TESTING

To ... not prepare is the greatest of crimes; to be prepared beforehand for any contingency is the greatest of virtues.

***Sun Tzu,* The Art of War**

Notice there is a laser resting at the base of the arms on the lift. The laser shines a dot on a mirror which is taped to the wheel. The mirror reflects the laser onto graph paper on the wall. We removed the shock and moved the wheel up and down to see if the laser dot moved on the graph paper. (If the laser dot moves, the suspension is changing in bump steer.) We then moved the steering rack until the bump steer was minimized. We used this technique to diagnose an elusive alignment problem we had on the prototype car. We finally traced the problem to our first steering rack; the rack was loose in the housing, among other things. We ended up engineering and manufacturing our own rack to solve the problem.

We aligned the car with very little toe-in so the car would "point" quickly in a turn. Toe-in tends to push back on the tires as the car moves forward and lock the suspension in place. The less toe-in the wheels have, the less push back there is on the wheels and the more critical it becomes to have everything tight. We used spherical bearings on all the suspension joints to keep everything tight—very desirable for a high performance car. Bearings immediately transfer any suspension problems directly to the steering wheel—leaving little margin for error in suspension execution. A typical street car uses a lot of toe-in because of the slop in the rubber-bushed control arms; rubber acts like a huge shock absorber at the cost of precision.

Thomas made some special spring cups to support the car without the shocks. He then bounced the car up and down and find out its natural frequency. With that number, he calculated the proper spring rates.

When we aligned the car, we placed the alignment plates on scales so we could "scale" the car—that is, adjust the individual ride heights to make the corner weights the same.

Here you can see we adjusted the front weights identically to each other. The rear wheel weights are within 5 pounds. Notice the complete car (without body, seats, fuel, and windshield) is only 1771 pounds.

Thomas was a flight test engineer in the Air Force—he loves data acquisition. Here the prototype car is hooked up with G meters, GPS, and a data logger to measure accelerations. The car easily pulls over 1g lateral acceleration.

We tested the chassis at speed over railroad tracks to make sure everything was working properly under severe road conditions.

More testing in front of our shop.

First test drive with the body on the chassis.

Larry wanted his car to be a little quieter than normal, so I downloaded a decibel meter for my iPhone. Here the prototype car is at idle reading 77 dB. Notice the tachometer is at 1000 rpms.

I measured one of our standard cars at 80.9 dB at 1000 rpms. Each 3 dB drop reflects a reduction in 1/2 of noise.

Here is the prototype car at 4000 rpms—92.2 dB.

One of our standard cars at 4000 rpms—94.8 dBs.

Once everything was together on the prototype car, we took it out for testing on the Miller Motorsports track. We had several professional drivers from all classes of racing—F1 on down—test drive the car and provide suggestions. We also asked one of our customers with extensive driving experience, Rick Lee, to evaluate the chassis. He offered many valuable insights.

My favorite comment came from the head of the Miller Motorsports Driving School. After several hot laps, he said, "You know, with a Cobra you run out of chassis long before you run out of motor. With this car, I just kept pushing it harder and harder. I ran out of motor before I ran out of chassis. This has potential for a serious race car."