

Performance Modifications for the Australian Forester GT MY98-03

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Many of you will own a Forester GT and read MRT's pages with enthusiasm thinking "I wonder what can be done to enhance the performance of my car? I know it's based on the Impreza GC chassis and it has a similar turbo charged engine after all". I like you, also wondered what could be achieved by tweaking the Forester. The answer my fellow enthusiasts, is plenty!

Certainly, modifying the GT is not without limitations. The Forester is not designed to be a pure sports car. If you want a WRX, it's probably best to go out and buy one straight up - their level of original equipment is designed more for speed and handling. The Forester has advantages though is in its load carrying capacity, off-road ability, comfort and refinement. It makes a terrific 'Grand Tourer'!



The Subaru Forester GT uses the same engine (EJ205T) as the WRX, albeit with slightly less aggressive cams and a smaller turbo charger (TF035 as opposed to TD04L in the Rex), designed to produce a lower output engine with mid range power and torque more matched to the designed purpose of this very versatile vehicle. It also rides on higher profile tyres (60 series) and has more suspension travel than the WRX, with a higher overall ride height and centre of gravity, and is a lot less aerodynamic!

This is not to say that the Forester GT cannot be modified to improve its road going prowess and tune it to the owner's specific requirements. Improvements can be made that will enhance not only the power delivery and responsiveness of the engine but also it's handling and braking, bringing it very close to or sometimes better than the overall performance of a stock WRX depending on the extent of the modifications.

The good thing about modifying a Forester is that many enhancements can be made without altering the overall look of the car from stock. We all know that the WRX is a magnet for the police and thieves. Imagine owning a Forester that out-performs a WRX but still looks like a standard Forester, retaining the original versatility of the wagon with some off-road ability too - all without drawing attention to it!

With this in mind, I set about 'enhancing' my Forester. What I've ended up with is a car that is infinitely better suited to my purposes - and I've stuck to my original plans to keep the car looking like a stock Forester from the outside. It is now however much more fun to drive! It will out pace a stock WRX, and both the handling and braking have been improved significantly.

My Forester is my daily driven work car, weekend recreational vehicle and my sports car all rolled into one. Along the enhancement path I had to make certain compromises to achieve the all-round driveability I desired. I sometimes take the Forester off-road, so this necessitated a compromise in the suspension upgrade to ensure there was a minimal reduction in wheel travel. I was also keen to preserve the vehicles reliability and its fuel economy, which meant tuning it accordingly.



Overall, I'm very happy with the result. The Forester is now the car it should be when it leaves Subaru's factory! As your purposes and budget may differ from mine, I've divided the explanation of the modifications I have made into three stages which approximate the order in which I did things.

These stages could be used as guide when deciding in what order to modify your Forester or to what level you want to go. You may not necessarily want to do all the things I did in each stage – see my recommendations at the end for what I'd do again and what I wouldn't.

I believe my enhancements stay on the safe side of what can be done with a Forester in terms of performance and reliability with mostly stock parts. The Forester engine (from what I'm told by the experts) can comfortably handle up to 15 psi of boost producing around 135kws at the wheels. Pushing the power output higher than this will perhaps have a detrimental affect on engine longevity, not to mention the ability of the standard brakes and suspension to keep up.

Of course if you want to make your Forester an all out track weapon or a show car then you can go a lot further than what I have. This might include modifying the internals of the engine - fitting forged pistons, a bigger turbo (the VF28 is a popular upgrade after the TD04), larger intercoolers, bigger fuel injectors, more aggressive cam shafts and more boost, bigger brakes, coil over suspension, body kits, bigger wheels and lower profile tyres, in car entertainment (ICE) – the list is endless. But that's just not what I set out to do - yet!



Stage 1

Summary

- Suspension - 20mm rear sway bar
- Air Intake - Re-Useable flat panel air filter and removal of in-guard resonator
- Exhaust - Centre exhaust pipe from a 99/00 WRX
- Gear Shift - KartBoy short shifter

Suspension – 20mm rear sway bar

The Forester (and indeed all Imprezas including the WRX) is typically setup to understeer when pushed hard through corners, as this thought as being the safest handling option for the average driver by the designers. It also means that the Forester does not corner well at higher speeds and exhibits a lot of body roll - which upsets its stability on the road.

The cornering ability of the Forester can be improved significantly by replacing the tiny 14mm standard rear sway bar with one of a thicker diameter to reduce the understeer and provide a more balanced and neutral handling car. This simple modification is one that you can do yourself with a couple of tools, as the old bar simply unbolts and the new one bolts back on the same way.



This was the first modification that I did, not only because it yielded an instant improvement but also because it was cheap to do! I bought a 20mm bar off a pre MY00 WRX second hand for \$20. All of the early WRXs share the Forester's chassis, so their bars will bolt straight up. Look for one that is at least 19mm in size – they vary across the year models. I'm not exactly sure which year the 20mm one comes off – it may even be an early model STi, but they can be easily measured with a set of vernier callipers.

Another alternative is to go with a new bar from a suspension parts manufacturer like Whiteline. They sell 20, 22, 24 and 20-24mm (adjustable) front and rear bars which would provide a good improvement as well. As the larger bars tend to reduce wheel travel and can

encourage snap oversteer in certain situations (eg. wet weather cornering), I did not go with this option - feeling it was safer to stick to 20mm.

It is also important that you retain the balance between front and rear bar size to ensure neutral handling when upgrading. You do not want a significantly heavier bar on the front than the rear for example, or else you will be promoting understeer again. The Forester has a 20mm bar on the front standard, so a 20mm bar on the rear is perfect in my opinion.

If you have a heavier bar on the rear only (22mm) then your car will oversteer more (or be even more neutral handling) than if you had the same size on the front. Oversteer is generally thought of as being a much less forgiving suspension set up – you get less warning when you are on the verge of losing traction when cornering, so it pays to be mindful of this. At the end of the day, it comes down to personal preference, the conditions in which you drive and your abilities behind the wheel as to which size sway bars will suit your car.

