RADIO MOTOR COMMENTARY

Meteor 61

PART TWO OF RCM & E's SIXTY SURVEY

By Peter Chinn

As noted in Part I, this two-part article covers 24 current production throttle-equipped 10 c.c.engines (i.e. almost every R/C .60 aircraft motor at present on the market) and every one has been put through our standard examination and test procedures. The data obtained is quoted in the two charts (one last month and one this month) that accompany this survey.

It will be noted that, at the foot of each column of engine data, the test motor's year of manufacture is given. In most cases, engines are tested soon after they first appear on the market. Therefore, if an engine has been in production for, say, four years, our test figures are likely to apply to a 1974 model. Most manufacturers make minor modifications (often without announcing them) to an engine during its production life, so that, in the case of some of the older motors, there may be slight differences between the engine that we originally tested and the example that you might buy over the model shop counter at the present time. These modifications may not have been sufficient to justify a complete re-test but where they may affect test results, or specifications, due comment is made in the notes given later on individual engine types.

Dimensions and Weights

The engine weights and external dimensions given in the data tables are actual measurements taken from the test engines. Manufacturers' quoted weights, in particular, are often inaccurate. Therefore, each engine was weighed, in grammes, with and without silencer, and the figures converted to ounces, correct to the nearest 1/10 oz. Bore and stroke dimensions given are, however, manufacturers' figures, since these are usually found to be tolerably accurate.

Port and valve timings

These were also checked on individual engines. Past experience has shown that, depending on the standards of quality control exercised by individual manufacturers, rotary-valve and cylinder port timings can vary somewhat and it is not unusual for opening periods to vary as much as 4 degrees of crank angle for cylinder ports and more for rotary-valves.

Carburettors, Silencers and Performance

More than half the 24 motors dealt with have, at some time, been offered with a different carburettor, or silencer, or both. A sizeable increase in carburettor choke area can add as much as 10 per cent to an engine's brake horsepower and up to 300-400 r.p.m. to its revolutions on a typical prop, while the use of a noisy silencer, rather than a quiet one, can add a good deal more than 10 per cent. Certain co-called silencers used formerly – notably the open-front, air-scavenged, extractor or venturi types, caused negligible power losses compared with the open exhaust condition, whereas some expansion chamber types of limited volume and small outlet area could reduce peak b.h.p. figures by 20-25 per cent.

Recent trends have been away from silencers having excessively large outlet areas (150-250 sq. mm.) and towards more effective ones of smaller outlet areas (60-80 sq. in.) and larger volume. Some of the older engines featured in this survey were tested with earlier inefficient silencers but, in many cases, manufacturers now offer better ones and these are mentioned in the following notes. Because of the lack of standardisation in silencer effectiveness, our b.h.p. figures include both 'silenced' and 'unsilenced' results. To give a fairer assessment of each engine's capabilities, prop r.p.m. figures quoted are for the open exhaust condition.

Bernhardt HB-61. This engine, manufactured in Germany by the Helmut Bernhardt company, first appeared in 1971 bearing the title "Veco 61 Europe Series" by agreement with the American K&B company, manufacturer of K&B and Veco engines. A number of internal modifications (including a new crankshaft, piston and cylinder-liner) were made to the engine during its first year of production and, in 1972, it began appearing in two "badge-engineered" models (identical except in name): the Veco 61, still distributed by Schuco-Hegi, and the HB-61 distributed by Graupner.

Our test engine was a 1973 model. At that time it was still supplied with the noisy HB vented front type silencer having a total outlet area of 142 sq. mm. For the past year or two, however, it has been available with an HB Type 75 closed front expansion chamber which is much quieter, although the outlet areas of these seem to have varied somewhat: the smallest examined being 8.5 mm. i.d. (56.7 sq. mm.) and the largest 10 mm. i.d. (78.5 sq. mm.).

Enya 60-IIIB and 60-IIIB G8. The only difference between these two models is that the 'G8' is fitted with the Enya G8 carburettor which has a 50 per cent larger choke area. This gives about 10 per cent higher peak horsepower. The Enya silencer for these engines has a screw-in nozzle which reduces its outlet area from 78 to 50 sq. mm. for better sound attenuation. The 'with silencer' output figures quoted are for the 60-IIIB *with* nozzle and for the 60-IIIB-G8 *less* nozzle.

