DYNOING NAKED

I guess I need to say more about dynamometers and dynoing procedures. I once wrote a paper on why you should use the dynamometer to break-in engines but because of the feedback I get from customers (and should have been customers) I feel that more needs to be said. When we build a customer engine we include the cost of dynamometer testing and make it a package deal, you can't get it any other way. We would, however, like to attract more walk-in type dyno business. I feel we have lost some of this type of business because I was not able to quickly explain to someone why they should spend some of their race budget on this when their engine builder has already assured them that the engine is perfect and has 572 horsepower. You can't expect anyone to buy a service they don't see any value in. Maybe they don't see value in it because they don't really understand it. I need to explain in more detail the value of dynamic engine testing and development. First lets talk about dynos in general.

The racing world would be a different place if we raced dynos. The biggest liar would always win. As engine builders we would like to determine race winners by dynoing all the engines after the race and the one with the most horsepower would be proclaimed the winner.
Engine dynamometer testing has be going on since 1881 but in regard to modern racing engines, as I see it, it is in its infancy. As with anything technical and new, it has its associated problems. The big problem is not with available equipment but in peoples interpretation of how it should be used. When you get a bunch (what is a bunch of engine builders called) of engine builders sitting around B-Sing about engines, - which only happens at the "Advanced Engine Technology Conference" held in Colorado Springs each year- one of the favorite subjects is dyno testing. Everyone agrees on about the same testing methodology, in other words, what are the best procedures for getting good data and what constitutes a good dyno cell. When you pin people down, most fess up and admit they don't do it the way it should be done. The first problem is that it takes money to change your system which often means changing the room or building. That is expensive. The other problem is the time it takes to do all this changing. As long as people are paying to use your dyno facility and there are engines waiting in line, why change it. Well we did change, because we want to learn what is really going on inside these things. We like to play scientist but we're more like engine nerds from hell. Another thing, do your customers require the Nth level of accuracy, that is, .2% repeatability or better. You need this kind of accuracy when you are looking for tiny changes. There are engine builders out there looking for these kinds of numbers, like maybe some of the Winston Cup or pro-stock engine builders who dyno the same

engine year round lusting after every drop of horsepower that can be rung from that particular combination. We are not in that category with any of the different types of engines we build. We are still looking for, and continuing to find gains in the 1 - 2% range. We can recognize small power changes in the 1/2 to 1% range. When you flog the same basic engine for several years you would have to learn a lot about it. I analogize this by saying it is like these people are making a small and intricate wood carving and we are still out back cutting down the tree. Actually we are further along than that. We have made great gains and are probably now making a carving, but it is just bigger. The bottom line to this is that no two engine builders use the same dynamometer testing methods and procedures and it is these procedures which are so important in getting good data. Good data is information and bad data can be mis-information. In other words you get the wrong answers. You are beating your head against the wall. Is what counts to go through the motions rather than results? If you're only using your dyno to generate income then maybe the answer is yes.

When I first decided to buy a dyno fifteen years ago I had no idea what I was getting into. I didn't know how much frustration and anxiety one of these things could create when I, more often than not, didn't get the results I was expecting and couldn't figure out why. On the other hand I had no idea that a dyno would enable me to learn so much and that it would become such an indispensable tool for doing engine work, or I should say, engine development. I must have been a visionary twenty years ago when I named my little operation "Sunset Engine Development". I was building engines then but by todays standards I certainly wasn't doing much in the way of development. It's still a challenge to try to put together a engine that must live for a long time at high rpm but it is certainly more challenging trying to give it competitive horsepower at the same time. I can understand why there is such a lack of understanding and mis-information out there concerning this part of my profession.

