



RotorWay
INTERNATIONAL
EXEC
90

*Your first helicopter
may come in a box.*

BY SETH B. GOLBEY
AND MARC E. COOK

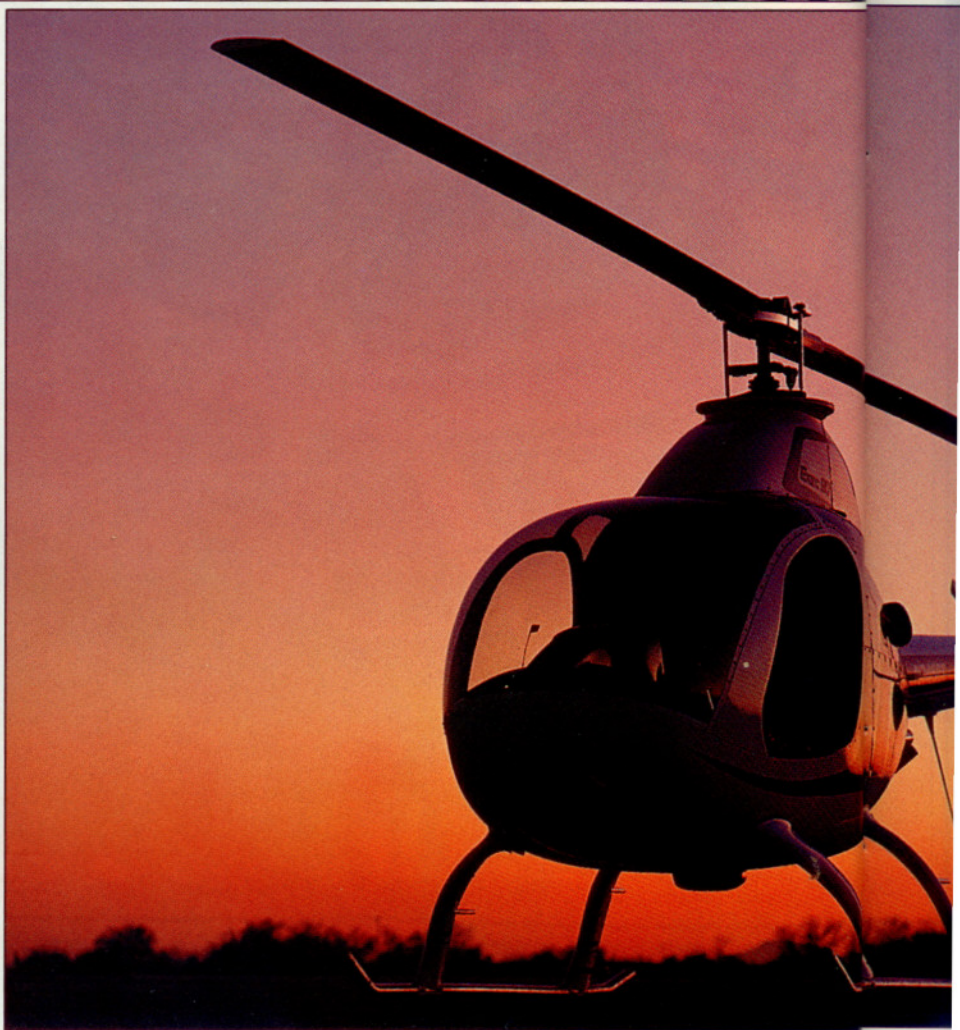
RotorWay Aircraft is dead. Long live RotorWay International. With new ownership, no corporate debt, an improved product, and new plant and training facilities in the works, this venerable little manufacturer of kit-built helicopters has a new lease on life.

At the helm today as president is John Netherwood, an irrepressible Englishman who bought his first RotorWay Exec in 1986. Netherwood acquired the company last year from its founder and owner of 22 years, B. J. Schramm, now president of the Sport Aircraft Manufacturers Association.

RotorWay was founded in 1967; its first product was a set of plans for a single-seat helicopter called the Scor-



A new instrument panel is just one of 23 enhancements distinguishing the Exec 90 from its predecessor.





pion. The two-seat Scorpion Too followed about four years later. Both used Evinrude marine engines. In 1974, the company began building its own water-cooled, four-stroke, four-cylinder engines; the first, at 133 horsepower, was offered for the Scorpion 133. That basic engine has been refined into today's 150-hp, 162-cubic-inch, dual-electronic-ignition RI162. In 1980, RotorWay began producing the Exec, the immediate forebear of today's Exec 90.