Enya 60XF. This powerful new Schnuerle scavenged Enya has a ringless aluminium piston running in a chromed bore, but instead of using a brass liner, it has an aluminium one. Its silencer is a new and larger expansion chamber with fixed 78.5 sq. mm. outlet.

Fox Eagle 60. The moderately priced Fox Eagle 60 has recently been given a new and stronger bead-blasted main casting in place of the tumble polished finish of our test model. It also has a more robust con-rod and other minor refinements. The Fox silencer for this engine is still the Fox 'C Type' which causes negligible power loss but is very noisy. For improved noise reduction, Fox is now offering an 'after-muffler' in the shape of a separately mounted rectangular expansion-box that is connected to the standard silencer with silicone tubing.

Fox Hawk 60. This more powerful Fox 60 also uses the Type C silencer which, as with the Eagle, can now be supplemented by a fuselage mounted expansion chamber.

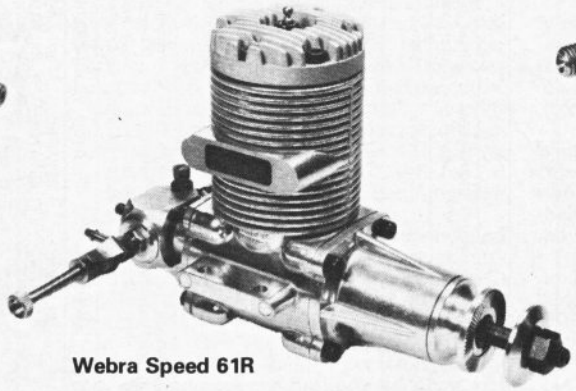
Incidentally, the manufacturer's recommended fuel mixture in the US for both these engines is Fox 'Missile-Mist' and for the benefit of American users, both engines were tested on this 25 per cent nitro blend in addition to our standard 5 per cent nitromethane mix. Power outputs (less silencer) were raised to 1.22 b.h.p. at 13,000 r.p.m. for the Eagle and 1.51 b.h.p. at 15,000 for the Hawk.

Hirtenberger HP-61F. This motor is basically a front rotary valve conversion of the original Bugl-designed rear rotary drum valve HP-61 that first went into production in 1968. Since our test was carried out on an early production model 61F, some modifications have been incorporated: the screw-in crankcase backplate has been replaced by a flanged one attached with four screws and the original die-cast conrod has given way to a forged one. A tumbled, rather than sandblasted, casting finish is used and the effective choke area of the carb has been very slightly increased to approximately 28 sq. mm.

