

→PROJECT CAR

PROJECT FAKE SNAKE: THE SWAP BEGINS

Starting the Process of Putting a Modern Ford Coyote Crate Engine Into Car Craft's 1999 Mustang GT

By Jeff Huneycutt / Photos: Jeff Huneycutt

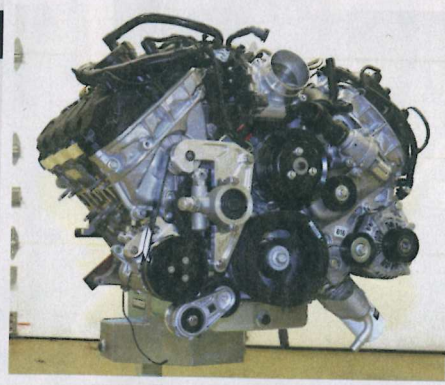
We've put in a lot of work to get to this point. The plan from the beginning was to significantly boost the meager 225 hp our Fake Snake Mustang was putting out to the rear wheels from the stock 4.6L Modular V8. But before we did that, we spent considerable time working on the chassis and suspension to prepare it so the car could reliably handle the added horsepower.

That's basically all done now. Thanks to BMR subframe braces and other components, the chassis can handle tons of horsepower without twisting up. A complete QA1 suspension, brakes from Baer, and significantly wider wheels and tires from American Muscle have done wonders to the Mustang's handling ability. And a new

9-inch from Quick Performance means we'll be able to make hard launches and do burnouts until the wheels fall off without worry.

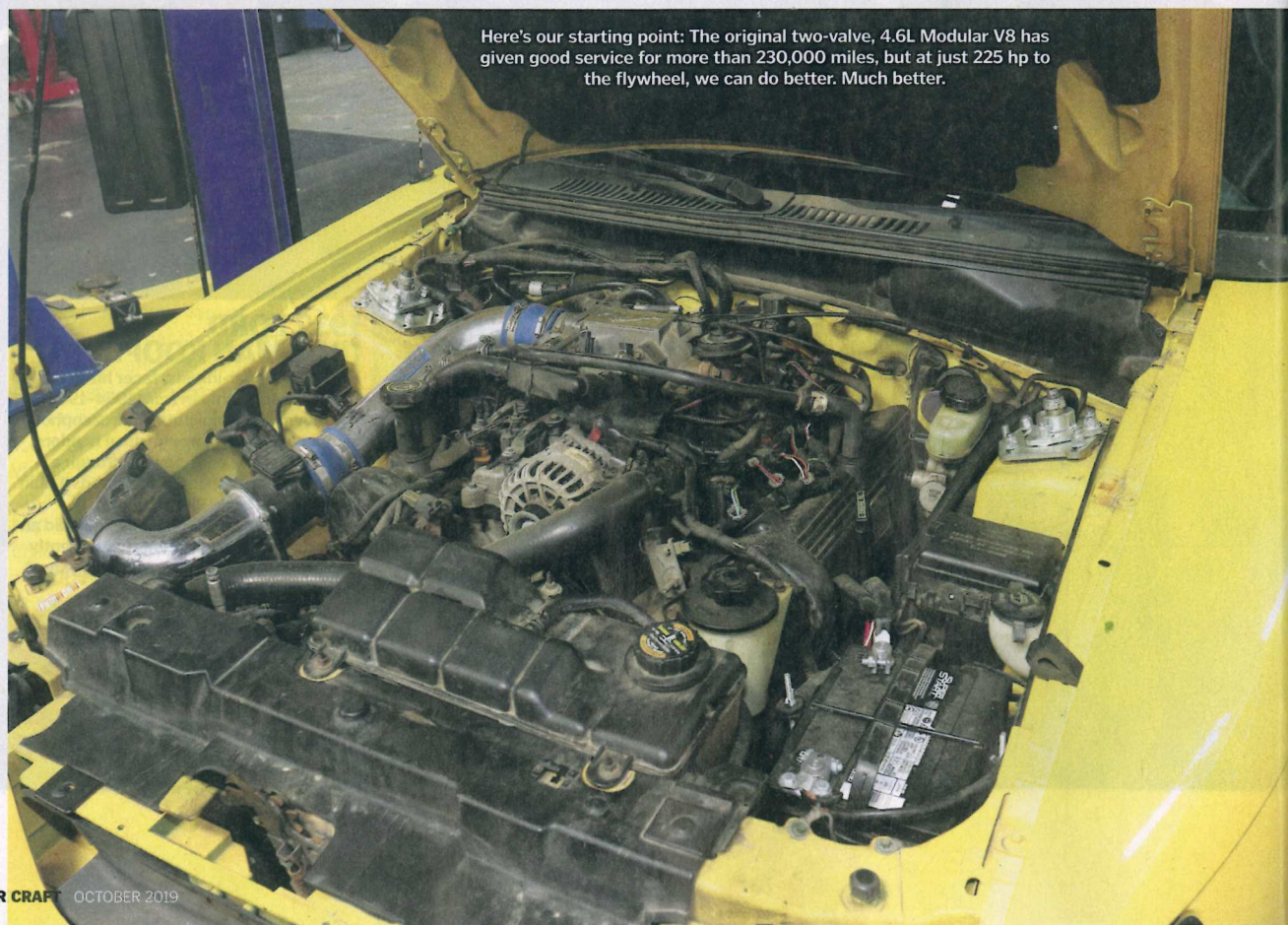
We're finally ready to make some power.

