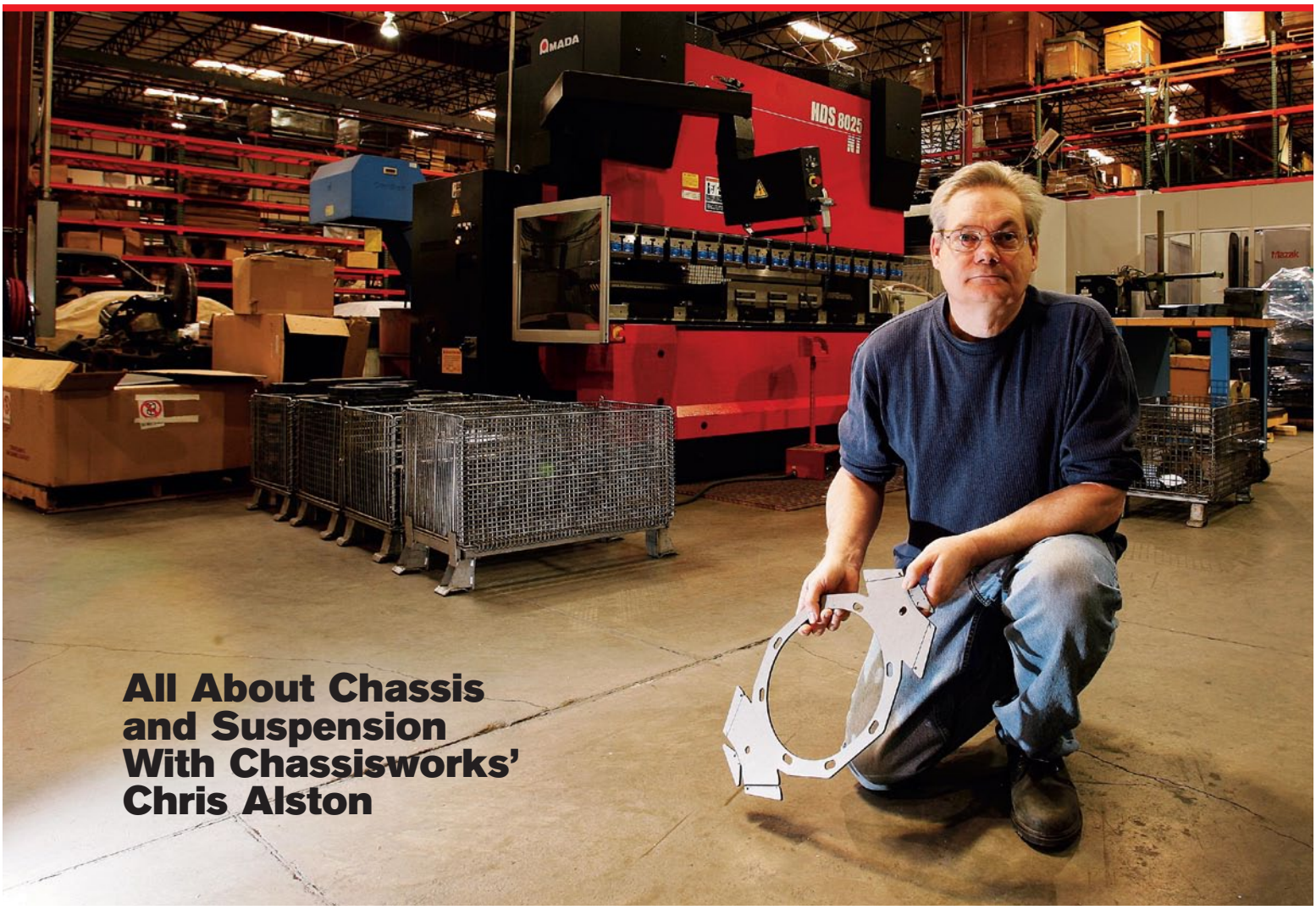

All About Chassis and Suspension With Chassisworks' Chris Alston

Most people think of us as a builder of drag-race parts, but that's only 35 percent of our business.

