

April 2014



Will this winter never end??? I suppose it's a nice reminder that I haven't really accomplished much in my winter project list. I think the point for me was made when I started making my spring to-do list on the same page. We'll see what happens, but I have a feeling some thing will be left for next winter. On a positive note, some good headway has been made on my Cruise for Troops project (www.cruisefortroops.com) and I did get my new shifter. My plan is to do a blurb on it for next month's newsletter, so I won't spoil the surprise other than to say that it's not a stock shifter and it's rarely seen in ANY vehicle.

I do want to say congratulations to Dave who has rejoined the workforce, and good luck to Darren who is steadily pursuing a new career. I'm not going to disclose where Dave landed, but it sounds like he's going to be making the rounds in his other hobby as well.

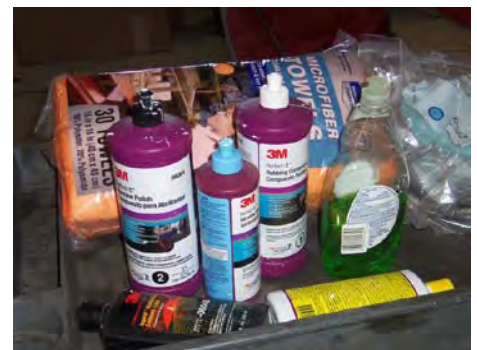
What happened at the March club meeting down at Craig's? Well, that's part of the fun about going to meetings. It's not a secret, but a big part of our club is the social aspect. We spend a little time BS'ing, a little time on club business, some time on whatever activity which is pretty well just more time hanging out together, and then after the meeting closed, there's usually a lot more casual hanging out. We have a new format this year where it's member-driven. Each month's meeting is "sponsored" by a member, which essentially means someone suggests a location, specific activity, or even volunteers their own home and spearheads the coordination. Even though that might sound a little daunting, it's really just suggesting something you think the group might be interested in and making a call to arrange it. If it's opening up your own place to the group, that's perfectly fine too, what we really need is a designated place to meet and while Man cave or Garagemahal type shops are really cool, they're not necessary. By the way, October and November are still open for suggestions.



Here we see car guys in a very rare pose. This is so unusual because they are typically seen bent slightly at the waist and facing an engine compartment, regardless of topic.



The topic was metal prep for paint, notice all the different products from filler to epoxy primers to primer surfacers, to final step wax/grease removers and catalysts. Notice the 3 spray applicators on the cowl.



Once you get that paint down, there's still the final treatments like machine polish, running compound, swirl removers and final polishes. 3M products are found in top shops.

What do you know about mufflers, other than they're usually boxy and have a big hole at either end? Here's a good article I read on Dragzine that hopefully will educate you beyond sound comparison and what materials were used.

Understanding Muffler Design and Sound Absorption Strategies

By [Bobby Kimbrough](#)

In this article we are tackling the age old question of how much of high performance muffler design is based on science and how much is slick advertising? With all the different styles and types of performance mufflers on the market with different sound attenuation strategies, it can get confusing to know what is best for your application.

Muffler manufacturers make a lot of claims about their products but some of the claims don't explain how their mufflers actually work and bring a distinct difference to the performance of a car. We enlisted some of the top minds in the exhaust game to understand the ins and out's of muffler design by reaching out to B & B Performance Exhaust, Corsa Performance Exhaust, Flowmaster Inc. and Hooker Headers to get the lowdown on muffler basics.

Muffler Purpose

Starting from the top we should define what the purpose of a performance muffler is. Performance mufflers have three simple goals for perfect operation. First to absorb and dissipate. Second to move exhaust gasses, and finally to maintain power and performance of the engine while achieving the first two goals.



Understanding the different types of internal configuration will help you pick the right muffler for your application.



Corsa's Brent Noward explained their unique chambered muffler design as Reflective Sound Cancellation (RSC) technology. "We use Reflective Sound Cancellation to capture specific sound waves and route them through an internal mechanism. That then reflects the sound wave back upon the next sound wave entering the mechanism all without interrupting the exhaust flow. Each muffler is designed and tuned specifically for the vehicle it is intended for taking into account everything from cabin volume, to exhaust length, to desired level of exterior volume."

