

Build Me an Aircraft—*Robinson Helicopter*

The highest standards

Robinson Helicopter aims for excellence

BY STEVEN W. ELLS

PHOTOGRAPHY BY CHAD SLATTERY

The Robinson Helicopter factory is quiet—there's no rivet banging or hammer slamming. Just a low hum emanating from row after row of large robotic, digitally controlled machines, automatically turning out helicopter parts. Some of the humming sound seems to be radiating from Frank Robinson's brain—he's always thinking about how to further streamline a company that's already known far and wide for its low-drag operations.

Robinson was captivated by helicopter flight as a youth when he saw a newsreel of Igor Sikorsky piloting his prototype helicopter in a hover in 1939. A restless young man, Robinson joined the U.S. Merchant Marine at age 16. He later graduated from high school and went on to earn an aeronautical engineering degree from the University of Washington.

The early days

"In the early days, Frank asked me if I knew why the tail rotor blade for his helicopter was a certain dimension, said Jim Chadwick, co-founder of Chadwick-Helmuth. "When I told him that I had no idea, he said it was because he couldn't get a longer one into his home oven to cure it. He was laying up the

adhesives during the day and using his kitchen oven to cure them when he was eating dinner."

After years of frustration as established helicopter manufacturers turned a blind eye to his belief in the potential of small, dependable, lightweight helicopters, Robinson finally took matters into his own hands. Starting a light-helicopter production company was no small undertaking. Few people believed in his vision, and money was tight. With one other engineer, design work was completed in the garage and at the dining table of Robinson's Palos Verdes, California, home.

Today Robinson Helicopter is the most successful manufacturer of small helicopters in the world. In 2005 Robinson sold 806 helicopters. More than 7,500 Robinson helicopters have been shipped to places as far away as Russia, Australia, South Africa, and New Zealand. More than 1,200 employees work at Robinson Helicopter.

The 2,200-hour plan

Frank Robinson has strong opinions about his helicopters. He will unabashedly say that he doesn't like the idea of certificated airframe and powerplant

"If Robinson Helicopter had toothpicks in its lunchroom, Frank Robinson would plant trees to ensure that the toothpicks would conform to his exacting standards, and so he would have control of the supply chain."

—Overheard at a recent Helicopter Association International convention.





Frank Robinson remains active in the company he founded in 1973. The company is concentrating on refining the R22 and R44 designs to enhance their performance and reduce the maintenance requirements for the aircraft.

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technicians making subjective decisions about the airworthiness of his helicopters. So Robinson has created helicopters that don't require any heavy maintenance—no engine overhauls and no transmission or tail-rotor gearbox overhauls, nothing except regular servicing such as magneto point adjustment and replacement as well as spark-plug, air-filter, and oil and oil-filter replacements—for 2,200 hours. Then the entire helicopter gets taken apart, inspected, and rebuilt to Robinson factory standards. “I don't believe in ‘on condition’ status for parts replacement. We run the Lycoming engines to 2,200 hours and they don't have any trouble getting there,” says Robinson.

Robinson doesn't hide any of this from prospective buyers. In fact, part of the success of Robinson Helicopter is because of the company's commitment to training both pilots and maintenance personnel. Operating-cost worksheets have parts and labor costs spelled out. An aircraft-overhaul parts kit for one of Robinson's four-place R44 Raven II helicopters is priced at slightly more than \$100,000. It takes 220 hours of labor to complete the overhaul. That does not include the engine overhaul.

How does Robinson get aircooled airplane engines to make time between overhauls? Forcing cooling air from a ducted fan past the cylinders is one factor, but his decision to de-rate the engines illustrates an underlying philosophy at Robinson. De-rating is the practice of limiting an engine maximum output to less than the engine manufacturer's ratings. The fuel-injected angle-valve Lycoming IO-540 engine installed in the R44 Raven II is normally rated at 300 horsepower. Robinson limits the engine power output to 245 horsepower for five minutes (82-percent power) and 205 horsepower (68 percent) for continuous operations.

The Lycoming O-360 engine installed in Robinson's two-place R22 also is de-rated, from 180 horsepower to 131 horsepower. Both of these Lycoming engines are given the Robinson treatment before being shipped across the country from Williamsport, Pennsylvania, to the Robinson factory in Torrance, California. More on that later.

A Robinson technician attaches an alternator to a Lycoming engine and starter.



Robinson's insistence on keeping an extremely tight rein on manufacturing and quality control under the roof of a 480,000-square-

foot facility in Torrance—only a few metal-plating and shot-peening operations are farmed out—can be seen during the weekly tours.

“We make a much higher percentage of our own parts than other manufacturers,” says Robinson. The company does so for three reasons. First, when everything is produced in-house, the potential for production delays because of a supplier's inability to maintain delivery commitments is considerably reduced. The second reason is to eliminate the potential for unexpected costs. And the third reason Robinson does almost everything under the company roof is to control the parts manufacturing standards.

Raw materials arrive, are inspected for compliance with company specifications, and if found OK, are routed to the proper area before the army of computer-controlled machines tagged with names such as Tsugami, Okuma, Studer, Fanuc RoboCut X-1C, and Haas automatically and precisely follows with the digital dictates of computer-aided manufacturing programs. These programs direct the cutting, bending, milling, and finishing of the parts that will later be assembled into helicopters. The product line is small and consists of three models—the two-place R22 Beta II and the two four-place models, the R44 Clipper II and the R44 Raven II.

