Parra T3 Racing Engine

Maris Dislers puts the production Parra racing diesel through its paces. It now has the mettle to take on the best in its class.

We reported in AeroModeller No. 927 May/June 2014 on the initial Parra T3 and T4 Vintage style engines from a small pre-production test batch. Our impressions were positive and flight testing showed the T4 engine of 3.2cc displacement to have performance right up to the allowed speed limit for BMFA Vintage Combat. The smaller 2.5cc T3 engine was also a fine performer, but fell a bit short of Alberto Parra's high expectations, as it was intended to be a top contender for Vintage A Team Race honours. That means matching up against Steve Rothwell's R250's which, while no longer made, continue to dominate the winners' podium.

Rather than release these engines in quantity, Alberto held back until further experiments and modifications to the design could be undertaken. Norm Kirton, as part of this program, conducted valuable flight testing at a 'secret facility' in Western Australia and loaned his new off the shelf production T3 engine for our evaluation.

Design developments

The Parra Tiger is of course based on the Oliver Tiger Mk 3, THE engine for Team Racing and Combat in the Vintage era – genuine Olivers are still being produced by Tom Ridley. Current competition rules also allow for certain more modern engines, including replicas of the Tiger. The Parra Tiger falls into that category by adopting the Oliver Tiger's principal design elements, but differing in detail. We listed

This racing version of the T3 has a shortened venturi insert for unobstructed airflow to the cylinder cooling fins, when shrouded in a Team Race model cowling.

Looking every part a thoroughbred, the Parra T3 is primarily intended for competition work, but would be a fine performer where high torque and good power output are needed.

T3 has Parra's usual four-slot back plate. Crankcase is intricately relieved between the two high quality ball races, providing a very limber bottom end assembly.

the main construction aspects in our earlier report, so this time we'll concentrate on the changes incorporated in the current version. Champion engines rarely come straight off the drawing board and it can be the small details that make a real difference.

Racing T3's compression screw takes Allen key for adjustment. Is easier to install in a model and operate than the traditional tommy-bar type supplied with the Combat version. Neatly angled nipple for fuel line is another example of thoughtful consideration from a user's perspective.

Historically, Oliver Engineering found it necessary to modify standard engines for customers demanding the very best performance. These modifications to Oliver Tiger engines aimed at extracting more horsepower at higher revs. That meant opening up the transfer passages to ease gas flow, extending intake duration and lightening the piston. There was also an idiosyncratic groove ground into the rear crankweb face, extending from the gas passage to the edge opposite the crankpin. Various theories have been proposed for how this groove might help performance, but it seems that no other manufacturer of similar engines (including Parra) has found the need for it.

The initial Parra Tiger T3 followed a similar design philosophy, but more from a modern racing or combat engine perspective. It had generous, rectangular ports in crankcase and crankshaft for precisely timed and quite unobstructed induction. The tapered outside of the lower cylinder liner and two side channels in the crank chamber provided ample room for gas flow to the four upper transfer passages.

No doubt the Rothwell R250 embodies a great deal of know-how gained from experience. By comparison with the MOD Oliver and initial Parra T3, the R250 has quite conservative port durations and a fairly 'cosy' crankcase interior. Parra developments appear to have arrived at a similar point. The crankcase intake window is now significantly smaller, reducing intake duration. Cylinder port timing is also slightly less. The crankcase interior now hugs the cylinder liner, significantly reducing crankcase inner volume. Notches in the cylinder's lower edge correspond with revised transfer channels.

Pistons are now made from a harder grade of cast iron with a flat crown and shorter skirt, giving significant sub-piston induction over top dead centre. The longer gudgeon (wrist) pin is pressed in, rather than being a floating fit, doing away with the need for wire retaining clips and the possibility of 'pounding out'. A new carburettor design focuses flow towards the smaller crankcase intake window and has a significantly shallower groove feeding the three peripheral jet holes.

Current T3's come in Racing and Combat specifications. This one is a Racing type with compression screw better suited for installation in a cowling. It takes a 4mm Allen key for adjustment. Similarly, the venturi insert is shorter than before and a new style needle valve assembly has its fuel feed nipple oriented for a racing model (close in and to the outboard side when mounted inverted). It

Parra T3 (right) shares principal dimensions and design elements with the Oliver Tiger Mk 3 engine (left). Note the T3's prop driver, which cups over the crankcase nose to protect front bearing from dirt.

