

AT ♦ THE ♦ SIGN ♦ OF

The Cat

The official publication of the Cougar Club of America



The 'Aero Cat' Spotters Guide

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The Cougar Club of America

Editor

Carl Graziano

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Editor's Desk

I still have a silly grin on my face that started in Carlisle, Pa., more than a month ago. There, at the famous fairgrounds that most auto enthusiasts (or, at least, the East Coasters) consider hallowed ground, the Cougar Club of New Jersey and Delmarva Cougar Club met under the CCOA banner to host the "Mid-Atlantic Prowl." About 60 cats showed up for three days of car and parts heaven. The Prowl occurred as part of Carlisle Production's annual All-Ford show, an event that, for FoMoCo lovers, has few equals east or west of the Mississippi.

So, I'm still smiling, as my three days in Carlisle were about the best time I've had since I became involved in this hobby so many years ago. The cars and camaraderie among Cougar enthusiasts really drove home for me the real truth about local club and CCOA involvement: There's no substitute for a flesh-and-blood (steel and rubber?) club experience, be it a show, a cruise night or other event. Personal, in-person contact with fellow Cougar lovers and their cars is what it's all about, my friends.

The CCOA, by the way, encourages more regional shows like the Mid-Atlantic Prowl and stands ready to support such events. If you have a hand in your local club's events planning, do yourself a favor and take the CCOA up on this offer.

Doh!

My apologies to Cascade Cougar Club member and fellow newsletter editor Bill Herbert for inadvertently leaving his name off the "Cat Tales" column in the Spring 2000 *ATSOTC*. Bill told the tale of how he found his '69 ragtop, "OURCAT." I suffered a brain cramp and forgot to tell you, the reader, that Bill wrote the article.

If you didn't see Bill's Cat Tales piece, check it out—it's well worth the read.

Photo Finish

I wrap up my column with a few thoughts on submitting pictures of your car for use in *ATSOTC*.

Please, if possible, send original, hard-copy photographs rather than scanned images on disk or as e-mail attachments. Why? Most digital cameras don't save photos at a resolution high enough to reproduce well in print. And photos scanned at a suitable resolution (300 dpi), create files too large to send to someone like me, who's still poking around the 'net at 56K. So, if you have show photos, submissions for the "Cats in Color" section or other shots, send me hard-copy originals—I'll return them when I'm done.



Carl Graziano

President's Report



Scott Ferguson

While the CCOA Board of Directors has been relatively quiet over the past month or so, senior officers have been burning up the lines of communication through e-mail and telephone discussions on myriad topics.

We have been considering expanding the judging rules for '74 and newer Cougars. I have owned many '67 to '74 Cougars and don't have a great deal of expertise with the newer models. We are going to see if we can get some help from both the Mustang Club of America and the national Thunderbird club to see what they are using now, and then modify the information to use it for our Cougars. Of course, we will need your help to compile as much information as possible on these models. Don't be shy about contributing; if you don't, we may not get the information we need. Please send the information to either CCOA Vice President Frank Paty or Technical Director Richard Hertzler.

As always, I and other CCOA leaders want to boost membership and, to that end, we are developing an incentive program for current members who help recruit new members. There are lots of Cougars out there, but not all of the owners belong to either the national or a local club. We have hundreds of potential members out there who just need a push in the right direction.

Another project under development is a guide book on hosting a local Cougar show. The guide will cover types of venues (park, hotel, shopping mall), documents and insurance you might need and other tips to make your event one participants

will look forward to year after year. The guide also will offer information and suggestions on hosting CCOA-sanctioned events, such as Regional and National shows, including what the CCOA expects from the local host club and what support the CCOA will provide. I know most of the local clubs have experience with hosting these types of events and we hope to help all clubs by drawing on that experience for the guide. Please send your suggestions to either Frank or me.

Frank and I have been working on a list of vendors that give discounts to CCOA members and we will publish this list in *ATSOTC* and on the CCOA Web site (www.cougarclub.org). So far, we have heard from only a few vendors. If you're a vendor and haven't responded, please contact me or Frank soon to secure your place on the list. The list represents a win-win situation for members, who receive discounted merchandise, and vendors, who establish contacts with new customers they might not otherwise have found. We also will publish excerpts of CCOA bylaws changes, which need to go to a member vote, later this year in *ATSOTC*. We will post the full bylaws on our Web site, too.

We are happy to report that Texas member Eric Overton will photograph member cars for the CCOA 2001 calendar. You might be familiar with Eric's work for other calendars in past years. You also may submit high-quality shots of your cars to Communications Director Jim Karamanis.

I will attend both national shows this year, as well as two regional shows. I will report on these events in upcoming issues of *ATSOTC*.

Regional Reports

2S Well, here it is spring, and the car nuts are active again. On April 9 the D/FW Cats club and the North Texas Mustang club got together and had a "Cat and Pony" swap meet. The clubs BBQ'd and we put out our spare parts to sell.

May is the big show month in North Texas. There is a show every weekend and, sometimes, more than one. There was a show April 6 at AER in Carrollton, Texas, which benefited the Kidney Foundation. About 126 cars (all makes) were entered in the show. Four cars from the D/FW Cats club were there.

The Rockwall County, Texas, Historical Society put on a show May 21 to benefit the society. About 180 cars were entered in the show. There was no Cougar class, but three of the five cars from the D/FW Cats club took home trophies.

In the Classic car class, Ken McDowell took second with his '73 convertible and Ray Bodensteiner took third with his '67 restomod. In the Muscle Car class, Doug Bodensteiner took second with his '69 Eliminator.

Things are happening in Wichita, Kan., home of the Heartland Cougar Club (HCC). The club is making its presence known and everyone is taking notice. On April 16, HCC members had seven Cougars entered in the Twin Lakes Car Show, which benefited Literacy Resources. They had six cars entered in the Classic Cobra II car show May 19 to 20, which was put on by the South Central Kansas Mustang Club. In the Cougar Class, Eamon Arndt took first place with his '68 DGS, Marty Farmer took second with his '70 Eliminator Boss 302 and the Swansons got

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third with their '69 XR-7. To top off the day, HCC took home the club participation award. Way to go HCC! They have been in existence less than six months and already have 25 members.

The next big event will be the CCOA East Nationals. Looking forward to seeing you there.

—Ken McDowell

5 As a copy of *ATSOTC* drops on the mat, so it's time for us directors to think about what we're going to write for the next issue of your favorite automotive magazine. Such is the lead time we work to.

As I sat staring at my blank screen, Jeanette reminded me that it was Mothers Day last weekend and that it has been 18 years since we first visited the United States. We know this because my nephew has his birthday about now! So concerned was his mother that we were out of the country, that she waited for us to get home before she let Shaun out to play in May 1982!

So, why were we in the United States at that time? Well, that it was for the first-ever CCOA nationals, May 7 to 9, 1982, at Bob Fischer's Fischer Classics, near Ashland, Va. We had been promising ourselves a trip over for many years and this seemed like the best excuse we could find. Or maybe it was just the excuse we needed to visit.

First off, we flew into New York's Kennedy airport and picked up our rental car. We had booked a Ford Fairmont but we were offered a small station wagon; we said "no." They gave us a T-bird and off we went to visit with Tom Jacobellis, co-founder of the CCOA and president at that time. Our plans were that we would take a week to get to Ashland, spend the weekend at the meet and take the next week to get back to NYC. This worked pretty well, except for a couple of wrong turns and missed off ramps. I suppose this was excusable, at least the first couple. Here we were, driving on the wrong side of the street with the steering on the wrong side of the car. And we were just a little jet-lagged. Jacobellis had a fit when I drove the wrong way down a street in the Bronx! Trust me, I had this feeling it was one way, don't know why, just did. It wasn't! I moved pretty darned quick to the right and I've never made that assumption again on subsequent trips!

We missed an off ramp just out of New York that sent us toward Pennsylvania instead of Niagara Falls, but that wasn't too important. We could have found our way back, but didn't bother. We'd never been to Pennsylvania either, so why not? It wasn't anybody's fault—the map we had was a bit vague. We picked up a better one and all went well from then on. We ambled through the Poconos, took in the wonderful smells that hang

over Hershey and trundled our way on toward the Shenandoah Valley, taking in Gettysburg along the way. We had the time, so along Skyline Drive we went. Anyone who's thought about taking that route and hasn't yet, do it. The views are great and it's a very sedate 35 mph all the way. We stayed overnight up there. To see the sun set and then rise over the Shenandoah is...well, figure it out.

We dropped down into Rock Fish Gap and, trust me, the Waltons weren't exactly the last thing on our minds. Especially that night when we learned that the motel manager's pet poodle was named John Boy! We stayed in Charlottesville and took in Thomas Jefferson's home, Monticello. Now, I don't want to ruffle any feathers here, but if that's the best you can do for a stately home... nah, I'm just joking again, we really enjoyed our visit there before we scooted over to Montpelier and Fischer Classics late Friday afternoon.

There were more Cougars there than Jeanette and I had ever seen before. I don't have the facts or figures any more—it's too long ago and I can't find a show report anywhere, but I figure 30 or 40 over the weekend. We met with just about everyone and, if you're still members and I can't remember your names, forgive me. I do remember Tom Jacobellis, of course, and Jim Rakowsky, Doug Fortune, Ted and Barb Cragulets. I think the Browns were there from Missouri, plus all the guys from Fischer Classics. I'm not certain now, but I think it was Wilma Brown who said of my accent: "You sound just like my dad. He came from Halifax, Yorkshire." I don't know about that; I'm from the other side of the mountain! (Forgive me if it wasn't you, Wilma.) Then there was someone who said, "This is Barrie, from England. Come say something in English." Eighteen years on and I'm still trying to figure that one out!

The weekend came to an end all too quickly and we spent the rest of the week making our way back to NYC. But not before we'd visited Colonial Williamsburg, the Chesapeake Bay, Fredericksburg and Washington, D.C., among other places. We picked up a load of bumper stickers along the way, including one that said "Virginia is for Lovers," which we lost when we sold the car that carried it. We've visited the United States and Canada many times now since 1982, but Virginia will always stay in our minds.

Thanks for sharing these memories with me.

—Barrie Dixon

6 Springtime has come to most of North America, which has caught up with the West Coast and Florida, where it's sunny and warm all year long, it seems.

It is time to roll the Cougar out into the sunshine. The only worry this year will be the price of gas, and for me that means two eight-cylinder vehicles to fill. Here in Ontario, through most of the winter, we have been paying 72 cents to 76 cents a litre, which, when measured by the gallon, is almost \$3 per. The federal government in Ottawa has said it will lower its share of the gas tax if the provinces will do the same. Some provinces have said no, but Ontario says it is willing to talk. In Canada, our federal and provincial governments are great for “studies” and task forces to study the rising gas prices. But three months later and a few million dollars, the study only will conclude the obvious: Canadians are paying too much for gas.

Now is the time for my annual history look at the Cougar years. It was 1970, which brought the second year of the model change and a new front grille with more of the '67-'68 look. Ford Motor Co. announces it will raise car and truck prices by 5 percent for 1971 and drop the five-year, 50,000-mile power train warranty on light trucks. Also: Nixon pulls out 40,000 troops from Vietnam, The Beatles decide to call it quits and release their final album, “Let It Be,” on Oct 4, and legendary blues rock singer Janis Joplin dies. In sports, the Kansas City Chiefs take the superbowl by defeating the Minnesota Vikings 23-7. On May 10, the Boston Bruins win their first Stanley cup since 1941 in a four-game sweep of the St. Louis Blues; Bobby Orr scores the winning goal. Here in Canada, 6,891 new Cougars rolled out of the showrooms, down from an all-time high of close to 12,000 two years earlier.

