BUILD BOOK

Robert McGaffin - Photographer

BUILD BOOK

1936 WILLYS
MODEL 77 PICKUP

Debut:

GRAND NATIONAL ROADSTER SHOW

Pomona, California - January, 24 2020

WINNER: AL SLONAKER AWARD 2020

Owner: Ron & Vicki Ernsberger

Builder: The Tin Man's Garage, Inc.

Build Book by: Krzmarzick Design Co.

Printed in Portland, Oregon U.S.A.

A NOTE FROM THE OWNER

Ronald E. Ernsberger

When I was a kid, I used to spend my lawn mowing money on *Hot Rod*, *Car Craft*, and *Rod and Custom* magazines. *Hot Rod* was my favorite because back then it had tons of for sale ads in the back. Race cars, street cars, hot rods, and all kinds of parts. I have always told people that I believe I was lucky to have grown up in the best times ever – Hot Rods, Rock & Roll, and hanging out with my friends. Simple times with a lot of good friends. I have been addicted to anything automotive for as long as I can remember. I can remember going to all of the different car lots with my dad when the new models came out and dreaming about what I would do with them.

Over the years, I have owned just about any kind of car you can imagine. I have been to Bonneville with my 1949 Hudson and made the 150 MPH club. I have ran my 1938 Willys pickup down the track at Bakersfield during the California Hot Rod Reunion.

Today I enjoy working on my collection of Willys cars and trucks.

I bought this 1936 Willys pickup truck from Bill Fowler at Hot Rods Plus out of Chatsworth, California back in 2002. It was an old U.S. Mail delivery truck at some point in it's life. I wanted to restore this truck from the moment I laid eyes on it. That brings me to **The Tin man's Garage** owned by Brian Limbirg. I bought a 1941 Willys pickup from Brian that one of his customers whos divorce forced him to sell. It is a very impressive work of art and I decided that I wanted Brian to do the restoration on my '36 as well.

The workmanship on the truck speaks for itself and it is a product of Brian's shop. The engine is one of only 5 all aluminum Arias six-cylinder Hemi's ever made. It is the only one with fuel injection. From the hand made all tube chassis to the final paint and interior, it is all first class. Brian and his crew at The Tin Man's Garage are all very talented. Steve and his team at Missile Enterprises did a great job with the motor. And finally, Adam Krause, his brother Tyler at The Refinery by Adam Krause, Inc. brought the truck to a whole new level with their paint and body work.

This is a once in a life time project for me and I could not think of a better group of people to work with from top to bottom. Thank you all very much for your efforts on my behalf. You have helped me create and produce a one-off example of a great traditional hot rod truck only in an up to date format.

ABOUT THE BUILDER

The Tin Man

By Tony Thacker

Hot rodders often bemoan the fact that there aren't enough young people entering the business, but they're young, they're like bikers and us old folks don't always see them and when we do~ often as not~ we write them off. It's fact of life.

Take for example, Brian Limberg, the Tin Man and the team leader responsible for this stunning '36 Willys pickup. Brian is not yet 40 and yet somehow has so much more than forty years experience under his young belt. Brian grew up in a hot rod family; his father Mike worked at Heidts Hot Rod Shop, and the pair would work together in the garage installing suspensions. Working alongside his father was the best possible grounding.

After high school, Brian enrolled at WyoTech in their street rod track, and there he realized that he liked this stuff. He entered school with a basic understanding but college helped him develop his skills, learn to weld, and come to appreciate the unique joy of an artist taking a flat sheet of aluminum and massaging it into a soft, curvaceous, sensual form. You might say he fell in love with the art of metal shaping.

"I was aware of others in the hot rod industry," said Brain. "Shops such as Hot Rods by Boyd where they could hand-form a complete car from flat sheets of inert steel. It was amazing and what was more amazing was that I felt that I could do that. I loved the strength of the machines, hammers such as the Pullmax, the thundering Yoder, they were such power houses and yet they could be tamed to form beautiful, elegant shapes."

Shaping metal became a passion for Brian and he has spent the past twenty years honing his skills. His first major, ground-up project was a completely scratch-built, hand-formed '29 Model A roadster the body of which was fashioned entirely of steel. The hood, grille, and top were likewise shaped out of aluminum. This was a work of art, begun when Brian was 20 years old and finished four years later.

Brian's career got off to a strong start when he was asked to run a shop of twelve people, but that proved difficult, as he was the youngest there. Eventually, he left to start his own business just as the economy tanked. However, with support from his mother, Carol, keeping track of the books, he kept the lights on and worked on several projects using any profits to buy more equipment and become more efficient. Efficiency, he felt was the way to make a time consuming passion profitable.

Eventually, in 2015, he was able to purchase an old 1940's Chrysler dealership at 500 E. State Street, Sycamore, IL. Within the 7,000 square foot facility Brian and his wife Stephanie have carved out space for a workshop where they develop and install suspension systems and build complete cars. There is also a metal shaping room where the fine art of traditional coach building is continued, on everything from concours restorations, preservations, and hot rod builds.

Because of a chance encounter, metal shaping has developed into a second career for Brian, now, as a teacher. "I was at a car show," said Brian, "and this guy kept saying he wanted classes. At first, I resisted but eventually he persuaded me and now we host at least four classes a year and I have worked with more than 100 people, even some from the other side of the world. It's very rewarding."

The Tin Man's Garage now employs six full time staff and has recently expanded into its own product line. Again, people were telling Brian he should sell some of the metal shaping tools he had developed to do his own work. Eventually, Brian developed his own line of dies and recently introduced his own planishing hammer that is based on the revered but discontinued Milwaukee X-183. "It's proven very popular," concluded Brian.

In these times of electronic everything, it is hugely gratifying to see a young man doing what he loves, making a living for his family that now includes his sons Logan and Gavin, and help shape an industry.


B
G
36

ROUGH BEGINNINGS

This is the condition of the truck when Ron delivered it to our shop. He originally told us that he just wanted some sheet metal work done on it. We had to break the news that there wasn't a lot left that was usable and if it wasn't missing or completely beat up, we had to start from scratch. So we were basically dealing with an original '36 Willys Pickup cab and a few salvageable sections of sheet metal that was mounted on a right hand drive Postal Delivery Jeep frame - GO!

Any parts that weren't cannibalized were made up with dented and beat up panels or stress cracked beyond belief.

"We were kind of in shock when it was dropped off, thinking what the heck does he want us to do with this?"

First thing we noticed was that somebody had cut multiple parts of the dash, hood sides, and grille surround with a torch to get the steering to fit and used gas pipe for the steering shaft.

WHAT CAN BE SALVAGED?

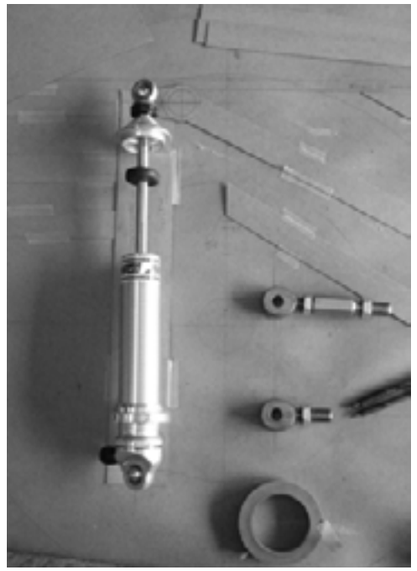
So the tear down begins: we stripped all the salvageable sheet metal off the truck in preparation for alkaline dipping to get everything super clean and rust free. After most of the sheet metal was removed, we could now get a good look at the chassis condition—it wasn't usable.

