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MAGNIFICENT M24

HELICOPTER COMFORT IN AN AFFORDABLE GYROPLANE

FIRST UK TEST Magni has produced the world's first side-by-side enclosed gyroplane – and it's just been approved for the UK





> GYROPLANES have come on a long way in the last few years. Back in 2006 the MT-03 sent a shockwave through the gyro community when it burst on to the scene as the first factory-built two-seat gyroplane to be approved in the UK. Then came the MTO Sport (an updated version of the MT-03), and the Magni M16.

All of these aircraft have two things in common – they are all factory-built and so freed potential owners from the requirement to build and maintain their own machines (I know this is a homebuilders' magazine, but DIY isn't for everyone) and they are all open-cockpit tandem aircraft. As well as bringing performance and ease of operation, these aircraft have also brought safety, and their record shows that the days of gyroplanes being thought of as inherently dangerous are now behind us.

Now I have to say that I have never flown anything other than open-cockpit aircraft. I started off flying balloons and from there went straight to gyros. For me, gyro flying has always been about wind-in-the hair (OK then, more draught-down-the-flying-suit) and the motorbike-in-the-skies experience (one of my students recently described it as 'like flying a broomstick'). But I've been wrong before – when I moved from balloons to gyros my first thought was that the ability to steer was highly over-rated!

Then along came the Magni M24, and once

again everything has changed. For the first time in the UK we have an enclosed factory-built gyroplane approved to BCAR Section T (the UK CAA's airworthiness code for light gyroplanes). Not only do existing gyroplane enthusiasts have a choice between open-cockpit and enclosed, but it opens the door to a whole new group of pilots who quite like the idea of gyros but who would never consider sitting outside when they go flying.

DEVELOPMENT

The M24 has been many years in the making. Building an enclosed gyroplane isn't as simple as just bolting a conservatory to the front of an existing design – put simply, the amount of side area the gyro has in front of the CofG must be balanced by a larger side area behind the CofG, otherwise the aircraft will spend its time trying to face backwards in flight.

In an aeroplane you just put a larger fin on or move the fin back – do that in a gyroplane and the fin will intrude in to the rotor arc. Make the fin deeper and you add weight, moving the centre of gravity further back and cancelling

'It opens the door to a whole new group of pilots who would never consider sitting outside'

out the benefits you were hoping for from a larger fin... and so it goes on. Putting the engine on the front solves a lot of engineering issues but you lose the fantastic visibility which is the hallmark of the gyroplane.

Needless to say, Magni Gyro went through a few design iterations before it arrived at the M24. The M19 and the M21 were both tandem enclosed machines, but Magni wasn't happy with the level of stability (in case you were wondering, the M20 was an enclosed single-seater which never made it to market). The Magni M23 was the pre-production prototype, first conceived in 2005 and which had its first flight in February 2007. The productionised version became the Magni M24 Orion which took to the air in June 2008 and with the first deliveries to carefully selected customers in August 2009.

TEARDROP SHAPE

First impression of the M24 is that it is an exceptionally pretty aircraft. The shape is very much 'teardrop' (or 'tadpole' if you are less kind), and the overall look is very clean and elegant. It photographs very well and has great presence in the hangar – take it outside and the lack of external protuberances (like a big prop on the front, a set of wings or an eye-level tail rotor) and the relatively short length of the cabin make it look quite small. Left to its own devices, it prefers to sit on its tailwheel with its nose in the air, and it's best parked this way



MAIN: teardrop shape of the M24's fuselage can clearly be seen. **RIGHT:** no need for heavy windproof clothing any more!



to avoid it tipping up unexpectedly when you turn your back.

The doors are gull-wing and are entirely clear with the exception of a thin frame. The external door latch is a work of art in itself – an elegant aerofoil-shaped handle which demonstrates the designer's attention to detail. The fuel filler is on the right-hand side, and the aircraft is usually fuelled with the door open to avoid getting splashes of petrol on the transparencies (and the seat then provides a handy place to leave the filler cap).

The turbocharged Rotax 914 engine is fully cowled, with flaps on the upper side of the cowl which allow good access for inspection. The radiator and oil cooler sit underneath the cowling, with the cabin heat system taking its warm air from a muff on the radiator. On the left hand side of the cowl another flap gives a view of the calibrated sight-gauge on the back of the fuel tank.

