



EXPERIMENTER
FEATURE



GREAT BIG ● GYROPLANE grins

THE MODERN RESURGENCE OF
A MISUNDERSTOOD MACHINE

STORY BY BETH E. STANTON
PHOTOGRAPHY BY CHRIS MILLER

AT FIRST GLANCE, GYROPLANES LOOK LIKE A FUNKY CROSS BETWEEN A HELICOPTER AND AN AIRPLANE. While sharing aspects of both, they combine a unique blend of flight characteristics into one exhilarating-to-fly package. There is a standard in the industry known as the Gyroplane Grin. After his first flight in a gyroplane at EAA AirVenture Oshkosh 2018, Jim Antes, EAA Lifetime 1170562, was hooked.

*Alvee has no pilot experience
but loved his gyroplane ride.*





“ALL IT TOOK WAS ONE FLIGHT, AND I HAD TO BUY THAT GYRO,” HE SAID. “I COULDN’T GET THE SMILE OFF MY FACE.”

Gyroplanes can take off and land in short distances and fly in wind and turbulence that keeps fixed-wing aircraft on the ground. They can fly low and slow or cruise along at around 100 mph. They are highly maneuverable, cannot stall or spin, and, since they’re always in auto-rotation, they gradually descend to a landing spot in the event of an engine failure.

Gyroplanes are a niche within a niche of rotorcraft and have been the outcasts of general aviation for decades.

“We’re always sort of outcasts anyway being a rotorcraft,” gyroplane pilot Paul Minear said. “Then flying this thing that’s really unusual, we’re really on the fringe of things.”

MISCONCEPTIONS

MISCONCEPTIONS ABOUT GYROPLANES span opposite ends of the spectrum, from so easy you can teach yourself to fly to the notion that they are difficult and dangerous. Historically, gyroplanes have had a poor safety record due largely to pilots teaching themselves to fly in the earlier, less stable designs.

“Everyone in aviation knows that there is a risk you take when you sit in a cockpit,” said Dayton Dabbs, EAA 1179353, a gyroplane CFI and designated pilot examiner (DPE). “I think modern gyroplanes have managed to very much mitigate that. I would argue that any aircraft flown within its limits by a qualified pilot that is mechanically maintained is a safe aircraft.”

Gyroplanes may have gotten a bad rap for years, but that is changing. Design advances have increased stability and minimized problematic handling characteristics such as pilot-induced oscillation (PIO) and sensitive control inputs. An increase in the number of gyroplane CFIs and DPEs has made it easier for pilots to access professional training.

CERTIFIED, EXPERIMENTAL, ULTRALIGHT

GYROPLANES RUN THE GAMUT from open-cockpit, open-frame, two-stroke ultralights to sleek carbon fiber factory-manufactured cruisers with sophisticated avionics and heated leather seats. There are about 4,000 gyroplane pilots in the United States, but the aircraft enjoys far more popularity in Europe. A lack of certification for gyroplanes in the United States prevents them from being sold turnkey from the factory or used in commercial operations as they are in other countries. Three gyroplanes were FAA certified

GYROPLANE GEMS ROTOR FLIGHT DYNAMICS DOMINATOR / N559RD



Plans and parts for this single-seat ultralight are produced in Florida. It is powered by a 65-hp Rotax 582 with a three-blade Warp drive propeller. It features 24-foot Dragon Wing rotor blades with a hydraulic pre-rotator, light-weight basic instruments, and rotor tachometer. Centerline thrust and a tall tail help stabilization in all power settings.

for commercial production in the 1960s and '70s, but they were economic failures. Recently, AutoGyro's Calidus was granted primary category certification (intended exclusively for pleasure and personal use) and it is the only current production gyroplane certified in the United States.

Gyroplanes missed the chance to be included when the light-sport aircraft category was created due to disagreement within the industry about requisite criteria. Subsequently, they fall under the ultralight and experimental categories. A sport pilot certificate with a rotorcraft gyroplane rating is required to fly non-ultralight gyroplanes. Pilots with a minimum of a sport pilot certificate can obtain a gyroplane endorsement to add to their existing certificate.

FIRST ROTORCRAFT

GYROCOPTER, GYROPLANE, AND AUTOGYRO are different names for the same type of aircraft. Gyroplane is the official FAA designation. The convoluted history of this remarkable machine stretches back nearly a century and predates the helicopter. With a mission to design an aircraft that couldn't stall, Spaniard Juan de la Cierva invented the Autogiro, the world's first rotorcraft, which flew in 1923. The design incorporated a propeller to generate thrust and an auto-rotating hinged rotor to create lift. Cierva used a free-spinning rotor and an airplane fuselage with ailerons, elevators, and rudders to control the direction of flight.

