

**The Bill Blackwood  
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**The 21st Century Gyroplane:  
The Practical Choice for Police Aviation**

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**A Leadership White Paper  
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## **ABSTRACT**

Police have used aircraft to support ground unit officers for almost 100 years. The first operational use of a rotary wing aircraft used in police aviation was a Cierva autogiro in England in 1932 (Police Aviation News, n.d.). Advancements in technology and increased mission requirements called for aircraft to do a wide range of activities to support the officers on the ground. The traditional air unit model thus emerged, consisting of a large turbine helicopter with the accompanying large acquisition and maintenance costs. After a period of growth in police aviation in the United States, the recent economic downturn forced many of the traditional air support units to reduce their flight hours or eliminate programs. However, the value of police aviation to support the officers on the ground has not diminished with the reduced budgets. A survey of large law enforcement agencies discovered that the primary missions for air support units is to respond to calls for service, photographic flights, and assist ground units in making arrests (Langton, 2009). In lieu of eliminating air programs because of reduced budgets, modern gyroplanes that can perform the primary mission profiles with lower acquisition and operating costs and improved safety should be placed into service.

The new modern gyroplane designs have an outstanding safety record, are more stable in rough turbulent air, and will not stall as a fixed wing airplane can during slow flight. The gyroplane is also safer than a helicopter if engine power is lost. A successful gyroplane program that was implemented recently at the Somerset, Kentucky police department realized the advantages a modern gyroplane can give an aviation unit, where low purchase price and low operating costs are ideal for any public safety agency (The Center for Rural Development, 2012).

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## INTRODUCTION

Police discovered the advantages of using aircraft for aerial patrol and support of ground personnel almost 100 years ago. The aircraft have evolved because of advancements in technology, expanded mission profiles, and other requirements specific to the agencies employing the aircraft, but the value of an air support unit has remained constant. The first aircraft used for law enforcement purposes were airplanes, and many varieties were utilized from 1914 until 1932, when the first reported rotary wing aircraft was used for police service. It was a Cierva Autogiro and it was used primarily for traffic control at the annual Derby Day in England (Police Aviation – A Chronology, n.d.). The autogiro was used successfully in Europe and the United States until advancements in the design of the helicopter led to its rise to prominence in rotary wing aircraft.

In 2007, about one in five large law enforcement agencies (agencies with over 100 sworn personnel) operated an aviation unit, of which 50% of these units operated helicopters at more than twice the number of airplanes (Langton, 2009). During the 1990s and continuing into the new century, there was growth in airborne law enforcement. Police agencies were given the opportunity for grant funding to acquire civilian aircraft, or retired military aircraft were offered through government surplus programs. A large number of military surplus helicopters were requested because of little or no acquisition cost and the ability to offset operational costs by using surplus parts and components (Cherney, 1999). This growth led to the traditional air support unit model consisting of a larger helicopter, often with a turbine engine, requiring a large support structure and operating budget. But, during the last few years, the economic

downturn has led to reduced revenues and, as a result, agency budgets being cut. Expensive aviation programs consisting primarily of helicopters are being affected by cutting back on flight hours or on programs altogether (Adams, 2010). The Houston Police Department dealt with tough fiscal problems in 2012 by reducing the maintenance and fuel budget for their fleet of 13 helicopters. That significantly reduced the flight hours from 24 hour coverage per day to just three hours (Pinkerton, 2012).

Even though the costs of operating a traditional aviation unit have increased, the value that the aviation assets bring to law enforcement is not diminishing with the budgets. Pennsylvania State Representative Garth Everett, a former United States Air Force Lieutenant Colonel, said, "I can tell you that aviation is a force multiplier" (Wilson, 2012, para. 9). Taking into account the current and uncertain future economic conditions, and because of the advantages an air unit provides law enforcement, the evolution of police aviation should continue to adopt new technologies and match the aircraft type with the mission requirements of each agency. Common sense should dictate the unit direction as presented in this statement by Captain Bob Mulhall of the Pasadena, California Police Department: "If the mission is to fly patrol, I don't need a seven-passenger helicopter to do that" (Adams, 2010, p. 2).