It took me several years of being frustration with lack of repeatability, control and conflicting data to realize that the most important part of a dyno facility is the cell itself. The room it sits in. An engine must breathe nothing but fresh uncontaminated air within a moderate temperature range if you expect to gather any kind of reliable data. This means the exhaust must be dumped outside the room. If the engine breathes air from inside the room it must be free of any exhaust contaminates and if it breathes air from outside the room it must not be too hot or too cold. Neither of these presents any problem by itself but there is more to it. In order to get valid and therefore believable data you must duplicate as closely as possible the conditions in which the test engine will operate. This means not only testing with the same kind of air it will use but you must also use the same parts on the dyno that it will see in use. Such as the exhaust system. The headers must exit in the same direction and dump into the atmosphere. To simulate atmosphere a large stainless steel exhaust system of at least five times collector area is used to carry exhaust out of the room. It is important that the pipe not be sealed at the collector as this stationary reflected wave will influence the system. We prevent the exhaust from mixing with air in the cell by creating a suction on these exhaust pipes from within the muffler room. Breathing fresh outside air is the most desirable as long as it doesn't get so hot or cold that it drives the correction factors to the far end of the chart. When this happens repeatability suffers. Not only that but most importantly, engines react differently to different atmospheric conditions. The SAE does not recognize correction factors over ten percent which must mean something. We don't like to see the intake air temperature get very low, so in the winter time we must mix the inside and outside air for best results.

We want to be able to predict how the engine will react at the race track so our testing procedures strive to duplicate how the engine will be used. For example, for a super-speedway stock car or an endurance boat steady state testing is best since the engine operates in a fairly steady and narrow rpm band. A road-race car or a short track type stock-car is constantly accelerating and decelerating and may benefit from an acceleration step test in a similar rpm/sec range that it will actually see. There is a thing called fuel-lag that can be compensated for and the spark lead requirement will be different for different size tracks. The first thing a drag race engine does when it is launched is to decelerate. Valuable insight can be gained by testing these types of engines not only in a acceleration mode but also a deceleration mode. This requires the latest in software and equipment. The equipment can be purchased, unfortunately the knowledge to interpret the data cannot. Also, in the name of testing it like it will be raced are factors which if not done right can lead you down the garden path. This is a trail that leads nowhere and pretty soon you have crossed over into, you guessed it, the twilight zone. One; the headers must be used on the same cylinder head that they will be attached to in the car. Reversing them on the dyno may lead to bad data. This means the dyno should have a driveline or an extended bellhousing to allow race car type exhaust systems to be used. Another is the cooling system, it must be pressurized just like it will be in the car. You can't start bumping the fuel curve leaner if you have air pockets in the head flashing to steam at high rpm. If detonation is to be avoided on the dyno then a pressurized cooling system is a must. The engine should also be tested with the same oil and water temperature that it will see on the track and with the same fuel delivery system.

Data is information and information is the tool from which we learn and gain experience. I will go over some of the most common types of data that we get from the dynamometer.

Horsepower & Torque curves. Many professional engine builders now realize that peak horsepower and torque figures are meaningless. What we like to see and tune for is the most area under the horsepower curve from a few hundred rpm below the torque peak to a few hundred rpm past the horsepower peak depending on the application. Getting the most power under this curve is what puts engines in the winners circle ahead of engines making more peak power. Goals must be set and trade-offs must be made. Here the engine builder must protect the customer (usually a racer) from himself and develop a package that will win on the race-track and not necessarily on the dyno printout.

From these curves proper gearing, propellers and impellers can be selected. The power curves on some engines (a lot of engines) take such a nose-dive after the horsepower peak that some drivers give away over a hundred horsepower by turning the engine too high. It doesn't make a lot of sense to pay the engine builder for all this horsepower and then go out and give it all away with improper gear selection. In a road-race car where all the transmission gears can be selected, knowing the horsepower curve is even more critical.