Aircraft designer Harold Pitcairn bought the American rights to the Autogiro, and the aircraft debuted in the United States in the 1930s. Although gyroplanes have short takeoff and landing distances (a few have jump takeoff capabilities), they still needed a runway and couldn't hover or fly backward. Igor Sikorsky used Pitcairn's patents to invent the helicopter. World War II drove rapid advancements in airplanes while the gyroplane languished in limbo.

Below: Instructor Chris Lord, left, and proud new gyroplane owner Jim Antes training in his AutoGyro MTOsport purchased at AirVenture 2018



Produced in Italy, the Magni M-16 has a 115-hp turbocharged 914 Rotax engine, aftermarket E-Props five-blade propeller, standard gauges, and Kanardia electronic engine management system. The panel includes a Garmin aera 660 GPS, ADS-B Trig TT22 Mode S transponder, and Trig TY91 radio. It also has a trailing-link nose wheel and flexible-shaft pre-rotator.

BENSEN ERA

THE GERMAN AND BRITISH MILITARIES experimented with gyro gliders to tow soldiers or, in Germany's case, U-boat observers, but the concept never gained much traction. A young engineer, Igor Bensen, was so impressed with the idea that he designed and built his own in the 1950s. He trademarked the name Gyrocopter and placed ads for the plans in *Popular Mechanics* magazine. The single-place Gyrocopter could be made with materials found at a local hardware store. It could be built first as a glider for training purposes, with a McCulloch drone engine installed later. When people finished building, they'd hop in and fly their new machine. The Bensen method of self-training was a slow process that could be successful if carefully followed. However, many builders didn't have the patience. The scenario of self-taught test pilots flying a twitchy aircraft resulted in a large number of fatal accidents.

EXPERIMENTING

BENSEN FOUNDED the Popular Rotorcraft Association (PRA) in 1962. The popularity of his Gyrocopter led people to experiment with new designs. With propellers now moved to the back in the pusher configuration, some designs created an offset between the center of gravity and the thrust line, creating the potential for a power push-over (bunt-over). These gyroplanes had a tendency to tip forward after adding power or leveling off from climb. With no horizontal stabilizer, these designs lacked dynamic stability, and oscillations would become unrecoverable.

Ken Brock modified a Bensen Gyrocopter that led to an entirely new design that was easier to handle and fly. Ken was among the first to start the argument about adding horizontal stabilizers to gyroplanes. He also developed one of the first two-place trainers that helped reduce incident rates.



In Britain, Royal Air Force Wing Commander Ken Wallis built a miniature gyroplane, the Wallis autogyro, which was famously flown by James Bond in *You Only Live Twice*. His designs were used by the military and law enforcement. Rotary Air Force, originally from Canada and now based in South Africa, made one of the first side-by-side enclosed gyroplanes. It was cost-effective and used a Subaru auto engine.

Jukka Tervamaki from Finland is considered the father of the modern gyroplane. He conducted extensive studies on stability and the use of a horizontal stabilizer. He helped convince the industry that this design was the way forward. When he decided to sell the rights to his JT-5 gyroplane, Vittorio Magni from Italy

bought it, and Magni Gyro became the first manufacturer of modern European gyroplanes.

HOME AND ABROAD

“EVERYBODY HAS THEIR own stuff that they keep more or less copying and modifying and changing and doing different things with,” said Chris Lord, gyroplane CFI and DPE. “That’s kind of how the industry is.” The players in the European gyroplane market all branched out from each other in interwoven ways. Magni Gyro is the longest manufacturer of European gyroplanes. ELA from Spain copied some of Magni Gyro’s designs. A German ELA dealer procured its drawings and began to build the kit in Germany and started AutoGyro.

In the United States, SilverLight Aviation makes the American Ranger, inspired by the AutoGyro design. Rotor Flight Dynamics makes the Dominator, with its long legs, horizontal stabilizer, and repositioned engine to provide centerline thrust, making it less prone to PIO. (European designs stabilized offset thrust by putting a large tail with vertical and horizontal surfaces in the back.) Sport Copter in Oregon has continued to innovate its designs for two generations.