Clearly, designing and engineering mufflers that efficaciously contain, absorb and dissipate noise pulses and maintain power with cost efficiency at the same time is no easy task. Nor is it a one size fits all formula.

Performance mufflers do not technically “add” any extra power to your car when you install them; however they can often help to maintain more of the engine’s power than a stock muffler. Many stock cars have restrictive exhaust systems to keep the cars quiet and cost much less for the manufacturer. Performance mufflers actually improve the efficiency of the exhaust system and retain most of the power that your engine creates. Some stock mufflers have been documented to rob 30 or 40 horsepower from a factory high performance V8 by creating excessive backpressure.

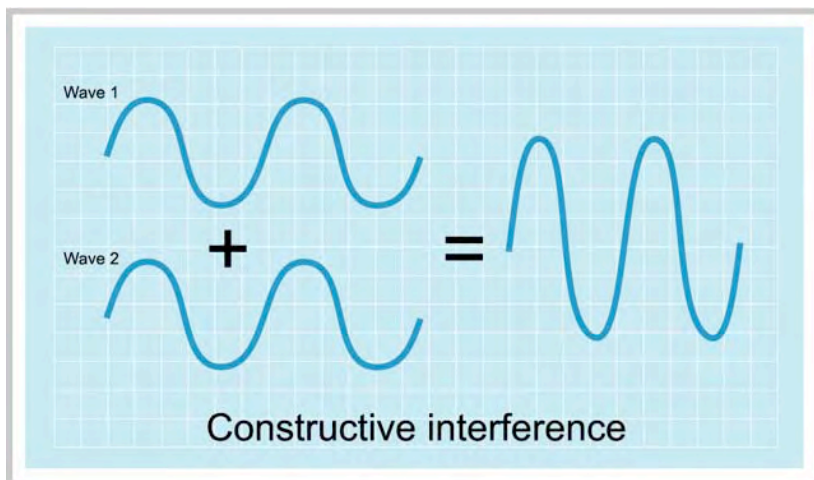
“Honestly, the most impressive thing that others identify in an automobile right away is the sound that your car makes.” – Cam Benty (Hooker Headers)

Adding a performance muffler to your car can also help to reduce wear on engine components, by reducing engine heat and boosting exhaust flow. Performance muffler designs also consider the sound that does come out of the tail pipe by improving the exhaust note to a more aggressive and exiting sound.

About Exhaust Noise

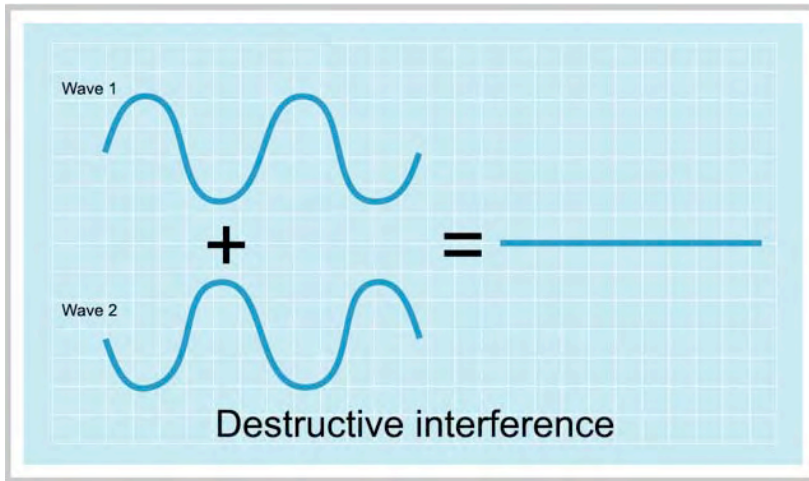
Sound is simply a vibration that spreads as a wave through air. This vibration, or pulses of high and low are pressure, move through the air at the rate of a mile in five-seconds on the average – commonly referred to as “the speed of sound.”

In an internal combustion engine, these pulses are created when the exhaust valve opens and the hot gas from the combustion chamber enters the exhaust system. The exhaust gas exits the combustion chamber under pressure and meets the low pressure gas in the exhaust pipes and stack up on each other. However, the sound waves migrate through the media without any resistance, making their way down the pipe faster than the actual gases do.



