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 (Schrick) 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!

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.

2nd update & 2 more pages (no changes to previous pages) ---

A month or so after the dyno tune, the timing chain / tensioner started making lotsa noise. Used the Mini Roadside Assistance system to have it taken to the nearest dealer. For them to fix it no charge to me, they had to update the ECU to the current programming, which included the "torque steering" fix. Of course, I said OK. I was able to get them to wait until I was able to get there and disable the AccessPort. When I tried to re-install the AP, it wouldn't recognize the last set of Alta maps. So, I limped home again and called Alta. Seems the ECU number is part of the Alta map series, so when the ECU program changes, the Alta map name needs to be changed. A couple emails and a day later, I had a new set of maps --- back on the road! One unexpected benefit is that the persistent cel, P0420, no longer comes up. Still get one "fatal" cel, P2885, when I accelerate too much in too high a gear --- too lazy to downshift. Tuners warned me this would happen. With practice, I'll get it less often. Easy enough to reset with the AP, and it doesn't happen under hard acceleration, like on the drag strip.

Sept, 2011, I obtained an OS Giken STR clutch, lightened flywheel, and LSD. Found a guy (in Portland, OR again) to install it for me. Dealers want over $2K and a couple days. Local shop wants about the same, but doesn't have a lot of Mini experience. Guy in Portland started about 8AM and called me about 3:30 PM to come get it. Had no problems. He has several years experience working on Mini's, and charges well under $1K for misc parts and labor. He was recommended to me by Alta, and I also recommend him. PM Alta or me for contact info. Now I need to learn to drive with a light flywheel and a clutch that doesn't want to slip. It's still a very "streetable" machine.

Driving to Portland twice, and climbing the Sierra Nevada mountain roads all summer, has worn out the OEM tires. Put on a set of "ultra high performance" Kumho Ecsta 4X KU22 All Season tires same size and ratings as OEM (195/55/R16 & 87V), but NOT run-flats. Good price compared to others available, and has a 7" wide tread contact. I'm keeping them on OEM wheels to maintain the desired "sleeper" effect. I make an extra effort to NOT attract a lot of attention, during normal driving.

As I get used to driving with an LSD and light flywheel, I notice that the "launch" performance isn't what it used to be! Alta maps have a typical launch RPM of 4500. No matter how much I slip the clutch (or try to slip it), there's still a significant loss of performance before the Garrett produces any boost. My guess is that the combination of the LSD and 7" tread width is causing too much traction for the light flywheel. The whole concept of lightening the flywheel is to allow quicker RPM ramp-up. This is done by creating less inertia at the crank. Disadvantage appears to be that RPM's decrease

faster also! So, when the clutch is released, the load seen at the crank is enough to lower the RPM's so the turbo isn't boosting. Working with Alta, they're sending me another set of maps with increased launch RPM's - 5000 & 5500. We'll see!

I gotta mention tho, the light flywheel makes for a noticeable increase in higher RPM acceleration. Anyone interested in rally or track performance should consider this upgrade. As it sits now, I'm NOT competitive on a drag strip! How it will affect launching with an OEM or hybrid turbo shouldn't be as significant as with the Garrett.

Tried slipping the clutch from a 5000 RPM launch. To keep the RPM's in the boost range, too much slipping is necessary --- takes too long to get moving, so the 5000 RPM launch isn't gonna work! This with the new Kumho's. Now that winter has arrived, I changed to my winter ice tires. Tried the 5500 RPM launch map and it works great --- with the ice tires! I'm gonna gamble on being able to get similar performance with the Kumho's, and ask Alta to change all 4 of my maps to a 5500 RPM launch. By the time winter is gone, I should have learned how to slip the clutch enough to use the Kumho's on the drag strip. Hopefully, I won't need special racing tires.

That's it so far --- no more upgrades planned for several months. I'm investigating the various water / meth injection systems as a potential upgrade. Stay tuned for a 3rd update to this journal.

October 2012

Nope, can't use my Kumho's on the strip --- no traction when turbo is boosting. So, my latest investment is a pair of 225/45R17 BF Goodrich Drag Radials and matching 17 X 7.5 rims. Looked at other popular racing tires - Hoosier, Yokohama, Nitto, Hankook, Mickey Thompson, softer Kumho's, etc and either couldn't find a size to fit, or it wasn't right for drag strip (for autocross instead). Chose the Goodrich because of the "UTQG" rating of 00BC, figuring it was the softest of the bunch. Now I might have to go with no launch RPM limit - first trial caused launch RPM's to immediately drop below turbo boost range. These are some STICKY tires! Minimum tire slippage at high boost. Just gotta practice slipping the clutch at launch.