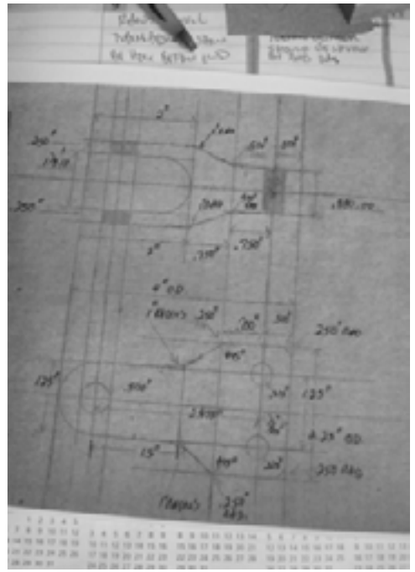
We did not strip the bed because it was so badly damaged. Instead, we opted to duplicate it from scratch.

CHASSIS

PROPER DISTANCE

The initial mock up of the wheelbase was done with the original cab and the new bed that we fabricated on jack stands. We played with the rear wheel location and moved it further back than the factory location. The original truck wheelbase looked strange with the bed hanging off. We are definitely traditional in the mindset of engineering and design and not savvy with solid works or drawing on the computer. We have to transfer what is in our minds and work it out with pen and paper. We knew that some of the components that we were using were larger than life including the Dana 70 8-Lug rear end and the Arias 498 Cu. In. V6 Hemi. The zoomie tubes would also be large measuring in 2½" in diameters. We wanted the frame to match the proportions of these larger components so the frame didn't look like a little tooth pick T-bucket chassis in comparison. The customer requested a double tube chassis and left it up to us for the overall design. We started laying out the frame full scale on cardboard from the top view and the side view. We made the wheel base line up from one to the other so we could easily reference both views. We also located the track width as well from the top view. We wanted the frame to hang down under the truck as much as possible for a look we had in our heads and we visually knew where that peak was and wanted the ladder bar pickup point to be going through that point. All great chassis designs are built around the location of the suspension pickup points and not the other way around. Building the frame and then locating the pickup points is backwards. We found the correct spec'd double adjustable Afco racing coil overs and engineered the suspension compression and extension all in full scale. We also designed all the suspension brackets and components the same way. We made the bracketry adjustable so the ladder bars could be adjusted to change the instant center which would allow for adjustments to be made to get it to hook up better on the track.



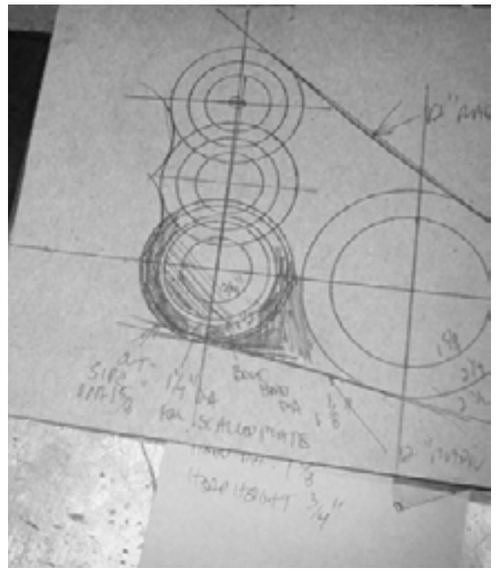


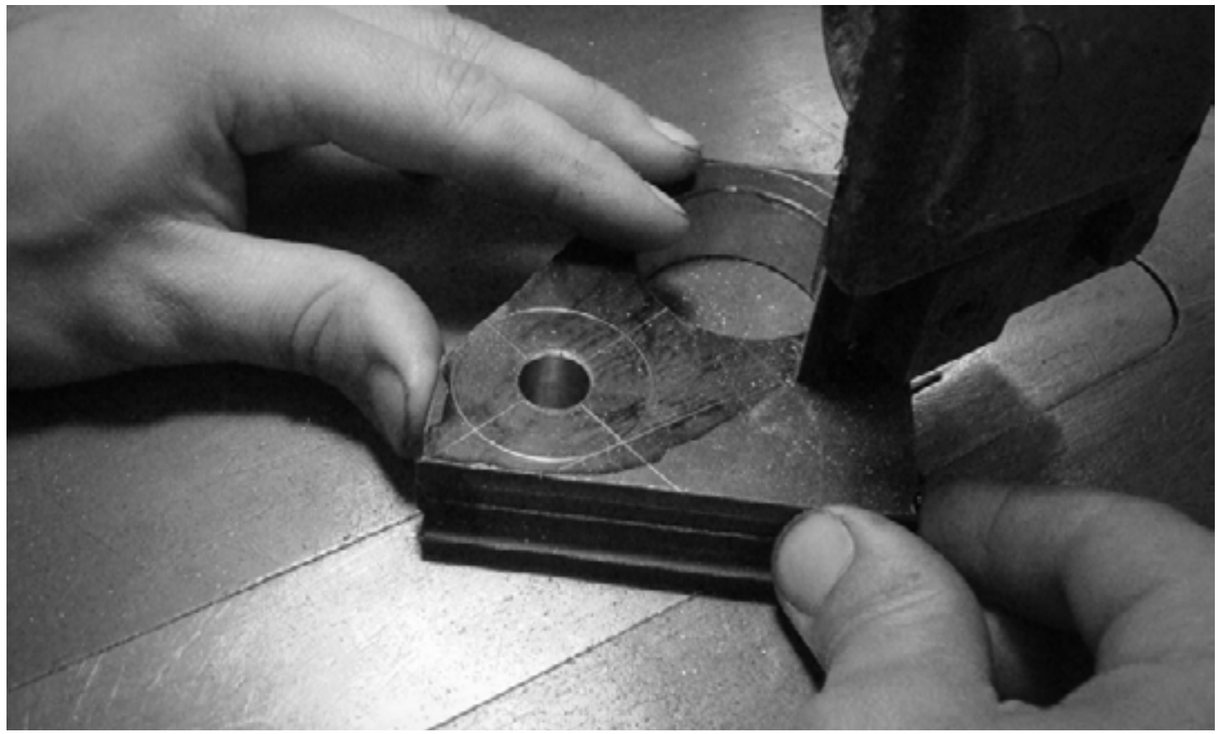
"We call it CAD: Cardboard Aided Design."

SUSPENDED

All the suspension brackets were drawn to full scale. We designed all the brackets with multiple suspension adjustment holes to be made out of 3/16" plate but wanted to keep them lightweight so made a "scallop plate" to reinforce those areas for a higher shear strength. The scallop plates were TIG welded to the main brackets. Every radius and diameter was careful selected to have the correct amount of weld area and so that the rod ends and washers all fit correctly with proportioned spacing were making them aesthetically pleasing when assembled. We manually machined all the holes and cut out all the brackets by hand on a bandsaw. The offset shock brackets were EDM cut from a solid piece of billet steel. We offset the shocks so that the upper mount hole bracket was in-between the ribs in the bed floor, which allowed us to place the shock between those ribs.

Precision manual layout to determine correct spacing and aesthetically pleasing finish washer diameter spacing.