Air Intake - Re-useable flat panel air filter and removal of in-guard resonator

The only change at this early stage I made to the engine was to replace the OEM Air Filter with a re-usable flat panel filter made by Uni Filter, and to remove the air intake resonator that resides in the driver's side front guard.



The resonator is designed to reduce the intake noise as it sits before the air box (first point of entry of air into the engine), and it does this quite effectively. The resonator also restricts the airflow, particularly at higher revs as it is only 75mm in diameter and quite convoluted.

The actual opening into the air box is 90mm in diameter, and good gains in responsiveness and power can be obtained by removing the resonator firstly, and then ultimately fitting a 90mm 'Cold Air Intake' pipe which feeds cool air to the air box from a low point behind the front bumper. This CAI is a modification I did in Stage 2.

Be warned - removing the intake resonator does come with the penalty of extra noise from the intake. Some people like it, some don't – again, its personal preference and whether you want the improvement removing it offers.

Exhaust - Centre exhaust pipe from a 99/00 WRX

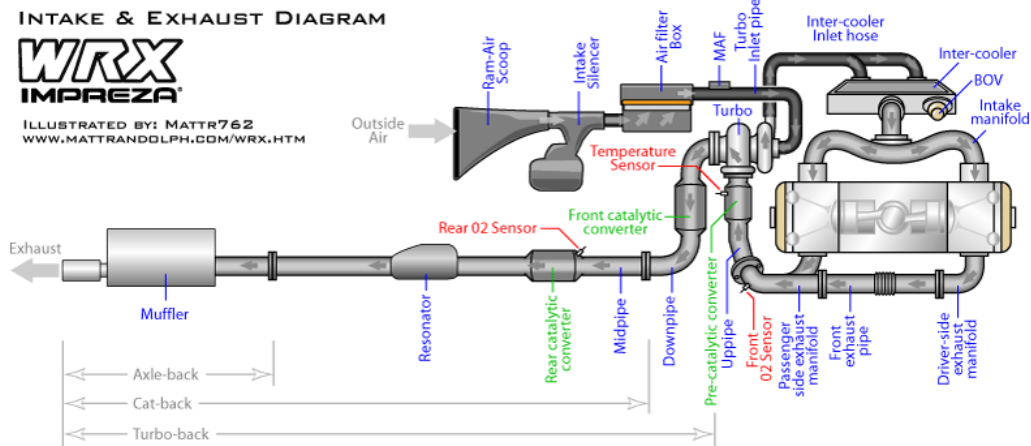
The exhaust on the Forester is comprised of 4 components typically adjoined in this order:-

- 1) The 'Up' pipe – which goes from the exhaust manifold (that comes off the cylinders) to the turbo charger.
- 2) The 'Down' or engine pipe – which goes from the turbo back down to the underside of the car and contains the Catalytic Converter.
- 3) The 'Centre' pipe – this joins onto the down pipe and is in the centre underneath the car.
- 4) The 'Muffler' or diff-back section - this is the last section of the exhaust and joins to the Centre pipe and ends in the tail pipe which protrudes from the rear of the vehicle.

It's useful to know about the different components and where they sit when you are trying to work out what is required for your car, and it also helps when you are talking with other people or receiving their advice - particularly suppliers!

The diagram below illustrates the Forester and WRX exhaust system. The terms mid-pipe and centre pipe are interchangeable for the centre exhaust pipe, as is axle-back and diff back when used to describe the rear section of the exhaust containing the muffler.

The term Cat-back is used to describe the section of the exhaust that includes the centre pipe as well as the rear muffler – ie. from the primary Catalytic Converter in the down pipe back.



One of the best ways to improve the performance of any car is to free up the restrictive factory exhaust. This works particularly well on the early model Foresters as they have an ECU that is more responsive to changes in exhaust (and air intake) than the 01-on Foresters. With the later models you really need to adjust the fuel mixtures via the ECU as well, or else you may even decrease the performance because the car will run overly rich.



The stock Forester (at least the early ones – 98,99,pre 11/00 as I have confirmed) have a restrictor built into the centre exhaust pipe, contained within what looks to be a Catalytic Converter. In fact, the 'cat' is all but an empty shell on these models - with a 20 cent coin sized conical restrictor inside it. As the 99/00 WRX shares the same size and shape centre exhaust pipe section as the Forester GT, it's a simple matter to replace the Forester's centre with the WRX one.

The benefit of doing this is that the WRX one does not have this centre restrictor in it, although it does have a real catalytic converter in there (there are 2 cats on a WRX, one in the down pipe and one in the centre pipe). Whether or not the WRX centre pipe actually flows better than the Forester has not been proven, but it looks as though it should. It depends on how restrictive that Catalytic Converter actually is. The fact that it comes from a WRX that has a higher output from the factory suggests that it is less restrictive though.

The good thing about doing this replacement really comes if you take it one step further – remove the catalytic converter from the WRX exhaust (any exhaust shop should be able to do this), and then bolt it up to the Forester. That way, you have an original looking exhaust, minus restrictor and minus the cat, and still have the Forester's original centre pipe untouched, ready to go back on the car if you ever want to revert back to the original specifications.

If you do remove the cat from the WRX pipe, when it comes to re-programming the ECU using ECUTEK, you will need an ECUTEK Type 1.5 as a minimum. This is because this modification will change how the car comes on boost. If you are using a stock Forester centre pipe Type 1 is fine.

Gear Shift - KartBoy short shifter

Something that is often over looked when enhancing a WRX or GT is the gear shift action – it is typically sloppy and the shifter is designed as a long throw and easy to shift item by the

factory designers. A much improved, short (30-40% less throw) and notchy action is achievable with an aftermarket short shifter installed.

These are available from several manufacturers but most seem to produce items specific for the WRX. The problem with these shifters is that they are usually 2 inches shorter in shaft length than the Forester's one - which means that it just doesn't suit the higher seating position in the Forester.

Luckily, due to demand from the US Forester XT owners, KartBoy has produced a shifter specific for the Forester XT (KB-001-XT) that also fits the GT here in Australia perfectly. These are approximately 1cm shorter in shaft length than the stock one, so maintain the height at which the gear knob sits relative to your elbow height. I'm really impressed with the way mine works in the GT.



