

# LRO WORKSHOP

## 90/110 DEFENDER



# Tdi Transplant

If your Defender engine struggles when it comes to towing, a 200Tdi engine conversion may be the answer. Sam Saunders did just that and his basic 90 is now a powerful and refined workhorse



Sam Saunders reckons his 200Tdi-converted 90 has all the pulling power to cope with a trailer-load of Range Rover. There's now some handy acceleration on tap, too

Off-roading, trialling and general roadwork was no problem for Sam Saunders' B-registered Land Rover 90. But, when faced with towing a trailer carrying his and Julian Buckmaster's Range Rover trialler, Sam found the 90's naturally-aspirated 2.5-litre diesel was having a hard time. The answer was to update the 90 by fitting a 200Tdi engine; and he's delighted with the result.

Sam bought the used 200Tdi motor with radiator and intercooler from Total Discovery of Barnsley (tel: 01226 341444). As you've probably guessed from the name, the engine came from a Discovery so it had the low-mounted turbocharger – unlike the typical 90/110 Td installations with the turbo mounted over the manifolds. This turbo position brought considerable problems with running the intercooler and air filter pipework. Robert Mallinson of Malltech Services in Cumbria (tel: 01539 560706) was brought in to swap the engines over and connect the various systems. Sam provided assistance and sorted the air pipework while friend, Mark Ibbotson, helped out with pipe fabrication.

Removing the old engine and installing the Tdi presented no problems. A point worth noting is that the 90's bellhousing flange has one less stud hole, compared to the 200Tdi

engine's flywheel casing, just below the centre line on the right-hand side; however, the engine can be bolted up regardless of this by simply removing the extra stud from the flywheel housing. The original engine mountings from the 90 were transferred to the Tdi block, which then bolted straight on to the existing engine mounting brackets on the chassis.

The 90's throttle cable and the hose to the vacuum pump connected straight on to the Discovery engine, and the starter motor cable also reached its terminals without modification. Other wiring connections needed slight alteration and the alternator multi-plug was cut off and replaced with the Discovery item, using good insulated connections. The Discovery exhaust downpipe was used to couple up to the Tdi manifold, though it was necessary to modify the downpipe by fabricating a new top elbow and manifold connecting flange in order to clear the bulkhead. By doing this, the original 90 exhaust system was retained.

The next job was to install the Discovery combined radiator, oil cooler and intercooler assembly. This unit is too high to allow the bonnet to shut, so the two radiator bottom mountings were removed from the 90's crossmember, lowered by approximately 1.5-inches, and then welded back in place.

The Discovery radiator's side mounting brackets were also cut away from the sides of the frame, and then re-welded to the top of the radiator frame where they would locate with the 90's upper mounting brackets.

With the engine radiator, oil cooler and intercooler assembly in position, the tricky job of making up the interconnecting pipework began. The oil cooler pipes were relatively simple, being extended to reach the cooler and using additional fittings to mate with the Discovery-type connections. The engine coolant system was also fairly easy to connect using the existing 90 hoses after some chopping and shaping. But, by contrast, the intercooler and air filter connections caused all the problems, mainly thanks to that low turbo position.

The air inlet pipe to the turbo had to run beneath the alternator (and work its way around the power steering pump), so that left little room for the turbo outlet pipe leading back to the intercooler. It was found that the best way to take the charged air to the intercooler was by routing the pipework up and forward over the alternator, but this compromised space for the air filter. The answer was to mount the air filter on the opposite inner wing using two purpose-made brackets which secured the filter casing to the wing and to a top bolt on the steering box.

The result was an efficient layout that left reasonable working space for maintenance. Here's how the system runs: A rubber elbow leads air out of the filter into a straight pipe running down and across the back of the radiator assembly to another elbow, ahead of the power steering pump. A steel straight section then takes the flow under the alternator where a dog-leg has been fabricated into the tube to bring it back into alignment with the turbocharger inlet, to which it's connected by a short flexible hose. Charged air from the turbo is led through a bend, vertically upwards, then forward over the alternator utilising the Discovery's old steel turbo inlet pipe. This feeds via a hose and specially-made steel elbow back down to the bottom inlet connection of the intercooler, where it is connected using a redundant 2.5-litre top-hose. Finally, air flow from the intercooler to the inlet manifold is provided by a single length of hose with a straight section of steel exhaust pipe fitted inside to prevent

kinking and to provide support over the extended length. Most of the steel pipe bends and hoses were salvaged from the 90 and Discovery parts; other hose lengths were obtained from a local tractor dealer (2.5-inch diameter turbo pipe) and cut to size. Steel sections were cut and fabricated from 2.5-inch-diameter exhaust tube.