If the primary mission profile is patrol, assisting ground units, search operations, and vehicle pursuits, you do not need a traditional police helicopter to fulfill the mission requirements. Economical operation and relatively low acquisition costs, coupled with safety for the crew and citizens, speed, crew visibility, increased loiter time, decreased noise signature, and reduced takeoff and landing distances become the main considerations when choosing a police aviation aircraft. Police agencies have a

responsibility to the community to provide the best police service possible and also an obligation to provide the best equipment for their officers who are the front line in fighting crime. An air support unit is a force multiplier in providing safety and security for citizens and officers. Agencies should select the modern gyroplane to provide the best combination of safety and economy while performing the air support mission.

## **POSITION**

Police aviation has evolved over the last century, utilizing many varied types of aircraft. This evolution landed, primarily, on the helicopter as the main choice for departmental aircraft. A study of aviation units by the Bureau of Justice Statistics found that only 20% of large police agencies had aviation units, and 13% of these were municipal police agencies (Langton, 2009). In order to increase the number of aircraft available to law enforcement, there is a new alternative to the traditional air unit that is also a return to the original rotary wing aircraft, the gyroplane. Gyroplanes are designed to be safe, economical, and simpler to fly, and come with either an open or enclosed cockpit. European light sport two-seat designs have been tested at two agencies in the United States (Tomball, Texas and Somerset, Kentucky) with positive results.

A light sport gyroplane can perform all of the mission profiles an agency might encounter with the exception of emergency medical service (EMS), or carrying multiple non-crew personnel, or activities requiring the ability to hover. While airborne, it can reach speeds over 100 mph while also being able to appear to hover during slow flight. Traffic enforcement, search operations, special event monitoring, aerial photography, and counter drug operations are all within the mission capabilities of the gyroplane (The Center for Rural Development, 2012). Enthusiasts of the traditional police helicopter

refer to other types of aircraft and their inability to hover. However, in a survey of agencies with an aviation unit, 98% respond to calls for service. The same number (98%), conduct photo flights, and 94% assist ground units. Other activities include assisting in vehicle and foot pursuits (92%), thermal imagery searches (87%), stolen vehicle recovery (72%), and to a lesser degree, traffic and DUI enforcement (47%). Much fewer participate in specialized operations with their aircraft. Only 36% of the agencies inserted SWAT officers using a helicopter, 35% conducted emergency rescue missions, and a mere 16% conducted hoist rescues (Langton, 2009). The majority of the air unit activities do not require the use of an aircraft which can hover, thereby opening the possibilities for the use of alternative aircraft.

Gyroplanes are more economical to acquire and operate than a traditional helicopter which can cost \$500,000 to \$4 million to acquire and can cost over \$1,000 per hour to operate and maintain. Gyroplanes, which are primarily in the Light Sport Aircraft category, typically use a Rotax internal combustion engine that can be operated on automotive or aviation gasoline and cost approximately \$110,000 to acquire and about \$40 per hour to operate and maintain (The Center for Rural Development, 2012,). Because the rotor system on a gyroplane is for lift only, the heavy and complex rotor drive system found even in a light helicopter is not necessary. The gyroplane can be made lighter and also is faster than a helicopter because the rotors are not providing thrust, only lift (Lewis, 2002).

Jeff Lewis (2002), in his paper on autogyro history and theory, stated that autogyros (the early term for gyroplanes) have the ability to fly slow and not stall: "Autogyros can fly at speeds as low as 15 mph. Men can run faster than that

speed...autogyros have a larger speed envelope, or they are capable of flying in a greater range of speeds than airplanes” (p. 4). He went on to say that, “The other part of an autogyro’s advantage flying at low speed is its inability to stall...the result of slowing an autogyro down too much is just that the aircraft will descend gently. It will not fall like an airplane does” (Lewis, 2002, p. 4). As the aircraft always flies in autorotation where the rotors are not powered by the engine, if the engine stops operating, the aircraft simply glides at a ratio of approximately four to one, which is steeper than a fixed wing airplane but also safer, as the gyroplane can land in an area approximately 50 feet by 50 feet (<http://www.ezgyro.com>).

