

Trade Winds

LYSHOLM PUTS OVER-THE-TOP POWER INTO A STEALTH PACKAGE FOR '03-'04 COBRAS

Text and Photos by **KJ Jones**

For whatever reason, there definitely has been a lengthy dry spell of sorts when it comes to talking about the factory-supercharged New Edge 'Stangs. Now before you start thinking that we simply don't have love for the '03-'04s, please believe us when we stress that is *not* the case. We certainly do dig SVT's Terminator Mustangs—a lot. However, the bolt-on tech side of our coverage on these cars has been limited over the years, mainly because there hasn't been much fresh gear for these 'Stangs.

As you know, we're all about getting after it, and being your go-to magazine for details on hot, new products that the aftermarket produces for all post-'79 Mustangs. Of course, Terminators are VIP members of that collection of Ponies, and we're happy to report that we were the first publication to work with Lysholm's new 3.3-liter twin-screw supercharger (PN 3320020; \$4,695.95) for '03-'04 Cobras.

For this exercise, we chose to forego doing the routine evaluation that starts with a stock car as a baseline. Instead, we are evaluating the effects of Lysholm's twin-screw unit and a set of hotter camshafts on a Cobra already modified with only the typical bolt-on pieces. On these cars, a small blower pulley, long-tube headers, and a CAI system are standard issue, but our test car also features a ported factory Eaton supercharger.

Miguel Gonzalez of Phoenix, Arizona, owns this ride. His '03 Snake, so modified, makes 500 horses at the rear wheels. According to a few noted Mustang tuners we conferred with about the overall performance potential of factory-blown Four-Valve combinations like Miguel's, horsepower in the low-to-mid 500s appears status quo for a hot Terminator.

Of course, sometimes we like to go beyond the status quo in these tech efforts, especially when the reward for exploring new performance territory is the proverbial big steam. Read on and follow closely. The accompanying photos



▲ The engine in our test 'Stang, Miguel Gonzalez's '03 Cobra, is about as maxed out as these bullets get before aftermarket parts such as bigger blowers and camshafts are added. With a small pulley on the blower, a cold-air-intake system, a big throttle body, long-tube headers, and a ported Eaton supercharger, Miguel's Snake puts 505 horses on the ground.

HORSE SENSE: "You guys never show the '03-'04 Cobras any love in the magazine." If we had a nickel for every time we've heard or read that comment—or a similar comment about another generation of 'Stangs—we all would be well on our way to having enough money to put down on '11 GTs!

TERMINATOR BLOWER UPGRADE

and captions detail our quest to bring 700 horses to the feet of Miguel's Cobra, through a Four-Valve camshaft upgrade and installation of Lysholm's new 3.3-liter twin-screw supercharger performed by the skilled snake charmers at AMP Performance in Phoenix, Arizona.



▲ As we've detailed in previous tech reports that involved cylinder head or camshaft swaps on modular-powered Ponies, AMP Performance performs such surgeries by completely removing the engine and transmission in one effort, using this purpose-built cradle to secure the assembly, while the 'Stang is lifted on a twin-post hoist.



▲ An '03-'04 Cobra's stock independent rear suspension is well known as the "weakest link" in any 450-plus-rear-wheel-horsepower Terminator's drivetrain, especially if the car is subjected to hard launches on the street or dragstrip. In anticipation of the power gains that a set of cams and Lysholm's 3.3 blower will bring, Miguel has already made the switch from IRS to an 8.8 rearend beefed-up with 31-spline axles, a Detroit TrueTrac differential, and 4.10 gears. Also, the Cobra's T-56 transmission was upgraded with a 26-spline input shaft.



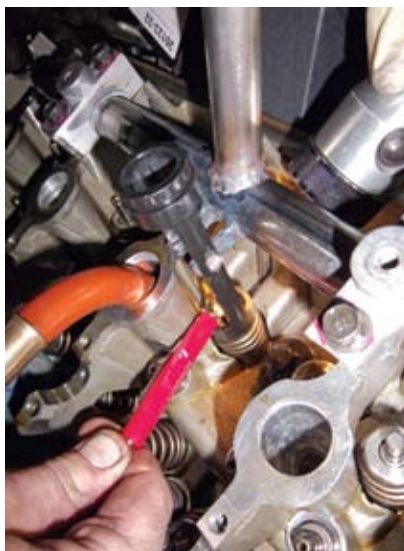
▲ Disassembling the top half of Miguel's 4.6 is the first order of business, and it is handled by AMP's top tech Chris Ciolek.



