

KITCAR- CHAPTER ONE

PREPARATION and PLANNING

This is the first of a series of articles that will cover building a kitcar, from its beginning of steel tubing and fiberglass mat, through completion and registration, and ending with a maiden voyage. This particular car is a Countach, but the techniques described here will apply to any mid-engine car as well as car building in general.

So where do we start? First lay out the frame rails? The journey of a thousand miles begins with one step. A wise old proverb but your author disagrees. A trip of that magnitude begins with a great deal of planning before the first step is taken. Likewise with this journey. This first tech article will cover all of the preparation required before our first cut or weld.

Before we can begin to plan, let us more closely define our project. In this case, the author wants a correctly done Countach. By correct we mean that the suspension is geometrically correct, safe, and sound. We mean that the fit and finish of all the body and interior is meticulous. We mean that the engine and transaxle is properly fitted and of sufficient horsepower and strength. Bottom line we mean something that is a pleasure to drive.

What we do not mean is a solid gold plated car. Projects like this rarely have an unlimited budget and establishing priorities for the existing budget is critical to the end results. Authenticity is not going to be a priority here. Rather, we would like to do a "pro touring" version of the 30 year old icon. Ironically when you see a '69 Camaro with 18 inch bling wheels, LED lights, and a carbon fiber dash, what you do not see is a forum full of onlookers claiming that it is not authentic. The author wants to apply this same bling and fiber treatment to a Countach.

It is hoped that this treatment will accomplish three things. First it brings the classic Countach design up to date with modern elements and technology. Second, It allows us more component choices with "off the shelf" pieces. More component choices means more pricing and vendor choices, which means more design flexibility and hopefully competitive pricing on parts. Third, and this is very important in the overall picture, it eliminates the need for \$300 cigarette lighter knobs.

As with any preparation, first comes an assessment of the existing. Four things are critical here. First, do I have the finances to do this? There is an old saying in auto racing that "expenses will arise to meet budget". We are going to budget \$40,000 for this project. That may sound high to some, low to others. At the end of the build we will see how we did. Realize that the amount can be spread over the length of the build but cash flow has a big influence on build time and quality. There is another saying in racing credited to the Toyota engineers when they were first tasked with the job of bringing Toyota into Nascar "We can have a budget or we can have an objective". If the objective is to build an absolutely accurate Diablo or Murci, the budget should be rethought.

Second, do I have the ability to do this? Basic fabrication skills such as welding are a necessity. Mechanical inclination and knowing which end of the ratchet the socket goes on is useful but not the

answer here. Again the author goes back to a racing reference. Over the years many people have asked for a job with a Nascar team stating that they were good mechanics. They are told that a mechanic bolts and unbolts parts, while a fabricator actually builds the part. Most of the parts are unique to that car, therefore the parts must be fabricated first. Likewise with our kitcar project. In both cases we are looking for fabricators, not mechanics, and they are a lot harder to come by.

Third, do I have the facilities, or infrastructure, to do this? We do not need a huge shop with expensive machines, but some basics are necessary. The author believes firmly that the ability to work comfortably will be a huge influence on the project's ultimate success. He also believes that there is no such thing as a big enough shop or one with enough electrical outlets. The last shop we built had a fourplex outlet every six feet and guess what? Not enough outlets! But it is not our intention to show how to build this out of a dream shop. Rather, we will build out of a typical two car garage, which meets the basic infrastructure requirements.

It is big enough to house tools and equipment and still leave room to walk and work around the car without tripping over or rearranging things. The floor is clean and free of oil stains and trash. It is well lit with adequate electrical outlets. It does not pop a breaker every time the welder turns on. It has a sturdy workbench that actually has a work surface which is not used as a storage shelf. It has a welder, air compressor, basic hand tools and basic fabrication tools such as a drill press. In short, it is the typical home workshop.

Before we leave the subject of the shop a word about one more item important enough to have it's own paragraph, a fire extinguisher. They are \$24.99 at our favorite store, Harbor Freight, and are cheap insurance, not just in the shop but in our finished car as well. In order to have it handy throughout the process, let us make this the first thing that we purchase for our build and the last thing that is installed on the car. Few things are more painful than watching helplessly as a candy apple hood bubbles and sizzles like bacon from a carburetor fire. Think that is from experience? One other thing on this subject, on any build of this size, sometimes we will be given lemons. When we are, let us cut a hole around the burned part, stick a tunnel ram through it, and make lemonade.

Fourth, Do I have the time to dedicate to this project? Whether it is 40 hours per week for 10 weeks or 4 hours per month for 10 years, it is still four to five hundred man hours. At the end of the build we will see how we did on this number as well.

If we have given an honest yes to these four questions, let us get down to business. Back to the question of where to start and the frame seems the logical place. Our available choices fall into four basic categories. The first is the donor car, typically a Fiero. The main argument in favor of it would be cost. We could probably build a car for less than our \$40,000 budget but we cannot achieve the goal of correctness, at least on that budget. Besides the wheelbase stretch, it would be necessary to at least change the brakes, suspension components and geometry, engine and even transmission. By the time the desired effect is achieved, we have gone to huge trouble to save the floorpan, steering column, and air conditioner of a 30 year old car. If ability and budget are concerns, this is an option. Because in this case they are not, let us look at others.