Originally, we started mapping out ways to boost the power with the stock 4.6L Modular V8. Then we thought about junkyard engine swaps. But nothing felt quite right until we talked to some friends at Ford, and they recommended one of their Coyote crate engines. At first, a crate engine may seem like a cop out, and until just recently we hadn't had the opportunity to do much testing with the Coyote. But that's changing. Mark Gearhart is doing some very interesting dyno testing on a Coyote you may have seen in



Ford sells the Coyote crate nearly complete, but there are a few things you need to make it work in a swap. Namely, modern Mustangs use electric power steering. To add a hydraulic power-steering pump that would allow us to keep our conventional power-steering system, we installed a Vintage Air Front Runner system on the Coyote. (You can see it on the left side of this photo.)

Here's our starting point: The original two-valve, 4.6L Modular V8 has given good service for more than 230,000 miles, but at just 225 hp to the flywheel, we can do better. Much better.



Along with the Vintage Air system, we also dropped the stock 8-quart oil pan for this road-racing unit from Moroso. Because this car is being built for high-speed handling, we must make sure there is proper oil control through sustained acceleration, braking, and high-G turns.



It is possible to do a Mustang engine swap with the car in your driveway on a set of jack stands, but it ain't easy. Mustangs are set up with a removable engine cradle (also called a K-member) that unbolts and allows the engine and transmission to drop right out the bottom of the car as one unit. That's only possible if you have access to a lift. If you are doing this with the car sitting on jackstands, the engine must be unbolted from the transmission and lifted out from above.

previous issues of **Car Craft**, and we wanted to cover the other side of the coin and get some firsthand experience with how the engine performs on the street and the track. Putting it in our Fake Snake Mustang project allows us to do that. And in true **Car Craft** tradition, it probably won't remain stock for long.

This particular Coyote is Ford's second-generation version of the motor. The Coyote first appeared in Mustangs with the 2011 model year sporting 412 hp and 390 lb-ft of torque. But that was bumped up to 435 hp and 400 lb-ft of torque with the second-generation Coyote that used several updates to improve efficiency without

Right: Besides removing hoses, electrical lines, and mechanical components connecting the engine to the car, to drop the engine from the bottom you will also need to unbolt the brake calipers and upper strut mounts. These are QA1 coilovers attached to a QA1 K-member we installed on the Fake Snake Mustang earlier to improve the handling. The steering rack can stay attached to the K-member, you just need to remove the hydraulic lines.



Within two hours, shop manager Paul Connor had the engine and transmission out of the car. If you aren't doing this every day, expect to spend more time to get to this point. The idea here is to show how much easier the process is if you can beg, borrow, or steal access to a lift. Next up will be to remove the exhaust, lift the engine and transmission, and separate them. All of that is tons easier when you can do it outside of the car.

Below: Rebuilding the busted T45 transmission was one of our first tasks when we purchased the Fake Snake. We also upgraded to a lightened flywheel and Sport/Performance clutch package from Advanced Clutch Technology. We love the feel the organic material clutch disc and pressure plate provides, and the ACT clutch is more than capable of handling the upgraded power of the Coyote. After a quick inspection, we simply moved the clutch over to the new engine.





Left: The stock T45 transmission bolt pattern fits the Coyote, so we'll be reusing it. This is, however, getting close to the transmission's power limit, especially if we will be driving in anger on the autocross course or dragstrip. We've got plans for a transmission upgrade down the line, but first we will see how long the T45 five-speed will last.