▲ While engine disassembly is a fairly routine process (take parts off and remember where they go; take photos for reference if necessary), we believe it's important to point out the fragility of the rubber O-ring that seals the plastic OEM timing-chain tensioners to a Four-Valve Cobra engine. Even with careful removal, the rubber usually tears, so having a new set of tensioners on hand is a good idea. Having a new set of Ford Racing Performance Parts' steel tensioners is an even better idea.



▲ As a practice, AMP Performance replaces the OEM oil pump with a Melling high-volume pump (PN 10227) on all modular-engine upgrades or builds that require removing the timing cover. Mickey Jacobs is the second half of this project's technician team, and he handled the pump replacement for this project.



▲ Due to the new cams' increased lift, Comp Cams' beehive valvesprings (PN 26123-32) and titanium retainers (PN 798-32) are installed before the cams are set. AMP techs definitely are all about having the right tools for a job; case-in-point is this custom, one-off Four-Valve valvespring compressor that Chris fabricated on the spot, which helped make quick work of the spring exchange.



▲ Here's a look at our entire valvetrain hop-up kit, which features Comp's Xtreme Energy high-lift camshafts (PN 106-462-9LI) and the aforementioned beehive valvesprings and ti retainers. With a 116.0 center line, lift for the hydraulic cams measures 0.475/0.450 (intake and exhaust), and duration at 0.050-inch is 238/240. We're certain the cams will make a noticeable difference in our engine's idle. However, more importantly, the cams' increased exhaust duration is exactly what the big blower needs when it starts making serious boost of 15 psi and better.

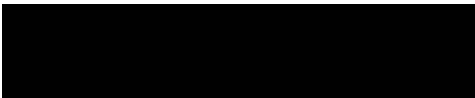


▲ Chris also recommends making ARP's timing-gear bolts a part of any mod-motor camshaft swap.

▶ When you hear the term ported Eaton used in '03-'04 Cobra circles, it refers to something that looks like this. Stiegemeier Engine Air Flow is the company that has mastered hogging out the passage area of OEM Eaton M112 superchargers. The increased size does not specifically increase



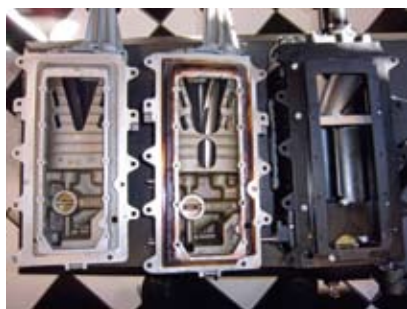
boost, per se, as Roots-style Terminator blowers only move a fixed amount of air volume. So, in lieu of boost gains, the size increase brought about by porting basically speeds up the rate that air is forced into the engine, and helps decrease the amount of heat that is generated by the rotors. With each port job, Stiegemeier also opens the blower's air-inlet passage, as well as the throttle-body plenum.



▲ While 3.40-, 3.20-, 3.10-, 2.93-, 2.80-, and 2.76-inch pulleys are the popular sizes for Cobras with stock superchargers (3.65 inches is the OEM pulley diameter), the eight-rib wheel sizes for our Lysholm 3.3-liter wind machine start at 4.25 inches and work downward to 4.00- and 3.75-inch pulleys.



▲ The new Lysholm supercharger is simply bigger than stock on all counts, and even other aftermarket superchargers for Cobras. Notice the huge twin-screw rotors. When this system is in effect, the male rotor turns in a clockwise direction, while the female rotor turns the opposite way. The rotors' counter-acting function forces and compresses air between both of them, and then forces it through this large discharge passage and into the engine.



▲ From left to right, we show an OEM Eaton M112, Miguel's ported stock blower, and the new Lysholm 3.3 we're replacing it with.