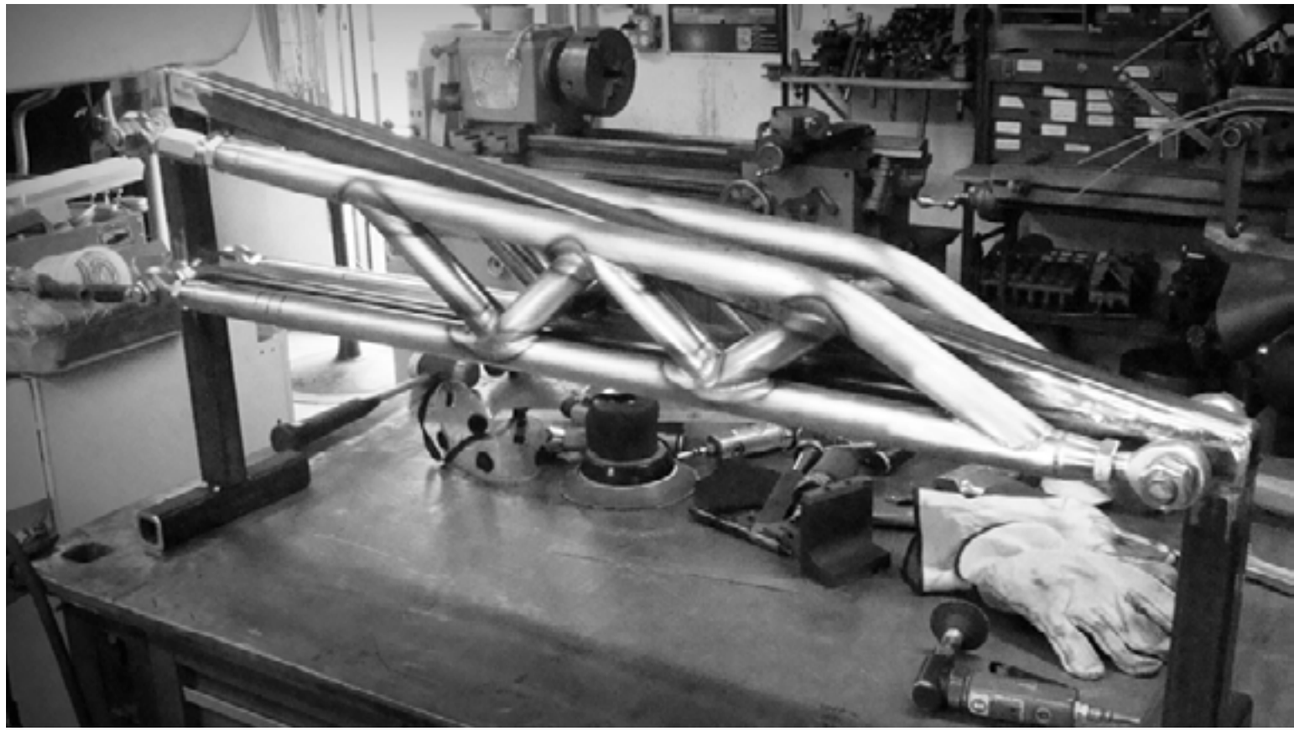




BUILDING LADDERS

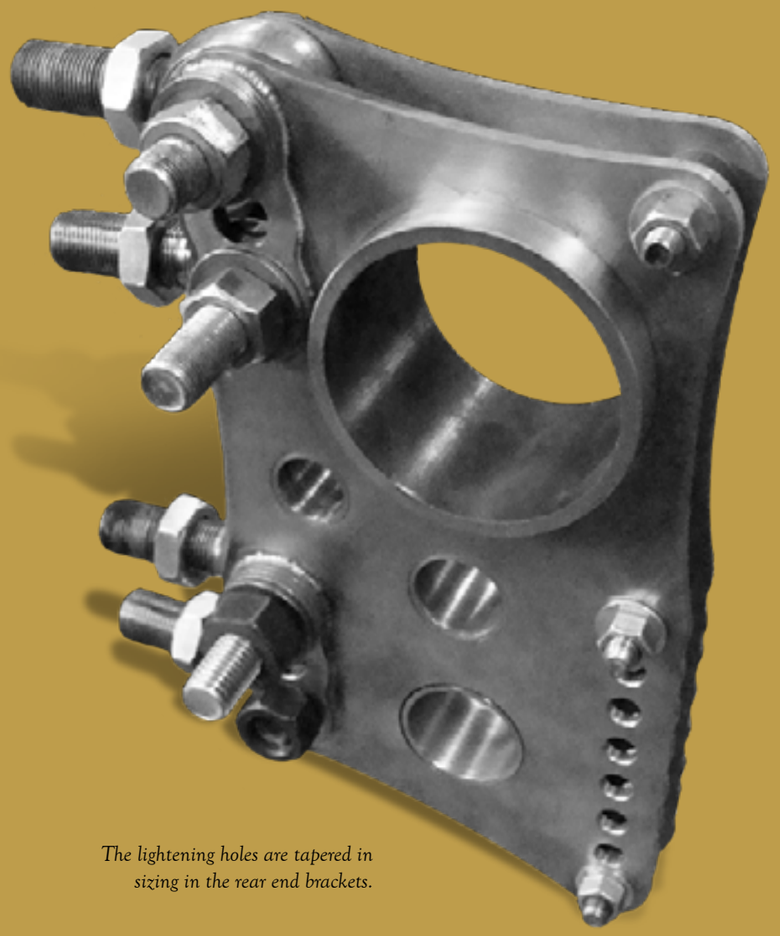
We made the ladder bars from 1¼" OD ⅛" wall 4130 Chromoly Tubing. We made a fixture that both ladder bars could be fabricated simultaneously. Each tube was cut and fit in pairs. We modified the weld in bungs by machining off the hex nuts since they were being used in a stationary setting. This is an extremely strong design taken from the aircraft world. This design is carried through to the frame and adds a high level of difficulty and additional planning double notching regarding logistics when it comes time to the frame fabrication.

Notice the detail of making the centerline of each gusset tube line up with the previous tube. This detail will be a prominent feature engineered into frame.

