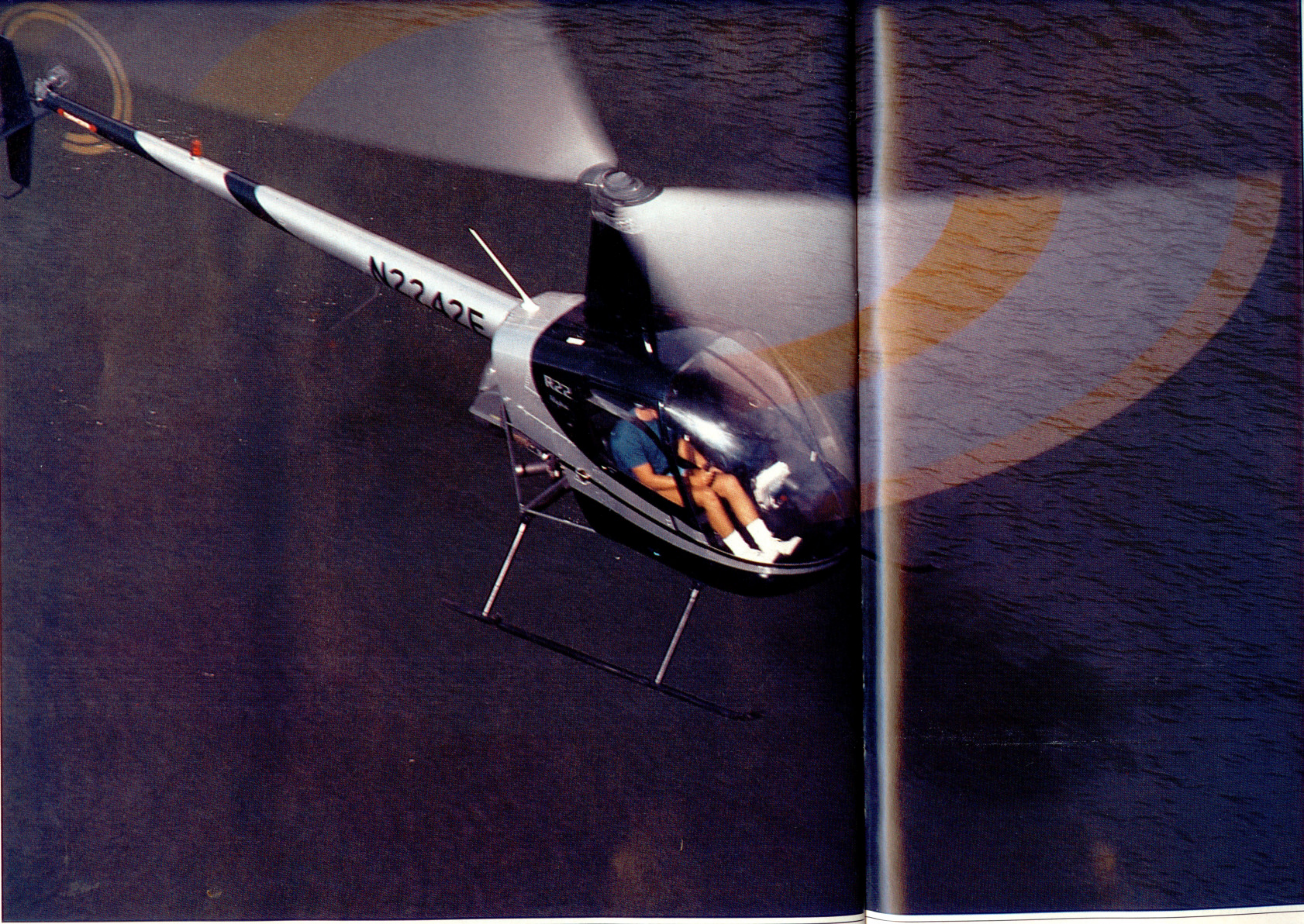
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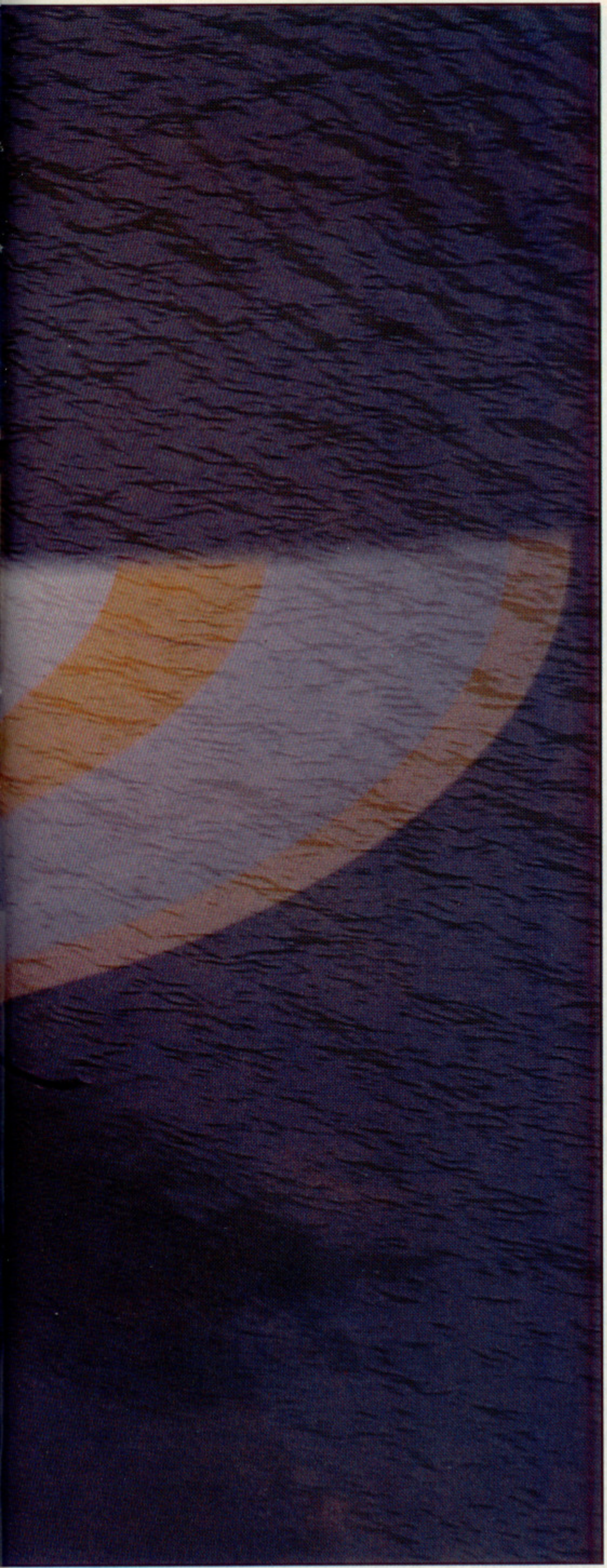

