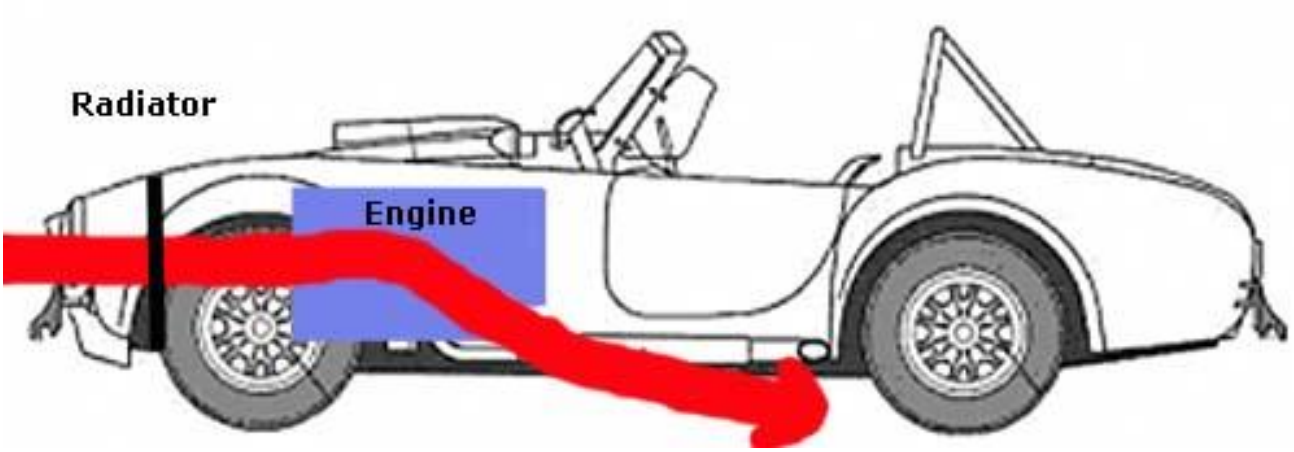
Daytona Coupe Cooling

Dave Martin – August 2012

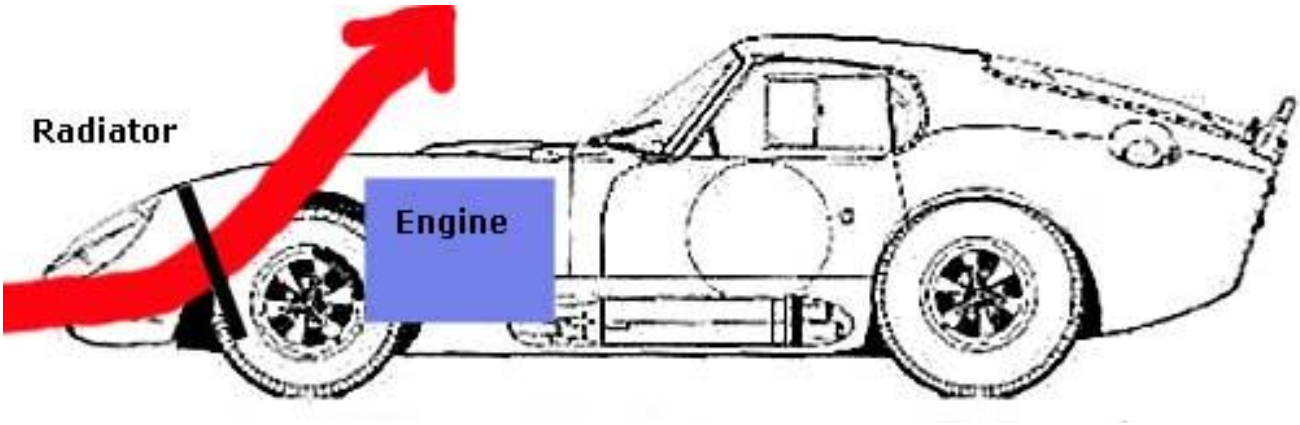
Any of us who have been around Cobra's have heard, and probably witnessed, the cars inability to stay cool in stop and go traffic. In Southern California where summertime temps are typically in the 90's plus, it's a killer for any type of casual drive around town. When was the last time you saw a Cobra in a parade? Won't happen… it would cook over after the first 3 blocks unless it's winter in Buffalo. Let's face it, you wouldn't expect a Race car to do it so why would we think a Cobra – designed for racing – to handle it any better? So we all spend a great deal of time trying to figure out the cooling. For those who are smart and have gone mild small block it's an easier task then the people who put monster big blocks in. When I had my NAF Roadster with a 429SCJ 10 years back I ended up wrapping the headers along with a lot of work around cleaning up the air flow thru the radiator and a really big electric fan – and even that just delayed the heat build up longer… still no parades! Now that I have a Daytona Coupe I've discovered another little problem unique to the Coupes. Let me explain…

