

Robinson R66 certificated



Frank Robinson explains how to design successful helicopters while staying out of jail. Pat Malone reports



The turbine-engined Robinson R66 helicopter, flight-tested for the first time in the October issue of *General Aviation*, has received its official certification from the FAA and the first production aircraft have been delivered to US customers. The first R66s in Britain may even reach our shores before the end of the year.

The FAA certificate was handed over to Frank Robinson, who officially retired from the company at the end of the summer, at a ceremony at Robinson Helicopter Company's headquarters in Torrance, California, on October 25th.

During a visit to Britain earlier in October Frank explained the thinking behind the R66 and its turbine engine. For many years he shied away from turbines because they cost so much to buy and run. But he told a packed audience at the Royal Aeronautical Society that he decided to embark on the R66 project because the oil companies made it clear they weren't going to be making avgas forever.

"Already, JetA is the only fuel available in large parts of the world," he said. "We had to switch or we were going to be grounded. For years we've been talking to the people at Rolls Royce to come up with a turbine engine with the right price and the right characteristics, and in the RR300 we have an excellent engine. It is considerably more reliable than

Top: the all-important certificate – from left, Kevin Hull, manager of the FAA's Los Angeles Certification Office, Frank Robinson, Albert Lam, R66 project officer at the FAA, and Kurt Robinson
Left: R66 could be over by Christmas



more than simply an engineering genius and an astute businessman; he's the man who made it possible for them to engage in helicopter flight, the man to whom they owe the experiences that come with the territory. There's an emotional bond with him and his machines; owners and pilots just wanted to say thank you, to have their photograph taken with him or to touch the hem of his garment. All of which must be pretty boring for him because he's a pragmatic kind of guy, and this is not the kind of treatment a pragmatic engineer expects to get.

Frank was introduced by David George, who has known him since he was a penniless engineer embarking on a highly risky venture. David, owner of Sloane Helicopters which sponsored the lecture, met an engineer called Gus LeFiel in Hawaii in the early 1970s, and LeFiel was by way of being Frank's partner – Frank would send him technical drawings of helicopter parts for Gus to machine in his workshop. Thus began an association, and a friendship, which endures to this day.

Frank started by sketching his background, and particularly his childhood in the Great Depression, which perhaps goes some way to explaining his robust attitude to pricing. "I was born two weeks after the Stock Market crash in 1930 and I grew up in the Depression, and it was bad," he said. "It was so bad that none of you who didn't live through it could know what it was like." He had two sisters and a brother, and his father was an unemployed miner in the low-grade coalfields of Washington State who supported the family by shooting deer, fishing and growing vegetables. Frank made his own contribution by hunting mink and selling the pelts, among other things. He attended a two-room school on Whidbey Island in Puget Sound, which had no



**Top: Frank Robinson delivers the Cierva Lecture at the Royal Aeronautical Society
Left: a section of the audience at the RAeS
Above: Igor Sikorsky flies the VS300, the machine that put Frank Robinson in the helicopter business**

the 250 Allison because it eliminated that long axial compressor, and I don't think we'll see many, if any, failures. It's smoother, it's quieter, the only drawback is that it burns a lot of fuel. I would have preferred a diesel cycle engine, but they're just too heavy."

Frank was in London to deliver the Cierva Lecture entitled 'The need for simplicity in helicopter design', a talk which turned out to

be a personal account of his life and times, and it attracted the biggest crowd the RAeS has seen for a while. It is unlikely that we will see Frank Robinson in Britain again, and many people were keen to meet and pay their respects to a man who stands alongside Arthur Young, Frank Piasecki and Stan Hiller in his contribution to the world of rotary flight.

In the minds of many, Frank Robinson is

electricity or running water. "Every summer the men would dig a new hole for the boys, and a new hole for the girls, then they'd lift up the outhouse and move it to the new hole," he said. "But I don't want you to think I'm making excuses for not being a better student."

When he was nine years old he saw a photograph in a Seattle newspaper of Igor Sikorsky flying his pioneering VS300, and he was entranced. "Underneath the picture it said what he could do with it," Frank said. "He could go up, down, forward, backward, rotate in any direction, and I was so overwhelmed by what I was reading. I had no idea these things were possible. From that moment I was converted for life; I knew I had to get into that industry, and make a contribution to it."

Frank was obsessively interested in how

things worked. "I took apart every little clock, every bicycle," he said. "I just loved mechanical things." But there was no question of his being able to afford to go to College – until, that is, the war started. All of a sudden there was work for his father, for his brother, and as soon as he was 16, for him – Frank worked on military transport ships, travelling all over the Pacific, and on the proceeds he was able to do a mechanical engineering major at the University of Washington.

He graduated in 1957 and bought a copy of *Jane's All The World's Aircraft* to see which companies were making small helicopters. "I wrote to pretty much all of them," he said, "and Charlie Siebel, who was chief engineer at Cessna, offered me a job working on the CH1 Skyhook. That was a real good place to start



Above: the Cessna CH1 Skyhook, the helicopter on which Frank first worked in 1957
Below: Umbaugh gyro – Frank had to cash his paycheck at a different bank every week



and I learned a lot at Cessna, but they were pretty cheap on salaries and when I saw an advert in *Aviation Week* for a flight test engineer at a small company called Umbaugh, I went for that. They were producing a gyroplane and it got FAA certification, but every week we'd have to find a different bank that would cash our paychecks so that didn't last long. But I learned a lot, and some of it was what not to do.

