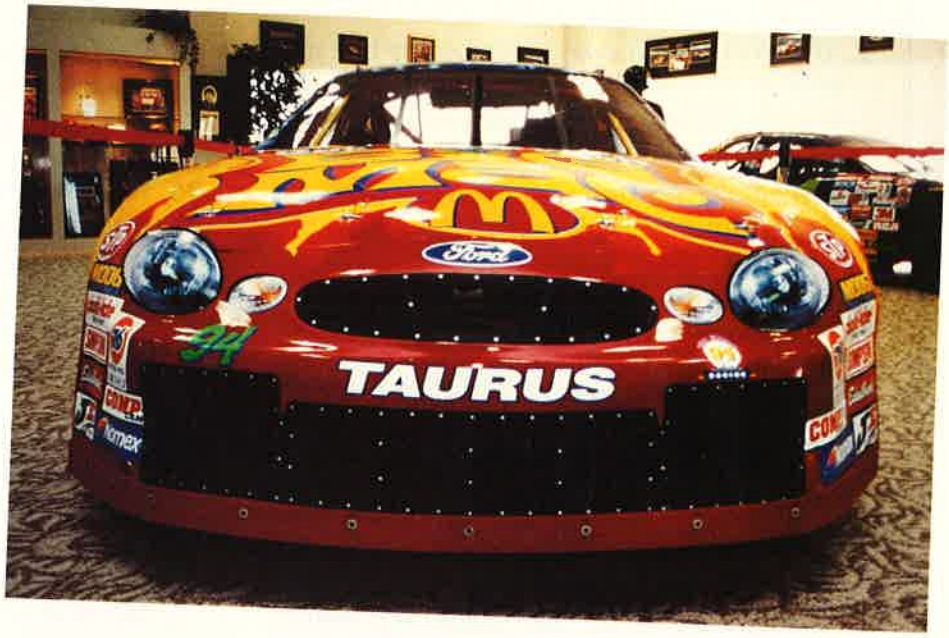
*story by Mark Davis*
*photos by Kevin Thorne*

# Building A Race Car: Part 1

## *It's more than nuts and bolts*

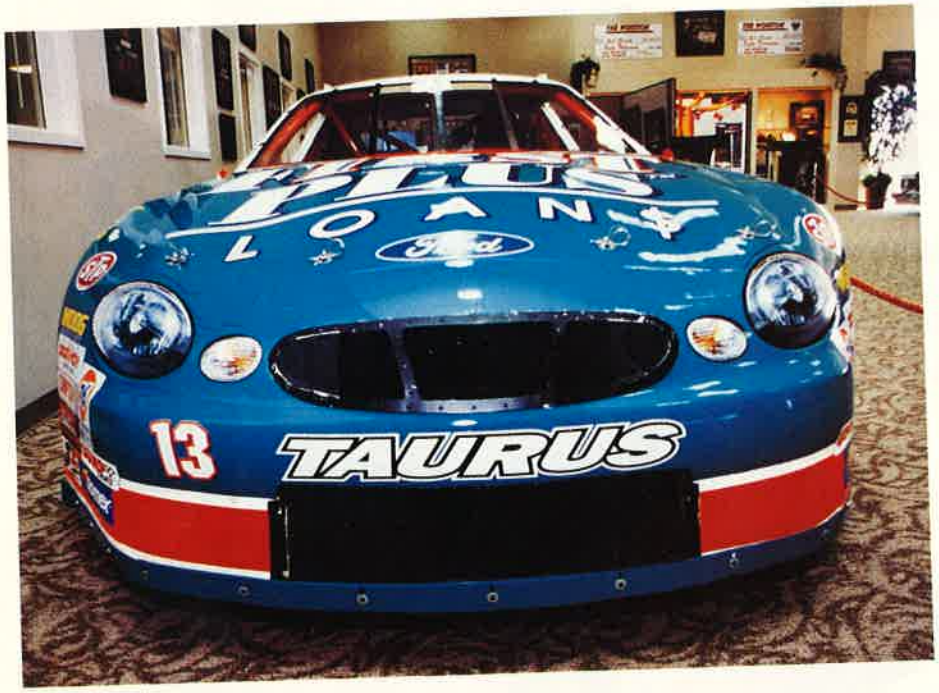
*In this issue, Mark Davis, director of the Bobby Isaac Motorsports Program at Catawba Valley Community College in Hickory, North Carolina, begins a 12-part series entitled, "Building a Race Car." Davis will take readers through the construction of a race car from 150 feet of roll bar tubing to a finished racing machine.*




***The car at the top is a short track car. Short track cars can be easily identified by the grille work, which incorporates brake ducts used to air cool brakes. The car below, which also came from the Elliott-Marino stable, is an intermediate car, which incorporates much smaller grille work. Both cars display similar aerodynamic features.***

Pull out your notebooks, sharpen your pencils, grab your checkbooks, call your accountants and whatever you do, don't tell your wife. We are going to build a Winston Cup stock car. For the next year, we'll lay out the chassis, components, bodies, paint and graphics, safety systems and even the test procedures. We will cover the basic materials used, while outlining construction techniques throughout the car building process.

