Hello, Hawker 850

Raytheon's homegrown winglets add 100 nm more range to the design's latest progeny.

By Fred George

Raytheon Aircraft turned a few heads at the NBAA's Orlando convention when Brad Hatt, president and general manager of the Hawker unit, announced that the $13.8 million Hawker 850XP, the newest iteration of the Hawker 800 family, would be fitted with winglets designed by Raytheon's own engineers. Up until then, it appeared to be a foregone conclusion that Aviation Partners' full-chord, 44-inch-tall winglets recently certified for the Hawker 800 would have been standard.

The Raytheon-designed winglets are about two-thirds the height of the API winglets and they occupy the rear two-thirds of the chord section at the wingtips. They feature a super-critical airfoil having a higher critical Mach number than the basic wing. This results in virtually no shock wave formation on them at high-speed cruise. The winglets provide 100 nm more range, which is about 4 percent better specific range. They do this by helping to neutralize the wingtip vortex, thereby reducing induced drag. They also improve climb rate by 8 percent and hold promise for better takeoff field performance, although runway numbers won't be recertified until after the Hawker 850XP deliveries begin in the first quarter of this year.

Raytheon Aircraft

The considerably larger API winglets, in contrast, improve range by 7 percent or about 180 nm, according to Aviation Partners CEO and founder Joe Clark. But Raytheon Aircraft's folks couldn't come to acceptable terms with API regarding the licensing agreement, so they elected to engineer their own winglets. Another reason was Raytheon's intent to double the 300-hour basic maintenance inspection intervals to 600 hours. The design of the homegrown winglets allows 600-hour inspection intervals. This lowers direct operating costs for owners.

But there's still an uncanny resemblance to the API winglets, according to Clark. "It appears that they went to school on us." Raytheon had installed a set of API winglets on a Hawker 800XP early in 2005 for evaluation purposes, so the firm's engineers had plenty of time to study the API design, Clark said. "It looks like there may be some legal issues involved here, but we haven't had time to fully evaluate the situation."

Hatt scoffed at the implication that Raytheon's winglets are scaled-down versions of API's. He noted that Raytheon Aircraft has developed winglets for other models in the past, including the Super King Air 350, so its engineers are familiar with winglet design. The 850XP winglets were designed using Raytheon's own CFD codes, he said, and they had been undergoing flight tests for several weeks before the announcement was made at NBAA in November 2005.

Similar to the API winglets, the Raytheon winglets are built from strong, lightweight composites. They increase wingspan by 3.5 feet, are fitted with long-life LED position lights and abrasion-resistant metal leading edges. In addition to stretching specific range, the winglets should enhance high-altitude, high-speed performance, helping to delay the onset of turbulence-induced, Mach-effect aileron buzz.

An additional 100 nm of range may seem like a modest increase, but Hatt claims it can make a big difference when flying against a headwind. Flying with six passengers from Teterboro to Van Nuys, Calif., for instance,

the 850XP will be able to buck 93-percent probability headwinds. Lacking winglets, the 800XP only can make the trip against 85-percent headwinds. Departing Teterboro for San Francisco, the 850XP can complete the trip against 80-percent probability headwinds, compared to 58-percent probability winds for the 800XP.

The Hawker 850 carries over many of the proven systems of the Hawker 800XPi, including its four-screen Rockwell Collins Pro Line 21 with engine instruments electronically displayed on the pilot's MFD, an IFIS file server and Airshow 21 cabin management system. The file server supports an optional e-chart function, along with enhanced map graphics and 3-D FMS route display. XM WX Satellite Weather or Universal Weather data-linked weather graphics are optional, but the Universal package requires a third VHF comm radio. The FMS CDUs have a radio tuning function, so there's no need for stand-alone radio tuning units.

The 800 series aircraft have one of the most comfortable cabin cross-sections in the midsize class, making it a perennial first-place finisher in the sales race. The new aircraft has a redesigned interior with better space utilization. It features a four-seat forward club section and an aft section with the two-place divan on the left side across from a single, forward facing chair on the right. This arrangement allows a large luggage storage closet to be fitted to the front section of the cabin, directly across from the entry door. There are LED direct and indirect lights throughout the cabin, eliminating all of the hot incandescent bulbs and trouble-prone fluorescent tubes. The LED lights, coupled with the Airshow 21 cabin management system, should increase dispatch reliability significantly.

The quality of the cabin completion is noteworthy. Raytheon's Little Rock, Ark., completion center is one of the best in the industry. No manufacturer offers better high-gloss, wood-veneered cabinetry. The leather upholstery on the cabin chairs is excellent and the fit-and-finish of all components earns top marks.

Flying the 850XP — Except for the Winglets

Strap into the left seat of a Hawker 800XPi and you'll find out what it's going to be like in the front office of the Hawker 850. Early last November, we flew one from San Diego-Gillespie Airport to Beech Field in Wichita. The new Pro Line 21 cockpit represents a large leap forward in technology compared to the Rockwell Collins Pro Line 4 and Honeywell SPZ-8000 systems installed in earlier 800 series airplanes.

