Flying controls are conventional, with the pilot seat to starboard (dual controls can be fitted for training). The cyclic-hand grip carries switches for bias trim, autopilot cut-out and autopilot manoeuvre. The collective-pitch, to the left of the seat, has the twist-grip throttle and a supplementary control box carrying the flying-controls power/manual, rotor speed selector (DCR/INCR), deck-releaser and landing-lamp switches, as well as a friction lock. The rotor-brake lever is aft of the collective pitch. Tail-rotor pedals are adjustable for reach by a console lever.

The port ends of the cyclic-control cross shafts are connected by bellcranks and levers to the pitch and roll trim bias-electro-actuators. Two rods run aft to a Z-crank under the rear of the cabin where the motion is transmitted up to a cross shaft mounted on the engine deck and thence by bellcrank to the cyclic spindle inside the rotor gearbox. An arm on the Z-crank assembly projects into a ring forming the primary stop, and it is at this point that the autopilot servo-motors are attached. The two cyclic jacks are mounted on the engine deck on each side and operate through cranks on the cross shaft.

**Flying-Control System**

Although the P.511 was flown with manual flying controls, with an electrical trimming system for centralizing control forces, it was decided in September 1960 to develop fully-powered controls. Main reasons were that this would make it easier to fit an auto-stabilization/autopilot system and it by-passed certain feedback effects which had appeared during flight testing. Since the manual characteristics were generally acceptable, an unduplicated system with manual reversion was chosen.

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**SCOUT AND WASP...**

the attachment holes are "ballized" to eradicate surface sources of fatigue cracks. The process consists of cold-forcing an oversize steel ball, lubricated with Rocol RTD compound, through the bores. On the blade extension-arm lugs the original hole is 0.7520in, the ball 0.7651in and the resultant, extremely smooth, bore 0.7635in. Ballizing has increased the fatigue strength by some 30 per cent.

Main rotor blades are manufactured by Westland at Yeovil to a design similar to that supplied by Parsons Corp to Hiller. The blades, which have twist and taper, are all-metal and assembled almost entirely by bonding. There is a D-section leading-edge spar of brazed cold-rolled steel plate, containing a reinforcing rod which also maintains the c.g. well forward. The bonded upper and lower light-alloy skins are joggled to lie inside the spar, and stiffened by four spanwise extruded channels bonded to the upper and lower members and to the extruded trailing-edge. One channel is fitted well inside the spar, and backed-up against flanges on the skins; the next two are aft of the spar/skin joint and faced to each other to form an almost closed box; the fourth channel is fitted with its web aft. The blade root is reinforced by bonded and bolted doubler shells, and external packing blocks provide parallel faces for the blade-extension jaws. Into the blade-tip cover are bolted internal balance weights and a tracking rib; and two trimming (torque-balancing) tabs are bonded to the trailing edge. The blade attachment joint is made by two ground pins passing through bushed holes in the blade and extension arm and screwed into flint nuts in a channel under the extension-arm jaw, the heads of the pins being locked by spring-loaded serrated collars. The two-bladed tail rotor is mounted by a single pin which allows it to rock ±7½° in the flapping sense. The hollow steel hub is mounted on a traverse pin with two taper-roller bearings providing it to rock ±7|° in the flapping sense. The hollow steel hub is designed and made by Louis Newmark in conjunction with Westland, the RAE and A&AEE. The equipment weighs about 551b.

**Performance**

*From the collective-pitch cross shaft a push/pull rod runs aft to the Z-crank assembly, whence another rod runs up to the collective-pitch beam on the engine deck and thence by push/pull tube inside the gearbox to the spider-actuating piston inside the rotor shaft. The collective jack is mounted on the front of the gearbox and operates the collective-pitch beam.

The spider-actuating piston rotates with the shaft, and carries the four tubular arms which are linked to the blade extension arms. The cyclic-pitch spindle, the foot of which is mounted in twin taper-roller bearings in its actuating crank, is displaced angularly to tilt the control spider. There is a compensator linkage to the torque and weights to damp the pitching moment. The collective rod ends in a collar around the cyclic spindle, supported in a ball bearing inside the piston skirt, which slides the spider piston up and down. Hydraulic control power is supplied by a pack (reservoir, accumulator, pump filter, cut-out, etc) mounted to port on the engine deck and powered by the main-rotor gearbox pump. Tail-rotor control is by cables and pulleys to quadrant wheels, under the engine deck, connected by the yaw force-sensing link for the autopilot. The run continues by cable and pulley, with the autopilot servo capstan attached to the port cable, passing in the Wasp through butting "bloater" cranks at the tail hinge. The Mk 28 autopilot/autostabilizer is a four-channel system designed and made by Louis Newmark in conjunction with Westland, the RAE and A&AEE. The equipment weighs about 55lb.