The MIKE BILLINTON Test

WEBRA 50 RC ABC

Mike Billinton reviews this versatile engine.

Lurking inside a .40 sized crankcase, the large bore Webra 50 is achieving quite a reputation amongst helicopter pilots on the grounds of its high Power/Weight ratio, its compact dimensions, and if this test is any guide, the high performance levels achieved.

In general, attempts to pack bigger engines into smaller dimensions have to be paid for finally in reliability terms and likely hotter running temperatures. However, the demands from airborne craft enthusiasts for weight reductions often pressures manufacturers towards the route of boring/stroking some of their existent engines rather than producing yet another new set of expensive castings.

Typical well-known examples are ducted fan units such as the OS77 and OPS80 engines, which are virtually .65 cu.in. sized engines packed out almost to bursting point. One has only to compare, for example, the 22 oz. weight of that OPS 80 Aircraft engine with the 44 ozs. of the only slightly larger capacity but Waterborne engine, the OPS 90 Marine racing engine, to comprehend the stark differences. The humorous suggestion is that the Marine racing engine is built that heavy and strong to allow temporary underwater travel at 25,000 RPM without the motor bursting hydraulically.

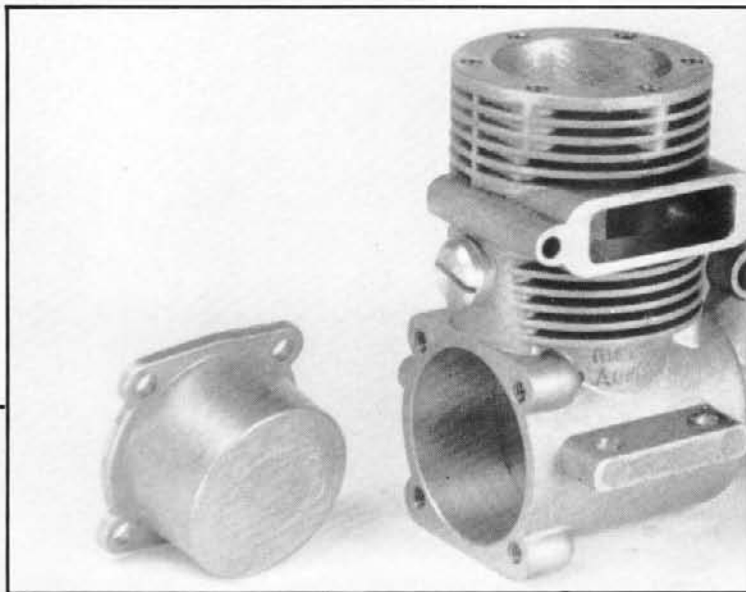
Nevertheless, it is surprising just how reliable and unfussy in performance these lightened Aircraft engines can be, and the Webra 50 similarly proved a very consistent performer under dynamometer test conditions at least.

