



Vertical Aviation Technologies' Hummingbird combines the proven airframe of the certified Sikorsky S-52 with streamlined Bell Helicopter JetRanger nosecone and windshields.

The Hummingbird Helicopter

The world's first four-place kit helicopter offers certified quality at a homebuilt price.

BY KEN ARMSTRONG

Many prospective buyers have dreamed of the day when a kit helicopter would serve as a magic carpet to transport their families to previously unreachable destinations. That day has dawned.

The Vertical Aviation Technologies, Inc. (VAT) Hummingbird kit helicopter is not only a fantasy fulfilled, it also possesses the potential to grow into a turbine-powered chopper. VAT has created a mock-up for a Hughes 500-like installation of an Allison (now Rolls-Royce) C-18 or later model turbine.

Where Have I Seen You Before?

If you think the Hummingbird's sleek lines and solid structure look familiar, you're correct, for a number of reasons. This kitbuilt design uses the proven airframe of the Sikorsky S-52 helicopter, which is then streamlined with a Bell JetRanger nosecone and windshields. Sikorsky's somewhat weak Franklin was replaced with a Lycoming VO-435—a vertically opposed 435-cubic-inch powerplant with an altitude

mixture compensating carburetor. This engine is well-proven in the certified helicopter world, and its use would make recertification of the type rather easy. The Hummingbird has a spacious four-place cabin (it's the world's only four-place kit helicopter), high payload, certified dynamic components rated at 1200 hours, wheeled undercarriage and exceptional handling characteristics for a homebuilt.

Because of the surplus of dynamic components, A&P Brad Clark and his helicopter pilot father, Fred, grasped

The Hummingbird

CONTINUED

the opportunity to produce a quality kit using almost all certified parts. Incidentally, VAT is planning to certify the helicopter again—but don't expect to buy that version at kit prices.

Fred logged 2000 hours on S-52s with Orlando Helicopters and claims it is his favorite design. With loads of experience, the group incorporated many improvements to the machine in the form of streamlining, installation of an electric forced trim system, modern instrument panel and cyclic sticks, and incorporation of composite panels for ease of maintenance. VAT also moved the horizontal stabilizers forward to minimize the rotor downwash and to gain improved control balance as a result.

Other improvements included modernizing the rotor blades for greater integrity, a change that produced a side benefit of a significant reduction in rotor vibration. The mixing actuator under the floor improves control feel and provides an *irreversible* that eliminated virtually all rotor feedback. Thankfully, the Hummingbird possesses light, responsive controls and does not require the complexity of a hydraulic system.



The Hummingbird landing gear is equipped with wheels rather than skids, a feature that offers improved flexibility and performance during takeoff, landing and taxi operations.

Hatching the Hummingbird

Fred collected components for his beloved Sikorsky for years and turned them over to Brad and his FAA-approved repair station in 1988. Brad completed the tooling in 1991 and quickly sold 11 helicopter kits before the original Hummingbird program ceased production; Brad had a contractual obligation to Papillion/Grand Canyon Helicopters on the development of the Sikorsky Whisper Jet S-55 conversions. After nine years on that certification program with 22 helicopters built (including one for Lockheed Martin), Brad reviewed the 11 Hummingbirds' progress and determined they had proven the maturity of his offering. The plans and construction manual are well detailed, the kit parts immaculately fabricated and the components provide stellar, dependable performance.

Additionally, there is a wealth of vendors, engineers, DARs and other professionals involved in this project. "It may be a kitbuilt," Brad says, "but we are still using the FAA level of quality as far as manufactured parts and quality are concerned."

To this helicopter test pilot, the Hummingbird possesses so many positive attributes that they are far beyond the scope of this article. For example, wheels are a major improvement over skid gear as they greatly enhance the