If a crest of a pulse wave meets a crest of another pulse wave of the same frequency at the same point, the displacement is the sum of the two waves. In an eight cylinder engine, you can have eight pulse waves at the same frequency at the same point creating a lot of sound.

When these pulses reach your eardrum, the eardrum vibrates back and forth which causes the brain to recognize the motion as sound. It is possible to add multiple sound waves together and get less sound by lowering the pressure pulses. This is where muffler design comes into play.



When two pressure waves have displacement in opposite directions there is an interference that occurs. This is the noise canceling effect that muffler designers use on certain frequencies to silence them, leaving only the desired frequencies.

Types of High Performance Street Mufflers

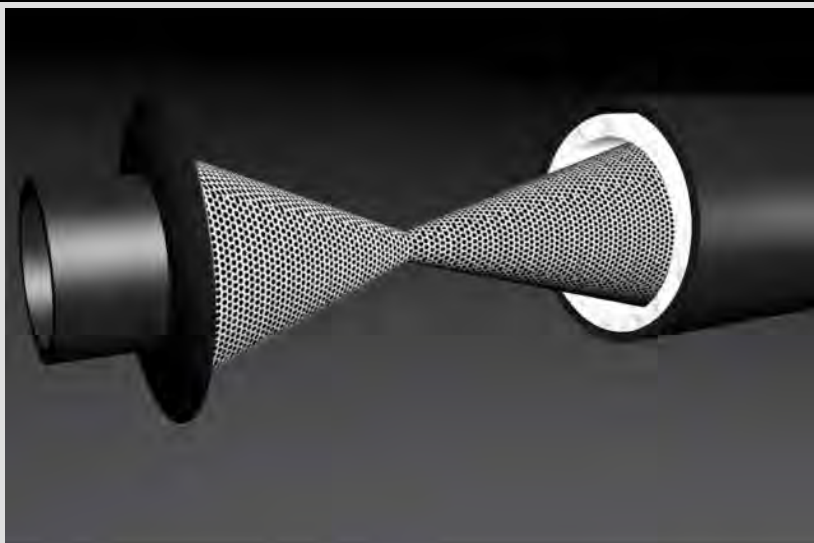
“Designing a high performance street muffler is a careful balance or blend of science and subjectivity,” says Hooker

Header’s Cam Benty. “Science is the easy part. What sounds good is much more subjective. The exhaust note is in the design, not the material.”

Muffler design types fall into three basic categories: reactive, absorptive, or a combination of the two. There are several other terms in usage today, like turbo, bullet and multiple baffles. Despite the different terms, they still fall into one of these three basic categories: reactive, absorptive or combination.

Making Music

“There is plenty of documentation on how sound waves move and the way that sound waves move through mufflers,” explains Benty as he described how formulas are used in locating the chambers and tubes inside a muffler. “Channels and chambers inside a muffler are there for a reason. Certain sound frequencies are eliminated and others are allowed to pass through. Honestly, the most impressive thing that others identify in an automobile right away is the sound that your car makes,” Benty added.



Flowmaster’s laminar flow muffler design forces the flow through two conical shaped perforated tubes before exiting the muffler. Flowmaster’s Nick Tauber explained the technology by saying, “These mufflers use what we call broad band sound cancellation. The sound waves expand to the outer core of the muffler where the sound waves are cancelled out similar to one of our chambered mufflers. Residual sound waves are then absorbed by the outer thermal barrier which also helps dissipate

radiant heat. As the exhaust pulse enters the muffler its velocity is increased using the venture effect. The increased speed of the exhaust pulse creates a low pressure area behind it. This creates the scavenging effect. This type of technology also works very well in turbo applications.”

Formulas used in targeting specific sound frequencies are generally based on the number of cylinders of the engine and the cylinder firing rate of the engine that an engineer is designing a muffler for. Internal design depends on space. Both the amount of space that is available in the platform and the volume of the muffler required for the engine size and rpm are important in calculating where channels and baffles go. Each type of muffler has its own design formulas and physics framework to adhere to when designing a muffler for a new application.

