

"A BATTLE OF E

When you're asked to evaluate the two most popular training helicopters on the market today, it's not as easy as it might sound. Is your point of view from that of the student pilot, the instructor, or the operator? Is one better than the other, or just different?

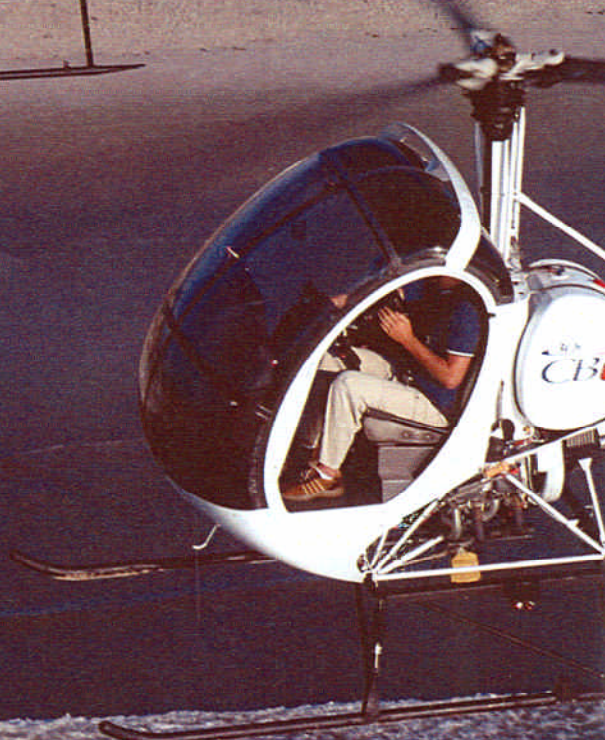
The Schweizer

In the first corner, we have the Schweizer 300CBI with a 40-year lineage that began with the Hughes 269 series (a.k.a. the TH-55), which was designed and built for the tough duty of training, and served as the primary US military helicopter trainer from 1965 to 1988. The stats are impressive: over 60,000 pilots trained, over four million flight training hours encompassing over 12 million touch-down autorotations. Additionally, the 269/TH-55 became the primary trainer for the military in 23 other countries, and was pressed into civilian use. Over 3,600 of the 269 series ships have been produced with more than 20 million hours being put on the fleet.

The Hughes 269 series included the A, B, and C model versions. The A and B models were powered by a 180HP Lycoming, whereas the C model (developed in 1970) sported a 190HP Lycoming and is flown PIC (Pilot-in-Command) from the left



Robinson R22 Beta II



Schweizer ★

QUALS?"

story by Guy R. Maher
photos by Mike Reyno



■ (main, overall spread) The Robinson R22 Beta II and Schweizer 300CBi, is one better than the other or are they just different?

■ (left, above) The R22 Beta II was introduced in 1995.

■ (right, above) The fuel-injected 300CBi was introduced in 2002.

seat to allow two passengers plus pilot. All variants earned the reputation for being hard-working, tough machines with an excellent crash-worthiness and safety history.

Schweizer Aircraft Corporation of Elmira, NY, in 1983, purchased the production rights, tooling, and parts for the series, began supporting the existing fleet, then refining and producing new 300C helicopters, and developing the turbine-powered 330 (later the 333). New 300Cs found their way into a multitude of utility, public service, and business uses but the training market was somewhat elusive. The price of the 300C was a significant factor, as was the introduction of the R22.

S ★ Robinson



In 1995, Schweizer introduced the 300CB, taking dead aim at the flight training market. Maintaining all the bulletproof, time proven aspects of the original airframe, it incorporated roughly 90 changes to reduce the cost of operation and improve field reliability. With the CB, the lowest life limit of all the mandatory retirement components was increased to 4,000 hours, with many well above that. The engine became a carbureted Lycoming HO-360 rated at 180 HP with a recommended TBO of 2,200 hours. The new 300CBi's fuel-injected HIO-360 Lycoming also delivers 180 HP with the same TBO. In total, over 170 CBs have been produced since 1995.