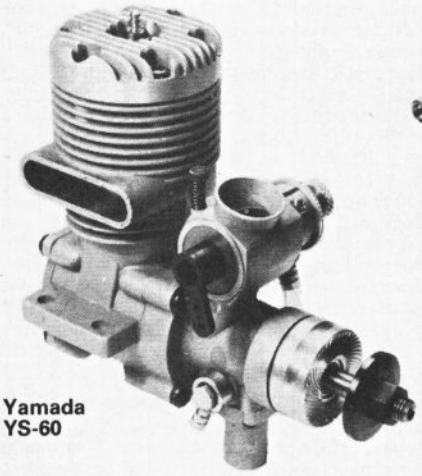
SIXTY PICTORIAL

O.S. Max-H60F-GR

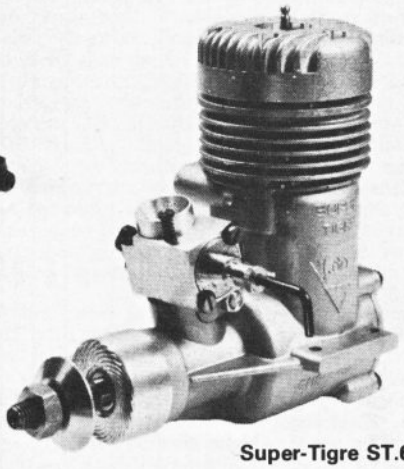
Merco 61 Mk.IV



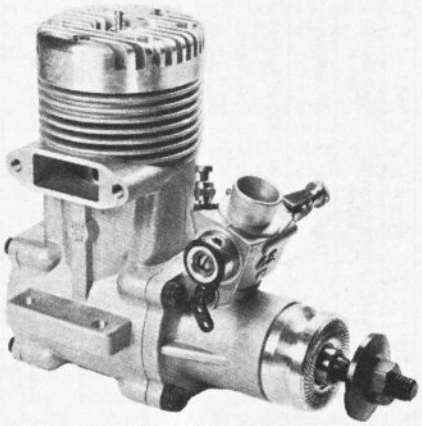
Webra Speed 61R



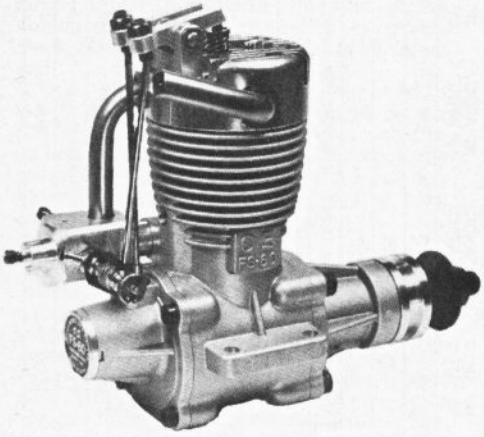
Yamada
YS-60



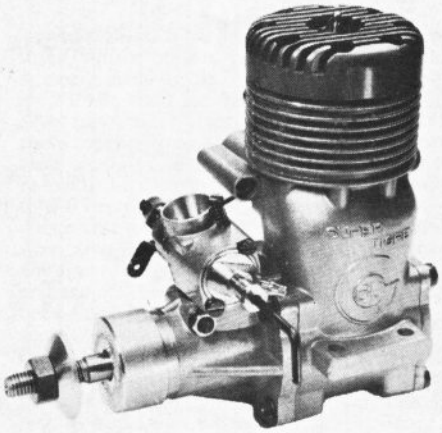
Super-Tigre ST.60



O.S. Max 60F-SR

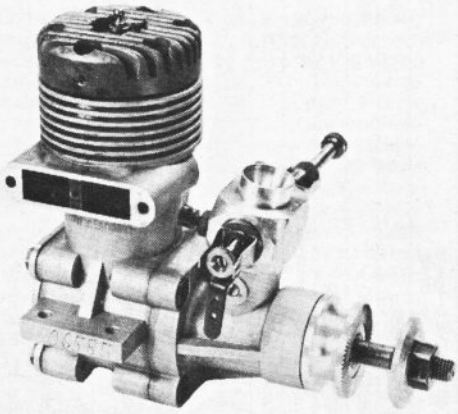


O.S. FS-60 Four-Stroke

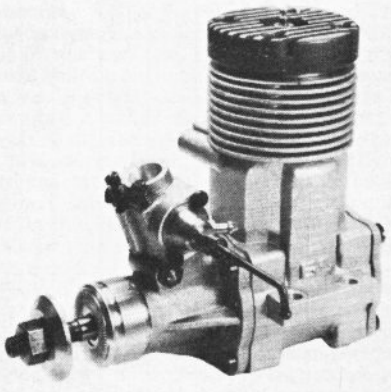


Super-Tigre G.60-ABC-PDP

Webra Speed 61F



Webra Blackhead 61 Ser. 73



OPS Ursus 60 Ser.74

'SIXTY SURVEY' – TABLE 2

		MERCO 61 Mk. IV	METEOR 60	OPS URSUS 60 SER. 74	O.S. MAX-H60F-GR	O.S. MAX 60F-SR	SUPER-TIGRE ST.60	SUPER-TIGRE G.60-ABC-PDP	WEBRA BLACK-HEAD 61 SER.73	WEBRA SPEED 61F	WEBRA SPEED 61R	YAMADA YS-60	O.S. FS-60 FOURSTROKE
SWEPT VOLUME	c.c. cu. in.	9.951 0.6072	9.951 0.6072	9.870 0.6023	9.953 0.6073	9.953 0.6073	9.953 0.6073	9.953 0.6073	9.953 0.6073	9.953 0.6073	9.953 0.6073	9.953 0.6073	9.953 0.6073
BORE	mm in.	23.88 0.940	23.88 0.940	23.9 0.9409	24.0 0.9449	24.0 0.9449	24.0 0.9449	24.0 0.9449	24.0 0.9449	24.0 0.9449	24.0 0.9449	24.0 0.9449	24.0 0.9449
STROKE	mm in.	22.22 0.875	22.22 0.875	22.0 0.8661	22.0 0.8661	22.0 0.8661	22.0 0.8661	22.0 0.8661	22.0 0.8661	22.0 0.8661	22.0 0.8661	22.0 0.8661	22.0 0.8661
WEIGHT less silencer with silencer	oz oz	13.7 16.2	16.4 20.5	17.9 21.2	14.7 17.6	16.6 19.7	13.2 16.1	16.7 19.6	15.3 18.4	16.4 20.3	18.0 21.9	14.9 17.7	20.8 —
LENGTH from prop driver face	mm	86	93	94	87	94.5	83.5	88.5	91	95	121	89	122
CRANKCASE WIDTH (bearer spacing)	mm	37	37.5	41.5	37	41	36.5	41.5	39	39	39	37	41
HEIGHT (C/L to top cylinder head)	mm	76	77.5	81.5	80	78	79	81.5	78.5	78	78	76	116mm inc. valve rockers
WIDTH across mounting lugs	mm	57.5	57.5	59	58	60	55.5	60	63	60	60	61	60
INDUCTION SYSTEM		Shaft rotary valve	Shaft rotary valve	Shaft rotary valve	Shaft rotary valve	Shaft rotary valve	Shaft rotary valve	Shaft rotary valve	Shaft rotary valve	Shaft rotary valve	Rear disc rotary valve	Shaft rotary valve	4-stroke OHV system with pushrod operated poppet valves
