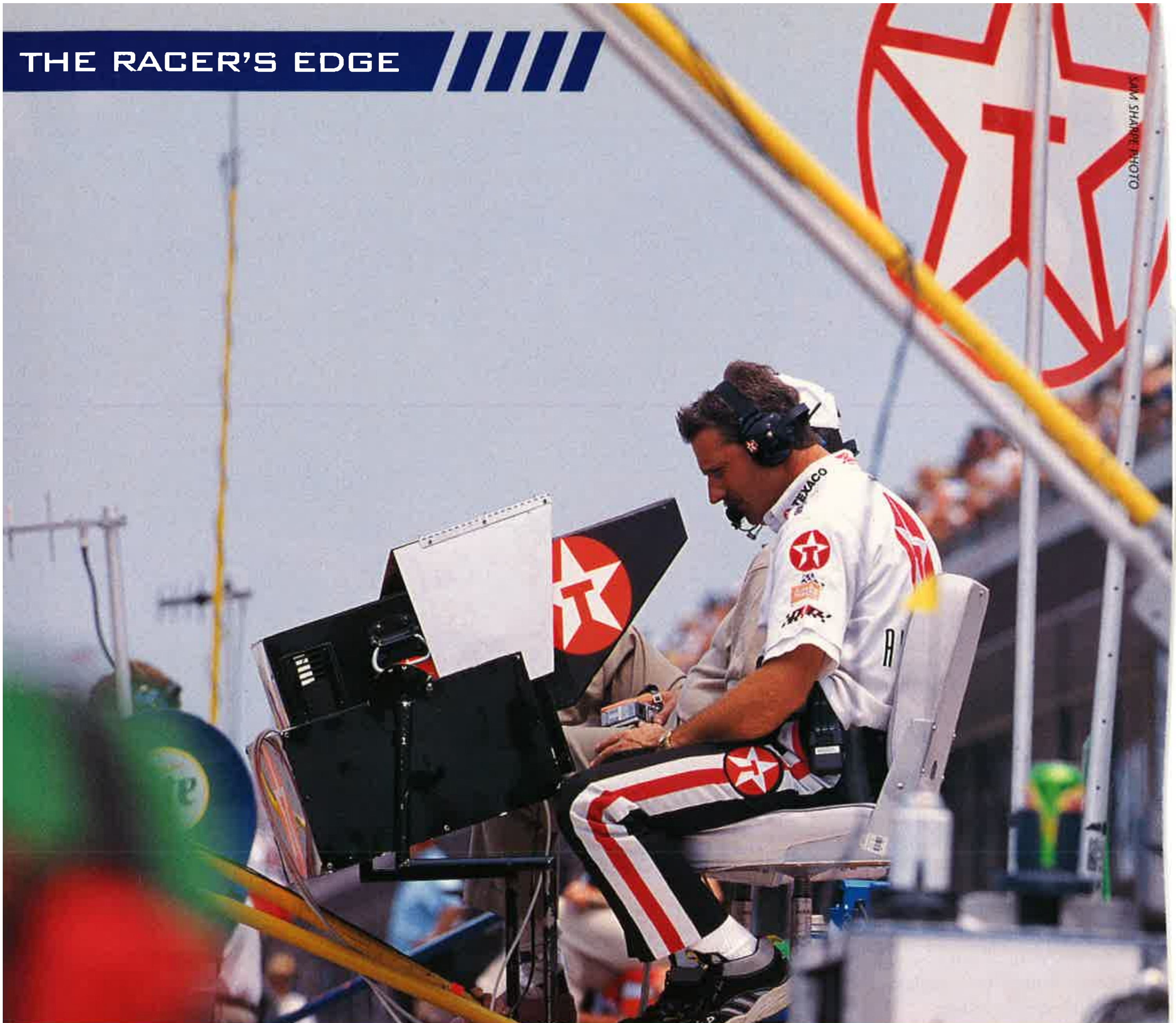


SAM SHARPE PHOTO

Building A Race Car: Part 9

A Data Acquisition Mission

story by Mark Davis

Early in the 1986 season, my boss told me that data acquisition was the key to success for a crew chief.

My thoughts turned to baselines, standards and procedures, the kinds of things I'd done in chemistry labs years earlier. Ideas about databases that could be referenced quickly and applied to the problem at hand raced through my head.

At that time, I was working for Curb Motorsports, a Winston Cup team, under the direction of Mike Beam, crew chief, and Kelly Hunt, shop foreman. The pair, although very young, had begun to prove their talents as chassis expert and car boss.