Fuel Flow & Air Flow Curves. Many times I've heard the expression "tuning is easy, just give the engine what it's asking for". For most it takes many years to learn to speak engineese, and it's certainly easier to learn to speak it than to understand it. Brake specific fuel and brake specific air consumption are two pieces of data that make it easier for the engine builder to interpret what the engine is asking for. The problem with this data is that each engine has its own BSFC curve that it is happiest at. We have never built two engines that were exactly alike enough to require the same bsfc at peak torque. The trap lies in forming pre-conceived opinions about what the minimum BSFC should be. If, for instance, the engine builder believes that since a particular engine has more static compression than the last one, he should therefore be able to calibrate it to give a lower bsfc. This type of thinking could lead to disaster. BSFC should be only one of the many clues the engine builder looks at to determine something like fuel mixture requirements.

Brake specific fuel consumption is calculated by dividing the uncorrected horsepower at a particular rpm into the instantaneous fuel flow rate at that rpm. The result is the fuel consumed (in lbs) to produce one horsepower per hour. The lower the "brake specific" the more efficient the engine. The BSFC is not a mixture indicator but a fuel efficiency indicator. For instance if we make a change to the exhaust port shape and this results in the BSFC going from .485 to .460 it means the engine is more fuel efficient. Normally piston domes and cylinder heads dictate the larger changes. However exhaust system, cam and intake manifolds can create a situation requiring a different optimum BSFC. We must be open minded about it.

Exhaust Gas Temperature (EGT). Here is another area where there is widespread confusion. I've had people ask me what their EGT should be for a particular engine. There is no way anyone can know this. There are simply too many variables that effect it. Such as - static compression ratio, rpm & throttle opening, fuel droplet size, volumetric efficiency, valve timing, spark timing, chamber and piston shape, coolant temp, coolant circulation, cylinder head material, fuel/air ratio, fuel type, air temperature, exhaust pipe dimensions, vapor pressure, barometric pressure, where the temperature is measured, exhaust port length, thermocouple type and size. There are probably a lot more. EGT is nothing more than an indication of how efficiently the engine is converting the fuel into usable energy. Thinking you are going to be able to tune your engine via EGT is wishful thinking. Sometimes I wish it was that easy but I'm actually glad its not. Fortunately the world is not a perfect place.

Additional Data: These are the basic and minimum types of data that the dyno should give us. With some instrumentation and data acquisition the dyno can become an incredibly effective diagnostic tool for learning how these things (engines) work. A dyno is like a race car in that it is a bottom-less pit in which to pour money. In a car it's for buying things to make it go faster, for a dyno it's for doobers. Doobers allow us to gather more information and hopefully learn more. They're transducers which cost a lot of money. You just can't seem to have enough of these things. Especially when you're not a very trustworthy person when it comes to believing anything electronic. Then we need doobers to verify the data we get from our other doobers. That is, analog doobers to make our electronic doobers more believable (remember we don't completely trust anything electronic). It is easy to become a data junkie. The more you learn the more you realize how much more you need to learn.

Another thing a engine builder has to get a grip on sooner or later is controlling the water and oil flow in the engine. There is considerable horsepower to be gained in this area. No two engines are ever the same and never does the water flow evenly on both sides of the engine right out of the box. With the proper doobers this can be measured and then modifications can be made toward balancing the flow. This goes along somewhat with getting steam pockets out of the heads. The same needs to be done with the oil system. The typical small block circle track engine flows from twenty to one hundred times (depending on how it's built) more oil than is necessary for reliable running. This can be greatly reduced by simply eliminating some of the major hemorrhages within the oil system. These can be observed by pumping oil through it on the engine stand. Not only can you carry less oil in the pan to reduce FHP, but it goes along way toward keeping oil out of the combustion chamber which must be avoided at all cost.

Measuring total air flow and brake specific air consumption are other pieces of data which can shed insight on how the engine is performing. It is very useful information when working on any part of the intake or exhaust system. The problem is it sometimes gives us more data than we want because often it becomes hard to explain why airflow went down when it should have gone up. Like how it can go up when you put on a smaller carburetor. Barron Hilton said it best "after thirty years in the hotel business the only thing I know for sure is that the shower curtin goes on the inside of the tub".