The problem solver

In the early years Robinson heard from customers complaining about high oil

consumption in their new helicopters. Ever involved in the evolution of his design, Robinson concluded that the ring-to-cylinder wear-in, which is essential to fully seat the rings, wasn't complete when the engines arrived from the Lycoming factory. Since the Lycomings installed in Robinson's helos would never produce the required combustion chamber pressures to fully seat the rings because of the de-rating philosophy, something had to be done. So Robinson changed the specifications with the Lycoming factory—today every Lycoming engine that's installed in a Robinson helicopter undergoes additional test-cell running time to seat the rings before leaving the Lycoming factory.

The first R22

“I didn't design the R22 as a trainer,” said Robinson during a recent tour. “It's not the most docile light helicopter. It's like the Luscombe was to the Cubs and Aeroncas.” The two-place all-metal Luscombe 8A is like a racehorse while the tube-and-fabric construction Cubs and Aeroncas are the docile horse the head wrangler at a dude-ranch gives the non-riding city slicker.

“My religion is simplicity. I wanted Robinson helicopters to be fast so I had to keep drag and weight down yet still make them reliable,” Robinson says.

The early 1980s found Robinson dealing with problems similar to those of any emerging aircraft builder—raising money, then dealing with product liability, and the additional burden of getting

to the bottom of why Robinson R22s were crashing with a greater-than-expected frequency. Studies soon found that helicopter flight instruction in the early 1980s was "awful," in Robinson's words. After presenting his findings to the FAA and petitioning for an increase in the minimum hours required for a helicopter instructor's rating, Robinson created a safety course for flight instructors in 1982. At about the same time, safety notices were inserted in the back of each pilot's operating handbook. These detailed accidents of other pilots and the mistakes that led to them.

Twelve years after Robinson's initial petition the FAA issued Special Federal Aviation Regulation 73. It specifies that no pilot may act as pilot in command of an R22 or R44 without taking specialized training from an experienced Robinson-qualified flight instructor.

There are rumors that occasionally surface about the safety of Robinson helicopters. The most-often-heard story is that Robinson main rotors go out of control and cut off the tail booms. "Mast bumping, more properly called 'low-G mast bumping,' is caused by rapid full-aft movement of the cyclic control while the main rotor is unloaded," says Robinson. "The result of incorrect control inputs is a loss of control in roll. Then the main rotor bumps against a device called a 'teeter stop' and the blades flex downward. The solution is to teach the pilots to never fly low-G maneuvers," says Robinson. That's just one of the topics covered in Robinson's extensive safety training course. Today, 130 pilots a month attend the Robinson safety course. "Today our accident rate is down with the best of them," says Robinson.

1,200 employees

What does it take to keep more than 1,200 employees happy? According to Frank Robinson, all it takes are good wages and good benefits. "We have found that hiring people off the sidewalk and training them works best—we have virtually no turnover," he says as he continues the tour through the sparkling-clean and well-ordered facility. Here and there throughout the factory, Robinson will stop to greet and speak with the employees, many of whom have been with him since as far back as 1979.

Robinson Helicopter is a modern facility. Since it's located in the Los Ange-

The assembly line for the Robinson R44 and R22 is sparkling clean.

les Basin, it has to comply with the toughest air-quality requirements anywhere in the world. This has forced Robinson to create and implement innovative clean-air techniques. Take the paint booths. In 2005 Robinson delivered—and painted—806 helicopters. The booths use a combination of recirculating dry air and infrared light to control emissions. The result is a paint job that complies with the clean-air mandates and still exhibits quality and color characteristics that are the envy of other light-aircraft manufacturers.

There are thousands of skylights throughout the factory. After all, in this part of the country, sunlight is abundant and, although the factory is on the same latitude as Phoenix, the temperatures are moderated by the Pacific Ocean.

Three out of every four Robinson helos are taken apart after final flight-testing and put into a big wooden box for shipment overseas. Being located in California midway between Long Beach and Los Angeles—two of North America's largest seaports—eases overseas shipping concerns. It also makes it easy for foreign buyers to visit the factory and attend training.

The future plan

Robinson helicopters have a reputation for quality, durability, safety, and excellent product support. Frank Robinson's latest goal is to convince businesses to install a small Robinson-designed helicopter-landing pad on the roof of their buildings. He's designed one but the idea has not yet taken off. But another Robinson idea has. During a visit with Frank Robinson and members of his staff in early 2006 it was obvious that Robinson's mind was wrapped around the idea of designing and producing a larger helicopter.

At the March 2007 meeting of Helicopter Association International (HAI) in Orlando, Robinson announced that a beefed-up version of the R44, which



will be called the R66, would be Robinson's next helicopter. The R66 will look similar to the R44 with a large internal baggage compartment. The R66 will seat five and will be powered by a 240- to 300-horsepower Rolls-Royce RR 300 turboshaft powerplant. Engine certification is expected in 2008.

Robinson is positioning the R66 as a replacement for the Bell JetRangers that are approaching airframe life limit times. The introduction of the Jet-A fueled R66 will further expand Robinson's market into areas of the world where leaded avgas is either extremely expensive or nonexistent.

Take the tour

The Robinson Helicopter factory is a long white building located along the south side of Runway 29L at Zamperini Field in Torrance, California. Guided tours are available for visitors on Tuesdays and Thursdays at 1 p.m. Visitors see the result of Frank Robinson's commitment to his vision, and learn how that commitment turned an idea that no one else believed in into the most prolific helicopter manufacturer in the world. **AOA**

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View the manufacturing process at Robinson Helicopter in an online video and through additional photographs on *AOPA Pilot Online*. www.aopa.org/pilot/robinson