Mechanical detail

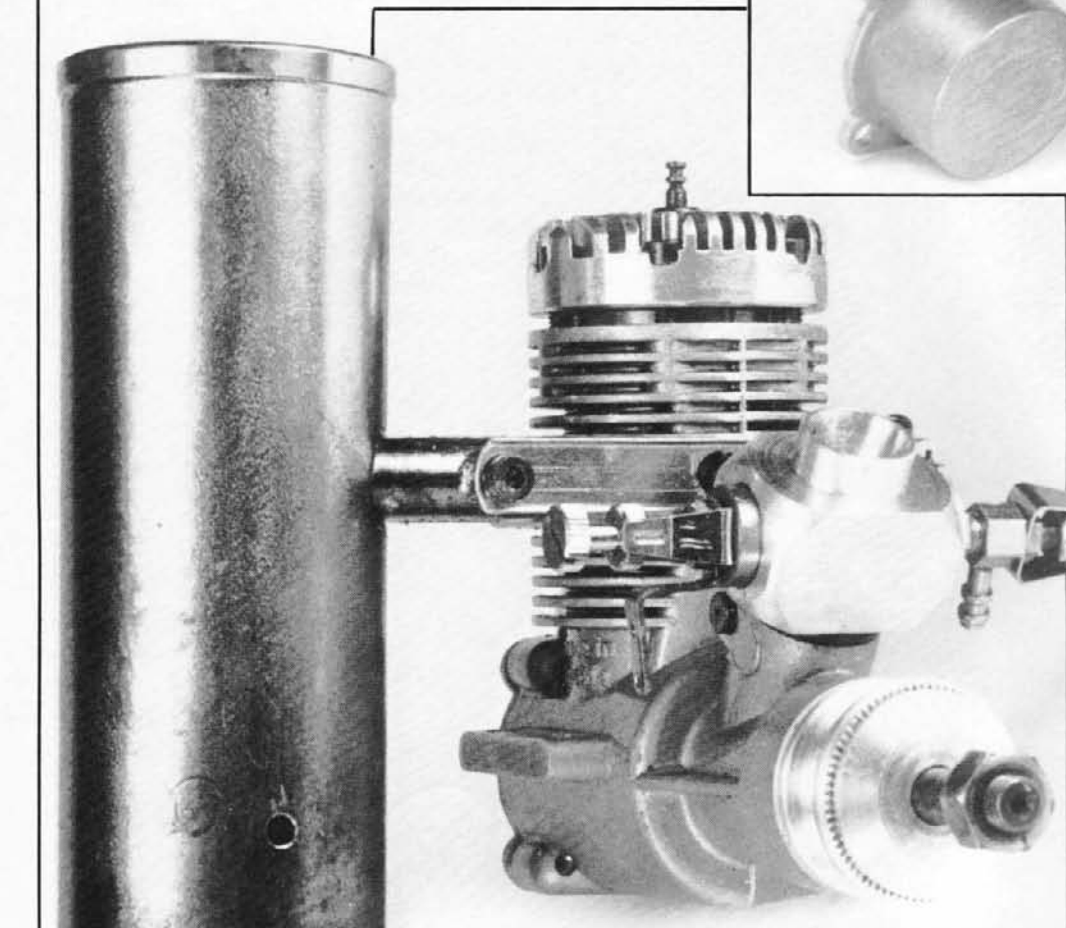
The Webra Speed 50 features standard ABC Schneurle-ported technology, with a well over-square Stroke/Bore ratio of .87/1. The piston bore of .907 in. certainly looks massive through the 154° timed exhaust port. Supporting this large piston is a surprisingly small dimensioned connecting-rod big-end. However, this gave no problem whatever during test and its small size made more sense when the combined piston/rod weight proved to be a very light .5 oz. This point probably also explained why vibration levels had been quite low throughout the RPM test range.

A chunkily constructed, front inducted crankshaft is housed within a finely produced one-piece die-cast crankcase, and has a fairly standard 188° total opening period. Flywheel or propeller driver fixing to shaft is by Woodruff key. Cylinder head combustion shape is normal 'bowler hat' and set at quite close squish clearance of .013 in. Resultant Effective compression ratio is pitched at a comfortable 8/1 and which should allow reasonable trouble-free performance either on low or high nitro content fuels, though only 5% was used during this test.

Carburettor is Webra's reliable twin-needle (TN) type, which continues to give good predictable control throughout — the only unusual finding being the noticeable power difference between throttle positions 7/8 open and fully open. This loss amounted to approx. 15%, and initial failure to spot this necessitated a complete re-run of most of the Schluter si-