Reactive Style Mufflers

Reactive mufflers are also commonly referred to as restrictive mufflers. The term “restrictive” has bad connotations, like restricting the flow of gasses out of the engine. All mufflers create some form of restriction as a byproduct of silencing unwanted sounds. Most experts agree that factory mufflers accomplish noise reduction by forcing gasses through smaller diameter passages causing the flow of the gasses to back up and form a type of air dampener for sound.

Despite the name, reactive style mufflers are revered for their ability to silence harsh engine noises. Using engineered chambers with plates or perforated tubes, reactive style mufflers can isolate and diminish a target range of tones. Mufflers can be tailor made for aggressive sounding exhaust note or a super quiet exhaust note depending on the noise canceling strategy built into the muffler.

Many of the reactive type mufflers use internal tubes, sound chambers and route the flow through increasingly smaller openings. “These types of systems do a good job of canceling out sound waves but they lack exhaust scavenging abilities,” said Nick Tauber of Flowmaster, Inc.

“Depending on which concept you use in muffler design, it is going to have a great impact on the tone that the muffler is going to have.” – Billy Boat

While the reactive style mufflers do a great job at noise reduction, they can also create the most back pressure. This style of muffler is normally designed to force exhaust gasses through smaller diameter passages. Minimizing the amount of restrictions is the chief goal in the design of this muffler type.

Using a unique system they call Reflective Sound Cancellation (RSC), Corsa’s Brent Noward admits that getting rid of restrictions is the key to designing a successful reactive style muffler. “With our RSC technology we target very specific frequencies and target our muffler designs to tune out those frequencies without impeding airflow.”

There are several companies that make a well designed reactive type muffler that reduces noise without generating excessive backpressure. Flowmaster, Corsa and Hooker Headers all have product lines of very well designed reactive style mufflers.

Reactive Muffler Noise Canceling Strategies

Former Indy Car racer and Midget Auto Racing Hall of Fame driver Billy Boat explains the strategy behind his company’s noise canceling concepts. “We consider two basic noise canceling concepts when designing mufflers for B&B Exhaust systems,” says Boat. “Reactive and

absorption. Depending on which concept you use in muffler design, it is going to have a great impact on the tone that the muffler is going to have.”



Flowmaster uses delta plates to divide the flow and bring it back together to cancel some noise frequencies.

Many reactive mufflers are designed with chambers and plates that deform the sound waves coming out of the engine. These techniques require the sound waves to bounce around and react against another pulse wave. Flowmaster takes a different approach. According to Tauber, “Flowmaster mufflers take the sound wave and split it. When the sound wave comes back together the like frequencies cancel each other out. The mufflers also scavenge exhaust by creating a low pressure area behind the delta plates.” Basically, Flowmaster controls the sound by using chambers and exhaust flow.

The more restriction there is in a muffler contributes proportionately to the lower sound waves and the amount of engine power that is wasted. There is a direct correlation between the amount of exhaust noise and power lost. Basically, the louder the exhaust note, the more power that is retained and can be used.

Depending on the sound level desired by enthusiasts, “The amount of delta plates and the use of a Helmholtz chamber can change the sound of the exhaust to anything from an aggressive note to something just above stock,” Tauber explained.

Corsa’s Reflective Sound Cancellation (RSC) technology focuses on getting rid of low frequency sound waves by diverting them into specifically designed channels and reversing the flow causing the sound waves

to cancel themselves out and eliminate the unwanted frequencies. “We generally try to use tubing equivalent to, or larger than, stock tubing to increase flow,” Noward added.



Multiple reactive technologies combine to create the exact signature tone for Flowmaster Mufflers.

Pros

- Great Sound Cancellation
- Good flow in well designed systems

Cons (according to some experts):

- High restriction

- Lack of scavenging ability

Examples of Reactive style mufflers:

Corsa Performance Exhaust

- RSC Mufflers (Reflective Sound Cancellation)

Flowmaster Inc.

- Super 10/40/44/50 Series
- Flowmaster 40/50/60/70/80 Series

Hooker Headers

- Aero Chamber
- Hooker Headers Turbo

About Absorptive Mufflers

Absorptive mufflers are designed so that the sound entering the muffler interacts with packing material and is converted to heat by the frictional process. This muffler's performance relies on absorption by the packing material for performance.

