APRIL 1982 70p
(IR £1.00, U.S.A. & Canada $3.25)

Radio Control Models & Electronics

MAP MODEL MAGAZINE

Hanno Prettner's World Champs Winner

It's MAGIC

Getting the treatment! Hanno takes the noise test during the Acapulco World Champs. MAGIC was the quietest model.

MAG

SINCE BEFORE the 1979 World Championships my latest design 'Magic', has generated a great deal of interest. My inability to compete in that event is now a matter of history, but the faith I had in this design prior to that Championship was amply justified by the model's performance at the '81 event in Acapulco, Mexico.

Constant pressure from the RCM&E editorial team has finally prompted me to make available the plans for the 'Magic' and these are shown here in the '81 Mexico form, and published in a model magazine for the first time.

Design requirements

The 'Curare' was, of course, the basis for 'Magic'. My initial design-concept called for retention of that model's outstanding performance while reducing noise. I also wished to modify its characteristics to give a more realistic flying style similar to full-scale flying, the style in fact provided by my Las Vegas design 'Dalotel'. This then required clean design for minimum drag. Tuned pipes provided very quiet operation and increased power but to meet my requirements, the pipe had to be installed within the fuselage with a downward facing outlet exhaust to prevent turbulence over the control surfaces. This type of installation has the double bonus of looking better and avoiding the oil staining of the finish that frequently spoils the looks of an aircraft.

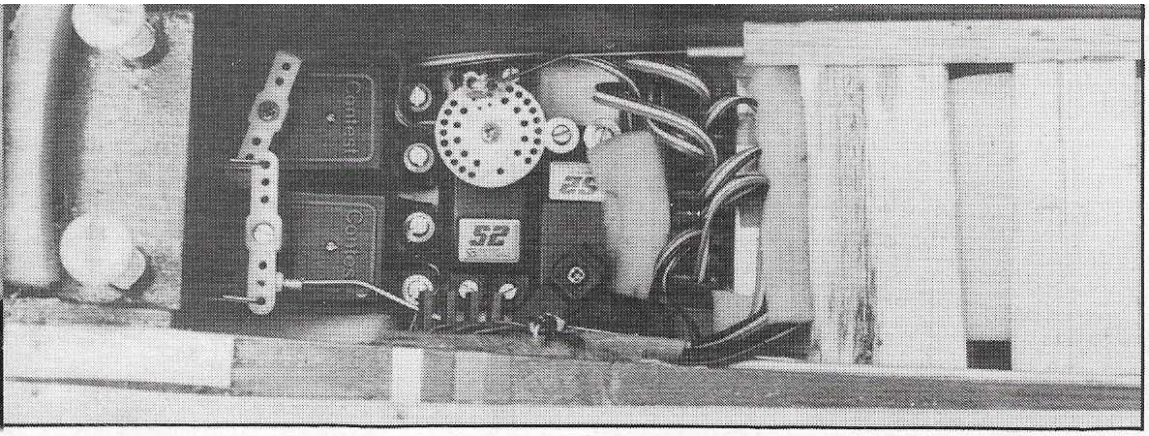
Prototype Number One

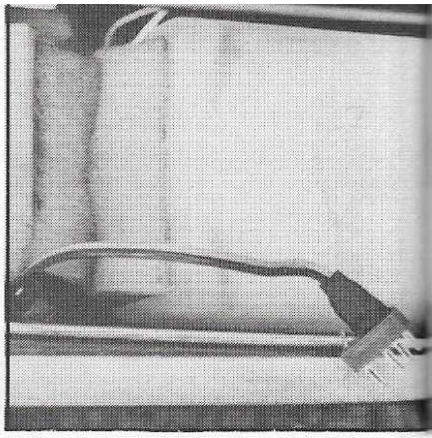
The first prototype was built for a rear-exhaust motor, mounted upright with the pipe fitted into a housing on the top. The system worked well but also presented some problems. There was no noise reduction beyond that offered by the pipe since the engine was not cowled. Cowling would affect the sound patterns, I had reasoned, but the upright mount did not permit a cowled design. There was also a substantial difference in height between tank centre and carburettor centre resulting in (in an engine without a pump) changes in fuel flow during manoeuvres. But the biggest problem was the enormous heat in the top of the fuselage.