Now that the cruise night and show season is here, I find out what is going on and I compile a list of events, too late for the last newsletter and all over by the time this issue hits the streets. For some of the events still to come in September and October, go to the Great Lakes Cougar Club Web site, at clubs.hemmings.com/greatlakescougar/, and check out the regional events page.

On the local scene, I would like to thank the other directors of the GLCC for their support and a sponsorship in my 10K walk in the Super Cities walk for Multiple Sclerosis. The MS Super Cities walk is held every year in April in several cities throughout Ontario. It was a sunny, but cool, day, but a good morning workout and some money raised for a worthwhile cause.

We in the GLCC have made plans to attend some shows as a group this summer, such as Canal Fest in Port Colborne, Ontario. In addition to attending a good car show, we get to watch the lake and ocean boats entering the Welland Canal from Lake Erie. We also plan to cruise to the Toronto area to Summit Ford and the Ford plant in Oakville.

A friendly rivalry goes on in the GLCC between our two NHL teams in this region: The Buffalo Sabres and the Toronto Maple Leafs. Last year, it was Buffalo; this year, it was Toronto. I can't close by saying, “How 'bout them Leafs?” as they are now out of the playoffs. This year in Carlisle, I won't be giving Randy Goodling a Toronto Maple Leafs Bic lighter. I look forward to the trip to Carlisle and the Mid-Atlantic Prowl, hosted by the Delmarva Cougar Club and the Cougar Club of New Jersey. I hope to see some old friends and meet some new folks. Until the next issue, have a good and safe summer.

—*Jim Megannety*

7 It's very quiet in this region at this time of year—not much doin'.

Leon Bray got himself a new cat to add to his collection, and so did I. I wonder if he will swap? His 1970 convertible CJ Ram Air for my cool-looking, original '70 standard with white walls and power windows! I can only dream, I suppose. I know one thing: I paid a lot less for my gem than Leon did.

We had a show and shine in western Sydney in early May, and we had three Cougars—that's one of mine and two of Graham Spinks'. But, alas, neither of us won any awards this year. That's life.

But we both know we have good cars, and that's the main thing. Graham's '69 convertible was his daily driver, but he bought a '74 460 BB XR-7 from an old man who had a Ford dealership in Parramatta and who is retired and had no use for the car. So, you can imagine that it was well cared for, and you would be right. It's a stunner, and Graham now drives that all around (I bet he wished he owned a gas company).

I am still waiting to see if we will get another drag race track in Sydney (biggest town in Australia and we don't even have a drag race track; unreal).

We are waiting for the Premier of this state to tell us what is going to happen. It's a bit like owning a massive bowl of chocolate-coated ice cream and not being able to eat it; you just have to wait and watch it melt before your eyes because you don't have a spoon. Well my car is ready to go, but we don't have a track to go to, so it might have to lose some of its performance so I can drive it on the road more often than I do now. I miss driving it, and you can only sit and watch so much.

That's all from me for now, so keep on cATTIN'.

—*Clive Dennis*

N=North, S=South. For a complete listing of states in each region, see “CCOA Leadership,” page 5.

Mercury's 'Aero Cat'

By Eric Dess

For those of us who weren't alive when Mercury introduced the original Cougar in 1967, the only Cougars we've known have been from the late 1970s to the present.

I clearly remember from my childhood the '77 Cougar's introduction and its great popularity. But I didn't really pay much attention to the Cougar until the 1983 model year, when Mercury introduced the "aero" look to the big Cat. It truly was love at first site—I had to have one. Not only did the aero Cats totally rejuvenate sales for Ford, but they captured many hearts with their sleek, modern styling and exceptional performance for a luxury coupe.

Between 1983 and 1986, there were three Cougar models: the base GS (which was never

others (power seats, power mirrors and, even, a power moon roof) were solely for creature comfort. What it all boiled down to was this: Anyone could create a unique factory Cougar. The list of options on these cars was unprecedented.

From 1980 through 1988, the Cougar was built on the venerable "Fox" platform. First introduced in 1978 on the Fairmont/Zephyr, the Fox chassis is best known for its use in the 1979 to 1993 Mustang. The 1980 to '82 XR-7 models rode on a 108.4-inch wheelbase; for 1983, Mercury shrank the chassis a bit to 104 inches to slim down the Cougar and distribute its weight more efficiently. In doing so, they created one of the most perfectly proportioned Cougars in years, probably since the original '67 Cat.

It's not really fair to directly compare a 1987 Cougar to a 1967 Cougar; about the only things in common are the rear-drive layout and the availability of a Ford V-8. They were different cars for different times. What sets the 1983-88 Cougars apart is the advancement of electronics to govern the car's systems. The 1983 V-8 model garnered a very rudimentary CFI (central fuel injection) system, which essentially mated a 2-barrel carburetor with two fuel injectors. While not the most fuel-efficient or performance oriented, it was a step in the right direction. By 1988, the 5.0L V-8 had one of the most advanced engine management systems on the planet (and is still a modern miracle, even by today's standards). The SEFI (sequential electronic fuel injection) system, mated to Ford's advanced EEC-IV computer, delivered extremely stable performance, very smooth idle and exceptional fuel economy. Unfortunately, stricter CAFE requirements left the V-8 Cougar with a watered-down 150 hp V-8 chock full of emissions equipment. As usual, the Cougar played second string to the performance-oriented Mustang. However, being a personal luxury coupe, the V-8 was more than adequate for normal driving and delivered more torque than some of the original Cougar V-8 engines. It is definitely a peppy motor, and, with the help of roller lifters added during the 1986 model year, the engine is known for its longevity.



The 1984 Cougar LS

badged as such); the LS (Luxury Sport); and the performance-oriented XR-7. However, there was no 1983 XR-7 model, as Ford had a few delays in getting the turbocharged engine into full production.

Beginning in 1987, the base GS was dropped and only the LS and XR-7 remained. Each model had its own level of options, but buyers could order almost any combination of options to satisfy their own tastes. Around the time the 1983 Cougar was introduced, Ford began offering PEP (preferred equipment packages) to gang up the most popular options. Because it was easier for the factory in Lorain, Ohio, to build cars with similar options, the PEP packages offered a good value.

But a customer could order a Cougar with any number of options without having to use a PEP package. Some items—the half vinyl roof, electroluminescent coach lamps and two-tone paint scheme, for example—were a throwback to the 1979-82 Cougars. Others, like the TRX suspension package and Traction-Lok axle, were of the performance-oriented persuasion. Still

One thing most of you probably aren't familiar with are the other two engines available during the 1983-88 model years. The 3.8L (232 cid) V-6 was first introduced in the 1982 Cougar and was designed from the small block Ford V-8 (it's essentially a 302 without the back two cylinders and a smaller bore). In fact, it shares the same small-block Ford bolt pattern. Originally it put out a paltry 110 horses, but in later years it produced around 140 hp to 150 hp with the addition of modern fuel injection.

To say the 3.8L was adequate to get the car going would be about right—no performance here. Fuel economy wasn't exactly stellar, but it was decent enough for its time. The 3.8 V6 is still in use today, although highly modified, in the Mustang and Windstar. The other motor was available from 1984 to 1986 and only in the XR-7 model. The 2.3L OHC inline-4 cylinder was adopted from the old Ford Pinto program of the mid-1970's. But for the Cougar XR-7, it gained a turbocharger (later used in the 1984 1/2 to 1986 1/2 Mustang SVO). From the start, the MFI (multiport fuel injected) four-cylinder put out 140 hp, although many learned quickly that by adjusting the boost pressure higher, much more power could be produced. Around town it was fairly sluggish, but once the turbocharger kicked in, the Cat definitely got out of its own way!

Ford certainly took a gamble with the use of such an engine in a sophisticated luxury sport coupe. What used to be exclusive V-8 territory now was home to a four-banger with a turbo unit. The XR-7s from 1984 to '86 were not really produced in high volumes because they attracted a much narrower crowd. That was the reason why the XR-7 switched to the SEFI 5.0 V-8 in 1987. Also, the turbo units were known for their short life, even with proper maintenance. Ford wisely added an intercooler for the Thunderbird Turbo Coupe in 1987.

The transmissions used in this generation's Cougars were very different than those of yore. From 1983 to '86, variants of the older C4 popped up in the C3, C5 and AOD (automatic overdrive). These three transmissions were among Ford's first to use all-metric components. The C3 and C5 were three-speeds; the AOD used a fourth gear to gear down the motor on the highway, resulting in improved fuel economy.

Starting in 1987, only the AOD was used in Cougars. While much improvement was made to these transmissions throughout the model years, they still had their share of problems with breakage. Still, the AOD has proved to be a worthy transmission in everyday driving and even some race cars. Transmissions available on the 1984-1986 XR-7 were either the four-cylinder spec AOD or the Borg-Warner T-5 five-speed

manual. This gearbox really helped the turbo-charged four-cylinder wind out its high-revving power.

Aside from refined power, the Cougars of this generation were known for their exceptionally crisp ride and tight handling. The Fox-chassis Cougar used a modified MacPherson front suspension; it's one of the only cars (aside from other Fox cars) that had the strut separate from the suspension coil. While it gained a nice ride, the trade-off was a huge turning radius. Still, it remains a very modern suspension configuration and one on which it is very easy to work.

Also up front was a beefy lower A-arm and a decent-sized front sway bar. Out back, a traditional four-link live axle was used with coil springs. Base models did not usually receive a rear sway bar; V-8 models had a very thin one. Only the XR-7's and some sport-tuned Cougars (such as those with the TRX option) received a thicker front and rear sway bar. The axle of choice for an overwhelming majority of Cougars during the 1983-88 years was the 7.5-inch Dana



The 1986 XR-7

rear end. Most cars ended up with the 2.73 open gear rear axle; the Traction-Lok option netted 3.08 gears. The 1988 XR-7s (and possibly some slightly older Cougars) had the 8.8-inch locking rear with 3.08 gears standard; this was a very similar axle that was used in the Mustang of that era.

Also unique to this platform was the use of axle dampeners (a.k.a. Quad shocks) to help control the behavior of the rear axle. They mounted horizontally, adjacent to the normal shocks, and had unique valving to let the shock stay in position instead of retracting like most gas-filled shocks do. The result was a noticeable difference in rear end stability and tightness. Again, the dampeners were found on all XR-7s and some cars equipped with the Traction-Lok axle.

But the most unique aspect of these Cougars was definitely the styling. Mercury's goal for the 1983 model year was to totally separate the

See **AERO**, page 10

AERO, from page 9

Cougar from its twin, the Ford Thunderbird, by introducing a controversial vertical backlite to the roofline. People either loved it or hated it, but even today it is one of the most instantly recognized rooflines in America. While this styling definitely gave the Cougar the advantage in rear headroom, it also hampered its drag coefficient to .40 (compared to .35 on the Thunderbird).

Nonetheless, the Cougar's use of traditional and rounded shapes lent an air of sophistication from the start. It was an instant classic. The formal Mercury waterfall grille, quad halogen sunken headlamps, integrated side markers, three-tier taillights and even the hump in the trunklid all gave nods to older Cougars. But the fender tops were rounded off; the hood was given an aggressive taper; and the side windows were fashioned in a striking "C" shape, all giving a very modern flair to the big Cat. It also retained the long hood/short deck formula that was so popular with the original Cougar.