Specification

Displacement	2.44 cc (0.148 cu. in.)
Bore	13.99 mm
Stroke	15.86 mm
Weight	156 g (5.5 oz)
Exhaust duration (degrees)	144
Transfer duration (degrees)	128
Intake opens (degrees ABDC)	32
Intake closes (degrees ATDC)	15
Intake duration (degrees)	163
Sub-piston induction, total (degrees)	54
Height (mounting face to top of cylinder)	52 mm (2.05 in)
Width (across mounting lugs)	42.4 mm (1.67 in)
Width (bearer spacing)	29 mm (1.14 in)
Length (Backplate to prop seat)	65mm (2.6 in)
Mounting hole spacing	14.4 mm x 35.5 mm (0.57 in x 1.4 in)
Venturi A diameter/choke area	3.0 mm / 7.07 sq. mm (0.118 in / 0.011 sq. in)
Venturi B diameter/choke area	3.2 mm / 8.04 sq. mm (0.126 in / 0.0126 sq. in)

New style racing needle valve assembly has O-ring seal. Cup-shaped spraybar nut can be shortened slightly to further ease entry between bearers into a racing model.

has an O-ring on the needle, sealing against the cup-shaped spraybar nut. This is easy to adjust, but provides enough friction to maintain the desired setting. The spraybar has an annular groove at the jet hole location so that its position is not critical. Actually, the spraybar can be reversed if desired and still feed the carburettor. Two carburettors of quite modest choke area are provided.

The combat T3 is the same, aside from a regular compression screw with tommy bar, taller venturi insert and combat needle valve assembly. Outwardly, it looks like our earlier pre-production engine.

On the Test Bench

Fits and finish of our test engine were excellent. Piston fit was relatively tight with a definite nip when turned over top dead centre. This presented no problems while running in, probably due to the relieved upper skirt, which helps to retain a protective oil film and allows thermal expansion of the piston crown without upsetting things. After an initial period of fairly slow and rich running to settle in the crankpin and conrod bearings, we switched to faster, but safely under-compressed near-peak running with an 8x4 propeller to stabilise the piston fit.

Response to controls was progressive with a fineness of adjustment more than adequate for optimising settings. These were easy to establish at slower speeds, having considerable latitude. At speeds approaching peak power, more care was required. It could take almost one minute's running for the engine to reach stable temperature. The Tiger tolerates an over-compressed setting well, so it can be easy to advance compression too far. Exhaust oil colour is a good indicator of an over-compressed setting, or listen for a hint of 'roughness'. It is useful to check the setting after prolonged running, to establish how much compression can be backed off, while still maintaining top RPM.

If needed for maximum fuel economy, mixture could be set to the point where misfiring begins to occur. This was better controlled and had much less effect on RPM than the pre-production engine, demonstrating the benefit of the new carburettor design.

Vibration was commendably low at moderate speeds and still quite acceptable at the top end. Starting was good, without the tendency to knock when hot and lightly loaded. The Tiger needed two to four finger choked turns, or an exhaust prime when starting. At no time did it start backwards, which sometimes happens with the Oliver and similar engines.

Performance Appraisal

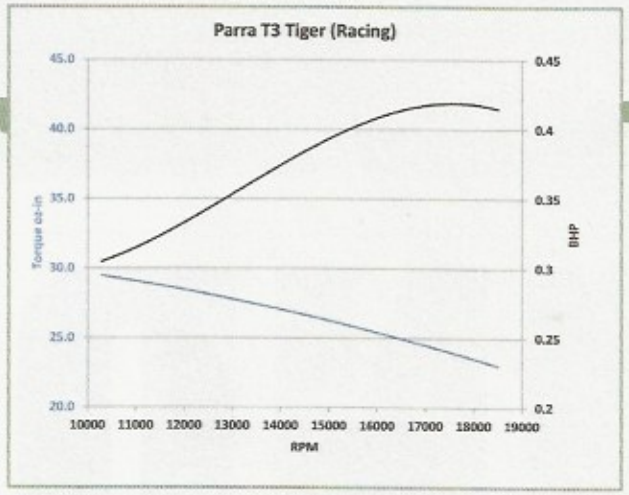
Our curves show power climbing steadily by almost 6% per 1000 RPM to around 16,000 RPM, before flattening out to an indicated peak of 0.42 BHP at a little short of 18,000 RPM. That's a very good figure for this style of engine, considering the modest 3.3mm choke size. No doubt the sub-

People who don't read instructions, beware! Backplate recess clears piston at bottom dead centre. Piston must be moved upwards out of the way when backplate is removed, or it'll end in tears.

Oliver piston/conrod (top) compared with Parra assembly. Upper 2.5mm of piston diameter is reduced by 0.03mm (0.001 in.) a standard feature of modern high performance engines.

Close up shot of factory modified Oliver Tiger Mk 3 crankcase. Note the flared lower transfer passages aimed at improving gas flow.