At the top of the mast sit the 8.5-metre long composite rotors. As with all current gyroplanes the rotors are fixed-pitch with a simple teetering design. Gyroplane rotors and rotor heads work on the KISS principle – the minute you start to think about hinges, variable pitch blades and collectives then the simplicity is lost and the cost, weight and maintenance overheads start to head skywards faster than the aircraft will.

The Magni rotors are one of the keys to the aircraft's handling and stability. Their high

inertia design and built-in self-stabilising capabilities give a rock-steady feel – but more of that later. The rotorhead is controlled by standard push-rods.

The propeller is the popular composite Arplast Ecoprop ground-adjustable unit, with an elegant spinner which blends in to the lines of the aircraft. Just forward of the propeller is the pre-rotation system – this is the device which is used to get the rotors spinning before the take-off run commences. It consists of a pair of pulleys on the propshaft driving a smaller pulley via belts. In normal flight the belts are slack and just slip on the pulleys – when the pre-rotator lever is pulled the belts are tightened and off we go. The smaller pulleys sit at the end of a flexible drive shaft, the other end of which terminates at the rotorhead where a bendix engages on a ring gear to drive the rotors. Should the pre-rotator lever not be released then the bendix will drop out once the rotor speed exceeds the pre-rotator speed; if the bendix jams on then the belts will slip or give way well before the rotors are at risk from slowing down.

‘The Magni rotors are one of the keys to the aircraft's handling and stability’

At the very back of the aircraft, the fin, horizontal stabiliser and winglets are all made from a single composite moulding. The empennage is the same unit used on Magni's tandem M16 gyroplane, something which surprised me as they are such different aircraft. This level of commonality is not just good for production costs, it also means that although it is a new aircraft many of the components have been tried and tested elsewhere. The rudder is cable operated and is connected to the steerable nosewheel.

MAKE THE MOST OF THE SPACE

All light aircraft cockpits are compact – to do anything else gives unacceptable weight and drag penalties – so the trick is to make the most of the space you have available. The Magni M24 sits low on the ground, so a small amount of squirming and wriggling is required to get yourself in – but once in then the magic begins.

The cabin has pretty good shoulder room to start with, but to avoid having the pilot rub shoulders with the passenger, the pilot's (left hand) seat is set a few inches forward of the right hand seat. Not only does this give the impression of almost unlimited shoulder room but it also improves visibility when looking out to the right as your passenger isn't blocking your field of view.

The view forward is excellent and the instrument panel sits low in your field of vision. There is an unimpeded view through the **▶▶**

> FLIGHT TEST



MAIN: rotor blades have plenty of inertia for safety and also for stability.
LEFT: empennage is the same as on Magni's open gyroplane.
BELOW LEFT: M24 handles well.

transparent doors and none of those pesky wings which LAAers seem so keen on get in the way so the view is panoramic. Rudder and cyclic controls are fitted for both seats. The rudder pedals are easily adjusted and can accommodate most sizes from ballet dancer to prop forward. Once settled into your seat you are secured by a four-point lap and shoulder harness.

The panel has conventional steam gauges for height and speed, and engine parameters are monitored by a Rotax Flydat – an instrument which has been left behind a little in terms of presentation but which still provides good functionality. A manifold pressure (MAP) gauge completes the engine instrumentation, and on the panel you will also find a rotor rpm gauge and an optional rate-of-climb. A vertical card compass is standard fit, as is a fuel pressure gauge and fuel contents. The standard radio is a Filser ATR500 which provides intercom as well as comms.

In the centre of the panel are the warning lights – two for the engine (to tell you if the turbo is malfunctioning), battery drain, low fuel, rotor brake warning and the fire warning light (an engine compartment fire detection

'Shove your head out of the door for a good look backwards and shout "clear prop"'

system mandated by the CAA). There is switchgear for the landing light, strobes and fuel pumps; magnetos are operated by a key switch and the starter is a simple push-button.

The throttle is a lever type located to the left of the pilot's seat and duplicated in the centre console. The wheel brake is mounted on the pilot's throttle lever and controls the hydraulic brakes on the main wheels (there is no differential braking). The parking brake is on the centre console between the two occupants and doubles as a brake for an Instructor in the right-hand seat.