Sales instantly jumped, and in 1983 the Cougar actually outsold the Thunderbird, one of the few years it ever did so. Sales continued to hover around the 120,000 mark through 1986, with some minor styling upgrades and a freshened interior in 1985. Ford invested some of its profits from the car into a major restyling for the 1987 model year. Going one step further into the "aero" age, the Cougar received flush aerodynamic headlamps; flush side glass; and a totally revised roofline, rear backlite, trunk, and rear quarter sections. These items helped lower the drag coefficient to a respectable .36. Still on the Fox chassis, the 1987 model was almost a totally different Cougar than that of the previous year. Only the windshield and hood remained unchanged. The interior was essentially the same used since 1985, with some creature comforts being added along the way. This styling continued through the 1988 model year, with the all-new MN-12 chassis Cougar being introduced in 1989. While having this body style for only two short model years, it has become a favorite of all Cougar lovers due to its enhanced shape and tasteful attention to details.

There were a few limited-production Cougar models to come out of the 1983-88 era. Probably the most coveted were the 1987 20th Anniversary models of which 5,002 were produced for the U.S., and an additional 800 for the Canadian market. The unique Cabernet Red and gold exterior treatment made for an elegant statement,

and they all came essentially one way: loaded.

Also of note are the 1988 XR-7s, with their striking monochromatic paint scheme. With more than 10,000 produced that year (more than double the average XR-7 model-year run of this generation), they cannot be considered rare. But the collectibility remains high due to the styling, color selection (red, white or black) and 5.0 V8 performance potential.

Starting in the mid-1980s, Ford dealerships were offered new styling packages for the Cougar, which usually consisted of unique striping or badging, or both, and sometimes a fake convertible roof. There were a good number of these kits offered, so production numbers are



The 1987 XR-7

not known. Probably the most famous of these types of kits were the Blue Max Edition (or Special Edition in some parts of the country) and the Bostonian Edition. Numerous dealerships invested in then-new aerodynamic styling packages (or ground effects kits) to further enhance the aggressive look of the Cougar. There have also been some other special Cougars, such as the 1988 Olympic Edition and even a few factory-sanctioned convertibles (1986).

The best part about owning a Cougar from the 1983-88 era is definitely in the driving. Sure, they're not the fastest cars on the road...but they sure are fun to drive. People everywhere admire the refreshingly familiar shape. And owners are rewarded with an exceptionally stable and dependable automobile.

Ford truly put their best effort into these Cougars and did a noble job of capturing the spirit of the original Cat. Although a majority of you are still in love with the 1967-73 Cougar, the 1983-88 cars are definitely worthy of their heritage. They are to my generation what the 1967 to 1973 Cats were to the generation before mine.

Truly, they can stand proud as an integral part of Cougar history, and the comeback of Ford Motor Co. in the 1980s.

*Eric Dess, CCOA No. 6366, is an Ohio graphic artist and Web site designer. He created **Cool Cats**, a site dedicated to the 1983 to 1988 Cougar. The site is at www.coolcats.net.*

Tech Center: The Cougar Q & A

Q: I am restoring 1971 XR-7 convertible with a 351-2V Cleveland. It had, some years ago, been converted to a four-barrel system with a Holley carburetor and intake, and headers. I am taking it back to original and have installed a two-barrel carb with the correct intake. I am using the same distributor that was with the four-barrel system (single vacuum diagram). I am having a devil of a time with roughness and can only figure that I have done something wrong someplace. I have a complete set of Ford manuals and a Mustang/Cougar vacuum schematic, but I can't find any help there. The vacuum sources are:

- a distribution port at the rear of the manifold, with one outlet for the brake vacuum assist, one for vacuum to the transmission (FMX) and two plugged, unused outlets;
- a single outlet in the middle of the manifold, ahead of the carburetor, to which I have connected a line to the distributor inlet; and
- a distribution valve, with three connections, on the thermostat inlet neck. I have one connection routed to the carb and the other two capped.

I also have a bimetal switch on the air cleaner assembly that requires a vacuum source. I assume that could connect either to the rear distribution port or to the three-outlet front distribution valve. My crankcase ventilation system has a control valve in the oil filler cap with that hose running to the inlet at the back end of the carb. There also is a hose on the right side valve cover that goes to an inlet on the breather.

—Vance Millar, #7000

A: OK, Vance, your question about rough running suggests it is time to cover some of the basics.

Windsor and Cleveland engines are normally very smooth and responsive. When they are not, something very basic is wrong. Before I cover your vacuum question, let me relate some of the more common things for you to check.

1. Be sure the No. 7 and No. 8 plug wires are not adjacent in the loom. The wires must be 5-7-6-8 to ensure there is no cross fire. This causes the mild lobe at idle and can ruin high-speed performance. It is in bold print in the shop manuals and I cannot count how many cars I have seen with this problem so easy to correct.

2. If you don't know how old the wires are, change them! The resistance type are particularly prone to breakage and can cause all kinds of roughness.

3. Inside the distributor, remove the breaker plate and be sure the three nylon glides are clean

and lightly lubricated with graphite. Likewise, clean the sticky gum off the bottom of the plate. This simple fix makes the vacuum advance work very fast and smooth. . . again, no count on how many cars out there have this problem.

4. On '69 only, be sure the ignition switch mod is installed! This causes the primary ignition to be intermittent, causes that cut off and misfire at the oddest times. My article on this was in *ATSOTC* a few years ago. By the way: '69 cars also were recalled for installation of a reinforced clip on the driver seat back pivot. Get this part (D7ZZ) and put one on! It prevents the seat back from falling rearward and leaving the driver with no control.

5. Set timing with vacuum disconnected. Be sure it is on the mark. There are some engines out there with dried out harmonic balancers that have shifted, thus moving the timing mark!

6. If you are still running points, put in the Pertronix ignition module. You will never regret it and car will run so much better.

Now, you need one vacuum line to the carb vacuum port! Not the manifold, as this will advance timing all the time. The 3-port block on the thermostat inlet is for A/C and some emission cars. Generally, the distributor line connects to the middle, carb vacuum is at the top and manifold, at the bottom. When the engine gets hot, the valve changes the distributor vacuum source to full manifold at idle and the engine speed increases (if base timing is set properly), and A/C works better in traffic. Don't worry about connecting this now; just be sure the distributor connects to the carb source, not the manifold.

Most common problem is the rubber tip on the manifold tee behind the carb, the one pointing down. This likes to melt, thus causing a leak. This also is a leading cause of headlights in earlier Cougars opening after engine shut off.

Connect a vacuum gauge to manifold port and run the engine warm at idle. The needle should be rock steady (12-15 lbs.) at idle, no vacuum advance. If low (less than 10 lbs.) you've got a leak. Likely suspects include the can for the heater control inside the fender well and broken lines to the A/C controls. Check it all out. If the needle is erratic, you've got valve trouble or grossly misadjusted idle mixture on the carb. At idle, set both mixture needles to peak the vacuum reading. If still erratic, do a compression test. Remove all the plugs and crank engine with a remote starter switch. Find the cylinder that is low and squirt some oil in the plug hole. Repeat. If the compression improves, you've got a ring problem. If it's still low, you've got a valve problem.

See **Q&A**, page 12

Question?

CCOA Technical Director Dick Hertzler will accept questions for the Q&A column by e-mail (preferred) or standard postal mail. E-mail submissions will be answered by e-mail and, possibly, in *ATSOTC*. "Snail mail" questions will be answered either in the newsletter or directly if members include a self-addressed, stamped envelope with their questions.

Send questions to dickiemag@aol.com or to Dick Hertzler, 69 Village Drive, Ormond Beach, FL 32174-2651.

Q&A, from page 11

If two adjacent cylinders are low, you probably have a blown head gasket.

If you hear a really uneven rhythm as you crank the engine, you know you've got valve trouble. Time to pull the heads and tend to it.

Feed the air cleaner with manifold vacuum. This opens the valve and admits more cool air under acceleration (this improves emissions only). Forget this until you have the engine idle very smooth, accelerating briskly (observe the timing mark with and without vacuum advance connected). The mark will advance slowly (centrifugal advance only) with vacuum disconnected and very fast and far with vacuum connected to the carb (only).

Try all the above. Find and cure any vacuum leak before you resort to other fixes.

—Dick Hertzler, #32

Q: I have a 1968 Cougar and am having headlight problems. When using high beams, after a short time the lights flash (looks like high/low beam) and then go out. Pressing the dimmer switch to low beam works well. The low beams cause no problems. In the past two years, I have replaced the light switch twice. The problem returns each time. Do you have a possible solution? I am not a mechanic and would appreciate any help you could provide. Second problem (not as important): The light covers do not close on their own. I have to close them manually. Any ideas?

—Al Rabjohn, #7118

A: I can guarantee you probably have a short circuit somewhere in the high beam circuit from the dimmer switch to the headlight assemblies. What seems to be happening, is the circuit breaker on the light switch is opening and when the short is removed, by switching to low beams, the breaker resets and the low beams work fine. I have seen many of these circuit breakers go bad. Remember, the high beams draw a lot of current. The breaker may just have been tired and you replaced the switch with one that also had a poor breaker.

A very recent issue of *Old Cars Weekly* had a great series on troubleshooting the headlights (e-mail Ron Kowalke at kowalke@krause.com and ask him which issue). Most likely, if not the breaker, you have a short in the dimmer switch where the high beam wire can touch ground. Also check the firewall connector. If you do not know who has worked on your car over the years, suspect anything! I have seen stereos connected to the dash light circuit!

Disconnect the headlight connectors and see if that stops it. This will tell you the problem is in

the headlight assembly itself. Again, I have seen pigtail wire from the headlamp bulb itself able to touch ground.

As to the lazy headlights, if both will not close, you've got vacuum trouble. The most likely culprit—and most common—is a rusty, leaky vacuum reserve tank under the front driver's side fender or a split in the hose where it connects to the tank, behind the driver's side headlight assembly. Check the vacuum tee on the manifold behind the carburetor. The connection that points down normally has a rubber cap on it, and it likes to melt, thus you have a pin hole leak and vacuum cannot build up in the tank to close the lights.

Next in line is the manual override valve near the washer. If you hear a vacuum leak when you turn the engine off in the area of the headlight switch, check for a cracked or disconnected hose. These headlights have dual action actuators, which need vacuum from one source to open and from another source (tank) to close. Many cars have slightly bent grille ribs that stop the closing action. Plenty of vacuum to open them, but very little available to overcome the rubbing to close them.

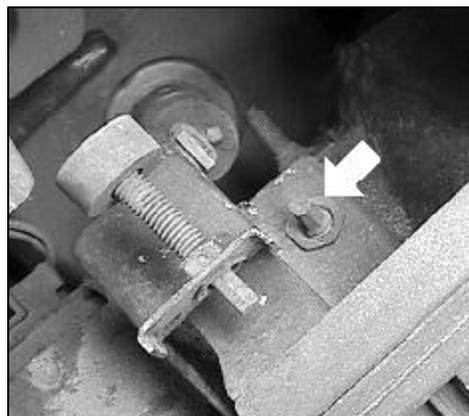
If only one assembly will not close, most likely the actuator itself is the problem. Either it's leaking or has a hole in the bellows. These have been reproduced, and can be had from most any Cougar vendor.

Good Luck! The headlights are fairly routine to troubleshoot. Like they say, follow the money. . .except here, follow the vacuum.

