

Enya Metal Products has acquired a reputation for consistently high quality by providing a wide range of 2-stroke engines for aircraft, helicopter, car, marine and C/L applications (35 basic units) as well as 4-stroke engines (nine-units). The new .41 4-stroke fills a gap between Enya's earlier .35 and the later .46 4-strokes. Designed for R/C sports aircraft, the .41 4-stroke improves on the 4-stroke's power/weight ratio because its power output equals that of the larger engine, but it's similar in size and weight to the smaller .35.

MODEL AIRPLANE NEWS ENGINE REVIEW

by MIKE
BILLINTON

lowered to avoid detonation.

The solid-aluminum front-crankshaft housing is fitted with a rear main ball bearing.

A hardened-steel cylinder liner is used with a high-duty/high-expansion aluminum-alloy piston that has a single, cast-iron ring. Diametrical piston clearances within the liner are the necessary 0.0035 inch at the skirt and 0.0045 inch at the crown. The

aluminum-alloy connecting rod is phosphor-bronze-bushed at both ends.

• **Cam drive.** The twin cam drive is by

the mixture. Note that this is the opposite of the usual idle fuel needle, which, when closed, effectively leans the mixture by reducing the amount of fuel in relation to the air supply, which is kept constant.

PERFORMANCE

A wide range of propellers was used during the one-hour running-in period and to assess the engine's general performance and handling. When turning high-load props, there was no trace of the detonation that Enya said was possible. The engine did quit at lean needle settings; when that happened, enriching the needle valve by about a half to three-quarters of a turn restored the fuel setting to the correct,

Enya .41-4C

A 4-stroke for sport fliers

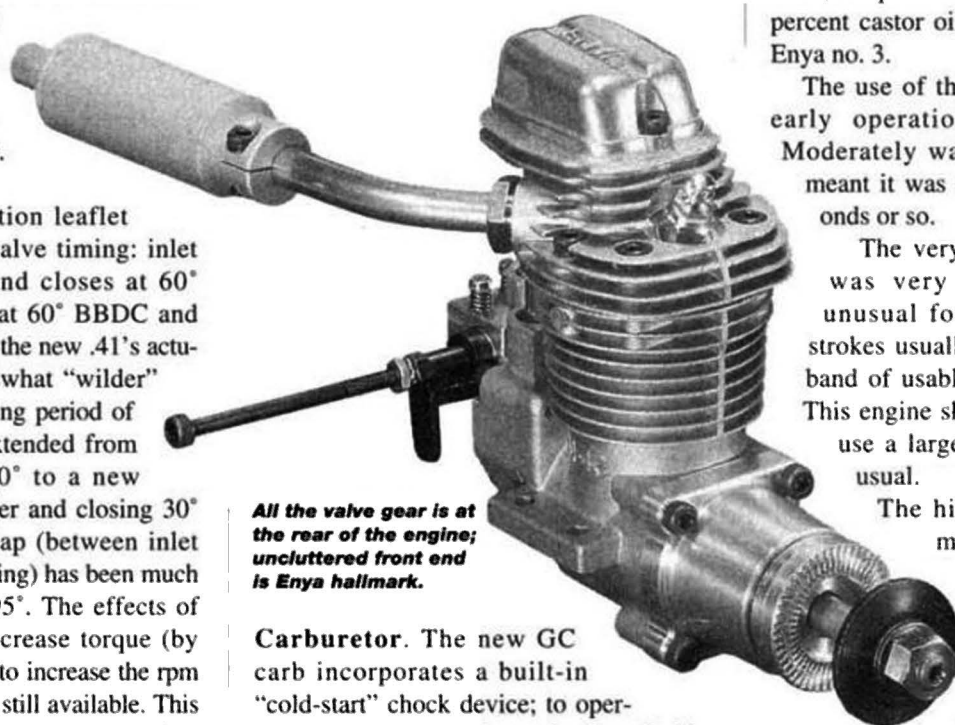
DESIGN AND CONSTRUCTION

Using the same 17mm stroke as the early .35 and with a much enlarged bore of 22.3mm, the engine has an over-square ratio of 0.759:1. Its larger bore allows the use of larger overhead poppet valves (8.29mm head diameter) behind which are port throughways of 7.6mm diameter.