The Robinson

In the opposite corner, we have the Robinson R22 Beta II. The original R22, which debuted back in 1979, was Frank Robinson's own unique design. Over 3,500 R22s have been produced, with many significant improvements being incorporated into the model over the years (and sales show no signs of slowing down). Oddly enough, the R22 was never intended to be a trainer. Frank Robinson wanted to bring a helicopter to market that would significantly lower the purchase and operational cost of owning a personal helicopter. As such, the R22 design and flight characteristics were aimed at transportation, photography, and light utility work.

■ (left) The fully articulated rotor system on the 300CBi provides for a smoother ride and better stability.

The diminutive R22 caught the industry's attention with the simplicity of its design, its significantly de-rated Lycoming O-320 engine, its simpler maintenance requirements, and the lowest acquisition cost for any new production helicopter.

The R22 sports a unique "T-Bar" cyclic control that comes out of the floor between the two occupant seats, pivoting on a "T" like a seesaw with a handle grip at each end pointed back at the floor. The new R22 also had a very low inertia, two-bladed rotor system and an engine/rotor tachometer that reflects information in percentages (just like turbine helicopters), but with very narrow green arch ranges.

Like most new designs, the R22 certainly went through some teething problems. But, Frank Robinson takes his helicopter business seriously, and the R22 was soon proving and making a name for itself in the areas originally intended; and becoming a leader where it wasn't intended – training.

Let's face it, significantly lower acquisition costs, day-to-day operational reliability, and easier maintenance are the formula needed for any business plan, especially a start-up in the high-risk helicopter business. But, the R22 as a mainstream trainer became a sphincter-tightening arrangement, especially

■ (right) The wide cabin of the 300CBi provides for plenty of shoulder room.

for the instructor. The low inertia rotor system left no room for mistakes during real or simulated engine failures, and the throttle was very sensitive making it quite a challenge to smoothly coordinate throttle actions during maneuvers. However, the training market was a lucrative one so Robinson went after it aggressively.

Two improvements that really addressed the R22's big negative issues were the addition of tip-weights to give the rotor more inertia (although it's still a low inertia system), and a throttle governor, which really helped with power management. Indeed, in 1991 Robinson saw their biggest single year ever for the R22 with 402 helicopters being delivered.

A series of fatal accidents did force a certification review, and while the aircraft emerged unscathed, a special section was added to the FARs in the Spring of 1995 (SFAR No. 73 to Part 61) to tighten requirements on pilot training for solo, as well as instructing in the R22 (and R44), as a means to prevent the rash of pilot-induced improper actions, which were deadly in the R22. It turned out that the students and low-time instructors who were transitioning from fixed-wing were the biggest segment bringing the R22 to peril. Robinson developed a top notch, factory-conducted ground and flight



■ (left) The R22 shines with a 102 kts VNe, and a cruise speed of 96 kts at 70% power.



■ (right) In spite of its smaller cabin, the R22 gets the edge for storage capacity.

fuel-injected and you prime with the pump, but starting is the same. Why Robinson had the edge is because rotor engagement in the 269s and CBs was a combination of skill, timing, and a little spell casting. The procedure is to get the engine up to 1,500 rpm then begin an off-and-on ritual with the rotor engagement switch until the rotor and engine rpm finally matched up. You also had to be much more careful regarding engine over speeds.

With the CBi, you get Schweizer's STAR System, which includes a start-up overspeed limiter, automatic rotor engagement, and a low rotor RPM warning. (Robinson already had a low rotor RPM warning system). Now they both start, engage, and warm up in similar fashion.

In the Air: The Real Battle

Since I flew the CBi first, I'll start with that experience. Picking up the CBi felt like old home week. It was responsive and solid. Since the helicopter was so new, it actually felt a little stiff, as if the friction was not all the way off, but the controls were certainly smooth. Those oleo struts on the gear give early warning when the CBi is getting light and allows easy adjustments for a smooth vertical lift to a hover. All the Schweizers maintained the electric cyclic trim feature from its earlier models, which is operated by a coolie hat

on top of the cyclic. A couple of easy button pushes in any direction, if you need a bit of trim, helps to balance out those control forces.

The R22 is on stiff gear so it takes a bit more effort finding that "sweet spot" for the lift off. Robinson has an excellent governor that smoothly adds the power as you raise the collective. The CBi touts a throttle correlator, which mechanically links the throttle and collective for some decent coordination, but you still need to be working that throttle much more than in the R22, which is almost turbine-like in its response.