In the late 1980s, RotorWay developed the Elete, which, while using the same engine and dynamic system as the Exec, was longer, taller, heavier, more stylish, and claimed somewhat better performance. The Elete's development costs, coupled with poor market conditions and unresolved engineering questions, almost spelled the end for RotorWay financially. Although the company sold 105 helicopter kits in its best year, 1987, these went at fire-sale prices. Only three Elete kits were delivered, and the aircraft is a "dead horse," according to Netherwood.

Instead, when he took over last June 1, Netherwood called together RotorWay's 12 remaining key employees (he calls them his "dirty dozen") and asked each to suggest 12 improvements that could be made to the Exec and 12 improvements that could be made in the manufacturing process. He took their suggestions, incorporated 23 changes into a new model dubbed the Exec 90, and built the first one in only seven weeks, finishing it in time for display at last year's Oshkosh fly-in. Netherwood cut the kit price—which includes just about everything except avionics and paint—from \$42,500 to \$39,000. RotorWay sold 17 Exec 90 kits at Oshkosh, where the company had never sold more than one before, and two more shortly after the fly-in. Since then, the company has sold more than 40 more. Deliveries of kits began in September and are rising toward a rate of three per week. "In our opinion, the Exec 90 is the bee's knees," says Netherwood, and it would appear that potential kit builders agree with him.

The Exec 90's airframe is of 4130 steel tube with a wraparound fiberglass fuselage. The monocoque tail boom is of aluminum alloy. The ship is unique among piston-engine helicopters in using rotor

blades with an asymmetrical airfoil, which the company claims provides more lift at lower pitch angles and improves autorotation characteristics. The two matched main blades feature aluminum alloy skins chemically bonded and riveted to an aluminum extrusion spar. They are attached to the teetering rotor hub (which is also aluminum alloy) by retention straps. A pair of elastomeric blocks accommodates thrust load during pitch changes of the blade. Blade pitch is controlled through dual push/pull cables, rather than rods. The teetering tail rotor comprises two blades with steel spars and aluminum alloy skins. All aluminum castings are fabricated in RotorWay's own fully automated foundry and finished in the company's state-of-the-art machining center. But perhaps the company's most notable design achievement is its powerplant.

Manufacturers of kit-built aircraft usually limit themselves to design and construction of the airframe and related systems, electing to fit or recommend off-the-shelf or modified existing pow-

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erplants. Not RotorWay. Along with the materials and plans for the Exec 90, the kit builder receives a complete engine, one that has been built and tuned specifically for installation in the RotorWay helicopter.

This engine's technology lies closer to automotive than aircraft. The basic configuration resembles the classic Volkswagen four-cylinder, right down to port location and valve train layout. Each of the four combustion chambers is far more compact than in a typical aircraft engine, with both spark plugs near the center, between the intake and exhaust valves. Compression ratio is 9.6:1, compared to the aircraft-typical figure of 8.5:1. As installed in the Exec 90, this



engine uses twin electronic ignition systems with crankshaft-mounted triggers. They are independent from the battery onward. Annunciators in the cockpit warn of a failed ignition system; a necessity, according to the company, because there is little power loss with one set of plugs off line. A single, two-barrel Dell'Orto carburetor provides the fuel/air mixture; stainless-steel tubes route exhaust gases to a large muffler.

Its major castings are poured in the factory's own foundry, and the vast majority of out-sourced parts are constructed to RotorWay's specifications. Such control of components has helped RotorWay keep the engine light and compact. Despite being liquid cooled, the whole engine, which incorporates aluminum cases, cylinders, and heads, weighs just 175 pounds without oil or coolant. For comparison, the Lycoming O-320 powering the Robinson R22 tips the scales at 253 pounds. Even with radiators and coolant, the Exec engine installation comes out lighter than the Robinson's Lycoming. Although it produces about the same power as the O-320, the R1162 displaces just 162 cubic

inches, slightly more than half that of the O-320. The company claims 150 hp at the crankshaft at 4,250 rpm; the firm also says that the engine has been turned to 6,000 rpm on the dynamometer, where it churned out 200 hp.