The second option is to follow an existing set of plans. Your author has found several designs but they all use Corvette suspension and/or suspension design. We can make four big arguments against this and are yet to find one argument in favor of it. The first is very simple, it says Corvette on it therefore it is expensive. Let us qualify that, there is nothing cheap when it come to building a car from scratch, some things are just higher than others. So to put it more correctly, it says Corvette on it therefore we believe that sufficient parts may be found elsewhere for less.

The next argument is about the geometry. Although it is close, the Corvette does not share the same ride height, track, and wheelbase as our project. There will be much more about these terms when we get into chassis design later. More importantly, it does not share the same tire and wheel size, which is the beginning of any suspension design. More about that later as well. Suffice to say at this point that we cannot easily achieve our objective of correctness based on these components. As a side note, for anyone wanting to build a Countach in the purist mode using 15 inch wheels, you cannot cram 18 inches worth of brakes into a 15 inch wheel.

The third argument is that it is just too complicated. One example calls for over 100 pieces to be purchased or fabricated for the rear suspension alone, and complication breeds expense as well. This author believes that both the front and rear suspension can be fabricated and hung using less than 50 pieces and repetition of design, and a more correct suspension designed in the process.

The first three arguments are fairly common knowledge, but the fourth argument, possibly the most important, seems to go totally overlooked. The width of a Corvette upper front a-arm is about 18 inches when measured along the centerline of the car, about nine inches is in front of the ball joint and nine inches behind. To understand the importance of this, let us begin our first chassis design lesson. It is the nature of the beast that on any mid-engine car the cockpit and footbox are cramped. That is because of the following design process. A wheelbase is established and the engine and transaxle is selected and located. That determines the farthest rearward point at which the engine/cockpit bulkhead can be located. Working from the front of the car, the front suspension components determine the farthest forward point that the front bulkhead or firewall can be located, in this case at least nine inches behind the front axle centerline. What is left in between the two bulkheads is the cockpit and footbox. If the upper a-arm could be reduced to say 12 inches with 6 inches behind the ball joint, a much appreciated three inches could like magic appear in the footbox. We believe that we can accomplish this without any negative performance effect and that those three inches may feel like a mile to the average height driver. Remember, one of our objectives was that this car be a pleasure to drive.

The third option is a custom built chassis. There are at least two and in our case three problems with this route. First is availability. The companies that used to build a Lambo replica chassis have all but vanished. Perhaps this is a mute point, because they used Corvette components as well and we have already decided that this is not the desired direction.

In our case there is the additional problem of wheelbase. These chassis were designed for the Diablo, which has a longer wheelbase than the Countach.

The fourth option is to build our own chassis. Confident with our design and construction ability, this is where we wanted to go all along. We just needed to logically arrive here. In one way it is more difficult, but in another way it is so much easier to start with a blank sheet of paper and no pre-existing limitations or compromises. We will gladly take the trade off. As a fringe benefit we will know the age and history of each part, all new in our case. Also we will have the ability to know that we can source these pieces again and repeat the chassis at a comparable price for another project.

Before we begin our chassis design, one final topic should be discussed. That is our accounting and bookkeeping methods for the project. The first thing, save all of your receipts and any paperwork that came with them! This is obvious but there are two other important reasons not so obvious. First, the receipts later become the Certificate of Origin needed to title the car. There will be more on this in a later chapter but for now proper documentation kept in proper order may save a big headache later.

Second, this is all of the individual component instructions and warranty documentation. Whether the car is to be kept by the builder or intended for sale, this is important info. Ever bought a motorhome and seen the collection of three ring binders full of this paperwork that comes with it? Everything from the refrigerator to the kitchen sink faucet has a warranty and instruction book, and all of those warranties are transferred to the purchaser. This is impressive stuff should the car be intended for sale.

We will start our expense ledger with the \$24.99 fire extinguisher receipt from Harbor Freight. It will not include tax on that. Since our corporation has a tax I.D. number and is in the automotive business, and this car is intended for sale, we will not pay sales tax on the parts. Instead, the sales tax will be paid by the purchaser at the time of registration. Since this tax will be paid regardless, it would be prudent for other builders to see if individual circumstance and particular state law would allow the initial parts to be purchased tax free, thus allowing those same parts to be taxed only once at the registration.

We also did not include the cost of the gasoline it took to go get the extinguisher and the time it took to get it was not entered into the time ledger. For this example, all we want is the cost of parts on the car. Expendables such as shop towels and welding gas will also not be included. Granted this is a cost involved with construction and should be considered at the end, but for now let us remove the variables from the cost equation and concentrate on the known hard costs. Likewise time to purchase the extinguisher will not be counted, only the time involved with it's installation. And also likewise this time should be considered at the end, but not now. If this part had been a mail order item, the cost of shipping would not have been included in our books for the same reasons.

With our preparation and planning done and all of this considered, on to the chassis build.