If you've never flown anything, the T-bar cyclic in the Robinson won't be an issue because you don't know anything else. If you've flown helicopters with a conventional cyclic, you may be stymied a bit at first. What I learned when I first flew the early R22s is that all I needed to do was imagine a stick going from the bottom of the R22 handgrip to the floor between my legs. Don't think about the mechanical path of the stick.

I jumped into the R22 immediately after the CBi and it was fine from the start. However, the R22 is more sensitive on the controls with a definite tendency to "teeter" under that two

bladed system. I needed a couple of minutes to get smooth again on that score. Because of the higher seating platform in the CBi, the "three-foot hover" sight picture needed adjusting. Having just come out of the CBi, I was flying the R22 a little higher than Stephane was comfortable with.

It was clear to see that the R22 Beta II does have more reserve power than the CBi while hovering, and therefore a higher hover ceiling. The CBi was pulling a good two inches of manifold pressure more than the R22. Although, they were both roughly three inches below their maximum allowed MP (a lovely hot, humid, Florida day), the lower top end MP restriction plus the de-rated engine is what puts the published HIGE for the R22 at just over twice the CBi at max gross weight. (Flying the CBi below gross is easy to do and considerably helps its performance). This wasn't an issue for my flying, but could certainly be a factor at schools based in higher elevations.

Following the hover work, the next items on my test card were quick stops and slopes. Both aircraft were straight-forward in the quick stop. The CBi required a little more attention to the throttle, but the R22 required more attention to rotor RPM control. I tried to

training safety course to deal with critical safety and operational aspects of the model. These actions significantly improved its safety record.

Reality vs. Myth

When considering the R22 and the 300CBi, one must try to separate fact from fiction. One thing which becomes clear is that many of those who favor one or the other are almost cult-like in their support while often being down right nasty to the respective challenger.

The 300CBi camp tout its tank-like strength and crashworthiness, 40-year airframe history, 3-bladed fully articulated rotor system, higher weight carrying capabilities, and ease of piloting. The Robinson camp brags about reliability, ease of maintenance, superior Beta II high-altitude performance, lower acquisition costs, and flight characteristics that prepare students for higher performance helicopters. So, let's find out.

Preparing for Battle

In the interest of having the latest information and experience for this report, I was hosted by Helicopter Adventures, Inc. (HAI). Based in Titusville, FL, HAI is the largest commercial helicopter training company in the world. It operates 20-300CBs, including one new CBi, and four R22s. I would get to fly the latest variant of each with my instructor for the day, HAI's Chief Pilot, Stephane Rebix.

Although the flight manuals for both are nicely laid out in the customary GAMA standard format, the R22's manual was more complete and easier to use. Some information, such as HOGE performance, was unavailable in the 300CBi's manual so you're forced to do some "rules of thumb" calculations.

Walking out to fly, the 300CBi has more ramp presence. Its cabin structure is wider and taller than the R22, however, the R22's rotor head actually sits a couple of inches higher than the CBi. The overall length of the CBi, from main rotor tip to tail rotor tip is almost 31 feet; while the R22 is just under 29 feet. For pre-flights, the CBi is pretty

much open for inspection, whereas the R22 has some covers and access doors. However, pre-flight of either aircraft is quite straightforward, easy, and I didn't feel like I was restricted from checking anything I wanted to see.

In spite of its smaller cabin, the R22 gets the edge for storage capacity. Not usually an issue in the training environment, but still worth a mention.

You climb up into the CB, and slide down into the R22. The instrument panel is larger and on a raised platform in the CBi, whereas in the R22 the panel has a lower profile and some of the controls and radios are on a pedestal that slopes towards the center collective.

The CBi definitely has the extra room and capability for the bigger boys. In fact, weight and balance is one of the major issues for the R22. With typical training fuel and two reasonably-sized adults in the cabin, you're pushing the limits for weight as well as forward C.G. in the R22. If you and/or your instructor are "plus-sized", it may not work. In

■ (left, top) The 300CBi has a conventional cyclic, note the coolie hat for trim control.

