

PROJECT XJR-6

From the wrecking yard to the race track



GREG PARSONS

aka **Dr JAG**

PROJECT XJR-6

Part 1

The first time I saw the car was on the back of a tow truck, the first time I heard it running it belched out clouds of white smoke and was clearly not happy about being started. I bought it anyway, as it was the first supercharged model Jaguar had made and that made it much more interesting, to see how they had added supercharging onto what was otherwise one of their standard engines.

With the motor removed and fully dismantled I could see what had gone so horribly wrong with one of the most reliable motors they had ever produced. It had been sucking in dirty air through a broken air hose on the main inlet pipe to the motor, possibly for years, and had worn the rings away to nothing and the pistons came out scuffed as if they had just been rubbed with emery paper. I couldn't help but notice that the engine was very robust internally with a strong crank, wide bearing surfaces and a very rigid engine block. This engine would handle more power and that got me thinking. This engine would be a good base to build a high performance engine that would still fit back into the same car, be usable as a daily driver and to see how much extra power the engine was capable of producing.

I was able to order most engine parts directly from the Jaguar Heritage Parts site, some parts at a greatly reduced price (I imagine to clear old stock) others at the usual Jag price, (for example the intermediate timing chain sprocket on the front of the engine cost more than the crankshaft). To begin with the new crank was smoothed over, bull nosed, polished and balanced, the new rods were de-burred, polished, shot peened and then balanced. I needed the pistons to be stronger than factory pistons which incidentally were not available from Jaguar any longer, so I ordered a new set of "JE" forged pistons to be specially made in the United States (I sent over a sample piston) I then decided to have them Ceramic and Teflon coated here in Sydney, and fitted them using file back rings.



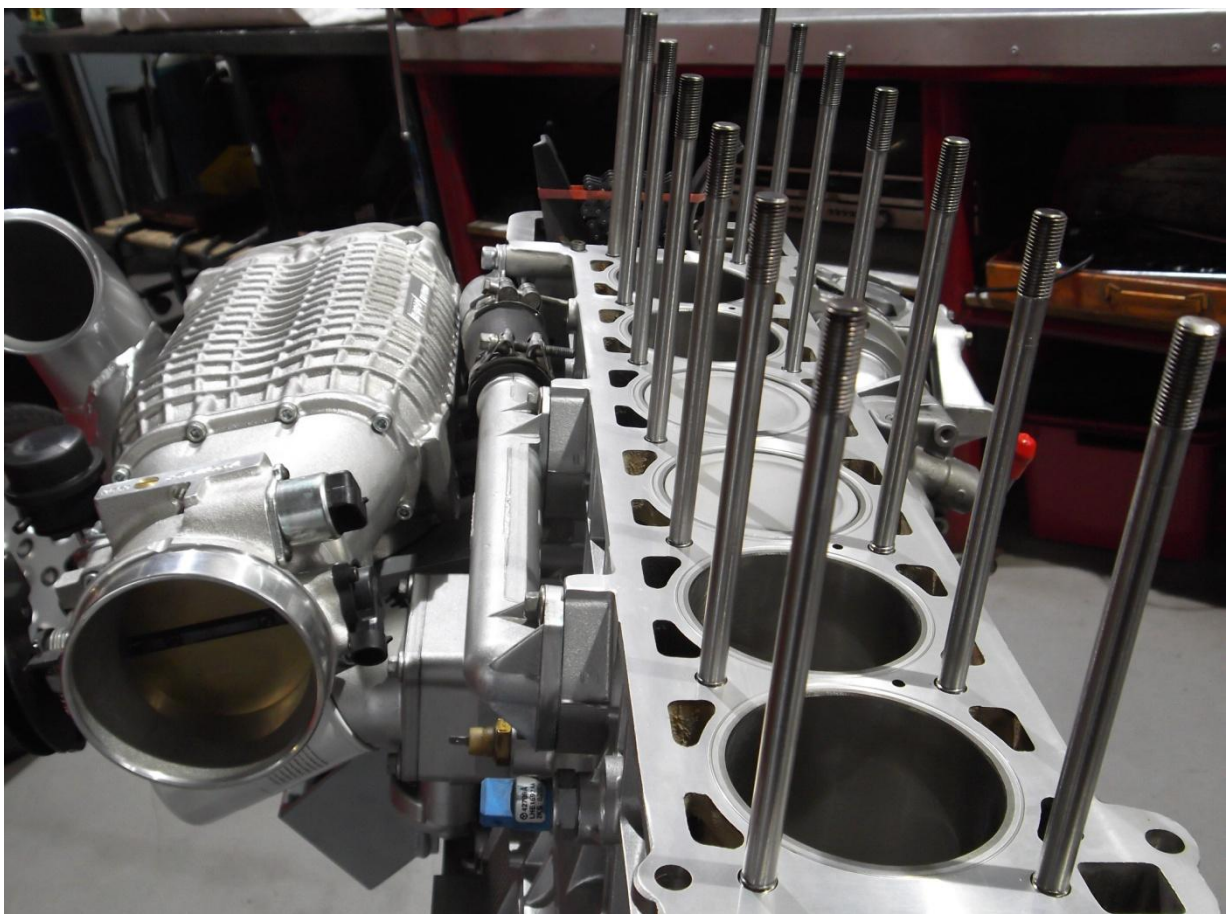
Forged piston, Ceramic and Teflon coated. Bottom end ready