A Cobra's cooling system air flow is similar to a daily driver. Air comes in the front opening, goes thru the radiator, helped by a radiator fan, where it then flows over and around the engine, and exits from the bottom of the car.



The Cobra's problem comes from the fact that the Engine is usually a lot "hotter" than your daily driver, and they run tube headers that instead of running straight down and back, run to the side where the merge into the side pipes. You end of with 12" to 16" of pipe (x 4 tubes per side) that are radiating heat inside the engine bay and back into your engine block. With a 16" tube that's 1.5" in diameter that's about 75sq/in per tube or 300 square inches of 600 degree radiating steel per side. Whew!

Ok, so the Daytona Coupe is a re-bodied Cobra so it should be the same right? Wrong! To get the speed he needed and keep it firmly planted on the track, Peter Brock designed the airflow to come through a radiator that is slanted forward and exits through an opening in the top of the hood thus creating downward force on the front end of the car at speed. This means that there is NO airflow over the engine or those 600 sq/in. of side pipes at idle and only a little at speed. Yes you do get some ground suction effect happening but you need to be moving upwards of 35-40 MPH to get there.

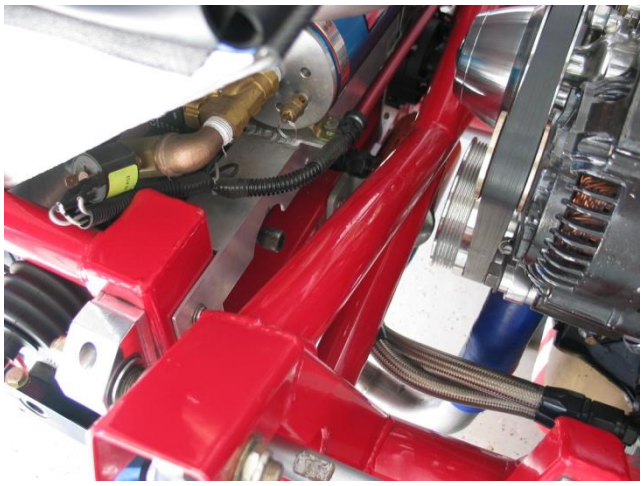


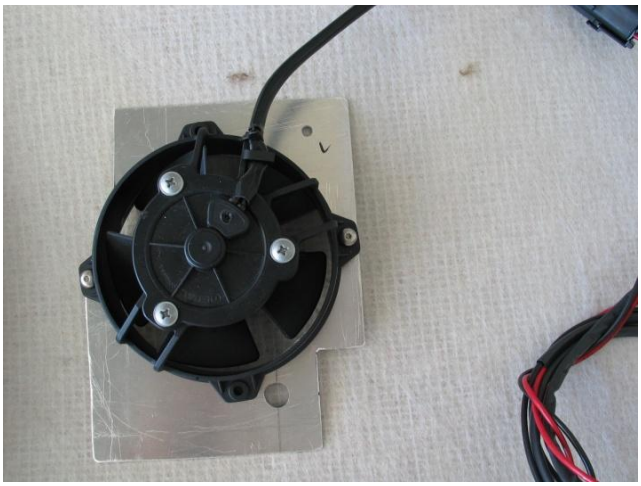
So basically at idle (parade speed or Southern California rush hour speed) the engine bay cooks itself and puts all that heat back into the engine block AND the carburetors. I can tell you from 4 years of driving it now that at any speed greater than about 40MPH I can go across a desert in 100 degree heat and just see the temp gauge kick up another 5 degrees from normal. Come to a stop and it's like watching gas prices go up in spring. I also tried to enclose the carburetors in a cold box but that made the problem worse as it blocked off the opening at the back of the hood that supplies cold air to the carburetors at speed – the area in front of the windshield becomes a high pressure area at speed so it forces cold air down through the opening to the carburetors. That opening was actually operating as an escape route for hot air from the engine bay at idle or low speed.