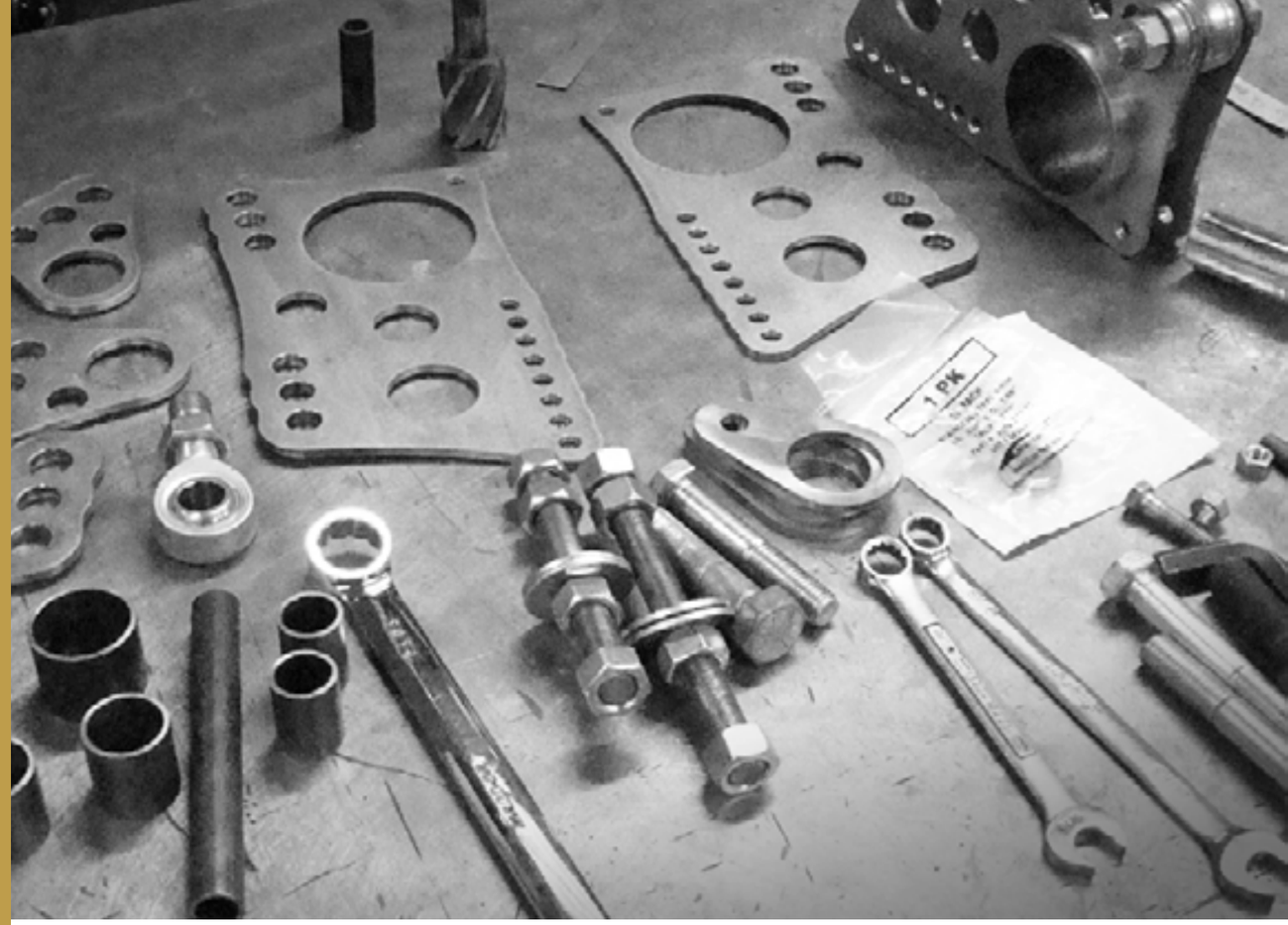


HOLES IN THE DESIGN

This is the build-out of the rear end housing brackets and the front ladder bar brackets. The edges were wrapped in 1/8" plate and the rear end brackets have a slight inset radius. The front ladder bar brackets were wrapped as well with 1/8" plate and were hand-formed and TIG welded.



The lightening holes are tapered in sizing in the rear end brackets.



MAKING TRACTION

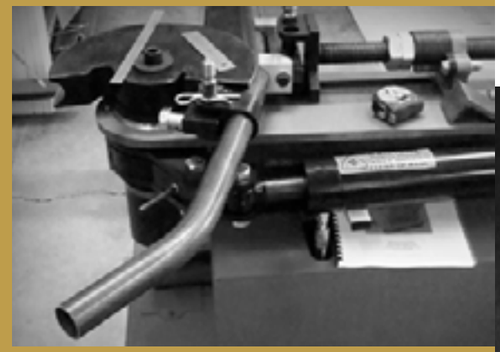
The wheels that the customer supplied to build the truck around are vintage magnesium Halibrands. The front wheels are spindle mounts and the rear wheels are an 8-lug bolt pattern. The customer located a Dana 70 out of a Dodge Dually that we narrowed. The front wheels are spindle mounts but we were unsure what spindle they fit so we did some research and with the help of the historical department at Speedway Motors; they had an original wheel advertisement from Halibrand with these wheels and it listed what spindles they originally fit as options. We looked up the easiest one to find on the list for a '40 Ford and checked the specs of the races and it matched up. We had a set of spindles laying around and ordered up all the bearing, races and seals and Bingo! We were in business! '40 Ford Spindles it was! Then we could start engineering the front axle.

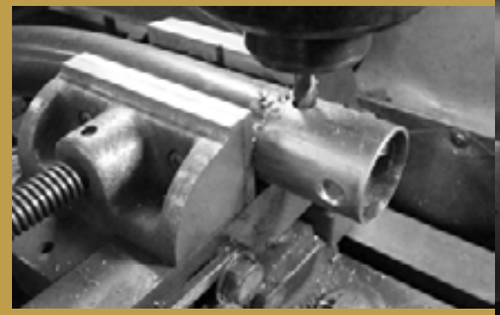
It doesn't get any better than a pair of Vintage Halibrand Mags with Hurst Pie Crust Slicks

Notice the sequence the tubes needed: there was only way this could have been assembled

GETTING TUBULAR

We started by building the frame's top level, if you will, of the double tube chassis. We bent up each section from the full size drawing and located it based off the center line of our frame table. Continuing to bend tubes to make the perimeter of the frame. We also had to add the kick up for the rear end travel and shocks. All the seams were sleeved with custom machined sleeves and plug-welded. The rear upper shock bracket was slipped over the main cross tube before the tube was fully welded. The tubes were strategically placed to have one corner transfer into the adjacent corner. Also note that the tube center lines line up and all the tubes are double notched. We made a sleeve to fit in the tubing so we could telescope the ends and fine tune the notches. Then we transferred those dimensions and the length dimensions to get the tubes to fit just right.





We kept notes of all the notched bend angles to help us move forward when it came time to do the lower section of the double tube frame.

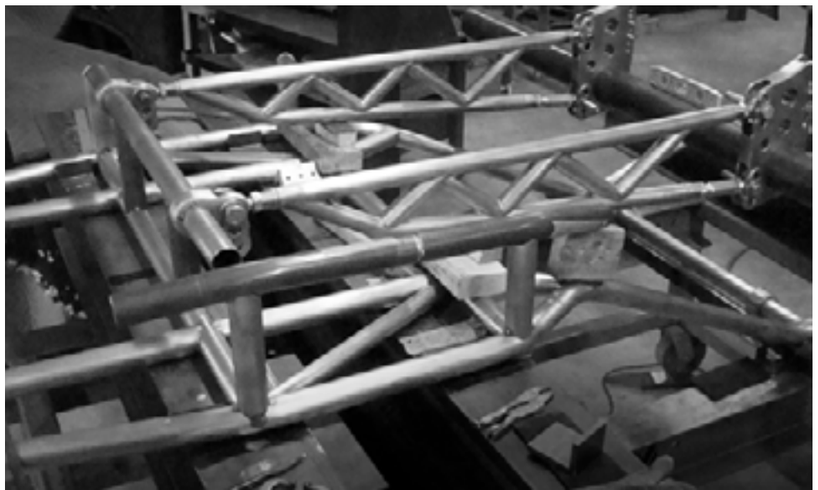
THE RIGHT ANGLE

After we built the top of the frame, we removed it from the frame table and finished welding a few hard to reach spots on the bench. After we got everything centered, square and level, we locked it down to the table with some welds. We began in the torque box area and added an upright and located the height at that point and then moved for and aft, locating the height of each up right. These points would add the beam height to the frame for strength and are also the pickup points for the front and rear suspension mounting points as well. When we had all those points set we began mocking up different bends to see how it was all going to work.

Our challenge was index or rotate bend to keep it plumb and parallel with the top tube (*or lower tube in the photos because it is upside down*). After we had it figured out, we bent up some more accurate sections to check our rotations and to double check the tangents. After we had all the bottom main tubes bent up we machined sleeves to slip everything together. We made up temporary fixturing devices to hold the bottom in the correct locations while notching the other uprights and diagonals. The two main tubes taper to the front adding some unique challenges to the sequencing of the notching, fitting, and ultimately the installation. These uprights are a smaller diameter tube measuring 1¼" .083" chromoly tube and the diagonals are 1" .083" chromoly tubes. The frame tapers so the notching angle is different from top and bottom and they have to be slipped in from only one direction. We also utilized our telescoping tube mock-up tool to figure out each double notch.

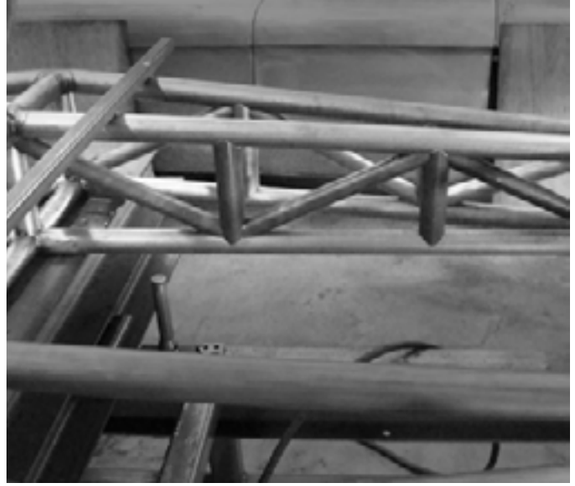
Notice the diagonals are double notched so each one of those has to go in from the one direction: this was the only way to complete the puzzle.