ROBINSON R22

The toylike appearance is only skin-deep.

BY MARK TWOMBLY

IF there's one job highway engineers out west know how to do well, it is drawing a straight line. The road we were skimming over in southwestern New Mexico took the shortest possible course to the horizon, as did most of the roads we followed since leaving Southern California the previous afternoon. Heading east from Deming, New Mexico, our last fuel stop, the only blemish that appeared on the flat, featureless landscape was a large white stucco teepee, an apparent architectural lure for motorists tiring of the hot monotony of Interstate 10. We dipped down from our cruising altitude of 500 feet to read a billboard that identified the teepee as a not-to-be-missed source of Indian artifacts and foot-long hot dogs. We decided against landing at the teepee for lunch in favor of pressing on to our planned overnight stop, and dinner. We reached our destination late in the afternoon and landed in an empty parking lot next to a Holiday Inn. The woman at the desk asked what kind of car we were driving. We explained that we arrived in a helicopter. "A *helicopter*?" She was incredulous. Unsure of what to put on the registration form, she decided, "I'll just write 'plane.' "

Paul E. Parszik, the helicopter pilot, and I would spend three more days tracking roads that twisted through mountain passes, crossed deserts, and paralleled hundreds of miles of Gulf of Mexico shoreline as we made our way from Torrance, California, to Orlando, Florida. Parszik's mission was to deliver a Robinson R22 Alpha helicopter to Americopters, a Robinson dealer at Orlando Executive Airport. I was riding along to gain some experience in the R22, the smallest and lowest-price production helicopter on the market. The five-day trip would cover roughly 2,500 nm and include 14 fuel stops, not counting our final landing in Orlando. We would spend 32 flying hours, in perfect weather, marveling at a wraparound view of the United States slipping by a few hundred feet below.

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When Frank Robinson began to sketch designs for a new helicopter 12 years ago, he had in mind a light, two-place, piston-powered ship that would be inexpensive to buy, fly and maintain. It was his idea of the ideal personal aircraft, one that would lift the helicopter out of its narrow status as a special-use aircraft. Robinson first flew a prototype of his design in 1975 and predicted that it would sell for $25,000. Four years later, the R22 received an FAA type certificate,