There is a lot of planning that goes on in team offices long before the first car in a racing fleet is built. First, owners must decide where to put their focus. That is, which tracks offer their driver the greatest chance of victory. Developing a strong Winston Cup team starts at the team's point of expertise. Team strengths and driver strengths determine this. Road racers concentrate on road courses; short track drivers look to short tracks; flat track teams put effort into flat tracks.

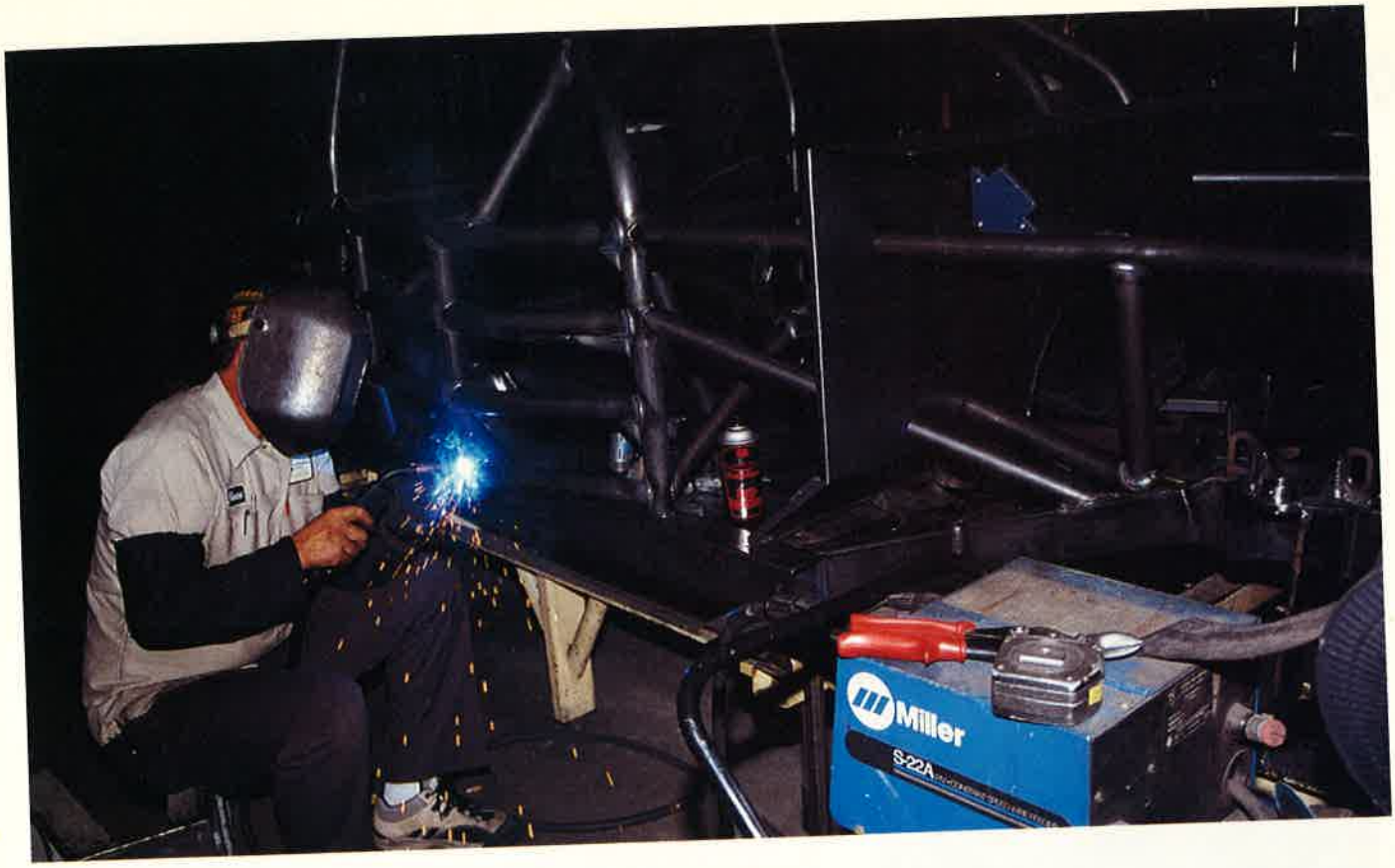



Sponsors often become part of this equation by sponsoring races at a track close to their corporate offices. These races allow sponsors to wine and dine associates and nothing is better than their team winning in conjunction with corporate happenings. Some teams put 200 percent effort in these races. Specialized cars are built to exploit these strong opportunities.

