THE HELICOPTER IN PRACTICE

In forward flight the flying technique resembles more closely that of the fixed-wing aircraft, although fundamental differences are still present. Perhaps the feature in which the helicopter differs most from the fixed-wing aircraft is the essential pitch, which does not necessarily involve a change in the fore-and-aft attitude of the fuselage. Climbing or descending is carried out by raising or lowering the collective-pitch lever, and the position of the nose rotor. The fuselage moves up or down with the helicopter, but the main rotor is not necessarily involved. This is in contrast to the fixed-wing aircraft, where a change in pitching attitude does not necessarily involve a change in the fore-and-aft attitude of the fuselage.

Once the helicopter has been settled into a steady condition of straight-and-level flight the collective-pitch lever and throttle can be left alone, and the pilot can concentrate on the control of the aircraft. The Bell 47, another useful little 2/3-seater trainer, has a separate friction device (or sometimes, in the case of the collective-pitch lever, an irreversible mechanism) which ensures that it will not move from the position in which it was last set. Control movements are created by the stick and rudder pedals, leaving one hand free to operate the radio, etc.

It is not proposed here to discuss all the helicopter flight evolutions, but mention should be made in passing of the phenomenon known as "auto-rotation." In terms of fixed-wing flying, this means nothing more nor less than "gliding." In the event of power failure the pilot must lower the collective pitch lever to its bottom stop, which will leave a small positive angle of incidence on the blades. At this angle, a little over 2 deg, the rotor will continue to rotate due to the aerodynamic forces acting on it, and will provide sufficient lift to allow the machine to glide in and settle down. Without this, a short-run take-off would result in a collision with the ground if the helicopter is not at a sufficiently high altitude. Engine failure does not affect the cyclic pitch or tail-rotor controls and the helicopter is maneuvered in the glide in exactly the same way as when under power. Rate of descent varies with forward speed and is greater in and is normal in a 2,000 ft power-off descent.

Of the secondary controls the trimmers vary from one machine to another, but are usually in a position convenient to the pilot's thigh-hand. The mechanism, for example, in the Hiller 360 comprises two sets of opposing springs fitted to the control-column linkage, one set in the fore-and-aft and one in the lateral sense. They hold the stick in tension at a central datum which may be shifted at will by increasing or decreasing the spring tension. In forward flight the stick must be held forward of the central hovering position to impart a continuous forward tilt to the rotor, and it can be trimmed in this position.

Handling-notes on Selected Types

On the Westland-Sikorsky S-51 trimming is effected by two small electric motors controlled by switches below the instrument panel. An upward or downward movement of one switch adjusts the cyclic pitch and tail-rotor control loads being transmitted back from the rotor to the stick. Without this artificial feel the stick would seem "dead." Earlier versions of the S-51 employed irreversible screw jacks to operate the collective pitch, and yawing control by lateral differential cyclic control. The collective-pitch lever and tail-rotor controls are similar, though these are rather smaller, and in this case adjustable by an electric control in the cockpit and power operated controls are similar to those of the S-51 and, if one may judge from the good handling qualities of that machine, combined with experience of the American Piasecki tandem-rotor configuration, the S-55 has all the makings of a good helicopter.

Metal blades are being developed by the company and are not yet in service. Control movements in the 171 is direct from the stick to the blades, there being no irreversible jacks in the system, and this principle is also carried out on the twin-rotor machine, though the controls are naturally more complicated. Fore-and-aft and lateral control movements are effected by setting a governor which actuates the cyclic pitch, and yawing control by lateral differential cyclic control adjusted by the rudder pedals. The collective-pitch lever and tail-rotor controls are similar, and the tail rotor is a transmission shaft which, running along the top of the fuselage, is geared directly the rudder motors, and allows power to be fed to both rotors from either engine in the event of the other engine failure. Similar stabilizing surfaces are also incorporated in the Westland-Sikorsky S-55's tail boom, though these are rather smaller, and in this case adjustable by an electric control in the cockpit to provide fore-and-aft trimming. Other improvements on the S-55 include a shorter arc of travel for the collective-pitch lever, making it more comfortable for the pilot to operate. Metal blades and power operated controls are similar to those of the S-51 Mk 3. The Sikorsky S-55's tail rotor is a three-bladed unit, whose invention shows promise of being equally as good as its American counterpart - a twin-engined version is planned.

In conclusion, if we were to venture an opinion as to which helicopter I would most welcome to operate, I would say, quite unequivocally, the American Sikorsky S-52; but I would still like to fly a machine with the same attributes as this helicopter yet affording stability comparable with that of a fixed-wing aircraft.