■ (left, bottom) The belt drive system is easily accessible for pre-flight inspection.

fact, Robinson has stopped producing the Mariner, Police, and IFR trainer versions of the R22, and will only allow a maximum of 20 pounds in options for new R22s in an effort to control the weight issue. (Robinson is now deferring these heftier roles exclusively to the R44). However, for my flight at HAI, loading worked out fine for Stephane and I (total about 400 lbs) and about 20 gallons of fuel. Similarly loaded, the CBi gave us a margin in excess of 100 lbs for more fuel... or fat.

Until the CBi, the R22 always had the edge in ease of starting; twist the throttle a couple of times for priming then close it, turn the key to start, immediately engage the clutch switch upon start and let the R22 do the rest as it engages the rotor and warms up. The original CBs from 1995 were carbureted. The engine start was similar to the R22 regarding priming, but instead of a separate key start, the starter was on the end of the pilots collective. Prior to the CB (the original 269 series), and now with the CBi, the engine is

■ (right, top) All instruments are on a large single panel. Schweizer offers a variety of optional panel configurations.

■ (right, bottom) The proven 269 series tail rotor is the same on the 300CBi.



over "cowboy" the R22 once to annoy the governor, but it hung on pretty good with only a little throttle coaxing. I did the slope landings on about five to seven degrees of slope, and they were benign for both aircraft.

For normal training flying, the two helicopters romp around at pretty much the same pace. The R22 is faster, so you'll typically see five to 10 knots higher speeds for climb, cruise, and approach versus the CBi. Certainly the R22's 90-knot cruise is much more appreciated when travelling somewhere or during instrument training where you can fly the published 90-knot scale. But, for most training it's about building time, so who cares. Figure on pattern speeds for both in the 60-knot range for climb and normal approaches, and about 75 to 80 knots for your level work.

Levelled off, the R22 has a more favorable nose attitude, but, of course, less room. Point to point is where the R22 shines because of its extra speed. However, even in a perfectly tracked rotor system, you will still get a small "two-per" from the main rotor system. Sometimes you only feel it in the small feedback from the cyclic stick, as was the case during my flight. The 300CBi that I flew was tracked out nicely and it was super-smooth. The CB series does give a better ride in turbulence, but, some of the worst wind and turbulence I've flown a helicopter in was in an R22, so it will do the job too.

Normal and steep approaches were conventional in every manner with both helicopters. The governor in the R22 had no problem in managing the power, whereas in the CBi, I had to do some basic throttle work to keep everything proper.

Without a doubt, the CBi gives you more reaction time when the power goes away, and requires less collective work throughout an autorotation. Upon chopping the throttle, I actually hesitated then lowered the collective. Once established in the glide, only a minor adjustment or two was necessary to

keep the rotor rpm in the green. At the bottom, the initial flare was very conventional to stop the descent and knock off the airspeed with a level and final pitch pull for a short slide on touchdown landing. Stephane let me do a number of these from a straight in and 180-degree position. The landing gear was excellent in absorbing the impact of the landings.

Autos in the R22 keep you much more on the edge. Stephane would only demonstrate the touchdown autos, and I was admonished to do power recoveries only – HAI school policy. The R22 is one tough little bird, but, with the stiff gear, you feel it much more in the seat than with the CBi. During the simulated engine failure, a rapid decrease in rotor rpm does occur and you have to be on the collective immediately (true with any helicopter, but much more the case with the R22). Additionally, the rapid lowering of the collective quickly returns the rpm and will actually overspeed quite quickly unless you adjust

with a little pitch pull. You are working the collective much more during the entire maneuver in the R22.

At the bottom, the initial flare comes at about the same time as in the CBi, however from here is where it's different. In the R22, once you are initially flared, you actually add some collective in the flared attitude to lose most of your forward motion before you level and give that last pitch pull. This must be well timed because the rotor rpm drops off fast. If you flare, level, then pull pitch, the R22 will just scoot along to a higher speed run-on type landing. After a few tries, I had the autos working pretty well to a decent power recovery. Although, the governor did require a little of pilot assist to make sure everything joined up smoothly.

