THE ENGINE ROOM CAR CLINIC

MAC#1

CAN YOU HAVE A BIKE-ENGINED SE7EN THAT CAN HOLD ITS OWN ON THE RACE TRACK AND STILL BE DRIVEABLE ON THE ROAD TOO? TROY ROBINSON FINDS OUT

PHOTOGRAPHY: CAPTURED IN DIGITAL

MALLORY PARK
THE FRIENDLY CIRCUIT

CAR CLINIC

In Car Clinic we take a PPC reader's modified car and assess it in the workshop and on the track to see how it could be improved. **Want to see your car here? E-mail kev@ppcmag.co.uk**

If ever there was a type of car just made for bike engines it's got to be your average Se7en. Sticking a super light, yet powerful motor in an already light chassis is a recipe for speed, noise and fun, but what are they like to drive on the road?

David Armour began building his Mac#1 in May 06 and it was SVA'd in May 2008. Like most kit car builds David's was interspersed with periods of feverish activity followed by long periods of getting on with life. A couple of years to finish a car is not unusual in the kit car world though as few people have the luxury of unlimited time and budget to blitz through a build.

This design follows the now familiar template of a light weight tube and box section chassis with riveted aluminium panels to add rigidity, all clothed in lightweight GRP panels. I think it's worth mentioning at this point that the panels are really nicely made on this car; they're both very light and well finished and as a result the fit and style of the car looks very sharp.

Front and rear suspension is unequal length double wishbones with Gaz coil-over damper units keeping the whole thing off the ground. The wishbones are made of flat bar and look really strong and well fabricated. The front suspension comes in wide track format as standard unlike many kit manufacturers who offer this as an upgrade package.

At the risk of stating the obvious, wide track widens the car's stance improving the front roll centre and therefore front grip. A less obvious benefit of wide track is decent steering lock. On many 7 style kits steering movement is limited by either the wheel or cycle wing touching the body on full lock.

This would be an MoT fail so lock stops are fitted to the rack resulting in a turning circle similar to that of a Jumbo Jet. I've been left mildly embarrassed on more than one occasion when I've forgotten this while pulling into our workshop, then having to do a quick shunt in the middle of the road just to get in the door due to pitiful steering lock. No such problem with the Mac#1, with full lock available it literally turns on a sixpence.

Drivetrain and brakes, as is often the case, draw heavily from the Ford parts bin using a Sierra XR4x4 LSD, calipers and driveshafts plus a modified Sierra rack and uprights at the front. Wilwood four-pot calipers are used to provide stopping power at the front.

The Mac#1 kit can be built using a Ford Zetec engine, or as in David's case a bike engine. The relatively wide engine bay area means that a number of different bike engines could be fitted using a variation on the engine mounting frame which bolts to strong points on the chassis. So that's the spec. What's it like?

ON THE ROLLERS

The engine is from from the Honda Fireblade 1000RR. This pint sized power house delivers 148 bhp@10,700 rpm in 2004/05 guise and this rises to a whopping 178bhp@12000rpm for the latest 2008/09 model engines.

The engine and gearbox combination weighs less than 90kg and the sequential gearbox gives the opportunity for super quick shifts. But the installed package in the car needs to mirror that of the bike as closely as possible if the full potential of the engine is to be realised, this includes the exhaust and air box which is a integral part of the intake system.

On the Blade engine the air box not only houses the air filters but also locates a secondary set of injectors and part of the throttle linkage. By running a secondary set of injectors outboard of the intake trumpets the engine can develop more power because of better atomisation of the fuel air mixture. As the fuel atomises and evaporates it also produces a cooling effect which results in a denser intake charge and improved cylinder filling. This evaporative cooling is said to be worth between 3 and 5% more power with no other changes to the engine.

So David needed to keep the additional injector rail but the air box was very tall. Even with the sump shortened to allow the engine to sit lower it would have protruded well above the bonnet. Using the standard box would have seriously compromised forward vision and wouldn't have exactly looked stylish.

