

Aviation Partners winglets debut on Hawker 800

Blended winglets show promise of increased range and improved climb performance.



By Clay Lacy

ATP/Helo/CFII

Boeing 747, Gulfstream II/III/IV, Hawkers, Learjets, Citations and 25 misc type ratings

I'd never seen a better-looking Hawker than the airplane that was parked outside my window at Clay Lacy Aviation VNY (Van Nuys CA) one Friday morning in late Sep. While it was your basic Hawker 800, this particular aircraft was outfitted with a pair of Aviation Partners blended winglets and the wing fences were removed. Standing 44 in tall, with an elegant wide-sweep transition, these winglets really added to the aesthetic appeal, size and perception of the Hawker 800. And they looked so natural that you'd think they'd always been there.

Blended winglets for the Hawker

800, anticipated to be certified within 12 months, are the same design concept and application of technology as the winglets you see on the Gulfstream II, the BBJ and the Boeing 737 next generation 700 and 800 series airliners. I've operated a blended winglet-equipped Gulfstream II SP for the past 7 yrs and was looking forward to learning more about how this advanced winglet technology would impact Hawker performance and handling characteristics.

Preflight

For a preflight roundtable discus-

sion, Aviation Partners CEO Joe Clark had flown in from BFI (Boeing Field, Seattle WA) along with Aviation Partners Dir of Flight Test Dick Sears and Aviation Partners Chief Pilot Rick Millson. We sat down to talk about the Hawker 800 and the Aviation Partners blended winglet program before heading out to the ramp.

Winglets have been around since the 1950s and they go back to Dr Richard Whitcomb's work at NASA Langley on aircraft designs during that era. Whitcomb also developed the supercritical wing for trans-sonic speeds, area rule fuelselage and supercritical propeller blade



Lacy takes a blended winglet-equipped Hawker 800 through its paces above Southern California.



Photo courtesy George Hall/Clay Lacy

cross sections. The 1st corporate jet to have winglets was a Lear 28. Those early winglets were later incorporated into the Learjet 55.

About 10 years ago, Aviation Partners came up with a revolutionary new winglet concept under the design leadership of Dr Bernie Gratzer, former chief aerodynamicist at Boeing. Gratzer had theories on what would make winglets more effective and he fine-tuned and patented blended winglet technology for the original Aviation Partners Gulfstream II program. While most aircraft are heavily loaded inboard and lightly loaded outboard, the relative wing loading



(L-R) Aviation Partners Dir Flight Test Dick Sears, Chief Pilot Rick Millson and Pilot Author Clay Lacy discuss performance specifications of the Hawker 800 equipped with Aviation Partners blended winglet technology.

Photos by Grant McLaren

shifts outboard with blended winglets. They take the span loading and make it much more elliptical by bringing it out farther from the fuselage. These winglets increase effective wing area while reducing drag. One distinctive feature of blended winglets is the wide curve transition from wing to winglet. This design takes the vortex completely away from the transition area and reduces overall aerodynamic drag.

GIISP operators, using these winglets, enjoy up to 7% additional range, a 2000-ft higher initial cruise altitude, boosted rates of climb and improved handling characteristics throughout the entire flight envelope.

The rationale for the 800 winglet program, Clark told me, was to do the same for the Hawker 800 series that was done for the Gulfstream II SP. While they are somewhat limited in range, Hawkers have one of the nicest cabins in this class of equipment. Giving the Hawker 800 an anticipated 180 nm additional range, through the aerodynamic benefits of blended winglet technology is probably something that will be worthwhile for many 800 owners. This range boost should transform the 800 into a reliable nonstop coast-to-coast and west-coast-to-Hawaii airplane under most conditions.

Sears was involved with initial flight-testing of the GII winglet system. He participated in the launch of the Hawker 800 program early

this year and reports that initial flight tests have proven to be a complete success. Aviation Partners put 20 baseline hrs on the aircraft calibrating onboard test equipment, plus another 20 hrs or so flying with the winglets.