The choke and rotor brake controls are on the bottom left of the instrument binnacle (by the pilot's right leg), and the pre-rotator lever, trim switch and radio push-to-talk are all mounted on the control column. During startup and taxi,

the stick is held forward by a stick-retainer (of which more anon).

STARTUP AND TAXI

It's a good idea to leave the pilot's door open when starting up. In a conventional aeroplane the prop is in front of you so it is easy to see if there is anyone near it before you spark the engine into life – not so in a gyroplane. So the startup procedure (brake on, choke on, fuel pump on, throttle set) is interrupted when you shove your head out of the door for a good look backwards and shout "clear prop!" for the benefit of anyone you may not have seen. The engine starts instantly and the choke can be eased off almost straight away. Visibility is good, but a quick clearing turn to the right can be a good idea to make sure nothing is sneaking up in your blind spot.

It's normal practice for a gyroplane to taxi with its stick forward and into wind – this gives the rotors a zero (or negative) angle of attack, so they are much less likely to start lifting and banging against their stops as you taxi. The Magni is no exception, and the stick retainer, a spring-loaded cable which is hooked on to the front stick, takes the work out of holding the



A BIT ABOUT MAGNI

BORN near Milan in 1938, Vittorio Magni started working for Agusta Spa in 1956 in the transmission, engine and airframe departments. In 1962 he was recruited as a specialist in helicopters, acquiring experience in crop spraying and aerial disinfections which was followed two years later when he established Elitaliana, a company for aerial work specialising in crop spraying.

In 1967, Magni collaborated with Silvercraft Spa (a brand new company created to build a new light helicopter). Ten years later he created the company VPM manufacturing composite parts for several aeronautical companies including Agusta and Aerea.

In 1967 he had imported the plans of a Bensen gyroplane from the USA, the first gyro flying in Italy, and Vittorio developed a complete range of one and two-seat gyros. In 1996 the old company VPM became Magni Gyro with the purpose of improving created models and designing new ones.

The company first expanded in 2000 when it moved to a 900sq m building in Besenote, a small town in the Varese district, north-west of Milan. Then in 2008 it moved into a new 2000sq m building which boosted production to six gyroplanes per month for an annual production of approx 60-70 aircraft. Varese is one of Italy's most important aeronautical centres with suppliers of aeronautical materials and a skilled workforce.

The factory has its own 600m grass strip and its own flying club.

www.clubitalianoautogiro.it

rotors in position.

When the engine has warmed up (a minimum of 50°C for oil and CHT), the Flydat engine instrument gives a useful 'Engine Ready' message and the unit's LED light goes green. As long as the LED stays green then everything is happy – if one of the engine parameters goes out of limits the light goes red.

TAKEOFF AND CLIMBOUT

Before lining up on the runway the trim is set fully forward, the rotor brake is released, the stick retainer is removed, controls are checked for movement (couldn't do that before because of the stick retainer) and we're ready to go. Facing down the runway with the stick forward and into wind (to stop the wind from blowing through the rotor disk and potentially destabilising the blades as they build speed), the pre-rotator lever is squeezed on until the belts start to bite and the rotors begin to turn.

Keep squeezing on the lever as the blades build speed, then once the rotors reach 130rpm the stick can come back allowing the wind through the rotor disk to help spin the rotors. Steadily increase the engine rpm to build rotor speed and once we're at 200rpm or more, we

can release the pre-rotator, release the brake and head on down the runway.

One of the tricks of a gyroplane takeoff is to increase power gently in the early stages until the rotors start to accelerate – too much airflow too soon and the rotors can become unstable. Once the rotors are happy then smoothly apply full power, progressively applying right pedal to counteract the effect of the prop wash on the tail. As the nose comes up, ease the stick forward to keep the nosewheel just off the ground and hold that attitude until the aircraft takes off. Once off the ground keep the nose low until the aircraft accelerates to 70mph, then ease the stick back to climb away. A few seconds of trimming is then required to deal with the stick forces and the aircraft will then look after itself.

Best rate of climb speed is 60mph – the initial climb is made at 70 to give extra energy in case of engine failure. Once at 200 feet the aircraft can be re-trimmed, power reduced to max continuous (100hp) and the climb maintained to your chosen cruise height. The rate of climb is over 600fpm at MAUW. When you reach the top of the climb just reduce power (30 inches MAP is usually about right), watch the nose

come down and wait for the aircraft to settle down to its trimmed speed.

