



Once the car reaches the track, it is set on scales and baselined. Any changes are recorded for future use.



The STP team is changing a spring shortly after a rubber was inserted and the race setup was determined.

Building A Race Car: Part 11

Winning a race is a package deal

BY MARK DAVIS • PHOTOS BY KEVIN THORNE

Last month, we tested the car at the track, concentrating on tuning the engine and chassis. Along with these goes aero tuning, because air management is vital to both engine and chassis tuning.

Engine tuning is affected by the intake into the carburetor, radiator and oil coolers. Openings for each of these also affect downforce and coefficients of drag. Likewise, openings for brake ducts follow the same pattern. Smaller air box openings increase down pressure, while they bring up pressure inside the air box, dropping coefficient of drag numbers at the same time.

Determining the air dam openings for the radiator and the oil cooler becomes a dance to create downforce, while maintaining proper temperature. More downforce enhances balance in the aero package, producing better handling, but can increase water and oil temperatures as well. As temperatures increase, engine tuning becomes part of the balance. Then the timing has to be changed to meet these temperature changes.

For a team to be successful in all this tuning, many players must be on the same page. The wants of an engine builder cannot take away from the handling package, while the handling package cannot take away from the engine's abilities.

Achieving the perfect balance requires endless adjustments. Tight chassis combinations need more horsepower and torque. Free combinations sometimes mean de-tuning for traction. Gearing choices that affect handling sometimes need different cam combinations for different tracks. More downforce — front and rear — enhances handling with faster speeds.

But many times, downforce can make engines look down on power. The demand for horsepower may result in drivers and crew chiefs receiving spiked horsepower numbers. Then the total package fails. Closing front openings can pick up downforce. The coefficient of drag drops with the application of tape to the grillwork, which brings up the tach as much as 300 RPM, which changes the handling package.

With so many combinations, driver, crew chief and engine man all have to work to enhance each other. Winning does not depend on the best car, best driving style or best engine, but on the total package. Now off the soap box and back to the race track.

New Cars Mean New Aero Packages

Many teams have years of experience and records from previous track testing. Baselineing a car comes quickly to these teams. The boundaries of the chassis have remained the same for years. However, aero packages change from year to year. The teams have found that the information for the downforce of a T-Bird or Lumina is not applicable to the Taurus and Monte Carlo. In the past few years many talented drivers and crew chiefs have experienced limited success when changing car body styles or manufacturers.

It is easy for a team to learn a package and utilize it with great success, but then lose all momentum when a body style changes. Track testing and an open mind lead to success. Good track times vary with

each track. Let's say after 20 or 30 laps shaking a car down, fast laps are in the 20.8-second range. But the pole record at this track for the last race was 19.75 seconds. The crew starts a process of tuning, comparing lap times for each run.

Once a consistent baseline is established on chassis handling, aero handling starts. Rear spoilers, tape on the nose, air dam height and fender widths are all applied to the handling package. Lap times and driver input establish choices for the package.

Uncomfortable but fast packages can be used for two laps of qualifying and are characterized as such. Shock packages for long runs are matched to chassis and aero packages. Remember: If the pole speed is 19.75 seconds when a car is cooled down, taped up, with stickers (new tires), then in most instances it will lose 3/10th to 4/10th seconds on a long run and run at 20.1 seconds. Race pace runs generally slow down nearly a second as tires and fuel are used. If your combination is comfortable for the driver and long runs stay between 20.1 and 21.0 seconds, you are good to go. Easy, right?

Adjusting the Setup

Most of the time, qualifying and long fuel runs utilize totally different setups. Crew chiefs are able to fine tune the car during pit stops with small adjustments. Changes that can be made during pit stops, such as air pressure adjustments, spring rubbers and track bar adjustments, are tested at the track, too.

Spring rubbers were originally designed to space springs up while extreme loads were carried. Racers soon discovered that these circular hard rubber spacers added to a right rear spring could loosen a car as much as adding a 25-pound stiffer spring did. In contrast, stiffening the left rear could actually tighten up the car. These spring rubbers can be removed under caution with ease. The original hard rubbers used to tighten or loosen a car were somewhat inconsistent so some companies have developed spring rubbers in color-coded pieces with different spring rates. The wrong selection to stiffen or soften can mean a missed setup.

The setup decisions made by drivers, crew chiefs and engine builders are based on testing at the track. Sometimes great notes, data acquisition, even luck, lead to Winston Cup wins. The ability to repeat a win at a track indicates a consistency in a team that is certain to bring success.

Recently, a good friend and I were riding along a deserted roadway when we happened on a man riding on a moped, stopping now and then to pick up cans. We both looked at each other and said, "Retired Winston Cup Crew Chief." We knew if all the possibilities to make race cars fast hadn't driven him to this occupation, then the stress of dealing with the personalities in the garage surely had. 🍷

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Left: As testing begins, shocks are baseline. Virtually every shock will be tried and tagged for future use. Qualifying shocks are also chosen. This shock cart holds 30 shocks, \$500 per shock. The human who takes care of these animals also makes \$60,000-plus a year. Center: Many teams have as many as seven carburetors and each has a personality of its own. The intake into the carburetor affects handling. Right: At Michigan this year, stagger had been built into sets of tires. Previous Michigan testing went out the door. Times that were inherently tight flew. What a difference a day makes.