Additionally, one of the safety advantages gyroplanes have over helicopters is when a helicopter suffers an engine loss of power at any speed, the pilot is required to reduce the pitch of the rotors to allow the free autorotation of the rotors through the air as the helicopter descends. If the pilot fails to flatten out the blade angle on the rotors, the rotor speed will decrease, eventually being too slow to maintain lift and the aircraft will fall. In a gyroplane, the rotor is in autorotation at all times during flight. The result of the engine losing power and propulsion to the aircraft is almost the same as the aircraft landing normally. The aircraft lands the same way whether the engine power is lost a few feet off the ground or a few hundred feet above the ground. In a helicopter there is a dangerous area in the flight envelope where a helicopter is too low and too slow and would not have enough altitude or time for the pilot to establish an autorotation and flair for landing in the event of an engine failure. The result always ends in a crash (Lewis, 2002).



Aerodynamically, the gyroplane also is a stable platform in turbulence which, in the unstable air of a Texas summer, would lessen crew fatigue and allow a more stable platform for the airborne optics for search and surveillance purposes. Police Chief Robert Hauck of the Tomball, Texas police department said, in answering why a gyroplane was selected for his air unit, "We were looking at getting a less-expensive, safe alternative for air support. We don't have the money for multimillion-dollar aircraft, but we also have 15-20-mile-per-hour winds in the afternoon and we needed a light plane that could handle that" (Bretting, 2011, p. 1).

The vantage point provided by the aircraft allows the crew to observe large areas that would take multiple officers on the ground. The air crews oversight, utilizing optical sensors and cameras, result in safer conditions for the arriving ground units. The speed of the aircraft allows the air unit to arrive on scene up to 15 times faster than a ground vehicle, and then be able to direct units for the safest possible approach (Indianapolis Metropolitan Police Department, n.d.). Utilizing the gyroplane's vantage point of 500 feet or higher above the ground in actual air support operations, the Tomball Police Department and the Somerset Police Department's success are certainly in the early stages with more work to do. But, with continued dedication to the use of alternative aircraft to more closely match the mission profiles required by each agency, this lower cost, highly dependable, and safe aircraft should serve the law enforcement community for many years.

## **COUNTER POSITION**

There are two main types of aircraft in use in law enforcement, fixed wing airplanes and helicopters. Each type has its positives and negatives, and aviators have

their preferences to which aircraft type is better suited for law enforcement. The gyroplane, as a technology, is not well known as it has not been in first line use since the middle of the last century, when the helicopter began gaining prominence as the rotary wing aircraft of choice for military and civilian use. The gyroplane is considered by many people in the United States to be unsafe and prone to Pilot Induced Oscillation (PIO) and Power Pushover (PPO), conditions that can result in a failure of controlled flight and a resultant crash. Unlike the airplane and helicopter, the gyroplane type of aircraft did not have design standards implemented to ensure safety as gyroplanes were developed, primarily for the homebuilt market. Without the design standards, regulatory oversight that would have ensured improvements in safety and also acceptance by the public were not established (Gremminger, n.d.b.). A large number of accidents have occurred with the experimental homebuilt gyroplanes prompting the lack of trust in the design. Another perceived disadvantage of the gyroplane is the lack of training available for pilots to either begin initial training to obtain a pilot's license, or for a certificated pilot to obtain a gyroplane rating in addition to their other ratings.