—Dick Hertzler, #32

Quick Tip

Droopy Eyelids?



If the headlight covers on your '67 or '68 sag a bit, you can adjust their closed position relative to the rest of the grille by turning the hex end of the adjusting bolt, indicated by the arrow.

The following information first appeared on the CLASSIC-COUGARS e-mail list server and was compiled for this article by Rob Hamill. To subscribe to the list, send a blank message to: CLASSIC-COUGARS-subscribe@egroups.com

Dash Pad Removal

Bob Sherry was trying to replace the dash pad on his '68 XR-7. Having removed the dash and six nuts from the underside of the pad, it still wouldn't budge. So, he went to the list for information about what he might be missing. Here's a summary of responses from Bruce Habel, JMF1848@aol.com, Bill Kitchens and some guy named Carl Graziano:

A nut secures the downward protruding extension of the dash pad on each side. You need to remove the glove box to get to the nut on the passenger's side and the heater control panel to get to the nut on the driver's side. Also, don't forget the screws and trim holding down the leading edge of the pad where it meets the windshield. And on some cars, there are hard-to-see screws near the point between the pillar pads and the downturns of the dash pad. Also, 30 years in the sun has a way of "welding" the dashpad to the underlying sheetmetal, so be prepared to scrape residue.

With this information, Bob was able to remove the dash pad and complete the install, and he said it looks great. He recommended that others taking on this project wait for a sunny day and do it outside—even with lots of shop lights, the under-dash work can be pretty dark.

Pulley removal tips

Mark Klingler asked: What's the secret to removing the pulley from the front of the harmonic damper? "I was able to remove the three bolts surrounding the center bolt but have been unable to get the large center bolt loose. How can I prevent the whole damper from rotating as I apply torque to the wrench?" Well, it turns out that the center bolt didn't need to be removed and the pulley, minus the three bolts, was being held in place only by three decades of grease and grime. List members did suggest using a harmonic balancer puller or, even, a steering wheel puller to free a stuck pulley.

Goin' Solo

Robert Craig asked the list: "I've been thinking of trying SCCA SOLO II in [the] Street Prepared class with my Cougar. Does anyone here do SOLO II? Trying to get a feel for how it is and type of competition you usually face."

When I first read this e-mail, I had never heard of "SOLO II." So, I figured I'd check the Sports Car Club of America's site (www.scca.org) to learn more. Here's the deal, straight from the source:

Solo II events (also known as autocrosses) are an all forward motion driving skill contest. Each driver is individually timed to the thousandth of a second, over a short, miniature road course clearly defined using traffic cones. Cars compete one at a time (hence, the name "Solo") in a class with similar cars. An event can be held on any flat paved surface, usually a parking lot or airport apron or runway. Solo II emphasizes driver skill and vehicle handling, rather than speed alone. The corners are tight and there are lots of them, so the driving is exciting and challenging. Solo II speeds do not exceed those normally encountered in highway driving. The costs of Solo II competition are reasonable because you can compete in anything from a real race car to the car you drive on the street every day. Entry fees are usually \$15 to \$20 per driver, and two drivers can share a car.

Hmm. . .now I don't know about you, but when I grew up, I couldn't wait until Friday nights to watch the Rockford Files and the weekly car chase. So, this sounds *very* appealing.

Vic Yarberry and Mike Warnock shared the following information about their experiences competing in Solo II with their cats: Solo II is a great way to learn to drive your car, they said. But, they cautioned, you'll need to build up some "seat time" before you're competitive. Ultimately you can do well with only a few upgrades (shocks, springs, sway bars, tires). Keep in mind though, vintage cars such as Cougars are at a disadvantage compared to late-model Mustangs and F-body GMs. "After your first run, your knees will shake from the adrenaline rush," Vic said. Vic and Mike definitely agreed on one thing about Solo II: It's great fun.

Kittens Due

Mitch Lewis received pre-order information back in March for the late summer and fall Johnny Lightning catalog and reports that the next series of castings for the the "Muscle Cars USA" series will include two Mercurys: a '67 Cougar and a '70 Cyclone. Looks like the first release is set for October. Meanwhile, the list was buzzing with messages about a 1:18 scale '67 cat being produced by Sun Star America Inc. The red Cougar was reported to be selling for between \$20 and \$30 through various vendors. Sun Star's Web site, with a picture of the Cougar, is at www.sunstartoys.com.

Rob Hamill, CCOA No. 5287, lives in Hillsborough, N.J., and is a member of the Cougar Club of New Jersey.

Cougars at Carlisle

The June 2 to 4 All-Ford Nationals at Carlisle offered something special for club members in the Mid-Atlantic region: a regional CCOA show hosted by the Cougar Club of New Jersey and Delmarva Cougar Club.

Former CCOA Vice President Bill Quay conceived the idea for this show, dubbed the "Mid-Atlantic Prowl." After last year's CCOA East Nationals at Carlisle, Quay thought it would be a good idea for a local club to maintain the momentum by putting together a regional show at Carlisle this year. The CCNJ and DCC discussed the idea and settled on a joint CCOA regional meet as part of Carlisle Production's annual All-Ford Nationals.

Planning took nearly a year, but the hard work paid off, as nearly 60 Cougars from up and down the East Coast packed the Carlisle show field. CCOA, CCNJ and DCC members spent the weekend comparing notes on their cars and establishing or re-establishing friendships.

The Prowl's Best of Show award went to a '69 Eliminator owned by Bill Thomas, of King of



Prussia, Pa. Class winners are listed in the chart on **page 15**. Also honored at the show was DCC member Phillip Payne, who won The Classic Cougar Network's first-ever "Top Cat" award, which recognizes "steadfast enthusiasm in support of the classic Cougar community."

Images from the Mid-Atlantic Prowl are featured in this issue's "Cats in Color" centerspread, **pages 16 and 17**. Look for color photos from and reports on the CCOA's two national shows in the fall 2000 issue of *ATSOTC*.

Cats on the Pier

The "Port Angeles Mustangs and Cougars on the Pier" show earlier this year in Port Angeles, Wash., featured cars owned by Cascade Cougar Club and Fordnutz Cougar Club members and Cougar judging by CCOA President Scott Ferguson.

Nine convertible cats were among the 26 Cougars at the show, including a '69 ragtop owned by Doc and Judy Anders (shown). Ferguson, Fordnutz president, picked the Anders cat as the show's best Cougar. Of the Anders' cat, he said: "It is modified and customized in a very classy and practical way."

Fordnutz won second place for best club display with its simulated, two-lane road, complete with wood chip shoulders. The show, which drew 7,500 spectators and raised thousands of dollars for charity, was sponsored by the Olympic Peninsula Mustang Club.



Carlisle Class Winners

Street Driven

Paul & Karen McCartney	1968 XR-7	1st Place
David Bailey	1968	2nd Place
Paul Scheerer	1967	3rd Place

1967-68 Standard

Brian Smitsky	1967	1st Place
Don & Judy Wussler	1967	2nd Place
Sudhakar Reddy	1967	3rd Place

1967-68 XR-7

Landy Adams	1968	1st Place
Tom Macmath	1968	2nd Place
Jim & Peggy Davis	1968	3rd Place

1967-68 XR-7G, GT-E, GT

Wayne Wachter	1968 XR-7G	1st Place
Phil Parcels	1968 GT	2nd Place
Mark Leathery	1967 GT	3rd Place

1969-70 Standard Coupe/XR-7

Paul Damato	1969	1st Place
Dave Roberts	1969	2nd Place
Ken Compher	1969	3rd Place

1969-70 Eliminator

Jim Munden	1969	1st Place
Tucker Callan	1970	2nd Place
Thomas Lawrence	1970	3rd Place

1969-70 Standard Conv./XR-7 Conv.

Steven Polansky	1969 XR-7	1st Place
Gary Hoffeditz	1969	2nd Place
Barry Reichenbaugh	1969	3rd Place

1971-73 Coupe

Joe Galanick	1973	1st Place
Robert Defeis	1973 XR-7	2nd Place
Mark Battista	1972	3rd Place

1971-73 Convertible

Jerry Laski	1973	1st Place
Frank Lanterman	1973 XR-7	2nd Place
John Wolf	1972	3rd Place

89-97, All

Bridget Widdowson	1991 XR-7	1st Place
Jeff Dillman	1989 XR-7	2nd Place
Casey Leonard	1989	3rd Place

98-Up, All

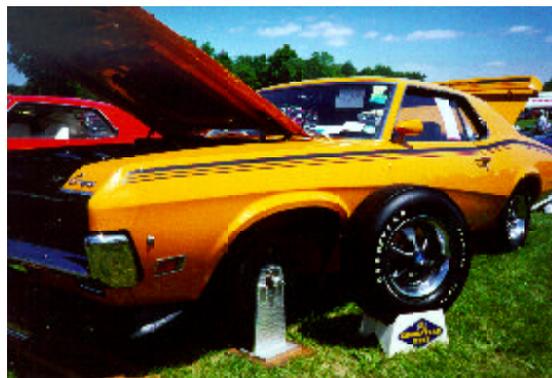
Richard Theoret	1999	1st Place
Seth Reithley	1999	2nd Place
—	—	3rd Place

Mercury, Modified

Matt Dishart	1985 Cougar	3rd Place
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Note: Automotive writers and other "celebrities" at the Carlisle All-Ford Nationals also awarded "celebrity picks" to Barry Zortman, Ken Compher and Bill Quay.

Cats At Carlisle





Photos by Kermit Burroughs & Carl Graziano

Ohm, Ohm on the Range



Eric Overton

First, a suggestion: You're probably going to want to save *ATSOTC* issues to follow the story line here. I'll do my best to make each of these columns stand as a veritable magnum opus on its own, but things will probably be a lot more coherent overall if you can refer forward and back.

I further forewarn you that in upcoming issues I'll be discussing a lot of first principles of engineering and then applying them, where appropriate, to the maintenance of the classic Cougar. This approach probably diverges from the traditional (and much more easily written) style in which the author explains, step-by-step, "Do this and then do that" without ever really addressing the question of *why* you would do this and then that. Because 99.9 percent of the shop manuals and repair books on the Cougar take exactly this step-by-step approach, I'm guessing that to contribute something new to the body of knowledge, I'm going to have to go for the more indirect route. You, the reader, will pay a higher price up front in learning the material. But I make no apologies for this, because if you understand engineering principles, you can reason through problems. And you then have a tremendous leg up on the fellow who can only follow shop manual procedures with slavish devotion. Besides, if you don't already own a shop manual, I expect that if you're serious enough about your car to read this periodical, you probably already have a manual on order.

With that said, we're going to pick up where we left off last time (with electrical systems) and discuss several new first principles of engineering. And although this all will look a lot like more electrical engineering (and it is), in the next two or three issues I'm going to show you how the principles and math we learn here can be used on any kind of mechanical or thermal system. By the time we're done, you'll be able to draw (and analyze) the "circuit" diagram for your suspension or your cooling system using the same techniques you're going to start picking up here to analyze your electrical wiring.

Ohm's Law

So far in this column, I've tended to avoid math in my descriptions of what's going on in the electrical systems I discuss. And as much as I might like to sidestep it indefinitely, doing at least a little "grocery store" math is unavoidable. So we'll start with the single most basic item: Ohm's

Law. Trust me when I say it's going to look remarkably simple to you now that you know (from reading the Winter 2000 installment of this column) the difference between amps (how many electrons are flowing in a circuit over a period of time) and volts (how much energy each moving electron has).