Looked at a couple of the more popular Water / Methanol Injection systems, and when Aquamist had a group buy on their new HFS-4, I signed up. Looked at the instructions and various installation options for a couple days, then took another couple days to install it --- I'm slow, it could be installed in less than a full day IF you've done it before. Next, find a source for methanol, preferably local, and small quantity --- 5 gallons or less. First source sells it out of a 55 gallon barrel, using your container. Problem here is they use a common pump for all their barrels of "stuff". This results in contaminated methanol! Didn't realize how sensitive the system was until it quit working. Only took half a tank to fail. So, 5 gallons of waste meth. Second source was a 5 gallon container of "Industrial Grade" meth. Found out after another failure that Industrial Grade means used once already --- another 3 - 4 gallons of waste meth. By now, the system is completely fouled with contaminants, and all the fluid handling components had to be

replaced. Replacement costs were more than the group buy savings --- an expensive learning process! More searching and I finally found some good stuff. All this took about 3 months, and I still don't have an ECU map to optimize the WMI. Kudos to Jeff Howerton for his patience and helpfulness in getting my WMI to work at all.

I wanted a WMI system primarily for keeping the cylinder chambers clean. With 280+HP and OEM bottom-end engine parts, more HP is risky. So, I opted for a 50 / 50 water to meth ratio mix. I'm told that this ratio seldom works for typical upgrades, and a ratio of 25% water and 75% meth is minimum acceptable. !00% meth is preferred. I consider my upgrades to be atypical, so a 50 / 50 mix should be workable.

After lotsa data logging, I finally got an AP map to use for WMI. Using the ever-popular "butt-dyno" the new map with WMI enabled, is at least as good as the last map without WMI. So, theoretically, I'm now getting the benefits of WMI cooling / cleaning, with no apparent power loss. Eventually, I'll arrange for another dyno tune, and if necessary, increase the WMI ratio for more meth. Before increasing the ratio too much, there's a fail-safe feature in the HFS-4 that needs to be connected. Due to my turbo being independent of the ECU, I left it disconnected. Hardware is available to make the fail-safe work with my Garrett, but I don't have it, yet.

What's next? I'm considering looking into a way to increase the boost beyond the OEM limits of 22PSI (MCS, not JCW). Some months ago, Jeff Perrin of Alta indicated there might be a way to defeat the limit using the AP. This didn't work out, so the next alternative is to add a voltage limiter between the MAP sensors (both of them), so the ECU doesn't see the "over boost". From what I've read on various forums, there are several checksums built in that will probably not allow this to happen, without causing some other fault to appear. I'm thinking of trying it anyhow, because my turbo is completely independent of the ECU. There might be some relationship with fuel flow, or air / fuel mixture. Have yet to find anyone that's successfully defeated the MCS ECU boost limits. Maybe I'll get lucky ---

In the meantime, this thing is a blast to drive. Yes, it handles different than most, throws a limp mode CEL when I get careless, and burns a lot of rubber when I demonstrate its capabilities. I'm thoroughly enjoying my second childhood toys!

November, 2012

Went online to look for a piece of equipment to limit the ECU boost signal. Found out it goes by a couple different names --- Fuel Cut Defender (FCD) or Boost Cut Defender. Of the few I found, I decided on a pair from the UK. A guy on e-bay, using the name "PocketRocket", is selling his home-made version. Lotsa issues with buying from an e-bay supplier, especially an admitted DIY'er from overseas. HOWEVER, his product is well described, it functions as I expect a voltage limiter (zener diode) to function, and the price was right. I recommend it highly for the R56.

Not to difficult to install --- I put them in the glovebox, next to my WMI controller. Cable holes were already punched and other wires already routed. Just had to add more wire. Painful having to remove the battery for working space, but it made the installation a lot easier than working around a battery. One problem was the FCD wire length --- not long enough to mount inside, away from the engine heat. I really want to keep this kind of electronics away from heat. In all probability, there is no circuit protection for adjustment stability, and heat will affect component values. So I spliced his wires to a set of 6' audio / video cables.