In planning the Winston Cup fleet, teams are confronted with the issue of back-up cars. For years, qualifying for races meant out-timing only 40 cars. Using "old" or "second string" race cars for back-up cars did not interfere with making races.

But today, one car per track is not

*Continued on page 72*



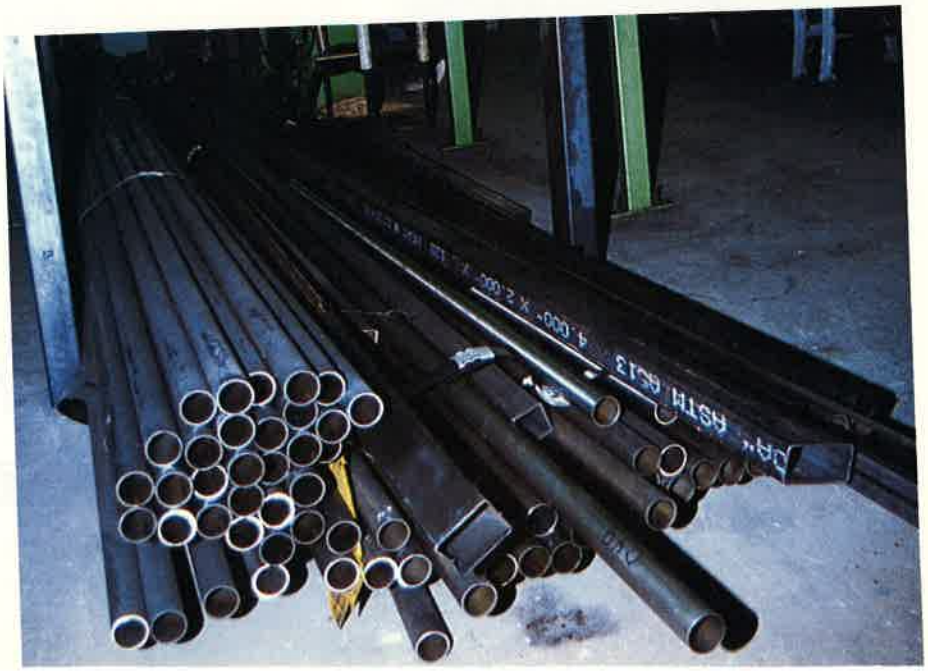

enough. Teams now prepare two equally matched cars for each race. These cars are mirror images of each other and therefore are completely ready to qualify or race, if the need arises. Since they are identical twins, teams can change the setup on the back-up car to match a damaged or disabled car in a short period of time.

In addition, cars must be designed for each track. New-generation crew chiefs surround themselves with talent in many areas. Engineers dealing with aerodynamics and chassis play a big part in car choices. Special engineering designs establish proper component placement and geometry used in the preparation of race cars. Component placement changes for each track. Flat tracks, road courses, restrictor plate tracks, concrete surfaces and high-banked speedways all have certain personalities. Aero packages, bodies, duct work, spoilers, air boxes all have to match chassis packages.

Some tracks have similar characteristics, which allow teams to develop race car packages that work at each track. For example, Daytona International Speedway and Talladega Superspeedway; Pocono International Speedway, Indianapolis Motor Speedway and New Hampshire International Speedway; Charlotte Motor Speedway, Atlanta Motor Speedway and Michigan Speedway; Dover Downs International Speedway and Bristol Motor Speedway; Sears Point International Speedway and Watkins Glen International Speedway require similar setups.

With the large number of cars needed to meet the team's needs, owners realize that work must be sublet or subcontracted

***Above: This cage being welded at Hutcherson-Pagan, has hundreds of continuous welds. Right: The material used in the average Winston Cup chassis consists of 150 feet of roll bar tube, 40 feet of 2-by-3 tube, 12 feet of 3-by-4 tube, and three 4-feet-by-10-feet sheets of 22-gauge sheet metal, 100 pounds of flat Stock brackets and 200 hundred man-hours of labor.***



to other sources. Hendrick Motorsports, at this time, is the only totally self-supporting Winston Cup team. Even the largest teams buy chassis and sublet bodies, headers, graphics, and more.

Refinishing race cars is very material intensive. Paint, material and graphics cost as much as $3,000 per project. Refinishing the interior, the exterior, preparation of the car, and graphics placement takes about 100 man-hours of labor at a cost of about $4,000.

Let's review. From chassis to refinishing, along with assembly labor, a car takes about 800 man-hours. Chassis manufacturers claim about 200 man-hours of labor are needed to produce the chassis and components. This means 1,000 man-hours of labor are needed per car to develop it from the chassis to the track. That, times 14 cars, equals 14,000 man-hours of labor. Divide that by eight off-season weeks and it equals 1,750 hours of labor per week. Divide that by a 50-hour workweek and a team needs 35 employees. Boy, we need to take a breath!