As we sat in a motel room one night reviewing some choices for the next day's practice, Kelly suggested we go on a data acquisition mission.

Immediately, the spur gears in my mind went into action. I asked how we could do that since the track was closed. Kelly's idea of data acquisition was sure different than mine. Kelly told Mike and me that Tim Brewer was hosting a big poker game and that we were invited.

It was more of a party than a card game, and the participants were very impressive. Among them were: Jake Elder, crew chief at the time for Morgan Shepard at Race Hill Farms; Herb Nab, consultant for Travis Carter's Harry Gant effort; Tim Brewer, head of operations for Junior Johnson's Neil Bonnet team; Robert

Harrington with driver Rodney Combs; Jeffery Ellis with a new Kodak Team; and a couple from Dale Jarrett's effort. Data gathering appeared to be the least important subject on anyone's mind.

Then the games began. Tim Brewer, a master of the mind game, stated that these narrow cars liked smaller sway bars. Jake Elder said he was crazy, that they liked big bars and high track bars. Nab put in his two cents — he felt that at 200 mph, big bars made the car more stable, but on the clock, they slowed them down. Beam, an expert at making a car roll free, thought that if a car liked a smaller bar, it was too tight or experiencing an alignment change in travel. They debated springs, horsepower, tires, gears and even discussed how much money their wives spent on these long trips.

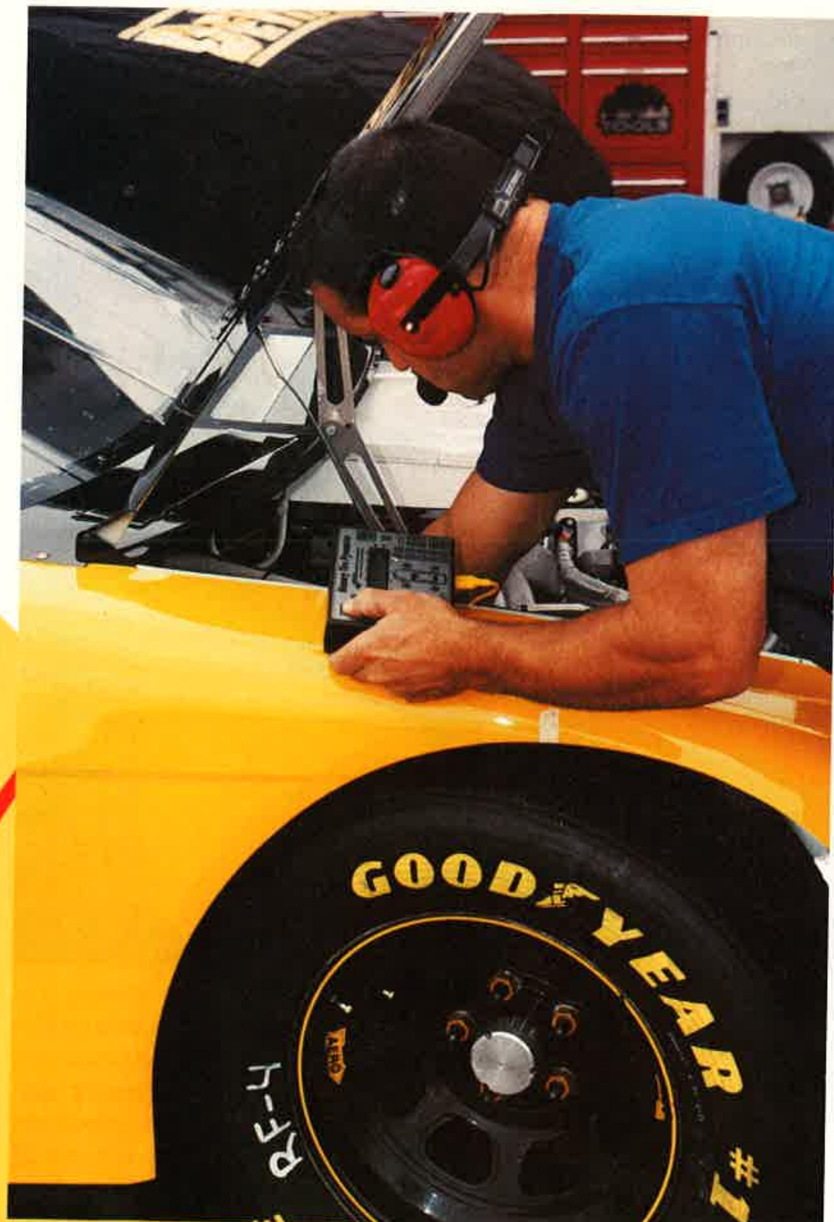
Exhausted, we took our new information and headed back to the motel. The ironic thing about this data acquisition mission was that at six a.m. the next day, each crew chief made wholesale changes and many ended up worse than they had been before the poker game.

