

# Improving the Elite, Eclat & Excel

Part 1 – Chassis, Body, Brakes & Transmission

Part 2 – Engine

Mike Taylor  
November 2007

# Improving the Elite, Eclat & Excel Part 1



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## ■ Lotus Elite & Eclat

- Head Lamp system
- Doors
- Rear Drive shafts & Wheel bearings
- Pedalbox
- Gearbox
- Cooling
- Brakes
- Chassis

## ■ Lotus Excel

- Brakes
- Suspension
- Diff
- Starter
- Clutch
- Water leaks



# Head Lamp system

- Probably the biggest complaint about the Elite and Eclat is that the headlamps wink at you....
  - This is because the headlamps are pulled down by a vacuum system that leaks and lets them back up after the engine is turned off
  - Vacuum system is shared with the heater
  - Normally the leaks are on the heater
  - Isolate the two systems with 2 separate non return valves and 2 separate vacuum tanks

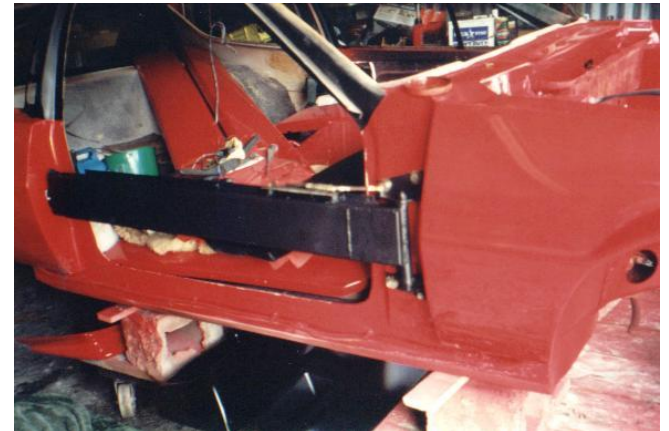
# Doors

## ■ Linkages

- Early cars had a awful system of spring clips to adjust the linkage rods between the handles and the door latch
- Replace them with the later threaded rods.

## ■ Door Hinges

- The hinge pins seize and turn in the upper and lower brackets giving play
  - Fit a grease nipple
  - Weld up any oval holes and re-drill
  - Ensure the door beam is well protected against rust



# Rear Drive shafts & Wheel bearings

## ■ Driveshafts

- The driveshaft is the top link of the rear suspension
- When the UJ wears, it gives the rear wheel excessive movement. Most cars I work on need new UJs to pass a MOT
- On my Elite – I have done 25000 miles over 6 years and never had to change the UJs
  - My secret – use top quality UJs with a grease nipple and grease them every 1000 miles when they are HOT so the grease moves freely

## ■ Rear wheel bearings

- Do not use LM grease – High performance “rally” wheel bearing grease – Castrol BNS or equivalent

# Pedalbox

- Clutch cables always snap on the Elite...
  - Make sure the plastic wheel in the pedal box is not damaged and turns freely
  - Use a very fine ultra flexible stainless steel braided clutch cable
- Accelerator pedal does not return properly
  - There should be a return spring from the carburettor linkage to the airbox – gets lost when K&Ns are fitted
  - There should also be a return spring on the pedal box to the pedal – frequently missing...



# Gearbox

- The S1 5 speed gearbox was originally designed to mate to a 1600 twincam engine in the Elan. It was derived from a Maxi gear set and not really up to the job in the Elite / Eclat.
  - If properly rebuilt and driven carefully the gearbox is fantastic to drive and can last.
  - Lotus replaced this with a Getrag gearbox when they facelifted the S1. This is the easiest upgrade
  - You can fit the gearbox from the Later Excel, but this is much more involved as you need to convert the pedal box to hydraulic operation and gently “adjust” the chassis in a couple of places





# Cooling

- Air flow – fit the later S2 front spoiler – much better air flow
- Fit a second rad fan – there is provision for this
- If aircon is fitted – ensure the condensor is not completely blocked up – this stops any air getting to the radiator
- Always ensure you use anti-freeze – the cars do not like water....



# Brakes

## ■ Spongy pedal

- Adjust the linkage pedal to servo
- Make sure there is no play in front wheel bearings
- Ensure the rear brake adjusters are working correctly
- Fit braided hoses

## ■ Brake Fade

- The front brakes tend to fade when used hard
- Use anti-fade pads
- Fit vented discs with original calipers

# Chassis

- The chassis does tend to rot...
  - Rear cross-member
  - Front turrets
  - Anywhere the paint comes off...
- Fit a replacement galvanised chassis
  - Replace the foam around the chassis with closed cell foam or another material that will not soak up water





# Rotten Chassis....



# Ultimate Chassis upgrade for the Elite & Eclat

## ■ Fit an Excel Chassis

- ❑ Outboard vented discs all round
- ❑ Bullet proof gear box
- ❑ Trunnions replaced by ball joints
- ❑ Conventional rear suspension
- ❑ Variable rate power steering
- ❑ Better engine mounts
- ❑ Can still fit original wheels – so not obvious externally