SCAVENGING SYSTEM		Crossflow	Crossflow	Schnuerle	Crossflow	Schnuerle	Crossflow	Special ST-Perry	Crossflow	Schnuerle	Schnuerle	Crossflow	
BEARINGS – main		2 ball journal	2 ball journal	2 ball journal	2 ball journal	2 ball journal	2 ball journal	2 ball journal	2 ball journal	2 ball journal	2 ball journal	2 ball journal	Crankshaft: 2 ball journal
– big-end		Bronze bush 6.35mm	Bronze bush 7.14mm	Bronze bush 7mm	Bronze bush 6.5mm	Bronze bush 6.5mm	Plain 7mm	Bronze bush 7mm	Bronze bush 6mm	Bronze bush 6mm	Bronze bush 7mm	Bronze bush 7mm	Camshaft: 2 ball journal
– small-end		Bronze bush 5.56mm	Bronze bush 6.35mm	Plain 6mm	Bronze bush 6mm	Bronze bush 6mm	Plain 6mm	Bronze bush 7mm	Dürkopp needle brg. 5mm		Bronze bush 6mm	Bronze bush 6mm	Drive pinion: 1 ball journal Big-end: Bronze bush 7mm Small-end: Bronze bush 6mm
PISTON		Alum. with baffle, 2 skirt ports. Bronze bushed bosses, 1 ring	Alum. with baffle, 2 skirt ports, 1 Dykes ring	Alum. Flat crown. Ringless (in chromed brass liner)	Alum. with baffle, 2 skirt ports, 1 ring	Alum. Flat crown. Single pinned ring	Alum. with baffle, Single Dykes ring	Alum. Flat crown. Ringless (in chromed brass liner)	Alum. with baffle, 2 skirt ports, 1 ring	Alum. Flat crown with single pinned ring	Alum. Flat crown with single pinned ring	Alum. with baffle, 2 skirt ports. 1 ring	Piston: Alum. Flat crown, 1 ring
CARBURETTOR – type and mixture control system		Merco 2-needle Adjustable auto. fuel metering	Meteor 2-needle Adjustable auto. fuel metering	OPS 2-needle Adjustable auto. fuel metering and airbleed	O.S. Type 74 (or 7B) Adjustable auto. fuel metering	O.S. Type 74 (or 7B) Adjustable auto. fuel metering	ST-Mag 2-needle Adjustable auto. fuel metering	ST-Mag 2-needle Adjustable auto. fuel metering	Webra TN 2-needle Adjustable auto. fuel metering	Webra TN 2-needle Adjust. auto. fuel metering	Webra TN 2-needle Adj. auto. fuel metering	YS pressure type (AFM) fed via YS pressure regulator	Carb: OS with adj. airbleed
CARBURETTOR effective choke area (approx.)		36 sq.mm	36 sq.mm	34 sq.mm	38 sq.mm	38 sq.mm	20 sq.mm	42 sq.mm	34 sq.mm	35 sq.mm	35 sq.mm	74 sq.mm	18 sq.mm