The block was chemically cleaned, crack tested, bored $+.020''$, decked and "O" ringed. "O" ringing is the process of machining a shallow groove around the outside of each cylinder bore and then setting a 1.2mm stainless steel ring in the groove so that it sits just proud of the top of the block. This ring then presses into the head gasket to form a much better airtight seal to prevent pressure leakage at high boost levels.

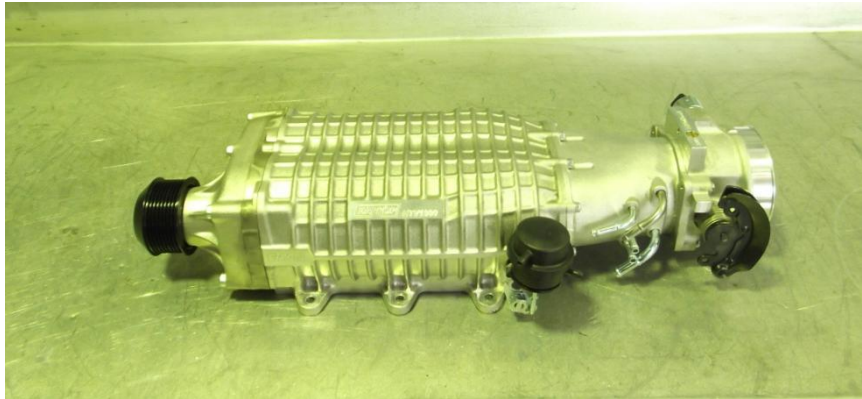
The bottom end was then assembled with new bearings, chains, tensioners, guides and sprockets. A new oil pump was fitted as was chrome molly main bearing studs (instead of the STD bolts that do not use all of the available thread in the block). I was lucky to find a brand new cylinder head, complete with new cams and rocker cover, wrapped up in wax paper and still in a rather nice Jaguar box. I spent a full weekend porting the new head which resulted in a 12% increase in air flow. I knew that for reliability on a boosted engine the head must be held down very securely so I had a 1.6mm copper gasket especially made that bites into the stainless steel "O" rings, mentioned above, and then I held it all down with a set of chrome molly head studs that reached deeper into the top of the block than the original bolts do (the chrome molly studs were specially made in Melbourne from drawings that I sent down). The engine internals were now done but it had taken two years to get to this stage and I wasn't even close to getting it running.