PHOTOGRAPHY BY THE AUTHOR

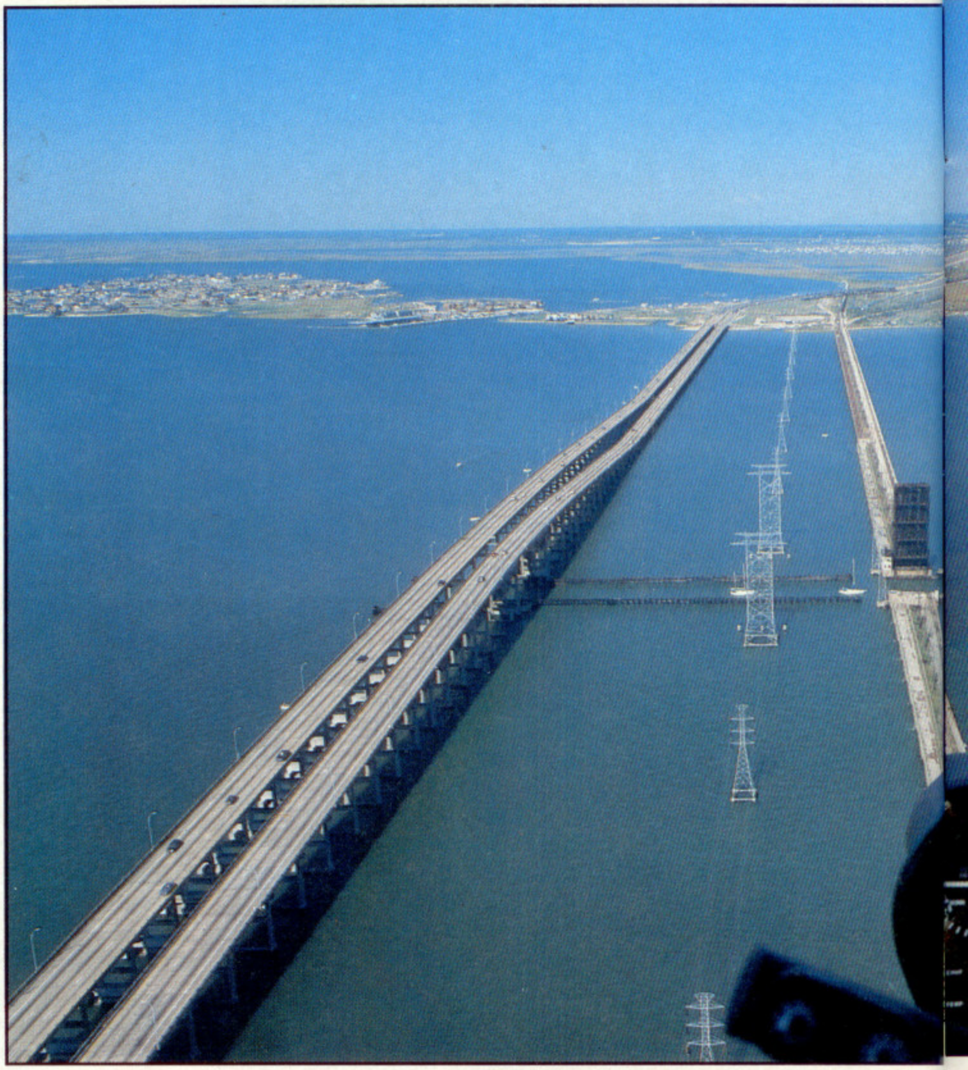
and Frank Robinson became a helicopter manufacturer.

Last July, Robinson Helicopter Company delivered the five-hundredth R22. That is far short of Robinson's prediction of a helicopter in every hangar, but then so was his vision of a $25,000 price. The first R22s listed for just over $41,000 each, and the latest model, the R22 Beta, sells for $85,850. Sticker shock notwithstanding, the R22 still is the least expensive production helicopter. Its closest competitor in the market, the Schweizer 300 (built by Schweizer Aircraft Company under license from McDonnell Douglas—formerly Hughes—Helicopter) lists for just under $150,000.

During its six-year production run, the R22 has outsold every other piston-powered civil helicopter manufactured in the United States, including the Schweizer 300, Enstrom F-28/280, Hiller 12-series and Hynes H2. In 1984, R22 sales accounted for 83 percent of all new piston-powered civil helicopters delivered by U.S. manufacturers. Helicopters may not be for everyone, but, among the believers, the R22 has won acceptance as a relatively inexpensive helicopter for personal transportation and flight training.

The R22 is a very small machine, a perception that showed on the faces of people we met during our trip. Those who identify every helicopter as a Bell JetRanger thought our R22 was a homebuilt, or just simply a toy. It is neither, of course, but it is compact. Empty weight of the R22 Beta is 825 pounds, and one person can roll an R22 around the ramp by slipping a pair of handling wheels onto the skids and pushing down on the tail boom. The bubble is about six inches wider than the cabin of a Cessna 150, and riding in the cockpit with the doors off is similar to sitting on the edge of a windswept ledge. The only places to stow baggage, paperwork and the wheels are bins beneath the hinged seat cushions, and, once underway, nothing can be retrieved.

Size and weight are two of the secrets of the R22's success. The payoff for small size and low weight is lower operating costs than other helicopters. The factory estimates that direct operating cost (fuel, oil and reserves for 100-hour inspections and unscheduled maintenance) for a new R22 Beta is $19.08 per hour. Add $18 per hour for overhaul reserve and a fixed annual cost of $9,548 for depreciation, liability and hull insurance, and the total estimated operating



R22

Wires and birds are feared; wide-screen views are revered.

cost based on an 800-hour year comes to $49.02 per hour.

Robinson's estimate paints a somewhat rosy financial portrait since few operators will log 800 hours annually in their R22s. The estimate also assumes three percent annual depreciation, while actual depreciation has been much higher—up to 12 percent annually for later models—according to the *Aircraft Bluebook Price Digest*. The $300 charge for a 100-hour inspection is on target, at least for the first 500 hours of operation, because Robinson guarantees the price. However, inspection costs for older machines probably will be higher. One operator said he pays an average of $600 for a 100-hour inspection on each of two

R22s that have logged about 800 hours each. The factory's estimate of only $150 for unscheduled maintenance every 100 hours does not seem realistic except for brand-new helicopters.

An R22 used for instruction, rental and other commercial operations could accumulate 800 flight hours in a year, but insurance premiums will be higher, and the wear and tear of frequent use by a variety of pilots and students undoubtedly will be reflected in the maintenance budget. Even so, the cost of operating an R22 can be significantly less than other light piston-powered helicopters. The combination of lower purchase price and lower operating costs, when compared to other light helicopters, has made the R22 a popular helicopter for training. Robinson estimates that two-thirds of the R22s in service are used for instruction at least part of the time.

