Helicopter trainers

ROTOR RATING

Learning the ropes in the Robinson R22 Beta II or the Schweizer 300CB

BY TIM McADAMS

Hovering a helicopter is like trying to stand on a basketball; it's all about balance. In fact, the smoothest helicopter pilot I know rides a unicycle in his spare time. It's an endeavor that invokes the most harmonious skills a pilot can offer. In flight, it's like dancing: flight control movements need to be smooth, coordinated, and well-timed. You must become one with the machine, so to speak. If you have an artistic side, then helicopter flight lessons could be your form of expression. ■ Anyone who's been exposed to the helicopter training world has heard of the Robinson R22. The R22 dominates the civilian training market. It's reliable, fast, and so cost effective that other helicopter manufacturers have struggled to compete against it. ■ Take Schweizer Aircraft, for example. The Elmira, New York, company builds the 300C helicopter. It is a similar two-seat piston-powered helicopter with a $215,800 price tag, compared to the R22's $135,000. The 300C costs $77.46 per hour to operate, including a reserve for overhauls, while the R22 is less at $51 per hour. So the company decided to reengineer the 300C, focusing on cost effectiveness and safety. ■ Schweizer introduced the 300CB in August 1995. The company moved the pilot's position from the left seat to the more-traditional right seat; installed a less-expensive, lower-powered engine with a higher TBO; and reduced the gross weight. Schweizer also extended the TBO on several major components and

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changed others to make them more accessible for servicing. These changes allowed it to lower the selling price to $187,500. Schweizer says the design improvements have made the 300CB more reliable and dropped the operating cost to $56.10 per hour.

Schweizer then teamed up with Jeppesen-Sanderson to produce a complete ground training package. The kit includes textbooks, self-test exercises, training aids, and a course syllabus. Although geared towards the 300CB, the package would be valuable to students learning in other helicopters as well.

While several flight schools have begun using the 300CB, the largest fleet (10) is at Helicopter Adventures, Inc. in Concord, California. Patrick Corr, the president, is an experienced flight instructor who started the company 10 years ago. Duain Martin, one of his CFIs, would take me through a flight lesson in the 300CB.

Preflighting the 300CB is a breeze. The engine, transmission, and flight control assemblies are exposed and easy to see and touch. There are eight V-belts, tightened via an electric actuator, that connect the normally aspirated, 180-horsepower Lycoming HO-360-C1A engine to the transmission. Also highly visible are the main rotor flight control tubes and swash plate assembly that transmit flight control inputs to the three-blade, fully articulated rotor system. This design allows each rotor blade to hunt (move forward or aft) and flap (move up or down) independently of the others. Mounted above the engine and behind the left side of the cabin is a 35-gallon fuel tank that gives the helicopter more than 3 hours of endurance with no reserve.

Schweizer angled the engine's exhaust pipe straight up into the main rotor downwash to reduce noise levels. (Just don't leave the helicopter out in the rain—the opening is not covered.)

The two-blade tail rotor is driven by a single drive shaft running inside the tail

The Schweizer 300CB's well-arranged basic panel configuration is well-suited to flight training needs. A student and instructor (below) practice hovering during training at the Helicopter Adventures flight training school in Concord, California.

boom and connected to the upper drive pulley. A bearing and dampener assembly is located at the midpoint to support the shaft and reduce vibration. A small door on the side of the tail boom allows for inspection.

Our preflight complete, we climbed into the cockpit. With me, Martin, and full fuel, the 300CB weighed in 100 pounds below the maximum gross weight of 1,750 pounds. The visibility is great; the pilot can look back and see the main rotor drive assembly and the tail rotor. The cabin is wide and comfortable, allowing the largest of students plenty of elbow room, yet the wide frontal area is one of the reasons the 300CB has a relatively low airspeed. That, combined with a high parasite drag from all the exposed components, keeps the helicopter's best-range cruise speed at 63 knots, compared to the R22's 83 knots.

Moving down the checklist: battery switch On, carburetor heat Off, magneto switch to the Both position, and mixture Full Rich. With a tap of the starter switch (located at the end of the collective control), the engine springs to life, and I set the rpm at 1,400 for warm-up. Engaging the rotor requires flipping the clutch switch to Engage, waiting for a 100-rpm drop, and then moving the switch to the Hold position. When the rpm comes back up, the pilot moves the switch back to Engage. This procedure is repeated until the engine and rotor

The panel of the Robinson R22 Beta II has room for additional instruments, such as an HSI, VOR, ADF, or engine-monitoring gauges. The narrow profile of the panel promotes good visibility for the pilot, while its simplicity is easy for students to grasp. The Beta II's chief improvement is its hot-and-high performance, thanks to the 180-horsepower Lycoming O-360 engine that has been derated to 132 hp.

Three views of the Schweizer 300CB show the roomy cabin and the conventional cyclic flight controls. The engine and flight-control tubes are exposed. The fuel tank is positioned above the engine. Flight control tubes run up to the rotor.

tachometer needles join. Pilots need to pay close attention here, because the 300CB's POH cautions, "too rapid or excessive engagement of clutch can lead to aircraft structural damage."