• **Timing.** The instruction leaflet shows mild, standard valve timing: inlet opens at 20° BTDC and closes at 60° ABDC; exhaust opens at 60° BBDC and closes at 20° ATDC. But the new .41's actual valve timing is somewhat "wilder" than that: the total opening period of both valves has been extended from the earlier mold's 260° to a new 320°—opening 30° earlier and closing 30° later. So the new overlap (between inlet opening and exhaust closing) has been much increased from 40° to 95°. The effects of these changes are to increase torque (by increased breathing) and to increase the rpm at which higher torque is still available. This causes an increase in horsepower and fuel consumption.

• **Cylinder and crankshaft.** The cylinder head has an angled, "pent-roof" combustion chamber and is set at a compression ratio of 6.9:1, which can be reduced further to 6.18:1 if the additional 0.016-inch gasket is used. These low figures suggest that the new valve timings were expected to increase breathing and, therefore, to cause higher cylinder pressures; so the compression ratios have been

means of a supplementary thin crankweb supported on ball bearings in the rear cover, which also houses the outer cam bearings and pushrod cam followers.



All the valve gear is at the rear of the engine; uncluttered front end is Enya hallmark.

• **Carburetor.** The new GC carb incorporates a built-in "cold-start" chock device; to operate it, simply slide the entire barrel sideways in the carburetor body. This allows extra fuel to be admitted and it closes the air throughway to produce the required richer fuel/air ratio for cold starting.

• **Other controls.** These include the standard main fuel needle, the throttle stop (for setting the idle level) and the air-bleed screw (which controls the fuel/air ratio for idling). Because the screw adjusts the amount of air, it should be closed to richen

slightly rich" area and ensured reliable operation.

• **Test 1. Open exhaust.** Fuel—10 percent nitro, 10 percent ML70 synthetic with 7 percent castor oils, and methanol. Plug—Enya no. 3.

The use of the cold-start choke made early operations relatively simple. Moderately warm ambient conditions meant it was only necessary for 5 seconds or so.

The very wide, flat, torque band was very welcome and highly unusual for a model 4-stroke (4-strokes usually have a much narrower band of usable torque than 2-strokes). This engine should certainly be able to use a larger range of props than is usual.

The high rpm at which maximum horsepower was achieved indicates that Enya's recommended speed range of 8,500 to 13,000 rpm is conservative.

The engine charged smoothly past 15,500rpm (the point at which I stopped) and operated well at around 7,000rpm.

• **Test 2. Standard muffler.** Fuel and plug—same as in Test 1.

The muffler is a small "straight-through" absorption unit without internal baffles. I thought it would have little effect; it did, however, seem to reduce noise inside my "dynamometer room."

WEIGHTS AND DIMENSIONS

Capacity	0.40429ci (6.625cc)
Bore	0.8785 in. (22.32mm)
Stroke	0.667 in. (16.9418mm)
Stroke/bore ratio	0.759:1
Timing periods—inlet	Opens—46° BTDC Closes—88° ABDC Inlet total—314°
—exhaust	Opens—93° BBDC Closes—49° ATDC Exhaust total—322°; overlap—95°
Combustion volume	1.12 cc average
Compression ratios	Geometric—6.9:1 average
Cylinder-head squish	0.035 in. (0.089mm)
Cylinder-head squish angle	0°
Squish-band area	0.140 sq.in. (90.3 sq. mm)
Carburetor bore	0.22 in. (5.58mm)
Crankshaft diameter	0.3935 in. (10mm)
Crankpin. diameter	0.2165 in. (5.5mm)
Crankshaft nose thread	0.247 in. x 28 TPI (1/4 INF)
Wristpin. diameter	0.1965 in. (5mm)
Connecting-rod centers	1.146 in. (29.12mm)
Engine height	3.71 in. (94.23mm)
—width	1.77 in. (44.96mm)
—length	3.76 in. (95.54mm)
Mounting-hole dimensions	1.476x0.59 x0.140 in. (37.5x15x3.54mm)
Width between bearers	1.184 in. (30.09mm)
Frontal area	5.1 sq. in.
Weight	Bare—13.5 oz. (383gm) W/muffler—13.9 oz. (394gm)
Crankshaft weight	1.45 oz. (41 g)
Piston and ring weight	0.22 oz. (7g)