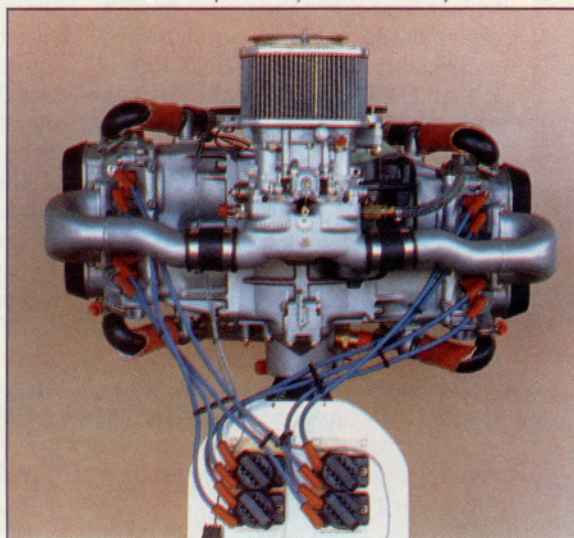
Central to the engine's power-per-displacement efficiency is rpm. Where the Lycoming fairly loafes at 2,652 rpm to produce 124 hp in the Robinson, the Exec's mill is turning 4,250 rpm in normal operation. More important, says RotorWay, is that the engine's torque

peak is found at 3,900 rpm, so should rotor rpm decay, the engine is capable of dragging the blades back to speed. While such engine speeds might sound like they'd adversely affect longevity, the RotorWay engine can handle it. With light internals and an oversquare design (with a bore greater in diameter than the dimension in stroke), the reciprocating mass should see less stress and lower piston speeds than in many large aircraft engines.

Power from this bantamweight engine is transmitted through a multirow chain and a series of belts to the main and tail rotors; there is no transmission proper. In fact, belts provide power all the way back to the tail rotor, unlike a more common shaft arrangement, and hang on pendulums that provide proper tension. The recommended replacement interval for the tail-rotor belts is 250 hours (a task quickly accomplished, according to the company) and 500 hours for the main reduction belts.

The buyer of an Exec 90 kit will find that all major components, like the engine and rotor system, come already assembled. Some welding is required,

Kit comes complete but for avionics and paint.



but all structural welding has been completed at the factory. The kit comprises 24 major subsections and components. These are packaged on 62 shrink-wrapped cards, complete with instructions. Build time typically runs 500 to 600 hours, the company says.

The builder's manuals are illustrated with photographs and drawings. While documentation was never a strong suit of RotorWay Aircraft, Netherwood and Vice President Dale Krog, who built his first Exec in 1982, have worked hard to change that at RotorWay International. The company expects a maintenance manual, an engine operating manual, and a flight manual to be back from the printer and ready for distribution shortly.

Late last December, RotorWay bought a plot of land near the north end of the runway at Stellar Airpark in Chandler, Arizona, south of Phoenix. Corporate, manufacturing, and training facilities, which currently are scattered around the Phoenix area, will be consolidated there around September. RotorWay has long offered maintenance and flight training; these programs will continue to be improved, the company says.

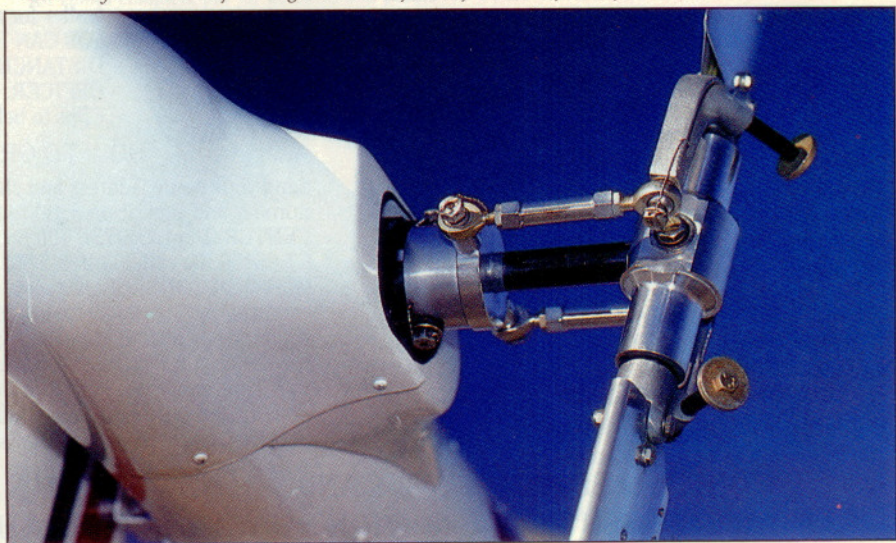
In flying the Exec 90, an important aspect of preflight preparation is weight and balance control. The helicopter, like several other piston-engine helicopters and unlike most turbine-engine helicopters, is soloed from the left seat. To keep the center of gravity within limits, a ballast weight is mounted on the front tip of the right skid. When a passenger is car-