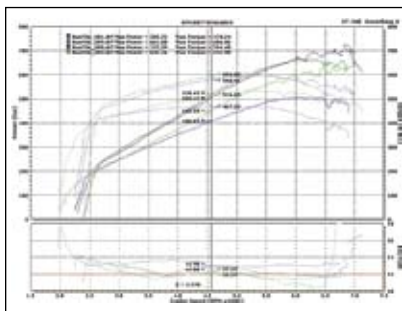


ON THE DYNO

RPM	EATON			4.25			4.00			3.75	
	POWER	TORQUE	A/F	POWER	TORQUE	A/F	POWER	TORQUE	A/F	POWER	TORQUE
3,500	299.60	449.58	13.48	356.48	534.94	11.60	349.56	524.55	12.28	308.80	463.38
3,600	311.38	454.28	13.48	371.61	542.15	11.50	364.35	531.56	12.10	323.02	471.26
3,700	321.51	456.39	13.50	385.58	547.33	11.57	377.92	536.45	11.93	335.90	476.81
3,800	331.58	458.29	13.57	400.60	553.68	11.68	393.02	543.21	11.84	347.08	479.72
3,900	341.98	460.54	13.67	412.54	555.57	11.78	404.24	544.38	11.95	361.20	486.43
4,000	353.21	463.77	13.64	428.39	562.48	11.87	420.01	551.49	12.22	373.66	490.62
4,100	359.13	460.04	13.54	444.44	569.33	11.97	434.66	556.80	12.46	385.70	494.08
4,200	370.15	462.87	13.48	459.22	574.25	12.01	450.62	563.50	12.64	400.56	500.90
4,300	377.46	461.04	13.45	476.07	581.49	12.04	465.24	568.25	12.80	413.01	504.46
4,400	391.80	467.67	13.31	490.21	585.15	12.09	479.11	571.89	12.89	425.91	508.40
4,500	399.71	466.52	13.01	507.09	591.84	12.21	494.10	576.68	12.90	440.88	514.57
4,600	408.86	466.83	12.84	522.61	596.69	12.38	510.09	582.40	12.91	453.37	517.64
4,700	417.80	466.88	12.85	537.03	600.11	12.49	522.95	584.38	12.94	468.12	523.11
4,800	427.59	467.87	12.88	549.89	601.69	12.46	539.33	590.12	12.98	481.27	526.60
4,900	436.70	468.09	12.90	564.97	605.56	12.42	550.11	589.64	12.96	494.10	529.61
5,000	443.46	465.82	12.92	577.06	606.16	12.32	563.77	592.20	12.81	505.30	530.78
5,100	450.94	464.39	12.91	588.85	606.41	12.09	574.09	591.22	12.60	515.96	531.35
5,200	460.29	464.91	12.88	598.21	604.20	11.86	585.93	591.81	12.41	528.33	533.62
5,300	468.54	464.31	12.87	607.57	602.08	11.69	599.87	594.45	12.25	539.06	534.19
5,400	476.02	462.98	12.87	619.06	602.11	11.57	607.51	590.87	12.12	544.78	529.86
5,500	485.14	463.27	12.93	627.96	599.66	11.48	619.88	591.95	12.05	555.37	530.34
5,600	491.96	461.39	13.02	637.47	597.87	11.43	629.89	590.76	12.04	565.67	530.53
5,700	495.87	456.90	13.07	639.44	589.19	11.44	637.75	587.64	12.02	571.52	526.61
5,800	499.73	452.52	13.09	647.35	586.20	11.44	646.13	585.09	12.01	565.87	512.42
5,900	499.95	445.05	13.07	652.58	580.92	11.43	654.03	582.21	11.98	590.49	525.65
6,000	502.87	440.19	13.03	660.03	577.76	11.42	663.64	580.92	11.95	594.26	520.19
6,100	503.34	433.38	13.00	659.28	567.64	11.45	664.43	572.09	11.89	602.51	518.76
6,200	500.14	423.68	12.97	660.04	559.13	11.52	672.68	569.83	11.84	609.07	515.95
6,300	501.41	418.01	12.91	659.10	549.47	11.59	691.57	576.54	11.79	597.84	498.45
6,400	502.45	412.33	12.97	655.88	538.30	11.61	679.79	557.87	11.76	596.12	489.23
6,500	493.70	398.92	13.17	647.31	523.04	11.63	684.67	553.23	11.76	626.61	506.31
6,600	478.29	380.61	13.16	648.20	515.86	11.63	692.17	550.81	11.80	610.75	486.01
6,700	493.15	386.60	13.16	633.82	496.85	11.63	688.84	540.06	12.06	614.59	481.78
6,800	485.15	374.72	n/a	655.54	506.32	11.81	697.75	538.94	12.74	622.21	480.58
6,900	451.04	343.32	n/a	629.57	479.22	n/a	715.57	544.76	13.87	617.43	506.68
7,000	n/a	n/a	n/a	633.49	475.31	n/a	656.47	492.58	16.23	627.15	506.77
7,100	n/a	n/a	n/a	n/a	n/a	n/a	622.91	460.97	16.44	629.13	500.65