"I went to work for McCulloch, the chain saw manufacturer, who'd designed an autogyro, and I did a lot of development work on that, but I realised that type of aircraft was never going to succeed because it is terribly inefficient at low speeds. The power that goes into the main rotor has to go through the propeller – you've got to put that energy into the airstream than take it out again as drag on the main rotor. Rotor efficiency at high speed was good, 70 or 80 percent, but at 30mph it was terrible. I advised everyone that that wasn't the way to go, and about that time, Kaman Helicopters contacted me because

they'd heard I had experience of gyroplanes, and Charlie Kaman made me a good offer. But they were stuck on the same concept. I convinced Charlie he should go down the gyrodyne route (with a powered rotor) but that company was not going well, so I moved to Bell Helicopters. That was a very legitimate company and I learned a lot, but eventually I got fed up with that and when I was contacted by Hughes, I went over there. Hughes was having trouble with its tail rotors, which weren't very efficient at altitude, so I designed a new tail rotor for Hughes. In 16 years, every company I worked for tried to get me to specialise in one particular area. I resisted that, and gained experience in all the areas."

When he was 43 years old, Frank read somewhere that whatever you're going to do in life, if you haven't done it by the time you're 40, it won't get done. "I figured I was three years past due," he said. "I wanted to design a very simple, emphasis on simple, low cost helicopter that could be produced efficiently and sold to the public at a price they could

This photo: Frank flies the R22 prototype for the first time in 1975
Below: landings at Frank's Los Angeles home led to the threat of a spell in jail
Bottom: the R22 prototype suffered a structural problem and ditched in the Pacific



afford."

Frank showed a photograph of a neat suburban home in Los Angeles in which the first Robinson helicopter was built and run – much to the consternation of his neighbours. "The Zoning Commission ordered me to cease and desist and all that sort of stuff," he said. "Then they said I'd have to pay a fine, \$800 or something, and of course I didn't have that kind of money. So they gave me some options,

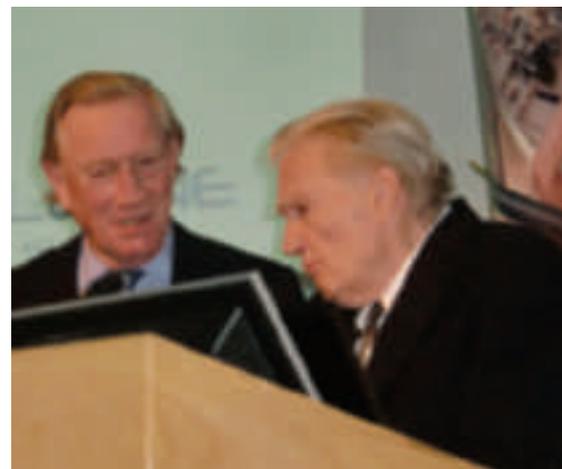


wanted quick returns with low risk. "No question, if I knew how hard it would be, I wouldn't have done it," Frank said.

In August 1975 the first R22 was towed to the west end of Torrance airfield and fired up for the first time. "Normally companies spend a month or more ground running before they think of doing even a tethered flight," Frank said. "I checked through all the systems on it, and everything performed exactly as I calculated it would. We tracked the rotor with a flag tracker, and a little after noon, I ran out of things to check. So I told the guys to take the blocks out of the controls and retire to a good distance, I ran up the RPM and started pulling up the collective, and it worked just fine. I hovered around the area, and everything performed just the way it should."

Certifying the helicopter was a protracted business full of incidents and frustrations, but Frank is nothing if not dogged, and the result is the billion-dollar company from which he has just retired, a company which has sold some 9,000 helicopters into the civil market.

Frank covered some of the patents he had filed for unique helicopter features like the



Top left: Frank Robinson and Gus LeFiel celebrate the certification of the R22 with two FAA men in 1979

Left: the Robinson factory in the 1970s
Above: David George has backed Frank Robinson's helicopter designs since the 1970s
Bottom left: more than 9,000 helicopters have come off Robinson's production lines



including eight days in jail. I was called in front of the judge, and he asked me how I pleaded, and I said 'not guilty', which was not the case. In fact, I was guilty as hell. I demanded trial by jury and said I'd be acting as my own attorney. So we swore the jury in, and I called my witnesses, and they called their witnesses. And I never tried to act all innocent, because I sure as hell wasn't, I just set out what had happened, and what I was

trying to do. And the jury wasn't out for more than an hour, and they came back with a verdict – innocent."

Frank's meeting with Gus LeFiel, who sought his advice on a kit helicopter he was planning to build, was fortuitous because Gus was an expert machinist, retired with time on his hands, and had a well equipped machine shop at home. Furthermore, he had plenty of money, having sold his company, which was good because Frank couldn't afford to pay him. "He could make just about any part," said Frank. "He became sold on the design we had, and I would send him the materials and the drawings and the parts would come back, beautifully made. The sheet metal parts were mostly made in my garage. The happiest time of my whole life was the year I spent assembling the first R22... I just loved working with my hands."

It was also the worst of times, because there was no money. Robinson Helicopter Company couldn't get bank loans, couldn't get supplier credit, couldn't interest venture capitalists who

three-hinge rotor head and the pitch change bearings. And he revealed what governed the size of the R22 tail rotor – it had to fit in his kitchen oven, where he cured the bonding at 260 degrees. He covered his meticulous testing of the flex couplings, the tail rotor drive shaft whirl modes and the damping that cancels out two of them, and the thinking behind the T-bar cyclic – largely to desensitize the stick to lateral vibration.

Frank's decision to make helicopters with piston engines was decried in the early days because of the widespread belief that turbine engines were so much more reliable. In fact, turbines are only more reliable when compared with the early piston engines that powered helicopters in the 1940s and 50s, and the de-rated Lycomings in the R22 and R44 have better reliability records than small turbines used in civil helicopters to date. Ironically, Robinson's move into turbines comes as Eurocopter is rumoured to be designing a helicopter to take a diesel cycle engine. ■