Absorptive type mufflers gained serious recognition in the late 50s by hot rodders and have continued to thrive with enthusiasts that want a very aggressive high performance sound. These straight-through designed mufflers produce a tantalizing sound and are sought after by many enthusiasts.

Enthusiasts wanting an absorptive style muffler should look to choose one from a reputable manufacturer like the ones that we have listed here. "Certain mufflers can burn out because the packing material is in contact with perforated tubes and the hot exhaust gases," said Benty. If the packing material burns out or is blown out of the muffler, its ability to provide any noise control is reduced.



Absorptive mufflers tend to be straight-through style wrapped with packing material for sound absorption.

"Absorptive muffler technology has been around since the 1950's," explained Tauber.

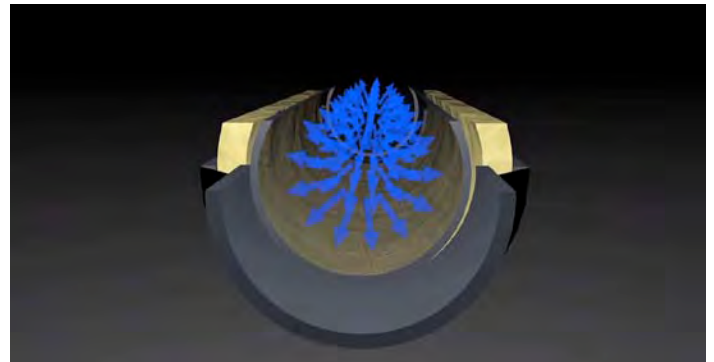
"The problem with this technology is that

even though the muffler looks straight through, the turbulence caused by the sound and exhaust pulses trying to escape into the packing material, causing back pressure."

"The quietest time in an absorptive muffler's life is when you buy it," says Flowmaster's Nate Shelton. Shelton has over 40-years of experience with performance exhaust since starting at Hooker Headers in 1972.

As Benty explained above, the packing material gets burned or blown out of the muffler. Condensation can soak into the packing material adding to the degradation of the muffler's ability to act as a silencer. Unless you plan on replacing your mufflers a lot more frequently, or wearing noise canceling headphones when you drive, straight-through mufflers may not offer the controlled sound level that you desire.

Sound waves move to the exterior through the packing material on its way out of the muffler. Many enthusiasts like the sound created by this style muffler.



Noward explained absorptive muffler's perforated tubing as being a big difference between the reactive style and absorptive style muffler design.

“We don't use porous tubing as a primary means of sound deadening as this type of methodology is generally used with a packing muffler as the primary means of sound deadening. These methods can actually impede flow.”

Pros:

- Aggressive sound
- Good flow

Cons (according to some experts):

- Poorly designed systems impede exhaust flow
- Do little to silence unwanted noise

Examples of Absorptive style mufflers:

Hooker Headers

- Sidemounts
 - Maximum Flow
 - Universal Elite and Turnout
- Combination (Restrictive and Absorptive)

“If you focus solely on noise cancellation or reflection, you're going to end up with a real 'tinny' sound and not really a desirable tone. If you rely purely on absorption, you don't cancel frequencies at the right areas and you get drone,” says B&B Exhaust's Billy Boat. “So, what we have learned in the last 20 years of muffler design, through trial and error and practical application, is that a combination of both is what we found to be the best.”

Boat, a graduate from Arizona State University, has performance credentials from top to bottom on his resume. “When it comes to muffler design, we will implement some element of absorption, which gives it a deeper tone, and elements of reflection which helps to eliminate the drone,” Boats added.

Tauber explained how Flowmasters combination mufflers work by saying, “These mufflers use what we call broad band sound cancellation. The sound waves expand to the outer core of the muffler where the sound waves are cancelled out similar to one of our chambered mufflers. Residual sound waves are then absorbed by the outer thermal barrier, which also helps dissipate radiant heat. As the exhaust pulse enters the muffler its velocity is increased using the venture effect. The increased speed of the exhaust pulse creates a low pressure area behind it, which creates a scavenging effect. This type of technology also works very well in turbo applications.”

Pros:

- Great balance of sound and exhaust flow
- Great for Turbo and power adder applications

Cons (according to some experts):

- Packing material can deteriorate or hold moisture

Examples of Absorptive style mufflers:

Flowmaster Inc.