The layout of the instrument panel and console is much cleaner than in previous

Hawker 800s. In older EFIS-equipped versions, many of the avionics controls looked like they'd just be jammed into the panel and console wherever they'd fit. This aircraft's cockpit, in contrast, looks more like a clean-sheet design. In keeping with modern cockpit design principles, for example, the flight guidance system control panel is mounted in the center of the glareshield, flanked by left- and right-side display control panels. The outboard wings of the glareshield panel house interior light rheostats and the audio control panels are fitted to the forward sections of the sidewall panels. We'd prefer a swap in location of the audio and interior light control panels.

The engine instruments are electronically displayed on the EFIS, but the aircraft retains three columns of annunciators in the center of the panel. Mounted above the annunciators is an integrated standby flight instrument with a flat-panel LCD screen, combining ADI, CDI, compass and air data instrument display functions. This replaces the trio of standby instruments in older Hawker 800s.

The basic arrangement of systems controls and traditional Hawker throttle fuel cocks remains unchanged. Starting each engine, for instance, requires pulling up on the fuel cock from shutoff to idle at 8 to 10 percent N2 turbine rpm, even though the DEEC monitors the start cycle.

The Rockwell Collins FMS boxes use the scratch-pad entry convention, similar to airline-spec FMC systems. We found them to be more intuitive to use than older generation FMSes installed in previous Hawkers.

Once the flight plan has been programmed into the FMS, the e-chart function is linked to it. This means that the departure airport charts are pre-selected for display. After start-up, the first one on the list is the airport diagram and it's geographically referenced. It shows the airplane position from the time it leaves the FBO until it arrives at the hold short line. The next chart on the list is the departure procedure, but San Diego-Gillespie doesn't have any published SIDs so we weren't able to call one up.

We noted that the latest Hawker retains the line's traditional steering and wheel brake systems. The tiller-controlled, hydraulically powered steering is a touch sluggish, requiring a heavy hand and some lead time for precision and smoothness. The brakes felt a touch grabby, even when warm. We checked thrust reverser and rudder bias system operation en route to Runway 27R for takeoff.

Hawkers always have been easy to fly, if not somewhat matronly in response, and the latest model is no exception. It feels like a big Citation II, so getting comfortable in the front office after takeoff takes very little time. Situational awareness with the large Pro Line 21 displays is excellent. The crispness of the imagery and the intuitive symbology make this aircraft even easier to fly than previous Hawker 800-series aircraft.

Raytheon Aircraft

Raytheon's homegrown winglets add about 4 percent or 100-nm range. In addition, their design is consistent with the Hawker 850's extended 600-hour scheduled maintenance intervals.

We noted that the latest model retains the pitch trim sensitivity of earlier models. Small blips of the trim switch work best. It's too easy to over-trim using the manual pitch trim wheel. But most of the time the autopilot will be flying the aircraft, so that's a moot point.

We leveled off at FL 410 in 25 minutes after takeoff, using a climb schedule of 250 KIAS/0.70 Mach. Aboard the Hawker 850, the climb should take 23 minutes. The Hawker 850 will have revised operating procedures to take advantage of the 8 percent improved climb performance thanks to the winglets. The cruise manual also will include a 0.76 Mach cruise climb schedule.

The aircraft accelerated to 0.77 Mach, resulting in a cruise speed of 430 KTAS at a weight of 22,860 pounds in ISA-7°C conditions. The Hawker 850 with winglets, in contrast, should cruise at 0.78 Mach or 435 KTAS on the same 1,650 pph fuel burn, according to Raytheon officials.

Descending into Wichita, we elected to fly a visual approach to Runway 36 at Beech Field, so there was no need to use the e-chart function. The 1,020-nm trip to Wichita took 2+18. The Hawker 850 with winglets will shave two minutes off that trip and five minutes off of a west-to-east transcontinental mission.

A Better Hawker 800

Raytheon Aircraft has no monopoly on iteration. It's rampant throughout the business aviation industry, as shown by dozens of model derivatives created in St. Cloud, Minn.; Savannah; and Wichita. After having spent in excess of $1.4 billion to develop the Beech Premier I and Hawker 4000, Raytheon officials, according to some industry observers, want to leverage their investments by creating even more derivative models. A prime example is the Hawker 850. Its winglets improve its performance, the Pro Line 21 avionics suite offers a leap forward in cockpit technology and the reconfigured cabin provides passengers with more usable space. The cabin systems are considerably more reliable because of the addition of the Airshow 21 cabin management system and LED lighting.

The 850 promises to retain all of the top-notch interior accoutrements of previous models and adds additional range to make possible nonstop east-to-west-coast missions against higher probability headwinds. Runway performance may be improved as well, but testing is not yet complete.

Future models of the legacy Hawker line will require Raytheon to make large-scale investments in engine, wing and system technology, along with lengthening the fuselage. That's likely to hike the retail price of the next model by several million dollars, nudging it ever closer to the Hawker 4000. That would position the next-generation Hawker much closer to some clean-sheet, super midsize models.

Since 1964, British and American owners of the Hawker type certificate have leveraged 45 derivatives off the original Hawker Siddeley HS125-1A model by making modest incremental investments. The Hawker 850 may be the ultimate iteration of the venerable design. And that's quite a tribute to the foresight of folks who created the world's first midsize business jet in the early 1960s. **B&CA**