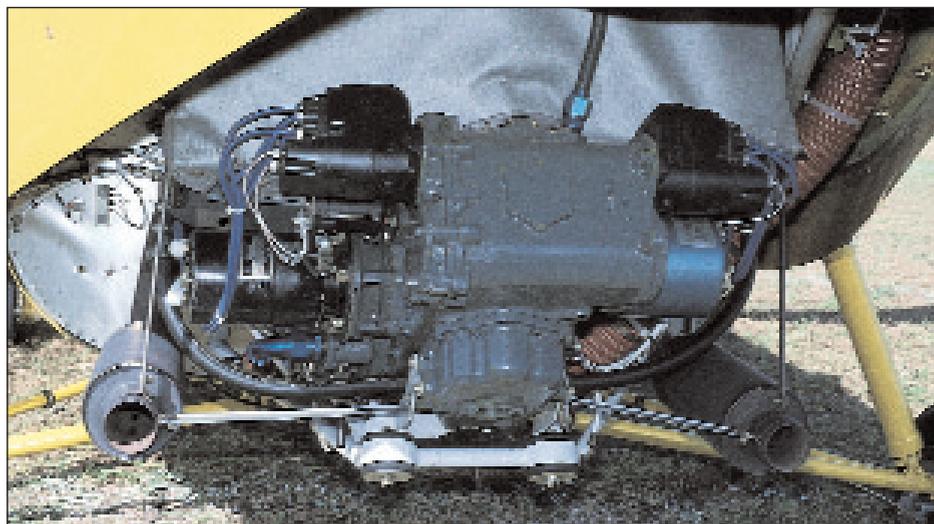
helicopter's abilities. While lifting 2700 pounds, the three-rotor, fully articulated disk produces enough wind to damage surrounding aircraft either directly or by blowing debris around the area. With wheels, a helicopter can use minimal power to roll away from congested ramps to the takeoff area. Then, with a heavy load, even at a high density altitude, it can roll along the ground until it exceeds the translational lift speed where it has an additional 25-30% lift to climb skyward.

Rolling landings also reduce power requirements as well as wear and tear on engine and drive train components, thereby reducing operating costs. Of course, when it comes to autorotation landings, the ability to roll along on a set of wheels with air-ride shock absorbers greatly enhances the outcome during that emergency procedure. Besides, try to find a new wheeled helicopter under a million dollars!

The Sikorsky's legendary reliability resulted in only one airworthiness directive in decades of S-52 operations; that AD related to torqueing the flywheel bolts on the Franklin engine.

"I have been flying helicopters for 40 years and chose to fly the S-52 series because it had proven components," Fred said. "And because I didn't want to be part of some manufacturer's learning curve and pay a terrible price for their errors."

"Mini 500 builders can now understand that concept!" Brad added.



VAT replaced the Sikorsky's Franklin engine with a vertically opposed, 435-cubic-inch, 260-hp Lycoming, a well-proven powerplant in the certified helicopter world.



Upgrades over the S-52 include a modern instrument panel and cyclic sticks in the roomy cockpit.

Tantalizing Turbine

It is only a matter of time until a builder installs a turbine; the 317-hp Allison is a logical choice as Sikorsky originally designed the S-52 for a 305-hp Franklin turbo installation at a gross weight of 3000 pounds. That Franklin engine faced developmental problems, and the 245-hp Franklin filled the gap, albeit at a 2700-pound gross. The C-18 Allison or some of its more powerful, derated versions are logical replacements as they would provide full rated power to higher density altitudes.

Also, the fuel flows of approximately 20 gph would be easily met by the 57-gallon fuel tank, and the beefy components would translate the turbine's twist into excellent vertical performance. To this end, VAT developed a 20-gallon auxiliary tank, which adds another 90 minutes or so to the Hummingbird's endurance and has an option price of only \$600.

Flying the Hummingbird

Even after flying hundreds of amateur-built aircraft, there is something reassuring about sitting in a comfortable seat in a large cabin knowing you're surrounded by certified components.

All controls come readily to hand, and visibility is very good. Space in the two-seat rear cabin is massive. The useful load of 900 pounds allows four 170-pound occupants and approximately 36 gallons of fuel to reach gross. As with almost all aircraft, payloads require some juggling of people and fuel, but the Hummingbird's lifting abilities are second to none in the kit helicopter world. Additionally, the weight and balance data on the helicopter allow pilots huge flexibility in loading. With the rotor above the aft cabin, virtually all the payload can be placed there without exceeding the aft c.g. To violate the forward limit would require two 290-pound pilots up front!

The Hummingbird boasts a 28-volt electrical system. To start up, simply turn the backup electric fuel pump on and briefly activate the primer. The engine quickly rumbles to life with the starter, and 1000 rpm should be held until the oil temperature shows an increase. The clutch engages the rotor system at 1700-1800 rpm and further warm-up occurs at 2200 rpm. Once the dual magnetos are checked, close the throttle quickly to secure operation of the one-way driven clutch to ensure autorotation capability. Next, we pull a little power and nudge the cyclic forward to taxi away from the collection of

Specifications

KIT PRICE	\$170,000
ASSEMBLY TIME	800 HOURS
ENGINE	260-HP LYCOMING VO-435
ENGINE PRICE	\$22,000
ROTOR DIAMETER	33 FEET
FUSELAGE LENGTH	0.5 FEET
HEIGHT	8 FEET 7 INCHES
MAXIMUM SPEED (V_{NE})	110 MPH
NORMAL CRUISE	90-95 MPH
RANGE	375 N.M.
RATE OF CLIMB AT 2700 POUNDS	950 FPM
SERVICE CEILING	12,000 FEET
FUEL CONSUMPTION	13 GPH
FUEL CAPACITY	57 GALLONS

smaller helicopters at the Sun 'n Fun line-up.