Cockpit layout makes good use of limited space. Unusual cyclic control bar pivots out of the way when climbing aboard, and baggage is stowed beneath the seats. The pedestal panel contains all instrumentation.

By keeping the R22's size and weight down, Robinson is able to extract good performance from the normally aspirated Lycoming O-320, the smallest engine used on any production helicopter. The Beta's 96-knot cruise speed is the fastest of all piston helicopters, and its hover ceilings compare favorably to other light, non-turbocharged piston helicopters. The R22's low weight also enabled Robinson to derate the 160-hp O-320 to 124-hp maximum continuous power. The engine, mounted horizontally behind the cockpit, has a TBO of 2,000 hours, the highest of any piston-powered helicopter.

Several versions of the O-320 have been used. The original model R22, now referred to as the standard, was powered by a 150-hp O-320-A2B flat-rated to 124 hp. In the fall of 1981, the R22 HP was introduced with a 160-hp O-320-B2C engine flat-rated to 124 hp. The additional power reserve raises the R22's hover ceilings about 2,000 feet.

The HP was replaced by the R22 Alpha in 1983. The Alpha has a higher gross weight (1,370 versus 1,300 pounds) than the standard and HP, almost all of which is available as additional useful load capacity. The Alpha also has a higher tail boom and muffler for increased ground clearance. Early in 1985, Robinson began offering an optional 10.9-gallon auxiliary fuel tank for the Alpha that increased usable fuel capacity to 29.7 gallons, extending the no-reserve range from 208 to 320 nm.

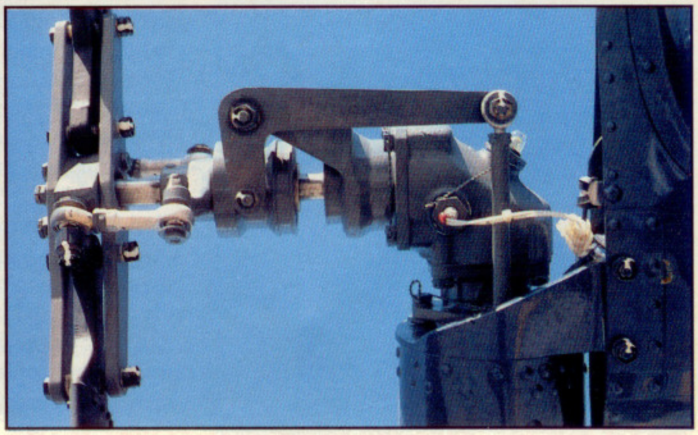
The increased gross weight on the Alpha exacted a performance price. According to performance charts included in the pilot's operating handbook, an Alpha operated at maximum power (about 23 inches manifold pressure) and maximum gross weight in sea level/standard conditions cannot hover out of ground effect. (Ground effect improves a helicopter's hovering performance substantially. When the helicopter is hovering above the ground no higher than about one-half the rotor diameter, the rotor blade airfoils operate more efficiently and produce more lift.) To correct the performance penalty imposed by the gross weight increase, Robinson introduced the R22 Beta in mid-1985, beginning with serial number 501. It features a five-minute takeoff power rating of 131 hp, which improves hover performance compared to the Alpha. A Beta operated at takeoff power (24 inches manifold pressure) can hover out of ground effect up to about 5,200 feet.

The main and tail rotors are driven through a system of pulleys, belts and gearboxes. A pulley mounted on the crankshaft extension turns four V-belts, which in turn drive a pulley on the main rotor transmission input shaft. The gearbox pulley has an internal clutch that drives both the main rotor transmission and tail rotor driveshaft. The clutch automatically disengages the engine from the rotors in the event of a power loss so that rotor rpm can be maintained in an emergency autorotation. A squirrel-cage fan on the rear of the engine collects cooling air and directs it over the cylinders. It also acts as a flywheel.

The main rotor blades, which Robinson builds, have aluminum honeycomb cores and stainless-steel leading edge spars bonded to aluminum skins. Each blade has a 1.6-pound weight buried in the tip to increase the rotational and gyroscopic inertia of the rotor disk. Tip weights give the R22 a slightly heavier, more stable feel and also help maintain rotor rpm throughout autorotation. The metal tail rotor blades have honeycomb spars, wraparound aluminum skins and forged aluminum root fittings.

