

I feel the need to document my thought process and the resultant events that occur as I take up a hobby given up a long time ago. In terms of this forum, my Mini Project.

After a few years of retirement, I decided to get back into building up a hi-performance street-capable race car. I originally wanted to build up a VW bug, but the vendor I wanted to buy the engine from didn't think I had enough experience with air-cooled engines. He was right, so I moved on. After a couple months of looking, I settled on a 2007 Mini Hatchback, the "S" version, with a stick shift. The one chosen was pure silver with black interior, and had about 35,500 miles on it. It's coincidental that the local NFL team, Oakland Raiders, have the same color scheme.

Since winter was coming, my first change was to put ice tires on a new set of wheels. Then I had to learn about TPMS and run-flat tires. Elected to skip run-flats but made a trip to the Mini dealer and bought a set of sensors. Wanted to ensure they were compatible with the cars ECU, and could reset them myself when I changed tires for the season. Wheels have a set of "locators" to fit over the hub, to center the wheel while mounting. Kind of a nuisance but makes for a larger selection of styles. Decided to keep the stock size, and not mess with speedometer / odometer accuracy. Bought a battery operated tire pump and a tire sealant / patch kit, instead of a spare tire. Keep it behind the back seat.

Really wanted to get a better camshaft set, but couldn't get the specs for the stock set, so nothing to compare to. The only sets I could find (Schrack) warned to check for valve clearance. Decided to forget a new cam set because I didn't want to get into relieving pistons for valve clearance. Gotta admit that I didn't look real hard for the OEM specs.

While looking for cams, I found Thumper Performance, a source for reworking cylinder heads. Personal opinion, this is a "must-have" upgrade! There are other sources for similar work, but this guy has the references and experience. I could either send him my cylinder head (gone for at least a month), or find a core for him to upgrade, then make the switch. Originally, I wanted to change the head myself, but after looking at a repair manual, I found that special tools / fixtures are needed. I'm equipped to work the old "elephant engines", but not these variable timing, ECU driven, high tech wonders. So, after he put me in contact with a previous customer, I obtained a TPR1, his upgraded head with stock size valves, drove it to my local dealer, and paid a small fortune to have them change heads. Very labor intensive! Found out the hard way that camshaft bearing caps are part of each head and NOT interchangeable between heads.

While arranging for the Thumper head, I bought other upgrades and had them delivered for me to install after the head installation. So I only drove with the Thumper head for a few miles before shutting down for more upgrades. The driving was not severe, just casual, around town stuff, but the improvement was remarkable.

First thing removed was the entire exhaust system, from the turbo to the rear bumper. It came out in two pieces, being joined at the down-pipe. Then the intake filter and pipes, following the K & N instructions, up to the part where new parts are installed. More to

remove first! The "Throttle In Pipe", as it's called by Mini Mania, was replaced completely at his point, along with installing an intake manifold pressure gauge adapter, under the MAP sensor. Both are at the rear of the engine compartment and out of the way of other work to be done.

Next to come off was the turbo. It's replaced by a Garrett GT28RS. I chose this one over a JCW version because of the three inch down-pipe. This is where the grief starts!

Turbo came from Turbo-kits.com, who, in turn, got it from ATP Turbo. I don't know which company put together the piece parts for installation, but they need to re-evaluate the pieces for a Mini '07 hatchback application! Oil fittings / plumbing are OK. Coolant hose to the engine block is OK, but its fitting at the turbo is very large and looks likely to interfere with turbo wastegate linkage. It doesn't interfere because the linkage moves away from the hose. The other coolant hose is supposed to be re-used from the original turbo, but it's about two inches too short! A trip to my local auto parts house fixed that.

After removing all the heat shields from the front of the engine, the turbo bolted nicely to the manifold. The manifold to the block was OK, difficult and a knuckle-buster, but OK. Connecting the new down-pipe to the turbo was tricky because the 3" pipe interfered with the nut installation --- had to start all nuts before tightening any of them. Like the turbo exhaust outlet wasn't designed for a 3" diameter pipe.

The down-pipe final outlet flange (it's a 2-section down-pipe) is not aimed at the center section of the exhaust "tunnel", and the flange for attachment to the engine block is not welded in the proper place. It's like the down-pipe was originally designed for another vehicle, but can be made to fit this one. The oxygen sensor, when installed, is also an interference fit with the hood. And to make it all fit under a closed hood, the underside hood support braces over the turbo housing (both sides) had to be cut away --- the turbo is too big to allow hood closure. Under hard acceleration, the torque causes the engine to rotate up into the hood. Different engine mounts should fix this problem, but also stiffen up the ride.