We also monitor the engine with a knock sensor which we are beginning to trust (once we learned where to mount it). We have tried every knock meter that has come down the pike and this one is the best so far. Its not perfect but in some rpm ranges we can believe it. We like to see the same knock meter follow the engine to the car or boat. I started my learning curve with knock sensors fourteen years ago just before they were used in cars. The main thing we learned was that there are too many other engine noises of similar frequency that triggers them. At least this one does show you that something is going on in there at the detonation frequency.

We have also tried four air-fuel ratio sensors in the last few years and none were worth a damn. It seems we now have a lambda sensor good enough to trust. It is very responsive (you can blip the throttle and see it change). They are affordable enough to be used in the car and even to monitor each side of the engine separately if necessary.

A blow-by meter can be a very informative tool. We use it to plot blow-by curves which represent ring seal quality. It becomes easy to see when the first and second rings start to flutter. The second ring is usually the first to flutter because there is less pressure drop across it. You can find yourself in trouble or at least in for a lot of work when you find the top ring giving up before the engine has reached its peak operating rpm. As you can see this is another electronic doober which connects directly to our data acquisition. These blow-by curves can be very interesting when doing oil system, ring and piston work but they really get startling when you start doing development on restricted intake engines such as with a small carb or restrictor plate. Inertia throttling loads can and do change the blow-by curve. For instance, it has been established by alot of engine nerds that 3700 Gs across TDC is around all a 1/16 top ring can handle even with a non-restricted intake and low crankcase pressure. Since our computer modeling prints out G loads across TDC we can now avoid this trap when the engine in the planning stages. We could change the stroke, rod length or lower the operating range by changing throat sizes in the head but its easier to just use a thinner top ring.

Procedures: A dynamometer is a far too expensive tool to be just used for break-in, tune-up and seeing that the engine isn't going to blow up in the first five minutes. It would be like having a milling machine and only using it as a drill press - or like me being married to Madonna. As with any tool the dyno must be properly used in order to maximize its value. If the operator is not skilled in the "operational art" (a General Schwarzkopf-ism) he can easily turn an engine into a smoldering puddle of slag and create a "non-engine" (another one). Our testing procedures are the results of 15 years experience, some good, some bad. We have learned that caution must be exercised continually during dyno testing. This is done in several areas like not rushing the break-in procedure, especially with flat tappet engines - stopping often in the early going to inspect and clean the oil filter - pulling the valve covers often to lash valves and look for any distress - monitoring break-in with leak-down tests and blow-by meters - retorquing bolts - observing part throttle air/fuel ratios - observing in cylinder conditions with a boro-scope - constantly monitoring spark plugs and most of all starting with a safe air/fuel mixture. Every engine seems to react differently and the dyno operator must vary his break-in procedures accordingly. Once the run-in process is over and the filter has been cleaned again a base line leak-down is done, the piston tops and cylinder walls are inspected (with the boro-scope), colder plugs are installed and then we generally make some pulls (at wot) at a rpm we know will be above the torque peak. This is done in case we are too lean because it is safer to be lean after the VE has dropped off somewhat than at peak torque where it is highest. At this point most operators would begin to do "fuel curve loops". This is a test performed by changing the air/fuel ratio until the engine loses power by going in both directions away from the optimum BSFC.

The use of an external device to easily vary the amount of fuel an engine is consuming is not a necessity but certainly a big help. My point here is that we have been bitten by trying to see a power drop as we lean the mixture. "We" do not understand how other people can get away with this - if indeed they really do. We have observed with our boro-scope that as the "lean-max-power" point is reached, most often we have just grabbed the cylinder wall with the piston, relaxed a ring land, tuliped a valve or damaged a bearing. Maybe this is why we take this type of testing more seriously than others we have observed. I feel that if some of these others were using the boro-scope the same way we use it they would be coming to similar conclusions regarding fuel curve loops.