CRUISE EXPERIENCE

Typical cruise speed is somewhere between 60 to 80mph, with the Vne of 100mph attainable in level flight. The cruise experience is really extremely relaxed. No control inputs are required – in fact the aircraft is very happy hands and feet off however bumpy the weather conditions, a capability which sets the Magni apart from other gyroplanes. Whilst pilots usually fly 'hands on' most of the time, this does make for a very relaxed flying experience and the low workload gives plenty of spare capacity for lookout, navigation and communication.

For most fixed wing pilots the sensation will be very familiar – as a long-time open-cockpit aviator it took me some getting used to not being cocooned in flying suit and helmet and being out of the breeze! The side-by-side seating provides a very sociable flying experience and is excellent for instructing (I find I use my hands a lot when I talk and instruct but that doesn't work so well in the back seat of a tandem aircraft). Noise in the cabin isn't excessive, and is sorted out easily ▶▶

*“The fin, stabiliser
and winglets are all
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The closed cabin helps with noise reduction and a good quality headset improves it even more

by a good-quality ANR headset. Stick shake is minimal, as is cabin shake, so the whole experience is very, very comfortable.

From a handling perspective the M24 is a doddle, and the view forward, up, and to the side is enormous. One thing I really noticed when I flew the M24 was how much more I looked out than in my tandem aircraft – with no wind buffet or bulky clothing it is so much easier to turn your head. When I first flew the M24 in Italy, I wondered how I would manage without a horizon reference in my field of view but I soon found my fears were unfounded. The aircraft is so stable that a reference isn't required and there is no tendency to porpoise.

Although I'm quite happy to fly my kids in the back seat of my M16, having passengers or students sitting beside you makes life just sooooo much easier. Having spent many hours sat in the back seat patiently explaining to my students "...and now we need to adjust the radio... no, the radio... that's the one, the round thing with numbers on... now push the silver button the top left, no the other left no, the top, ... yes that's it, press that button once... no, that was twice...", the thought of being able to just point fills my heart with joy. For carrying the nervous passenger, young child or dog (yes, really) sitting side-by-side is a boon.

LET'S ROCK AND ROLL!

You aren't going to get the 'Gyrocopter Grin' without having some fun! Although the M24 is probably best thought of as a laid-back touring machine, it can hold its own when it comes to yanking and banking. An airspeed of about 70mph seems to suit it best for tight turns, as it allows plenty of energy to recover if things don't go quite as planned. Tight turns in a gyroplane are always very comfortable

'You aren't going to get the Gyrocopter Grin without having some fun – yanking and banking'

affairs – although you might be turning in not much more than your own length the G-forces are really very modest so it tends to look more spectacular than it feels.

One difference with the M24 is that the side-by-side seating gives a much greater impression when the aircraft banks. In a tandem gyrocopter the horizon moves but it all feels quite relaxed as you are at just over 1G so everything is very natural. In the side-by-side M24 you are either looking up or down at your passenger with the ground/sky through the door next to them, so a very different perspective on life and it really feels like you have some bank on.

SLOW AND VERTICAL FLIGHT

So far so good, but there's no point in having a gyroplane if you aren't going to do some gyroplaney things with it. Slow flight isn't a bad place to start, and at full power the M24 will maintain level flight at about 30mph. Increase that speed up to about 35 to 40mph and the aircraft will have a very low ground speed whilst not demanding anything like as much power, ideal for taking in the sights or watching what's going on.

Take the power off, hold the attitude, wait for the airspeed to bleed off to zero and the aircraft will settle down in to a vertical descent. The M24 retains excellent rudder authority in

a low speed descent, giving it a very helicopter-like feel and allowing you to yaw the aircraft left and right to get the best view. I really like being able to share the same view with my passenger, and if the object of interest passes down my side being able to just kick the aircraft around to let the right-seat occupant see it is a real plus.

Recovery from a vertical descent is really simple – just let go of everything and the nose will drop. As the aircraft accelerates the nose comes up and you settle down to your trimmed speed. If you are on approach at the time then a quick tweak of the stick is all that is required to get yourself lined up on the runway, and there is little to do until it is time to flare.