We set out to completely re-fixture the completed top frame section upside down. We did this to build the lower level of the double tube chassis.

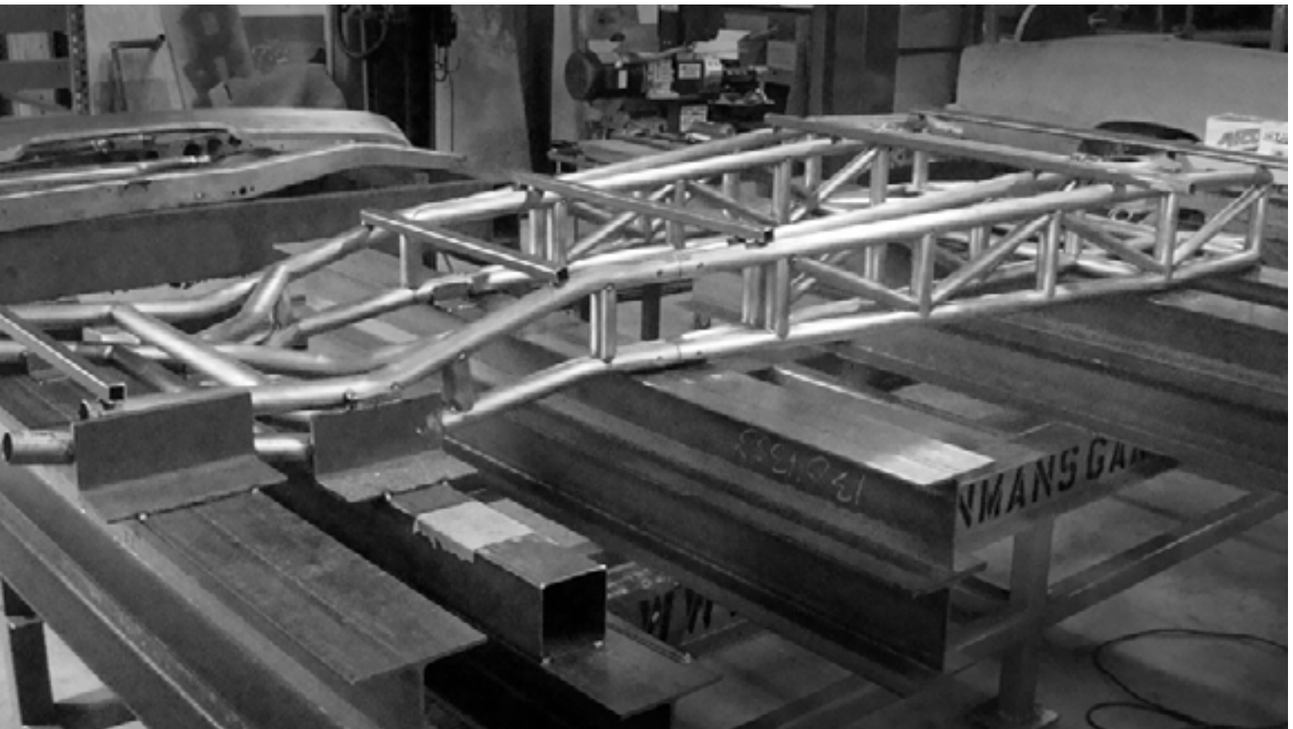


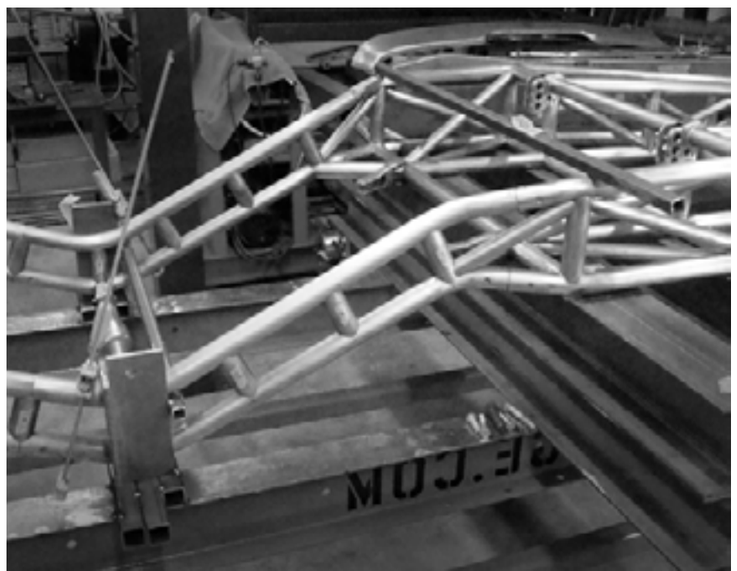
WORKING UPSIDE DOWN

After all the upright and diagonal tubes were fit to the bottom of the frame, it was tack-welded in its correct location with fixtures. The upright 1⅝" Chromoly tubes were first tack welded and then the diagonals. All the uprights and diagonals were fully welded to the one half of the frame. This is the time that some of the tubes would not go in because of the frame tapering to the front. So we planned for this by removing the top (actually bottom) of the frame and setting it on the bench. We cleaned all the tack welds and welded all the areas that could not be welded on the frame table and we also dropped those last few diagonal tubes in place. We then re-fixtured the frame and final welded all the uprights and diagonals to the other half of the frame. We then began fabricating the bottom or lower section of the rear double tube frame which was a little easier since the top section was already done and we just had to mimic it at the correct height.

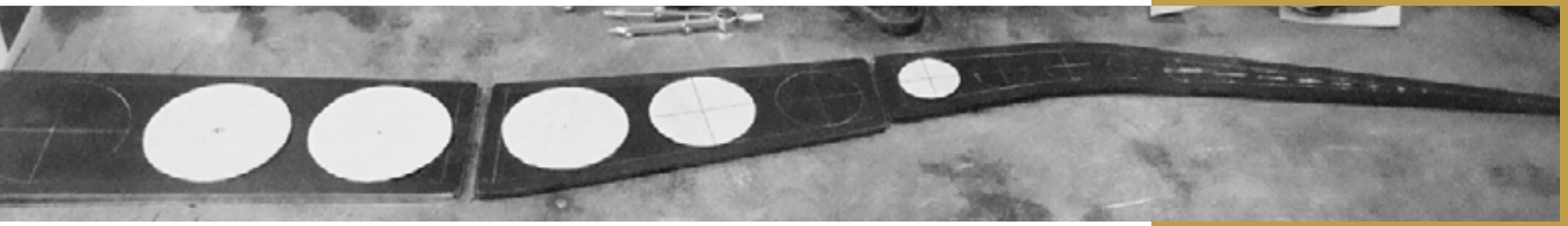


"We mimicked the original front crossmember in both the top and body tubes for a design element like the original frame."





It was definitely confusing and challenging at times to build the frame upside down.