At this point I should take a small detour and explain our feeling regarding the boro-scope. We don't use a flexible fibre-optic boro-scope but a rigid one because the colors and image are more clearer and realistic (sometimes too realistic). It never ceases to amaze us with the uses we find for it. You can look into the intake manifold, valley, oil pan, hoses, tanks, and especially those cylinders. It's like being in there standing on the piston looking around. We have come to rely on this tool so much that if we didn't have it, it would feel like we were dynoing naked or like we were throwing darts blindfolded.

Any way "spark loops" should also be done early on to see what timing each particular combination likes best. If your unsure about your camshaft you can do "lash loops" to see if the cam wants more or less duration. Once a base line fuel curve and spark curve are established we can start trying to improve on the horsepower, torque, BSFC, acceleration, deceleration, area under the curve or any combination of these things. This is done by changing parts. Generally one thing is changed at a time and then other parts are changed to see how they are affected by the original part. Accurate records must be kept and each test must be repeated a least two and preferably three times to verify results. The parts should then be changed back and the previous tests rerun to be sure there was a gain or loss. If the previous test cannot be repeated then obviously anything that happen there after cannot be believed. Quite often there are "hidden variables" or counter-acting gains and losses that offset each other. A change of or to any component in the flow path can and usually does change the air/fuel ratio and you don't really know if there is a gain or loss until you return the engine to the same mixture ratio - assuming it was correct to begin with. There are times when a series of minor errors combine imperceptibly to create a major one without there being one obvious and isolatable cause. Some of these phenomena or anomalies can cause even someone skilled in the "operational art" to feel stupid, depressed and generally feel like a whipped dog at the end of the day. It is common that out of five things you just knew would produce a gain for four of those to show a loss. What saves the situation though (and your sanity) is to be able to return to the baseline and repeat within .5% the original data. If you can't do that you are indeed throwing darts blindfolded.

One of the main things regarding procedures is trying not to do too much too fast and make a mistake or overlook something or forget to do something that could later become a mistake. When customers have the burner turned up under us to rush through the dyno process (you can't blame them because it's costing them money) is when we (we, being human) make the most mistakes. Mistakes don't necessarily mean we hurt something but usually it means we missed a piece of information and an opportunity to learn something about that particular engine combination. If we had only slowed down and thought for a few minutes about where we were and what we were doing that would have been prevented. Opportunities multiply as you grab them. They die as you neglect them.

I have heard it said that "it has been apparent to anyone doing any amount of dyno work that more power can be developed in a given engine by tuning it properly than by just adding any combination of current state of the art cams, headers, manifolds, etc". For the most part this is true but that statement would have to assume your combination is close to begin with because we have seen 5% power gains from things like cams, manifolds, carbs and a couple other items I will not mention. These types of gains are not common and we refer to them as "break-throughs". It is rare however that there cannot be some gain in power or lower BSFC by dynoing even the most meticulously thought out engine package.

Additional Dyno Features: There are other features that can be incorporated into a dyno installation that may make it easier on the engine as well as the operators.

* The first would be the pre-heating of the water and oil prior to initial firing. It makes sense that this should be a nice way to treat any engine especially a fresh one. In his book Bill Jenkins gives reasons for this and indicates it is a "must do". We use a hot water heater to pump hot water through a fresh engine.

One of the main ingredients for obtaining decent repeatability (this paragraph should have been up in the procedures section) is to make sure each test is made at the same oil and water temperatures (also at the same oil level in a wet sump) therefore a oil heater with a thermostat is desirable as it will maintain a minimum oil test temperature. The dyno must have a oil cooler large enough to maintain a constant maximum temperature that you can adjust via water flow. The cooling tower, pressurized or not, must be able to flow enough to hold the water temperature at the designated maximum. We plumbed our dyno with an oil temperature thermostat which means even on wet sump engines where we don't use a blanket type pan heater, warm up time is kept to a minimum by bypassing the oil until it is 190 degrees. Also, use only a non-bypassing type of filter system and a minimum of -12 hose size.