APPROACH AND LANDING

The standard powered approach is flown at 19 inches MAP and 60mph. The M24 isn't quite as forgiving of low approach speeds as its tandem cousin, and if you are too fast it will tend to float. For a tandem pilot the challenge is to keep the aircraft straight down the runway. We are accustomed to lining up the apex of the instrument panel and the yaw string in front of us as we land – try the same trick in an M24 and you will touch down sideways!

On my initial landings I used the 'land it so that it feels like it's yawed to the right' technique, but that changed to a 'look straight ahead and not at the yaw string' approach instead, which seems to work well enough.

Gyroplanes normally land in a crosswind using an equivalent to an aeroplane 'wing down' approach – with stick into wind to fly down the centreline and out-of-wind rudder to point the aircraft down the runway ('crossed controls').

The M24 is no different, and as the aircraft ➤

> FLIGHT TEST

'Engine off landings in the M24 are a doddle leaving you with spare processing power'

is held off in the flare the power is eased off to stop the float and settle it on to the ground. The low, straight keel of the Magni means that touching down tail first is not uncommon, and this is dealt with by the small tailwheel at the back of the aircraft. Ground roll is gyroplane-short and the aircraft stops within a few yards.

Power-off approaches are much steeper, great for obstacle clearance and another eye-opener for fixed-wing pilots. My normal approach is power-off and although much has been said about the M24 being like a little helicopter this is one area where the two aircraft really differ. Engine-off landings (autos) in a light helicopter such as the R22 are exciting to say the least. Engine-off landings in the M24 are a doddle – so not only are you more likely to execute a good emergency landing but you will have enough spare processing power to choose a decent spot, brief your passenger and make a radio call on the way. All in all, it sounds to me like a fair exchange for the ability to take off and land vertically.

OPERATION AND OWNERSHIP

The Magni M24 has a very compact footprint, so although it needs to live inside, very little hangar space is required. As for strip length, it depends a great deal on what is at each end. A 200m strip with no fence or obstructions at each end is enough to operate from, 300m without high hedges or trees is sufficient in most conditions, and you'll not get caught out if you have 400m.

Operating costs are on a par with most other microlights and light aircraft. A 100hr/annual engine and airframe service costs about £300. Standard service parts and wear-and-tear items are held by Magni Gyro in the UK and are dispatched on a same-day basis; if you need something unusual then delivery from the factory in Italy is rapid. There is a growing network of authorised maintainers in the UK and support is available from the two Magni Gyro Centres of Excellence at Rufforth and Old Sarum. The annual Permit to Fly is administered directly by the CAA, with a renewal cost of £246.

CONCLUSION

The M24 is a unique machine. The combination of gyrocopter fun, helicopter-like visibility and capability plus the ability to share the experience with someone sat next to you in the comfort of an enclosed cabin is hard to beat. Combine that with aeroplane-like running costs and exceptional stability and handling and you have a winning combination.

The M24 is already proving to be a huge hit in the UK. Having sold 60 M24s to customers around the world in the last 12 months, Magni Gyro has already delivered six aircraft to the UK since approval in October 2010 and scheduling additional production slots to deliver more UK orders in early 2011. These aircraft are selling both to existing gyro pilots and to people who are new to unpowered rotors showing that the Magni M24 is bringing new people into both aviation and the world of rotary-wing flight.

MAGNI GYRO M24 ORION



ABOVE: well laid-out cockpit of the M24.
BELOW: strong undercarriage legs.
RIGHT: engine cowled behind fuselage.
BOTTOM: one-piece empennage.



ESSENTIAL INFORMATION

PERFORMANCE

Max speed 115mph
Cruise 90mph
Rate of climb 625ft/min
Ceiling 10,500ft
Takeoff roll 30-70m
Landing roll 0-30m

115hp
Rotor diameter 8.53m
Prop Arplast ECO
GL-3, ground adjustable, three-blade, 1.7m diameter

PRICE

Base price 69,000 euro + VAT

DIMENSIONS

Max weight 500kg
Empty weight 285kg
Payload 215kg
Width 1.8m
Length 4.3m
Height 2.8m
Fuel capacity 82 litres

MANUFACTURER

Magni Gyro s.r.l.
via Volpina
21010 Besnate (VA)
Italy
www.magnigyro.it

TECH SPEC

Engine Rotax 914
Turbo producing

UK AGENT

Magni Gyro UK
www.magnigyro.co.uk