Latest Parra T3 crankcase showing revised inner shape aimed at minimising crank chamber volume.



piston induction plays its part in this result. Maximum torque occurs at speeds below our test range, but was a stout 30 oz in at 10,000 RPM. Thereafter, torque declined at a steady 3% per 1000 RPM, to a solid 23 oz-in at the peak BHP point. The accompanying table gives RPM results for potentially suitable propellers.

Our tests with the smaller (3.0 mm) venturi showed an average drop in power of almost 8%, or 300-600 RPM, depending on the propeller. This was quite consistent across all speeds. Alberto reports that it delivers significantly improved fuel economy, resulting in 75 laps per tank in Vintage A and a smaller fuel payload in Combat. At the other end, we would anticipate a similar gain in power if a choke diameter larger than 3.3 mm was used.

It is fairly common practice to judge an engine by an RPM reading with a single 'standard' propeller, such as the APC 7x6 for Oliver Tiger Class engines. Of course the choke area and its effect on RPM should also be considered when comparing engines 'A and B'. We did not experiment with fuel mixtures for absolute best performance, other than opting for a little more ignition improver than normal. In the cold 12-15C conditions, this added a few hundred RPM at the higher running speeds. Our test mix of 20% castor oil, 30% ether, 50% jet A-1 plus 2% EHN was fine for our purposes of characterising performance over the useable speed range, but T3 owners will probably find a better fuel blend for their particular needs.

In summary, it seems in light of recent experience, that the 'Oliver' cylinder porting of four exhausts with four transfers is the defining design element, as it sets the upper RPM limit at which effective scavenging can be maintained. 'Freer breathing' upstream and longer port durations in pursuit of higher RPM to gain horsepower cannot overcome that. Parra's latest changes therefore appear to lift useable performance by achieving and maintaining high torque levels within the practical RPM range. In addition, attention has been paid to carburetion consistency and practical considerations for 'real world' applications.

A New Old Classic!

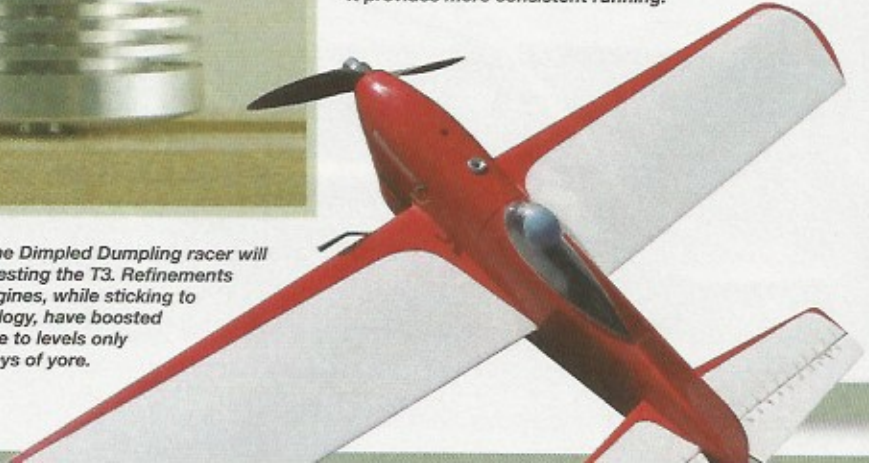
This version of the Parra T3 should, be 'in the money' for Vintage A Team Racing, Oliver Combat and Australian Vintage Combat, and would be a delight in a suitable Classic FF Power model. On a more subjective basis, we rate it high for 'user friendliness' and would not hesitate to recommend the Parra T3 Tiger for general control line sport flying. Or perhaps put that low end torque to work in an Old Time or Scale FF or RC assist model?

You can find out more about the T3 via albparra2@gmail.com at www.clubtamaran.com/Parra.htm or talk to Alberto Parra on one of his many visits to Vintage/Oliver Combat events in the UK. ●

Propeller	RPM
APC10x4	10300
Graupner 9x5	10800
Kavan 8x6	12700
APC 9x4	12900
APC 8x6	13300
Master S-2 8x6	13800
Graupner 8x5	13900
APC 7x7	14000
JXF 7x6	15600
APC 8x4	15800
APC 7x6	16200
APC 7x5	17300
APC 7x4	18500

Oliver Tiger (L) and Parra T3 (R) cylinder assemblies have significant exterior differences, but actual port openings in the cylinder bore are almost identical.

New venturi insert design (L) has fewer jets, smaller fuel channel and downstream aperture volumes when compared with earlier design (R). It provides more consistent running.



Norm Kirton's fine Dimpled Dumpling racer will be used for flight testing the T3. Refinements in models and engines, while sticking to vintage technology, have boosted modern performance to levels only dreamt of in days of yore.