Ohm's Law forms a relationship between volts and amps. If your gut tells you that if you give the electrons in your circuit more energy, then more of them are going to flow through the circuit over a given amount of time, you already understand Ohm's Law intuitively. Ohm's Law simply says that volts (the energy of a moving charge) is proportional to amps (the number of charges that flow per unit time) in a circuit. And if you sense that a charge's ability to flow through one circuit might be greater than in another circuit that offers it more "resistance," you can probably guess that there's some constant of proportionality between volts and amps that is a property that's going to vary between, for example, the light bulb in a dome light and your headlights. After all, both are powered by 12 volts, but you can leave your dome light on all night and still stand a reasonable chance of starting your car in the morning. But you know that leaving your headlights on for a much shorter period of time is going to flatten the battery, since even though all the charges in the system carry 12 volts, there are a lot more of them (more amps) that flow in a headlight than a dome light. And once they've all flowed out of your battery, you have...well, a dead battery.

So if we were to put some mathematical teeth into Ohm's Law, it would look like this:

$$V = I \times R$$

where V is voltage, measured in volts (energy per charge), I is current, measured in amps (charges per second) and R is a circuit property known as "resistance" (measured in a new unit called, of all things, "ohms").

If the current flowing in a headlight is 12 amps (which I chose to keep the numbers round) and you've got a 12V electrical system, the headlight has a resistance of 1 ohm. Or mathematically:

$$12 \text{ volts} = 1 \text{ ohm} \times 12 \text{ amps}$$

If your dome light draws 1 amp of current, you could say its resistance is 12 ohms, because 12 volts = 12 ohms x 1 amp.

If your ignition ballast resistor drops your coil voltage from 12 volts to 5.5 volts (which is about

Eric Overton, CCOA No. 7297, lives in Austin, Texas. You can contact Eric at eoverton@texas.net.

what it does), you can say that the voltage loss across the resistor is 12 volts - 5.5 volts, or 6.5 volts. And if you knew that the current flow in the primary ignition circuit were about 4.3 amps (which is about what it is), you could find the value of the ballast resistor by saying:

$$V/I = R (6.5 \text{ volts}/4.3 \text{ amps} = 1.5 \text{ ohms})$$

In practice, were you to measure the resistance of the ignition ballast with an “ohmmeter,” you would, in fact, find it to be somewhere around an ohm and a half.

Figure 1 shows the ignition circuit, complete with ballast resistor and tachometer.

There it is: Ohm’s Law—demystified a bit, I hope. I will note (and this will be the subject of next issue’s column) that there are special devices for which the resistance of the device changes over time, so there is a more general name for “resistance” called “impedance” that recognizes those special cases where the value of “R” above actually is a function of “T,” or time. The ignition coil itself is an example of such a device, since initially its resistance is one value, but once the magnetic field in it gets set up, the coils in it behave a bit differently because. . .well, they’re now in a magnetic field.

So, What’s ‘Ground’?

“Ground” seems to be one of those concepts that mystifies people. It’s as if there were some mystical spot in the center of the universe called “ground,” and calling anything else “ground” would be tampering with the primal forces of nature. Fact is, ground is a point where you say that the amount of energy a charge has when it’s there is zero. Ground is thus the point you define to have zero volts, and that’s all there is to it.

Ground can therefore really be anywhere you want it to be, so long as when you work your way around your circuit, you remember where your point of reference (your “zero”) is. By convention, we say that automotive electrical systems are “12 volt” and “negative ground,” meaning that the point we call “zero volts” is the negative terminal of the battery and the highest energy any charge in the system is going to receive is 12

volts above that. But I could easily call the positive terminal of my battery “ground,” as long as I took care to observe that I now had a “negative 12 volt” electrical system and that my frame, instead of sitting at ground, was sitting at -12 volts. There’s absolutely nothing stopping me from doing this, and, in some cases, the mathematical analysis of a circuit can be a lot easier if I choose my ground to be at some location that makes certain expressions fall out of the equations faster.

By analogy, the average person in the world is about 5 feet 6 inches tall. I could define, if I liked, this height to be my zero point. A midget might

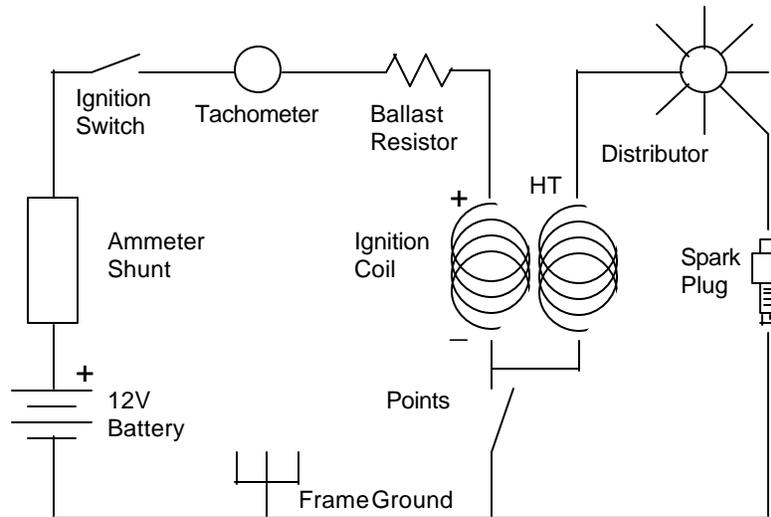


Figure 1

then be minus 2 feet tall. And a basketball player would be plus 2 feet tall.

So, ground is relative. Just remember where it is (and on automobiles it’s usually on the negative terminal of the battery and the frame) and tailor your measurements and math accordingly. Also, don’t assume that every circuit needs to be connected to something somewhere near ground. The Cougar tachometer is the perfect example, since it actually is designed to operate with both its terminals very close to 12 volts. Trying to wire either one to ground while the other is connected to 12 volts will burn out the tach or a wiring harness.

Series vs. Parallel

Series and parallel circuits are pretty easy to tell apart. In a series circuit, an charge in motion has to visit every single part of the circuit on its way around. In a parallel circuit, a charge can take multiple paths. Probably the fastest way to illustrate the idea is with a pair of pictures. In the first half of Figure 2, all the bulbs are wired in series, and if one bulb burns out, the whole string

See **CIRCUITS**, page 26

Local Clubs

Do you have updated contact information for your club? Please send it to ATSTOC, 4012 Hamilton St., Hyattsville, MD 20781-1842; graziano@cais.com; or (301) 864-4460 (fax).

Australia

Cougar Club of Australia

Contact: Clive Dennis
clive@eagles.com.au
Telephone: 029-623-2780

California

Northern California Cougar Club

91 Molokai Court
San Ramon, CA 94583
President: Dave Vandever
(408) 226-1595

Cougar Club of San Diego

P.O. Box 16092
San Diego, CA 92176
President: Lou Otte
(619) 442-7869
www.adnc.com/web2/
cefrein

Southern California Cougar Club

5527 Bluebell Ave.
North Hollywood, CA
91607
President: Mike Brown
(818) 762-6424
thebrowns1@earthlink.net
home.earthlink.net/~epike

Stray Cats

P.O. Box 41
Fairfield, CA 94533
President: Dennis Pierachini
(415) 621-7648
pierachi@wellsfargo.com
www.classiccougar.com

Canada

Fordnutz Cougar Club

P.O. Box 24015 Airport
R.P.O.
Richmond, B.C. Canada
V7B 1Y2
President: Scott Ferguson
(604) 421-4518
fordnutz@direct.ca
www.bigfoot.com/~fordnutz

Great Lakes Cougar Club

5622 Lowell Ave.
Niagara Falls, Ontario
L2G 4E2
President: James Megannety
(905) 358-5967
jmegs@sympatico.ca
clubs.hemmings.com/
greatlakescougar/

Colorado

Colorado Cougar Club

P.O. Box 27435
Lakewood, CO 80227
President: Gary Wilmon
(303) 343-3978
coloradocougarclub@juno.com

Connecticut

Connecticut Cougar Club

54 Trafford St., Unit 10
Meriden, CT 06450
President: Marc Nettleton
(203) 238-7787
MN73cougar@aol.com
pages.cthome.net/cougar

Delaware

Delmarva Cougar Club

P.O. Box 5266
Fort Lee, VA 23801
President: Jim Karamanis
(703) 491-8710
jimk@cougars.com
www.dconline.org

District of Columbia

Delmarva Cougar Club

P.O. Box 5266
Fort Lee, VA 23801
President: Jim Karamanis
(703) 491-8710
jimk@cougars.com
www.dconline.org

Florida

Sunshine State Cougar Club

12621 Beltingle Court
Orlando, FL 32837
President: Steve Weir
nitmoves@webtv.net
www.motorhood.com/
classiccdrive/sscc/

Georgia

Georgia Cougar Club

388 Dacula Road
Dacula, Ga. 30211
Vice President: Linda Goff
cougarway@aol.com
www.georgiacougarclub.com

Kansas

Heartland Cougar Club

3337 S. Vine St.
Wichita, Kan. 67217-2639
President: Kevin
Smokorowski
drgracjnky@aol.com

Maryland

Delmarva Cougar Club

P.O. Box 5266
Fort Lee, VA 23801
President: Jim Karamanis
(703) 491-8710
jimk@cougars.com
www.dconline.org

Pennsylvania

Great Lakes Cougar Club

5622 Lowell Ave.
Niagara Falls, Ontario
L2G 4E2
President: James Megannety
(905) 358-5967
jmegs@sympatico.ca
clubs.hemmings.com/
greatlakescougar/

Michigan

Great Lakes Cougar Club

5622 Lowell Ave.
Niagara Falls, Ontario
L2G 4E2
President: James Megannety
(905) 358-5967
jmegs@sympatico.ca
clubs.hemmings.com/
greatlakescougar/

Montana

Treasure State Mustang & Specialty Ford Club

(Includes Cougars)
B. Wilkes
1516 Seventh Ave. N.W.
Great Falls, MT 59404

New Jersey

Cougar Club of New Jersey

P.O. Box 121
Springfield, NJ 07081
President: Don Wussler
Donwussler@aol.com
members.aol.com/wdcougar

New Mexico

Cougar Club of New Mexico

5413 Territorial Road, NW
Albuquerque, NM 87120
President: Rich Gilkerson
(505) 897-2080
rgilkerson@uswest.net

New York

Great Lakes Cougar Club

5622 Lowell Ave.
Niagara Falls, Ontario
L2G 4E2
President: James Megannety
(905) 358-5967
jmegs@sympatico.ca
clubs.hemmings.com/
greatlakescougar/

Long Island Cougar Association

Contact: Steve Cameron
licougars@msn.com
members.tripod.com/
licougars/home.htm

Nevada

Sierra Nevada Cougar Club

40 Careros Drive
Sparks, NV 89436
Contact: Gary Guzelis
(775) 425-1113
merc-cougar@home.com

North Carolina

Carolina Cougar Club

5970 Fairview Road
Suite 106
Charlotte, NC 28210
(704) 643-6430
(704) 643-6425 (fax)
Contact: Marvin Wyant
panther@webservice.net
members.aol.com/
cougarcats

Ohio

Great Lakes Cougar Club

5622 Lowell Ave.
Niagara Falls, Ontario
L2G 4E2
President: James Megannety
(905) 358-5967
jmegs@sympatico.ca
clubs.hemmings.com/
greatlakescougar/