Connecting them to the sensors was not as simple as it could have been. MAP sensor on the manifold is 3-wire, while the sensor over the wheel well (2 different sensors) is a 4-wire harness. The 3-wire setup was easy enough --- power source is a twisted pair leaving only the signal wire. The 4-wire harness uses the same colors as the 3-wire with the obvious 4th wire. Problem is, the boost sensor wire is not the same color in both sensors, as I assumed it would be. Power source is the same color twisted pair. So I had to re-do that one signal connection. Easy enough to find out which wire is which, IF you have access to a voltmeter --- boost sensor tracks boost immediately, while the temp sensor is significantly slower to change. I don't recommend doing this without a good DC voltmeter, and someone else to either read the meter or drive to create the boost while you do the other, altho it can be done.

Adjustment process is well described. I adjusted mine one at a time using my voltmeter, disconnecting the first one to do the 2nd. I didn't want any interaction, and since I'm not sure what function each one performs, I thought it best to isolate the setup. There is a remote possibility that only one FCD is required to prevent the overboost CEL. I was too anxious to complete the install, than to try the FCD's separately. Adjustment process is:
-Set MBC to initiate overboost signal --- 22+psi
-Measure sensor output --- mine was 4.0VDC at 22psi
-Connect FDC
-Drive to create max boost while measuring at FDC
-Adjust FDC to a voltage less than overboost voltage --- I set mine to 3.9VDC (one complete turn on the trimpot corresponds to about 0.1VDC)
-Disconnect FDC signal wire
-Repeat the above for the other FDC, except don't disconnect when finished (this is a good time to find out if only one FDC will work)
-Reconnect first FDC and enjoy
I found that 1st and 2nd gear overboost would not cause a CEL, just lousy performance. Probably common knowledge, but not documented anywhere I've looked. Made it easier to adjust the FDC's, by not having to get up to high speeds.

Another issue is, when datalogging with an AccessPort, boost data will not exceed the FCD setting. So to determine actual boost you need an external boost gauge. I have yet to learn how this will affect my next dyno tune. So far, and just for checking my work, without using my WMI system and custom map, I've had the boost up to about 25psi, in 3rd, on my ProSport gauge, with no CEL. Until I get on a dyno, the MBC is dialed back to 22psi --- the original dyno tune is for 17 - 20psi.

So, bottom line is, the 22psi ECU limit for the R56 MCS can be defeated. The concern is, you gotta have the turbo to provide the extra boost. Then you gotta find a tuner with the expertise to make it all work. And a "remote tune" probably won't cut it! I'm only familiar with two on the west coast, and one of them isn't working with AccessPort any more.

April, 2013

Still no dyno tune. Working with Cobb, So Cal, and will eventually make the trip there. Gotta get past some personal problems first. Maybe this Fall, before the snow flies.

Last month, I ordered and installed a Hotchkis rear anti-roll bar, the 25mm hollow tube version. Connect the tie rods to the center hole. Not a lot of fun, but can be done by one person without any special tools. Makes a significant difference on high speed cornering, i.e., freeway clover-leaf on ramps. Haven't tried it on a track, yet.

My original OCC install consisted of the catch can connected to the line feeding the turbo inlet, nothing else. This means the hose from the valve cover to the intake manifold is still in use. After several months of driving with the OCC, there was still no oil showing on the OCC dipstick. After seeing several online posts with pics of their catch, I did some research.

According to the Bentley manual, the line to the turbo is used when manifold pressure is "under load". The line to the intake manifold is used during "deceleration or idle". Since most of my driving is not under load (I use a lot of cruise control and highway driving), the OCC wasn't getting used. So, the question is, should I cap the manifold line, or route it to an OCC? Because of cost and ease of installation, I took the cap option. Bought two vent caps from my local Audi dealer, part number 036131510, removed the hose, and installed them. Peugeot also sells them as #0361.S4, and ECS Tuning sells them online, all for about $10 each. Didn't take long to catch oil in the OCC. Hard part is figuring out how to remove the hose without breaking it. Once you see how the vent cap is designed, it's pretty easy to figure out.

After a couple tanks of gas, I noticed crankcase oil level was down a quart. This is the first time this has happened - this engine hasn't burned oil in the 20K miles / 2 years I've driven it. First guess is crankcase pressure is forcing oil past the valve stems into the combustion chamber. This implies the vent plugs I just installed messed things up. So, I ordered a Dual Boost Tap, bought some hose and a "tee" fitting, and connected the rear (passenger side) valve cover outlet to the existing OCC. While in there, I disconnected the turbo air inlet hose for a quick look. Worst fears realized --- oil puddle in the air chamber!