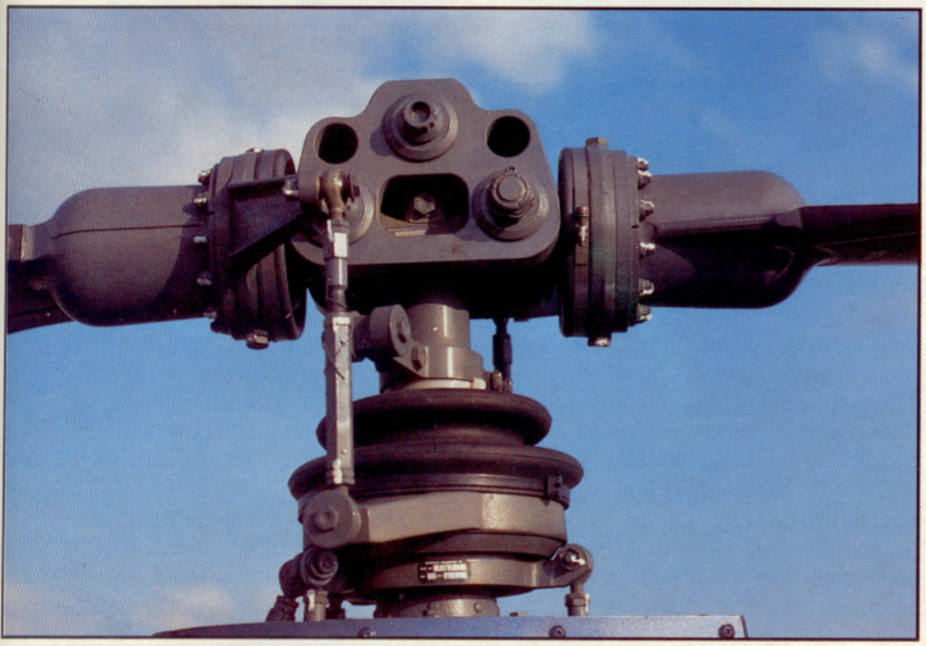
The blades have a 2,000-hour service life and are the only ones approved for use on the R22. There have been three fatal accidents involving failures of earlier blade designs. Two people were killed in Southern California in May 1980 when the trailing edge of an R22 main rotor blade delaminated. The delamination was traced to inadequate acid etching of the aluminum blade skins by a vendor, according to Robinson, who then incorporated etching into the helicopter company's in-house blade manufacturing process. New blades were shipped to the existing fleet of about 30 helicopters, which had been grounded following the accident.

A second fatal crash occurred the following summer in Connecticut when a main rotor blade separated from an R22 carrying two people. Investigators determined that the blade had failed as a result of a fatigue crack in the root fitting near an attach bolt hole. Modified blades were made available, and by the end of 1981 an all-new blade had been designed and put into production. R22 owners were urged but not required to replace existing blades with the new models. In July 1983, an R22 crashed near Canton, Pennsylvania, because of fatigue failure in a blade root fitting. That R22 was one of about 18 that had not been retrofitted with the new blade. An airworthiness directive mandated retrofit of the new blades on all R22s.



R22

Simple design contributes to low maintenance.



There have been no failures of blades that went into production at the end of 1981 or revisions of that design.

One of the R22's unusual features is the Y-shaped dual cyclic control bar. Except for the helicopter's scaled-down proportions, the Y-shaped bar probably contributes more to its junior birdman image than any other component or characteristic. It may look like a remedial training version of a cyclic stick, but the bar saves weight, complexity, cost and floor space over a dual cyclic stick system. The bar has grips at each end that are manipulated forward, aft and laterally, just like conventional cyclic sticks. The bar pivots vertically at its center to position the grips for use by either the right- or left-seat pilot. Airplane pilots usually are confused by the bar because they equate it to an airplane control pedestal, but it doesn't take long to get the hang of it. It seems an awkward arrangement for flight training because the instructor has to reach up, grab the grip and pull it down to take control of the cyclic, but several R22 instructors said it does not present a problem in a training situation.

The airframe consists of a welded steel-tube framework supporting the engine and main rotor system, a riveted aluminum load-carrying cockpit structure and fiberglass and thermoplastic bubble, and an aluminum monocoque tail boom. The landing gear system and cockpit support structure are designed to absorb impact loads to protect the pilot and passenger. The aluminum-tube skids are shod with replaceable tungsten-carbide wear shoes.

Standard equipment on the Beta includes interior lights, landing and anticollision lights, rotor brake, dual controls, throttle synchronizer, inertial reel shoulder harnesses, intercom system, windshield cover, blade tie-downs, ground handling wheels and an instrument and avionics package adequate for most VFR missions. It includes a King KY 197 communications transceiver (but no navigation radio or transponder), rate-of-climb and airspeed indicators, electronic combination engine- and main-rotor-rpm gauge, altimeter and manifold pressure gauge. A tuft of yarn screwed onto the outside of the bubble centerpost serves as a yaw indicator. Turn coordinator and artificial horizon are not standard.

Robinson does not authorize or condone retrofitting R22s in the field with additional avionics, lights or other items that require internal wiring because of potential interference with the control system and electronic tachometers. Optional flight instruments and avionics can be installed by the factory. Robinson also offers an R22 IFR Trainer equipped with electrically driven artificial horizon and turn coordinator, encoding altimeter, HSI, ADF, King KX 165 nav/com, transponder, marker beacon and digital clock. The IFR Trainer is not certificated for IFR operation, but it can be used for instrument instruction.

A police version of the R22 is available with searchlight, loudspeaker and special communications radios, and the company recently won certification of a float-equipped model called the Mariner. A stretched, four-place version of the R22 is being developed. Some of the major components already have been designed, but it will be several years before a prototype will be ready to fly, according to the company.

The R22 incorporates a number of design innovations that contribute to its simplicity and low maintenance requirements. All major components, including rotor blades, main and tail rotor transmissions and bearings, have a 2,000-hour service life. The airframe is covered by a two-year or 1,000-hour warranty. An electrically actuated jack screw automatically adjusts tension on the V-belts as they warm up and stretch, which helps extend belt life. Power is transferred from the clutch to the main transmission and tail rotor driveshaft by maintenance-free flex-plate couplings instead of gears, joints and bearings.