Flying the 800 with winglets

At our fairly light takeoff weight of 22,400 lbs, we rotated from VNY runway 16R direct to 13,500 ft VFR to MHV (Mojave CA). Climbout was at 220 kts. Elevator forces were light and the 800 seemed to fly off the ground with very little pitch required. Chief Pilot Millson remarked that with blended winglets elevator control pressure during rotation is reduced.

At 13,500 ft for a few minutes, I did 45 and 60 bank turns before bringing the power to idle for descent into MHV. While I'm not a high-time Hawker pilot, the 800 seemed to want to glide, like all airplanes with effective winglet systems. I used speed brakes to increase rate of descent and we set up approach for runway 08 at MHV. Book Vref was 128 kts. For the 1st landing, I cut power to idle as we came over the end of the runway at 128 kts. We were really floating—so much so that it gave me the feeling we'd come in too fast. After a full stop, we taxied back and flew the pattern again. For the 2nd landing I tried Vref minus 5 kts and approached on final at 123 kts. I pulled power



Standing 44 in tall, widesweep blended winglets offer an increased wing area and a reduction in drag.

back at approximately 50 ft and we had plenty of flare left. I came back on the yoke until we ran out of elevator for touchdown at 110 kts.

After taxi back we departed with a right turn out for VNY climbing to 10,500 ft. This time I approached on the glideslope flying the last mile on final 5 kts below Vref at 123 kts. I shot for a point just a little short of the displaced threshold and held off for a touchdown at 110 kts. The wing still felt like it had lots of life in it and there was

still plenty of aileron roll control. We turned off at the highspeed taxiway about 3000 ft from touchdown with idle reverse and little brakes. While tests to determine the actual stall speed have not been performed to date, I will not be surprised if it is around 5 kts less than the stall speed without winglets.

Overall I felt the handling qualities and performance of the 800 with winglets were excellent. You don't lose any of the great handling characteristics of the stock 800 but you benefit from having more lifting surface. With book Vref of 128 kts we'd been touching down at 110 kts which is just 13% over stall. This indicates to me that we were getting more lift with blended winglets at the same angle of attack.

Summary

The Hawker 800 series is an extremely popular airplane for traditional flight departments, fractional ownership and charter applications. While it's not a particularly fast airplane, and it's a little low tech compared to some other business aircraft, the big cabin, ruggedness and reliability form a winning combination.

These days a good used Hawker 800 is running \$6–\$7 million.



Aviation Partners CEO Joe Clark poses with Aviation Equipment Pres Bill Rooke at Clay Lacy Aviation VNY (Van Nuys CA). Clark created the blended winglet program and Rooke builds blended winglet shipsets for the Gulfstream IIISP.

When you've got a popular airframe with such great residual value, I believe it's definitely worth investing in sensible upgrades. While you're not likely to pay back cost of the blended winglet modification on fuel savings alone, I'm sure you'll get all of it back on resale. We certainly see this in the used Gulfstream II market. GIISPs sell faster and at a higher price than stock GIIs. In addition the extra 180 nm range that blended winglet technology brings will save a Hawker 800 operator at least a few

Increased efficiency with winglets*

- 1. Increased range:** Fuel consumption is reduced up to 7%, resulting in an increased range of 180 nm.
- 2. More speed for same fuel:** When speed is more important, aircraft can fly at M.75–M.76 at the same fuel burns as M.73–M.74 as the stock Hawker 800.
- 3. Fuel savings:** A decrease in fuel for a flight results in an increase in fuel reserves.
- 4. Faster climb to altitude:** Climb to initial cruise altitude is faster and less fuel is used.
- 5. Higher initial cruise:** Step climbs can be reduced or eliminated for shorter trips. Climbing directly to cruise altitude or higher results in pilots flying above most traffic and weather for direct routing by ATC.
- 6. Second segment climb:** Second segment climb is significantly improved, allowing more flexibility in hot-and-high situations.

*data provided by Aviation Partners



Clay Lacy, founder of Clay Lacy Aviation at VNY (Van Nuys CA), is a 50,000-hr pilot who has been performing flightchecks for Professional Pilot since May 1997.

intermittent fuel stops a year, which saves time and money.