David removed the top half of the air box and mounted the secondary injector rail above the trumpets on some spacers and initially used the car like this. The problem was that because the side of the air box also located the throttle cable the throttle was no longer opening fully. The engine was also drawing unfiltered air and the induction noise was too much for many track-day noise limits.

David brought the car to us last year to see if we could help with this problem. The only solution was to make a new air box that would sit in the space to the right of the engine. This would mean that much longer curved runners would feed air from the air box to the throttle plates and into the engine. The only drawback was that the induction length would be much longer than is ideal for an engine revving to 13000 rpm.

By carefully matching induction and exhaust length it's possible to improve cylinder filling, using pressure pulses that travel up and down the inlet and exhaust system. The rule of thumb for an engine revving to 8000rpm would be an intake length of around 300mm from trumpet end to the back of the inlet valve and an exhaust primary pipe length of around 710mm. For the high revving bike engine this distance would be almost halved. We decided that with the benefit of cool filtered air, having the throttle fully opening and being able to fit the bonnet, the longer induction length was an acceptable compromise.

The significant change in the position and orientation of the secondary injectors meant the standard ECU was no longer correctly calibrated. When driving bike engine cars I've often found them very fussy at anything less than full chat. With sharp clutches and sequential boxes you can get shunts and chatters at low rpm and light load that can really spoil the driving experience.

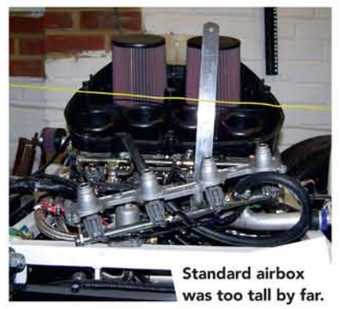
So we carefully mapped the Power Commander piggy back ECU which allows fuel values to be edited right through the RPM and load ranges. The engine was loaded at varying throttle angles from as low as 1500 rpm right up to maximum revs which at 13k can be quite unnerving for the dyno operator. The result was an engine that drove superbly both when trundling around in traffic and also when pulling flat out. Ultimate power was affected by the long induction and exhaust length and the engine came up 20bhp short of its quoted output at 138bhp. This sounds like a bad result but the car can now be used safely on the road and track, and we know the engine was making less than 100bhp before.

Standard 'Blade airbox in Westfield.

Good grip on track despite road tyres.

Mapping second set of injectors.

Power Commander corrects fuelling.


Standard airbox was too tall by far.

SUSPENSION GEOMETRY

When I road tested the car after air box and mapping work last year I was really surprised how little front end grip the car had. The suspension felt very soft and with the wide track and standard ratio steering rack the car had almost four turns lock to lock. Pressing on into a roundabout and I found myself adding more and more steering angle to get the front end to follow the line I wanted.

To make matters worse when accelerating hard out of slow corners the rear tyres would quickly spin up highlighting a lack of rear grip as well. Although the car was still very competent it just felt like it could be so much better.

On the scales the car weighed in at just 476.5kg and the front wheels had 109kg and 102kg of weight on them while the rears had 138kg and 127kg giving a rearward weight bias of 55%. With the driver on board the rearward weight bias increases which further compromises front end grip.