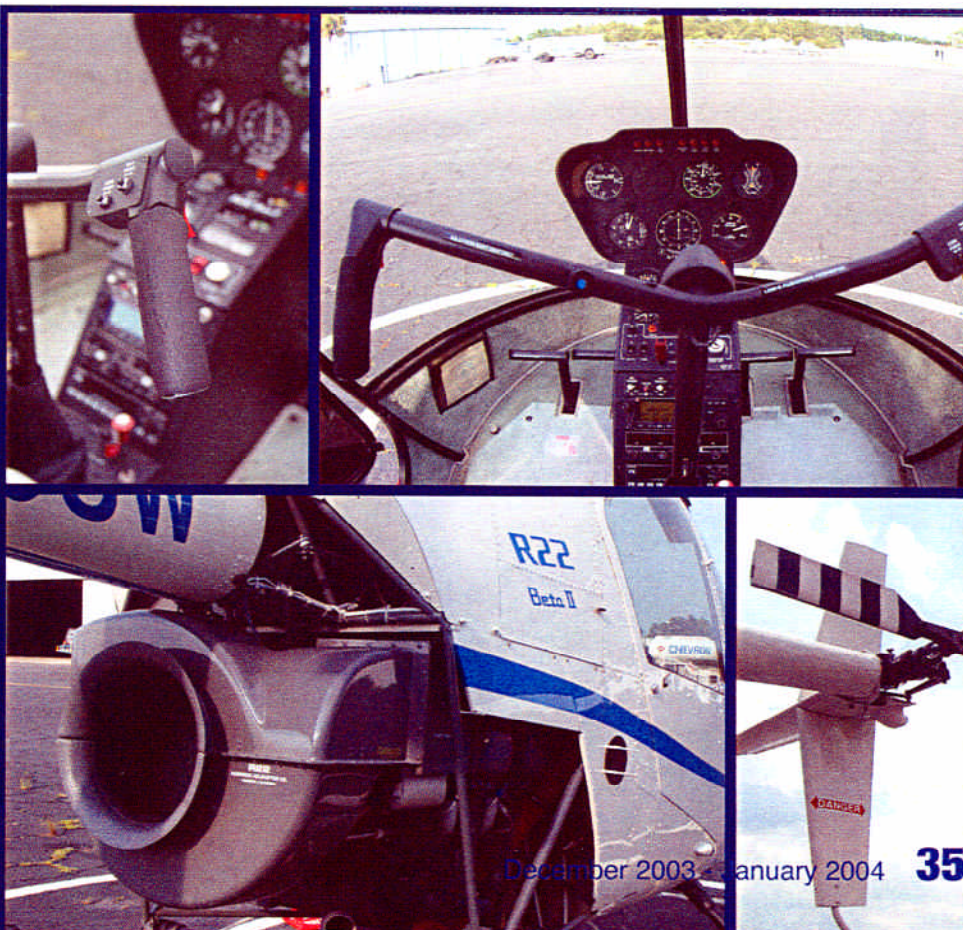
One operational point: personally I don't like carb heat in the R22, didn't like it flying the original 300CB, and am so glad the CBi is injected (wish the R22 was the same). I will say that Robinson has significantly improved on this with

■ (left, top) The "T-Bar" has a handle grip at each end pointed back at the floor.

■ (left, bottom) Although R22 components are enclosed, they are still very accessible during pre-flight.

■ (right, top) The R22 sports a unique "T-Bar" cyclic control, which saves space.

■ (right, bottom) The tail rotor on the R22 is similar in design to the MD500.



their new "Carb Heat Assist" feature in the Beta II. Essentially, this correlates the application of carburetor heat with changes in collective position. Lowering the collective mechanically adds heat and vice versa. Flying the O-320 versions of the R22, as well as the straight CB, means you're juggling the carb heat along with everything else. (I'm sure many will disagree). The original carbureted 300CBs, though, can be converted to fuel-injected engines.

Once the flying was done, hover taxiing back, then the cool downs and shut-downs were normal in every respect. One nice thing about the R22 is the rotor brake, which is applied at about 30 seconds after the engine is shut off after cool down. In the CBi you just wait for the rotors to stop on their own.

Reality Check

To cut through the chaff regarding these two machines, dump the hype and face the realities that each aircraft has its strong and weak points and that everything is relative. What might make an R22 or 300CBi good for one operator might be a minor factor for another.