PERFORMANCE

Max. B.hp	0.74 @ 14,900 rpm (open exhaust/10% nitro) 0.67 @ 15,200rpm (standard muffler/10% nitro)
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Max. torque	51 oz.-in. @ 10,600rpm (open exhaust/10% nitro) 49 oz.-in. @ 10,300rpm (standard muffler/10% nitro)
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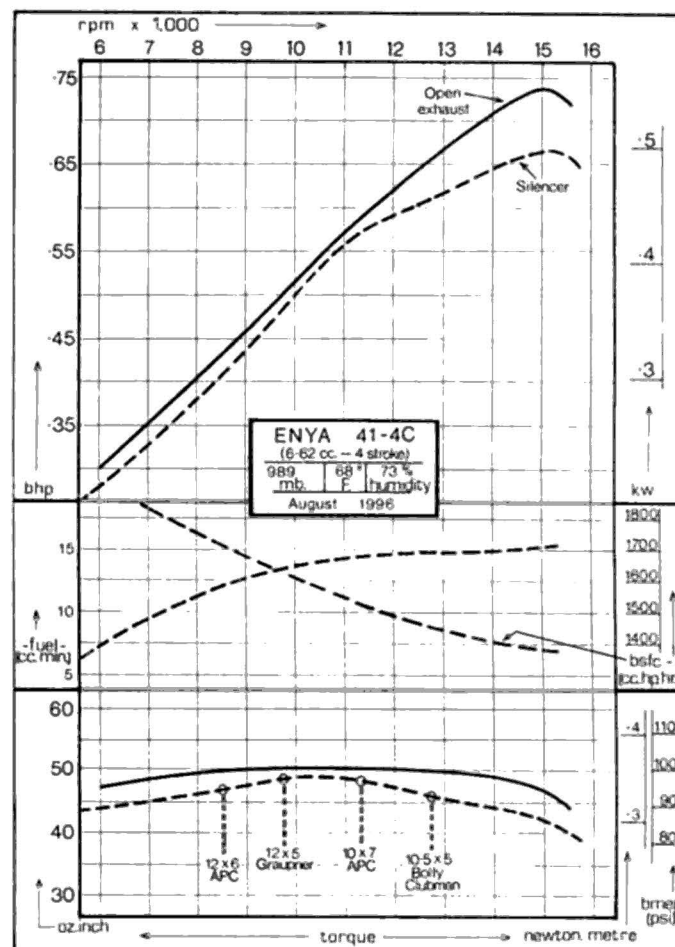
Hits

- Good power-to-weight ratio • Very wide, flat torque band

Misses

- None found

Comments: the new Enya .41 4-stroke is a well-engineered design for reliable sport flying.



RPM ON STANDARD PROPELLERS

	Open Exhaust	Standard Muffler
14x7 Graupner	5,100	5,070
12x7 Mastro	7,240	7,160
13x6 Top Flite	7,450	6,950
13x6 MK	7,720	7,460
12x6 APC	8,690	8,540
10x9 APC	9,780	9,530
12x5 Graupner	9,790	9,740
11x6 Graupner	9,815	9,750
10x8 APC	10,740	10,562
10.5x6 Graupner	10,970	10,840
10x6 MK	11,080	10,790
10.5x6 Bolly Clubman	11,120	10,860
10x7 APC	11,560	11,270
10.5x6 Bolly Clubman	13,080	12,726
9.5x6 Bolly Clubman	13,740	13,344

PERFORMANCE EQUIVALENTS

B.hp/ci	1.83	1.66
B.hp/cc	0.11	0.10
B.hp/b.	0.87	0.77
B.hp/kilo	1.93	1.70
B.hp/sq. in. frontal area	0.145	0.13
Oz.-in./ci	126.1	121.20
Oz.-in./cc	7.7	7.39
Oz.-in./lb	60.5	56.40
Nm/cc	0.055	0.053

Manufacturer: Enya Metal Products Co., Ltd., Tokyo, Japan.