So what do I do about a basic design problem (for a street car anyway) in the Coupe? Superformance made a couple of changes in their Peter Brock redesign. The most noticeable is placement of two vents in the hood of the car and the running of the header pipes "Up" before going back down so a lot of the heat goes up and out the vents. Most Superformance cars I've seen have also wrapped their headers to further reduce the amount of heat staying in the engine compartment. The other thing that you don't see is they've added a couple of fans to a panel under the car around the transmission area so they draw air out of the engine bay and put it back under the car like the normal airflow would be. This makes the Brock Coupe a much more "streetable" Coupe then most.

So back to my Coupe... Before I jump all the way into wrapping the headers I wanted to first get some airflow moving over the engine and headers so I had to figure out how to mount some fans inside the engine bay to get air moving. Since my Coupe is to the original proportions – 90 inch wheelbase and narrow body – everything was sitting too low and too close to the transmission tunnel to do what Superformance had done with fans underneath so I had to look inside the engine bay itself. Ideally if I could mount a fan right under the headers I could pull the hot air down and underneath but I just didn't have the room without the fan being very, very close to the header pipes which would lead to a melted fan. The only space I could find that would provide me with the airflow I was trying to get was just in front of the engine in the cross braces for the front suspension. All I had to do was find a fan to fit and fabricate the needed brackets to mount them.

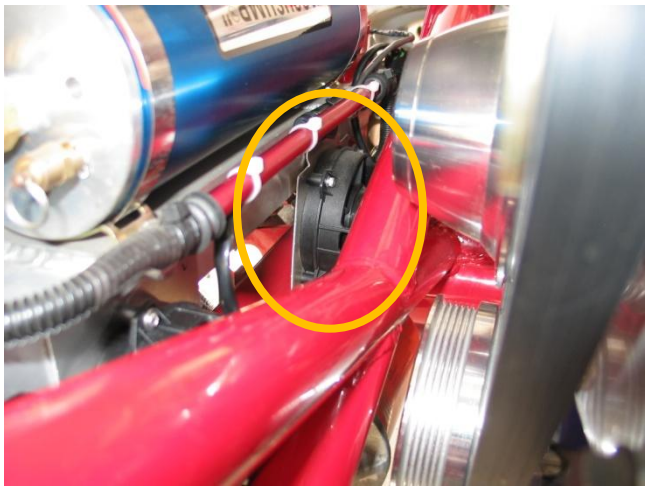
The area is only about 3 inches deep and not very wide, along with the fact that the drivers side also has a steering shaft going through it. If I could get a fan into this space it would flow air through the opening and back on each side of the engine, over the headers and then out the side openings in the hood.