Made a couple calls about turbo repair / replacement. One shop that knows Garrett turbos, told me that high crankcase pressure can cause oil to "backflow" thru the turbo oil drain line, and cause the symptoms I'm seeing. Resolve the high crankcase pressure

issue, and the oil consumption problem will go away. Then there's an oily mess to clean up --- from the turbo air outlet to the intake manifold. This is several months after the initial OCC install. I've created the very mess the OCC was installed to prevent! The WMI system should keep the rest of the lines clean, once the oil source is removed.

After reading some of the various threads on OCC's, oil consumption, and bad smells, it's my guess that they have a similar problem --- 2 vent caps installed, or a dual boost tap adapter connected with the plug installed. I still don't understand how this adapter can read boost when it's connected to the crankcase / valve cover vent line. Maybe if installed at the manifold end of the hose and then plugged, but I don't know what's happening inside the throttle control box.

Anyhow, I installed a BSH Dual Boost Port Adapter on the valve cover, in place of the hose --- plugged the boost port connections, but not the main vent. Then routed a hose from this adapter to a "tee" I added to the OCC inlet hose. I'm trusting the Bentley manual when it indicates that only one of the two vents are active at any time.

After a lot of oil cleanup, a month or so of driving, and a couple tanks of gas, there seems to be no more oil consumption or leakage thru the turbo. It's pretty easy to remove my turbo inlet hose to check it.

There are those who say I'm "all wet" with this theory, 'cause they've had virtually no problem with their OCC single line install. It's my belief that it's all dependent on driving habits --- with the rear "low pressure" vent plugged, there is little or no pressure relief in the crankcase, so it builds up until it finds a path out --- in my case, the turbo seal. I've read where others have leaking valve cover gaskets --- another probable pressure relief path. My valve cover has been removed / replaced a couple times, so not a weak spot. The "burning oil" smell often noticed, in my case was probably from the oil puddle in the turbo air inlet chamber. When the engine is off, fumes can escape thru the air filter. There was also oil residue on the turbo outer surface, and the oil hoses aren't leaking.

During this time, I ran a compression check. Had to chase down a 12mm hose adapter, then had 23" of hose to do the test. Hopefully, this is what caused all my readings to be low --- 110 - 115psi with a cold engine. Since then, I've shortened the hose and re-run the test. Hose length (plug to gauge) is now 16". With engine cold, one 110psi cylinder changed to 105psi and with a hot engine the same cylinder read 95psi. I'm not concerned with the low readings, as long as the four cylinders are close together --- no blown parts, just normal wear and tear. Two years ago, a dealer checked it for me and reported 168 - 171psi. No indication of equipment used for the test. They may have run a "leak-down" test to get readings that high!

Another interesting note --- the start button will cause cranking for 17 secs before stopping by itself. Engine cranking can be stopped anytime by pressing the start / stop button again, or releasing the clutch pedal, while it's cranking. I had been afraid to try it with all plugs installed, so went on-line for info. Makes the test a lot easier to run.

May 2014 update

Not much activity between April '13 and May '14. After lotsa discussions on NAM and MA, I was finally convinced that my PCV was shot —- not relieving crankcase pressure when manifold was positive PSI. So, in late 2013, I changed the valve cover myself, no warranty. Still using the dual OCC with both vents connected, nothing blocked. Since then, nothing else was changed, I was just adding miles.

In Feb 2014, I signed up with "Hooked On Driving" for a session at ThunderHill Raceway in No. Cal. Our local Mini Club, Sierra Nevada Minis, had a couple members interested in driving the course, so I went along. I adjusted my boost controller down to about 20PSI, to not stress the engine too much. Just before lunch, half way thru my second run, my "trainer" noticed smoke from the engine compartment. After an early exit from the track, I found my valve cover was warped enough, from turbo heat, to allow oil to get all over the exhaust pipe. Three years of driving with no turbo shield, and never got it this hot. Sure was having fun for awhile tho!