Starting duties will be handled by a Powermaster PowerMAX Plus starter. This permanent-magnet starter is small to fit between oil pans with kick-outs like ours and also underneath most long-tube header designs, which can be an issue with larger starters. The gear-reduction system helps create 160 ft-lb of cranking force, which is necessary to reliably spin our 11:1-compression engine.



Left: What you are looking at is a project-saver. There aren't many header options for Coyote swaps into older Mustangs, but BBK makes what we consider an excellent one. These are BBK's Coyote-swap long-tube headers for 1979-2004 Mustangs. They are constructed from 1 3/4-inch tubing that's CNC mandrel-bent for consistency and maximum flow to improve horsepower.



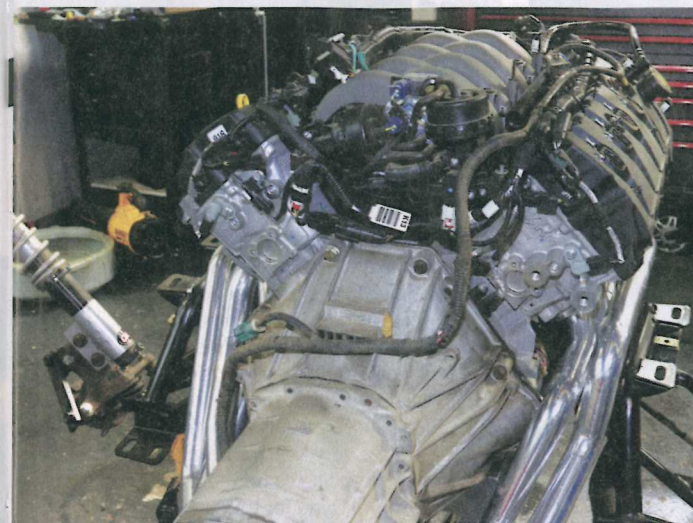
Above: The team at Pro Dyno says they've had excellent results with Cometic's exhaust header gaskets, so we're using them to help seal the BBK headers to the Coyote's cylinder heads.



Ford includes this small oil cooler on the Coyote. It won't fit any 1994-2004 Mustang K-member, so it must be removed and the oil filter fitted directly to the block.



The Coyote needs a return-style fuel system to work properly, so we're working with Aeromotive to put together a fuel system with a high-flow fuel pump, fuel regulator, and return lines. Pro Dyno helped us source a set of billet fuel rails that can be easily plumbed for a return fuel line. Here, they are being fitted with the stock fuel injectors off of the OEM fuel rails.



The transmission wiring harness includes connections for the reverse light and O₂ sensors on the exhaust and will plug directly into the Ford Performance wiring harness for the Coyote. Note the black canister just behind the intake: it's the Intake Manifold Runner Control (IMRC), which hits a flange on the firewall. We had to pull the intake manifold off so it can be removed. The IMRC is often removed for performance applications, so it wasn't going to last long on our Coyote.

increasing displacement. Ford's engineers did it with new cylinder-head and intake-manifold designs, bigger cams, larger intake and exhaust valves, and redesigned pistons. To help handle the extra power, Ford also gave the second-gen engine tougher forged connecting rods to go with a forged crankshaft. Not only does this engine respond incredibly well to forced induction from turbos and superchargers but the beefed-up internals also mean it can handle big boost without any issues.

The third-gen Coyote first appeared in the 2018 Mustang GT. It bumped the compression up to 12.0:1 (from 11.0:1), which helps increase the power and torque numbers to 460 and 410, respectively. That's nice, but the third gen also introduced the use of direct injection. We chose to go with the second-gen engine simply because it has been around longer and enjoys more aftermarket support, although we're sure the third-gen will eventually catch up. (Fans of the newer, third-gen Coyote can still follow Mark Gearhart's series of test stories.)

Of course, we won't pretend that any modern engine swap—no matter the manufacturer—is as easy as dropping