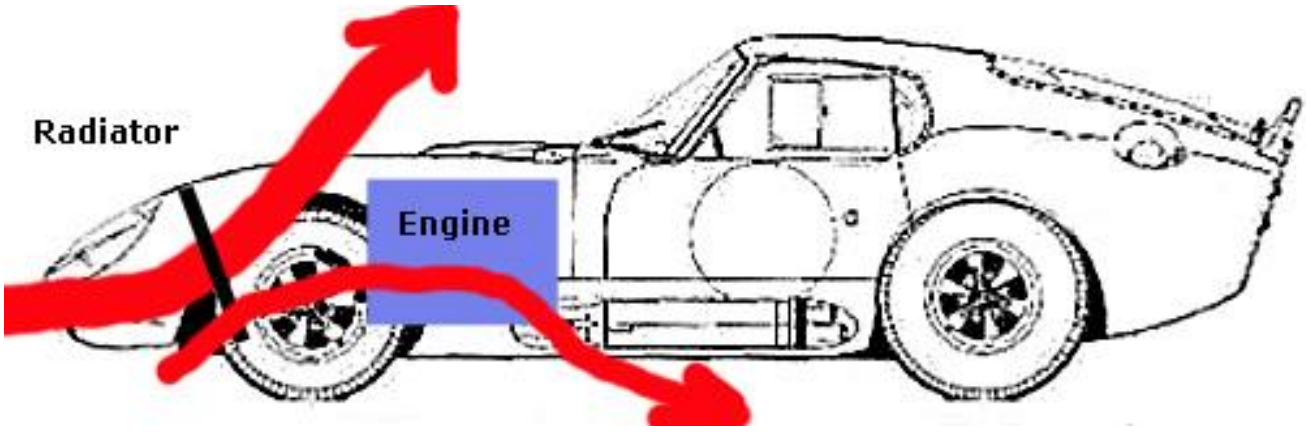




I found a suitable fan through a lot of searching and ordered two SPAL VA32-A-101-62A 12V fans which is a 4” fan, 2” tall and kicks about 240 CFM at about 3 amps each fan. They are used on ATV’s and off road vehicles so they should survive inside my little heat box. Fabricating the bracket was simple with using foam core to get the basics and then transferring it over to .050” aluminum sheet.

The passenger side went in easiest as it was pretty clear space. With drivers side though, I had to make concessions on fan placement because of the steering shaft so I’m not getting 100% of the airflow through unrestricted, but anything at this point is good.





Initial running around town seems to show an improvement in the engine runnning, not a solution, but by how much? To get the data I borrowed a thermal meter which uses thermocouples to

measure temperature on an easy to ready digital gauge. It allowed me to set thermocouples at 4 different points in the engine bay and get actual readings from under the hood. Since I have the "auxiliary" fans on a switch, I can make measurements with them off and then again on. I also have a thermal Infrared "gun" that takes surface temperature measurements off an object by aiming the laser dot to the point you want measured and then the gun takes the infrared measurement from there. I took the measurements on two consecutive days when the air temperature in the garage was the same so I didn't have to worry about different starting points for both the ambient air and the engine. All temperatures were taken with the hood closed and latched and at 5 minute intervals up to 15 minutes. The car facing out – so it's drawing fresh air into the front – and the side garage door open to the rear for hot exhaust gas to escape.

Location	Initial Pre-Start	15 mins w/o fans	15 mins w/fans	15 mins w/fans and hood open
1 - Garage	81	84	85	88
2 - Cars Temp Gauge	--	**215**	**215**	195
3 - Top of Valve Cover	78	171	172	145
4 - Rear Carb Fuel Bowl	78	121	120	97
5 - Inside Mater Cylinder (rear brakes)	77	122	124	102
6 - 1" in Front of Air Cleaner	81	190	**165**	111
7 - Drivers Collector at 02 sensor	78	655	**630**	593
8 - Passenger Collector at 02 sensor	78	675	**632**	579

All Temperatures in Degrees Fahrenheit - Location 1 measured by a wall thermometer, Locations 3 – 6 measured with K-Type Thermocouples, Locations 7 and 8 taken with a laser IR gun

Results – The jump up summary is that although the auxiliary fans help the overall cooling it is not enough to overcome the basic problem of the side pipes radiating in an enclosed space and the Coupe air flow design – it only delays the temp rise. Interesting observations to note are:

- With the hood up and open the engine doesn't have a problem staying nominal - proving the cooling system is sized correctly. Temperatures were up to 50 degrees cooler and on average 20-30 cooler.
- Air temperature in the front of the carburetors is ridiculously high during low speed idle (84 outside air temp but 190 at about 1" in front of the air filter housing at the front of the motor). Really hot air coming into the carburetors is not a good thing. Reduced 25 degrees with fans.
- From the 5 minutes mark – when the water temp reached 185 degrees - or operating temperature – all temperatures continued climbing in excess of 50 degrees EXCEPT the temperature of the fuel bowl and the master cylinder which only increased by about 30. Good news.
- With the Aux fans on I see a reduction in header temps and the front of the air cleaner by 25 degrees and more. It also equalized out the left and right headers… interesting.

As with anything on a custom car it takes time and hard work to dial things in. Science is helpful and I now have a much better idea of what I'm dealing with.
So the next thing to do is wrap the headers and take another data set. Stay Tuned!!!