- Super HP-2
- Pro Series
- DBX Series

B & B Performance Exhaust Mufflers

Inside the Muffler

Mufflers silence sound waves by converting the sound wave energy into heat by passing the exhaust gas and its accompanying wave pattern, through perforated tubes and tuning chambers. Passing into perforations and reflectors within the chamber forces the sound waves to dissipate their energy. There are several different design techniques used by the muffler manufacturer’s to accomplish their task.

The criteria for developing a new muffler boils down to the amount of noise reduction required, restrictions on shape based on the vehicle, the pressure drop through the muffler and the market’s economic considerations.

According to Noward, “Mufflers all have limiting attributes dependent upon the vehicle application. We pre-spec the sound level we are designing for and benchmark that against the stock level exhaust sounds both internally and externally.”

Boat explains the design process used at B&B Exhaust, “We don’t take a regular 9-inch x 5-inch muffler and try to make it fit every application. We take every application and determine what is going to be the best configuration of muffler inside and what our latest technology is to develop the system.”

“Typically engineers begin by identifying the target size, based on the vehicle, then go to a target frequency and volume,” said Benty. “Shape is largely determined by available space in the



While straight-through exhaust mufflers look like the gases and noises go straight through the muffler, there is actually a lot going on inside there.

vehicle application and how much clearance is acceptable. We design our exhaust systems to have stock or near stock levels of ground clearance,” added Noward.

“We’ll take a look at what the factory has done. Years ago there were big gains possible from what the factory put out to the aftermarket. The factory has gotten a lot better in the past 10 years, but there is still a lot of room for improvement. We take a look at what they have done and figure out where we can make improvements,” states Boat. “You have to look at every application and see where the improvements can be made. Sometimes it’s size and sometimes it’s muffler flow or how the exhaust routes through the muffler. We look at improvements on a case by case basis.”



B&B Performance Exhaust uses many techniques in their exhaust design. One of these techniques is a bi-modal exhaust system, meaning it has two passages, that the exhaust can travel through the muffler. Each of the mufflers

has two outlets, with one side having a butterfly type valve which allows the exhaust flow to be shut off, regulating which side of the muffler the flows exhaust.



Every manufacturer told us that each application is specific. There is no one size fits all “universal” muffler for every application. Based on the concept of improving performance, the manufacturer’s look at the factory muffler’s tube size and muffler volume. Then they examine the reflection properties and cancellation notes to figure out where improvements can be made and which unwanted sounds need to be cancelled out.

Noward explained how Corsa design process works with their engineers. “Our proprietary RSC technology is designed differently dependent upon the sound level we are targeting. We change our exhaust note by changing how we design our RSC technology inside of the muffler removing frequencies or allowing additional frequencies to be heard.” To Corsa, targeting the sound is primary to designing the internal parts of each muffler.

The Design Stage

Like most of the high performance muffler companies, Noward explains the software involved in muffler design. “We’ve invested in designing proprietary software that aides us in the configuration of the muffler design based on a set of inputs. That program gets us to a starting point and then we perfect it through trial and error and re-designing the internal RSC configuration and muffler attributes as necessary. Acoustically we use our proprietary software to help us target the acoustic levels we are trying to attain.”

Noward went on to say, “Due to our RSC technology, our systems feature a free-flowing straight through design that provides extremely low back pressure that allows the exhaust to flow very

freely boosting performance. Each muffler is designed and tuned specifically for the vehicle it is intended for taking into account everything from cabin volume, to exhaust length, to desired level of exterior volume.”



Hooker Header’s Maximum Flow mufflers utilize two perforated tubes branching off of a single entry tube to a twin exit.

You can never tell what’s going on inside a muffler just by looking at the outside. There are chambers, tubing, plates and all kinds of devices at work on the inside.



The Bottom Line

Billy Boat summed up the muffler design process by saying, “Muffler design is fairly complex. From the outside looking in, a tube wrapped around another tube with some packing isn’t the way the technology is anymore. There are a lot of things going on in modern mufflers that helps achieve the sound and performance that we are looking for.”