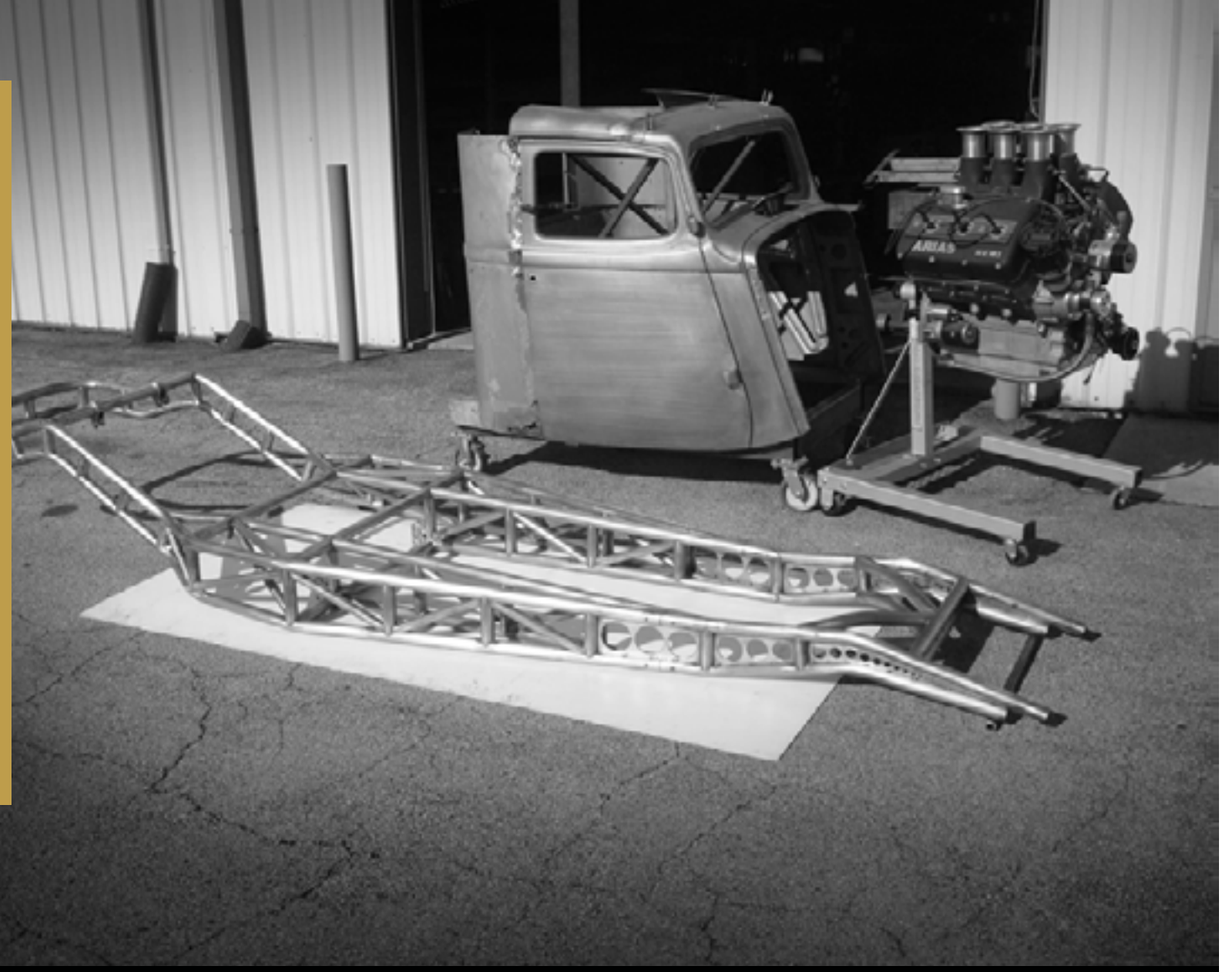


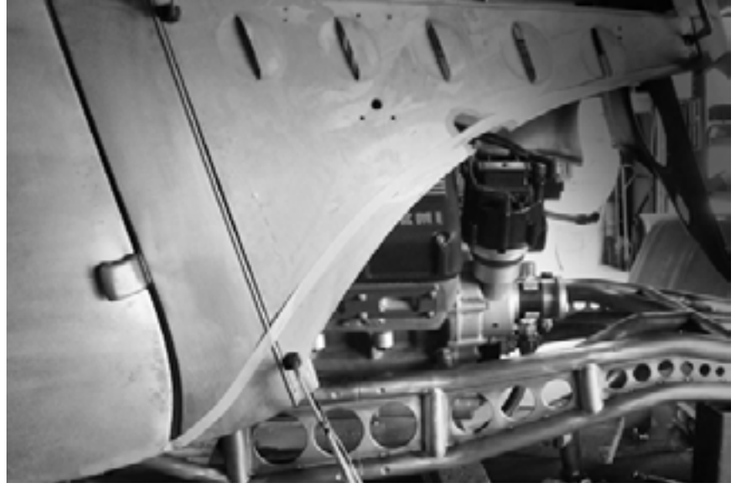
Notice there is the same amount of space around every single hole laid out on the tapering plate. Every single hole is a smaller size than the one before it.

Filler plate with lightening holes that connects the two halves of the frame at the K-member and T-intersects the side plates.

LIGHTEN UP

Laying out the lightening holes on the front frame plates: Each hole is a different size so there is the exact same amount of space around every side of the hole top, bottom, and side-to-side all the way to the front. Each hole that we did not have a drill bit for was manually machined in the Bridgeport with a turn table. The back torque box areas got their final diagonal tubes that needed to clear the ladder bars through compressing the suspension.





We dissected as little as possible to try and get the engine to fit, but you can see we had to cut a large area of the cowl off and the hood side just to clear the valve covers.

"We weighed the frame at this stage and it came in at an impressively light 270 pounds."