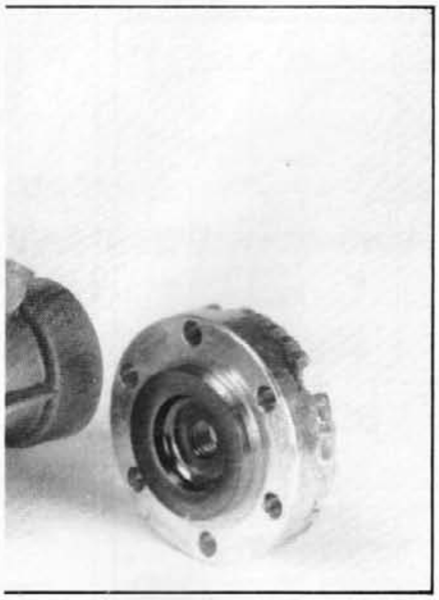


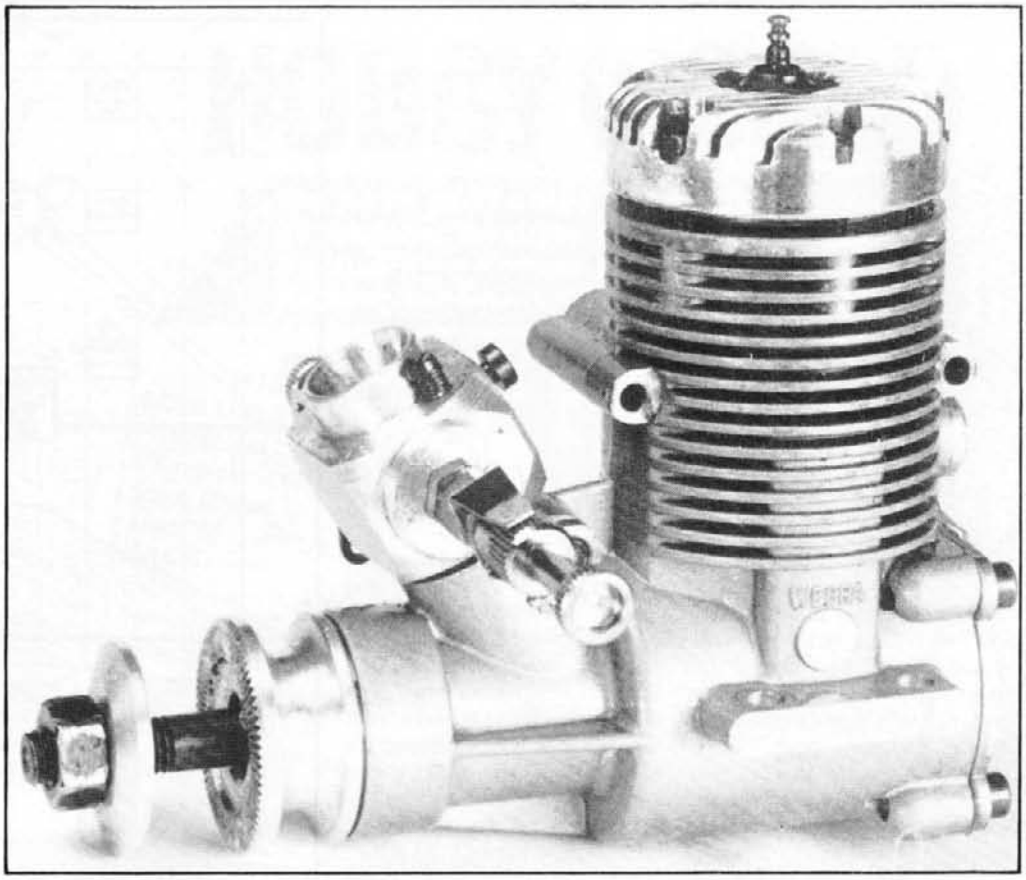
Combustion chamber shape is 'bowler-hat'. Case is honed to receive liner.



Schluter helicopter gave fine wide-band performance and effective sound suppression.

Connecting-rod big-end is surprisingly small, but supports light piston and rod. Very solid crankshaft accentuates short stroke crankpin throw.





Webra Speed 50 is a neatly compact and powerful high-speed performer.

lencer figures as well as the Open exhaust ones above 18,000 RPM. At high RPM the loss equates to around 900 RPM and 10 oz.in. Torque on a given load.

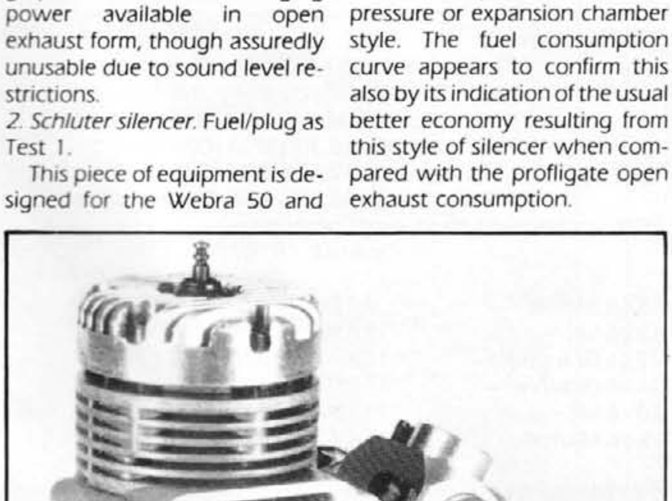
Test results:

1. *Open exhaust*/fuel — 5% Nitro. 10% Castor, 10/ ML70/ OPS 250 plug

Webra's instructions are for 'at least 20% oil' so a 50/50 mix of castor and synthetic was used here. They make no comment on Nitro levels. A small 5% was therefore added. Balance of fuel was Methanol as usual. The graph shows the wide ranging power available in open exhaust form, though assuredly unusable due to sound level restrictions.

2. *Schluter silencer.* Fuel/plug as Test 1.

This piece of equipment is designed for the Webra 50 and the associated helicopter and, contrary to information received, appears not to be any sort of tuned device. In fact partial dismantling of it reveals, as does the power graph result, that it is a quite normal back-pressure or expansion chamber style. The fuel consumption curve appears to confirm this also by its indication of the usual better economy resulting from this style of silencer when compared with the profligate open exhaust consumption.