The modern gyroplane design has been researched closely by engineers in recent years and a determination was made that it has definite safety advantages which are now being accepted with the growth of its popularity in Europe. Manufacturers in Germany and Italy designed two seat gyroplanes, both with and without a protective canopy. The new modern gyroplanes are designed to be stable and maneuverable by utilizing aerodynamic efficiency derived from the use of vertical and horizontal stabilizers trailing behind the propeller. According to Gremminger in his report on gyroplane stability, "more stable gyroplanes have large and effective vertical and

horizontal stabilizers...just looking at a truly stable gyroplane, it's easy to see attention to aerodynamic alignment and cleanliness, from large tail surfaces, to enclosures, landing gear and even wheel pants that minimize aerodynamic pitching actions on the airframe" (Gremminger, n.d.a.). Engineers such as Chuck Beaty have researched the causes of gyroplane crashes and have concluded that, from the standpoint of controllability and making flying easier, the propeller thrust line should extend through the center of drag and the center of gravity and that a horizontal stabilizer's volume should be equal to at least 12% of the rotor volume (Beaty, 1995). This follows the same design standards Cierva used in his autogiro's in the 1930s, where he used 12% to 15% of total rotor volume for his horizontal stabilizers (Beaty, 1995).

The Federal Aviation Administration (FAA) also took notice of the large number of accidents involving gyroplanes and they included gyroplanes into the sport pilot and light sport category rules. By being included in the new rules, consensus standards were developed by the American Society for Testing and Materials (ASTM) at the request of the FAA. The result of the work performed by subcommittees of ASTM was design and performance standards for gyroplanes in the light sport category. These standards are international in scope and addressed the real issues of gyroplane safety and performance (Gremminger n.d.b.).

The new modern, more stable and maneuverable gyroplane designs were chosen for the two test aircraft used in Tomball, Texas and Somerset, Kentucky. The Tomball Police Department's program was implemented with assistance from the National Institute of Justice (NIJ), Aviation Technology Program. Mike O'Shea, Aviation Technology Program Manager, reported the NIJ had researched the German built Auto

Gyro and found the aircraft to have an outstanding safety record. He also advised the aircraft was affordable to small and rural agencies that cannot afford to spend millions of dollars on a helicopter to conduct aerial support (TechBeat, 2012). Robert Hauck, Chief of Police in the Tomball Police Department, advises his staff had researched gyroplanes and, based on the outstanding safety record, low cost of acquisition and operation, and the capabilities and performance, they chose the MTO sport (Hauck, 2011). Desmon Butts, president of Texas Auto Gyro and Light Sport in Tomball, Texas, said in a discussion about the earlier designs of gyroplanes in the United States, "People were training themselves on these things, but also killing themselves on these things. But today the technology has gotten so much better" (Bretting, 2011, para. 2). Mr. Butts continued by saying the MTO sport gyroplane can sustain 40 knot crosswinds with high gusts. Gyroplanes are more stable than a similar sized small airplane, particularly in the wind. While the rotor blades absorb the rough air, fixed wing airplanes bounce making the ride in a gyroplane a much better experience than in a small airplane (Air Gyro Aviation, 2012).

During the Somerset, Kentucky Police Department testing and evaluation period of the Italian made Magni M24 Orion gyroplane, it was utilized for traffic enforcement, search and rescue, traffic flow monitoring, aerial photography, and counter-drug operations. Lt. Shannon Smith piloted the gyroplane during the testing and said, "It really increases the safety of the officers, the suspects, and the public. We consider it a success" (The Center for Rural Development, 2012, p. 1). Because the evaluation of the Magni M24 was so successful, Somerset PD subsequently purchased an AutoGyro Calidus gyroplane as the full time aviation unit aircraft. The second gyroplane was

purchased because the evaluation period with the first gyroplane proved that using the alternative, non-traditional aircraft resulted in increased public safety at a decreased cost (Tomlinson, 2012).

