EcuTek on the Dyno

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We check out some real-world gains tuning a MY03 WRX with EcuTeK software...

Part two of the Independent Story by Autospeed

Words by Michael Knowling, Pix by Julian Edgar

In a previous article ("EcuTeK Tech") we explained the technical aspects of the EcuTeK tuning system for late-model Subarus. In this article we'll show some real-world examples of what can be achieved by EcuTeK-ing a MY03 WRX. What difference does altering cam timing make? What - if any - gain is there in raising the rev limit? These and other questions are about to be answered.

The demo car for these tests was a MY03 WRX owned by Luke Marchant of Sydney's MRT Performance. The car had already been equipped with MRT's so-called Type XC kit, which comprises a full-length exhaust, cold air intake with filter and "resonator-ectomy" plus a VF30 turbocharger. Due to the downsizing of the standard MY03 fuel system, the Type XC kit also includes a 400hp fuel pump and a larger set of 550cc STi injectors (which are a straight plug-in).

Paul Fisher - MRT's leading technician - was the man simultaneously at the helm of the '03 Rex, the EcuTeK software and MRT's DynaPack hub dyno. Let's check out what he could do...

EcuTeK On the Dyno

First Run - Standard Maps

Our first power run was performed with the car running its factory mapping. The bigger injectors fitted to this car were inevitably going to cause excessively rich mixtures but, nevertheless, this was our baseline. Anyone who has fitted some breathing mods and slipped in some bigger injectors will be at this stage.

With an M&W UEGO sensor sniffing exhaust gasses prior to the cat converter, we witnessed full-load low rpm mixtures of 10.3:1 quickly going richer than 10.0:1 (off the scale) as revs rose. The big injectors/standard management combo was absolutely flooding the engine and, not surprisingly, the power and torque curves were appalling. Torque plummeted more than *50 percent* between 4000 and 6000 revs but recovered slightly at the top-end to achieve a peak power figure of 124kW (as shown by the blue plot). This was achieved in fourth gear. Note that a standard MY03 WRX, we are told, makes about 130 - 140kW at the hubs....

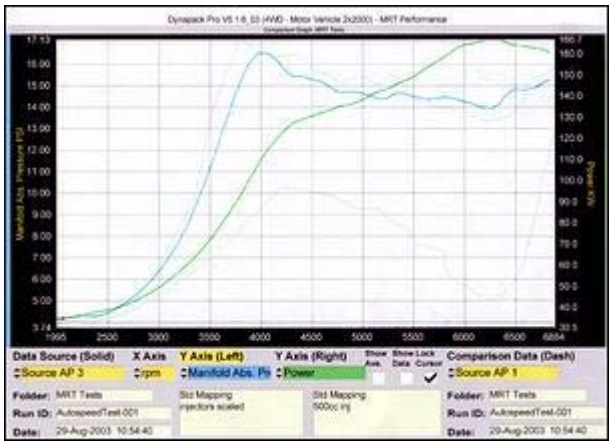
To put it mildly, some drastic tuning was required to make the most of the existing mechanical configuration!

Second Run - Altered Injector Scaling

In order to accommodate larger injectors, the EcuTeK tuner needs to alter a table called Injector Flow Scaling. These values are shown in hexadecimal but the numerical injector capacity is revealed in a pop-up box whenever the laptop cursor is placed over a particular hex value. The standard injector capacity is 380cc, so all Paul had to do was enter a hex value that equates to 550cc. Easy when you know what you're doing.

Note that once a new program has been programmed onto the laptop, it must be flashed to the Subaru ECU via the OBDII connector. This requires switching off the ignition and restarting the vehicle. The biggest downside of the system is mapping changes cannot be made in real-time.

With the injector scaling altered, the demo MY03 WRX made another power run. As seen in this graph, the new power plot (in green) picked about 30 percent at the hubs and the curve was *much* smoother. Full-load mixtures remained richer than 10.0:1 (off the scale) by 3000 rpm, but we can only assume they were leaner than previously.



The only major problem with the current tune was the lack of boost control - as indicated by the blue plot. Manifold pressure peaked at around 16.5 psi in the mid-range falling to 14 psi at around 6300 rpm.

Could Paul use the EcuTeK software to hold 16 psi to the redline?

Third Run - Holding Higher Boost

With the mixtures now set to an acceptable (but still very conservative) level we gave Paul the challenge to maintain the peak boost value all the way to the redline. Plenty of enthusiasts feel the need to spend hundreds of dollars on an electronic boost control system, but could a similar result be achieved with a few keystrokes?

There are two changes necessary to raise the boost level. First, the tuner must raise the peak solenoid duty cycle map and, second, change the boost target map.

Before making changes, though, Paul first entered the DeltaDash live display mode to sample the boost solenoid duty cycles that were currently being used throughout the rev range. It turns out the standard maps were giving around 90 percent duty cycle up to 2000 rpm, falling away to about 30 percent at higher revs.