There will be a marginal amount more noise transmitted to the cabin because the KartBoy shifter does not have the rubber cushioning in the shaft that the Subaru one does, but really this is barely noticeable and the advantages of the short shift far outweigh the small increase in NVH.

KartBoy also make shifter bushings that replace the factory ones where the shifter mechanism mounts to the gearbox under the car, but these make only a very small improvement in shift action relative to the amount of noise transmitted to the cabin with them in place. You can certainly hear the gearbox whine more loudly. I fitted them and then took them off my car again, due to the extra cabin noise.

The KartBoy shifters are easy to install with a couple of tools, and the shorter, less sloppy shift action certainly makes changing gears much nicer. Highly recommended! These are available from www.kastleskornet.com via airfreight from the USA.

Stage 2

Summary

- Suspension - Heavy duty sway bar links and mounts
- Exhaust – MRT 3 inch cat back system
- ECU – ECUTEK version 1.5
- Blow Off Valve – Boost control disabled
- Brakes – DBA slotted rotors, Formula Ferodo pads and MRT brake bracket
- Air Intake – Cold air intake duct
- Gauges – Auto Meter boost gauge

Suspension – Heavy duty sway bar links and mounts

Fitting heavy duty sway bar links to replace the flimsy stock plastic items, and also heavy duty sway bar mounts on the rear of the Forester further enhance the on-road handling at the expense of a marginal amount of off-road wheel travel.

The sway bar links serve to make the action of the sway bar more linear, as with the plastic links, upon cornering, you experience two rates of sway reduction. The first is the rate of the plastic link's elasticity, and the second the action of the steel sway bar. By stiffening up the link point, the rate of the sway bar is the one now



acting to reduce body roll. This provides a more direct and positive feel on the road when cornering.

The heavy duty sway bar mounts are what holds the bar to the rear chassis, and there have been reports of these failing under high cornering loads. I replaced these just because I thought it was good insurance, especially as the sway bar can be subjected to all sorts of forces when driving off-road over uneven surfaces.

With the increase in Power that Stage 2 brought to my car, improving the handling was important to enhance its control. This addition has been a very worthwhile investment in my mind at only \$300 and would be good even on a stock Forester with no other modifications except a heavier sway bar on the rear.

Exhaust – MRT 3 inch cat back system

At Stage 2, I replaced the stock centre pipe and rear muffler with an MRT 3 inch stainless steel exhaust. This is commonly known as a 'cat back' system because it goes from the catalytic converter (which is in the factory down/engine pipe in the Forester) back to the rear of the car. This exhaust replaces the restrictive centre exhaust pipe (either the original Forester one or the WRX fitted in Stage 1) and rear muffler.

Improvements in the exhaust note are immediately apparent (you now get the nice 'boxer rumble'), without it being too loud or droning in the cabin. I installed MRT's oval muffler especially built for the Forester as it has a longer exhaust tip that extends to level with the back bumper (a legal requirement). Many WRX specific rear mufflers are too short at the exhaust tip.



The MRT muffler also seems to fit very nicely into the space that exists to accommodate the muffler – there is an improvement in ground clearance over the stock muffler (a bonus off-road), and it is almost visually undetectable to the uninitiated, meaning it won't draw undue attention to your car – I liked this added bonus.

Note: You may recall the 'up pipe' component of the exhaust that fits between the exhaust manifold coming from the cylinders and feeds into the Turbo charger. On the later models of Forester (01-on) the up-pipe contains a catalytic converter which is a restriction that robs power. Best bet is to replace it with a pipe from a 99/00 WRX without the Catalytic Converter or an aftermarket pipe such as the one MRT supply.

The earlier model Foresters don't have the catalytic converter in their Up pipe, so no problem if you have the early model like me – it saves you the hassle of replacing it, and the expense.

ECU – EcuTeK version 1.5

Alterations to the boost pressure, air/fuel ratios and other parameters to increase the output of the engine are most reliably done using either an aftermarket plug-in ECU upgrade or by re-programming the stock Subaru ECU using software specially designed for this purpose.

There are several manufacturers that produce an after-market ECU upgrade and two of the most popular for the Forester are EcuTeK and Unichip. EcuTeK is generally thought of as being the more advanced because you can manipulate the original ECU directly.

MRT Performance in Sydney is the Australian agent for the EcuTeK software that allows the factory Subaru ECU to be re-programmed to enhance its performance.



After careful consideration of all the options to increase the power and driveability of the Forester, I decided to go with the EcuTeK upgrade for several reasons:

1. No extra ECU to wire into the car - you can't tell the EcuTeK has been done visually.
2. Greater flexibility in the re-programming when compared to other systems - more parameters can be adjusted to obtain a better tune.
3. Cold start and other ECU functions remain unchanged – no problems running all the other electronics and systems in the car.
4. Pre-programmed and fine tuned levels available for 'plug n play' installation - no dyno time required for the lower levels.
5. One of the most experienced teams in Australia is responsible for the tuning supplied - they have done more cars of the same type than any other team.

MRT offer 4 levels of tune, Type 1, 1.5, 2 and 3. More information is available on each level on their web site, but basically, Type 1 is suited to unmodified cars and cars with very minor modifications, 1.5 for cars with slight modifications but more than Type 1, 2 for cars with significant modifications and 3 is a custom tune performed on a dyno (a machine to measure the engine output and parameters whilst tuning) and can be tuned to your preference.

Correspondingly, each comes with its own price, increasing as you go up the scale – representative of the time it takes to develop the tune that corresponds to each of the 'maps'. More work goes into tuning a car with more modifications so that it can make best use of them. The most work goes into performing a Type 3 (or custom tune).

I upgraded my Forester at this point with a Type 1.5 tune. This was because the Type 1 tune is only suitable for cars with minor exhaust modifications ie. rear muffler only. As I planned on putting on a cat back (centre and rear muffler) system on my car I had to go with the next level of tune up from a Type 1 - the Type 1.5 - if I wanted a pre-tested tune 'plug n play' tune.