After checking to see that the engine gauges were in the green and flight control friction locks were off, I wound the engine rpm up to 2,700. As I lifted the 300CB into a hover, it felt smooth and solid. The electric trim system, with the switch located on the cyclic control, worked well in removing control forces. After performing some pedal turns, I took off to try some normal and confined-area approaches. Through all the maneuvers, including an out-of-ground-effect hover and autorotations, the 300CB was stable and predictable.

Although the helicopter has a throttle correlator, it still requires the pilot to watch rotor rpm and make adjustments to keep the needle in the green arc. However, because the engine is operating below its maximum rated rpm, there is a good margin for error. In general the 300CB is pleasingly forgiving, allowing students time to straighten out a botched maneuver without the flight instructor's having to take the controls.

The forgiving nature of the 300CB is one characteristic that attracted Corr to the helicopter. He runs a specialized flight school for professional helicopter pilots and feels that the 300CB allows his students to meet the FAA's practical test standards faster. Corr also operates four Robinson R22 helicopters. While he believes that the R22 is not as forgiving as the 300CB, he wants to expose his students to both helicopters. Besides,

the R22 is so popular with flight schools that having flight time in it is important for the freshly rated helicopter flight instructor looking for a job.

Indeed, Robinson's R22 is by far the most widely used helicopter in the flight training industry. Designer Frank Robinson acquired his success by building exceptionally engineered helicopters at a cost well below that of his competitors. Robinson has continued his tradition of innovative engineering by introducing several design changes to the R22 Beta model.

In the helicopter now called the R22 Beta II, the 160-hp Lycoming O-320 engine has been replaced with the more powerful 180-hp O-360. Although it is derated to the same output as the O-320, it gives the Beta II an increased power reserve and better hot-and-high performance. The increased power will help to provide a better safety margin for low rotor rpm encounters, especially at higher altitudes. Originally, the new engine had a little higher vibration level. Robinson began experimenting with ways to reduce the roughness and found that the engine was running too rich. He replaced the O-360's carburetor with a smaller one, and the engine smoothed right out. The engine still developed the proper power, and the fuel consumption dropped from 11.4 to 9.6 gallons per hour in high-speed cruise. All new Beta IIs have the new carburetor.

The Robinson cabin is narrower than than that of the Schweizer and features a T-bar cyclic flight control. Unlike the design of the Schweizer, the cowling provides protection for most of the engine as well as the flight control tubes.

The fuel mixture control has been replaced with a vernier-style control for more precise leaning. The control has been moved up to the main console, away from the cyclic trim lever—a change pilots have been wanting for a long time.

The Beta II has a redesigned rpm governor. Robinson pioneered the use of rpm governors on piston-powered helicopters to decrease pilot workload and increase safety margins. The 300CB and other piston helicopters use the more traditional throttle correlator, a less effective mechanical device that adjusts the throttle according to the position of the collective control. The new rpm governor precisely senses the engine rpm and then makes throttle adjustments only (the former one would also move the collective control) to maintain the correct setting. The governor can be switched off so that instructors can teach students to control rotor rpm manually. An amber light on the instrument console stays lit when the governor is off.

IF YOU'RE GOOD AT STANDING ON BASKETBALLS OR RIDING UNICYCLES, TRY FLYING HELICOPTERS.

Also new is an automatic carburetor heat system. When the system is switched on, carburetor heat is automatically applied when the pilot reduces power. The pilot can manually adjust the control to keep the carburetor air temperature out of the caution area as well. The system was designed to help reduce pilot workload and the need for pilots to remove their hands from the flight controls during critical phases of flight. It is still the pilot's responsibility to maintain an awareness of conditions conducive to carburetor ice and to ensure that adequate carburetor heat is applied or that the system is on.

Preflighting the Beta II does not require any additional checks to those for its previous model. With full fuel, Robinson instructor Dan Benton, and me, the helicopter was about 15 pounds under the maximum gross weight of 1,370 pounds.

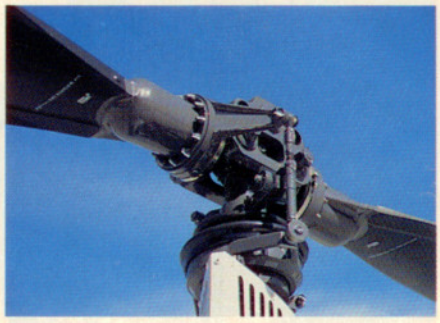
Once we were belted in, it became

The hovering capability of the Robinson R22 Beta II has been improved by the more powerful engine. Note the overhead window that allows the pilot, sitting on the right, to look upward to his left. A student and instructor (right) preflight the tail rotor at Helistream in Costa Mesa, California.

apparent how narrow the Beta II's cabin is compared to the 300CB's. The narrow cabin maximizes aerodynamic efficiency and is the primary reason that the helicopter performs so well. After engine start, I flipped the clutch switch to Engage and waited about 30 seconds for the light to go out; the rotors were then fully engaged.