## ■ Issues

- ❑ The shape around the diff is changed, so localised fibreglass mods are required
- ❑ The front anti-roll bar to body mount are in a slightly different position
- ❑ Need to modify the bottom of the fuel tank to clear top of rear shock absorbers
- ❑ Hydraulic clutch conversion



# Lotus Excel



# Brakes

- The brakes on the excel work reasonably well if in good working order
- You can improve the performance by using better pads – Mintex 1144 compound
- There are kits available to fit 4 or 6 pot calipers and 310mm vented discs which will give the ultimate stopping performance



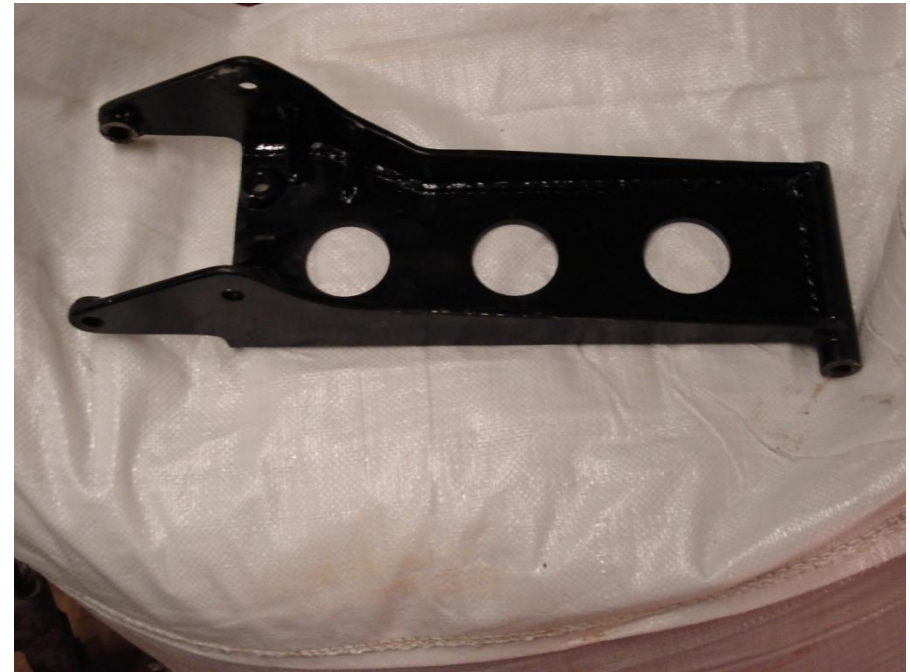


# Suspension

- Adjustable dampers are available off the shelf – AVO, GAZ etc
- Excel Springs are a not a standard length and diameter so changing rate is not easy – unless you move to a 2.5” coil-over solution
- Advantages
  - Adjustable ride height
  - Springs available off the shelf

# Differential

- Biggest weakness of the differential is the nose mounting bracket which fractures
  - Uprated brackets are available
- You can fit an LSD – several options
  - Standard Supra LSD
  - Tightened Supra LSD
  - TRD LSD.... The ultimate solution – 3 different settings



# Starter

- The early excels had the Lucas 3M100 starter motor carried over from the Jensen Healey. This starter motor is not geared and the current draw very high
- The later Motorola geared starter motor is much better and can be easily retrofitted



# Clutch

- Many people complain of a heavy clutch
  - This is normally down to a semi-seized slave cylinder
  - This results in people forcing the pedal and bending the pedal box and pedal
- If the engine is uprated, then the clutch can be marginal
  - There is a larger Supra friction plate that will fit with a Eprit turbo pressure plate
  - The ultimate solution is a 7.5" Twin Plate clutch for competition or track use

# Water Leaks

- Most Excels seem to leak water into the front foot wells
  - A lot of these can be traced to poor door sealing or windscreen sealing
  - The more common and very easily fixed cause is blocked drain holes in the bottom of the air plenum. This causes the plenum to fill with water and then drain through the heater into the foot well
  - The drain holes in the bottom of the doors also tend to block up and then drain into the car





# Improving the 907 / 911 / 912 Engines

## Part 2



Mike Taylor - November 2007

# Contents

- A Little History
- Improvements made by Lotus, 907 – 911 - 912
- Improving the performance further
  - Stage 1
  - Stage 2
- Fuel injection
- Capacity increase – 2.5 litres



# History – 907 – 2.0 Litres

- The first production 907 engine was fitted to the Jensen Healey S1 in 1972
- There were significant improvements made to the engine in 1974 when the JH S2 was released.
- At roughly the same time the Lotus Elite was launched with the 907 engine in Spec 1 tune
- This was revised in 1975 to spec 3 tune, and then again in 1976 to spec 5 tune to coincide with the launch of the Lotus Eclat and Esprit S1



