to my inputs was an Extra 300.

We finally land, on the spot, and I'm completely converted. We go into Chris' briefing room and I phone Gerry Speich at Rotorsport to place my order... I haven't flown P1 in a fixed-wing since that day.

I think that I was, in some ways, a typical PPL(A) pilot. What

Below The Calidus in flight. These modern machines are well developed and beautifully made.

I really enjoyed was the challenge of learning something new, but the £100 cup of tea wasn't enough. Gliding was great fun, and I'm planning to take that up again, but for me flying a gyro is as close to those childhood dreams of flying as I've ever had.

One of the big pluses for me is the safety of gyros. As we all know, when flying, height is safety. The higher you are, the more time you have to deal with a situation. The fact that gyros are a fundamentally safer form of flight means we can fly them lower and still remain safe. That they can land in a very small space, and that at touchdown you should be hardly moving, means that even in an engine failure situation, with the correct techniques you should be relatively safe.

So, where I fly in Devon, we are often 'in' the landscape. Flying up river valleys, or around the tors of Dartmoor, along a beach, we see the shape of the land, and because of that we have a sense of relative movement.

I do believe that flying gyros is just simply more fun than flying your average fixed-wing. Why do I think it's more fun? Well because they are safer you can fly lower and slower, they're more manoeuvrable, they're more tolerant of crosswinds, of wind gradients, and in an emergency they can land in a tiny space; if you maintain a sensible power setting and a sensible attitude you can spend most of your time looking out of the window; good for lookout, good for enjoying your flight. Put all that together and you just have more time to enjoy this amazing privilege of flight.

A significant number of gyro pilots are conversions from fixed wing or helicopters. And quite a significant number are ex-military or commercial pilots. I believe that flying gyros, particularly open-cockpit, is the antithesis of what those professional pilots do for their day job, and they relish the back to basic, stick in hand, flying.

I am regularly asked if gyros are easier or harder to fly than a fixed-wing but unfortunately, that's not a simple question to answer. They are very responsive and accurate to fly, they do exactly what you tell them but, if you tell them the wrong thing, well… they'll do it!

Arguably, one of the most important skills is the ability to control the gyro in yaw, being comfortable using your feet. Gyros demand to be landed accurately, pointing in the direction of travel, with NO drift. I often describe flying a gyro as like flying a fixed-wing that can't stall, but it's probably more accurate to say a taildragger that can't stall. Just like a taildragger, you need to be nimble and accurate with your feet (and after landing be very conscious of your stick position). So, if you're converting, it probably depends on what you're converting from. If you have hundreds of hours in a PA28 you are probably going to need to learn to use your feet. If you're converting from an Auster (as I was), then you'll probably feel quite at home.

Obviously, I'm a bit biased, but I will be honest. When someone comes to me for a trial lesson, part of my job is to find out what they're trying to get from flying, and if I think that fixed-wing flying would suit them better, I'll tell them. If their dream is to travel long distances, in straight lines, in comfort, with luggage for a week in France with their wife, or husband, I'll recommend fixed-wing. If their dream is to fly along the coast, on a summer's evening, going nowhere in particular, just enjoying the pure magic of flight; well, there is simply no better aircraft to do that in, it has to be a gyro!

So, there you have it!

In several ways the relationship between downhill skiers and snowboarders is similar in the relationship between fixed-wing pilots and gyrocopter pilots – we live in the same space but seem very different. Whereas downhill skiing is a gliding motion, snowboarders, although they can glide too, are apt to change direction constantly, and their descent path is usually much steeper. Mixing the two forms of skiing can be tricky for both parties and it is often better to keep them separate. Similarly, particularly in the neighbourhood of an airfield, the slower moving and steeper- descending gyroplane can create conflict, and even danger, when in a busy fixed-wing environment. Gyrocopters seem to be harder to see for fixed-wing pilots, perhaps because of their different flight profiles. Because of this, I am an avid supporter of PilotAware, and it has saved my life on a couple of occasions from planes overtaking me from behind and below – I transmit ADSB, Flarm, ModeS and PilotAware to try and make myself visible to everybody!

The world of gyrocopters is a fascinating one and I love every minute of it. If you see me in my new machine – G-CLZV, come over for a chat and I'll show you around. ■

Above You certainly aren't confined to straight and level, these gyros are as agile as a typical light aeroplane.

Specifications Cavalon

Crew: 1 + 1 passenger in tandem
Length: 4.6 m (15ft 1in)
Width: 1.9 m (6ft 3in)
Height: 2.8 m (9ft 2in)
Gross weight: 450kg (992lb)
Powerplant: 1 × Rotax 912ULS 75 kW (100hp)
Main rotor diameter: 8.4 m (27ft 7in)
Range: 700km
Top speed: 160km/h (99mph, 86kn)
Cruise speed: 145km/h (90mph, 78kn)
Manufacturer: AutoGyro GmbH

Specification Calidus

Crew: 1 + 1 passenger side-by-side
Length: 4.78 m (15ft 8in)
Width: 1.73 m (5ft 8in)
Height: 2.74 m (9ft 0in)
Empty weight: 265kg (584lb)
Gross weight: 450kg (992lb)
Fuel capacity: 86 litres (19 imp gal; 23 US gal)
Powerplant: 1 × Rotax 912ULS 75 kW (101hp)
Main rotor diameter: 8.4 m (27ft 7in)
Main rotor area: 55.4 m2 (596 sq ft)
Maximum speed: 185 km/h (115mph, 100kn)
Cruise speed: 160km/h (99mph, 86kn)
Never exceed speed: 185km/h (115mph, 100kn)
Rate of climb: 5m/s (980ft/min)
Disk loading: 8.1 kg/m2 (1.7 lb/sq ft)