The results of the EcuTeK tune have been very worthwhile, the car has approximately 30% more power than it had before, and the improvement in low down torque and responsiveness of the engine is amazing. It feels like a totally different engine has been supplanted into the Forester! It's a much quicker car off the line and you can get away with a lower gear than what normally would be required in many situations – it's got that much more torque.

In hindsight, I would have done this stage slightly differently however if I knew then what I know now! The EcuTeK really makes the most of the stock Forester's engine, so much so that it really works the little TF035 turbo hard. Boost pressure has been increased from the factory stock 6psi to somewhere around 12-13psi in the Type 1.5 tune. Whilst this in no way affects the reliability of the turbo, it does make it much more noticeable that you are driving a turbo charged car - you can really feel the difference between on boost and off boost now.



The small TF035 turbo comes onto boost very early. By 2200rpm the turbo is delivering almost full boost, and this makes the car a little more challenging to drive. Don't get me wrong, the performance is outstanding, but if you are driving every day in heavy traffic with a lot of stop start motoring, it could get wearing after a while.

The issue is that the boost comes on with a rush now whereas before it was more a gradual rise, and not to as high a level ultimately. If you don't keep the revs low (<2500) when driving in traffic, you tend to experience this rush of acceleration as the turbo spools up, which can sometimes catch you by surprise. The car just needs more input from the driver, and I believe this gets tiring in certain situations.

Going by my experience with EcuTeK so far, I would only recommend you only get a Type 1 tune done if you intend keeping the stock TF035 turbo and if your car is a daily driver. The Type 1 has marginally less boost than the 1.5, and if you stick at this level, the effects of the early spool up would be a little less noticeable I expect.

The early spool up is less of a problem if you change the turbo to the WRX's TD04L, as it spools later in the rev range due to its larger size. After fitting one of these turbos in Stage 3, I'll be upgrading my level of EcuTeK to Type 2 to take advantage of it. From all the reports I get, the TD04L is very well matched to the Forester's engine, with its emphasis on producing mid-range torque and power and improves its driveability immensely.

As previously mentioned, with a Type 1 tune you are limited to installing a 3inch diff-back muffler only (if you want the boxer rumble!), and not a 3 inch centre pipe as well. Installing the 3 inch centre will only enhance the extremely early boost you are trying to avoid, because of the reduced back pressure in the exhaust this would give. It's a good thing you are not advised to use a 3 inch centre pipe by MRT with the EcuTeK Type 1 tune then!

You will be extremely pleased with the result of the EcuTeK Type 1 update - just leave anything above this level until you change the turbo as well, or alternatively, get a custom tune done (Type 3). The EcuTeK Type 1 would definitely be worth doing on a totally stock car, and would also be useful if you were doing a lot of towing, fully laden touring or off-road work. Whether you have an auto or a manual – the benefits are still the same. The extra power certainly comes in handy when overtaking on the open road, and as an added bonus, fuel economy is improved because the air/fuel ratios are optimised.

Blow Off Valve – Boost control disabled

The BOV serves to release the boost pressure between gear changes when you come off the throttle to prevent air being forced back into the turbo which could damage it. It is typically mounted to the front of the Intercooler on the Forester GT and the excess air is vented back into the engine rather than the atmosphere (as is commonly the case with some after-market blow off valves that make a 'whoosh' sound – I'm sure you've all heard one before).

There was a slight modification made to the vacuum piping leading into the BOV at this stage to disable the boost regulation that occurs at the BOV. This is not relevant to the later model (01-03) Forester GT's as they don't have this particular type of BOV that limits boost.

On the early model Foresters (98, 99, pre 11/00) Subaru installed a 2 chamber BOV, which is designed to prevent over-boosting. Manifold pressure is equalised between the rear chamber and the Intercooler side (inside of the BOV), which essentially means the spring pressure of the BOV is all that keeps it shut. This spring pressure is enough to keep the valve shut until around 8-10psi boost is reached (standard boost level is closer to 6psi), so without any boost changes, it won't have any affect.

Where it does have an effect is when you up the boost over 8-10psi ie. when you have an EcuTeK map installed in the ECU, or if you are using a manual boost controller of some description. The stock BOV system regulates the boost back down, effectively removing the boost that you thought you were adding! Obviously some changes have to be made to allow you to run the boost you want.

The easiest way to do this is to block the small pipe (C-D in the picture) with a ball bearing or sawn-off bolt and then replace the pipe. The setup then looks entirely stock, and no one needs to know any changes have been made. Boost pressure will no longer be fed to the rear port on the BOV, and therefore the valve will not open because pressure will always be greater inside the valve (Intercooler side) under boost. When a vacuum is produced in the intake manifold (off throttle) the valve is then triggered to open via the line that connects it directly to the manifold.



Another option is to fit a Blow off Valve from a 99/00 WRX (they bolt straight on) and eliminate the pipe that runs to the Boost Control Vent and I ended up doing this at this time. A couple of straight through connectors are required in this instance to replace the T-piece in the Manifold Pressure pipe (runs from intake manifold directly to end of the BOV), and also the T piece in the Boost Control Vent pipe on the drivers side of the manifold. This therefore isolates the pipe that runs to the secondary port on the BOV and it can be removed from the car. The third option is to install an aftermarket BOV such as one from a manufacturer like Go Fast Bits (GFB). See Stage 3 for details on this!

Brakes – DBA slotted rotors, Formula Ferodo pads and MRT brake bracket

The Forester's brakes have never been its strong point, and with the added power the EcuTeK brings, it's even more apparent that they need to be upgraded!

A quite simple, street legal, upgrade is to fit some new slotted rotors and some better quality pads that have more 'bite' and that will work at higher temperatures – producing less 'fade' under hard braking. It's also a good idea to replace the standard DOT 3 factory brake fluid with DOT 4 Fluid at the same time, as DOT 4 is more resistant to boiling. This isn't absolutely essential though, it depends a lot on whether you are actually going to be using your brakes hard enough to get them that hot.

Disc Brakes Australia sells heavy duty slotted rotors in the size for the front and rear for the Forester. The advantages of slotted rotors are several if you believe the advertising propaganda. All I can say is that the braking on my Forester is vastly improved over stock with these rotors and with new pads installed.