Oregon

Cascade Cougar Club

P.O. Box 94243
Seattle, WA 98124
Chairman: Neal Jacobson
(425) 397-7284
Badcatt2@theglobe.com
clubs.hemmings.com/
cascadecougar/

South Carolina

Carolina Cougar Club

5970 Fairview Road
Suite 106
Charlotte, NC 28210
(704) 643-6430
(704) 643-6425 (fax)
Contact: Marvin Wyant
panther@webservice.net
members.aol.com/
cougarcats

Texas

DFW Cats Club

4752 Scots Briar Lane
Fort Worth, TX 76137
President: Ken McDowell
president@mercurycougars.com
www.mercurycougars.com

Virginia

Delmarva Cougar Club

P.O. Box 5266
Fort Lee, VA 23801
President: Jim Karamanis
(703) 491-8710
jimk@cougars.com
www.dconline.org

Washington State

Cascade Cougar Club

P.O. Box 94243
Seattle, WA 98124
Chairman: Neal Jacobson
(425) 397-7284
Badcatt2@theglobe.com
clubs.hemmings.com/
cascadecougar/

Wisconsin

Wisconsin Cougar Club

3850 Schneider Drive
Stoughton, WI 53589
President: Jim Severson
(608) 873-0719

Treasurer's Report

CCOA Financial Statement, Fiscal Year-To-Date: 06/30/00

Revenues

	9/30/99	12/31/99	03/31/00	06/30/00	'00—YTD
Dues	5,927.00	5,999.88	9,870.00	2,030.00	11,900.00
Ads	160.00	60.00	230.00	225.00	455.00
Clothing	1,185.00	250.08	0	37.50	37.50
Directories	0	0	0	0	0
Calendars	52.00	98.00	435.00	633.00	1,060.00
E. Nats.	237.50	190.00	745.00	2,585.00	3,330.00
Judging Bks.	220.00	128.00	45.00	21.00	66.00
Total Revenues	7,781.50	6,725.96	11,325.00	5,531.50	16,856.50

Expenses

Postage	1,271.64	1,657.94	371.97	1,499.77	1,871.74
Copies	0	0	0	0	0
ATSOTC	2,776.46	2,983.14	2799.19	3,571.05	6,370.24
Supplies	104.60	81.01	48.66	49.82	98.48
Calendars	0	0	1,200.00	0	1,200.00
Ads	0	401.76	0	6.62	6.62
Rebates	0	0	0	0	0
Contribs.	0	0	1004.95*	544.38*	1,549.33
E. Nats.	0	0	0	265.18	265.18
Advances	413.08	(4,148.49)	(92.31)	5,660.46	5,568.15
Total Expenses	4,565.78	975.36	5,332.46	11,597.28	16,929.74
Net Income/(Loss)	3,215.72	5,750.60	5,992.54	6,065.78	73.24
Beg. Bank Balance	10,162.93	13,378.65	19,129.25	25,121.79	19,129.25
End. Bank Balance	13,378.65	19,129.25	25,121.79	19,056.01	19,056.01

* 3/31=nat./reg. show support; 6/30=annual liability insurance policy and related expenses.

Note: Bank balance=\$19,056.01 less reserve accounts: two qtr. newsletters, \$9,000; '01 shows, \$4,000; Web site maintenance, \$1,000; multimedia projects, \$3,000; '01-'02 event insurance, \$550; total reserve accounts=\$17,500; ACTUAL WORKING CAPITAL=\$19,056.01—\$17,550=\$1,506.01.

Registries

National Database (all Cougars): Phil Parcels *cougdb@juno.com*
7227 Heath Markham Road, Lima, NY 14485-9508, (716) 624-8011

1968 R-code, Non-GT-E: Bill Quay *wquay@aol.com*
7113 Old English Road, Lockport, NY 14094-5408, (716) 433-9267

Cobra Jet (428/429/351): Scott Taylor *scott.a.taylor@intel.com*
2151 W. Shawnee Drive, Chandler, AZ 85224-1740, (602) 857-2005

Dan Gurney Special: Scott DeFriez *demingdobes@zianet.com*
6420 Hermanas Road S.W., Deming, NM 88030-9519, (505) 544-4444

Eliminator: Frank & Sharon Bowers *bowers@clnk.com*
P.O. Box 775, Wister, OK 74966-0775, (918) 655-3352

GT, XR-7 GT, 6.5 Litre: Brett Irick *xr7gt@prodigy.net*
2 Brookwood Lane, Dearborn, MI 48120-1302, (313) 240-6418

GT-E: Jim Pinkerton *pinktwo@gte.net*
20727 106th Ave. S.E., Snohomish, WA 98296-7166, (360) 668-0243

Sports Special: Bruce Wallace *bwallace@ccci.org*
8709 Catbriar Lane, Orlando, FL 32829-8619, (407) 826-2936 (o), (407) 273-1092 (h)

XR7-G: Royce Peterson *royce_peterson@toyota.com*
2701 Montair Ave., Long Beach, CA 90815-1212, (562) 377-0763

The Personal Touch

In September 1966, my husband and I were married and going to school at Utah State University. The next summer, we took a trip to visit his brother, Bill, who lived in Eagle Mountain, Calif. Jack also had a friend, David, who lived there and had just bought a new 1967 Cougar. I loved that car.



In August 1997, my sons, Jack and Jason, reported that a Cougar that Jack had wanted to buy a couple of years earlier was for sale again. We, as a family, discussed it and decided to make an offer. Jack called and found that the seller had received an offer of \$1,100. We offered \$1,200 cash, and the cat was ours. Jason paid the next day, but it was the next weekend before Jack drove the car home. We now had a 1968 Cougar XR-7 that needed a lot of work.

The kitty had to sit outside for a month or so before we could pull it into the shop to begin work. In the meantime, we talked about what I wanted to do to it (the car is mine, since my husband's baby is a 1996 WS6 Trans-Am). I sold some water shares we had and began the restoration. I spent hours looking through catalogs from Auto Krafters, Paddocks, National Parts Depot, Highway Classics and Ken's Cougars for parts for the Kat, at the price I could afford.

After the car was in the shop, the engine (390 GT) was removed and disassembled. The block, heads and crankshaft were taken to a machine shop to be hot tanked, checked and machined. While this was being done, the fenders were removed. The front end was checked. The tie rod ends, ball joints, lower control arms, and

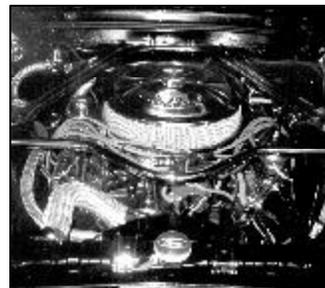


brake pads were replaced and the rotors were turned. The power steering was checked and we rebuilt the control valve and resealed the cylinder. We cleaned about 4 inches of dirt and grease from behind the springs and control arms. Everything was cleaned and painted as the car went back together. The fenders were repaired, cleaned, sanded and painted on the inside and reinstalled.

In the engine compartment, everything but the master cylinder and steering column was removed, checked and painted. The radiator was removed, taken to a shop, flushed and painted. By this time, the block was back at our shop. We were all filled with excitement, but there was still a huge amount of work to be done.

The undercarriage was cleaned and undercoated. A new exhaust system replaced the old hole-filled relic.

The engine was reassembled using .030 over forged pistons



and .020 under main and rod bearings. An Edelbrock 600 cfm electric choke carburetor was purchased and installed.

Chrome "Power by Ford" valve covers were used. An Edelbrock air cleaner sits atop the carburetor. The completed engine was placed back in the car.

After cleaning the passenger compartment and trunk, they were sanded and painted. The car was off to the paint shop for more body work and the final paint: Highland Green with Blue Green Pearl in the clear coat.

The interior design and fitting was now underway. I spent numerous hours looking at books and making drawings of what I wanted (something simple but elegant). I chose white vinyl for the

upholstery and black carpet. The Mercury logo was sewn into the seat backs, as well as the door panels, quarter panels and package tray. The Cougar head has been sewn into the trunk lid

panel. Soon, a Cougar on a tree branch will be be airbrushed onto the hood and tire covers.

A few changes were made to the interior, mostly because of parts availability. The original bucket seats had been replaced with high back seats that just didn't look right, so we replaced them with '70 Mustang deluxe buckets. The pillar and window moldings have been changed to Mustang pillar posts and windlace. The courtesy lights in the door panels have been changed from the long narrow ones to the short and wider Mustang ones. The speakers in the doors when we purchased the car were removed.

We ordered a white headliner, but it wasn't what we wanted. So, I used it as a pattern and made my own with the same white vinyl as the rest of the upholstery (this led to quite a discussion with my husband—he was not a happy camper). But it turned out beautiful. The trunk also was included in the transformation.

A new custom console was designed and built by my uncle. It is made of oak and uses the original ashtray, light and chrome shifter plate, but a battery-operated clock replaces the original one. A new shifter handle sits atop the stick.

A new white-and-black Grant steering wheel (with a cover to match the interior) replaces the old aftermarket wheel, which was pretty beat up and without a horn button.

We got the car back from the paint shop March 4, 1999. We installed all the exterior parts—with a few changes. I didn't care for the large front marker lights and rear reflectors, so we used '69 markers instead. We also installed an Eliminator-style hood scoop and trunk spoiler. New "XR-7" emblems replaced the old, broken ones. The old emblems and mouldings have been highly polished and reinstalled. New rocker panels highlight the beautiful new paint and pinstriping.

We had to rush to finish the car—we had made plans for the *Hot Rod Magazine* Power Tour '99. We just made it. Everything was completed on Mother's Day, five days before we joined the tour in Flagstaff, Ariz. It turned out to be a 4,300-mile, cross-your-fingers maiden outing. For an untried vehicle, it was a good trip with a few not-insurmountable problems (a bad distributor, leaking fuel pump and a blown exhaust manifold gasket we had to live with until we got home).

During the next few months, we attended several car shows around Utah, Colorado and New Mexico. We met a lot of people who "had a '67" or who told us, "A friend of mine had a '69 Eliminator." Most people who stopped to talk had memories of good times and Cougars. We've had a lot of complements on our "Kat."

We think it's pretty nice, too.

—Gina & Jack Manchester, CCOA No. 7042

Cars for Sale

1970 XR-7 convertible, 86,000 miles. Exterior: Deep Gold Metallic. Interior: Ginger (light brown). Brown top, very sharp, excellent condition, always covered. 351C-2V, automatic trans., power windows, power steering, power disk brakes, cold A/C, center console, Magnum 500 rims with new tires. Asking \$10,500, price negotiable. Contact Verlin at (605) 229-0986 or at dvsminis@basec.net. Photos and video available (video: \$5).

Parts for Sale

NOS Cougar mouldings: '67-'68 wheel lips, '67-70 deck, '69 hood lips. Contact Tucker Callan at (716) 538-9560 or at BossT7@juno.com.

1967-73 Cougar parts: sheetmetal, glass, trim, interior, wiring, mechanical, parted 70 cars. Contact Randy Goodling, 2046 Mill Road, Elizabethtown, PA 17022. (717) 367-6700. SASE, please.