The rest of the exhaust system is an Alta 3" system. I bought both their cat-back muffler and 2-section down-pipe, not knowing the turbo came with its own down-pipe. The Alta down-pipe is designed to fit a Mini turbo, so it starts at much less than 3" and has different bends / curves. Not useable with the Garrett! The rest of it was used to complete the system. The whole exhaust system is about one inch too short! It's hung, but I removed a section and added another resonator to make it fit better and sound quieter. The extra resonator is a larger diameter than Alta's, and I had it installed over a brace that goes across the tunnel. The six bolts holding the brace to the chassis had to be lengthened and 1 1/2 " spacers installed for the brace to clear the resonator. Really screws up the ground clearance. The down pipe was interfering with the frame and engine due to the down-pipe flange and curvature, but that was fixed when the resonator was added.

Next I installed an Alta intercooler. It will fit but it's tight, braces need to be cut / trimmed and the hose connections are much too short --- hose clamps had to be installed and tightened before putting it in place. Note that it's not bolted in, rather "wedged" between a radiator frame and the bumper. If I had to do it again, I'd use hose couplings on the intercooler so they would protrude through the intended openings.

More turbo parts problems --- not enough hoses are supplied with the turbo. One more 90 degree hose and coupling are needed to connect the turbo to the intercooler. Also, the original turbo has a built-in electronic by-pass or BOV valve controlled by the ECU. The turbo kit has an external by-pass valve that needs to be connected.

Another turbo difference is the Garrett air supply connection is 3" diameter, so the K & N fittings won't work, and the crankcase breather tube now has no place to connect. Between turbohoses.com and ATPturbo.com, I was able to get "tee" hoses, couplings, and transitions to make it all fit. I elected to connect the new by-pass valve (BOV) output to the air intake between the MAF and the turbo --- keeps it a closed-loop system.

Finally, there's two gauges, from Alta again --- for turbo boost and coolant temperature. Both mounted in pods behind the tachometer. AltaPerformance.com neglected to enclose their own installation instructions, that include where to connect power wires, and how to route the sensor wires. Gauge mfg. instructions (ProSport) don't address wiring connections, just wire ID. I punched a hole in the floor of the center console, behind a panel on the driver side for sensor wires, just missing a wire bundle. After a phone call, Alta sent me a copy of their installation instructions --- very well illustrated. The hole I punched works for sensor wire length, has a grommet, and is filled with silicone. I also didn't expect a manifold pressure gauge adaptor to be included in the turbo kit, so I bought one from Alta. Now I have an extra. It should be noted that the coolant temp gauge did not come with a fitting to clamp into the coolant line. Gotta buy that separately 'cause they don't know which vehicle the gauge will be used in, and there's a variety of sizes. Gotta mention that the two gauges would not power up when wired together for power, as indicated by ProSport instructions. Maybe if I wired them for white lighting instead of amber, but I wanted them to match the other gauges. Finally got them to work, but no thanks to ProSport. I can furnish a wiring diagram (in PDF) showing power connections if anyone's interested.

Still need to address the heat shield issue with the larger diameter exhaust pipe. Original shields won't fit without serious bending / cutting, so I'm probably going to wrap the down-pipe section with a ceramic header wrap, and lose the original shielding. Waiting until the final tune is completed.

Next is a dyno-tune and custom ECU mapping with AccessPort (AP). That should complete my initial upgrade activity. AP is a pricey but really handy tool. While waiting for the dyno tune, emission errors pop up on a regular basis. The pre-loaded ECU maps help minimize them. Not supposed to "floor it" before a good tune up, but just "punching it" once or twice is enough to set off an alarm. The AP has been able to reset all the alarms so far and keep me out of the dreaded "limited performance" mode. A frustrating

feature is the displayed code. There's no list anywhere that I can find for the code definitions. So far, mostly manufacturer-specific codes have shown up, only one ISO standard code, P0420, and I haven't been able to get anyone to share their list. Gotta trust your tuner. But when you get an indicator, and read the code, then what?

After all parts were installed, it was started and driven around town for a few miles. While checking fluid levels, I noticed a small oil leak. Not from an area I messed with, and not readily visible where it's coming from, so made an appointment with the dealer who replaced the head for me. Dealer found a bad crankshaft seal and a bad valve cover gasket, all covered by dealer and factory warranties.