The slots on the rotors are supposed to de-glaze the pads, keep them cooler and allow gases and dirt to escape from between the disk and the pad surface meaning that the pads have better contact with the disc. A worthwhile investment in my opinion – especially if you've done more than 75000k's on the stock rotors – they are probably due for replacement anyway.

When looking at replacing pads, I read all the reviews and the posts on the forums and singled out a few different pads suitable for my purposes. These were the Formula Ferodo TS2000, Ferodo DS2500, RaceBrakes RB74, RaceBrakes Comp 2, Bendix Ultimate, and Bendix 4WD. The DS2500 and the RB74 are a track/street pad, the TS2000 and Comp 2 are sold as a street pad that can handle some light track work, whereas the Bendix are all strictly street ONLY pads. The Bendix pads can be dangerous to use on the track as front pads – so don't do it unless you want to damage your rotors and have no stopping power!

As I do 95% of my driving on the street, but intended to go on the odd driver training day with my car which would involve some light track work, I narrowed my choice to the Formula Ferodo or RB74 for the front - as these seemed to offer the best compromise having high temperature fade resistance, a reasonable price tag (a lot less than the DS2500) and easy availability.

As previously mentioned, you often see that the Bendix Ultimate pads are fine for the street, but they are strictly NOT for use on the track, and that's why I stayed clear of those even though they are a similar price to the Formulas. If I was only driving on the street, I probably would have gone with the Bendix 4WD's all around, because at half the price of the Formulas, RB74's and Ultimates - they are good value for a robust street pad.

I fitted the Formulas first, but they tended to exhibit some fade if you got them really hot and they created a lot of dust. As I wasn't entirely happy with them, I then fitted the RB74 and I can report that these are a definite improvement – better fade resistance and a lot less dust!



The front pads are by far the most critical for braking – as up to 90% of the stopping power of your brakes is afforded by the front brakes on a Forester. Therefore, it is less critical which pads are used on the rears if you are not doing a lot of track work.

As I was using quite aggressive pads now on the front, it made sense to me to fit something with a high co-efficient of friction so that the braking bias front-rear was maintained. The RB Comp 2 were selected on advice from the guys at Race Brakes - as the RB74 and the Comp 2 are well matched together for street and occasional track use on a Forester GT (or WRX).

A brake master cylinder support bracket is also a worthwhile investment for the Forester and markedly improves the pedal feel of the brakes. This bracket bolts to the side wall of the engine bay and supports the Master Cylinder, allowing less flex at the firewall when pressure is applied to the brake pedal.



The master cylinder now exerts more force rearward against the pedal pressure thus improving the pedal feel. In effect, the pedal sinks less towards the floor when the brakes are applied because the flex in the firewall is counteracted.

Brake support brackets are available from MRT and are easy to install yourself.

Air Intake – Cold air intake



As I'd already removed the air box resonator from the drivers side guard in Stage 1, the natural progression was to install a cold air intake duct which would draw cool air from low down behind the front bumper. Cooler air (as opposed to the warm air from the engine bay) is fed into the engine and this theoretically improves the performance of the engine due to the fact a cold air mass is more dense than a warm air mass and consequently more fuel can be burned for the same volume of air.

There is some debate over whether the Cold Air Intake actually makes a difference to the performance of a turbo charged engine however, because all of the intake air is passing through the turbo charger (where it is compressed and heated) and then through the intercooler into the intake manifold. Whether the original ambient temperature of the air has any effect on reducing the intake air temperature when it finally reaches the manifold is anyone's guess! A normally aspirated engine would certainly benefit though because the air travels via a much more direct path straight into the intake manifold.

The CAI does have some other benefits besides delivering cooler air to the intake. It serves to significantly quieten the intake noise of the open air box with the resonator removed, and it also aids in directing more air with a less turbulent air flow into air intake which aids performance. In my experience they do make a noticeable difference to engine responsiveness and power output higher in the rev range – mine is here to stay!

A CAI duct can be purchased from a variety of suppliers, although it is a relatively straight forward job to make one out of a 25mm long length of 90mm diameter storm water pipe and four 45 degree male/female pipe bends (2 at each end, with the ends at right angles to each other) all stuck together with plastic cement.



This will fit perfectly into the opening in the Forester's air box (with the rubber seal removed), and can be secured in place using a couple of cable ties attaching it to the guard support. If you paint it black with some spray paint it's unnoticeable when viewed through the hole left by the removal of the resonator in the engine bay. People tell me there is a plug made by Subaru to fit into the hole in the engine bay, but I have not been able to find one that fits the Forester the only one I know of is for the Liberty and that one doesn't fit!

One thing to be careful of with a CAI is driving in floodwaters or creek crossings. There is a chance if the water is deep enough, that it will be sucked up into the air intake system and cause damage to the engine. If these conditions are to be experienced, it's probably advisable to steer clear of a CAI, or fit a much shorter one than would normally be used.

Gauges – Auto Meter boost gauge

To monitor the increased boost pressure now programmed into the ECU, an Auto Meter brand boost gauge was fitted in the cabin. Apart from the obvious 'bling' factor, the boost gauge is a useful tool on a turbo charged car so that you can make sure that the turbo charger and associated plumbing is in good operational order. Its important from a performance perspective that the car is not running on less boost than it should, and from an engine longevity point of view that its not running more.

Some of the guess work is taken out of boost control by using EcuTeK, as the boost level is programmed into the ECU. Boost is more difficult to tune reliably if you are using a manual boost controller plumbed into the boost control system of the engine. It would be absolutely essential to run a boost gauge with a manual boost controller so you know when you've dialled in the correct boost level.



The Auto Meter boost gauge is a mechanical gauge that relies on a pressure line fed to it from the intake manifold. Essentially it is reading the manifold pressure at any given time and all that is required is to connect the nylon tubing to the manifold vacuum that runs from the intake manifold to the blow off valve.