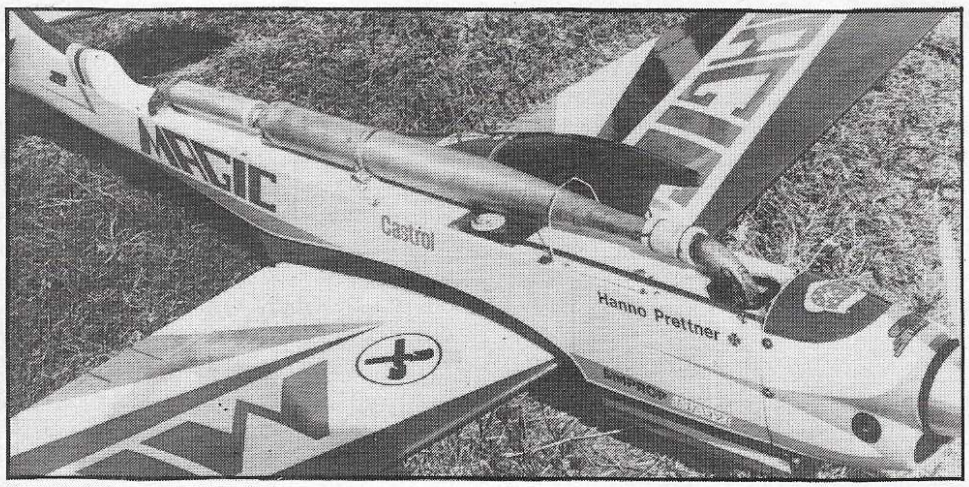
Even with plenty of air intake for cooling,

GIC

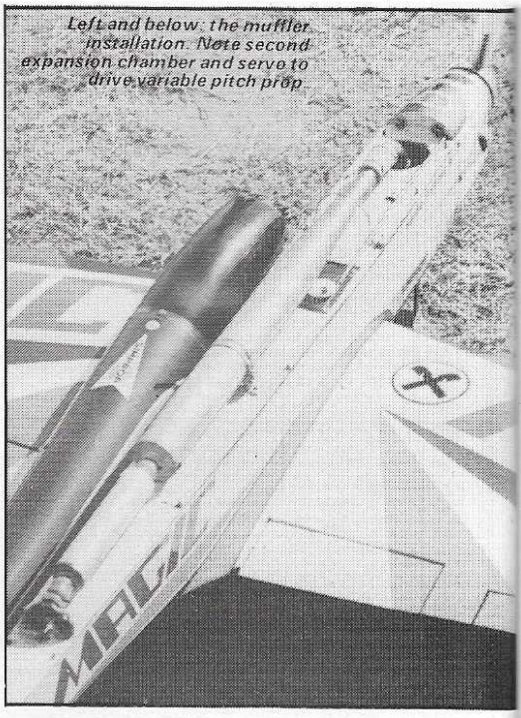
HANNO PRETTNER'S WORLD CHAMPIONSHIPS WINNER – IF FAI AEROBATICS IS YOUR GAME, IT'S THE ONE TO FLY!



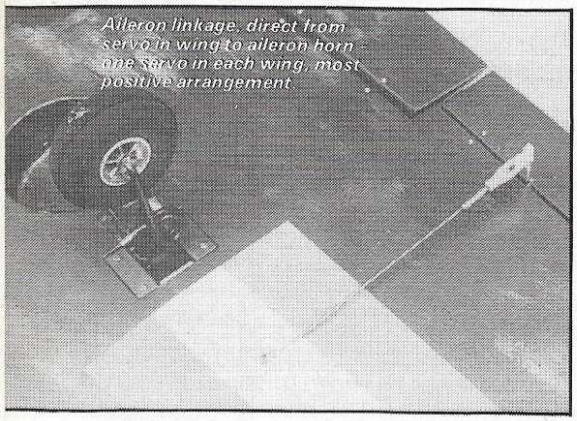




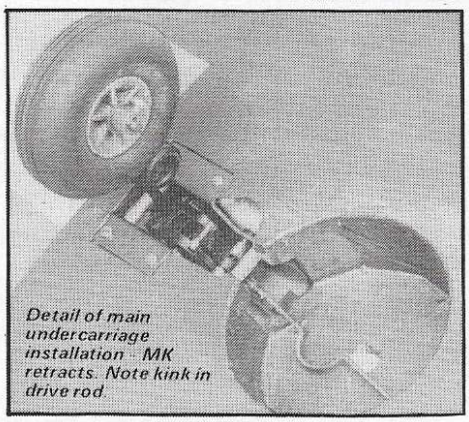
FUSELAGE INSTALLATION. Above left: servo arrangement. Note that rudder is driven by closed loop linkage and elevator push rod is attached to servo arm by ball type joint for minimum float. Other two servos operate throttle and mixture. Above: tank installation at front of compartment. Above right: nosewheel well. Note simple rubber band tensioner and tenk vents for filling and pipe pressure line.