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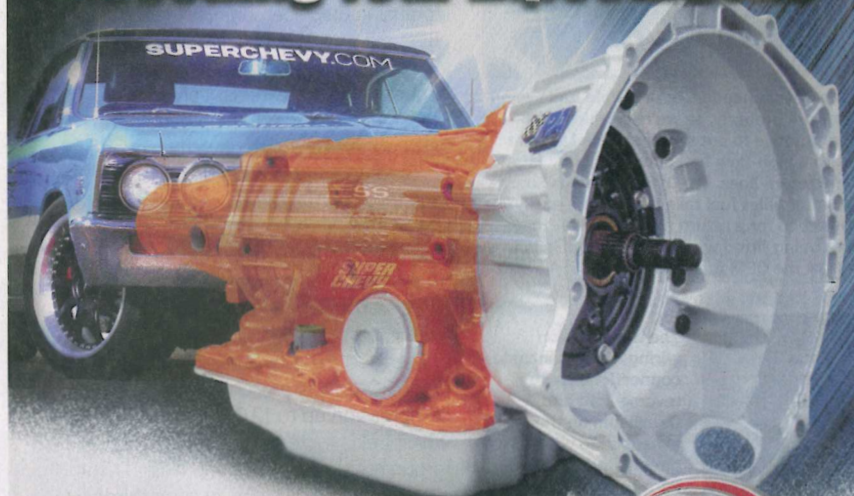
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Here, you can see the Coyote engine and T45 transmission sitting in the QA1 engine cradle ready to be raised into the 1999 Mustang's engine bay.

in a carbureted small-block. There's a drive-by-wire throttle that requires a new fuel pedal, multiple sensors, and unique fuel-system needs. Ford includes an option to purchase a wiring harness specifically for swaps using the Coyote, but there's still a lot to it. To be able to give you the very best information possible, we partnered with Pro Dyno for this stage of the project.

Pro Dyno is a speed and tuning shop in Fort Mill, South Carolina, specializing in Fords in general and Mustangs in particular. We've always been impressed by its builds, and when owner Dan DeSio offered to lend a hand with the engine swap, we couldn't say yes fast enough.

That turned out to be an excellent idea. Shop manager Paul Connor has already done this swap numerous times and attacked the

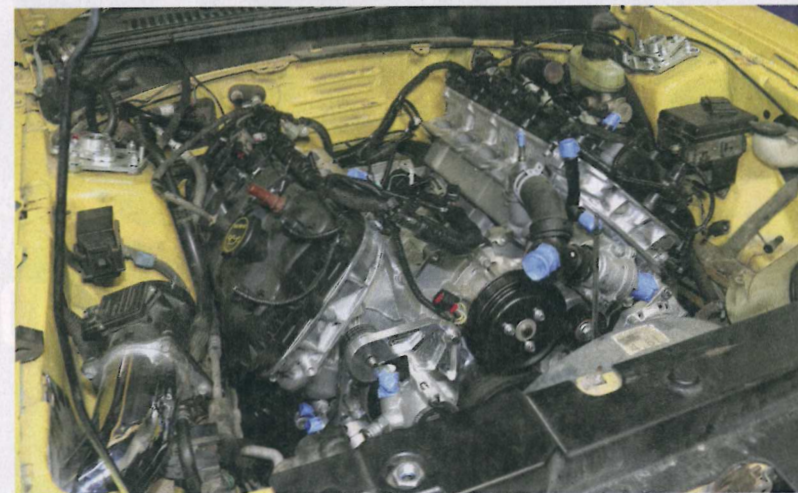


This photo shows how the IMRC canister just barely hits this flange in the engine bay. If you want to keep the IMRC, you can cut a little sheetmetal to create the clearance needed. It's up to your preferences.



Above: After pulling the intake manifold, the engine fit with no further issues. Connor bolts the QA1 K-member back into the Mustang.

Below: It's tight in a few spots, but the Coyote certainly fits and looks good in the SN95 Mustang. There's still a long way to go, but the first sight of a new engine in a car is always a pulse-quickener.



project like a dog on a bone. We started at 8:30 a.m. and the 4.6 Modular, along with the transmission, was sitting out of the car on the shop floor by 11:30 a.m. Getting the new engine and all the support systems into the car is a bit more involved, but we're already spotting mistakes we would have made that Connor has helped us avoid. He was generous with the knowledge and

experience he's gained over the years, and we'll be sharing everything we've learned with you here.

This is the first of two parts on the Coyote engine swap. If all goes well, we will finish up the necessary fabrication and installation in the February 2020 issue when we get the car up on the chassis dyno and out on the road to see how it all works. Stick around! ☑

→ SOURCES

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BBK Performance; 386/624-0025; BBKPerformance.com
Cometic Gasket; 800/752-9850; Cometic.com
Ford Performance; PerformanceParts.Ford.com
Powermaster Performance; 630/849-7754; PowermasterMotorsports.com
Pro Dyno; 704/651-3807; Pro-Dyno.net
QA1; 800/721-7761; QA1.net
Vintage Air; 800/862-6658; VintageAir.com

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