Dyno testing after changes is always the most-anticipated phase of projects like this '03-'04 Cobra cam/big-blower upgrade, and we certainly didn't waste any time getting Miguel's freshly modified '03 Terminator loaded onto the Dynojet chassis dyno at AMP Performance. With our goal being to see how far a switch to hotter camshafts and a much-larger supercharger takes horsepower and torque, we evaluated the new setup using blower pulleys measuring 4.25, 4.00, and 3.75 inches. Our sights were on seeing 700-or-better horsepower from the new combination.

For this experiment, the numbers tell it all. With PCM calibration accomplished using DiabloSport's Chipmaster Revolution tuning software and through a Predator handheld flash device, our cams/twin-screw combination (with the big 4.25-inch pulley) immediately came within 40 hp of our ultimate goal of 700. Belt slippage limited this and the two other configurations (4.00- and 3.75-inch) from showing the setup's true hand, which we believe ultimately could



approach 800 horses at the feet. (An unofficial pull with the 4.00-inch pulley netted 735 hp.) For the money you'll invest in parts and labor, the package is a beast!

We're firmly entrenched in a time when 600 horses is the expected norm for street-driven Mustangs, as bolt-on power adders have made reaching the once-unfathomable mark quite doable. To have a completely driveable 'Stang that puts nearly 800 horses on the ground is truly

◀ Gains across the board! That's what we like to see when we do projects like this. We gave our power-improved Snake a severe workout on AMP's Dynojet chassis dyno, and the numbers were incredible. You'll notice the distortion in the 6,700-rpm area of each curve—a telltale sign of belt slippage, which came about consistently just as boost reached 17-20 psi. Unfortunately, limited time prevented us from experimenting with idler pulleys that we think would have helped our cause. But as the graphs show, the addition of hot camshafts and the big supercharger definitely puts the Cobra's power and torque output on the next level.

above-board, especially for Terminators with stock-bottom-end 4.6s as opposed to Shelby GT500s with fully built supercharged 5.4s.

It indeed is refreshing that despite all the forward progress the aftermarket is making for the latest Mustangs, new technology for '03-'04 Cobras is still being developed, and in some ways, performs even better than similar hardware for later models.

EATON VS. 3.75

A/F	POWER	TORQUE
12.40	9.20	13.80
12.26	11.64	16.98
12.05	14.39	20.42
11.79	15.50	21.43
11.60	19.22	25.89
11.76	20.45	26.85
11.91	26.57	34.04
11.97	30.41	38.03
11.98	35.55	43.42
12.03	34.11	40.73
12.16	41.17	48.05
12.27	44.51	50.81
12.32	50.32	56.23
12.33	53.68	58.73
12.30	57.40	61.52
12.16	61.84	64.96
12.01	65.02	66.96
11.82	68.04	68.71
11.61	70.52	69.88
11.48	68.76	66.88
11.43	70.23	67.07
11.33	73.71	69.14
11.12	75.65	69.71
10.81	66.14	59.90
10.77	90.54	80.60
10.82	91.39	80.00
10.78	99.17	85.38
10.59	108.93	92.27
10.36	96.43	80.44
10.35	93.67	76.90
10.91	132.91	107.39
12.86	132.46	105.40
18.00	121.44	95.18
n/a	137.06	105.86
n/a	166.39	163.36
n/a	n/a	n/a
n/a	n/a	n/a

► This 4.00-inch pulley proved the best of the rest during our dymo session. However, when the slipping situation with the 3.75-inch wheel is corrected, we're sure Miguel's '03 Cobra will approach the magical 800-rwhp mark.