Raw, ugly steel tubing goes in one door, and race cars come out the other. Performing such a spectacular metamorphosis takes some serious talent, and Chris Alston's been doing just that for the better part of four decades. He started building race cars at home in his garage during the early '70s to help support his racing fix.

Always striving to improve his craft, his expanding collection of equipment necessitated renting out a small shop. Over the years, Chris' experience building turnkey race cars led to the development of off-the-shelf chassis components and innovations such as door-slammer chassis kits. His product line eventually expanded into the muscle-car market, and today Chassisworks is one of the most respected names in chassis and suspension components. From concept to production, Chassisworks incorporates an OE level of automation and sophistication that's rare in the aftermarket. During a recent visit to his shop, we had a long chat with Chris—we covered everything, from fabrication techniques and suspension design to tips on real-world dragstrip tuning.

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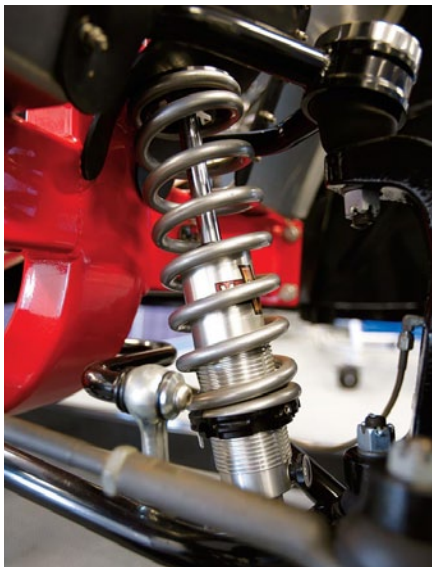
FAB SHOPS

Like trying to find a good machinist, tracking down a qualified chassis shop can be daunting. "The first thing you have to deal with is that building cars is difficult business," explains Chris. "Very few people have the skill set needed to be good at it; customers sometimes have a very difficult time clearly defining what they want, and unfortunately customers let car builders lie to them. To avoid this, ask for the names of three or four regular customers—not just a few guys the shop is buddies with—whose cars he's done in last year, and talk to them. If you don't have to wait to get into someone's shop, that's probably reason enough not to go to them."

SPRING TUNING



"A drag car should run the lightest front spring rate possible without allowing the shocks to bottom out when making a pass. Generally, lighter springs allow the car to easily transfer weight and settle faster down track. Changing spring rate affects ride height and the rate at which weight is transferred to the rear tires. A softer rate makes the front easier to raise during acceleration, while a stiffer rate makes it harder. If you're having trouble getting the front end to rise, you can soften shock rebound valving or change to a softer spring. When using lighter-rate springs, preload must be added to achieve proper ride height. The worse a car hooks, the more shock extension travel it will need. If you need more extension travel, preload can be removed to lower ride height. This method will cause the car to have less ground clearance and reduce the amount of compression travel. If you are going to operate the shock at a ride height shorter than recommended, the upper chassis mounts must be relocated to correct any major vehicle ride-height issues."

MILD STEEL VS. CHROME-MOLY

"Most people think chrome-moly is lighter than mild steel, but they actually weigh the same. It's a fallacy. Steel is steel and it weighs what it weighs. Since chrome-moly is an alloy and stronger than mild steel, you can use a thinner material, which is where the weight savings comes from. In a full rollcage, chrome-moly will weigh about 35 percent less than mild steel, which equates to roughly 30 pounds. In a tube-chassis car, the weight difference is closer to 100 pounds. The big disadvantage of chrome-moly is that it costs three to four times as much as mild steel. Likewise, mild steel is easy to work with and can be MIG-welded, while 4130 chrome-moly has to be TIG-welded, which is a much more labor-intensive process. Gaps between the tubing must be much tighter with chrome-moly, and it's easier to overheat it while welding. So while chrome-moly is marginally lighter, it costs much more in terms of labor and the material itself."