With VAT test pilot Ron Mander at the controls we are quickly airborne for a photo shoot, which he accomplishes with aplomb. Now it's my turn. The controls are responsive but not overly sensitive, and this big kit helicopter motors along in a dignified, solid manner. Perhaps Mander said it best: "It flies like a Sikorsky."

Unlike its bigger brothers, the S-55 and S-58, it does not have roll rate limits to reduce stresses on the main rotor system. It has a sportier feel, although one should remember its design concept is that of a transport. This is a dignified participant of the vertical lift realm, not a sportster for yankin' and bankin'. We were operating at gross weight with nearly full fuel and three heavyweights aboard and noted the following data at a density altitude of 2500 feet: cruise speed with a conservative setting of 24 inches manifold pressure was 93-98 mph indicated; pulling slightly more power would allow the Hummingbird to easily reach the published V_{NE} of 110 mph.

Changing power for circuits uncovered the first minor weakness of the type as the throttle correlation is only fair, thereby increasing the workload for a pilot until he or she becomes

The Hummingbird

CONTINUED

accustomed to the Hummingbird. Mander reduced the challenge by volunteering to monitor the same so I could concentrate on my observations. The first approach and landing are easily accomplished as I shoot my approach to touchdown on a cattle field. My first takeoff uncovers my first real dissatisfaction with the Hummingbird—because I was forewarned, I should have been forearmed. Brad advised that the anti-torque tailrotor pedal travel from autorotation to full-power application is quite long. During takeoff, I realize the validity of his observation as I run out of legroom. I should have adjusted my pedals prior to start-up to avoid this potential problem. Nonetheless, the takeoffs, translations and climbs in excess of 500 fpm all go so smoothly we quickly approach the time to test the helicopter's autorotation capabilities.

Once again possessing typical Sikorsky tendencies, the Hummingbird flutters earthward at 60 mph at an aver-



The rotor blades were modernized by VAT, and a significant reduction in rotor vibration (compared to the S-52) resulted.

age descent rate of only 1450 fpm. “You don’t look between your feet to determine where your autorotation will take you as you would with a Bell 47 and other helicopters,” Fred said. “You look out ahead, and when you roll on the Hummingbird at 20 mph it’s just like a normal landing.”

Margin for Safety

It should be noted that all of our flight tests indicated the Hummingbird meets or exceeds all of the certification

standards initially achieved by the S-52. Of course, most of those requirements are not mandated for amateur-built helicopters, so the Hummingbird’s performance provides a large safety margin for pilots. Although some other kit helicopters meet or exceed many of these limitations, they have not passed the ultra-expensive certification requirements. Effectively, the Hummingbird has no competition among kit helicopters.

VAT tells KITPLANES® that the



Two rear seats make the Hummingbird the first four-place kit helicopter commercially available. The 900-pound useful load allows for four 170-pound occupants and about 36 gallons of fuel.



VAT moved the horizontal stabilizers forward to minimize rotor downwash and to gain improved control balance as a result.

correct correlator will be installed in production kits to enhance engine/throttle control and the tail-rotor bellcrank will be modified to minimize pedal travel. An additional bonus concerns the availability of high compression pistons, providing an additional 15 hp for builders wanting maximum thrust. Of course, you must use the more expensive 100LL fuel with these domed pistons instead of auto gas or 80/87 (where available). Nonetheless, these modifications greatly enhance an already exceptional helicopter.

The Kit

Hummingbird builders will receive an advanced kit with all parts more than 2 feet long preformed. Tools required are typical for building a riveted aircraft and include an air compressor, rivet gun, Clecos, blind rivet puller and a 2-foot bending brake. Plans, building manual and photos ensure the challenges of kit building are not overwhelming for the average person.

The Hummingbird's four-module packaging allows budget builders to invest when they can, and the kit contains everything but avionics, paint and the engine (which can be purchased through VAT separately). Unlike many kits, all necessary nuts, bolts, switches, wires, circuit breakers, rivets and nutplates as well as the basic instruments are included.

Conclusions

Ask yourself, where can you find an essentially certified, four-place, wheeled helicopter with a full operating cost including reserve towards overhaul, fuel and oil for only \$47 per hour? In terms of purchase price, the skid-equipped Robinson R-44 costs more than twice as much. When you consider the fuel capacity, cabin volume, range and endurance, the Hummingbird appears to be an excellent buy. ✚

FOR MORE INFORMATION on the Hummingbird, contact Vertical Aviation Technologies, Inc. at 407/322-9488 or visit www.vertical-aviation.com.