Brand new GT-40 aluminum heads, \$1,100 a pair; NOS C8AZ-13AO16-A automatic headlamp dimmer, for Fairlane, Comet, Falcon, Mustang, Cougar, T-Bird, Ford, Merc, Mark III, Lincoln Continental, \$200; Ford 14x6 styled steel wheels (also called GT wheel) from 1968-1969, painted, no caps or rings, \$35 each; 428 exhaust manifolds, C8AE-9431-B & C8AE-9430-A, \$50/pair; 428CJ heads, cast number C80E-6090-N, dates 9C13 & 9C25, \$500; 39OGT heads, cast number C8AE-H, dates

8E2 & 8E3, \$200; 39OGT cast iron intake, C6AE-9425-G, \$100; 427 valves, C5AZ-6505-N & C5AZ-6507-N, 16 NOS in the box + extra valves, \$200; 1968 302-4V smog heads, \$250; 351C-4V exhaust manifolds, \$75 each; (314) 351-1789 AFTER 8 p.m. Keith Litteken. kslitteken@aol.com (MO).

Misc. for Sale

Keys, NOS. Keys and gold-plated keys and key rings for all Cougars. Keys cut by code. Lock cylinders also available. Contact Joey Jesser, 26 West St., Dept. CCA, Akron, OH 44303-2344. (330) 376-8181. 24-hour fax: (330) 384-9129. www.jesserclassickeys.com.

CCOA items: hat, \$7.50; patch, \$7.50; window decals, \$1; 1991 & 1992 Region 3 North regional show dash plaques, \$3/ea.; CCOA 1999 calendars, \$10; 2000 calendars, \$15; Judging Handbook, \$7. Add appropriate shipping costs, make checks payable to "CCOA." Mail orders to Randy Goodling, 2046 Mill Road, Elizabethtown, PA 17022 (717) 367-6700.

Parts Wanted

Ford CB radio, made by Motorola. Optional equipment on Cougars and T-birds in 1979. It came complete with a rear-mounted transceiver and interface cable, and power antenna. All conditions will be considered. Contact Mr. Jean Marcel: 2597 Delisle, Montreal, QC., Canada H3J 1K8. (514) 935-9020.

Members may place a Cougar-related classified advertisement of up to 100 words per issue at no charge. Non-members may place classified ads at a rate of 30 cents per word. Display advertising rates are available; contact Wayne Wachter at (410) 775-2740 or at wwachter@erols.com for details.

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Scott (604) 786-FORD, Barry (604) 574-2746

E-mail: BlueOval@bigfoot.com

Web: <http://www.bigfoot.com/~BlueOval/>

Specializing in 1967-1970 Mercury Cougar Parts

2000 Calendar

CCOA Events in *bold*

Date	Event	Contact
July 28-30	Summer Carlisle Collector Car Flea Market & Corral, Carlisle, Pa.	(717) 243-7855
July 29-30	Prowl 2000, Cascade Cougar Club, Kirkland, Wash.	(425) 397-7284
July 30	Tri-State Mustang Club 20th Anniversary Show (Ford powered), Cincinnati, Ohio	(513) 771-4558
Aug. 5	Seventh Annual David "Pud" Pannell Memorial Car Show, Radford, Va.	(540) 731-3617
Aug. 6	22nd Annual New England Regional All Ford Show and Swap Meet, Northampton, Mass.	(508) 674-5462
Aug. 12	FoMoCo at the Copper Club, Aurora, Colo.	(303) 628-5330
Aug. 12-13	11th Annual Yellow Rose Classic All Ford Show, Fort Worth, Texas	(817) 595-6900
Aug. 13	Fordnutz Cougar Claw In Y2K, Surrey, B.C., Canada, CCOA Regional Show	(604) 786-3673
Aug. 13	Phil Long Ford All-Ford Day, Bandimere Speedway, Morrison, Colo.	(303) 697-6001
Aug. 13	22nd Annual Regional Mustang & All Ford Show, Decatur, Ill.	(217) 245-4848
Aug. 13	Mustang & All Ford Car Show, Columbus, Neb.	(402) 564-3218
Aug. 13	Sixth Annual All-Ford Car Show, Niles, Ill. (Stallions Gate Mustang and Ford Club)	(773) 589-2657
Aug. 19	Mid-Michigan Mustang Club 8th Annual Car Show & Swap Meet, Galesburg, Mich.	(517) 639-4703
Aug. 19	Pacific Cascade Mustang Club All Ford & Mustang Show, Kent, Wash.	(206) 937-7436
Aug. 19	Sixth Annual All-Ford Show, Arlington, Wis. (Badgerland Mustang Club)	(608) 439-4648
Aug. 19	All Ford Car Show & Swap Meet, Springfield, Mo. (Greater Ozarks Mustang Club)	(417) 581-8988
Aug. 20	14th Annual All Ford Show, Bloomfield, Iowa (IO-MO Ford Club)	(515) 664-1025
Aug. 26	Mustangs and Fords in the Park IV, Hagan Park, Rancho Cordova, Calif.	(877) 388-6962
Aug. 26	All Ford Car and Truck Show and Swap Meet, Newport News, Va.	(757) 874-8202
Aug. 26	Mason-Dixon All-Ford Show, Mason-Dixon Dragway, Boonsboro, Md.	(301)663-6903
Aug. 27	Third Annual Blue Oval Blast All Ford Show, Lansing, Mich.	(517) 649-8805
Sept. 1-3	22nd Annual Ford Expo Car Show, Drag Race & Swap Meet, Columbus, Ohio	(740) 983-2273
Sept. 10	21st Annual Summer Show and Sale (Mustangs Unlimited), Manchester, Conn.	(508) 674-5462
Sept. 10	20th Annual Mustang & Ford Fall Car Show, Mt. Laurel, N.J.	(856) 768-8428
Sept. 10	Sixth Annual All Ford Show, Plattsburgh, N.Y. (contact: mach1scj@primelink1.net)	
Sept. 15-17	Millennium 2000 Charlotte Spectacular, Charlotte, N.C. (Int. Mercury Owners Assoc.)	(773) 622-6445
Sept. 16	17th Annual Mustang and Ford Show, Richmond, Va.	(804) 271-2139
Sept. 17	11th Annual Fords at Trebour show, Trebour Ford, Randolph, N.J.	(201) 666-8022
Sept. 17	All Mustang and Ford Show, Birch Run, Mich.	(517) 823-8802
Sept. 17	Mustang and Ford Show, Syosset, N.Y.	(516) 798-6223
Sept. 23	Fifth Annual Mustang & Fords Show, Salt Lake City, Utah	(801) 629-5556
Sept. 28-Oct. 1	Fall Carlisle Collector Car Flea Market & Corral, Carlisle, Pa.	(717) 243-7855
Sept. 30	20th anniversary All Ford and Mustang Show, Matthews, N.C.	(704) 541-5842
Oct. 7	19th Annual Mustangs of Memphis Car Show (any Ford-powered), Memphis, Tenn.	(662) 895-8989
Oct. 7	Custom Car and Street Rod Show, Bethesda, Md.	(301) 657-4000
Oct. 7-8	11th Annual Regional Mustang and All Ford-powered Show, Oak Ridge, Tenn.	(865) 481-8108
Oct. 14	All Ford Fun Day, Letchworth State Park, Mt. Morris, N.Y.	(716) 538-9560 bosst7@juno.com
Oct. 14	13th Annual All Ford Day 2000, Richmond, Va.	(804) 590-9583
Oct. 14	22nd Annual Shenandoah Valley Mustang Club Classic Car Show, Winchester, Va.	(540) 662-0584
Oct. 21	Cruise Night, Old Town, Kissimmee, Fla. (Sunshine State Cougar Club)	nitmoves@webtv.net

Let the CCOA know about your club's event or other all-Ford events happening in your area. Send calendar submissions to ATOTC, 4012 Hamilton St., Hyattsville, MD 20781-1842; graziano@cais.com; or (301) 864-4460 (fax).

CIRCUITS, from page 19

goes out. This is because every charge must at some point pass through that bulb, and since it's burned out, this can't happen.

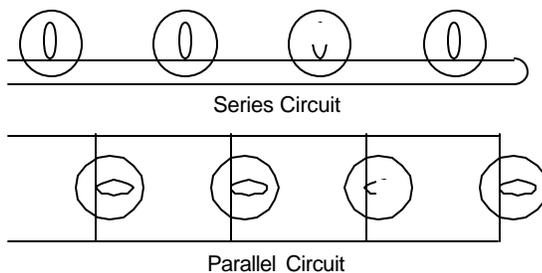


Figure 2

In the second half of Figure 2, if one bulb burns out, the remaining bulbs each provide a charge an alternative path to the path that's been interrupted by the burned-out bulb. So, the other bulbs still light. Note, though, that this second circuit requires more wire. Something for nothing you ain't gonna get.

The Cougar tachometer is a perfect example of a device that is wired in series in its host circuit (refer back to Figure 1 to see why). Every electric charge that goes to the ignition coil *must* pass through tachometer on its way there. The reason for doing things this way ought to be obvious—if we make everything that pulses to make a spark pass under our scrutiny, we can count how many times the points open and close. (Actually, there are other ways to make this count also—and a lot of aftermarket tachs use these techniques. But for now we'll stick to discussing the stock unit.)

From this, you can also see that if your tach dies, your whole ignition system dies, much as one bad bulb can shut down a whole string wired in series. And in fact, after 30 or so years of use, a lot of the solder joints on some of these tachs are now getting old enough and stale enough that many tachs are now dying. (The good news is that they're also easily repaired by reheating the solder until it melts and forms a new joint.)

Power

Now that we've got the concepts of voltage, current, and resistance under our belts, we can have a look at another concept called power—and later in this column that of power transfer.

We know that voltage is a measure of the energy a charge in a circuit has. And we know that current (amps) is a measure of how many charges flow in a circuit. If we were to multiply the two, we'd get:

$$\text{energy/charge} \times \text{charges/second} = \text{energy/second.}$$

Now that's a useful number for telling the rate at which a circuit is consuming energy—and, by

extension, how much useful work it can do.

For example, let's say I replace a 12 volt motor that draws 1 amp with a 6 volt motor and I ask you how many amps the new motor would draw, assuming it consumed the same amount of power. You might think that because the new motor is fed with charges that have only half the energy of the first batch, it'd take twice as many of them for the motor to have the same power output.

In mathematical terms, we can express power with the equation:

$$P = V \times I$$

where P is power, V is voltage, and I is current (amps).

Note that in the case of the first motor we could calculate its impedance (using Ohm's Law) as:

$$R = V/I \text{ (12 volts/1 amp} = 12 \text{ ohms)}$$

In the case of the second motor, we can calculate its impedance as:

$$R = V/I \text{ (6 volts/2 amps} = 3 \text{ ohms)}$$

(Yes, for you purists, I *am* skipping the discussion of motor inductance, which affects resistance. But I promise to get to that in the next issue of *ATSOTC*.)

Notice that the new motor, which runs on half the voltage of the first (but twice the current), has an impedance that is *one quarter* that of the original motor. I won't do it here, but the mathematicians among you might want to combine Ohm's Law and the Power Law to derive the following two equations:

$$P = V^2/R \text{ and } P = I^2 \times R$$

Kirchoff's laws

Kirchoff was a fellow who concocted two very useful laws that, in conjunction with Ohm's Law, will enable you to describe what just about any circuit is doing.

The first law (the voltage law) says that the sum of voltages around any complete circuit is always zero. It's a bookkeeper's sort of law that says assets must equal liabilities, or somebody's been embezzling.

Figure 3 illustrates the point. In the top half of the figure, we have a 12V battery and three resistors in series that reduce this voltage by 6V, 2V, and 4V as a charge goes around the circuit. And the math (12V - 6V - 2V - 4V = 0V) works as expected.