The main rotor, rotor hub and tail rotor ride in maintenance-free bearings. The main rotor blades have integral pitch-change bearings lubricated by a permanent, sealed oil reservoir. Coning hinges, which allow each blade to deflect up as it generates lift, ride on self-lubricating Teflon-lined bearings. The hinge connecting the rotor hub to the main shaft also has greaseless Teflon-lined bearings, and all tail rotor and tail rotor hub bearings are lined with Teflon.

One R22 mechanic we spoke to noted that an unexpected fringe benefit of the bearing design is a tidier appearance for the entire helicopter. The mechanic had worked on other light helicopters with rotor system bearings that required servicing every 25 hours, and he recalled that a freshly lubricated machine soon would be smeared with grease thrown off by the spinning hub and blades.

There are 93 R22 service centers authorized to perform regular maintenance, but none are permitted to do major overhauls. Those that have reached 2,000 hours in service must be flown or shipped to Torrance to be overhauled at the factory. The helicopter is disassembled, and all life-limited parts, including blades, are destroyed. The main and tail rotor transmissions are overhauled, and Robinson exchanges the engine for an Avco Lycoming-overhauled engine. The helicopter is reassembled on the new-aircraft production line. A new interior is installed, and the assembled ship is painted and sent through a production flight test. The factory's 2,000-hour overhaul is thorough and, at $36,000, expensive. Some operators are critical of

R22

Frank Robinson has developed police, IFR trainer and float-equipped versions of the R22 and is designing a four-place model.

the overhaul policy because it leaves owners with no alternative and the factory with no price competition.

Robinson argues that it takes special skills and equipment to overhaul an R22, and the only way to ensure that the job is done correctly and safely is to do it at the factory. He enforces the policy by refusing to sell certain critical parts and components to service centers. The company has been urged to establish an East Coast overhaul center, but there are no plans to do so.

The only liability and hull insurance available to most R22 owners is through the company, which controls the conditions of the insurance policies, sets the premiums, evaluates claims and does all the repairs. A damaged helicopter must be shipped to Torrance for repair at the owner's expense. Robinson decides what repair is needed and then performs the work. The owner pays the first $5,000 for the repair, plus a prorated share of the cost of replacing life-limited components based on their time in service. If the helicopter is a total loss, Robinson decides whether to attempt to repair it, replace it or pay for it. In any case, the claim is reduced by $18 for every hour the helicopter has flown since new or overhauled at the factory.

The provisions of Robinson's in-house insurance program, which is underwritten by Houston Casualty Company, are restrictive, but the premium is low compared to other helicopters. The annual premium for hull insurance on a new R22 used for flight instruction is $5,600. The annual premium for $1 million worth of liability coverage is $2,750. Premiums are lower if the helicopter is not operated commercially. By comparison, the annual premiums for hull and liability insurance on a $150,000 Enstrom helicopter used for rental and flight training are about $28,000.

Robinson's factory insurance program was instituted when owners began having difficulty finding affordable insurance. Insurance underwriters are increasingly reluctant to provide coverage for products and services that pose any significant risk of loss. When insurance is available, the premium rates can be prohibitive.

I spent the first two days of our transcontinental delivery flight enjoying the spare beauty of the Southwest and watching Parszik fly. Robinson hired Parszik, who is a rated airframe and powerplant mechanic, while the R22 still was being developed. Parszik helped build the first two production machines. He was not a pilot at the time, but he soon began fixed-wing flight training. After his first flight in an R22, he switched to rotorcraft training. Only recently did he add a fixed-wing rating to his pilot's license.

Parszik has worked in almost every department at the Robinson factory, and after several years of flying in R22s, he now works as a production flight test pilot. All Robinson flight test pilots are qualified mechanics. They fly, fix, then fly again to check the fix.

Parszik handles the aircraft with precision. His control inputs are almost imperceptible, especially when hovering. R22 pilots are fond of saying that just thinking about moving a control is enough to make it happen; it is very sensitive to control inputs. Somewhere over west Texas, Parszik offered me the controls, and I discovered how sensitive the aircraft is. We meandered over a good part of the region before I learned to relax and stop overcontrolling. Parszik assured me that most airplane pilots overcontrol for the first few hours. As in any helicopter, there is a lag between control movement and change in aircraft attitude. This lag, coupled with the sensitivity of the controls, inevitably causes novice pilots to overcontrol.

The R22 must be hand-flown every minute. The right hand encircles the cyclic grip, which controls the attitude of the rotor disk and therefore the direction of flight. The left hand rests on the combination collective and throttle, and feet rest on the rudder pedals, which control the pitch of the tail rotor blades. The pilot does not have to manipulate the twist-grip throttle with each movement of the collective—there is a mechanical linkage between the collective and throttle so that raising or lowering the collective (which increases and decreases, respectively, the pitch of the main rotor blades) automatically adjusts the throttle. During cruise flight, tension springs keep the collective from creeping and hold the cyclic in a neutral longitude position. A push-pull trim knob located near the base of the cyclic stick is connected to a spring. Pulling the knob out tensions the spring and puts a slight right bias in the cyclic to cancel a slight left force caused by aerodynamic moments on the rotor at cruise speed.