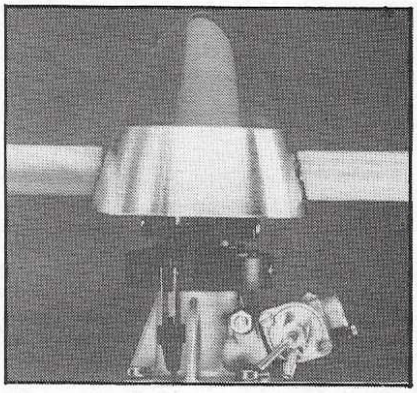
Left and below: the muffler installation. Note second expansion chamber and servo to drive variable pitch prop.

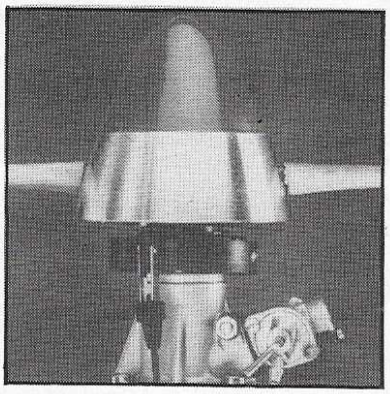


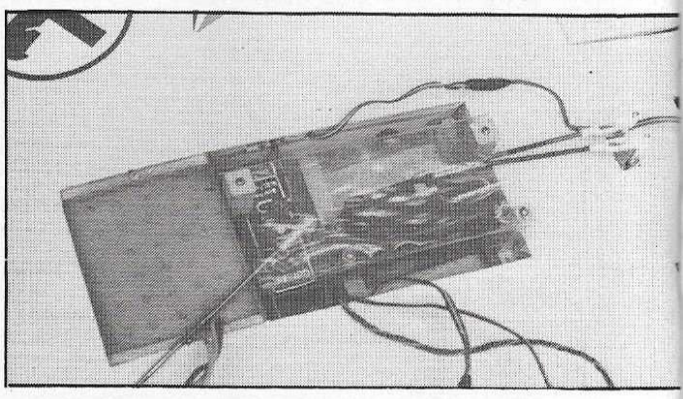
Aileron linkage, direct from servo in wing to aileron horn one servo in each wing, most positive arrangement.

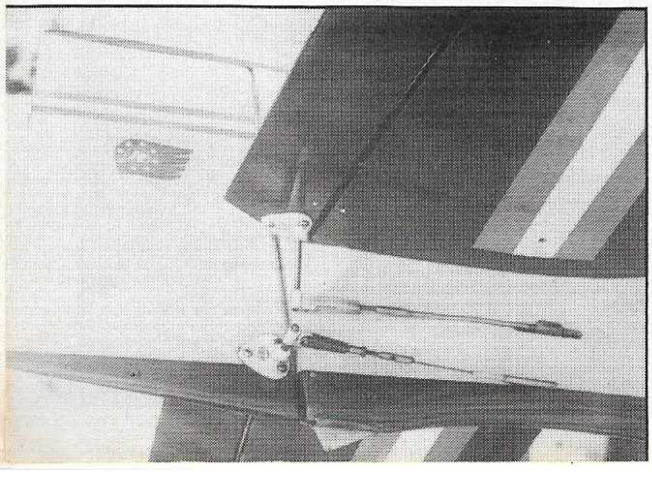


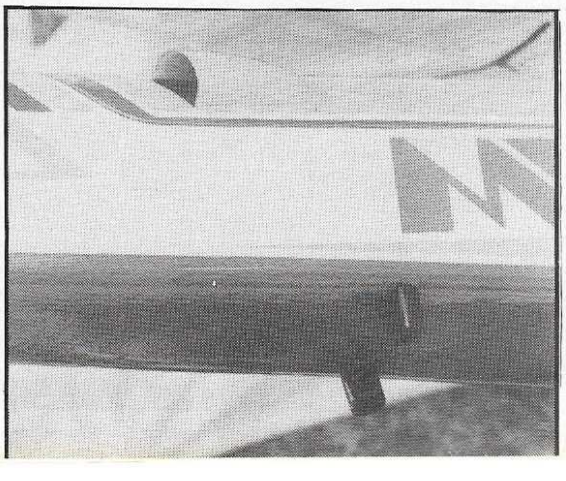
Detail of main undercarriage installation MK retracts. Note kink in drive rod.