Conveniently, I had a blue T piece that came off the vacuum line when I removed the Forester BOV and replaced it with a WRX one. The branch off this T-piece is the perfect internal diameter to insert the nylon pressure line into.

Once the pressure line is connected, you need to run this back through the firewall to the back of the instrument console. I mounted the Auto Meter gauge just behind the steering wheel on the left hand side, attaching it with the screw supplied in the kit. One small hole was required to be drilled in the plastic surround it is mounted onto.

The electrics for the light in the gauge can be connected to the cigarette lighter power which is accessed by removing the fascia surrounding the stereo and air conditioning controls. Don't worry too much if you can't get the light to dim with the dimmer control on the indicator stalk. The gauge light is less bright at maximum intensity than the other gauges on the instrument panel anyway.

Stage 3

Summary

- Exhaust – MRT 3 inch down pipe with waste gate splitter
- Turbo – TD04L turbo from a WRX
- Fuel Pump – 400hp Walbro fuel pump
- ECU – EcuTeK Type 2
- Intercooler – Samco Sport silicon Y pipe and Intercooler Tilt
- BOV – GFB plumb back BOV
- Redline shock proof gearbox and differential oil

Exhaust – MRT 3 inch down pipe with waste gate splitter

To complete the full 3 inch turbo back exhaust on my GT, an MRT down pipe was fitted at the time the new turbo went on. It was convenient to do at this time because the factory one had to be unbolted from the turbo anyway!

Substantial gains in performance can be gained through fitting an aftermarket down pipe. The MRT one incorporates a high flow catalytic converter (for legal emissions control), which replaces the factory restrictive one, and also has a special splitter flange where it bolts onto the turbo.

The splitter in the flange separates exhaust gases from those of the turbo wastegate, reducing turbulence and enhancing evacuation of the exhaust gases, which ultimately aids turbo spool up and hence performance. Its important to remember that the TD04L turbo is a 'laggier' turbo than the original TF035, and therefore any changes that keep this lag to a minimum are worthwhile.

All of the exhaust components I've sourced from MRT have been well made and have fitted perfectly together even though they weren't all obtained at the same time. The overall performance of the exhaust is excellent, it is not too noisy and there is no drone in the cabin at cruising speeds. As you'd expect, it is louder than the stock one!

I'd recommend the down pipe with the catalytic converter in it, the centre pipe with the resonator, and the oval muffler on the GT - to keep the noise to a minimum. Any excess noise will echo in the GT's wagon body more than it would in a WRX sedan.



It's a good idea to put the cat in the down pipe instead of in the centre pipe - as it heats to operating temperature more quickly which is better for emissions reasons. If it was under the car in the centre pipe, it could also potentially ignite a grass fire off-road or be damaged by hitting an object.

Turbo – TD04L turbo from a WRX

The WRX from 99-present ships with the Mitsubishi TD04L turbo as standard, and this turbo proves to be an excellent match for the EJ205T engine. It differs to the standard turbo on the GT (TF035) in that it is larger, and will produce boost a little later in the rev range (2500 and up generally), and can maintain consistent boost levels through to around 5500 rpm. This means the engine will be able to produce more power and torque, as TD04L turbo can move

a larger volume of air than the TF035 at the same or greater pressure with greater efficiency at high RPM and higher boost levels.

The torque curve of the engine with the TD04L is shifted slightly higher in the rev range as well with the TD04L, although the GT's engine still produces more torque lower in the rev range than the WRX with the same turbo due to other design factors such as the cam profile used.



So well is the TD04L turbo matched to the GT - it is at its maximum efficiency at the same point the engine's cam profile is designed to produce its maximum power. This means that the GT with the TD04L turbo is a very 'streetable' car – driveability is excellent! It has good low down torque still and a lot more top end than it did with the TF035 installed. My GT is certainly better to drive since fitting it.

The TD04L turbo bolts straight up to the same flanges and mounting points as the stock turbo, so there are no problems installing it. The only slight modification required is to one edge of the original heat shield to make it fit perfectly. Once the turbo is installed, you cannot tell that it's not the stock one on there, they look that similar externally.

Fuel Pump – 400hp Walbro fuel pump

To support the increased fuel delivery requirements that the use of the TD04L turbo and ECUTEK 2 upgrade will bring, MRT recommended a new up-rated fuel pump be installed. This is an in-tank fuel pump that replaces the existing unit.

It is important to deliver enough fuel to the engine to prevent fuel mixture leaning at high rpm/high boost applications. Leaning issues can potentially cause engine damage through heat damage to the pistons. Piston number 2 in the WRX and GT engine is particularly susceptible to this due to the design of the fuel delivery system.

The stock fuel pump typically runs at 90-95% capacity with the TD04L turbo and ECUTEK 2 installed at high RPM, so fitting the up-rated fuel pump provides an extra measure of safety. It's really just good insurance to guard against engine damage.

One thing to note when fitting an aftermarket fuel pump is that you should use the bag on the bottom of the factory fuel pump. This is to avoid surging issues when throwing the car around corners with the fuel level under $\frac{1}{4}$ of a tank. The factory bag allows fuel to be picked up reliably when the fuel level is low because it is bigger than the Walbro one I'm told.



ECU – ECUTEK Type 2

To make the most of the upgraded turbo, the ECU was re-flashed again to install the ECUTEK Type 2 base map. Like the Type 1.5 this is a pre-optimised map developed over time on several different vehicles to provide a safe level of enhanced tune. The ability of the Subaru to learn and adjust to small variations between vehicles means that there is no problem running a pre-tuned map such as this – after all, the original Subaru base map is just that.

MRT has developed the Type 2 tune for a certain level of modification that includes all the items that I have done in this stage or previously ie. full 3 inch turbo back exhaust, flat panel filter, cold air intake, upgraded fuel pump, and TD04L turbo. Sticking with MRT's recommended components guarantees a good base level tune as these were used in the development of the Type 2 ECUTEK map. However, it is not absolutely essential to buy all MRT's components, as there is a level of tolerance built into the map that allows it to accommodate the slight variations between different manufacturer's items.