In the 1950’s cutting edge technology was taking a 3-inch core and put a 4-inch sleeve around it and calling that a muffler. By today’s standards that isn’t doing too much because we have a better understanding of the area needed for absorption. Wrap that same core in an 8-inch sleeve and you may have a fairly effective muffler.

Benty tells us that a new muffler design will “go through a lot of different iterations and be subjected to a lot of different things in prototyping before it is ever tested for production.” By the time a muffler hits the shelves at your local parts store, new mufflers are well scrutinized for their specific application and use. When it comes to muffler design – we’ve come a long way baby.

Corsa Performance Exhaust Corsaperformance.com (440) 891-0999	Flowmaster Inc. Flowmastermufflers.com (707) 544-4761	Hooker Headers Holley.com (662) 369-6153
B & B Performance Exhaust BBexhaust.com (888) 228-7435		



April club meeting- 4/26 12:00 Chris P's shop in Stanchfield

Topic: rear axle setup Bring: chair

MN State Fairgrounds

4/5-4/6 GSTA Rod and Custom Show 9am
Minnesota State Fair Coliseum, St. Paul, MN

4/26 Boost for Boobies charity event 9:30 am
MA Performance Cottage Grove
Info: <http://maperformance.com/>

5/4 Spring Extravaganza State Fairgrounds 7am
Gopherstatebuick.org

5/4 Northern Lights Blacksmith Lounge
Hugo 7am

5/17 Eden Prairie High School 8-noon
Info: www.ephscarclub.weebly.com

5/17 CLUB MEETING 1-3pm.
TPiS in Chaska

5/18 First Fifty car show 9am
MN state fairgrounds

5/18 Breakfast and Car Show 8am
The Point Restaurant, Hastings
www.riverbendautoclub.com

5/24 TSI car show Brooklyn Park 10am
Free admission, free food

5/26 Memorial Day
5/26 Sherburne County Fairgrounds 10-3pm
Info: neilhanderson@msn.com

5/26 Elk River Lions Club car show 9am
Sherburne Cty Fairgrounds

6/1 Spring Meltdown 9-3pm
Broadway Pizza Elk River
Info: www.frankensteiners.com

6/1 Concours d'Elegance Excelsior Bay 10-4pm
Excelsior Commons
Info: 10000lakesconcours.com

6/7-6/14 Hot Rod Power Tour
June 7.... Charlotte, NC
June 8.... Knoxville, TN
June 9.... Charleston, WV
June 10.... Norwalk, OH
June 11.... Crown Point, IN
June 12.... Bettendorf, IA
June 13.... Wisconsin Dells

6/13-6/15 Albert Lea Car Show
Info: www.cochrancarshow.webs.com

6/20-6/22 Back to the '50s

6/28 CLUB MEETING 2PM
John Delke's then Anoka Cruise

7/18-7/20 Car Craft Summer Cruise
MN State Fairgrounds
CLUB MEETING

8/? CLUB MEETING
DEREK AND JENNA'S

9/27 Cruise for Troops 9/27
CLUB MEETING

10/11 Frankensteiners Ball 9am
Anoka County Fairgrounds

**Recurring shows and cruises: check info for
blackout dates**

5/10 Anoka cruise opener
Saturdays 5-9pm
Info: www.anokaclassiccarshow.org

5/17 St Francis City Center Mall opener
Fridays 5-dusk
Info: Dick Henz 763-753-1092

5/26 Ricky's Embers in Fridley opener
Thursdays 4-8pm - Labor Day
10% off total bill

5/31 Hastings cruise opener
Every other Saturday
Info: www.Hastingsdowntown-mn.com

6/4 Stillwater Cruisin' on the Croix
Wednesdays 5-9pm
Info: www.discoverstillwater.com/events

6/6 North St Paul History Cruise opener
Fridays 6-10pm Info: www.historycruzer.com

MN Cars and Coffee AutoMotorPlex Chanhassen
1st Saturday 8-11am

Meister's Bar & Grill Shoreview
Saturdays 5-10pm

Lookout Bar & Grill Maple Grove
3rd Wednesday starting in May 6pm
15% off food, Raffle/door prize

Culvers Anoka
3rd Thursday 5/15, 6/19, 7/17, 8/21, 9/18
50 % off meal