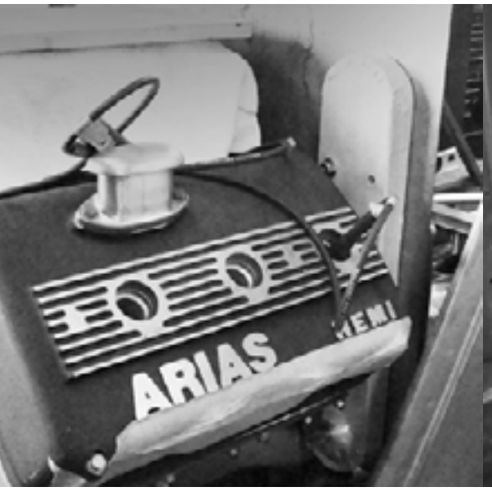
RIGHT SIDE UP

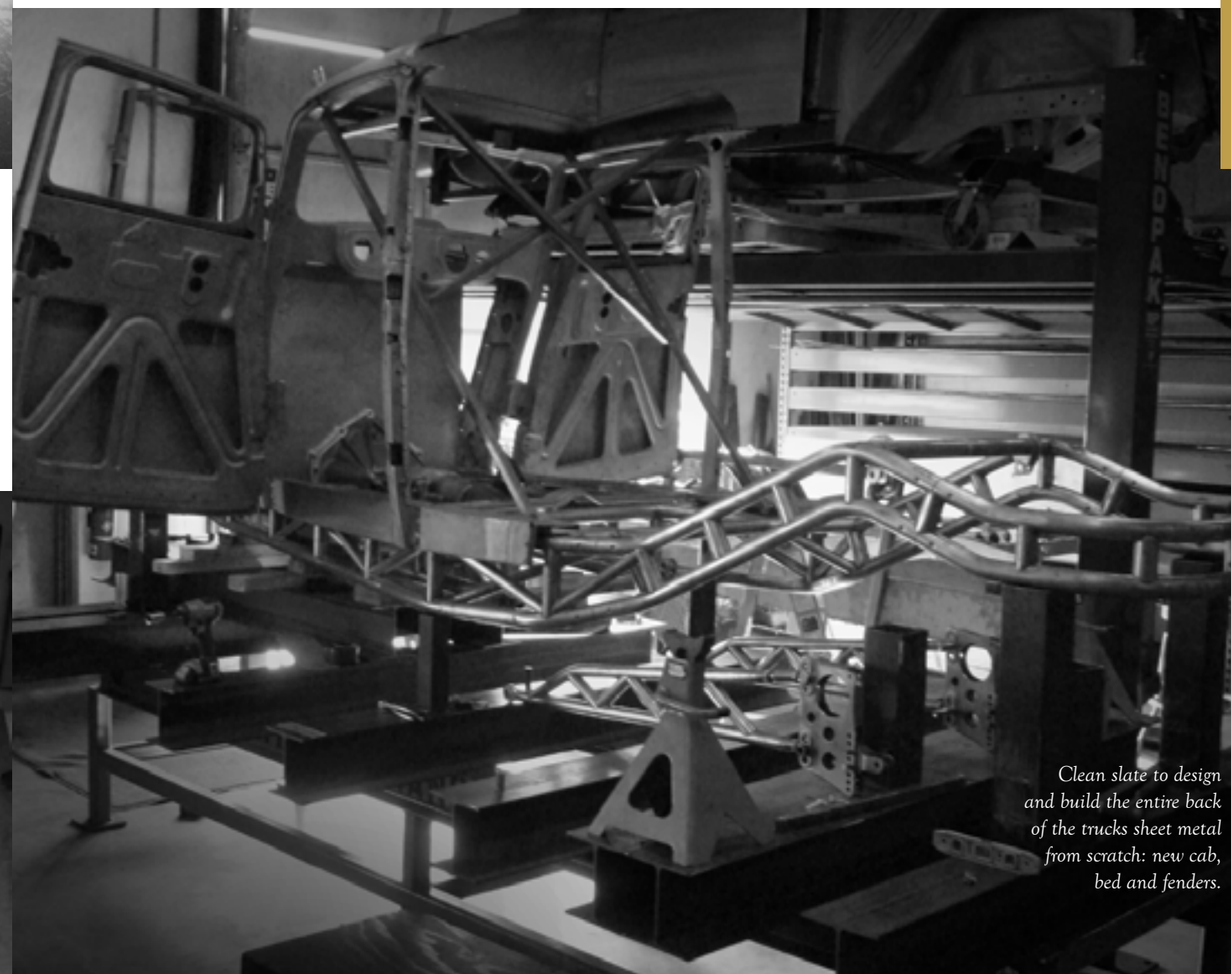
The moment of truth: cutting the upside down frame off the table and getting it into the day light with its future components. The 498c.i. Aluminum Arias V6 Hemi Monster and the original '36 Willys Cab. We set up the frame at ride height on the table. We located the cab and the bed roughly and mocked up the rear fender and wheel to see if our measurements were close and they were on the money. We took a lot of time mocking up the engine's location. This was critical because of the modifications to the front-end sheet metal that were going to be added as we made our way to both the front and rear of the truck—all while being mindful for the driver space. We finally found a happy medium and pinned it down with a temporary fixture.

Setting everything up and making sure it all fit like we planned: fine tuning the engine location for maximum interior space and front-end sheet metal clearance.

ENGINE MID PLATE

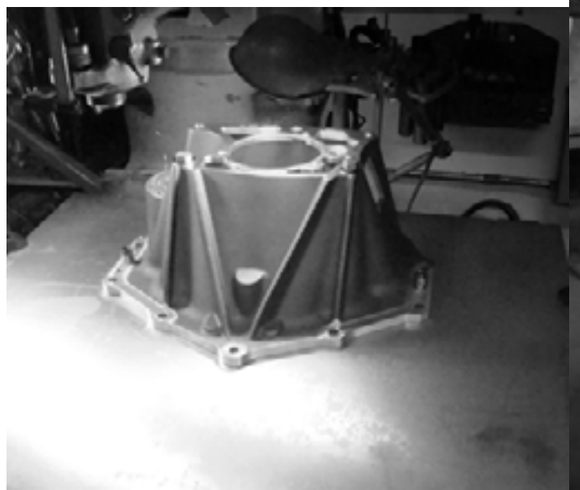
We made a cardboard pattern to get the rough exterior foot print of the mid plate. Because we were going to incorporate this into the body by making it flush mount with the sheet metal, we needed to make it fairly large. We transferred all the measurements from the engine to the 1/4" 6061 T6 aluminum sheet and set it up in the Bridgeport for machining. We fabricated the main cross tube and welded in some bungs that we machined to keep the socket head bolts flush on the face of the tube. These bolted to the bottom of the mid-plate and the cross-member is welded to the frame.





Clean slate to design and build the entire back of the trucks sheet metal from scratch: new cab, bed and fenders.

Laying out mid-plate mounting holes to the frame and engine dowel pins for bell-housing.

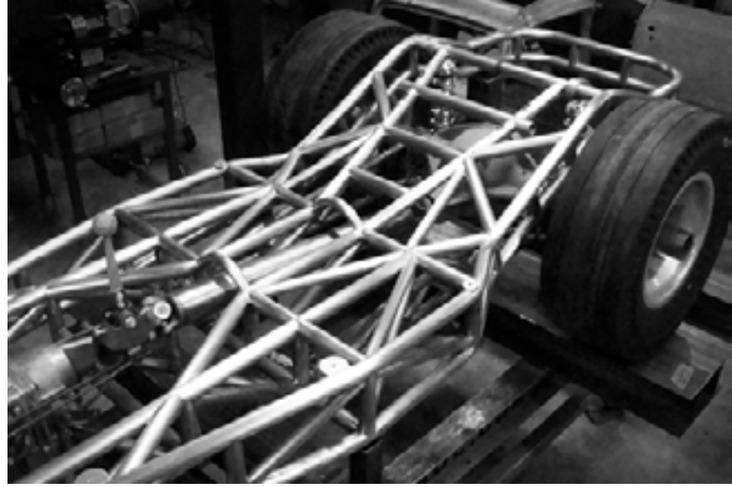


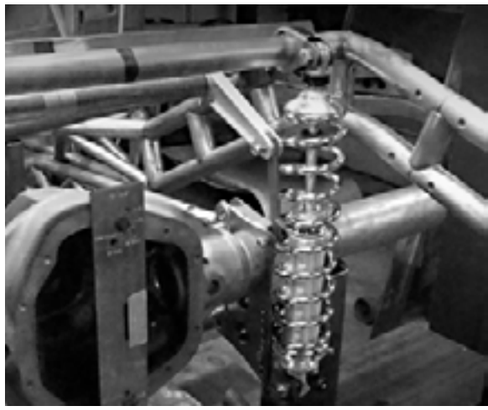
REAR SWAY BAR

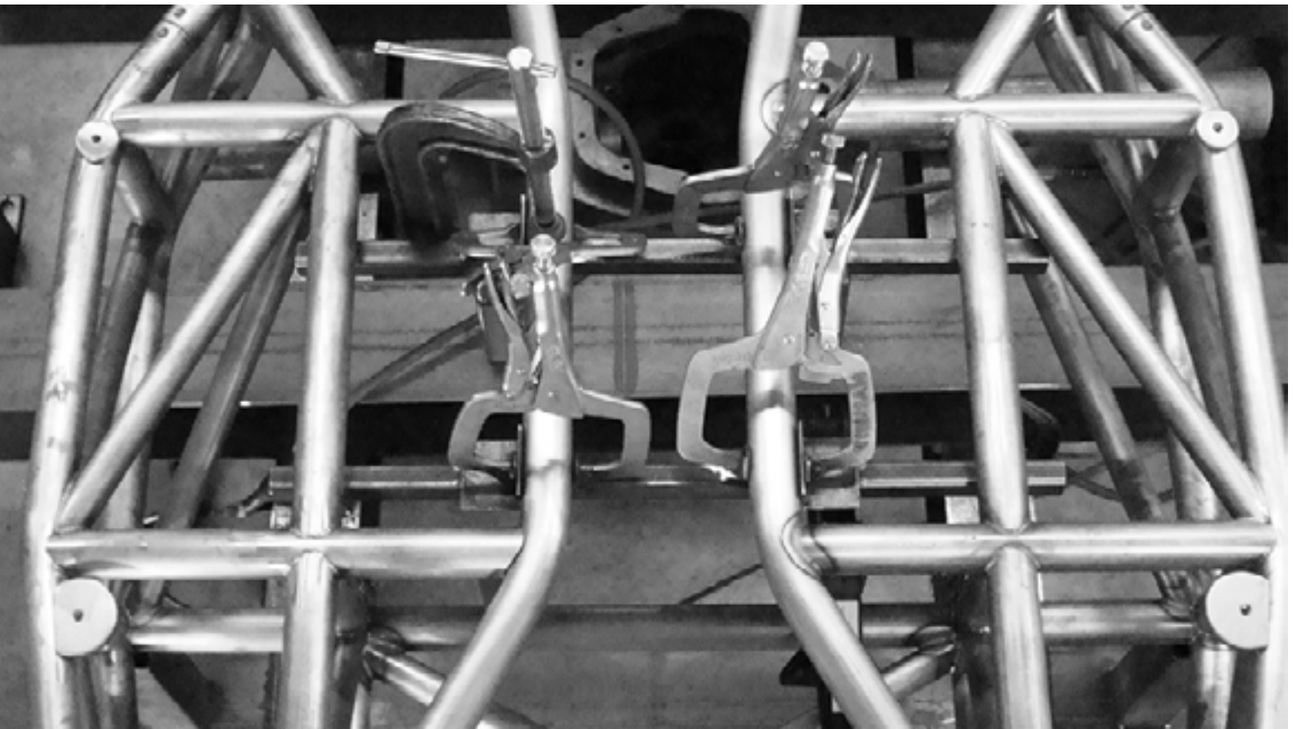
We manually machined these coupler brackets that bolt the tubes together so we could drop out the cross member that the sway bar fits inside. This allows removal of the torsion bar. With the clearances being so tight with suspension travel, this design would make everything fit in a tight package and remain removable for servicing. We located the sway bar torsion tube with a temporary fixture and made the tubes that run along side the driveshaft come up and through the tube itself.

