Dalton Klinkenberg

Mr. Dale DeRoche

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The Rise and Fall of Project: Angry Tomato

I loved cars ever since I was born, always having racing games, to Hot Wheels. I always looked for something that could be fast while looking different in a crowd of Mustangs and Corvettes. When I was active duty in the Army, I was stationed in Germany. I saw this as my opportunity to own something special and went out and bought a 2001 Lotus Elise. It was a car that I still use as a standard for how a car should feel and handle, it taught me a lot about what I want from a car. After getting married and with a kid on the way, I needed something larger than a two-seater sports car with no cargo space. We looked around and came across a little Fiesta ST. With plans on staying in Germany, we wanted something small, fuel-efficient, safe, fun to drive, reliable, and most importantly has four doors with backseats. The car ticked all the boxes, but as most plans tend to fall apart.

A few months after we ordered the car, I got orders to go back to the states. The goal with the car was to make it the ultimate daily, powerful enough to make a stock v8 blush, yet able to drive in the winter and work every day. The original goal was to take the car to 300 horsepower at the wheels and be done. Nothing can affect the day to day driving, because, at the end of the day, it is a daily road car. I had everything plan out for the build and over a time

frame of 2 years, I hit my 300-wheel horsepower goal. I had a hybrid turbo setup with all supporting mods. This means my turbo was the same size as my stock turbo, but I had a larger compressor wheel. The reason why I went with this turbo originally, first, I wanted my car to drive and feel the same, just with more power. Second, I didn't want to deal with big turbo problems and complexity. Well with my luck, two months later, my turbo blew and I had to go back to stock. Two weeks later, my engine follows my turbo and goes as well. Both popped during normal driving conditions. So, I now have to replace the engine and turbo on my daily

After a trip to the dealership for a quote of five thousand dollars, I decided that I am going to make this into a learning experience and replace the motor myself. I've already replaced an engine in my lotus before, how hard can it be? So, a friend of mine named Karl, and I got the outline set out for two different outcomes, the cheapest way to make 400-wheel horsepower and the most power I could make for five thousand dollars. After a couple of things that we looked into, I've decided that going for 400 horsepower would be plenty.

The plan was to get a new block, some forged internals, a Gen 2 GTX 2860r turbo, a 4-port aux fuel system with all the supporting mods. There are two major problems with the 1.6 Ecoboost engine. First is the lack of aftermarket support, which we will dive into. Second, the engine is an open deck design, which is great for cooling, but bad for high boost applications. The first thing was to see if we could make the built engine as reliable as a factory engine at 400 hp. After looking around for a while, we came across a company that specializes in building cylinder support kits. This turned our open deck design into a closed deck system. This already added 500 dollars to our budget. Yet, we were the first people to get this special block.

It seemed clear, however, also while looking for this, we discovered that the highest Fiesta ST horsepower record was around 430-wheel horsepower. Because of this, the plan has changed, we are now after the highest horsepower record. So now we have to adjust the build sheet to support everything. When I bought rods and pistons, there was not a forged crank option on the market. We know the crank would go bad on cars that pushed well into the 400-horsepower range so we looked into who has designed and built them. Luckily, Callies answered the call and were about to make their billet crankshaft for the 1.6 Ecoboost. This billet crank was made to handle more power, but even Callies wasn't even sure what that power was. I sent them the money and a very long 3 months later, I was the first one to get a billet crank.

Since we had changed from just 400 horsepower to the record, a lot had to get changed out. The Gen2 2860r turbo was sold before even going on an engine and was replaced with a slightly larger Gen2 2867r turbo. This turbo would cause a lot of lag but would provide that top-end power that we were going for. This brought more problems since we weren't sure how if our fueling would be enough. There wasn't much on the market with upgraded fuel injectors since the engine was direct-injected. So instead, we went with the 4-port aux fuel system with 45lbs injectors between the head on the engine and the intake. If we needed more fuel, we could swap them out with 90lbs injectors if needed. Our stock fuel pump in the tank was able to deliver enough fuel as well and we wouldn't need to worry about it.

One thing I wanted to change was the exhaust manifold. The stock manifold on the 1.6 looked like it was built for mass production and could use some room for improvement. I found someone who had a custom equal length header, which was rare at the time. The best part

was that the head was ported to a larger size and allowed more flow to the turbo. We measured the manifold and compared it to the stock head. It was significantly larger and allowed us to bore out the head to allow more flow to the turbo. This was supposed to help with reducing the turbo lag and get on max boost faster in the rev range.