ROTARY VALVE – opens – closes		28° ABDC 68° ATDC	47° ABDC 45° ATDC	43° ABDC 55° ATDC	35° ABDC 50° ATDC	28° ABDC 55° ATDC	30° ABDC 50° ATDC	30° ABDC 47° ATDC	20° ABDC 55° ATDC	35° ABDC 45° ATDC	37° ABDC 48° ATDC	38° ABDC 56° ATDC	Inlet valve opens: 30° BTDC Inlet valve closes: 55° ABDC Exh. valve opens: 90° BBDC Exh. valve closes: 28° ATDC
EXHAUST PERIOD		140°	137°	142°	135°	142°	140°	150°	135°	142°	140°	142°	
TRANSFER PERIOD		120°	112°	126°	115°	120°	118°	134°	113°	120°	118°	130°	
THIRD PORT PERIOD		—	—	120°	—	115°	—	134°	—	110°	110°	—	
BHP at rpm (less silencer)		1.20 at 14,000	1.10 at 13,500	1.55 at 16,200	1.35 at 15,000	1.58 at 16,200	0.95 at 12,700	1.60 at 16,500	1.30 at 14,000	1.50 at 15,000	1.62 at 16,600	1.35 at 16,000	0.62 at 10,500 (with 6mm exh. pipe)
BHP at rpm (with silencer)		0.98 at 12,700	1.01 at 13,000	1.50 at 15,800	1.10 at 13,500	1.27 at 15,700	0.95 at 12,700	1.34 at 15,000	1.02 at 12,800	1.46 at 14,500	1.48 at 15,500	1.05 at 13,000	
TYPICAL PROP RPM (less silencer)	14 × 6 TOP-FLITE	8,900	8,700	9,500	9,150	9,550	8,200	9,400	9,100	9,500	9,500	8,800	7,300
	12 × 6 TOP-FLITE	11,200	10,800	11,800	11,400	12,000	10,400	11,850	11,400	11,900	11,900	11,250	8,800
	11 × 7½ POWER-PROP	12,000	11,700	13,000	12,500	13,200	11,300	13,000	12,400	13,000	13,100	12,300	9,700
	11 × 6 POWER-PROP	13,400	13,000	14,500	13,800	14,600	12,600	14,600	13,700	14,400	14,600	13,800	10,700
TEST FUEL – nitro content		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	10%
SILENCER USED IN TESTS		Merco "Peak Power"	Koelliker large vol. exp. ch.	Koelliker extr. type	OS-704 exp. chamber	OS-704X exp. chamber	ST S-56 open front type	ST-2520483 vented front	Webra 1100/61 exp. ch. (9mm)	Webra open front type	Webra open front type	YS expansion chamber	6mm i.d. exh. pipe only
SILENCER – outlet area		71 sq.mm	88 sq.mm	148 sq.mm	45 sq.mm	45 sq.mm	249 sq.mm	67 sq.mm	64 sq.mm	255 sq.mm	204 sq.mm	80 sq.mm	28 sq.mm
SILENCER – noise suppression		Fairly good	Fair	Poor	Fairly good	Fairly good	Very poor	Fair	Fair	Very poor	Very poor	Fair	Very good
Year of mfr. of test unit		1973	1972	1974	1974	1975	1970	1976	1974	1973	1975	1973	1977