* We use a Oberg dual element type of screen filter that enables us to see absolutely anything that tried to go through it. We look at it and clean it several times early in the break-in cycle. During power testing we use it as a way to relieve the nervousness and sick feeling in your gut when the engine feels, sounds, looks or smells funny.

* It can be handy to be able to change timing either mechanically or electronically from the console. This makes quick work of a spark loop. The same can be said for a way to change fuel mixture. However this will be limited to just a few types of induction.

* We like to have visual type fuel flow meters (rotometers) to back up our electronic ones. The electronic ones are too dumb to know if there are air bubbles present in the fuel which changes the reading. We use three rotometers for various engines because you sometimes need to monitor return fuel in fuel injection systems. We are building a float type tank which hopefully will make this unnecessary.

* The same is true of the EGTs (exhaust gas temperatures). We like the analog ones because they provide a quick visual monitor that constantly shows us all cylinders are firing. During a steady state test it is possible to see detonation as evidenced by a drop of temperature in one or more cylinders. The digital printout would never show this kind of a trend.

* The dyno must be equipped with a accurate vacuum gage for isolating carb circuits and observing intake system trends.

* We have sixteen additional channels for monitoring and gathering data on various temperatures and pressures just about anywhere in the engine or in the oil and cooling system.

* A separate stand alone data-acquisition system for 24 channels of data. This system has programmable maximum and minimum alarm thresholds for all channels.

* Wiring harness for late model Corvette TPI engines.

* Rev-limiting, emergency shut down capability and alarm lites.

* Correction factor from inlet air temp, barometric pressure and humidity. All air is equal its just that some air is more equal.

"Isn't dyno testing hard on the engine" is a question I'm often asked. What is worst is an engine in the hands of an unskilled tuner, whether at the track or on the dyno, always receives the greatest abuse and that's where the horror stories are generated. In the hands of an experienced dyno technician and engine tuner the engine sees very little under-load time. A day's worth of dyno testing may only be equal to one or two 1/4 mile passes or a couple of laps on a circle track.

Is dyno time worth the expense? The cost of traveling to an event and not qualifying would, by itself, pay for a day's dyno time. There is also piece of mind in knowing the engine is making competitive power and the reason you're off the pace is because of the driver or the chassis. If you have wrung out what you consider to be near the maximum power per cubic inch the engine can make on the dyno and you get to the track and someone drives past you on the straight you can be fairly sure he's cheating. There are many other reasons that make it cost effective but I have already said those things before. There is one scenario however which is worth thinking about. That is the real price you pay when you break or are not competitive. The lost dollars are usually the least damaging to someones racing career. But think about what kind of value can be put on a year of your life - which is what a racing season equals - and what is the value of reputation and the way you look to your family, friends, fellow competitors and especially potential sponsors.

A dyno facility that has good repeatability, that backs up runs three times within 1/2 to 1%, combined with good procedures, an understanding of what the engine is asking for, enough doobers and time can stack 50 horsepower on the competition and usually make the engine more reliable because of it.

At this point in time we do not have enough software and especially hardware to satisfy us. We are working on this however and hopefully within the next year will have even more doobers and data gathering capability. Data is a lot like horsepower, you can never have too much of it and when you suddenly have more power or data it takes you awhile to get used to it. You have to learn how to use it. However as soon as you get used to it and learn how to apply it you immediately want more. Even with unlimited dollars to invest in equipment and our facility we probably still wouldn't be happy because there is so much to learn and so little time. So we will never be satisfied with where we are. As soon as we become satisfied with our reputation or position we will doomed to fall behind. Learning is like rowing upstream. If you don't advance, you drop back. It requires a great deal of discipline, persistence and dogged determination to become a good dyno operator or engine builder.