GYROPLANE VS. HELICOPTER

HELICOPTERS CAN HOVER, but that ability comes with a steep price and complexity. A gyroplane’s engine powers a propeller that drives the vehicle forward. Oncoming air comes up through the bottom of the rotor (similar to a maple seed) to create lift. The rotor spins on a free wheel bearing and is not connected to the engine, though many gyroplanes have a simple pre-rotator that uses engine power to help get the main rotor up to speed prior to takeoff; the air through the rotor system keeps the rotor spinning. The aircraft either goes forward with the thrust of the prop or down with gravity. Conversely, a helicopter engine drives the main rotor that pulls the air down. This requires a transmission to drive both the main and tail rotor and a swash plate to change the pitch of the rotor blades, making it much more complex (and expensive). The auto-rotating blades of a gyroplane don’t need to be governed, versus a helicopter where the pilot must adjust the pitch and monitor rotor rpm.

UNIQUE CAPABILITIES

THE GYROPLANE HAS airplane capabilities, but can also do nearly everything a helicopter can at a fraction of the cost. They can fly low for ground-level surveillance and have flown as high as 26,000 feet. They can stay aloft at extremely low airspeeds or cruise at 100 mph. They can be used purely for local recreation or as a long-distance travel commuter.

According to pilots, one of the best things about gyroplanes is flying in windy conditions. Rotating blades form a disk with the blades occupying less than 5 percent of the total disk area. Fixed-wing aircraft have a large surface area to collide with wind while the gyroplane rotor slices through it. The rotor also acts like a suspension from which the pilot hangs to create a smooth ride in turbulence. When it gets blowing around 15 mph, the fun really starts. With a stiff wind, gyroplanes can do some of the same

GYROPLANE GEMS SILVERLIGHT AVIATION AMERICAN RANGER / N205AR



Produced in Florida, the Ranger has a tandem-seat open cockpit and is powered by a 115-hp turbocharged 914 Rotax engine with a Kiev propeller and a rotor pre-rotator. The standard analog instrument package includes iFly 740 GPS and instructor flight control package.

things as helicopters. They can take off and land with zero roll and mimic hovering into a head-wind. Experienced pilots can face into the wind and do a 360-degree pedal turn staying in place.

FUN FLYING

“I THINK WHEN people see gyroplanes, they look like they fly aggressively even though that’s just how the gyroplane operates,” Chris, EAA 672753, said.

Landing and stopping short, steep banked turns, and stopping in midair (with wind) are all well within the normal flight envelope of gyroplanes.

“With a gyro, we bank into a 30-degree turn, and that’s nothing because you are a pendulum underneath,” Paul said. “Your butt might swing out 30 degrees to the side, but you don’t feel any different in the machine because you just feel 1g. It’s like taking a corner in a motor-cycle. You feel the turn and then you straighten out and then it’s all back to normal again.”

In the air, a gyroplane flies very much like a fixed-wing aircraft and once trimmed out, is stable and can be flown hands-off.

“You can bank and yank without any fear of overstressing the aircraft or accelerated stall,” Dayton said. “It’s never going to exhibit any strange handling characteristics.”

Greg Spicola, EAA 1155919, a commercial helicopter pilot and gyroplane CFI, loves being able to take off from a spot, lift up, fly away, and land wherever he wants.

“You don’t need an airport runway,” he said. “The maneuverability is low and slow. Rotorcraft are designed to operate close to the ground at low speed to interact with objects on the ground.”

Dayton once flew with a bald eagle in Alaska.

“I literally passed a bald eagle, turned around, and flew next to it for two or three minutes,” he said. “It’s amazing to fly with the open cockpit, having the wind in your hair. I told everyone when I first started flying them it is as close to being Superman as you could possibly get.”

Below: Red Bull helicopter pilot Chuck Aaron, left, had the Gyro Grin after his first gyroplane flight at AirVenture 2018 in Greg Spicola’s American Ranger. He’s going to begin training this spring.



Produced in Germany, the 2017 MTOSport includes heated seats with lumbar support. It’s powered by a turbocharged 115-hp Rotax 914 engine. The panel features a Garmin 796 GPS and electronic airspeed indicator, Funke comm radio, and Mode S transponder. It also has a pneumatic clutch pre-rotator.

SIMPLE TO SOPHISTICATED

OPTIONS FOR A GYROPLANE span a huge range depending upon mission and the amount of money one wants to spend. Fuselage styles range from bolted tubes to a full carbon fiber mono-coque enclosed cockpit. They run the gamut from a single seat, no instruments, no windshield, wide-open seat-of-the-pants flying machine with a two-stroke engine to a two-place side-by-side technologically advanced cross-country cruiser with a 400-mile range and turbocharged engine.

Compared to building an airplane, building a gyro is a relatively simple process. Many airplanes take thousands of hours, but gyrocopter kits can be built in as little as 80-100 hours. A special 51 percent checklist is granted for gyroplanes, and builds done on-site at the factory can typically be done in less than two weeks.