Part 2

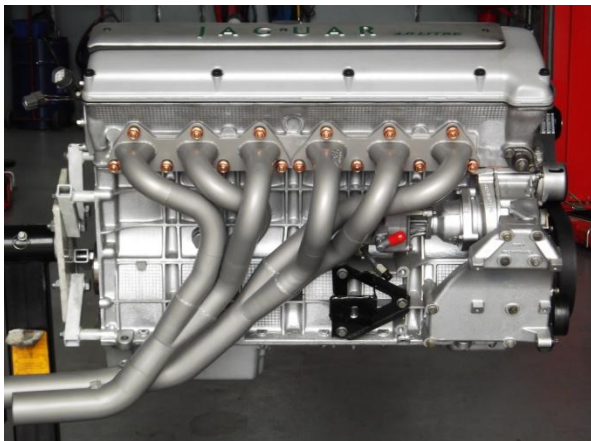
The next thing was to start thinking "outside the block". With a stronger engine I could now use more boost to make more power so I was going to need a larger more up to date supercharger as the newer design of superchargers can generate higher boost levels with less heat build up and, at the same time, take a bit less power from the engine - sounds too good to be true. I chose a Eaton RVT1900 supplied from Harrop Engineering in Melbourne, normally fitted to the 6Ltr V8s. As a comparison to the STD Eaton M90, this new supercharger is 30% bigger in capacity and 25% more efficient. I used a Corvette

adaptor and a 90mm throttle body, (upgrade for an HSV) to complete the supercharger. Seeing no one else had ever fitted one of these to a Jaguar engine there was no fitting kit or any ideas on how to mount such a thing for



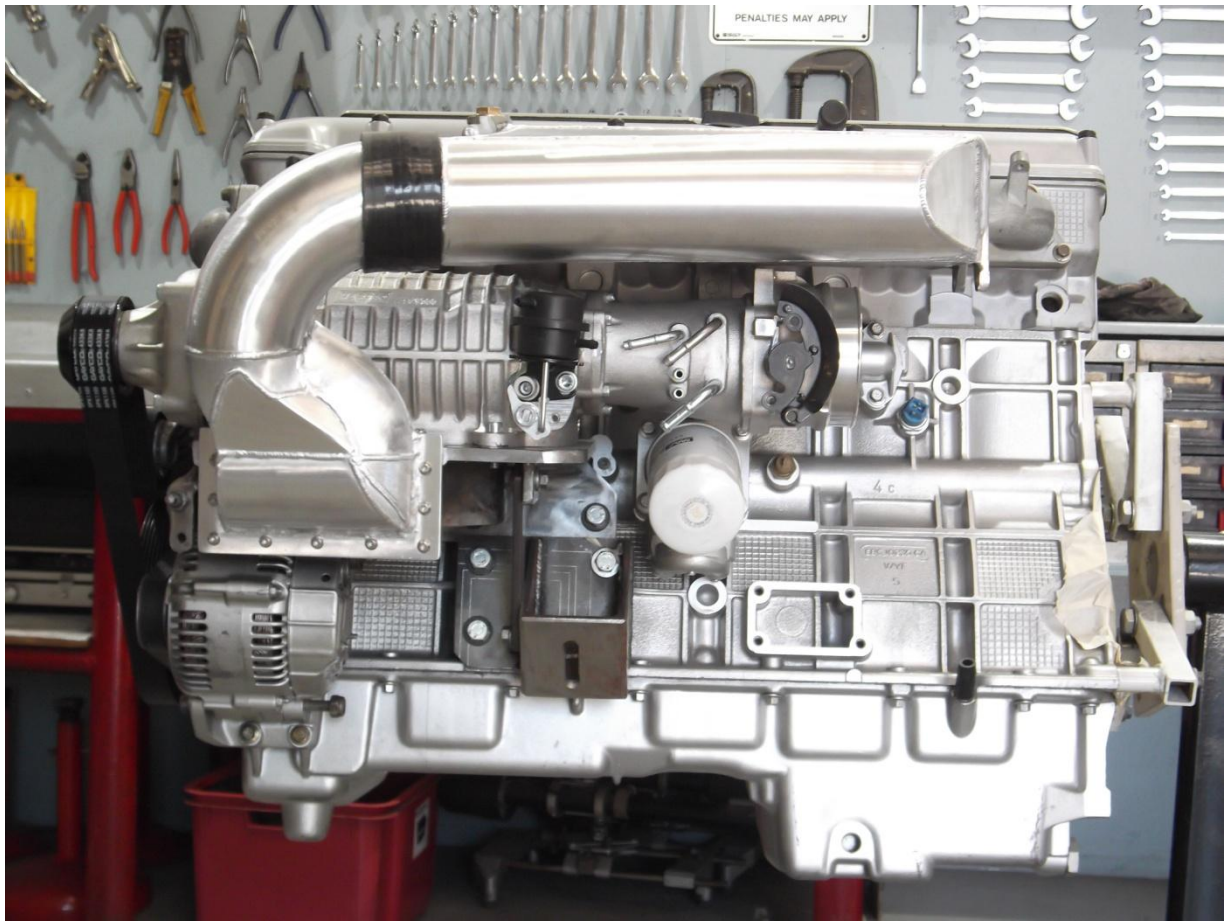
that matter. With the engine water pump removed it would fit horizontally on the side of the motor just above the alternator and just under the intercooler. I made a steel bracket out of 10mm plate that was held securely to the side of the engine block and fitted it up. I used a wider drive belt and made an automatic belt tensioner to transmit more power to the supercharger than the original belt set up. I then had a fabricator make up a specially shaped alloy pipe to connect the new supercharger to a modified inlet system on a new intercooler.