ried, the weight is moved to a rear mount tube under the tail boom. The maximum permissible weight of pilot or passenger is 210 pounds, but the maximum weight of pilot and passenger together must not exceed 400 pounds. Another 100 pounds of useful load is available for fuel (automotive gasoline) and ballast. Fuel capacity is 110 pounds. Empty weight is 925 pounds; maximum takeoff weight, 1,425.

The Exec 90 is capable of a maximum speed at sea level on a standard day of 115 mph (100 knots), but a typical cruise speed is 95 mph (83 knots). The helicopter may be flown sideways or backward at speeds up to 20 mph (17 knots). Autorotations are performed at 65 mph (56 knots). According to company specifications, the Exec 90's service ceiling is 10,000 feet; it will hover in ground effect up to 7,000 feet and out of ground effect to 5,000 feet (though out-of-ground-effect hovers are "prohibited" by the com-

RotorWay eschews shafts and gearboxes in favor of a series of belts for main and tail rotor drives.





pany for pilots with less than 150 hours in the ship). Range with maximum fuel at optimum cruise power is 180 miles, about two hours' flying time. Flight with doors removed is permitted. The helicopter is restricted to daytime VFR flight unless the builder elects to add lights.

In terms of specifications, performance, and handling qualities, the Exec 90 is generally similar to the Robinson R22. Indeed, we used an R22 as the camera platform for the photographs accompanying this story, and the two machines seemed well-matched for the mission. This is not surprising, given their similarities in size, weight, power, and rotor systems. Strangely, when the two machines were parked near one another, the Robinson appeared markedly larger than the Exec 90, probably a result of the R22's higher stance on its skids and taller rotor mast and the Exec 90's sleekness. In reality, the R22 is only 9 inches taller and is actually 1 foot 4 inches shorter in overall length.

The Exec 90's cockpit is snug without being cramped. The form-fitting seats are quite comfortable. Noise levels are typical for a piston-engine helicopter (which means headsets are mandatory for any extended flying). Noise levels are, of course, highest with the doors off, but the cabin is not at all drafty in this configuration. Controls are sensitive but comfortably positioned for precise control. The instrument panel, one of the 23

changes in the aircraft, is large enough for all necessary flight and engine instruments and a couple of radios to boot; the new design improves forward visibility as well. A pair of eyebrow windows, also new, markedly improves visibility in turns.

Having not flown a RotorWay helicopter before, we found ourselves surprised that it flew just like . . . well . . . a *real* helicopter. Having thought that, we were immediately ashamed. The Exec 90 is in every sense of the word a *real* helicopter, one that should elicit every bit as much pride from its owner as any production model. A bit more, perhaps. After all, the owner has the immeasurable satisfaction of having built his ship himself and, as such, is probably much more intimately familiar with its innards than the purchaser of a production helicopter.

Under the guidance of Netherwood and Krog, RotorWay should be bringing that pride and satisfaction to an ever-increasing number of builder-pilots in the future. Hover lovers are sure to be attracted to this stylish, practical, and economical machine, and we can hope that the Exec 90 is just the beginning of a line of exciting new kit helicopter designs from RotorWay International. □

For more information, contact RotorWay International, 300 South 25th Avenue, Phoenix, Arizona 85009; telephone 602/278-8899, fax 602/278-7657.