# History 911/912 – 2.2 Litres

- Spec 5 continued up till 1978 when the engine was stretched to 2.2 litres and became the 911 and then 1980 the 912 was released
- The 911 engine was fitted to the Lotus Sunbeam which went on to win the World rally championship fitted with the “works” version of the 911 coded the 908
- When Talbot launched the S2 Lotus Sunbeam, there were some subtle changes to the engine which carried over from the 912
- The S1 Esprit had already become the S2 by now and then when the 2.2 912 engine was fitted it became the S2.2.
- The Lotus Elite and Eclat also adopted the 912 when face lifted to the S2 versions.
- The initial 912 engine was in Spec 9 tune which continued with few changes up till 1986 when the 912 High Compression engine was launched in the Excel and Esprit – spec 10 tune
- The 912 HC continued up till 1993 when it was discontinued – (along side some unusual lower power spec 9 versions)

# 907 Engine development

	<b>JH S1/S2</b>	<b>Elite S1 1974</b>	<b>Elite S1 1975</b>	<b>Elite/Eclat &amp; Esprit 1976 -</b>
<b>Quoted Power</b>	<b>140 BHP</b>	<b>160 BHP</b>	<b>160 BHP</b>	<b>160 BHP</b>
<b>Carbs</b>	<b>DHLA 40</b>	<b>DHLA 45</b>	<b>DHLA 45</b>	<b>DHLA 45</b>
<b>Choke size</b>	<b>36mm</b>	<b>38mm</b>	<b>35mm</b>	<b>36mm</b>
<b>Compression</b>	<b>8.0:1</b>	<b>9.5:1</b>	<b>9.5:1</b>	<b>9.5:1</b>
<b>Cams</b>	<b>C</b>	<b>D</b>	<b>C</b>	<b>E</b>
<b>Distributor</b>	<b>25D</b>	<b>25D</b>	<b>25D</b>	<b>23D4</b>
<b>Cambelt tensioner</b>	<b>Manual</b>	<b>Manual</b>	<b>Manual</b>	<b>Auto</b>
<b>Cambelt teeth</b>	<b>Flat</b>	<b>Flat</b>	<b>Flat</b>	<b>Flat</b>

# 911/912 Engine development

	<b>Talbot Sunbeam S1</b>	<b>Talbot sunbeam S2</b>	<b>Elite/Eclat/Excel &amp;Esprit S2.2/S3</b>	<b>Excel SE and Esprit HC</b>
<b>Quoted Power</b>	<b>155 BHP</b>	<b>155 BHP</b>	<b>160 BHP</b>	<b>180 BHP</b>
<b>Carbs</b>	<b>DHLA 45</b>	<b>DHLA 45</b>	<b>DHLA 45</b>	<b>DHLA 45</b>
<b>Choke size</b>	<b>37mm</b>	<b>37mm</b>	<b>37mm</b>	<b>37mm</b>
<b>Compression</b>	<b>9.5:1</b>	<b>9.5:1</b>	<b>9.5:1</b>	<b>10.9:1</b>
<b>Cams</b>	<b>E</b>	<b>107</b>	<b>107</b>	<b>104 in 107 ex</b>
<b>Distributor</b>	<b>43D</b>	<b>43D</b>	<b>43D</b>	<b>45D</b>
<b>Cambelt tensioner</b>	<b>Auto</b>	<b>Auto</b>	<b>Auto</b>	<b>Manual</b>
<b>Cambelt teeth</b>	<b>Flat</b>	<b>Flat</b>	<b>Flat</b>	<b>Round</b>

# Improvements made by Lotus

## ■ With the Jensen Healey S2

- Rope crank seal changed to the conventional spring loaded rubber seals
- Engine crank case breather position improved
- Oil pump modified to reduce time for oil pressure to build up when starting

# Improvements made by Lotus

- With the 1974 Lotus Elite – power increased to 160BHP
  - DHLA 45 carbs fitted with 38mm chokes
  - Compression increased to 9.5:1
  - Cam duration and lift increased
  - Port size in the cylinder head increased from 24mm to 25.5mm

# Improvements made by Lotus

- With the 1975 Lotus Elite – spec 3
  - DHLA 45 carbs fitted with 35mm chokes
  - Cam lift decreased
  - More low down torque – no “quoted” reduction in power



# Improvements made by Lotus

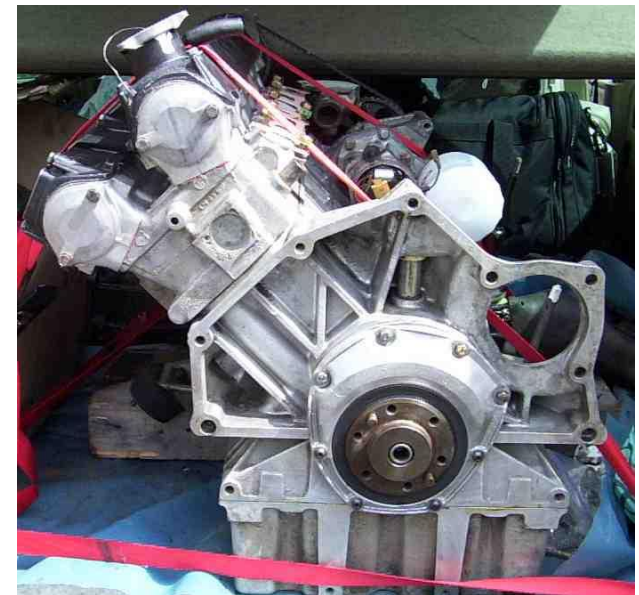
- With the 1976 Lotus Elite/Eclat/Esprit – spec 5
  - DHLA 45 carbs fitted with 36mm chokes
  - Cam lift increased half way back to spec 1
  - Cam duration reduced
  - Rear water outlet from repositioned from rear of inlet manifold to rear of cylinder head to remove “hot spot” that was causing detonation issues on cylinder 4
  - Manual cambelt tensioner replaced by the auto tensioner
  - Esprit was given cross-drilled crankshafts

