BLR Aerospace improves airflow

Originally with VGs and now with winglets and fins, BLR studies flow control problems and builds beneficial corrections.

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First certified on the King Air 200, BLR winglets are now found on King Air 90s as well. BLR winglets are factory-installed on the current production King Air 90GTX and King Air 250 models.

LED lighting packages are standard equipment on BLR winglets as of May of this year. Retrofit lighting kits for legacy winglets are also available through BLR.

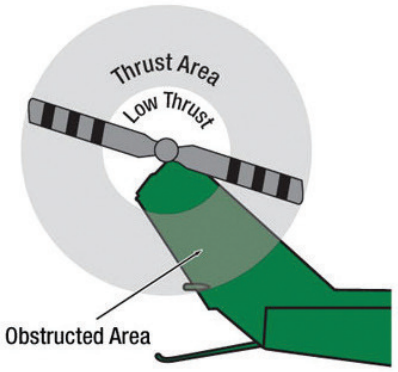
By most accounts the great recession is largely over. While the economy is still far from robust, in business aviation at least, OEMs are announcing new models, FBOs are consolidating, and new developments in the aviation aftermarket marketplace are growing. BLR Aerospace, 1 of 3 well-respected aftermarket performance-based aircraft modification companies in the Pacific Northwest, is no exception.

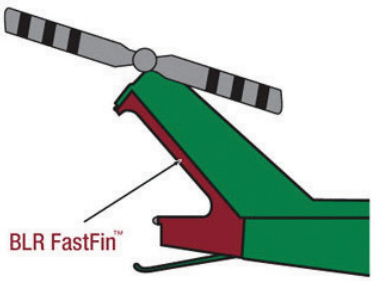
BLR VP of Sales and Mktg Dave Marone sums up BLR Aerospace's mission succinctly. "Flow modification is our company's core business. Everything that we make, certify and develop, involves flow modification and precipitates an actual performance manual change." While other well-known aftermarket performance-based aircraft modification companies tend to concentrate exclusively on fixed-wing applications, BLR Aerospace is one of the rare companies that focuses on both fixed and rotary wing aircraft, with the latter type accounting for almost 60% of their current market. Combined, BLR Aerospace is holder of more than 100 Supplemental Type Certificates (STCs) for fixed-wing and rotary-wing aircraft. As Marone explains, "Getting aircraft off of shorter runways, or off the same runway with more payload, is what we do on the fixed-wing side. On the rotary-wing side it's all about improvements to the payload or the helicopter capabilities of hovering with a load."

BLR was founded in 1991 by Bob Desroche, a US Coast Guard veteran and accomplished pilot. As Marone describes him, "He had an advanced aptitude for airflow visualization and could, in a seemingly effortless manner, identify opportunities to improve the management of airflow around the structure of any helicopter or airplane." BLR Aerospace had humble beginnings. It started by providing vortex generator (VG) kits for an impressive variety of piston singles and twins, later branching out to create a full performance package for the Beechcraft Duke. Dubbed the Grand Duke, the performance package adds

BLR FastFin increases usable thrust area

Starboard view of vertical stabilizer and tail rotor





The Bell 412EP has greatly enhanced hover and load capability with the BLR strake and FastFin® system. Strakes on the left side of the tailboom address Coanda effect and Karman Street Vortex Shedding, while the reshaped vertical stabilizer provides greater tail rotor authority.

VGs, dual strakes on the bottom of the fuselage to dampen yaw oscillations, and notably, winglets that are fully compatible with BLR's 30 gallon tip tanks for the Duke. In total the Grand Duke results in an additional 225 pounds of useful load, 43% greater climb performance and significantly lower approach speeds, plus the attendant advantages in runway performance. But why the Duke? Simply because Desroche loved the airplane. As Marone notes, "The Duke was a good airplane that could be made better. And it had some sizeable problem to solve." About 70% of the BE 60 Duke fleet has been retrofitted to the Grand Duke standard. More notable however, is that the Duke was BLR Aerospace's first STC for winglet systems in 1994, and it portended future mod programs to come for other Beechcraft models.

Rotorcraft developments

In the late 1990s, shortly after success on the Duke, BLR Aerospace entered into a license agreement to develop and bring to market a rotorcraft technology NASA once experimented with but didn't produce.

As the story goes, during the Vietnam war the US Army's venerable Bell UH-1 Iroquois—more commonly or affectionately known as the Huey—was suffering an inordinately high loss rate due lack of tail rotor effectiveness, or LTE. Just as NASA had figured out a solution to the problem, the war had largely ended, and with it, the interest in the cause of the Huey's LTE woes. NASA's study was shelved until, quite by chance, BLR Aerospace discovered the paper. With the license agreement from NASA secured, BLR Aerospace was granted sovereign use of the technology. They wasted no time in bringing to market the complementary technologies of dual tailboom strakes and the FastFin system.