Dyno tune found another problem with the turbo installation. Seems the Garrett wastegate works opposite from the OEM wastegate. Garrett starts out closed and wants a positive manifold pressure of 10 - 12 PSI to open. The OEM wastegate is open while the engine is off, and apparently closes when the engine starts. Probably opens again as set by the ECU map. So I was forced to limp home with a temporary ECU map, and learn more about turbos. Just connecting the OEM hose to the Garrett diaphragm WILL NOT work! My temporary fix is to cap off the OEM hose and connect the Garrett diaphragm to the boost gauge hose with a tee connector. This will get me to the next dyno tune. Just before dyno, moved the diaphragm hose to a manual boost controller connected to the turbo compressed air outlet. Recommended by Alta to allow a good dyno tune. The chosen boost controller is adjustable from 0 to 30 PSI. Electronic boost controllers are not compatible with the R56 ECU without changing the waste gate diaphragm spring, and extensive re-mapping. I'll let the tuner adjust the controller, hopefully for maximum safe boost.

While at the first dyno garage, I learned what an "oil catch can" was for. Got one and installed it. It also fixed some of the hose layout issues. The OEM crankcase breather hose is pre-formed and had to be bent a lot to fit the new air intake system. Oil catch can hoses fit a lot better.

My original intent was to buy all the kits needed to upgrade specific features, shut it down, install the kits, get it tuned, then go have fun. As it turns out, each kit is designed to fit only the original Mini (or a close similarity), NOT to be interfaced with other kits. I probably paid more in shipping charges than some of the kits cost, trying to get parts to make the different kits fit. All the kits except the turbo came with installation instructions, and MOST of them were accurate and easy to follow. I learned AFTER installation that ATP Turbo has generic installation instructions on their web site.

One obvious disadvantage to doing all the upgrades at once is there's no way to evaluate the performance change of each individual part upgrade. There's also the mating of separate kit parts that are not factory, and chasing down parts that will work. The biggest advantage is just having to take something apart once.

DYNO-TUNE FINISHED! May 4 2011

Had to drive to portland, OR to get a dyno tune with AccessPort capability. Before hooking up to the dyno, a couple problems had to be fixed --- the tee coupling for the BOV was leaking like a sieve where the 1" fitting was joined to the 2 3/4 " hose - just a bad job by whoever put the two pieces together! The manual boost controller wouldn't operate the same way consistently - probably a burr inside catching on the spring. Both pieces were replaced and the car put on the dyno.

Three hours later, I had dyno results --- best results were obtained by getting to a serious boost at about 3600 RPM, then increasing by 3 more PSI to the max. This was achieved at 14 - 17 PSI where torque peaked at 232 ft/lb and HP peaked at 276. Same process was used for 17 - 20 PSI, but I didn't make note of the torque, just HP which peaked at 282. My graph can be seen at <http://accessecu.com/dyno/> when the blanks are filled in. To date, mine is the only Mini that shows up in the Surgeline database.

While waiting for the second dyno tune, I installed a pair of inserts in the lower engine mount, to try reducing engine movement under heavy load / torque conditions. Didn't work - engine still rotates enough to cause interference with the hood.

Talked to the tuners about maxing out the boost, and they tell me that a MINI "S" ECU cannot support more than about 20 PSI. Slightly more for a JCW, but the JCW MAP sensor will not function on the "S". It's possible that someone may be able to re-program the "S" ECU to accept the JCW part, but not likely. Maybe someday, there will be a big enough demand for it, and an effort will be made. At least, that's the way I understood it! My wife teases me, that I was acting like an expectant father in the waiting room. And she's right! This dyno tune was a long time from when I was ready for it.

Driving home from Portland, I continued to throw a variety of cel codes, some "fatal". There's still some map work to be done, but it shouldn't affect driving on race day, just around town. Also noted the ECU had 40.0 MPG when I got my first fill-up in OR. No self-service in OR and can't trust them to top it off. Used cruise control getting there - very relaxed trip. Slightly more aggressive coming home, and the ECU now shows a 38.1 MPG. Maybe the difference is elevation change - Portland is almost sea level, while my home is at about 4400 ft. Doing the math after topping off the tank gives 36.8MPG for 1330 miles.

The original turbo BOV connection, when left disconnected, will cause a P28b1 cel. The easiest way to prevent the code is to remove the BOV from the turbo, connect it to the cable, and zip-tie it out of the way. My BOV solenoid measures 12 ohms dc resistance, so I bought a 12 ohm resistor network, high wattage, from Radio Shack and connected it to the BOV cable. No more BOV cel, and the old turbo is still intact!

Next, I remove more metal from underneath the hood for turbo clearance. Also gonna remove the support from underneath the exhaust resonator. I'm told it's not for structural support, more like a safety net for broken exhaust pipes. Then I work with a dealer to get an ECU update to minimize the torque - steering problem. Then it's off to the races!

OldBrokenWind's log / diary of his retirement project

Probably not going to re-install the heat shields, but use some exhaust manifold wrapping, mainly for the hood scoop area.

I'm happy to discuss or explain any of the above issues, just start an email with the forum's messaging system. There's lots of details left out --- I figure 5+ pages is enough for most people.