## 907 2.0L to 911 2.2L

- The first 2.2 engine was the 911 engine for the Lotus Sunbeam. Due to the engine bay and suspension cross member layout in the sunbeam, the sump pan was moved to the front of the engine for the 911.
- Due to the issues with the 907 engine bottom end, the bearing cradle was strengthened and made larger
- The crank was stroked with new pistons to give 2.2 Litres
- Most other parts were carried over from the 907 spec 5 except for carburettor and ignition settings

# 911 to 912 and 911 S2

- After producing the 911 engine, Lotus stretched the 907 to 2.2Litres and called it the 912. These changes were also carried back to the 911 Lotus Sunbeam S2 engine
- The crank was stroked a further 7mm
- New hepolute 2.2 pistons as fitted to the 911
- The cams were changed to 107 cams,
- Valves, springs and caps were changed to the "2.2" style
- The bearing cradle was strengthened with more dowelling and a larger sump fitted with the pan in the same location as the 907
- Mod to improve thrust bearing lubrication
- Solid flywheel was replaced by the flexi-plate flywheel
- Lumention Electronic Ignition

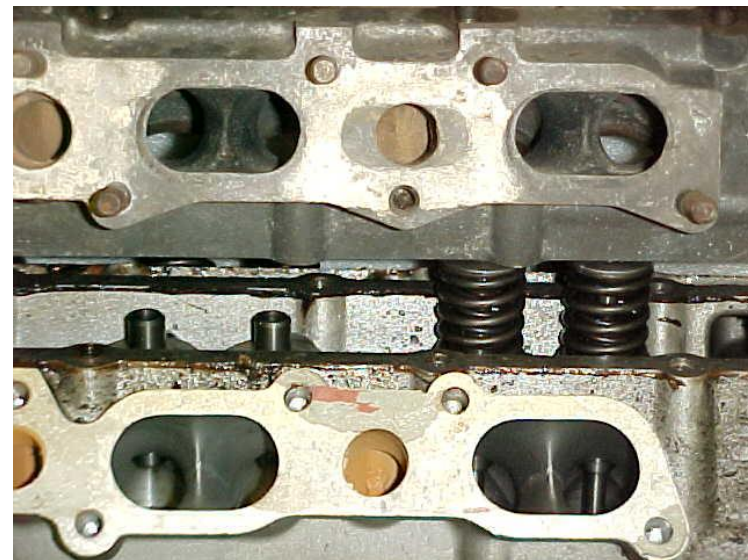


## Lotus improvements to the 912 LC

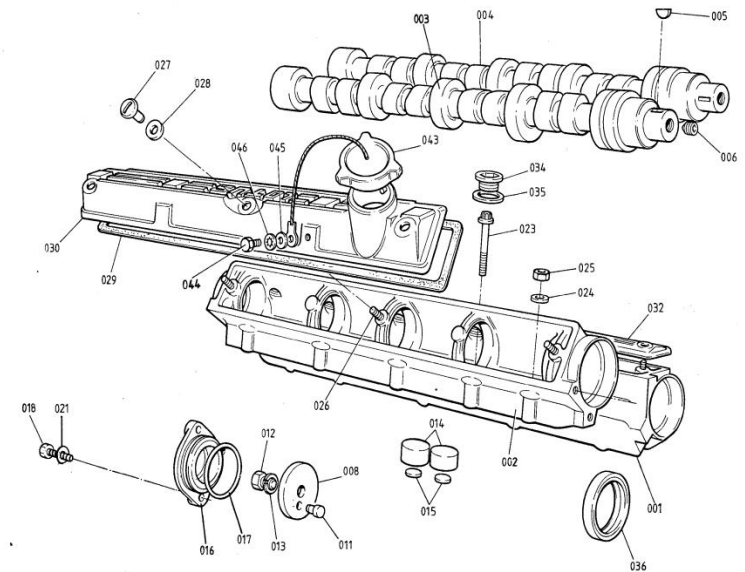
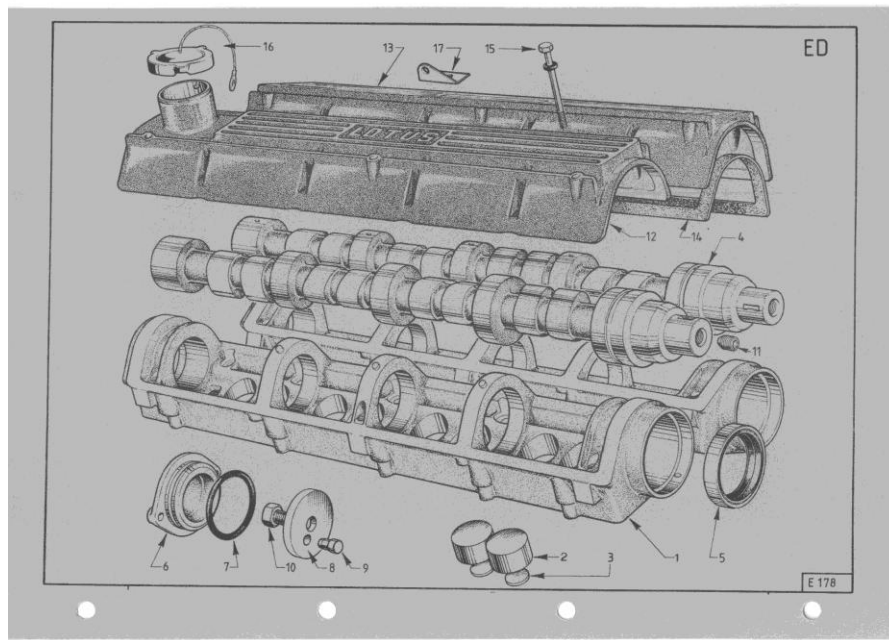
- When the Lotus Excel was launched, Lotus moved to the Lucas AB14 constant energy ignition system, which is much more reliable than the Lumenition system