To fully appreciate the simple elegance of the BLR Aerospace solution, one must appreciate the incredible complexity of helicopter aerodynamics, particularly that of the Huey and its derivative models. First, the anti-torque rotor is what provides the essential yaw control that counteracts the tendency of the main rotor to yaw the helicopter airframe in its opposite direction. In a Huey, for example, one applies the left pedal while in a hover to keep on a steady heading. Yet, due to the blunt airfoil shape of the enclosed tailboom of the helicopter, downwash from the main rotor creates low pressure resulting in lift on the left side of the tail boom. This is called Coanda effect, a low pressure that acts against the anti-torque rotor that requires progressively greater tail rotor torque, which ultimately draws engine power and reduces hover and load efficiency. Further, as the airflow departs the underside of the tailboom, Karman Street Vortex Shedding occurs. This is a principle in fluid dynamics that can be seen in weather patterns of certain islands and where water burbles as it flows around river rocks. The same thing happens in helicopters. It is an oscillating pattern of vortices created by the movement of a fluid around blunt objects such as the enclosed tailboom of a helicopter. It is in fact the phenomena that causes helicopters tails to waggle, for lack of a better term. Finally, due to the pusher nature of the anti-torque rotor, much of the rotorwash from the helicopter must find its path around the disruptive structure of the vertical fin, causing a degradation of hovering capability in certain wind azimuths. The result of these 3 forces is a helicopter with limited hover capabilities in terms of payload and wind azimuth, and higher pilot workload.

BLR Aerospace's solution incorporates 2 fixed strakes along the left side of the tail boom—an upper and a lower strake—and a reshapes trailing edge of the vertical fin. The upper strake acts a stall strip, destroying Coanda effect on the left side of the boom, while the lower strake reshapes departing airflow to largely eliminate Karman Street Vortex Shedding. The FastFin, BLR's reshaped vertical fin, allows not only more airflow around the verti-

Installation of the BLR winglet system underway on a King Air 90. The winglets reduce time to climb and extend range, among other features.

cal fin, but smoother airflow too, resulting in up to 12% greater tail rotor authority. The combined effect of the strake system and FastFin is stunning on helicopter performance, giving them up to 91% greater hover capability and adds up to 1250 lbs of useful load.

The complete FastFin system, including Dual Tailboom Strakes, are STCd for the Bell UH-1H and its derivatives, including the Bell 205, 212 and 412. Further, strakes have been STCd for the Bell 206 JetRanger and OH-58 models. By 2010, BLR Aerospace had signed a long term contract with Bell Helicopter Textron. Factory installation of both systems also began on current production line variants such as the 412. Most recently BLR Aerospace received EASA certification on the 412 FastFin system. Thus far, BLR has sold some 650 FastFins. Demand and production for the 412 is up year over year, largely due to the renewed high altitude hover capability of the aircraft brought by BLR Aerospace's systems.

Fixed-wing system

About the same time BLR Aerospace had received the STC for its FastFin system on the UH-1H, development was underway for its 2nd winglet system for a Beechcraft product, this time for King Air 200s. The winglet system, which adds a little over 3 feet to the aircraft's wingspan, results in a shorter time to climb, reduced fuel consumption, increased cruise speeds and better range, among other benefits. BLR Aerospace's winglet system was initially tested, and ultimately certified, as an aftermarket installation on the King Air 200 series.

According to Dave Marone, the marketing strategy was somewhat unorthodox, if not humorous. In 2005, after receiving the STC for the King Air 200, Marone personally flew around the country, visiting the general managers of the Beechcraft Service Centers—which were then known as Raytheon Aircraft Services (RAS)—in order to discuss the positive implications of offering BLR's winglet system installation through their service center network. Having generated dealer excitement for the product, his last stop was strategically Wichita Mid-Continent Airport (ICT, Wichita, KS) at RAS headquarters. Marone picks up the story. "I introduced myself to Skip Madsen, then head of RAS, who responded 'I know exactly who you are. I've been hearing from my GMs all week!'" After this meeting Beechcraft endorsed the BLR Winglet System within their aftermarket network.

After certification on the 200 series, BLR Aerospace launched into a flight program to certify a winglet system for the King Air 90, resulting in an STC in 2009. Prior to BLR's work, the only King Air model equipped with winglets was the top of the line King Air 350. Today, the BLR Aerospace winglet is a factory-installed standard on the current production King Air 90 and 200 series, the King Air 90GTX and King Air 250. BLR's winglets are also available as an aftermarket installation on the King Air C90 and C90A, the 200 and 200C and the 300LW. In total, some 670 BLR Aerospace winglet systems are installed, 237 of the units on the King Air 90 series alone.

On the horizon

Most recently announced in May at EBACE this year, BLR Aerospace is now equipping its winglet systems with an LED lighting package to replace the legacy lighting systems which use incandescent bulbs. BLR also offers this package as a retrofit kit for its existing winglet systems. Though LEDs are certainly favored for their longer life, greater dispatch reliability and higher intensity light, Marone noted an odd and frankly unexpected benefit—less of the pilot-blinding diffused flash normally found in traditional strobe operations in IFR conditions.

Tantalizingly, Marone notes that more projects are in the works on both the rotorcraft and fixed-wing side, and not just 1 or 2. All told, BLR Aerospace is currently in different phases of development of some 7 flow modification programs, including 3 winglet programs and four rotorcraft programs across 6 different OEMs. The 1st of these programs is already in flight test validation and it is very likely that at least one of these programs will be announced at the upcoming NBAA Convention & Exhibition this October.

Douglas Wilson started as a lineman at JGG (Williamsburg VA). An active pilot, he now serves as President of FBO Partners, an aviation consulting firm specializing in asset management, marketing and other FBO disciplines.