In the Type 2 map, the boost pressure has been increased to 15-16psi, as the TD04L is able to efficiently run this level of boost higher in the rev range than the TF035. Hence there are also changes to the way this boost is delivered, and the air/fuel ratios are also altered.

The ECUTeK software is not limited to just adjusting boost and fuelling though like some other manufacturer's ECU upgrades. Other parameters that can be manipulated include open and closed loop settings, advance multiplier settings, timing, rpm and speed limiters and other boost and waste gate settings.

To get the ECUTeK update installed, I sent my ECU to MRT in Sydney via courier after removing it myself because at the time, there was no local ECUTeK tuner that could update a pre-01 ECU. MRT flashed it and returned it the same day to arrive the next morning. All you need to do is include with it some details on the model and build date of your car (month and year), fuel type used (eg. BP Ultimate 98 RON) and modification details (eg. full 3 inch exhaust, TD04L turbo).

The ECU resides behind a kick panel near the front firewall on the passenger's side. To remove it, first make sure the battery is disconnected (remove the negative terminal) then peel back the carpet to expose the kick panel. Remove the kick panel and then the ECU, unplugging the 3 leads that attach it to the wiring harness. The ECU is protected inside an aluminium case, so there is little risk of any static damage occurring. Replacement is the reverse of the removal procedure.



Once installed, the ECUTeK Type 2 map feels spot on with the new turbo! There is ample low down torque, and full boost is delivered from 3000 rpm almost to redline. The power delivery is much smoother than it was with the ECUTeK Type 1.5 map and small turbo installed.

Intercooler – Samco Sport silicon Y pipe and intercooler tilt

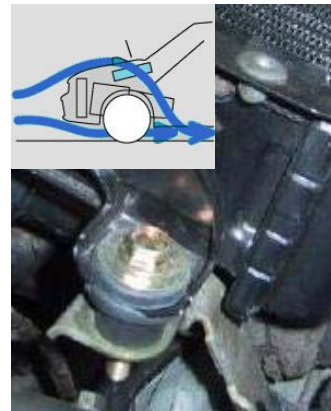
The standard Forester intercooler inlet pipe is a convoluted item that restricts airflow to the intercooler and there are also questions over whether it is suitable to run the higher boost levels the ECUTeK 2 and TD04L turbo run - as there have been some reports of them splitting under high boost applications.



As a precaution against failure and for the extra performance (ok, and because the blue silicon pipes look cool!) I replaced the one on my GT with a Samco Sport silicon hose kit that includes the intercooler Y pipe, inlet manifold pipe and blow off valve pipe. Since I had to remove the intercooler to change the turbo anyway, it seemed an opportune time to do this during this stage.

I also added some spacers to the intercooler mounts to tilt the intercooler up at the rear before putting the intercooler back on. It has been proven that the post intercooler intake temps are reduced by up to 8 degrees by doing this, which improves performance as lower temperatures means the intake air is denser. The cooling effect is attributable to the increased airflow through the intercooler because of the tilt.

To make an intercooler tilt kit you will need two 8mm x 45mm long x 1.25 thread bolts plus two aluminium spacers cut out of 15-20mm diameter aluminium tube. The driver's side spacer should be 13mm in length and the other 21mm. Its then a simple matter to bolt the intercooler back on with the spacers underneath the original rubber washers.



BOV – GFB plumb back blow off valve

The BOV is there to vent high boost pressure in the intercooler at full idle throttle (between gear changes for example) to prevent turbo backspin. To finish this stage of enhancements, a Go Fast Bits BOV was fitted to the GT. Besides good looks (and the whoosh noise if you want it) there are some performance benefits to be had by fitting an aftermarket one.



GFB makes a number of different types of BOV, from full atmosphere venting to part venting and to the full plumb back model. I wanted to keep the GT as quiet as possible, so opted for the silent operation of the GFB Plumbback valve. This BOV vents all the released air back into the air intake rather than to the atmosphere and therefore it doesn't make any noise.

If you are looking at an atmosphere venting valve, then it is advisable to get one that partially plumbs back some air. Cars equipped with Mass Airflow sensors (MAF) will run rich and there may be some backfiring in the exhaust if all the air is vented external to the intake system.

The advantage of the GFB BOV over the factory one is that it allows boost to be created more quickly, which enhances the responsiveness of the engine. A typical GFB BOV remains closed at negative manifold vacuum pressure when there is no boost pressure in the intercooler - unlike the factory valve. This means that boost pressure is not being lost out the open BOV.

The factory valve only relies on one signal to open and that is manifold vacuum. This means that when there is a partial vacuum in the intake manifold (often at normal cruising throttle) the factory BOV is wide open. When you apply the throttle, there is some delay before the idle vacuum decreases enough (to near atmospheric pressure) to close the valve. It is only after the valve closes that real intercooler boost pressure can be maintained and built upon.

The typical GFB BOV (Basic, Hybrid, Stealth etc) differs in that it needs two signals to open, manifold vacuum and boost pressure. You need full idle vacuum in the manifold and boost pressure in the intercooler to help push the valve open. With the Plumbback, it is slightly open at full idle vacuum, but shuts the instant manifold vacuum moves from full idle vacuum towards positive pressure – much sooner than the factory one would close.

The Plumbback valve is easy to fit, but requires an adapter flange that bolts onto the intercooler where the factory valve attaches. GFB makes these adapter flanges, and the valve then just slots onto the end of it. An internal o-ring seal makes it air tight, and a couple of screws are used to secure it. The intake manifold vacuum line is then attached directly to the end of the valve, and the plumb back pipe to the 30mm port on the side.

Redline shockproof gear and differential oil

Based on the recommendations of many of the WRX driving fraternity, Red Line's Lightweight Shockproof gearbox and differential oil was put into the GT's manual transmission and rear differential. This is a fully synthetic oil that offers superior protection to enhance gearbox and differential life in vehicles that are driven harder than average.

Since installing the Red Line oil, I've also noticed that gear shifting is much smoother, which is undoubtedly due to the friction reducing properties of this synthetic formula. There is less gearbox and differential noise than before too.