Parszik claims it is possible to fly a well-trimmed R22 hands-off in smooth air, but generally the pilot has to maintain a constant grip on the cyclic and make continuous control corrections. Handling navigation charts can be a difficult chore for a pilot alone in the cockpit, and next to impossible if the doors are off. It is a potentially dangerous situation because any paper or debris that blows out of the cockpit can tangle with and damage the tail rotor blades.

Just when I thought I was getting comfortable with the R22, Parszik let me try hovering. The helicopter is suspended from the rotor like a pendulum, and the smallest control input can start a chain reaction that will have it swinging in every direction. My brief exposure to hovering was enough to convince me that there isn't much a pilot can do in an airplane to prepare, except perhaps practice maintaining altitude and heading within one foot and half a degree while cycling the throttle, patting your head and rubbing your tummy.

When I had developed a softer touch with the cyclic in cruise flight, Parszik removed his right hand from the grip, but he never lifted his left hand from the collective except to momentarily adjust his headset or unfold a sectional chart. During the entire 32-hour journey, he was poised to respond to a power loss by entering an autorotation. An R22 pilot has about one second to react to a power loss by pushing down the collective and gently pulling back on the cyclic. This flattens the pitch of the main rotor blades and trades altitude for rotor energy. The objective is to keep rotor rpm in the green arc (97 to 104 percent or 495 to 530 rpm) for a controlled autorotation descent and landing.

The pilot must quickly establish an airspeed of about 65 knots for a steep,

R22

R22 pilots must be proficient and must fly with precision.

1,500-fpm descent and—altitude permitting—turn the helicopter into the wind. The rule of thumb to ensure maneuvering room in an autorotation is to maintain a cruise altitude of 500 feet agl if flying crosswind or into the wind, and 800 feet when flying downwind. On the way down, the collective may be raised slightly to stabilize rotor rpm near the bottom of the green arc. At about 40 feet above the ground, the cyclic is pulled back to flare the helicopter and reduce rate of descent and airspeed. Forward cyclic levels the helicopter just prior to ground contact at a forward speed of 10 to 15 knots. Rotor rpm can bleed off quickly in an autorotation when forward speed drops, so the pilot must time the flare precisely to avoid losing rotor rpm too high above the ground and risking a rotor stall. Wait too late to flare and the helicopter may impact at a high rate of descent and forward speed. Practice autorotations normally end with a power recovery before ground contact.

Precise pilot technique is critical in all phases of flight in light helicopters because of the low inertia of a lightweight rotor system. Failure to immediately lower the collective to correct for low rotor rpm, whether in high-speed cruise, a hover or a power-off autorotation, can lead to blade stall. When the blades stall, the helicopter stops flying. If the helicopter has enough forward speed, the stalled blades can blow back and sever the tail boom, but in any case the helicopter will descend out of control.

The National Transportation Safety Board (NTSB) became concerned in 1982 that R22 pilots may not have enough time to recover from a loss of rotor rpm. The board cited three fatal accidents that had occurred within two weeks in which the pilots appeared to lose control because of low main-rotor rpm. One R22 crashed when the pilot allowed rotor rpm to decay while hovering over a parking lot. A second accident occurred when a combination of high forward speed and low rotor rpm led to a retreating blade stall. In each case, the rotor blades severed the tail boom.

In the third accident, the R22 crashed following an abrupt maneuver to avoid high tension wires. Investigators determined that the rotor mast had failed because of excessive pounding of the rotor hub on its stops, also known as mast bumping. The R22 rotor hub is attached to the mast by a teetering hinge that allows the hub and blades to tip in response to movement of the cyclic control. If the helicopter is forced into a sudden push-over that results in a low-G or weightless condition, main-rotor rpm will drop, and tail-rotor thrust will force the helicopter into a rapid right roll. The instinctive reaction may be to apply full left cyclic. The rotor will tilt left, but there is not enough thrust in the rotor system to counteract the tail-rotor-induced roll to the right. The hub can tilt past its design limit and bump the mast, which may fail. The proper response to a low-G condition is to apply gentle aft cyclic to restore main rotor rpm, then add left cyclic to stop the roll.

NTSB took the unusual step of recommending that the FAA suspend the R22's airworthiness certificate and conduct a study of the helicopter's main-rotor stability and stall characteristics. The safety board wanted assurances that there is adequate engine torque and pilot reaction time available to recover from low rotor rpm. The board also sought confirmation that the main rotor system complies with airworthiness standards for normal category rotorcraft.

The FAA declined to suspend the airworthiness certificate. A design review proved that the R22 rotor system does comply with rotorcraft airworthiness standards, the FAA said. In addition, a joint FAA/Robinson Helicopter Company flight test of the main rotor system uncovered no unusual flight characteristics when the aircraft is operated within approved limitations. The FAA noted that it has enough power to recover from a rapid loss of rotor rpm; however, a telegraphic airworthiness directive was sent to owners. The AD required resetting the low-rotor-rpm warning system to go off at a higher rpm. The AD also called for installation of a low-rotor-rpm caution light next to the engine and main-rotor tachometer.

Meanwhile, the R22 was compiling a poor accident record in the hands of students and low-time pilots. Training accidents account for a large percentage of R22 accidents. Of the 112 accidents that occurred between 1980 and mid-October 1985, 55 involved training situations, according to FAA records. Training accidents peaked in 1983, when 12 of 20 accidents, or 60 percent, occurred during instruction flights. The percentage dropped to 40 percent in 1984 and had decreased to 35 percent by mid-October 1985.