Many single-seat gyroplanes fit on a trailer and may be stored in a garage, negating the need for a hangar. The aircraft can be driven to the airport and assembled in about half an hour.

GYROPLANES AT AIRVENTURE

IN THE 1970S AND ’80S, Ken Brock dazzled the crowds at EAA AirVenture Oshkosh with an air show routine in his KB gyroplane that demonstrated the incredible performance of the machine. A maximum performance takeoff highlighted its short-field capabilities. After gathering airspeed, a vertical climb to altitude followed. A signature maneuver was a near vertical descent from a few hundred feet while kicking the rudder and spinning the gyroplane around the vertical. This move was frequently performed dead-stick.

“It just blew everybody’s mind,” Greg said. “The crowd response was amazing.”

At AirVenture 2018, many gyroplane manufacturers and models were on display and flying demonstration and passenger flights at the Fun Fly Zone.

“When you’re in the Ultralights area, you’re truly in the EAA sector,” Chris said. “The people there might not have the funds, but they have the dreams and the desires, and they’re



looking for something to fit their niche. That's exactly what the gyroplane industry is."

"The EAA rotorcraft volunteers do an amazing job every year," said Geoff Downey, EAA 105011 and rotorcraft chairman. Paul, in his open-cockpit one-seat Dominator, captured the attention of the announcer and crowd as he flew circles around the ultralight runway.

"I'm right out in the open," he said. "They see me come zipping by, and a couple minutes later here I come again."

He burned through 72 gallons of gas that week.

"I'm trying to be an ambassador," he said. "I wanted to keep up there as much as I could to give something for people to watch and get more people down to the Fun Fly Zone."

GYROPLANE COMMUNITY

THE GYROPLANE COMMUNITY is a close-knit one where everybody knows everybody else.

"The clubs and the people are fantastic, more than I've seen in any other form of aviation," Greg said. A lively and sociable culture thrives at fly-in events and PRA chapter meets across the country. The Bensen Days Rotorcraft Event in Wauchula, Florida, is held the week before the SUN 'n FUN International Fly-In & Expo. After Oshkosh, the gyroplanes head over to the PRA convention where hundreds gather in Mentone, Indiana, for the largest gyroplane fly-in in the country. In September, the Ken Brock Freedom Fly-In is held on the El Mirage dry lake bed in California.

Gyroplane manufacturers, CFIs, and DPEs have worked together closely over the years training students and promoting the industry. Arranging instruction, scheduling a checkride, and help with maintenance or a build is only ever a phone call or email away.

"My heart is in it for the passion of the gyroplane," Chris said. "The goal is to bring the training up to a different level and move this whole industry forward."

Dayton believes the notion that gyroplanes are unsafe is shifting as progress is made in the industry.

"The longer this new generation of gyros is out, the more people are starting to look at them as viable aircraft," he said.

Two additional AutoGyro models are on track for FAA certification in 2019.

"We will finally have the three that we can use for aerial work, and we don't need to get a letter of deviation for training," Chris said. "It doesn't seem like much for most people, but to the gyroplane industry, it's going to revolutionize everything. It's starting to open the door to get more of them out there."

VEHICLE OF DISCOVERY

JIM MET an F-15 pilot at AirVenture 2017 who told him that the most fun he has flying is when he jumps into his gyro.

"I'm like, how is that possible?" he wondered.

He vowed that the next year he would fly a gyroplane at Oshkosh.

"When I found out that they were offering discovery flights I jumped on it," he said.

It has been a whirlwind for Jim since that day. He bought an open-cockpit gyroplane and, within months, earned his endorsement and has been flying all over his home state of Massachusetts. It's nothing like his Comanche.

"I can smell and I can feel the temperature," he said. "People are waving at me from 500 feet up. New England has all these mountains and rivers. I've lived here my whole life, and I'm able to discover areas that I only heard about but had never seen up close. It doesn't even feel like I'm operating a machine. It's just like I am flying like a bird. The freedom that it gives you is amazing." *EAA*

Beth E. Stanton, EAA 1076326, flies an experimental Lazer in aerobatic competition and is a director of Northern California Chapter 38 of the International Aerobatic Club. She can be reached at bethstanton@gmail.com.

GYROPLANE GEMS **AUTOGYRO CAVALON / N477AG**



The Cavalon is produced in Germany and features a side-by-side monocoque carbon fiber cockpit, gull wing doors, leather interior, Garmin aera 696 GPS, Garmin radio, and transponder. Pneumatic systems assist the pilot in pre-rotation, trim, and rotor braking.