Engine Theories: I don't want to make it sound like dyno testing is always a confusing and frustrating affair. I don't want to make us sound stupid to customers, only to ourselves. After all, "in the land of the blind the one-eyed man is king". Kidding aside, after fifteen years of this we can see how silly this whole horsepower thing can be. What counts is how it runs on the racetrack. The dyno doesn't add any horsepower to the engine, it is only a tool for analyzing its behavior, diagnosing its problems and reshaping its personality. Sounds like the dyno operator is a engine psychiatrist. The interpretation of data is what the field of statistics is about. Since a large portion of our observation and theories are of an empirical nature we as engine builders and dyno nerds gather and interpret our data like statisticians. One premise of statistics says that it is a basic characteristic of experimental science is the necessity for reaching conclusions on the basis of incomplete information. You can certainly never be sure that your analysis of why the engine reacted the way it did is valid or not, but until you have more evidence, knowledge or whatever, its your theory and your entitled to it. In 1915 Albert Einstein published his new general theory of relativity which blew Isaac Newton's laws of motion and gravity, which had dominated science for more than two centuries, out of the water. So far, Einstein's work has stood up better than Karl Marx's or Sigmund Freud's. It has turned back repeated challenges and remains, even now, the very basis of modern physics. But that doesn't mean that tomorrow some other nerd with some new theory couldn't make Albert look like a hacker. Same with motors, and that's why we believe very little of what we read or hear and put more faith in what we observe with our own eyes. There has yet to be a case where some "engine expert" has told us that a particular part would not work with our existing combination we had on the dyno, that we haven't been able to prove him wrong. Everybody knows more than somebody, but nobody knows more than everybody.

* Statistics is the study of methods and procedures for collecting, classifying, summarizing, and analyzing data and for making scientific inferences from such data.

* Because of sampling variation we cannot say that the exact parameter value of some specific number, but we can make in some sense an optimum single choice based on sample information and then perhaps indicate a range of values within which we are confident the unknown parameter lies. Inferences of this sort fall into the category of estimation.

* Statistical inference is concerned with the procedures whereby generalization or inductions can be made.

* It is incorrect to assume that two experienced and mature statisticians or investigators (or dyno nerds) would come to the same conclusions concerning adequacy or suitability of a given

set of data for further statistical treatment. Statistics is both an art and a science.

* We know that it is unlikely that the values of a point estimator and the parameter it is estimating will exactly coincide - in fact, for a continuous random variable (like power at a particular rpm) the probability that the estimator will equal any particular value, including the fixed unknown value of the parameter, is zero.

This means the odds of ever knowing your exact horsepower are zero. So why dyno it.
Once again I will finish by passing on some quotations that I believe in. I don't know who said most of them but it sounds to me like they were probably racers.

* None of us learns as much from WINNING as from LOOSING. PROGRESS comes from LOSING, not from WINNING.

* Improvement does not come easy. There are no free lunches.

* Sometimes it is more important to know what not to do than to know what to do.

* The more a man knows the more he forgives.

* As we acquire more knowledge, things do not become more comprehensible, but more mysterious.

* A man who carries a cat by the tail learns something he can learn in no other way. (Mark Twain)

* Life is the art of drawing sufficient conclusion from insufficient premises.

* When you are right no one remembers, when you are wrong no one forgets.

* Only some of us can learn by other people's mistakes. The rest of us have to be the other people.

* You should learn from the mistakes of others. You can't possibly live long enough to make them all yourself.

* Some people use statistics like a drunk uses a lightpole, for support rather than for illumination.

* The only place where success comes before work is in the dictionary.

* The people who try to do something and fail are infinitely better than those who try to do nothing and succeed.

* Thinking is the hardest work there is, which is the probable reason so few engage in it.

* There are two ways to slide easily through life: believe everything or doubt everything. Both ways save you from thinking.

* You shouldn't go looking for trouble, but if you get in a fight, make sure you win it. (John Wayne)

* If you think you have the answers, it's obvious you don't even understand the problem.

Pat Usher