Now look back at the ignition circuit shown in Figure 1. You'll notice here that the voltage drop across every component in the circuit adds up to the voltage of the battery, for both the case of "points closed" and "points open." If you recall

from our ignition troubleshooting guide in the winter issue, I said that when you measure coil voltage with the points open, you'll see something close to 12 volts. The reason is that because we've got a series circuit, with the points open the series is incomplete. Thus no current can flow, and the voltage drop across the tachometer is zero (0 amps x 0 ohms

= 0 amps), the voltage across the ballast is zero (0 amps x 1.5 ohms = 0 volts), and the voltage across the coil is zero (0 amps x 1.3 ohms = 0 volts). So everything in the circuit upstream of the open points must be at 12 volts.

Close the points and the rules of the game change. The charges have a path through a complete loop from the battery back to the battery. And everywhere they go, they must (1) obey Ohm's Law and (2) gain and lose a total amount of voltage such that the sum of voltages around the loop is zero.

Again, a picture (and a little bit of practice) is worth a thousand words, so I encourage you to follow a charge around the loop in the picture, doing the math for yourself along the way. For reference, the resistance of the ballast is 1.5 ohms and the coil, 1.3 ohms.

Kirchoff's current law says something similar to the voltage law—only for current. In essence, it says that the number of charges that flow into any place in a circuit had better equal the number that flow back out. (Again, it's an "assets must equal liabilities" sort of bookkeeping law.) This ought to be intuitively easy to understand. For example, if your headlights are all on and drawing 30 total amps of current, and your radio is cranked up and drawing another 10 amps, your alternator had better be putting out 40 amps of current. If it's only putting out 35 amps, Kirchoff's current law says that there's an imbalance and something (in this case your battery) had better be making up the 5 amp difference. Alternatively, if your alternator is putting out 45 amps, you've got 5 amps that can be charging your battery.

The second half of Figure 3 should drive this point home. If 1A of current flows into the node connecting two resistors wired in parallel, the sum of the currents passing through these resistors must also equal 1A. In this case, I've drawn resistors that each carry 0.5A, as their value of resistance (number of ohms) is the same.

If the resistors were of unequal value, each would carry a different current, but the sum of their currents still would be 1A.

Keep Kirchoff's current law in mind when sizing your alternator.

Voltage Divider Equation

If you look closely at the ignition circuit with the points closed, you'll realize that, indirectly, I've already shown you the voltage divider equation. It says that in a series circuit, the voltage at any point in it will be:

$$V(\text{node}) = \text{Source Voltage} \times (\text{sum of resistances below node}) / (\text{sum of all resistances})$$

In the case of the ignition circuit with points closed, the voltage at the "+" terminal of the coil would be $12\text{V} \times (1.3 \text{ ohms}) / (1.3 \text{ ohms} + 1.5 \text{ ohms})$, or 5.5V.

Note that the use of this handy equation would allow me to find all the voltages at all points in the ignition circuit without every explicitly calculating the current in it. Sometimes the current in a circuit is of no real interest, and this equation is a handy shortcut to finding out what we want about voltages.

Source Impedance

So far, we've been discussing only circuits in which there is an energy supply that will maintain a given voltage regardless of how many amps we try to pull out of it. And this is a pretty good sort of energy supply to discuss in the context of automotive electrical systems, because this is about how a car battery works. But the ugly truth is that if you try to pull a whole lot electrons out of your battery at once, the voltage it puts out is going to start to sag. (Back when I was growing up, I lived in places where if you plugged in your electric razor, you could see the streetlights dim. The phenomenon is the same. And I'm sure that more than one of us has noticed that when the headlights are on, the defroster and windshield wipers are going full blast and the turn signal is on, the little turn indicator light on the dash stops flashing, mainly because there just aren't enough electrons left over to trip the little relay under the dash that makes that light turn on and off.)

Essentially, the reason your battery voltage drops is that it has a characteristic "source impedance." This impedance (or resistance) can be drawn like a resistor in series with the "ideal" voltage source that would put out as many charges as you wanted forever. In the case of a car battery, this source impedance is so low that it's almost not worth mentioning. Almost.

For example, if the impedance is 1/1,000 of an ohm (a pretty low number), you could pull 100

See **CIRCUITS**, page 28

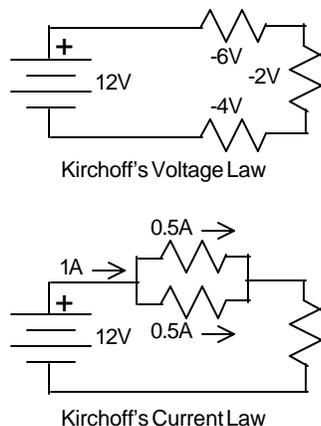


Figure 3

CIRCUITS, from page 27

amps out of the battery and probably not notice the fact that, according to Ohm's Law, your battery output was only 11.9 volts instead of 12 volts. (Battery voltage would be 12 volts minus $100 \text{ amps} \times 1/1,000 \text{ ohms}$, according to a combination of Kirchoff's voltage law and Ohm's Law.) But if you were to try to pull 1,000 amps out of the same battery, you'd see 12 volts - (1,000 amps $\times 1/1,000 \text{ ohm}$) at the terminals, and this would only be 11 volts. You'd notice a full volt drop.

Power Transfer Equations

Power transfer equations put the concepts of resistance, source impedance, and power together in a surprising manner that you can use to choose your next car (or home) stereo speakers.

For example, say you have a set of stereo speakers that are 8 ohm units (like the stock units on most Fords of late '60s vintage) and you want to get more volume out of your system without changing your radio or amplifier. So you reason:

$$\text{power} = \text{voltage}^2 / \text{resistance}$$

and conclude that this is the appropriate power equation to use, because you know that the voltage of an automotive electrical system is 12 volts. So you buy some spiffy new 4 ohm speakers, plug them in, and expect the volume to be twice what it was. Only it's not. In fact, your stereo just got quieter.

Your buddy comes along and says, "Look, you had 12 volts running through 8 ohms, so Ohm's Law tells you that the current had to be 1.5 Amps. And because:

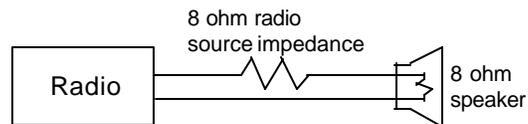
$$\text{power} = \text{current}^2 \times \text{resistance}$$

you just need to double your resistance (since you know the current is 1.5 amps) and you'll get twice the volume out. So you buy another set of speakers (this time 16 ohm units) and plug them in. And again, you hear the volume drop. So far, nothing has been louder than the 8 ohm units with which you started.

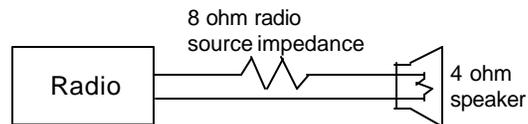
The reason for this is that you've forgotten that every voltage source *also* has a characteristic source impedance. Take a look at Figure 4 and follow along with this reasoning, noting that in the figure, I've used a slightly different set of equations than those in the text (although they yield identical results):

Here, your source impedance was probably 8 ohms. So, according to resistive divider equations, in the system in which you started the voltage across the speaker would have been $12 \text{ volts} \times 8 \text{ ohms} / (8 \text{ ohms} + 8 \text{ ohms})$, or 6 volts.

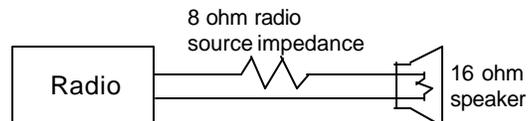
The power through the speaker in the first case would therefore have been $6 \text{ volts}^2 / 8 \text{ ohms}$, or 4.5 watts.



Current in circuit: $12\text{V}/16 \text{ ohms} = 0.75 \text{ amps}$
Voltage across speaker: $0.75 \text{ amps} \times 8 \text{ ohms} = 6\text{V}$
Power in speaker: $0.75 \text{ amps} \times 6\text{V} = 4.5\text{W}$



Current in circuit: $12\text{V}/12 \text{ ohms} = 1 \text{ amp}$
Voltage across speaker: $1 \text{ amps} \times 4 \text{ ohms} = 4\text{V}$
Power in speaker: $1 \text{ amps} \times 4\text{V} = 4\text{W}$



Current in circuit: $12\text{V}/24 \text{ ohms} = 0.5 \text{ amps}$
Voltage across speaker: $0.5 \text{ amps} \times 16 \text{ ohms} = 8\text{V}$
Power in speaker: $0.5 \text{ amps} \times 8\text{V} = 4\text{W}$

Figure 4

When you dropped the speaker resistance to 4 ohms, you made the voltage across the speaker (again, using the voltage divider equation) $12 \text{ volts} \times 4 \text{ ohms} / (4 \text{ ohms} + 8 \text{ ohms})$, or 4 volts. And in this case, the power through the speaker became $4 \text{ volts}^2 / 4 \text{ ohms}$, or 4 watts. So yes, your speaker was now putting out half a watt less power and sounding quieter.

When your buddy suggested increasing the resistance of the speaker to 16 ohms, you caused the actual voltage to appear across the speaker to be $12 \text{ volts} \times 16 \text{ ohms} / (16 \text{ ohms} + 8 \text{ ohms})$, or 8 volts. The power through the speaker then was $8 \text{ volts}^2 / 16 \text{ ohms}$, or 4 watts. So again, you lost half a watt of power output.

With a little bit of differential calculus (which is way beyond the math I'm going to present here), I could prove to you that power transfer in a circuit is maximized when the source impedance (in this case the output impedance of the amplifier) is exactly equal to the destination or load impedance (in this case the impedance of the speaker). For now, I'll let you play with the grocery store math a little bit and convince yourself that the rule that says you ought to match source impedances to destination impedances is a good one.

In any case, the next time somebody tells you to "replace that 8 ohm speaker with a 4 ohm unit and get more power out," you'll know better. Assuming the electrical-to-mechanical energy conversion efficiencies of the speakers are the same, your best bet is always to match the source impedance to the speaker impedance.

Some of you also will notice that because of the voltage divider equations, if the source and

load impedances are matched and power transfer is maximized, the greatest power transfer efficiency you're ever going to get is 50 percent. Sorry, but that's how it is.

Summing up

While it might seem a bit tricky at first, the math for most electrical analysis of automotive systems is pretty simple, so you don't have to be afraid of it. If you can balance your checkbook, chances are you can do 90 percent of the electrical engineering math you need to do to wire an automobile. And the other 10 percent isn't all that much worse.

With all of this said, we still have a few more bases to cover in the electrical ballpark, and those will be the subject of our next lesson. In the fall issue of *ATSOTC*, you can look forward to getting a closer look at your condenser and the ignition

noise suppressors in series with your radio. And together we'll debunk a few of the more prevalent myths (at least I've seen them more than once on the CLASSIC-COUGARS Internet list server) regarding how much current a starter motor pulls when the battery starts to lose voltage and die.

And before we're done, we'll look at what might happen if you hooked a coil in *parallel* with a condenser. (The answer is you'd get something that looks remarkably like the tuner section of an AM radio; and the math that describes its behavior would look an awful lot like the equations used to model a suspension. So yes, we *are* in fact going someplace with what was, I'll admit, a rather esoteric discussion this time. And we'll find our way out of the electrical maze—and into the mechanical one—in the most surprising way.)

All this and more, next issue.

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