SUSPENSION BUSHINGS

Urethane bushings and spherical bearings are arguably the two most popular types of suspension bushings for aftermarket applications, so which is better? "Urethane is revered but doesn't deserve its reputation," Chris opines. "The only reason to use urethane is that it's a cheap way to do a difficult job. Urethane acts a little like a shock absorber, which is good for NVH [noise, vibration, and harshness] reduction, but that same compliance isn't desirable for optimal handling. Despite its higher cost, a spherical bearing is a better choice due to its higher load capacity, better suspension control, and greater range of movement."

PROPER SUPPORT

If you ask five people how to support a vehicle while installing a 'cage or subframe connectors, you'll probably get five different answers. Luckily for us, Chris has the right info. "On a stock-bodied street car, it needs to be sitting on the tires before you start any welding," says Chris. "Cars bend and flex so much that if they're not resting on their tires, they'll sag. If using jacks, put them on the rear-end housing to support the back of the car, and as close to the A-arm mounts as possible on the front of the car."

HOOKING UP

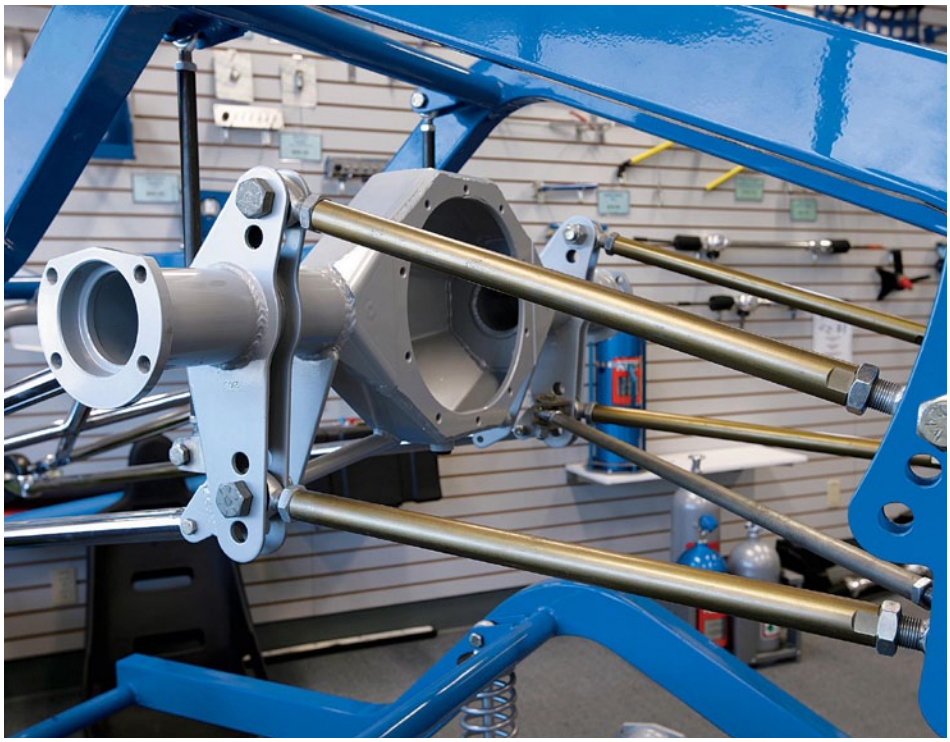
Obviously, the best mod for hooking up at the track is a fat set of meats. However, if class rules or wheel-well clearance limits tire size, good bushings and adjustable shocks are the most critical components in putting the power down. “To get a street car to work requires one thing first: The bushings must be able to handle load without inducing wheelhop,” says Chris. “After that, you need a really good set of double-adjustable shocks to tune the car. There is a tremendous amount of traction to be gained from controlling the compression and rebound of the shocks. It doesn’t matter if you can’t afford it; that’s what works.”