## 912 LC to 912 High Compression

- For 1986 model year, the 912 engine had a major overhaul increasing the power to 180bhp
- New cam carriers – that did not leak oil!!!
- New inlet cam – 104 inlet – 107 exhaust
- HTD half round cam belt and wheels
- Manual cambelt tensioner
- New forged Mahle pistons – 10.9:1 compression
- Improved alternator mounting
- Power-jet carburettors
- New cylinder head casting – bigger ports
- Improved water circulation to head
- New Exhaust manifold



# Cam Carriers



EXCEL (86 M.Y. Prior to Eng.No 22903)  
4.0.07B

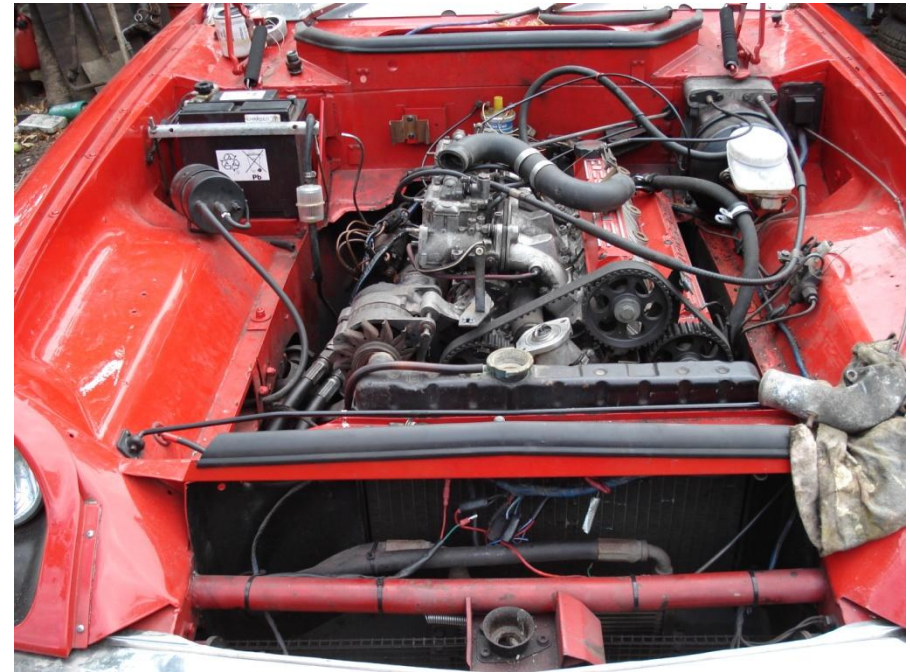
Lotus 910 turbo parts that can be used to improve the 907/912

- Lotus fitted a lighter steel flywheel to the turbo engines – much better for competition use or high revving engines
- Short inlet manifold fitted to LC turbo – some engine tuners swear by them
- Conrod modified with groove to spray oil on back of piston
- Zeus Cylinder head casting



## Improving your engine – first step

- Lotus developed the engine for 20 years. Pretty much all of the changes can be applied back even to 1972 Jensen Healeys. The Lotus parts bin is the easiest place to look for reliable upgrades for early engines. This can take a 140BHP engine to a reliable 180BHP.
- Eg: Any 907 can have the 2.2 HC internals fitted with HC cam carriers etc



## Getting even more power – Step 1 (Starting with the 912HC spec)

- More power can be obtained by getting more air in and out and by safely increasing the revs.
- To get more air in and out of the engine you need to remove the restriction to allow it to breathe better – this restriction can vary from engine to engine and vehicle to vehicle
- Fitting an all singing and dancing fire-breathing engine to a Jensen will have very little effect if the original limiting component was the exhaust!!