The peak solenoid duty cycle at mid-range and high revs was then adjusted to allow a maximum of 40 percent. The peak solenoid duty value must be set high enough to achieve the desired boost pressure, but low enough to provide engine protection against overboosting. Paul says the ability to guess the appropriate duty cycle comes from experience.

With the peak solenoid duty map adjusted to allow headroom for more boost, the target boost values were then altered in a 3D map. This data must be entered in hexadecimal at adjustable 700 rpm increments. Again, the appropriate target boost value is known through experience with a given turbocharger.

And here's the result. The blue plot shows a relatively stable 16 psi of boost (give or take 0.5 psi) all the way to the redline. With a little more fine-tuning the numbers Paul says it's possible to achieve a *perfectly* flat boost curve. In terms of power, the boost increase gave 181kW at the hubs - a 14kW improvement (8 percent) gain on the previous run.

With safe mixtures and a solid 16 psi of boost to redline we'd be very content to settle with the current tune. But what - if anything - could we pick up by altering the MY03 WRX's inlet cam timing?

Fourth Run - Advanced Cam Timing

The MY03 is the first WRX to receive the variable inlet cam timing system that was previously exclusive to the STi. Cam timing is said to have a noticeable effect on the torque spread throughout the rev range as well as emissions.

Camshaft timing on the MY03 can be altered via the EcuTeK software system on a 3D map. This map has the same number of sites as a fuel or ignition map, so there's plenty of tuning resolution. Tweaking the hex values once again, Paul advanced the cam timing by a mild 2.1 degrees across the rev range, flashed it to the ECU and fired the car up once more.

The new power run (as indicated by the green plot) shows a *very* small increase all the way through the revs - its almost imperceptible. This came as no surprise to Paul. "You might pick up a little bit of torque here or there on an engine with a really big turbo and lots of mods, but you generally won't improve much on the standard maps," he says.

Fifth Run - Optimised Mixtures and Ignition Timing

For those interested in pushing the envelope further, we then elected to take a bit of fuel out across medium to high revs and add as much ignition advance as possible.

Paul says the standard MY03 tune (and the standard tune to suit 550cc injectors) is very rich at anything above about 5500 rpm. In order to lean things out, Paul accessed the main fuel table and entered some new hex values. The new values were an educated guess based on experience.

Added ignition advance - particularly in the low to mid-range rpm - can make a tremendous difference to drivability. Instead of simply forcing extra advance, however, Paul made use of the WRX's brilliant knock sensing system. By adjusting the amount of knock timing correction we witnessed up to 4 degrees extra advance at certain points in the rev range.

We then saw full-load mixtures within the scope of MRT's air-fuel ratio meter, with 11.0:1 held to the redline. The leaner mixtures and extra advance yielded a massive 20kW gain in the top-end and a very strong gain through the mid-range. This was simply stunning and at no time did we hear detonation (with the car running 98RON fuel).

Sixth Run - Raised Rev Limit

The final task for Paul was to show whether raising the rev limit might be of benefit in a MY03 WRX fitted with a VF30 turbo.

Raising the rev limit is as simple as changing two numbers. These come factory set at 6900 and 7100 rpm respectively, but Paul plugged 7150 and 7200 rpm as the new values. Note that none of the fuel or timing data needs to be altered when raising the rev limit by a relatively small amount.

As seen at the very top of this graph, the existing cutout at around 6900 has been extended to 7140 revs. Power held to about 206kW at the hubs through the extended rev range; there was no drop-off. This could be very useful in a circuit sprint scenario where the driver doesn't want to make a brief up-shift before braking for a corner.

Summary

With an experienced tuner, the EcuTeK software system is a wonderfully fuss-free and fast approach to engine management mods. The more experienced the tuner, the better the result. The biggest downside is the lack of real-time tuning, which would make tuning even more accurate and swifter.

Pre-Tuned EcuTeK Kits From MRT

MRT has released three power-up kits to suit MY99-onward WRXs. These are known as the Type XA, XB and XC kits.

The XA kit comprises a 3-inch rear muffler, a replacement panel air filter with resonator-ectomy and an EcuTeK Type 1 software upgrade. Fitted and tuned, this kit costs AUD$1695 (including GST) and gives a gain of more than 20kW (15 percent) at the hubs.

The XB adds a MRT front and middle section of exhaust, a MRT cold air pipe, a 400hp fuel pump and a dedicated EcuTeK tune. This kit gives more than 40kW at the hubs (30 percent) and costs AUD$3795. Add AUD$575 for an up-pipe in MY01/02 models.

The top-line XC kit takes everything as mentioned in the XB upgrade and goes further with a VF30 turbo, 550cc STi injectors and another dedicated EcuTeK tune. This upgrade costs MY03 owners AUD$6895 fitted or an extra AUD$400 for MY01/02 owners. Depending on your choice of muffler, this gives a gain of 55kW or more at the hubs (a gain of around 40 percent).

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