Robinson believes lack of experience among flight instructors was a key factor in many of the accidents. Compounding the problem of poor instruction were pilots who refused to take the R22 seriously as an aircraft that demands proficiency and precision. High-time airplane pilots making the transition to the helicopter were among the worst offenders, according to Robinson, who places much of the blame on regulations.

A private pilot can obtain a helicopter rating with a minimum of 15 hours solo time in helicopters. Worse, in Robinson's opinion, are the experience requirements for adding a helicopter rating to a flight instructor's certificate. A flight instructor need log only 50 hours in helicopters, including 15 hours of instruction and 15 hours as pilot-in-command. The requirements were even lower when Robinson added a helicopter rating to his commercial fixed-wing certificate, and he says now that, until he had logged a lot more time, he was not competent to fly as a commercial helicopter pilot. Robinson believes the FAA should up the ante for an add-on private pilot helicopter rating to a minimum of 40 to 50 hours experience; to obtain a helicopter/commercial/flight instructor rating, 150 to 200 hours.

Robinson responded to the accidents by writing a standard training syllabus that formed the basis of a factory safety course for flight instructors. All R22 flight instructors are required to take the course to qualify for Robinson Helicopter's insurance program. Attendance is not mandatory for individual R22 owners, but those who take the course receive reduced insurance premiums.

The three-and-a-half-day course, which is held once a month at the Robinson factory in Torrance, is an intensive ground and flight review of situations that can and have gotten R22 pilots into trouble. Instructors review accident case histories and point out what students need to be taught to avoid potentially catastrophic situations such as low rotor rpm and push-overs.

Robinson also has tailored the factory insurance program to emphasize operating experience. Flight instructors who have flown only R22s must have logged at least 150 hours to qualify for insurance. Student pilots must have at least 20 hours of dual, including 10 hours in the R22, before soloing. A newly rated R22 pilot must log another 25 hours and have at least 75 hours total time in the R22 before taking pasengers aloft. The requirements are less stringent for experienced helicopter pilots.

Federal Aviation Regulations generally make allowances for the special operating virtues of helicopters. Helicopter pilots have a lot of freedom to fly at low altitudes and in reduced visibility and to land just about anywhere, as long as it is safe and legal. Helicopters are exempt from the one-mile visibility minimum that applies to aircraft operating under special VFR clearances in control zones and in uncontrolled airspace below 1,200 feet agl. They also are exempt from the minimum safe altitude restrictions that apply to aircraft, as long as they pose no hazard to people or property on the ground. Helicopter pilots also are supposed to avoid the flow of fixed-wing traffic when approaching an airport, unless otherwise instructed by air traffic control.

To be honest, I had mixed feelings about the R22 before I made the trip. The stylish little helicopter had gotten a lot of attention because it held the promise of lowering the high cost of rotorcraft flight training. On the other hand, it seemed too small to be taken seriously, and I was vaguely aware of a troubled past. I had little time in helicopters and little understanding of the arcane aerodynamics involved in rotary-wing flight.

I ended the trip admitting that I was wrong about the R22's sophistication. It is by no means a toy or just another little aircraft. Like any light helicopter, it must be flown conservatively and with precision; there is little tolerance for sloppy power management or poor control technique. The pilot must know and heed the operational and practical limits of the machine, and the potential R22 owner must know the limits of the factory's overhaul policy and insurance programs.

Given the caveats, the R22 can deliver on its promise of relative economy. Its small size limits its utility—it cannot carry an external sling load, for example—but its size, price and operating costs make it the ideal aircraft for a variety of tasks. Crossing the United States with a picture-window view may be one of them. □

Robinson R22 Beta

Base price: $85,850

Specifications	
Powerplant	Avco Lycoming O-320-B2C
	Normal rating: 160 hp @ 2,700 rpm
	Continuous rating in R22: 124 hp @ 2,650 rpm
	Five-minute takeoff rating in Beta: 131 hp @ 2,652 rpm
Recommended TBO	2,000 hours
Main rotor blade service life	2,000 hours
Length	28 ft 8 in
Height	8 ft 9 in
Main rotor diameter	25 ft 2 in
Tail rotor diameter	3 ft 6 in
Main rotor disk area	498 sq ft
Disk loading	2.75 lb/sq ft
Power loading	11.05 lb/hp
Cabin width	3 ft 8 in
Empty weight	825 lb
Gross weight	1,370 lb
Useful load	545 lb
Payload w/full fuel	426 lb
Fuel capacity, std	119 lb (115 lb usable)
	19.8 gal (19.2 gal usable)
Fuel capacity, w/opt tanks	184 lb (178 lb usable)
	30.7 gal (29.7 gal usable)
Oil capacity	6 qt
Baggage capacity	100 lb (50 lb under each seat)
Performance	
Max demonstrated crosswind component	17 kt
Max level speed, sea level	102 kt
Cruise speed/Range w/20-min rsv, std fuel (fuel consumption)	
@ 75% power, best economy	
3,000 ft	96 kt/189.5 nm (49.8 pph/8.3 gph)
Hover in ground effect	6,970 ft
Hover out of ground effect	5,100 ft
Max operating altitude	14,000 ft
Limiting and Recommended Airspeeds	
Vy (Best rate of climb)	53 KIAS
Vne (Never exceed)	102 KIAS

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