With less reaction times and narrower margins, especially for the critical maneuvers, the R22 is more difficult to

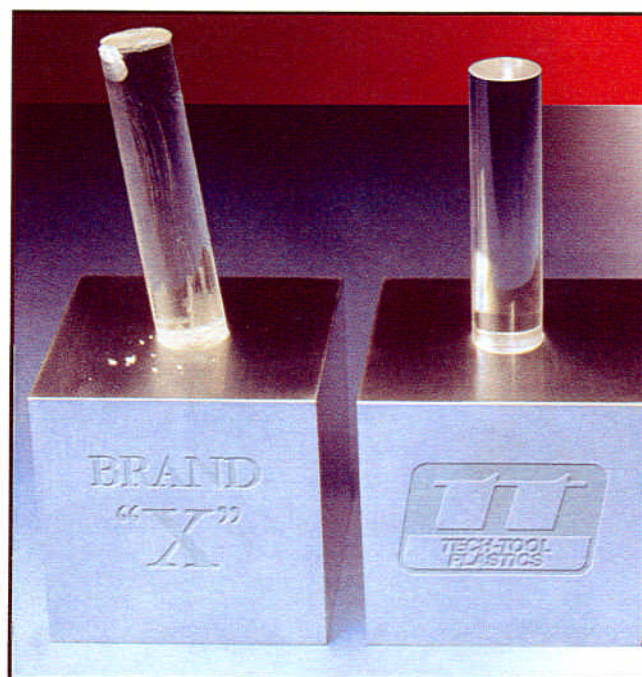
fly. The R22 camp likes to say this is good because it prepares you for the turbine-powered ships you're likely to be flying as a pro pilot. Clearly, with its turbine-like governor, RPM information presented in percentages like the turbines, lower inertia rotor system, and autorotational characteristics more like a Bell 407, this argument has merit. However, keep in mind that this is like saying: if you want to train as a circus juggler, you should start right off with five balls instead of three.

For the instructor, you're "on alert" factor is definitely higher in the R22. Your reaction times are less and the teetering T-bar cyclic means that your hands can not be in a comfortable position around the stick because it's up out of its normal position. The 300 CBi gives you more time to allow the student to react to a developing bad situation in any regime before you have to intervene. I observed that Stephane was more relaxed when I was at the controls of the CBi versus the R22, even though he has well over 1,000 hours in each type of ship.

Another reality for a budding professional pilot to consider is that your path will most likely include instructing.



And, since there are so many more schools using R22s, your training should include some R22 time. You'll need 50 R22 hours before you can be an instructor. Additionally, the R22's big brother, the R44, has become a major force in the commercial helicopter industry. Flying more like a piston-powered JetRanger, the R44 has taken many of the roles formerly dedicated to light turbine helicopters.



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■ Levelled off in cruise, the R22 has a more favorable nose attitude than the 300CBi.

Safety is always a consideration, whether you're the student, instructor, or operator. The R22 has certainly taken some hits in this area, but it's not just about its more demanding flight envelope, one must consider the fleet exposure to the most typical "stupid" type of accidents that occur in training, as well as flying by low-time owners and renter pilots. It all comes down to the operator and training. Robinson informed me that the culprits who do not take this seriously will be the ones to suffer a significant insurance premium increase. Robinson announced that any operator who had an accident after July 15, 2003, would realize a 50% insurance premium increase. So far, the accidents have significantly decreased since then. Coincidence? As *Vertical* was going to press, the 300CB and CBi series have gone without a fatal accident since their release in 1995 – representing well over 250,000 hours of flying on a fleet of 170 helicopters. While this fleet size (and its associated hours) is considerably smaller than that for the R22, it is still a highly commendable statistic, since low-time pilots fly these ships as well.

For the owner/operator of the flight school, there are a few points that

need to be mentioned. On purely an economic basis, the reality of either purchase is that you either pay now, or pay later, but, interestingly, you'll actually pay about the same. The R22, similarly equipped, is US\$50,000 less in purchase price than the 300CBi. This is not quite an issue with the large flight schools who favor the CBs, but this is clearly the most significant aspect for many small flight school operators, as well as business and private owners who gobble up R22s at a 3 to 1 ratio over the 300CBs. Additionally, there seems to be many more financing and leasing options available for Robinsons than for the Schweizers, as reported to me by a number of small fleet operators who would have gone with the 300CBi, but couldn't get an acceptable finance/lease package.