The systems worked fine, though Sam says the engine's viscous cooling fan is too far back from the radiator and will be replaced with an electric fan mounted ahead of the rad. But there's no problem with cooling: the temperature gauge gives a steady reading, slightly over the halfway mark when fully warmed up. The engine is fitted with the vehicle's original 2.5D sender unit connected to the original gauge.

After 1,800 miles with the Tdi, Sam confirms the 90 is quieter-running, has better acceleration, and has that much-needed extra pulling power to tow the Range Rover on its trailer. The 90 is also thirstier now, but Sam points out that maybe that's down to the novelty of having a good engine and using his right foot more often – it could be down to the lower gearing as well.

The transfer box on this early 90 is unnecessarily low-g geared for the Tdi, restricting cruising speed to around 65mph, so Sam is considering changing the ratios. But this will need to take a back seat for the moment, because a couple of normally simple jobs have recently turned out to be



Problems encountered with pipework were soon forgotten once the motor was up and running

more complex on the new installation. A recent starter motor replacement involved removal of the manifolds and turbo assembly to gain access. Recent replacement of the clutch slave cylinder called for removal of the exhaust downpipe, though it provided the opportunity to place heat protection around the clutch and brake pipes where they ran close to the exhaust.

Such major modifications are inevitably followed by fine tuning and minor embellishments. But there's no doubt that Sam has turned his basic 90 into a powerful and relatively refined workhorse – and with surprising acceleration thanks to that low gearing. So, if you're driving a Tdi Disco and get blown away at the traffic lights by a B-reg 90 – it'll be Sam Saunders!

## How hard how easy?

● HOW DIFFICULT?

● HOW EASY?



You need a reasonable familiarity with the support systems for each engine: fuel, cooling, electrics, air, and some inventiveness to make up the connections.

It helps to be able to crib from a similar donor vehicle. Photos and notes will help. As engine transplants go, this is a fairly easy one.

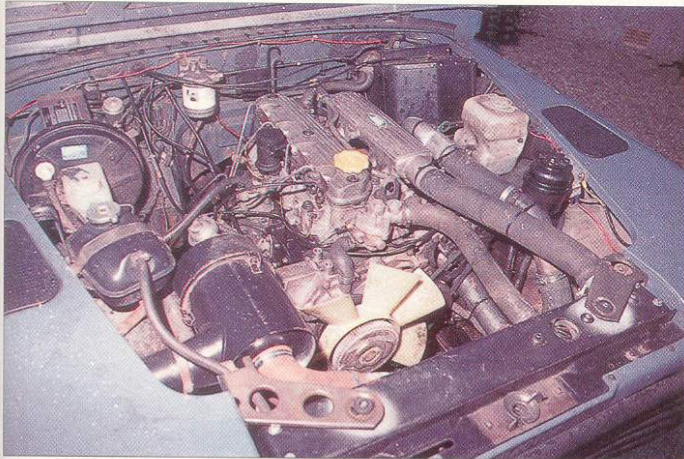
● SPECIALIST TOOLS NEEDED: Engine hoist, welding and cutting equipment, a couple of willing mates.

● TIME: Allow a day for the engine swap and another for the connections; that is, if you have all the gear and materials at hand.

