



## Opinion on Maintenance

# "If That Thing Ever Flies..."

by Gavin Miller

When Sikorsky's first helicopter, the VS-300, was plucked from its home at the Edison Institute last May to celebrate the 65th anniversary of its first untethered flight, it struck me just how young our industry is. In the midst of all the excitement over such technological wonders as the AgustaWestland EH101, Eurocopter's AS 332 Cougar, and Sikorsky's S-92 Helibus, it's easy to forget the staggering pace of helicopter development over the past 65 years.

Presently, I'm writing a book about how helicopters work. In the course of my research, a fine fellow named Jack Schofield loaned me an old hardcover book published in 1945. Entitled *Pioneering the Helicopter*, the copy was penned by C. L. (Les) Morris, former chief test pilot for Sikorsky. His account reveals that the development of the VS-300, and the efforts required to tame it, almost defied description. Apparently, the prototype machine—a welded steel tubing frame powered by a 75-hp engine—went through so many modifications in its short four-year life that when it was officially retired after a little more than 100 flight hours, the only original parts remaining were the wheels, seat, gas tank and center frame. Morris also revealed that few were even sure what could be done with a helicopter, let alone whether this one could do it.

Teaching oneself how to fly a helicopter would have been difficult enough without also having to establish design needs at the same time. The things modern training schools carefully address with each novice pilot—resonance, translational lift, power settling and autorotation—all had to be discovered the hard way. It took years to determine how to make things like the swashplate and rotor hub function as intended, and every solution illuminated new, unanticipated problems.

Whether or not Igor Ivanovich "invented" the helicopter is a moot point. While several machines lifted clear of the ground before the VS-300 did, Sikorsky was the first to perfect the conventional main and tail rotor design, and its controllability, to such a degree that his machines were truly practical.

What accounted for Sikorsky's success? "I believe now that his success can be charged to his calm, forceful, sometimes dogged confidence, coupled with sound engineering and intuitive judgment," said Morris. Indeed, Sikorsky had a reputation for doing things others said couldn't be done. One of his own engineers is reported to have said, of the VS-300, "If that thing ever flies, I have never been, am not, and never will be an engineer."

Sikorsky did finally coax his (tethered) machine into the air for the first time on September 14, 1939, but was not impressed. "She vibrated badly," said Sikorsky. "I got shaken up on the

ground and in the air. They say I was just one big blur."

Three months later, the VS-300 crashed when its limited control was overcome by a gust of wind. At this point, Sikorsky abandoned the idea of cyclic control and added two long outriggers with a small horizontal rotor on each to complement the conventional tail rotor. Rather than angling the main rotor, the entire machine was tipped backwards, forwards or sideways by these auxiliary rotors. Redesigned, the VS-300 made its first untethered flight on May 13, 1940. However, while it could ascend vertically and could also fly sideways and to the rear, it could not fly safely forward. According to Morris, forward flight "was quite uncertain!" When forward airspeed reached 30 or 40 mph, the machine began to exhibit "mysterious, uncontrollable antics."

Nevertheless, Sikorsky continued to perfect and redesign the aircraft, eventually returning to cyclic control of the main rotor in June 1941, but only for lateral control. For fore and aft control, the outriggers were replaced with a single tower at the tail with a horizontal rotor on top. Once that configuration had been developed as far as it could, the tower was removed and full cyclic control of the main rotor was restored. Unfortunately, the resonance problems that had plagued the machine also returned and it wasn't until Sikorsky installed hydraulic dampers on the main rotor lag hinges that on December 8, 1941, the VS-300 was flown in its final modern configuration. On the last day of 1941, Sikorsky reported, "excellent flights were made."

Sikorsky's next "real" helicopter was the XR-4, whose blades were out of track so the cyclic stirred around in sympathy with the rotor. Les Morris recounted the initial attempt to fly it: "At last the wheels began to dance gently on the ground, and one more pull of the pitch lever broke us loose. Instantly, we began drifting sideways, and I moved the stick to correct it. But this ship was heavier than the VS-300—its reaction time was totally different. At first I under-controlled, then went to the other extreme and moved the stick much too far. The controls were stiff, especially the rudder pedals. The main pitch lever was extremely heavy, and it required a constant strong pull to keep it from going down. The whole situation felt very much as if I were supporting the entire weight of the craft in one hand while trying to balance it very delicately with the other by means of a control stick that was performing fanciful gyrations in front of me."

As helicopter development continues to hurtle forward from those first uncertain steps, we can realize how much has changed. Yet, the essence of what helicopters were intended to do and how they help people remains the same. And we can thank Igor Sikorsky's vision for that. 