On the other side of the engine I needed to let plenty of exhaust gasses out in a hurry. You can't buy



exhaust extractors for these engines off the shelf anywhere in the world so I had a customised set of tuned length, stainless steel, ceramic coated, large bore extractors made in Brisbane to suit my particular engine. The rest of the exhaust system is then a dual 2.5" stainless steel system that Steve Appino helped me to road test first. I then made up a new set of stronger engine mount brackets and fitted V12 mounts to hold it all in place. There will be a lot more torque on the engine mounts now under full power and the original brackets were already cracking.

I stripped out the engine bay and had it re-painted and then tidied up all the parts that were going back in. I re-routed the wiring harness and the air conditioner pipes away from the extractors and made up a new heat shield to protect the engine bay from the excessive exhaust heat. Finally, it's time to put the motor back in where it came from nearly three years ago.



Part 3

It's a great feeling settling the motor back into its rightful place under the bonnet but hardly anything fitted back up as I had changed so much. Starting from the front I had a new alloy intercooler radiator specially made to fill the space in front of the radiator where the original intercooler used to sit but this new one is 50% bigger and more efficient. I found a factory engine oil cooler to go under it, the mounting points were all there, and was able to order in new oil pipes from the UK (strange thing that all the European XJR's were fitted with the oil cooler but no Australian models had them). I decided to fit a new factory radiator and air conditioner core as well to complete the package.



As mentioned earlier I had built the engine without any water pump fitted to make room for the bigger supercharger so I made a custom bottom radiator hose and then fitted a Davies Craig electric water pump under the left hand chassis rail to circulate the water through the engine. I then made up all new water hoses for the engine and heater, fitting a small bleeder pipe to both the front and rear of the cylinder head to assist in a more even warm up and also no chance of an air lock.



The water to air intercooler also has its own electric water pump which I upgraded to a larger Bosch unit to circulate the water faster through the now bigger intercooler. I deliberately separated the intercooler system from the engine cooling system so there is no chance of any heat contamination from the engine coolant. I also added its own small expansion tank, mounted at the back of the engine bay, now that is a separate system.