Given the good quietening effect of this Schluter (steel) silencer, it was an unexpected finding that it did not suffer from the usual marked fall-off in power at high RPM. In fact at 23,000 RPM power levels were back on a par with the open exhaust figures.

3. *OS 46 tuned pipe* set at 360mm from plug to first max. dia. Fuel/plug as Test 1.

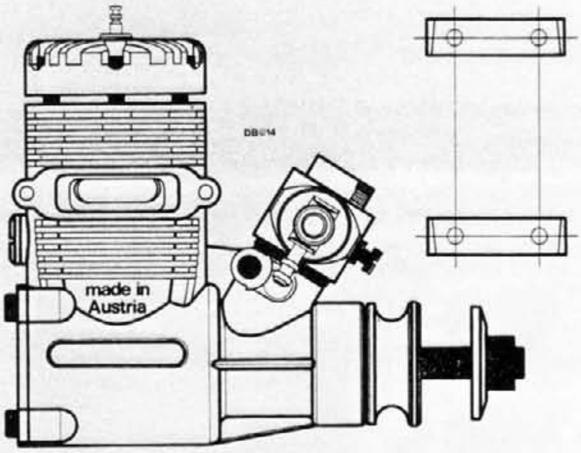
The attempt to use this seemingly appropriately sized tuned pipe proved an error. The overall result has been omitted from graph as figures were repressed below even those of the Schluter silencer. Covering RPM from 9,000 to 16,000 showed clearly that the pipe was really acting as a severely restricted back-pressure silencer. Admittedly a shorter pipe length would have improved matters slightly, but logically a larger volume pipe definitely seemed to be needed. The dampening effect of too small a tuned pipe volume has been noted previously.

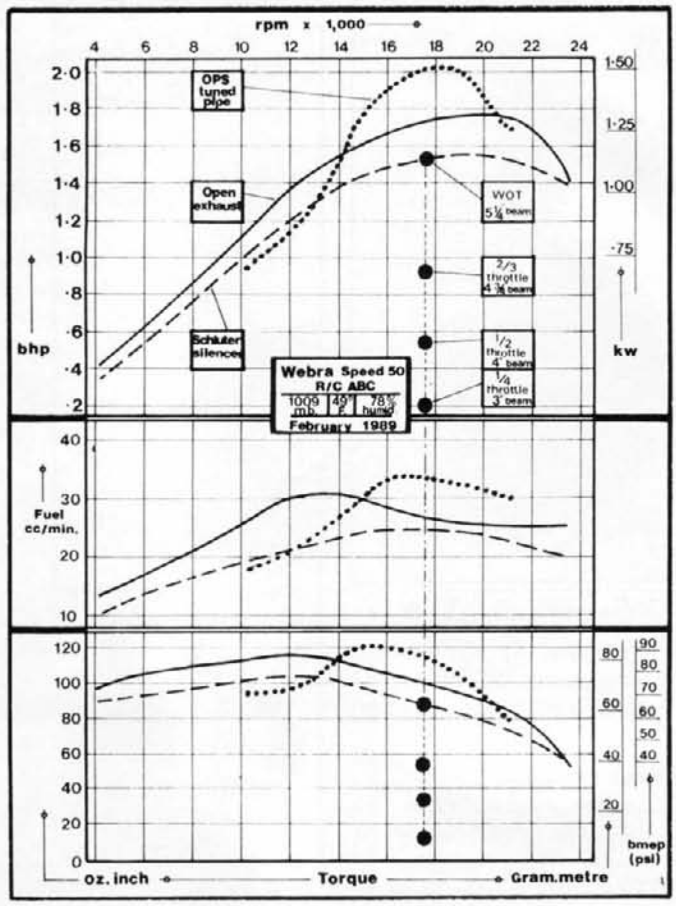
4. *OPS 60 tuned pipe* set at 300mm from plug to max. dia. Fuel/plug as test 1.

This pipe was a clear improvement, with a significant resonant point in the 16,000 to 18,000 RPM area. This resulted in the maximum HP and Torque of the test, and would represent one way forward for those using the Webra 50 Heli engine in out-and-out speed runs. Further shortening of the pipe — say to 280mm — would raise HP and RPM levels slightly more.