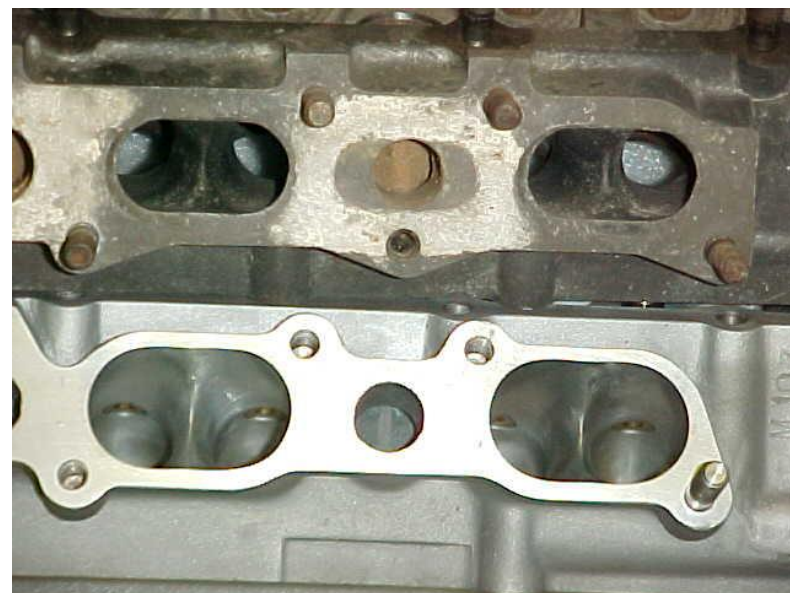
# Getting more power – Step 1

## 200 to 215BHP



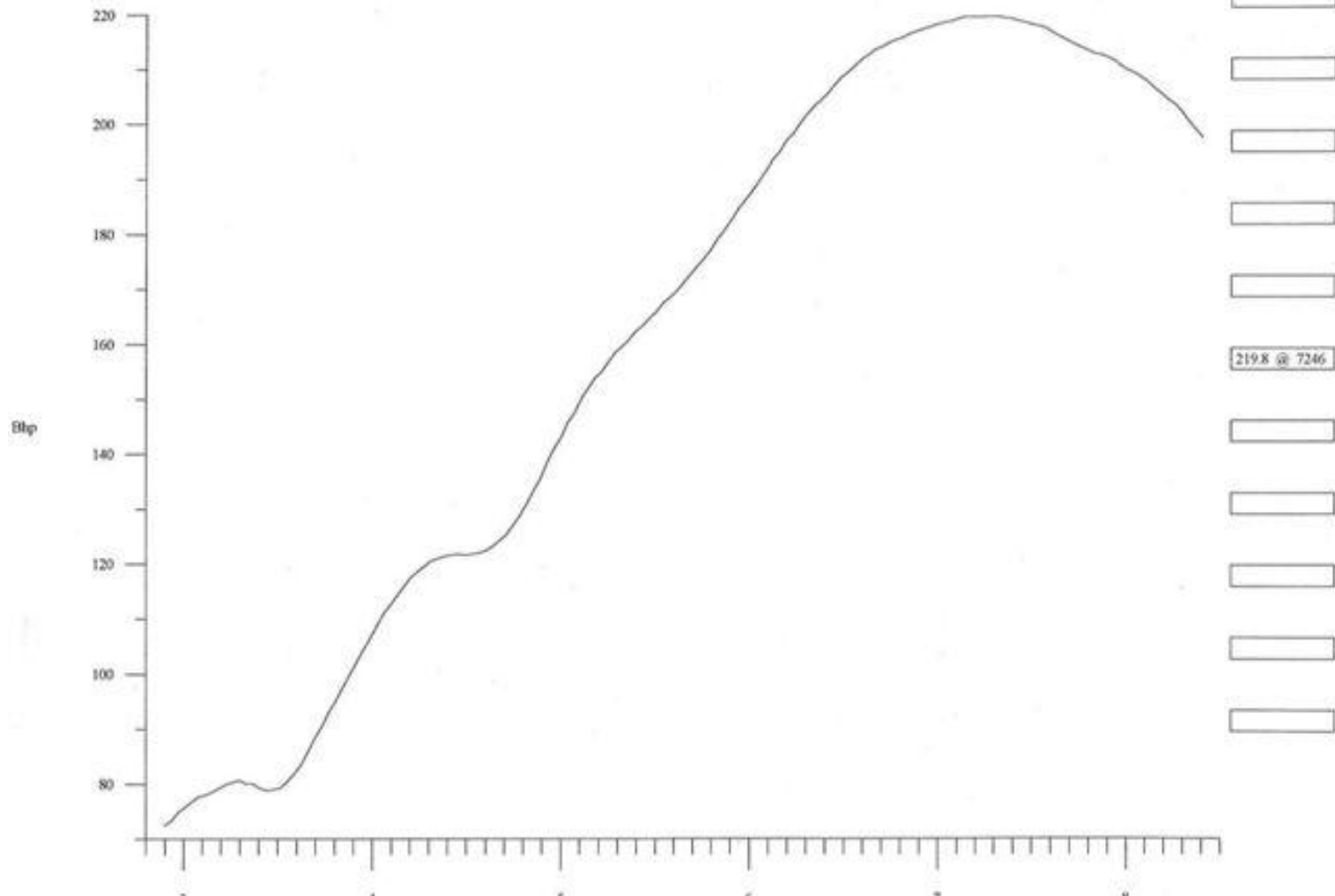
## Getting more power – Step 1 200 to 215BHP