The average Winston Cup car takes about $35,000 worth of labor and $35,000 worth of parts, making each Winston Cup car built in-house worth about $70,000. This number can increase up to $100,000 if the car has been totally sublet. Quite an investment!

With these topics in mind, building Winston Cup cars into successful teams takes serious thought in chassis components and bodies. A mistake in choice can cost tremendous amounts of time and money.

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By the early 1970s, teams began relying on chassis manufacturers to produce surface plate cars setting competition standards. Banjo's Performance Center and Hutcherson-Pagan manufactured 90 percent of cars raced. Today, Hutcherson, Laughlin Racing Products and Ronny Hopkins Race Car produce 80 percent of all cars raced in Winston Cup.

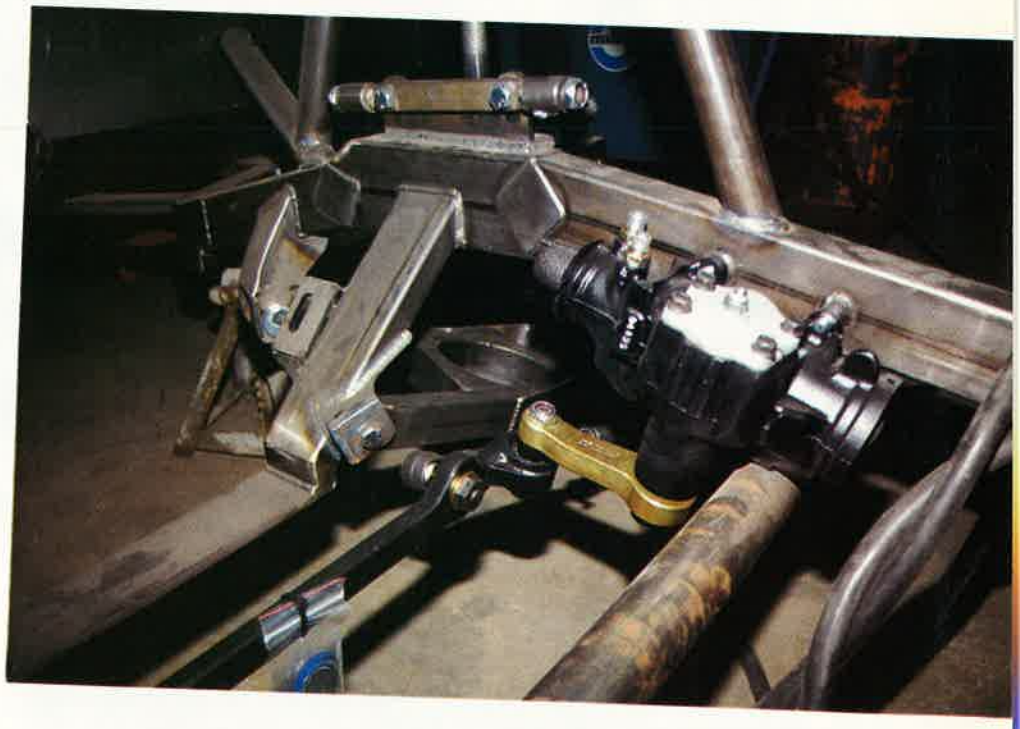
As technology sharpens, car owners have found that current successful crew chiefs call on both chassis engineers and aerodynamics engineers to create databases that establish design criteria for programs using designated geometries such as roll centers, Ackerman, bump steer, ride heights, instant centers, scrub radius and so on.

Crew chiefs call on chassis builders that are user friendly to the team for chassis designs, and established aerodynamics engineers match chassis, track and body. Down force, lift, coefficient of drag, along with all forms of air management, establish base lines for competition. Team owners choose chassis builders on many merits: workmanship, availability, ability to turn around repairs, confidentiality in design and cost.

The average Winston Cup chassis can cost as much as $8,000.

Teams experience problems producing racing bodies in-house as well. Bodies hung in-house take 300 man-hours of labor each. When dealing with a fleet of 10 cars, teams realize 3,000 man-hours of labor. Limited fabricators on staff make subletting bodies cost effective. The average Winston Cup body costs around $8,500, which only includes body placement and exterior panel development. Aluminum crush panels, window treatments, duct work and bracketry cost another $4,000.

*Our thanks to Hutcherson-Pagan Enterprises and the Bill Elliott Racing Team for opening their facilities for photos.*



***Front steer chassis moved Winston Cup cars into the future. The steering box location is in front of the engine crossmember. Moving steering out of the engine bay area allows engine builders to perfect exhaust systems, and change oil pump, oil pan combinations into valuable horsepower.***