The excellent reliability of the R22 is well known. But, the Schweizer is no hangar queen either. It is here, though, where the bottom lines of the two aircraft converge. The R22 has one overhaul number to consider and that's 2,200 hours and/or 12 years. At that time, the R22 must be returned to the factory for a complete overhaul, which,

right now, costs \$95,000. The machine goes down the assembly line and leaves the factory just like a new helicopter. You can order an \$85,000 kit from a factory service center and do it in the field, but then you have your labor costs. Figure on your R22 being out of service for three months when the overhaul is performed by the factory, and whatever you can work out if you use the service center option.

Robinson operators reported a somewhat higher factory overhaul expense because of transportation and other "realities." So, if we say an even \$100,000, this means the maintenance reserve for overhaul is \$45.45 per hour. This also means that you better be flying at least 183 hours per year or you're leaving hours on the table. This may be a factor for private owners, but it better not be for a flight school, or you have more problems than the overhaul cost you should be worrying about.

If you take every time limited airframe part on the CBi and divide its cost by its maximum life, you get a figure of \$27.79 per hour. This is based on full retail price, but it also assumes that all parts achieve their full potential (not very



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likely on any aircraft). Engine overhauls for the HIO-360 currently cost about \$15,500, so if they make it to 2,200 hours (again, not always the case) this equates to \$7.05. Add the two together and multiply by 2,200 to give a comparison to the R22 overhaul, and you get \$76,648 for the CBI compared to \$100,000 for the R22. In 4,400 hours, this difference well makes up for much of the higher initial cost of acquisition of the Schweizer, even if the components don't all achieve full TBO. Also, factor in that the 300CBI could have much less downtime in its lifecycle and more timetable flexibility for scheduled overhauls. If you only went for the first 2,200 hours, the R22 would be due for the full overhaul, where the CBI would just need an engine. Even at just 50 hours per month of use, the big bill would be due in just 44 months.

Another important consideration is that the Schweizer, just like most

commercial helicopters, is equipped with a separate weight-on-skids Hobbs meter which only records flight time for maintenance purposes, while the revenue meter records engine running time. The R22 uses the engine Hobbs for both and can result in a significant difference between the two and a considerable savings for the CBI operator, because 100 revenue hours may only wind up being 80 to 90 maintenance hours. The operators I spoke with that use both aircraft indicated that the 100 hour inspections take a little bit longer in the CBI than the R22, but this is more than offset by the Hobbs set-up. Rental rates for either aircraft typically are about the same, which also bears out the similar cost recovery for the two, and both are proven moneymakers for many operators. So, which one should you train in? Schools, like HAI, offer the best of both worlds. They do the initial private certificate training in the 300CBI,

then instrument training in their IFR R22 trainers, providing good R22 experience, and flight time necessary towards flying PIC and teaching in the R22. Then, they do the commercial training in the CBI or R22, and finish with the CFI certificate in the CBI (mandatory for the full down autos).

First and foremost, if you are a beginning student pilot, do not venture out of your way to fly one helicopter if there is a good school close to you who is offering the other. Evaluate your school based primarily on their program, safety and performance record, instructors, professionalism, cost, financing, your goals, and their references rather than if they use the CBI or R22 exclusively. Barring that, if you must choose, go take a ride in each one and see what feels right for you. Just know that you can learn to be a good helicopter pilot in either aircraft, and both will prepare you nicely for what's to come. 

	Robinson R22 Beta II	Schweizer 300CBI	
	Lycoming O-360 Four-Cylinder, Air-Cooled; De-rated to 131 horsepower at 2652 rpm	Lycoming HIO-360-G1A Engine (Max Take Off 180 shp 134 kw; Max Continuous 180 shp 134 kw)	
1,370	Gross Weight (lbs)	Maximum Airspeed-Vne (kts/mph)	102/118
1,750			94/108
855	Empty Weight (lbs)	Cruise Airspeed (kts/mph)	96/110 (@70%power)
1,088			80/92
115 (19.2 gal)	Fuel Weight (lbs)	Maximum Range (miles) no reserve	>200
192 (32.0 gal)			220
63 (10.5 gal)	Auxillary Fuel Weight (lbs)	Maximum Range (miles) w/auxillary fuel	>300
192 (32.0 gal)			430
400	Useful Weight w/standard fuel (lbs)	Hover Ceiling IGE	9,400 ft (@1370GW)
662			7000ft (@1600lbs)