- Well Ported cylinder head and matched inlet manifold
- Pair of 104 or L14 Cams
- Tubular 4-2-1 manifold
- Unrestrictive exhaust system
- You may also want to consider
  - Light Steel flywheel
  - Oil restrictor to the head
  - Steel cam followers
  - Vernier campulleys
  - Fuel injection with 45mm throttle bodies



# Getting more power

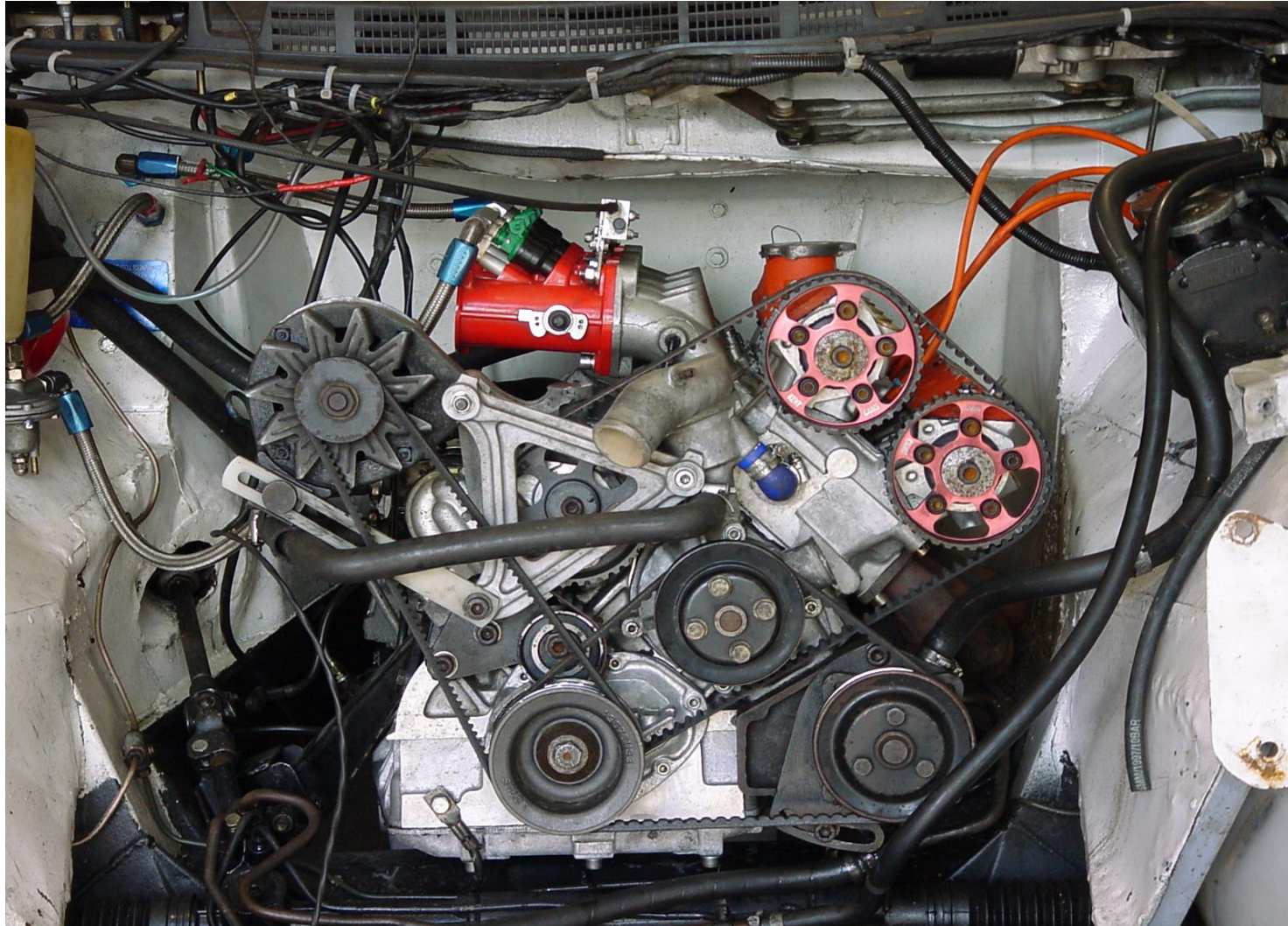
DynoPlot Northampton Motorsport Ltd 01604 766624 WWW.northamptonmotorsport.com