In flight the Beta II handles the same as the Beta model, with a little beefier engine sound. I performed several steep banks and watched in amazement as the governor held the rpm right in the green arc. That was every bit as good as—if not better than—any turbine-powered helicopter I've flown. The new governor is so accurate that the rpm gauge's green arc has been reduced from a range of 97 percent to 104 percent, to a range of 101 percent to 104 percent. I performed a series of maneuvers, including an out-of-ground-effect hover, and noticed that the R22 required less manifold pressure than the 300CB. Although both helicopters' engines are rated at the same 180 hp and each aircraft has the same payload, the R22's basic empty weight is much less than that of the 300CB (852 versus 1,101 pounds), giving the R22 a better power-to-weight ratio. Consequently, the Beta II felt light and crisp during the entire flight.

In fact, the R22 has become known for its responsive control characteristics. Some pilots believe that this is not a good trait for a training helicopter. Rod Anderson disagrees. Anderson is president of Helistream, Inc., a pilot training school in Costa Mesa, California, and a designated pilot examiner. He was trained in the military, has more than 11,000 flight hours in various helicopters, and is an instructor for the Robinson factory safety course. He feels



Schweizer uses a three-blade system (below), while Robinson uses two blades. The Robinson rotor is greatly simplified and uses Nylon and Teflon bearings, eliminating all grease fittings. Thus, maintenance costs are expected to be lower.

that the R22 produces the best pilots because they learn to fly to much higher standards from the beginning. He adds that the R22 will not tolerate students' being sloppy. The sharper skills required make transitions to high-performance turbine helicopters much easier.

Anderson also believes that the R22's responsiveness can be an advantage for an experienced instructor. For example, it allows the CFI to recover rotor rpm quickly during practice autorotations. Experience and proper training are the key to safely operating the R22 or the four-seat R44. To ensure that instructors have sufficient experience, the FAA has issued Special Federal Aviation Regulation 73 (see "Pilot Briefing," May 1995 *Pilot*). It effectively raises the requirements to act as pilot in command or a flight instructor in a Robinson R22 or

R44 helicopter.

According to the rule (which expires December 31, 1997), to teach in either helicopter a CFI must have 200 hours of helicopter time, of which 50 must be in the type of Robinson model to be flown. Anyone acting as pilot in command must also meet these requirements or have had 10 hours of dual instruction in the appropriate model; students must have a minimum of 20 hours of dual instruction prior to solo. In addition, the special regulation requires awareness training on the hazards of flying a two-blade, low-inertia rotor system. A pilot's flight review must be in the appropriate Robinson model, and pilots with fewer than 200 total hours and 50 in an R22 or R44 must have an annual flight review.

There is no question that learning to fly a helicopter is a challenge. If you're good at standing on basketballs or riding unicycles—or if you just like challenges—flying helicopters might be for you. To find out whether you have what it takes, stop by a local flight school and spend some time behind the controls. □

Robinson R22 Beta II
Base price: $135,000

Specifications

Powerplant	Lycoming O-360, 180 hp
TBO	2,000 hours
Maximum gross weight	1,370 lbs
Empty weight	855 lbs
Fuel capacity	19.2 gal
Auxiliary fuel tank	10.5 gal
Seats	2
Length	28.6 ft
Height	8.9 ft
Main rotor dia.	25.2 ft

Performance

V_{NE} (maximum airspeed)	102 kts
Maximum range	256 nm
Maximum operating altitude	14,000 ft
Hover ceiling IGE	9,400 ft
Best range cruise speed	83 kts
V_Y (best rate of climb)	53 kts
Fuel consumption	9.6 gph

For more information, contact Robinson Helicopter Company, 2901 Airport Drive, Torrance, California 90505; telephone 310/539-0508; fax 310/539-5198.

All specification are based on manufacturer's calculations. All performance figures are based on standard day, standard atmosphere, sea level, gross weight conditions unless otherwise noted.

Schweizer 300CB
Base price: $187,500

Specifications

Powerplant	Lycoming O-360, 180hp
TBO	2,000 hours
Maximum gross weight	1,750 lbs
Empty weight	1,101 lbs
Fuel capacity	35 gal
Seats	2
Length	30.8 ft
Height	8.7 ft
Main rotor dia.	26.8 ft

Performance

V_{NE} (maximum airspeed)	94 kts
Maximum range	230 nm
Maximum operating altitude	10,000 ft
Hover ceiling IGE	4,600 ft
Best range cruise speed	63 kts
V_Y (best rate of climb)	41 kts
Fuel consumption	10.5 gph

For more information, contact Schweizer Aircraft Corporation, Post Office Box 147, Elmira, New York 14902; telephone 607/739-3821; fax 607/796-2488.

All specification are based on manufacturer's calculations. All performance figures are based on standard day, standard atmosphere, sea level, gross weight conditions unless otherwise noted.