Reduced throttle 'spot' points

These points on the graph were recorded when Schluter silencer was fitted, and are checks on ability of carburettor to provide correct fuel/air mixture when throttle is closed — even though RPM remains constant ... being broadly the way in which helicopter engines operate when allied to variable pitch blades. Because of the high inertia of the helicopter blade, speed changes to the craft (upwards or forward) are effected by pitch change rather than by the difficult to achieve RPM change. So, with rotor and thus engine RPM remaining relatively constant at differing throttle and pitch/load settings, it is clear that the Heli engine carburettor sees a higher velocity passing through it (at any part throttle setting) when compared with the fixed wing aircraft with its variable RPM engine. All of which means that the standard model engine carb





is under some scrutiny in the Heli application. Suffice to say here that the Webra TN carb proved nominally to retain correct fuel settings as throttle was closed step-wise to each of the three smaller throttle openings, and thus was a practical usable device. Similar tests were applied to the YS 60 Heli and Super Tigre S61 Heli, and they too exhibited good linear settings.

Idling speed on a 10 x 6 MK "Fixed wing" propeller and Schluter silencer was 2,200 RPM.

Summary

The Speed 50 is clearly at the high RPM/high performing end of the range of currently available Heli engines. It is a fine example of reliable though lightweight machinery and, from its condition at end of test, seems capable of extended life at high RPM. The wide-spaced Torque curve indicates, however, the possibility of effective operation at lower RPM if harnessed to longer tuned pipes and thus to give quieter but stronger performance in the 12,000 RPM area.☐

Dimensions & Weights

Capacity — .5104 cu.in. (8.364 cc.)
Bore — .907 in. (23.05mm)
Stroke — .790 in. (20.06mm)
Stroke/Bore ratio — .871/1
Timing Periods:
Exhaust — 154°
Transfer — 120° (angled up 10°)
Boost — 110° (angled up 50°)
Front Induction:
Opens — 36° ABDC
Closes — 44° ATDC
Total period — 188°
Blowdown — 17°
Combustion volume — .85cc
Compression ratios:
Geometric — 10.84/1
Effective — 8.01/1
Exhaust port height — .227 in. (5.78mm)
Cylinder head squish — .013 in. (.33mm)
Cylinder head squish angle — 10°
Squish band width — .168 in. (4.27mm)
Carburettor bore — .307 in. (7.82mm)
Crankshaft dia. — .5902 in. (15mm nominal)
Crankshaft bore — .378 in. (9.62mm)
Crankpin dia. — .2162 in. (5.5mm nominal)
Crankshaft nose thread — .250 in. x 28TPI (1/4 UNF)
Gudgeon pin dia. — .196 in. (5mm nominal)
Connecting rod centre — 35mm
Engine Height — 3.38 in. (86mm)
Engine Width — 1.97 in. (50mm)
Engine Length — 3.34 in. (85mm)
Mounting hole dimensions — 42 x 18mm with 3.5mm holes
Width between bearers — 1.346 in. (34.2mm)
Ex. manifold bolt spacing — 39mm (3mm bolts)
Frontal area — 5.4 sq.in.
Weight — 12.75 ozs (362 gms)
Silencer weight — 5.95 ozs (169 gms)
Crankshaft weight — 2.3 ozs (65 gms)
Piston/Rod weight — .50 oz. (15 gms)

Performance:

Max. BHP— 2.02 @ 18,300 RPM (OPS pipe/5% Nitro)
1.75 @ 20,400 RPM (Open exhaust/5% Nitro)
1.56 @ 19,586 RPM (Schluter silencer/5% Nitro)
Max. Torque— 120 oz.ins. @ 15,300 RPM (OPS pipe)
116 oz.ins. @ 12,600 RPM (Open exhaust)
103 oz.ins. @ 13,120 RPM (Schluter silencer)
RPM, on Standard (fixed-wing) propellers

	Open Ex.	*Schluter Silencer*	*OS46 Pipe*	*OPS60 Pipe*
15 x 6 Airflow —	7,220	6,660	—	—
13 x 6 MK —	9,630	9,168	—	—
12 x 6 Graupner —	11,460	10,600	11,200	—
11 x 6 Graupner —	13,050	12,623	12,464	—
10 x 6 MK —	14,180	13,673	13,710	14,820
9 x 6 Master —	17,490	17,285	16,200	18,350

Performance Equivalents:

BHP/cu.in. — 3.95
BHP/cc — .24
Oz.in./cu.in. — 235.1
Oz.in./cc. — 14.35
Gm. metre/cc — 10.28
BHP/lb — 2.53
BHP/Kilo — 5.57
BHP/sq.in. frontal area — .374

Manufacturer:

Webra Modellmotoren, Austria.

UK Distributor

Jack Williams.