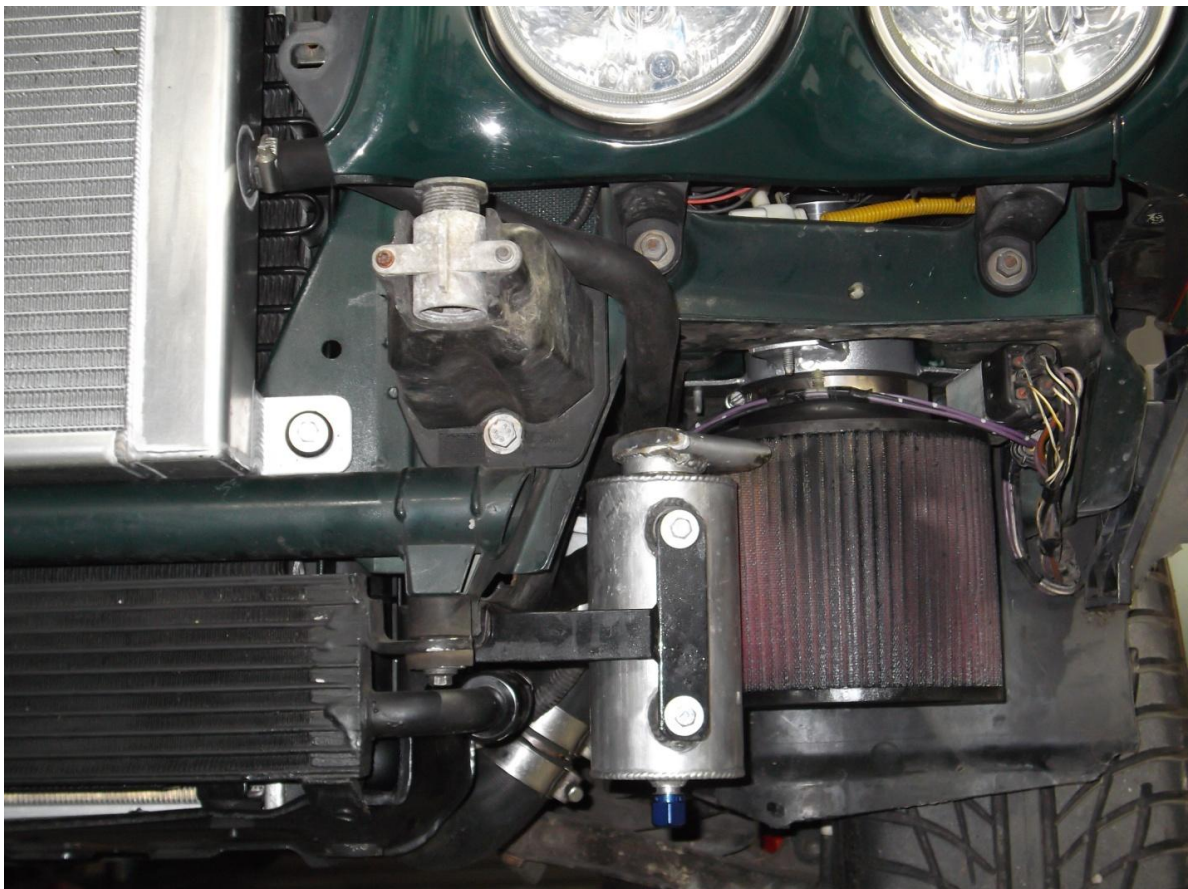
I then made up some wiring and used a two speed cooling fan relay connected to both my electric water pumps so I can run both the water pumps at half speed when ever the ignition is on, up to 86degC then the STD radiator fans come on at half speed and the water pumps switch over to full speed until 98degC when the fans also switch over to high speed, all using the original Jaguar temperature sensor in the radiator. I have three tell-tail lights on the dash so I can monitor the



three states of engine cooling from inside the car. Also, if I turn the engine off with the water above 86deg, the fans and water pumps will continue to run like an XJS except the whole cooling system is running.