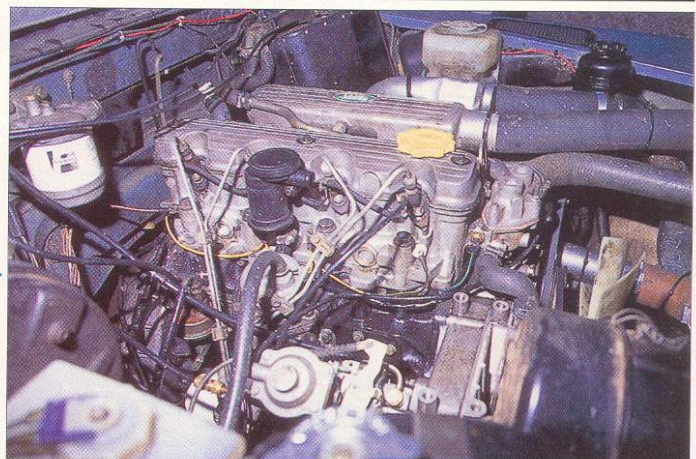
In practice, these jobs can be a case of find-as-you-go, so set two or three weekends aside.

● COST: Engine prices vary greatly. A good, checked and warranted 200Tdi might typically cost around £1,000 (you can buy others for less) so, if you can do the work yourself and your vehicle is in good condition, you'll have a cheap conversion.

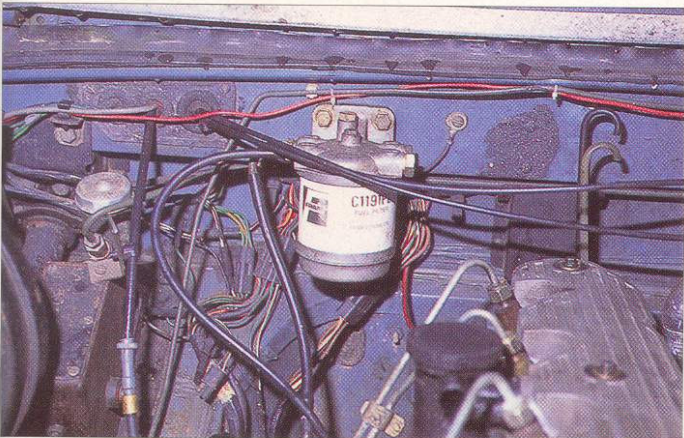
If costs are likely to rise, be aware of the residual value of the converted vehicle as compared to the cost of trading in for a genuine early Tdi Defender.



1 The 200Tdi sits well back in the 90 engine bay, leaving plenty of front access for maintenance, especially without a radiator cowling



3 Glow plugs were wired direct from the key switch. Crankcase breather pipe is still to be fitted – another tidying-up job



2 The original filter housing was retained after re-piping and blanking off connections to suit the Tdi fuelling system



4 Main piping problems centred around the turbo air connections. Steel pipe has since been painted black to prevent rusting



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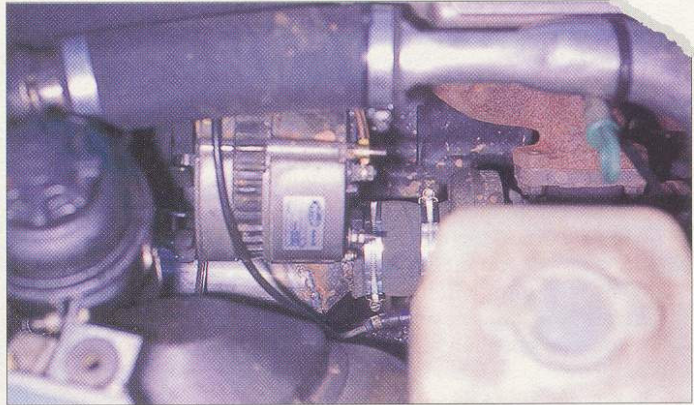
## 90/110 DEFENDER

LAND ROVER  
THE LRO  
SHOW  
MAY 18-20th 2001, NAC STONELEIGH PARK, WARWICKSHIRE, ENGLAND

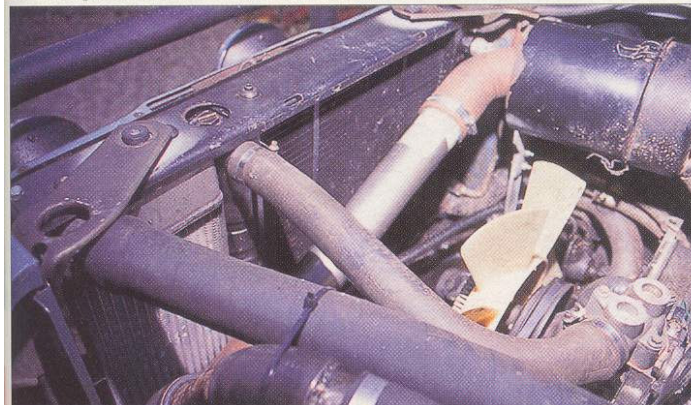
FUN FOR ALL  
THE FAMILY!