ThunderHill Raceway is located about 150 miles from my home, across the Sierra Nevada mountain range —- lotsa uphill, high elevation driving. While limping home, I noticed the oil was only leaking when manifold pressure was positive. Now I'm wondering if the PCV can handle the high boost with both vent lines in use. In order for the Dual Boost Tap to monitor boost, there must be a direct opening between the intake manifold and the valve cover rear vent —- no "control valve" in-between. Which means manifold boost is present at the valve cover's PCV system. More on this to follow —-

Early Feb, after ThunderHill, I decided to update the "engine internals" —- CP Carrillo rods / pistons (10.5:1 instead of the recommended 10:1), and SuperTech valve springs. While it's all apart, the head went back to Thumper, with both manifolds. He matched both manifolds to enlarged head ports, cleaned up the valves (instead of a walnut blast), installed the new springs, matched the exhaust manifold to the Garrett adapter and exhaust gasket, and ID'd the head as "Mod", next to his TPR1 mark. Now the head and manifolds are a matched set. Gotta get this thing on a dyno!

During the rebuild, had all kinds of grief —- OS Giken flywheel is the early version, without the 90 deg timing feature. I was able to get a scrap unit from a dealer, install it (after pulling the whole engine / transmission), then finding the special timing tools, timing it, and switching back to the Giken unit. I'm too cheap to invest in an updated Giken flywheel. Just gotta do the timing right the first time! Pulling the entire drivetrain was NOT part of the original plan. While it's apart, I changed all the tranny seals. Changing these seals really should be done with the Bentley recommended tools. I improvised, and had one huge mess!

More on tools —- not really special, but I had to buy a nice set of torx (male) and star (female) sockets. Had a small set of torx bits that fit a screwdriver handle, but head, rods, flywheel, all used these in LARGE sizes and needed lotsa torque. Never even heard of "star" sockets until this rebuild. More tools to find storage space for!

Mid March, the head came back, I started putting it all back together, and discovered the need for another tool —- the Injector Seal set, for installing a teflon seal on each of the DI lines. Should have done the DI lines first, at the dealer. But no, I had the head installed, timed, and almost all the other bolt-ons mounted, before doing the DI system. One week later, I had the right tool and changed the seals. Pricey and hard to find. Dealer was willing to change them for me, BUT he needed the head and the DI system at the same time. Seems there's a few minutes window between changing the seal and installing the sealed line in the head. The teflon seal expands —- doesn't stay compressed when installed, making it nearly impossible to mount in the head, outside that window of time. My options were start over and take the parts to the dealer, or buy the tool and do it myself. I bought the tool!

Another "shoulda done" was bleed the air conditioning lines before pulling the engine. It made lotsa noise and a mess on the floor when the lines were disconnected.

Back to the valve cover —- newest one is shot, so I did a "destructive evaluation" on its PCV system. Not real thorough, but I'm going to try a fix on my original unit. Assuming the vent to the turbo is blocked, I'm punching a hole from the valve side of the cover to the vent outlet. This creates a constant opening for crankcase gasses to the turbo (via the OCC). The rear vent and the manifold connection have both been blocked off with the caps again. And, I'm only using half the dual OCC. So, effectively, the PCV system has been disabled —- there are no smog requirements where I live.

Also added a home-made turbo shield. Don't want to repeat my ThunderHill fiasco. I used the original shield parts, cut one to fit between the turbo and manifold then added a couple wraps of asbestos around the turbo, avoiding the waste-gate linkage. I also enlarged the cut-outs in the hood, to allow for the shield under hard acceleration.

Now, early May, the car is running, with no codes. My memory is better than I thought —- no pictures or cable markers were used, but I'm pretty good with jig-saw puzzles. This was a big, messy, 3-D puzzle! The only left-over parts are associated with the OEM turbo, which I don't need. Had a couple minor "do-overs", but nothing serious. A few minutes after the first engine start, there was a small coolant leak. Chased it down to a cracked aux coolant pump, the one for the turbo. I was kind of rough with it while parts were all over my garage, and didn't notice a hairline crack. Painful to change on a fully assembled car, especially with the oversized turbo.

Still gotta complete a break-in procedure for the new rings / rod bearings. I'll save a new compression test 'til after break-in is complete. So far, with minimal stress on the engine, my modified PCV system seems to be functioning OK —- no codes. I'll know more when break-in is complete, and / or I drain the OCC. And, as I've been working on for a couple years now, try to find a tuner willing to work with my mod package. Maybe the beefed-up bottom end will help. More to follow —-