SHAKEDOWN TESTING

“When testing a freshly built car for the first time, verify that the vehicle tracks straight before aggressively launching from the line. Begin with light acceleration and low speeds. If the vehicle tracks and drives acceptably, make incremental increases in acceleration and speed. On vehicles not tracking straight, you should verify all chassis settings such as alignment, bumpsteer, and tire pressures. Once the vehicle drives safely at speed, move on to test launching. Test launches should consist of only the initial launch, with no subsequent gear changes. Begin with low-rpm launches and gradually increase rpm and severity. At this time, we are only determining that the car launches in a controlled manner to avoid damaging components or the vehicle. The vehicle should leave in a straight line without extreme wheelstanding or harsh bounces. Sudden, uncontrollable front-end lift should be corrected by adjusting instant center. More-gradual front-end lift can be corrected by adjusting the shock valving. If the car gradually wheelstands or bounces violently, adjust front suspension first, then rear. If there is rear tire shake, wheelhop, or excessive body separation, adjust rear suspension first, then front. After the car has been adjusted to launch straight, test-launch and include the first gear change. Repeat until the car can be launched straight and driven at speed safely over an entire run. The car is now ready for fine-tuning.”

SWAY BARS

Drag-race sway bars and road-race sway bars are different animals, so don’t expect them to work effectively in applications they weren’t designed for. A drag sway bar will result in far too much roll stiffness and oversteer for a road-race car, and a road-race sway bar won’t adequately control body twisting at launch in a serious drag car. “In either application, the function of a sway bar is the same, controlling weight transfer from side to side,” explains Chris. “The difference is that a drag sway bar sees much more load, since it’s trying to prevent the rearend from twisting in the chassis due to the torque of the driveshaft. Consequently, drag sway bars can’t have any flop, because that’s what gets used up first and causes the car to rotate before the bar can do its job.”



FOUR-LINKS VS. LADDER BARS

A four-link rear suspension is the ultimate in traction, but it isn’t always the most practical for street or moderate drag-race use. Unlike a factory-style suspension, a four-link’s adjustable pivot points allow dialing in more antisquat for improved grip. There are two basic styles of four-links, one for drag cars and one for street cars. “In a drag four-link, the intersect point is different and the rearend can’t roll, while a street four-link will allow a bit of roll,” explains Chris. For street use, Chris says a ladder bar may be a better option. “Physically, a ladder bar has only one front pivot, as opposed to two pivots in a four-link. Although a ladder bar is less adjustable, it’s easier to tune and make drivable. A four-link can be made to hook better, but since it takes more work to set up, you’re better off with a ladder bar if you don’t have the patience to tune it right.”

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As a car gets faster, the basic 'cage doesn't change, but the protection surrounding the driver gets more elaborate. If only pros built 'cages, the rules would be more lax, but since they have to account for home builders, rules have to be strict.

SHOCK TUNING

"Front shock rebound determines how quickly a car's front end rises at launch and during gear changes, while shock compression determines how quickly it settles. Too light of a rebound setting on the front shocks allows excessive front-end chassis separation and may result in the front wheels jerking violently off the ground during launch. During gear changes, too light of a setting allows the car to bounce off its front rebound travel limiter and then bottom out in an oscillating manner. Conversely, too firm of a setting will prevent the front end from rising sufficiently, limiting the amount of weight transferred to the rear tires. As for front shock compression, a firm setting will cause the chassis to bounce off the front tire as the chassis settles down, while too light of a setting allows the shock to bottom out and bounce off the stop travel bumper. Adjustments should be made in one-click increments. In the rear, the suspension should be as firm as possible before a loss of traction occurs. Changes to the vehicle, such as ride height, tire size, weight distribution, or suspension link adjustments, will alter the instant-center location in relation to the vehicle's center of gravity. Any shift of either the instant center or center of gravity will usually require a shock-setting adjustment to optimize traction."