Considering the growing enthusiasm for the European designed aircraft, the opportunities for professional pilot training is also advancing. According to the Popular Rotorcraft Association website there are 33 Certified Flight Instructors (CFI) in the United States who are members of their association, with three being located in Texas. One of the three, Desmon Butts, president of Texas Auto Gyro and Light Sport, offers training in Tomball, Texas for aspiring gyroplane pilots who already are a certificated pilot and also for non-pilots. One factor in the success of the Tomball program is the collaboration between the Tomball Police Department and the Harris County Sheriff's Office (HCSO). The chief pilot for HCSO was instrumental in the selection of the gyroplane and has now obtained his gyro-certified flight instructor certification. With the instructors certification, he is able to train more law enforcement officers to fly the gyroplanes in the State of Texas (Hauck, 2011).

## **RECOMMENDATION**

Many new police officers are drawn to a law enforcement career because of the flexibility in the work. No two days are exactly the same. Yet in police aviation, the traditional air support unit consists of expensive helicopters or airplanes requiring a lot of money, infrastructure, and support. If the budget was reduced, the traditional course of action is to reduce or eliminate the air support available to the officers and community. Chief Robert Hauck of the Tomball Police Department said, "The law enforcement community has failed to search aggressively for safe, low-cost and

practical alternatives” (Hauck, 2011, p. 52). Law enforcement should remain flexible and be open to new technologies in how the air unit mission is carried out, matching the aircraft capabilities to the needs of the agency and community they serve. For this reason, law enforcement should focus on the use of economical gyroplanes for the primary air support mission profiles.

The use of the gyroplane allows a greater number of agencies to acquire and operate an air support unit as a force multiplier. A two seat gyroplane can be purchased for approximately \$110,000 and be flown for about \$40 per hour. This is in comparison to a traditional helicopter which can cost \$500,000 to \$4 million and cost over \$1,000 per hour to operate and maintain (The Center for Rural Development, 2012). A two person crew consisting of the pilot and Tactical Flight Officer (TFO) can perform their duties safely over a populated area as the gyroplane’s autorotating rotor system cannot stall if engine power is lost. As the engine does not power the rotors, the gyroplane flies in autorotation during flight, so it merely glides down to a landing within an area approximately 50 feet by 50 feet (<http://www.ezgyro.com>).

The design of the gyroplane results in a safe, more stable flight than in a light airplane. The rotors of the gyroplane absorb the rough air common to a Texas summer day while also providing greater ability to handle the strong crosswinds during take-off and landing (Bretting, 2011). With the ability to fly very slowly in stable flight for search operations while also being able to accelerate to over 100 mph to rapidly reposition to handle calls for service, the gyroplane is certainly capable of handling all of the most prevalent mission profiles reported by the large law enforcement agencies who operate

an air support unit. The top four activities undertaken were calls for service, photographic flights, assisting ground units, and vehicle pursuits (Langton, 2009).

In May 2012, there were over 1,000 Auto Gyro aircraft in operation around the world (Air Gyro Aviation, 2012, para. 1). The continued growth of the civilian gyroplane market and acceptance by the NIJ Aviation Technology Program for law enforcement use will certainly gain momentum in the United States. As this occurs, interested agencies, such as the Mesquite Police Department, should look to the example set by Chief Hauck and the Tomball Police Department. His advice was to partner with a larger agency who already has an air support unit to gain advice and who could assist in training. In Mesquite, Texas, there is a City owned airport with enclosed hangar space, including space which is occupied by the Texas Department of Public Safety helicopter and flight crews. There is also an operational flight training school on the airport to provide Federal Aviation Administration (FAA) testing and ground school support. And at the heart of the program are several officers who are already FAA certificated pilots. The FAA requires that licensed pilots receive additional gyroplane training and a flight check, but that could be accomplished with a partnership with the Texas Department of Public Safety or the Tomball Police Department and the Harris County Sheriff's Office.

As Chief Hauck with the Tomball Police Department said, "The Auto-Gyro and the aviation program in general are opening a door and giving small and middle-sized agencies a chance to have a force multiplier in the air" (TechBeat, 2012, p. 4). That same opening will keep the larger law enforcement agencies also involved in police aviation even in lean budget years.

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