# Getting more power – Step 2

## 215 to 250BHP



# Getting more power – Step 2

## 215 to 250BHP

### ■ As previously plus

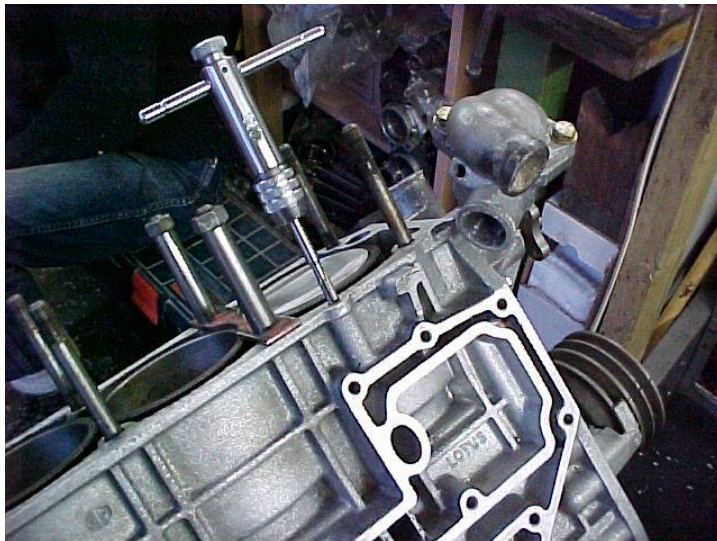
- VERY well ported head and inlet manifold
- Sport 300 inlet valves
- Pair of High lift high duration cams
- Steel followers
- Light High compression pistons (12.5:1)
- Light, balanced steel rods
- High pressure oil pump
- Cross-drilled crankshaft
- Fuel injection and mapped ignition – 48mm throttle bodies
- Steel flywheel

### ■ You may want to consider

- Straight inlet manifold
- Works style inlet manifold
- Short inlet manifold
- Dry sump
- Deeper S4S sump
- Larger water pump and alternator pulleys



# Oil Restrictor





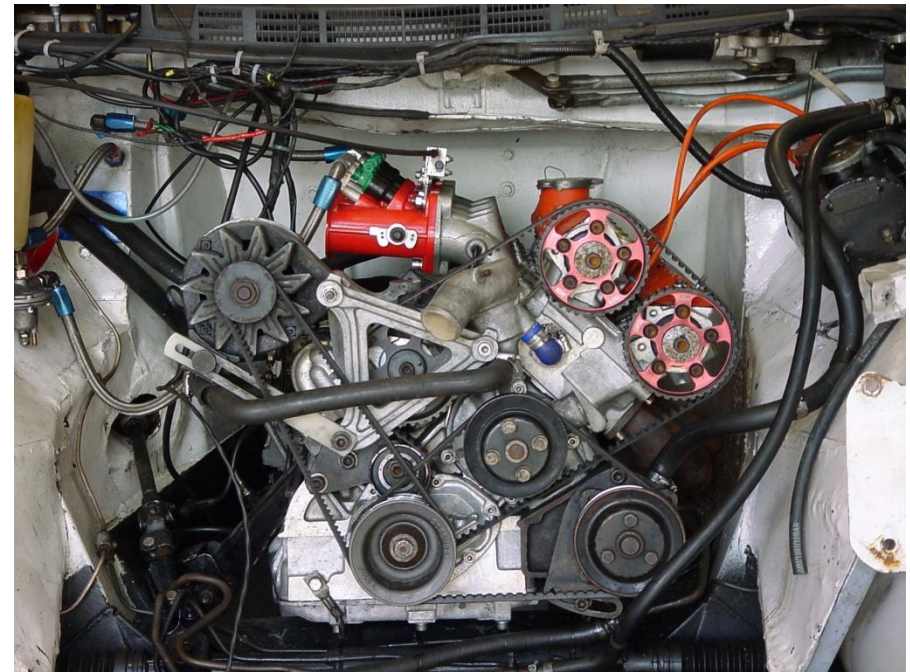
# Fuel Injection

## ■ Benefits

- Better fuel economy
- Better drivability
- Better cold and hot starting
- Smoother progression
- Allow the use of more radical cam profiles
- More reliable
- More tunable

## ■ What fuel injection will not do

- Increase the top end power



# Fuel Injection

## ■ Required components

- ECU and wiring loom
- Throttle bodies, Injectors, Fuel Rail & Linkage
- Fuel pump, Pressure regulator, swirl pot
- Return fuel pipe and fitting to tank
- Sensors
  - Crank position, Air Temp, Coolant Temp
- Toothed wheel or machined flywheel

And Finally for the really power hungry...

- 2.5 Litre conversion
- Lotus stroked the crank from 69mm to 76mm to give 2.2 litres. This can be stretched further to give 2.5 Litre
- As the capacity has increased, the top end air flow needs to be improved again
- 300BHP plus should be achieved



# 2.5 Litre conversion