The next issue was not an easy fix. The car's rev limiter was 6,500 revolutions per minute (RPM). The turbo would start to make max boost of around 5,000 RPMs. We needed to push the engine further to make the most of our power band since we were close to changing gears when we would hit max power. Karl and I looked into modifying the head to allow better flow and allow the valvetrain to spin faster without valve float. After inspecting the cylinder head, we noticed there was a lot of room for improvement on both intake and exhaust ports. The cylinder head was dropped off to a guy in Indianapolis to port and polish the head.

Meanwhile, some research showed that there were valve springs and camshaft upgrades that will put the engine's powerband to over 8,500 RPMs, perfect for what we want to do. The 1.6 Ecoboost engine is a dual overhead camshaft setup that uses the camshafts to press down on the valves themselves, not rods or rockers between cams and valves. For this to function at thousands of revolutions per minute, the valves and valve springs have a shield called a cam bucket. This reduced wear on the cams and the valve springs. These cam buckets needed to be measured and checked for gaps at the correct speciation and since I was switching the camshafts, some would need to be changed. After several measurements and some math, the correct buckets were ordered and we had everything we needed to complete the head.

Next was getting the internals balanced, which was easier than I thought. There were many options for pistons, but I went with a set of 2618 79mm Diamond performance pistons. I wasn't sure the power we were going to make with this setup and wanted to make sure I had a material that had higher tensile strength and deals with the higher boost temperatures. Attached to them were billet K1 H beam connecting rods made from 4340 steel. Karl and I went with a CNC shop in town and they were able to balance everything in a week.

With the head picked up and now assembled, and the piston rings gapped and set to a cylinder, it was time to look how everything was going to mount up. The 1.6 Ecoboost engine uses bolts for both the head and the crankshaft main bolts. This was another weaker point of the engine that we did not want to leave to chance. Karl and I looked around, we were able to find some ARP head studs and we converted the engine from bolts to head studs. The main bolts, however, we were not as lucky, we looked for some stronger bolts to hold the extra power and settled on that since no one would build us the studs that would fit in the engine.

With everything coming together, we were looking at our next challenges. The first was to see what the transmissions would hold and upgrade the to a clutch that will handle it. The clutch was the easy part, and since everything was already out, we swapped out the flywheel with a lighter one to help the engine change engine speeds. Clutch was looking for one that made enough power, which they made and installing it with the flywheel. Our main concern was the axel shafts. The Fiesta ST comes with a two-piece CV axle shaft and we knew owners with 400 horsepower were on the edge before breaking already. The Fiesta's larger brother, the Focus ST also had a two-piece CV axle shaft from the factory, but with models getting over

600 horsepower, the aftermarket made some solid CV axels shafts that would hold the power. Sadly, no one wanted to make one for us and we could not find anything that would fit.

Another problem and the part that brought everything down was the engine bearings. We knew to go into this project that we would need a stronger bearing to deal with the power and weight of everything. Ford had their original manufacturer bearings and that is what most people used, but they also would use the original crank. We originally want to get a tri-metal composite rod and main bearings. Many companies had them in parts catalogs as well, including Clevits and King bearings. Yet even with part numbers listed, it was impossible to obtain a set of bearings. I would call in about once a week asking about these bearings. All I would get was “There isn’t the demand for them for us to put them on a press.” I would try to get other engine builders in the Fiesta ST community to stir up some demand for these parts. After six months of calling for these parts, I gave up and started looking elsewhere.

So instead of tri-metal bearings, let's go for upgraded bi-metal bearings. Kings Bearings was able to supply a set of rod bearings relatively fast; anything was then six months and a "no." Now for the main bearings, which was more of the same, “We can make it, but there is not enough demand to make them.” This continued for a few more months, infuriated we looked to see what we could do. After talking with many people, the best option that we had was to run a slightly larger gap on the main bearings and run a thicker oil. The thought process was the oil in between the crank and the bearing would help with the wear and abuse the OEM bearing was going to receive. It was the best option we had at that moment and while things have gotten better in the market now, it is still hard to obtain some engine bearings.

What is even more frustrating is that the Focus ST has multiple options and it is very easy to obtain these parts.

Even the bearing issue, we were still getting close to full assembly and it was to tackle cooling. We knew this engine was going to push out more heat has it did power, so we prepared for that. While everything was apart, I ordered a triple pass radiator by Mountune to help with coolant. We also had space for an oil cooler if it was needed later. As for intake air charge temperatures, I had an upgraded intercooler already installed, but we knew it was not going to keep up with the amount of air coming through. We discovered someone who built custom intercoolers for the Fiesta ST and just started his own company, Bravo Alpha. Bravo Alpha has since become famous for its intercooler quality and performance for the Fiesta ST. It is the largest on the market today and on top of that, he is local! A quick drive to meet the man himself and to pick up car parts.