Hirtenberger HP61FS. Although it retains the HP61F's 24.5×21 mm bore and stroke and its Schnuerle scavenged front rotary-valve layout, this engine bears little resemblance to the earlier model. Instead, it follows the basic layout of the Billes-designed HP40 and, in consequence, looks rather similar to the Webra Speed 61 – also a Billes design. Minor improvements have been carried out since the 61FS was first marketed in 1975. Our test was carried out on a 1976 model. Optional extras for this engine include an 'in-flight' mixture control and a tuned exhaust pipe/silencer.

K&B 61, Pumper-61 and Lee-Custom 61. The 'Series 75' K&B 61 is the latest development of the American Veco 61 which was acquired by K&B when they took over Veco production from the Henry Engineering Company in 1967. Normally fitted with a standard Perry carburettor, it is also obtainable in a 'Pumper' version with Perry fuel pump/regulator unit and large choke 'pressure' carburettor which adds about 10 per cent to its power output.

Both engines are also obtainable in special tuned versions from Clarence Lee who designed the original Veco 61. Ours, a pump version, was given the full treatment which consists of 'blue printing', adding Perry directional transfer ports (PDP) and increasing the exhaust period. These mods were found to add another 10 per cent to the engine's power output. To reduce power loss, the Lee modifications also include fitting an enlarged silencer tailpipe (14.2 mm. i.d.) which substantially improves power by comparison with the performance available on the standard silencer, but at the expense of considerably increased noise.

Kraft 61. As originally marketed, this interesting engine was equipped with the manufacturer's own automatic mixture control carburettor. More recently it has been available with a Perry carburettor. The Kraft expansion chamber silencer has a relatively large i.d. tailpipe but is of somewhat smaller volume than most others so that both power absorption and noise levels tend to be rather high.

Made by Kraft Systems Inc, the world's largest manufacturer of R/C equipment, the Kraft 61 has some unusual features including an investment cast crankcase, a domed piston crown and a glass-nylon backplate. It has not, however, proved so popular as had been expected.

Merco 61 Mk.IV. The first Merco 61 appeared in 1963, a development of the original Merco 49 which had gone into production at the beginning of the previous year. The present Mk.IV model was introduced in 1973 and develops about 35 per cent more power than the Mk.I of 1963. Although the basic design is now quite old, this British engine is still competitive, having the advantage of lighter weight and lower cost than most of its imported rivals.

Meteor 61. Another reasonably priced British engine of orthodox design, the Meteor has been completely re-tooled since we tested the first production version in 1972. The current model has a new set of castings, a new cylinder-head, new carburettor and a modified front end with new prop drive assembly. It also has improved performance. When the tests were carried out on the earlier model, the manufacturer's own silencer was not yet in production and one of the recommended alternatives, a Swiss Kö (Koelliker) large volume expansion chamber was used. This was tolerably effective and caused quite a modest power loss. The Meteor silencer has almost the same outlet area but a smaller volume and may be expected to absorb slightly more power.

OPS Ursus 60 Series 74. The Italian OPS company, now in its tenth year of model engine production, has always specialised in high performance motors but when the original Ursus 60 R/C engine was released in 1972, its performance, notwithstanding Schnuerle scavenging and other 'advanced' features, was, to say the least, disappointing. We were, in fact, hard pressed to extract a gross output of 1.0 b.h.p. from it but, even before the engine was tested, we had doubts about certain aspects of its design and these were communicated to the manufacturer. The engine was subsequently withdrawn from production and completely redesigned during 1973, reappearing as the Ursus 'Series 74' with a new main casting, having wider transfer channels, a new crankshaft with enlarged and re-timed rotary-valve, new cylinder liner with larger port areas and extended timing and a new carburettor with 30 per cent larger choke area. The sum total of these improvements was to lift the Ursus into the very top bracket of high performance 10 c.c. R/C engines with a gross output on 5 per cent nitro of 1.55 b.h.p. at 16,200 r.p.m. – a clear 55 per cent more than the 1972 model.

Prospective purchasers of secondhand engines may care to note that the *early* model is readily identified by a brown (instead of red) anodised cylinder head attached with *eight* (instead of four) head screws.

In 1976, some further modifications were made to the Ursus, including a stronger conrod, a modified combustion chamber and slightly modified cylinder porting. The stock carburettor became a standard Perry with the extra cost option of a new type of OPS carb. Replacing the Kö extractor type silencer, formerly recommended, is a new OPS expansion chamber with a 75 sq. mm. outlet area which reduces power output but offers much improved muffling.

O.S. Max H60F-GR. Identified by a black anodised cylinder head, the improved 'GR' model Max H60F superseded the popular 'GP' (Gold Head) model in 1974. Originally fitted with the excellent OS Type 74 carburettor, it is now equipped with the even better Type 7B. Although the basic design of the Max H60F now goes back some 10 years, it continues in production as a less expensive option for those who do not require the additional performance of the Schnuerle scavenged Max 60F-SR.