Impressions

My Forester GT is now an amazing car to drive after Stage 3! Its acceleration is really strong on boost all the way to redline, yet it is much nicer to drive slowly in traffic because of the improved torque, and because boost does not come on as early as it did in Stage 2.

It has all the sounds you would expect of a performance Subaru - a nice subdued boxer rumble at idle which is virtually unnoticeable, with a growling intake noise and exhaust bark when you stomp on the loud pedal! At cruising speeds the exhaust is barely audible and there is certainly no drone, a testament to the MRT exhaust.

I'm really happy with my GT after completing Stage 3. No other vehicle will do as much as the Forester GT will, as well as it will. It's a quick and comfortable tourer, carries all the gear that you want to carry, is a fun car to drive at the track, and still goes off-road as well as it did before any of the changes. Overall it's been a very successful project!

Parts list Forester GT MY00

- 20mm WRX Subaru rear sway bar (equivalent Whiteline 20mm bar p/n BSR20)
- Whiteline heavy duty swaybar mounts with 20mm bushings p/n KBR30-20
- Whiteline spring steel swaybar links front p/n KLC20A MRT p/n MUSS126
- Whiteline spring steel swaybar links rear p/n KLC19 MRT p/n MUSS127
- KartBoy Short Shifter KB-001-XT
- MRT down pipe with catalytic converter p/n MUSSE033SBJ (will fit auto and manual car)
- MRT centre pipe with resonator p/n SUWE032TDJA (will fit auto and manual car)
- MRT oval muffler for Forester GT/XT p/n SUFE031TA
- MRT flange adapter Factory down pipe to MRT Centre pipe p/n MUSSE035A (required for cat back MRT exhaust) or MRT flange adapter Factory centre pipe to MRT muffler p/n MUSSE035 (required if only MRT diff-back muffler fitted)
- Unifilter flat panel air filter p/n TT355 150S MRT p/n MUSSE040A
- TD04L turbo from an 03 WRX
- Samco Sport silicon intercooler pipe kit Samco p/n TCS143 MRT p/n SUWE128HE
- GFB Plumback BOV p/n 1002 and flange 5101 MRT p/n MUSSE127G2 / MUSSE129G1
- ECUTEK Type 2 ECU update MRT p/n ECUTEKA2
- Auto Meter boost gauge 2 & 1/16 size p/n AU2601
- Auto Meter boost gauge Cup Mount p/n AU2402
- Walbro 400hp fuel pump MRT p/n MUSSE008H
- Disc Brakes Australia slotted rotors front and rear p/n 648SL 648SR 644SL 644SR
- Race Brakes RB 74 front brake pads 1342
- Race Brakes Comp 2 rear brake pads 1379
- Redline Lightweight Shockproof gearbox and differential oil

Recommendations

Here are my thoughts on the enhancements I'd incorporate into the various stages if I was doing it all again. Of course, these suggestions are what would work for me with the type of driving I do which includes off-road as well. After all, the Forester GT is an SUV (a fast one!) I've tried hard to think back to when I first thought about modifying my GT early in 2004 and what I wanted to achieve at each stage. Be warned - once you start, it's hard to stop!

Disclaimer : The responsibility for enhancing your GT Forester rests entirely with you and by reading this document you agree not to hold liable the author in any way for anything that occurs as a result of you undertaking an enhancement to your car that has been mentioned herein. This document is a personal record of my experiences when modifying my own vehicle only and you use it as a guide totally at your own risk. Please also be aware that modifying your vehicle without obtaining approval could also mean that it will not conform to your state's motor vehicle registration regulations.

Stage 1 - Modifications for someone wanting an improvement in performance, responsiveness, handling, and braking, and who wants to keep the look of their car totally stock.

- ECUTEK 1 ECU update
- WRX 20mm oem sway bar or Whiteline 20mm sway bar
- Unifilter flat panel air filter
- DBA slotted rotors front

Stage 2 - Modifications for someone wanting more of an improvement in performance, responsiveness, handling, and braking, and who wants that characteristic boxer rumble, but has a budget to stick to.

- ECUTEK 1 ECU update
- WRX 20mm oem sway bar or Whiteline 20mm sway bar
- Unifilter flat panel air filter with resonator removal
- MRT 3 inch oval muffler and rear flange adapter
- DBA slotted rotors front
- Racebrakes RB74 front brake pads

Stage 3 - Modifications for someone wanting a large improvement in performance, responsiveness, handling and braking and who wants to stay within the reliable limits of the stock GT engine.

- ECUTEK 2 ECU update or ECUTEK 3 custom tune at 15psi boost
- TD04L turbo from a 01-on WRX
- WRX 20mm Subaru rear sway bar or Whiteline 20mm sway bar
- Whiteline heavy duty sway bar mounts
- Whiteline spring steel sway bar link kits front and rear
- MRT turbo back exhaust system with centre pipe resonator and catalytic converter
- Auto Meter boost gauge and mounting cup
- KartBoy Short Shifter
- GFB plumb back BOV
- Samco Sport silicon hose kit
- Unifilter flat panel air filter with resonator removal and cold air intake duct
- DBA front and rear slotted rotors
- Race Brakes RB74 front brake pads
- Race Brakes Comp 2 rear brake pads
- Walbro 400hp in-tank fuel pump

Credits

Thanks go to Brett and Paul at MRT – I've learnt a lot! Thanks also go to all the people that contribute their experiences on the various forums at www.mtrally.com.au/forums, www.scoobymods.com, www.subaruforester.com, www.rexnet.com.au, www.perth-wrx.com.

The performance shops and manufacturer's whom I've mentioned in this document also have comprehensive web sites that are full of useful information. See www.gfb.com.au, www.uniflow.com.au, www.mtrally.com.au, www.maximumms.com.au, www.revlimitms.com.au, www.whiteline.com.au, www.dba.com.au, www.racebrakes.com.au, www.samcosport.com, www.autometer.com, www.motospecs.com.au, www.rocketindustries.com.au, www.ecutek.com.au, www.kartboy.com.au, www.autospeed.com.au, www.modyourcar.com.au, www.kastleskorner.com, www.racebrakes.com.au, www.users.bigpond.net.au/msgofast.

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