Now with everything getting assembled, it was time to get the engine installed and running. This project has taken about a year at this point and I was eager to see some results. One thing that surprised me during this build was the cost. The big purchases were expected but no one talks about all the little engine stuff like the fluids, water pumps, gaskets, and seals. While these are cheap compared to a turbo, there are many parts and they all add up fast. Luckily most of these could be found on any parts store or dealership. Karl and I get the engine in the car and everything hooked up. I have a video of my kid getting the honors to try to start it up first. Of course, it did nothing but turn over, but after inspections, a few changes, and a couple of fuel priming sessions, we got the car fired up on New Year's Eve. The car drove, not great, but it drove. I got to take the car home that day.

We started the engine breaking in process. Our first problem was oil pressure, and the car hated idling. Fiestas with upgraded camshafts are a rare thing as well, so the tuner did not have a base map for use that he knew would work. He requested a log as soon as possible, but we were not anywhere near that with the engine break-in period. The car would be great on the freeway, and while it was cold, but as soon as it would warm up and be in traffic, it would stall out and have a hard time starting. After 30 miles on the built engine, something broke and it was dead. The car sat for a year since I had to deal with a lot with family, work, and school and I couldn't put any more money into a project that was already costing me over ten thousand dollars at this point.

Once I had some free time, I pulled the engine out and apart. I have found that our engine bearings did not hold up and spun. It became a pancake and folded around the crankshaft girdle. Cylinder 1's rod bearing also decided to become dust and that whole area was burnt. On the top of the engine, the exhaust camshaft was starting to see some wear as well. That wasted the cams and the head. No one was still making the bearings we wanted in the first place, and it would be thousands of dollars for the parts to be replaced and fixed. At this point, I was ready to hold off on the built engine.

For the time being, I wanted to throw another stock engine into the car, transfer the fuel system and turbo, then be back on the road. Luckily, Ford made these engines to be put in everything, Fiesta, Focus, Fusion, and the Escape all had the 1.6 Ecoboost. Finding one in a junkyard for cheap was fairly easy. After taking a trip to Michigan and spending about 600 dollars, I picked up an engine that had less than 40 thousand miles on it. It took about a weekend to switch the engines out and get the car going on the road. After sitting for about

two years, it was time to get new tires. Easy process, tires swapped, and drove it back home. I tried to start the car the next day however, it is rotating super slow. Thinking that it is the starter motor has gone out, I bought another one and started disassembling the car. What caught my eye however is the water sitting in my charge pipe when I disconnected it from my intake manifold. It turns out that my engine hydro locked and broke many things in the engine. Including a brand-new hole on the side of the block. The car also started leaking out what looks like chocolate milk.

So that is where we are at currently with the Fiesta. The big power parts have been taken off and the car is paid off. I am still debating on what I want to do with the car. The plan is to get another stock engine and put the car to stock. If I have any issues with the car, I will sell it and make someone else's life hell. If not, then I have a paid-off car that only has 50 thousand miles and a new engine. Either way, I see this as an absolute win.

There are several things I've wish I did differently with the car. For starters, the engine bearings, apparently 2 years later, some companies are starting to make them and they are getting easier to obtain. I feel like I should have waited for something and while I wouldn't be able to drive it for a while, I would have saved some money in repairs and could have it running today.

Another thing we considered but did not do anything with was a complete engine swap. We were talking about swapping the 1.6 Ecoboost engine to a 2.0 Ecoboost engine from the Focus ST. Looking back, it would have been more work, but it would be a lot cheaper to make even more power. For example, the crankshaft that I bought, the first of its kind, was a 1,200-dollar

purchase and took over 3 months to get. A Focus ST can use the Focus RS crank, which is forged, and built by Ford, and cost 200 dollars and got it 2 weeks later. The engine bearings? Focus ST had them for around 200 dollars and one could get them in a week.

While my car has been the punching bag for many jokes, as well as the comments I get from wasting everything from time to money. I am still glad to have jumped in this project, many more Fiesta owners are starting to do engine builds and I have helped in the process to support companies take their parts from prototype to actual production. I got to meet a lot of people who were interested in cars like I was and I learned a lot about assembling an engine, even if it was a failure.

Now I plan on building something when I get done with school. Not sure quite what it is at the moment, but I know it will be fun to do so nonetheless. My biggest lesson and one I will say to anyone is, DO NOT MODIFY YOU DAILY CAR!