O.S. Max 60F-SR. Our test model was one of the first production engines and was manufactured early in 1975. At that time it had the 15 mm. o.d. 11 mm. i.d. crankshaft dimensions common to most front rotary valve 10 c.c. engines, but this has since been replaced by a new 16 mm. nickel-chrome shaft with 11.7 mm. gas passage and replaceable prop stud. Other changes have been new ball bearings, a 7B carburettor in place of the previously used Type 74 and a new large volume silencer (OS-744) with 58 sq. mm. outlet area in place of the very restrictive OS-704X, all of which should add up to useful increases in power.

Super Tigre ST60. Super Tigre 10 c.c. R/C engines come in two series, the lightweight 'ST' models which date back to 1964 and the heavier G models which were first marketed in 1966. The ST60 tested was made in 1970, since when the ST60 has remained basically unchanged except for a Mag-III carburettor with diecast body in place of the machined body Mag-II type. Also, the extremely noisy no-loss open front Super Tigre S-56 'silencer' has been withdrawn and replaced by a closed expansion chamber which can be expected to lower peak power output by 15 per cent or so.

Super Tigre G60-ABC-PDP. Until recently, all G60 R/C engines (and there have been numerous versions over the past 11 years) have used needlessly restrictive carburettor chokes and, largely on this account, have lacked the performance expected of them. In this new ABC version, however, the effective choke area has been doubled and the orthodox crossflow scavenging system has been replaced by Super Tigre's own high-performance porting layout combined with Perry directional ports to give a gas flow similar to that of a Schnuerle system. The result has been a spectacular increase in performance, raising gross power output by some 45 per cent compared with the first 'Blue Head' G60 of five years ago.

The G60 is also obtainable in a crossflow-PDP scavenged version with ringed piston.

Webra Black Head 61 Series 73. This is an updated version of the 1969 model Black Head 61 (dealt with in our 1970 *Sixty Round-Up* article) which itself was developed from the original Webra 61 of 1967. It has a re-balanced crankshaft, a new conrod and a larger choke carburettor increasing effective choke area from 26 to 34 sq. mm.

Webra Speed 61F. This Austrian made Webra was introduced in 1973. In no way related to the Berlin-built Black-Head 61, it features Schnuerle scavenging and is heavier and more powerful than the German Webra.

Since our original test, the Speed 61F has undergone a certain amount of development. It now has a longer exhaust period, slightly modified transfer timing and very much later rotary-valve closure. Also available is a new carburettor, the Webra Dynamix with enlarged (44 sq. mm.) choke area. The unacceptably noisy open front Webra silencer used for our tests has now been superseded by a new baffled expansion chamber type.

Webra Speed 61R. This is basically a Speed 61F with different front and rear ends to convert it from front (shaft) rotary valve induction to rear (disc) rotary valve. It is longer and heavier than the 61F and, although slightly more powerful at the top end (actually, on average, the 8 per cent increase in gross b.h.p. that separated it from the 61F in out tests is more likely to be reduced to around 5 per cent) is not so popular as the 61F.

Yamada YS-60. This was the first engine to be fitted with a built-in pressure-regulated fuel system, enabling an extremely large choke area to be used for extra power and, at the same time, vastly improving the engine's ability to function smoothly almost irrespective of tank position of model attitude. In these respects the YS pressure system is second only to the Perry diaphragm pump.

Our test motor, an early production model, was also unusual in having a chromed aluminium alloy cylinder liner, whereas all the engines sold in the UK have, it is understood, been fitted with ferrous liners.

OS FS-60 Four-stroke. As it is a throttle equipped 10 c.c. aircraft engine, the new OS FS-60 is included in the data table although, in fact, it is really in a class of its own. Being a four-stroke, it is by far the most complicated and expensive and has a substantially lower power/weight ratio. It is not to be regarded therefore as an alternative power plant to a hot two-stroke .60 for a typical high-speed PFB (plastic/foam/block) aerobatic model. Rather, it is for the user who favours the more traditional built-up airframe of large wing area and moderate weight. It is perfectly capable of powering a model through mild aerobatics provided that the model's wing loading is kept at a reasonable level, when the overall flying qualities are pleasingly realistic, as is the engine's subdued low-pitched exhaust note: this, even without a silencer, is far less objectionable than that of the typical two-stroke with one.

No doubt the FS-60 could be tuned to deliver more power but the manufacturer's primary purpose was to offer a quiet, easy to operate engine with good throttle response and in these respects they have obviously succeeded. No silencer is offered with the FS-60 at the present time.

Please note that rotary valve closes at 55° ATDC, not 40° ATDC as printed.