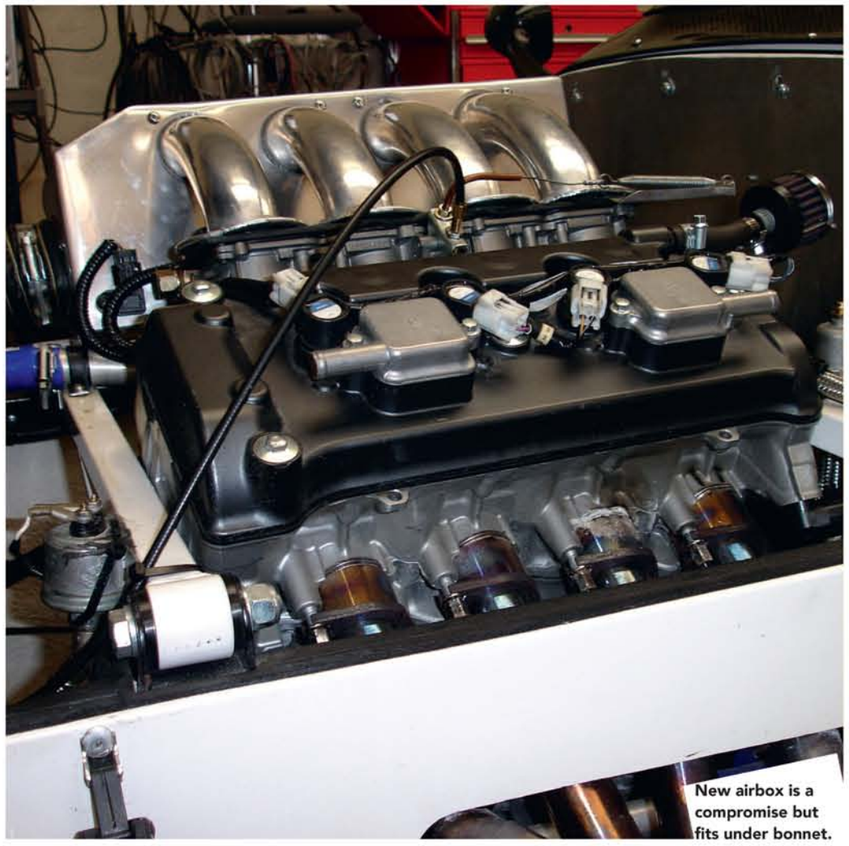
While on the scales, and with the dampers set to soft, the car could be easily bounced indicating very soft springing. The fact that both front and rear damper units were heavily inclined means that the effective spring rates are further reduced.

On the lift we removed a damper from each end of the car to see what spring rates it was running. The fronts were 275lb and the rears were only 175lbs. Although this is a lightweight car, with the dampers as heavily inclined as they are it needs much heavier springs to control body roll especially as it has no anti-roll bars fitted. We upped the spring rates by 50lbs front and rear and also went for springs that were an inch shorter. This was because the suspension won't settle as far with the harder springs and we wanted to make sure we could keep the ride height at 4½ inches at the front and 5 at the rear.

As well as the changes to the spring rates the steering rack was up rated with a quicker rack and pinion supplied by David. Although the rack started life in a Sierra the casing had been shortened to fit the Mac#1 as has the internal rack shaft. The new shaft also had to be machined before it would fit the modified casing, but once fitted it reduced the lock to lock figure to 2¼ turns.

Finally, the suspension geometry was optimised to give more camber front and rear and the front toe was reset to give parallel tracking. Like a lot of kit cars we've seen recently there was no adjustment for rear toe. Had this been available we could have optimised the geometry even further. Still, the values were acceptable.

Suspension mods dramtically upped grip levels on track.



New airbox is a compromise but fits under bonnet.

ON THE TRACK

The following morning it was off to Mallory for the acid test to see whether the suspension changes had the desired effect. I've come to the conclusion that I've got to stop singing in the shower as for the fourth consecutive visit it was raining at Mallory.

The first few steady laps immediately showed that even in the wet the car had much better balance and turned in readily to the high speed corners like Gerard's and the Esses as well as the much slower entry into the hairpin. While wet it was quite easy to unstick the rear end with good thrust on the accelerator pedal but as the track dried throughout the morning the car just felt really well balanced and it was possible to exit the hairpin flat out in 2nd gear with no wheel spin at all.

The car was sitting on Toyo T1-S tyres, which are much more of a road pattern than the sticker 888s so I was really pleased with the grip level. Even though the car felt considerably stiffer than the last time I'd driven it there was still a good degree of compliance which will make it nice to drive on the road.

On the engine front it pulled cleanly through the rev range although it did feel a little bit strangled above 10k. This is probably down to the exhaust and air box dimensions and David may invest in a bespoke exhaust at a later date to improve performance and further quieten the car. That said it was still mixing it with full on track cars round Mallory so I don't think it will be found lacking either on the road or the track.

New springs 50lb harder, inch shorter.

Inclined coil-overs need heavier rates.

Exhaust could be improved further.

Good power and driveable too.

Wide track makes for low roll centre.

No anti-roll bars but little body roll.