U.S. distributor: Altech Marketing, P.O. Box 7182, Edison, NJ 08818-7182.



The rear main ball bearing acts as "locator" into crankcase. The piston and front housing have been machined out of solid aluminum alloy. The cam drive and cams have been hardened.

The power graph and the prop rpm figures confirm that the muffler does have a restrictive effect. The final decibel (dB) figures show that even at around 9,700rpm, the engine/muffler combination meets the

required restrictions of 82dB at 7 meters (U.K.) and 90dB at 9 feet (USA). Compared with open-exhaust figures, power was only slightly lower while high-rpm operation was slightly enhanced.

Enya's stated fuel-consumption figures of 18/20cc/minute, are higher than my tests showed. This probably reflects the extra-safe, rich settings advised and the in-flight throttle variations (neither of

ENYA .41-4C SPORTS 4-STROKE

which are features of normal, constant-rpm maximum-power testing).

• **Idling.** A Graupner 12x5 prop and the 10-percent-nitro test fuel allowed idling down to 2,700rpm. Attempts at lower rpm led to the plug's gradual cooling off. If the plug were kept lit by a normal battery supply, rpm down to 2,100 could be maintained.

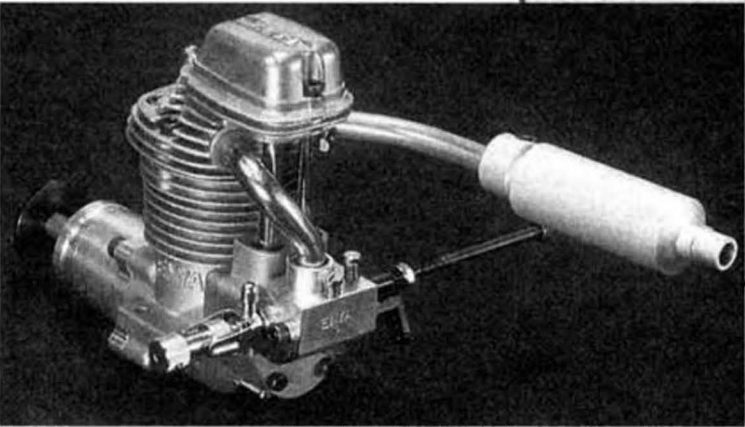
SUMMARY

At the end of the tests, the compression seal had markedly improved, and all the runs, including final dB and idling checks,

Enya .41-4C Sports 4-stroke dB levels	Wind 3mph				
9 feet at AMA/USA	Graupner 12x5 (9,700 rpm)	92	94	88	91
	Bolly Clubman 10.5x5 (12,700 rpm)	97	99	94	97
7 meters at BMFA/U.K.	Graupner 12x5	83	82	78	81
	Bolly Clubman 10.5x5	91	88	83	84

Engine: Enya .41-4C (.404ci 4-stroke)
Equipment: standard muffler
Fuel: methanol with 10% nitro
Temperature: 66°
Humidity: 70%
Pressure: 995mb
Meter: Radio Shack type 33-2050 using GA601 calibrator set to NPL standards
Height: meter and engine set approximately 1 meter above concrete
Location: outdoors, next to farmland

dB meter



Here, the air-bleed idler hole is at rear of the carb. This relatively small 4-stroke muffler just meets regulation noise levels.

were performed at very steady rpm levels. I expect this particular .41 4-stroke to have a

long, reliable life as a strong sport performer.

*Addresses are listed alphabetically in the Index of Manufacturers on page 137.