Today the industry has changed totally. The days of grain scales and calculators have given way to computer scales and modern acquisition equipment. In the last issue, we discussed a car's setup and talked about the many different measurements that had to be taken and recorded because changing one component meant others must be altered, too. Bump steer, cambers, casters, tow and Ackerman all need to be measured accurately and adjusted relative to each other to compete successfully.

Many years ago, Longacre, a company based in the Northwest, set the standard in data acquisition equipment. Computer scales replaced commonly used grain scales, which started a trend in racing. The user-friendly components allowed racers to make changes with documentation. Baselines and information could be gathered in the shop, then applied at the track.

As time went on, many companies joined the data acquisition market. Now scales measure the center of gravity and fuel mileage by weight. These connect to laptop computers and produce computer-generated databases and computer notebooks, which allow teams to sort information affecting setups, from weather to springs. For example, a few years ago a number of new tracks popped up. Using the length of the track, the degree of banking, the G-forces, the elevation and weather, these databases were able to simulate hundreds of races, sort them and suggest a basic setup.

Following the development of the computer scales, manufacturers found that many racers had a difficult time doing mechanical measurements. The equipment available in the automotive industry was expensive and did not give racers the information they needed. For example, front-end alignment gauges used in the automotive industry failed to measure excessive



KEVIN THORNE PHOTO

Above left: Crew members on Kenny Irwin's #28 team call up information from practices on the computer screens. Stored data on each component of the setup makes quick changes possible. Above: Using a computer pyrometer, a crew member measures the brake rotor temperature after each practice. These readings are stored in a database.

cambers and casters.

The data acquisition industry adapted a simple billet gauge using the bubble-level method for measuring caster-camber combinations with provisions for large angles. This simple gauge is extremely versatile and accurate and has a purchase price of less than $200.

A bump steer gauge was not offered as alignment equipment by any street car manufacturer. Racing equipment manufacturers developed a simple stand using dial indicators to measure bump steer.

A lot of industries, including automotive, HVAC and even culinary arts, use pyrometers to measure temperature. Measuring tire temperatures, exhaust temperatures and rotor temperatures all require the use of pyrometers. For years, race crews used gauge-type pyrometers to measure tire temperatures and recorded these manually. The gauge types took 30 to 60 seconds to top temperature after zero. Again, data acquisition experts designed temperature-reading computers that record and store temperatures immediately, and the information can be recalled for future use. An infrared pyrometer was introduced to read and track ambient air temperatures, component temperatures and driver environment temperatures. This simple trigger-activated pyrometer can read varying temperatures in just 6/10 second.

Below: This crew member on the #17 DeWalt team is hard copying information as it is gathered during a test session at the track.

SAM SHARPE PHOTO

For decades, racing tire pressure gauges were the standard gauge type. Air temperature, humidity, type of air mixture etc. produced inconsistencies in pressure. Precision-calibrated gauges used for manual readings were introduced first. These gauges read only two-pound increments. The introduction of radial tires brought on gauges that read quarter-pound increments. Using these gauges for reading pressure meant manual documentation and sometimes human error. The introduction of computer pressure gauges allowed teams to record pressures as they were taken and then transfer the information into databases.

Alignment procedures have also moved into new areas with laser light systems. These systems can set rear-end alignment, front-end alignment, check toe and offsets.

NASCAR does not allow any on-board acquisition systems during races. But practices are different. Lap timers are used to record changes in lap times as chassis and engine tuning begins. Diagnostic probes can be installed to check shock travel, suspension travel, wind speeds, cowl pressures and tire temperatures. This information is used to set a baseline.

All this information deals with setup and track tuning. In-house data acquisition includes shock and spring dynos. This equipment can check shock ratios so changes in compression and rebound can be made.

The results of these tests are then used to tune the chassis. The changes to each component and the results achieved from these are stored and recalled when needed.

The same holds true for springs. Data comparing components was developed to rate sway bars. Some companies offer a rating system that measures the rate of a radial tire. Air pressure can actually change the effective rate of a tire in pounds. Every day, new information is gathered relative to performance. The ability to organize this data and apply it is vital for success.

As we start our track and engine tuning, we will relate the use of this equipment to each change we talk about. Ten years ago, racers couldn't even spell computer acquisition; now each member of the team has to be a specialist.

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