TERMINATOR BLOWER UPGRADE



▲ The stock intercooler is reused with the new supercharger. Prior to installing the cooler, Chris applies a bead of silicone around the base of the blower to ensure a strong leak-free seal.



▲ With the intercooler secured to the blower, Chris lowers the new unit down atop our freshly cammed Four-Valve. The blower features a billet adapter plate that allows for simple attachment to the OEM lower manifold; an integrated 44mm bypass valve assembly, a cast inlet manifold and a high-flow throttle body; and remote mounts and relocation pieces for the throttle cable, IAC and EGR valve. The throttle body in question is a 13.694-inch monoblade unit that offers 73 percent more flow over the factory piece.



▲ Reinstalling the OEM six-rib drive pulleys and serpentine belt for accessories is one of the final assembly related tasks that Chris performs before the big-boosted bullet is returned to the Cobra's engine bay.



▲ When considering performance changes such as installing a large-displacement supercharger and going after big-time horsepower, converting a Cobra's factory fuel system to return-style is a must. Lysholm does provide fuel rails with its Terminator system. However, we chose to install a complete return-style fuel kit from Lethal Performance (PN LP-0304COBRETURN). This turnkey system includes Fore Precision Works' dual-pump fuel hat; Fragola Series 8000 Push-Lite race hose and AN -8 hose ends/fittings; Fore's high-flow fuel rails; two Walbro GSS342 fuel pumps; and all of the wiring and incidental accessories that are necessary for installation, which can be done in about two hours.



▲ Fuel-injector selection really is dependent on the overall horsepower you hope to achieve. Our sights are set on seeing 700 horses at the feet of Miguel's Cobra, so Ford Racing Performance Parts' 80-lb/hr injectors (PN M-9593-LU80) were chosen to round out Lethal's return-style fuel system. As a package, this fuel system will easily support 850 rwhp.



▲ We're pretty sure Miguel's vanity license tag will require changing after this cammed, Lysholm-topped Four-Valve is bolted in and cut loose on the dragstrip!



▲ Once the fuel tank is bolted back into the Cobra and lines are installed, Chris and Mickey lower the car down over the engine and transmission, and complete the installation by making the final hose and wiring connections.



▲ Fore Precision Works' billet fuel-pressure regulator also is included in the Lethal Performance fuel-system package. Mickey affixes it to the passenger-side inner fender on Miguel's ride.



▲ Due to the enormous size and installed position of the supercharger's mass-air tubing, a Terminator's battery must be relocated to the trunk, using a remote-mount kit that's available through most Lysholm dealers. Notice how AMP stealthily mounted an On/Off switch for the battery behind the passenger-side taillight?

▶ Since major power is the primary goal of this effort, we opted for Lysholm's optional 5-inch Cold Air Inlet Duct Assembly and its massive 123mm mass-air housing rather than the 4-inch/90mm set that is standard with the supercharger system. We're tuning our setup using the stock mass-air sensor, however, the Ford GT sensor may be a better bet for this large-diameter inlet.



▲ Here's Miguel's engine, with its new Lysholm 3.3-liter supercharger sitting front and center. The wicked-cool thing about this application is that despite the blower's massive size and the 5-inch air-inlet ductwork we used, it all fits cleanly below the Cobra's stock hood! **5.0**

SOURCES

AMP PERFORMANCE

(800) 454-8387
www.ampperformance.com

COMP CAMS

(901) 795-2400
www.compcams.com

DIABLOSPORT

(877) 396-6614
www.diabloSPORT.com

FORD RACING PERFORMANCE PARTS

(800) 788-FORD
www.fordracingparts.com

LETHAL PERFORMANCE

(877) 2LETHAL
www.lethalperformance.com

LYSHOLM SUPERCHARGERS

(805) 247-0226
www.lysholm.us