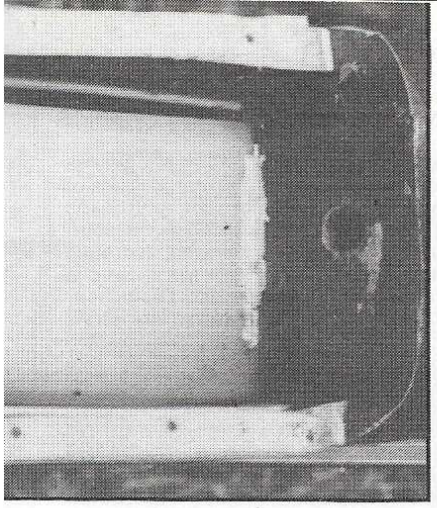








Above left: at Acapulco World Champs, Hanno used prototype MK variable pitch prop with coarse/fine/reverse settings. Production model seen here in two position form. Above: servo well in wing centre section showing single retract servo for mains and noseleg, plus flap servo and linkage. Far left: elevator and rudder linkages. Note that rudder uses horn either side for closed loop, but has stiff wire rather than usually favoured flexible multi-strand cable/tube arrangement. Elevators each have horn linked to pushrod by fork arrangement. Left: vent system for muffler. Note bifurcated muffler/pipe exhaust at bottom of fuselage. Faired air outlet is one of two for exit of cooling air.



both balsa and paint had a tendency to change to a brown colour. Epoxy joints also softened and weakened. Heat was so great that even the soldered connection to the whip aerial loosened. (Fortunately, I had the model on the ground when this happened). Added to all this was a very high consumption of silicone connections between pipe and engine.

I tried every trick I knew to insulate the structure from this heat, but nothing really helped. It simply wasn't possible to cool the pipe while hot air poured from the engine cylinder fins.

Prototype Number Two

I spent many weeks of thinking and designing until a very simple solution was devised; inverted engine mounted with an 'S' type pipe connection. A lot of advantages were found. A noise reduction of about 3dB resulted from an integrated engine cowling that forces sound patterns through solid material which acts as a filter.

By placing the carburettor inside a cowl, a substantial amount of intake noise is also filtered out. I also use a thin foam intake filter that helps in noise reduction as well as providing obvious protection from ingestion of dirt by the engine's vital parts.

The heat problem was eliminated because cylinder cooling air is routed from the bottom and only cool air flows over the pipe. No heat-resistant material was required to protect the top that was merely 1.5mm balsa. With this cooling improvement, it became possible to fit an additional second chamber silencer to further reduce noise levels.

Fuel tank is now correctly aligned with the carburettor, which eliminates the pump, and the engine is now at an optimum point in relation to the centre of the gravity line. This is important when flying with a variable pitch propeller as I used at Acapulco as it eliminates attitude changes during propeller pitch changes.

Inverted engine operation

No operating problems were encountered with the inverted engine, the new generation of model engines are better starting, and it has never been necessary to start the engine by inverting the aircraft.

It is, of course, important to avoid flooding when choking; but then that's true with upright mounting as well. I always start the engine by opening the throttle halfway followed by application of an electric starter, the engine is running in 3 to 5 seconds. Most pilots think an inverted motor is easy to flood, but think again on this point. When the engine is inverted, the crankshaft is above the carburettor intake; only fuel drawn into the engine in the normal way, or put there by the operator, can reach the cylinder. The engine can't be flooded by fuel syphoning, as can occur with normal upright operation.

Aerodynamic considerations

There are some new ideas in the area of 'Magic's' aerodynamics, some of which were tested on the 'Dalotel' and/or the 'Curare'. The newly developed airfoils have a decreased thickness percentage, resulting in lowered drag compared with the 'Curare'. The 'Dalotel'-style wing tips yield a further reduction in drag. The linear change over the complete wing of the airfoil lift coefficient produces a much slower landing speed and greater flight stability in turbulent air.

The fuselage is designed as an airfoil with a thickness of about 6.5%. The high point is exactly identical to the total centre of gravity. This helps rolling manoeuvres and knife-edge flight. Because the fuselage centreline is higher than 'Curare's' (caused by a hidden pipe), it was necessary to increase the wing's dihedral and this has a positive effect on flight stability and rudder effect.

For a more realistic flying style that moves away from the very fast flying, jet style so prevalent today, 'Magic's' wing area was increased to lower overall wing loading. The increased area compensated for the additional weight of 'Magic' caused by its *MK* variable pitch propeller.

Development of 'Magic' is, for me, the start of a new generation of models that fly at a more constant speed through the various manoeuvres and at much lower noise levels. Couple this with a variable pitch propeller and the result is additional control of manoeuvre speed beyond that offered by use of throttle alone.