SPOILERS

Rear wings are mainly for aesthetics in production cars, but that's hardly the case with race cars. "The speed at which you need a rear spoiler really depends on a car's body style," explains Chris. "Newer cars move through the air more cleanly, but the rear ends of older cars become very light at 130 mph. The unfortunate thing is that cars are usually fastest without enough spoiler angle on them, and the extra stability comes at the expense of a few mph in trap speed." Consequently, it's best to start off with an aggressive spoiler angle, then gradually back it down until reaching a trade-off between stability and speed that a driver is comfortable with. That said, it's possible to go overboard with downforce. "If you get too much downforce, you can compress the springs enough to push the wheeltubs into the tires. I've seen up to a 1.5-inch loss in ride height at speed because of downforce and tire growth."

MOTOR AND TRANS PLATE

As the rearend twists in one direction and the engine twists in the other, the result is an out-of-shape launch that makes a car difficult to drive. Tuning the suspension to alleviate this condition is only part of the solution. By holding the engine and transmission securely in place with plates, chassis flex is greatly reduced. "A car with engine and trans plates is much easier to tune," says Chris. "Without them, it's impossible to get the tires to load evenly, since the chassis will twist. You might get one tire to hook up but not the other."

In the old days, it didn't matter how much power you had, because you couldn't get the tires to hook up. That's not the case anymore.

INSIDER

BACK-HALF KITS

When in doubt, back half. According to Chris, once you need a tire that's too big to fit your car, it's considerably cheaper and easier to install a back-half kit than it is to make the necessary suspension upgrades to make smaller tires hook up. "People are intimidated by the thought of installing a back-half kit, because you have to cut the floor, but there's such a wide knowledge base from backyard mechanics who have done it that it's easy to install," he explains. "If you're in a class that allows back-halved cars, it's much easier to get a car to hook with big tires, and it takes much less skill. Anyone with an average level of skill should be able to install one, and we have detailed instructions and pictures on our Web site."

AUTOMATED MANUFACTURING

As one of the most automated aftermarket companies around, Chassisworks has been on the cutting edge of computer-controlled manufacturing for nearly two decades. Eliminating the potential for human error improves product quality, and streamlined manufacturing reduces operating costs, which means less-expensive parts for consumers. "With our automated work cells, when we go home at night and the lights are out in the shop, the parts are still getting made while we're sleeping," says Chris. "A mandrel bender costs $250,000, so most shops can't afford them. However, you can't just mandrel-bend parts and call it a day; the process must be precisely controlled with computers." At Chassisworks, CNC machines load and unload themselves and perform quality checks without any human intervention. "Whether it's our suspension pieces or rollcages, we can ensure proper fitment because of the extreme control we have over our manufacturing process."

Front-end rise without any appreciable traction gain is wasted energy that should be used to propel the vehicle forward instead of up.

SETUPS

Dialing in a suspension for the dragstrip, road course, and street calls for trial and error, but Chris has some tips to help you get started. Depending on the application, shock travel will be reserved in different percentages for compression and rebound. "Street vehicles require more available compression travel for improved ride quality and unexpected road hazards," explains Chris. "At baseline ride height, the shock and spring should collapse 40 percent from their installed heights, resulting in 40 percent of travel available for extension and 60 percent for compression. Since road-race vehicles are usually limited to smooth surfaces, less compression travel is required and a 50/50 split will suffice." Drag-race vehicles generally require more rebound travel to help weight transfer, and since the dragstrip is very flat, less compression travel is needed. The amount of rebound will drastically affect how the car works. "At baseline ride height, the shock and spring should collapse 60 percent from their installed height, resulting in 60 percent of travel available for rebound and 40 percent for compression."

RACING

Chris doesn't have the time to race these days, but he still has two shop cars that his family campaigns within the West Coast's various 10-inch-tire classes. The lessons learned while racing 7-second drag cars provide real-world R&D for Chassisworks' product line. "Our tubular front clips were originally designed for Pro Touring cars, but we modified them to work on drag cars as well," explains Chris. "Whether you're going straight or turning, the requirements for good handling are the same." Likewise, Chassisworks' line of drag-racing brakes was also developed on the company's race cars. "Cars are much heavier

these days than they used to be, which requires bigger brakes. Our 11.75-inch brakes weigh the same as other brakes on the market that are much smaller." ***CHP***

GET THE HOOKUP

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