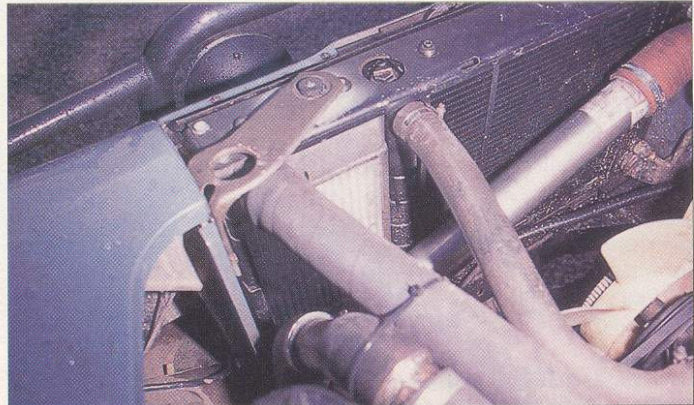
**5** To make more space for the turbo outlet pipe, the air filter was re-sited on the right-hand inner wing, using specially-made brackets



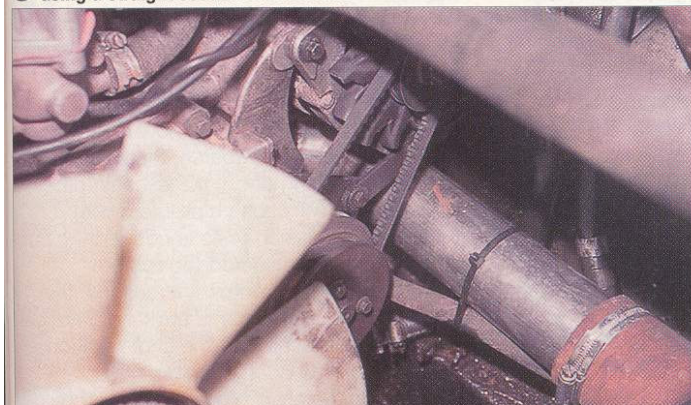
**9** Turbocharged air is ducted overhead and forward, before dropping to the intercooler inlet via a specially-fabricated pipe bend



**6** Air from the filter is ducted across the engine bay at the back of the radiator using a straight section of steel tube



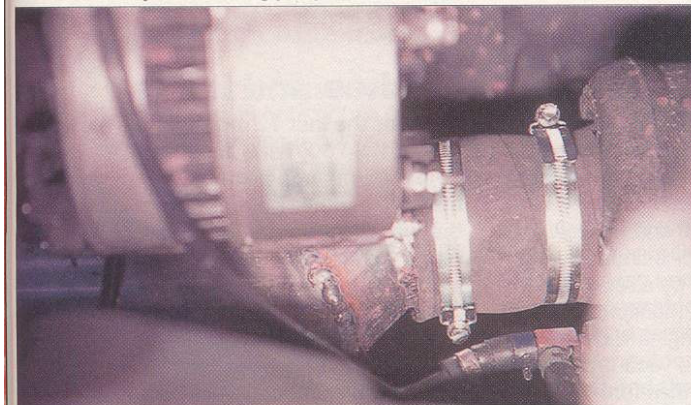
**10** A straight pipe from the intercooler's upper outlet connection feeds directly to the manifold in the normal way



**7** Pipework is then led back along the left side of the chassis, far enough over to clear the power steering pump



**11** The exhaust down-pipe was refabricated with a new manifold flange and a tighter bend, to avoid fouling the bulkhead



**8** Beneath the alternator, a short dog-leg aligns the air supply pipe to meet with the turbo inlet via a rubber connecting pipe



**12** Radiator mounting spigots were transferred to the top of the casing to match the 90 brackets on the inner wings