The next thing was how to get plenty of cool clean air into the back of the supercharger. As I was using a 90mm throttle body the air ducting had to be no less than 100mm all the way, so I made a pipe and hose to run from the back of the motor up to the front of the car and mounted a pod style filter under the inner guard just below the left hand headlight where the brake duct normally is. With the brake duct removed there is plenty of cool air for the air filter and enough left over for the brake cooling. Another change is that the engine oil breather hose which normally runs back into the engine and coats the supercharger and intercooler with oil and moisture, now runs into an oil/air separator mounted right next to the outside of the air filter so that no oil can enter the engine inlet system thus keeping it clean as new but any fumes that escape the separator are gathered up by the air filter. As there is no physical connection between the two no oil can possibly enter the engine through the inlet system.

Ok the moment of truth has arrived, this is where half of you can't wait to start it and the other half is wondering if you have remembered to do everything.



New intercooler-silver radiator, with new oil cooler under it.

Oil/ air separator-silver cylinder, with pod style air filter next to it.

PART 4

Well, wouldn't you know it. I had a few people there for the momentous starting ceremony, I said "here goes" and turned the key. Nothing happened!! I tried it again, nothing. Checked the battery terminals, still nothing. Locked and unlocked the car to reset the security module, nothing. The crowd is losing interest and I'm thinking of all sorts of wiring connections that I was going to have to check again, this could take a long time when my wife asked "have you got it in park?" Well that made all the difference. It spluttered into life, ran a bit rough for a while but it was running! The next day after some all important tinkering, I drove the car up to be blue slipped for rego. Regardless of all the modifications the car always was a supercharged Jag and the engine number had not changed so he passed it for fully legal road use.

I had earlier decided to run-in the engine using the original XJR tuning, but that would limit power to factory levels, not a bad thing on a new motor, and this gave me time to sort out all those little problems associated with running lots of new systems. After 5000km the time had come to get serious with the power levels and go beyond the factory limitations.

I fitted a set of replacement fuel injectors that would deliver 50% more fuel and found an air flow meter (off a supercharged Mustang) that was good for at least 600HP. I then took the car down to an engine tuning specialist, the only one in Sydney who said that he would attempt to access the Jaguar computer and make it talk to the Ford air flow meter, Holden throttle body and the oversized fuel injectors I was using. This guy, Dave from Silverwater Automotive Services, is some kind of genius. After a week of reprogramming the computer and 76 full power runs on the dyno (running at 18pounds boost) the engine was now making 430Kw of power and 700Nm of torque, that's a 80% increase over the standard supercharged motor or a 130% increase over the non supercharged motor, more than I had ever hoped for.



100mm main air inlet pipe with new air flow meter

It had plenty of power now but the auto was struggling, and not because it wasn't strong enough. All 6 cylinder XJR's are fitted with the very strong GM4L80E auto box, the same one that GM fit into the Suburban SUV. The problem was that at just 20% throttle I was now making double the power that it was expecting to see and that meant the gear shifts were too soft and changing at the wrong times. The answer was to fit an adjustable transmission computer which would allow me to set the shift firmness and shift points myself to suit the engine's new power delivery. This works a treat and now that the power can get through the auto more effectively, the car feels much better to drive. A side benefit to this is that this controller allows me to lock the torque converter anytime with a manual override switch on the centre console. This makes it feel more direct like a manual, but still

with automatic gear change, or I can lock it into a gear and it will not change up or down no matter what I do the accelerator.

Because it makes the engine feel connected directly to the road wheels, like a manual, the car feels better to drive at highway speeds. Another advantage is that it improves the fuel consumption and lowers the oil temperature in the auto transmission. More modern cars are locking the torque converter early for the very same reasons.



To sum up now, I spent way more money than I needed to and it took four years to complete the job but in the end the project was a great success. It was a huge challenge to find or make the parts I needed in order to put together a high performance engine, without any previous examples to follow, when virtually no performance parts are made for this model.

As a side note, I took the car to Eastern Creek drag strip the other night to record a quarter mile time, (another way of measuring a cars performance) and for a 1.9 ton car it did a 12.55 second pass@185kmh, faster than a number of newer "high performance" cars that were down there that night. I was quietly smug on the drive home that night, very happy with my little kitten.

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