Detail of custom machined in-line tube couplers.

Keeping the two main center tubes low profile and tying everything together from front to rear

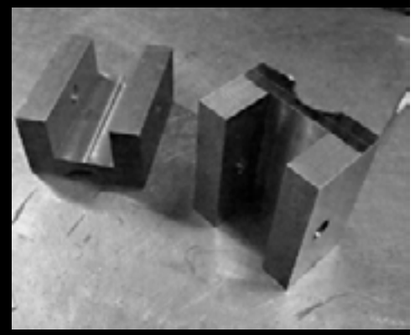


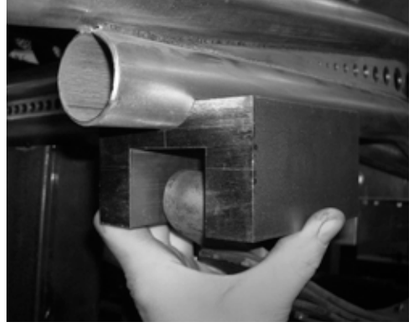


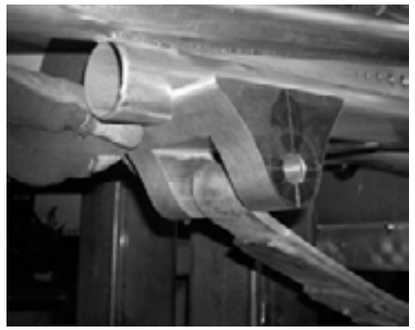


STARTING BLOCKS

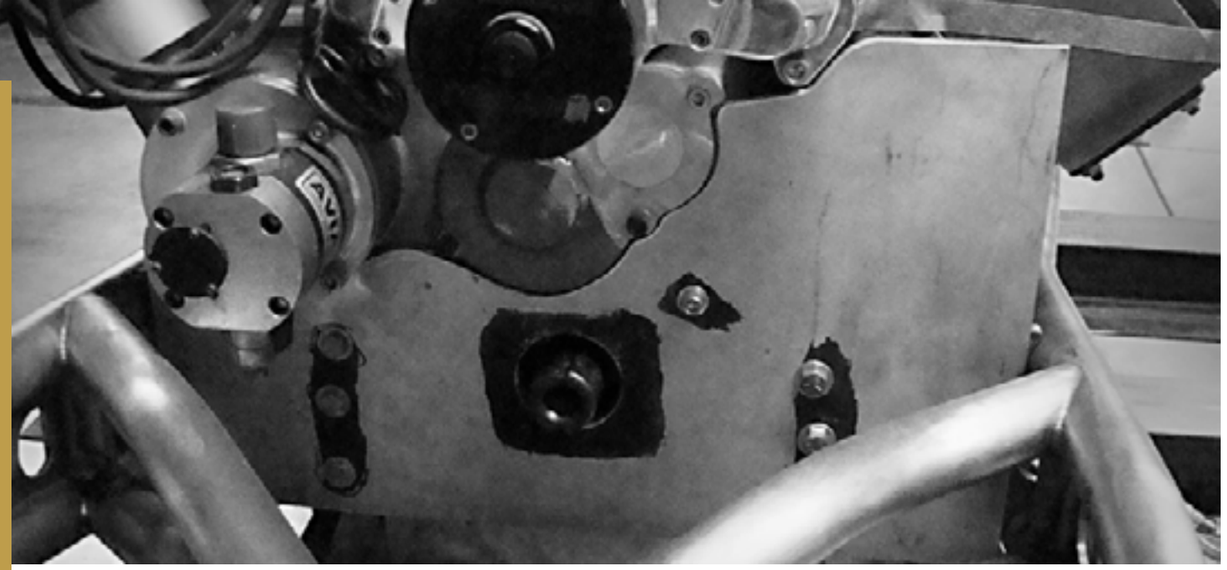
We started with a solid block of mild steel and machined the spring pocket out first and the radius to match the frame. The sizing was *yet to be determined* so we wanted to start off on the large side and just keep whittled away material until we had something elegant for the front spring perch bracket. After the rough machining was completed, we cut out the profile with the vertical bandsaw. Then we machined the angle on the top to blend into the top of the frame tube. After a quick mock-up, we decided we needed some matching lightening holes drilled. We fabricated our own rear shackles as well. Once the rear shackle mount was located, squared and welded, we were able to install the brass bushings in the front spring mounts we machined. Then we installed a solid $^{5}/_{8}$" rod to help measure and square up the front springs. We then machined four half-round caps. Then we cut the horns back and TIG welded the caps to finish off the front frame horns.







"Creating something functional yet attractive is always our motivation"

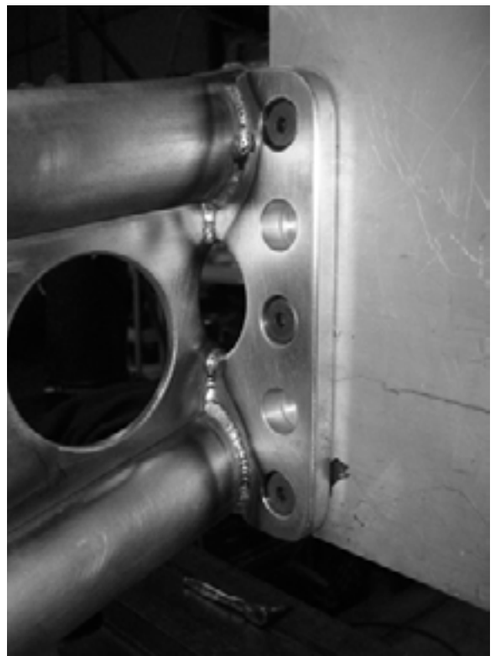


PUSH-BAR FABRICATION

Everything was designed slightly larger on this chassis. With the massive sized engine that is wider than it is long and with the 2 ½" diameter zoomies, the Dana 70 axle tubes are 3½" in diameter. We utilized the mock up tube for the rear suspension fixture and fabricated the traditional style push bumper with it. We then machined half round spheres that slid in the end of the tubes for a cleaner more modern take on the traditional threaded pipe cap used on some vintage gassers. We also machined in-line tube mounting brackets similar to the rear sway bar mounting brackets. After everything was located and tack welded, the brackets and push bumper were final welded.

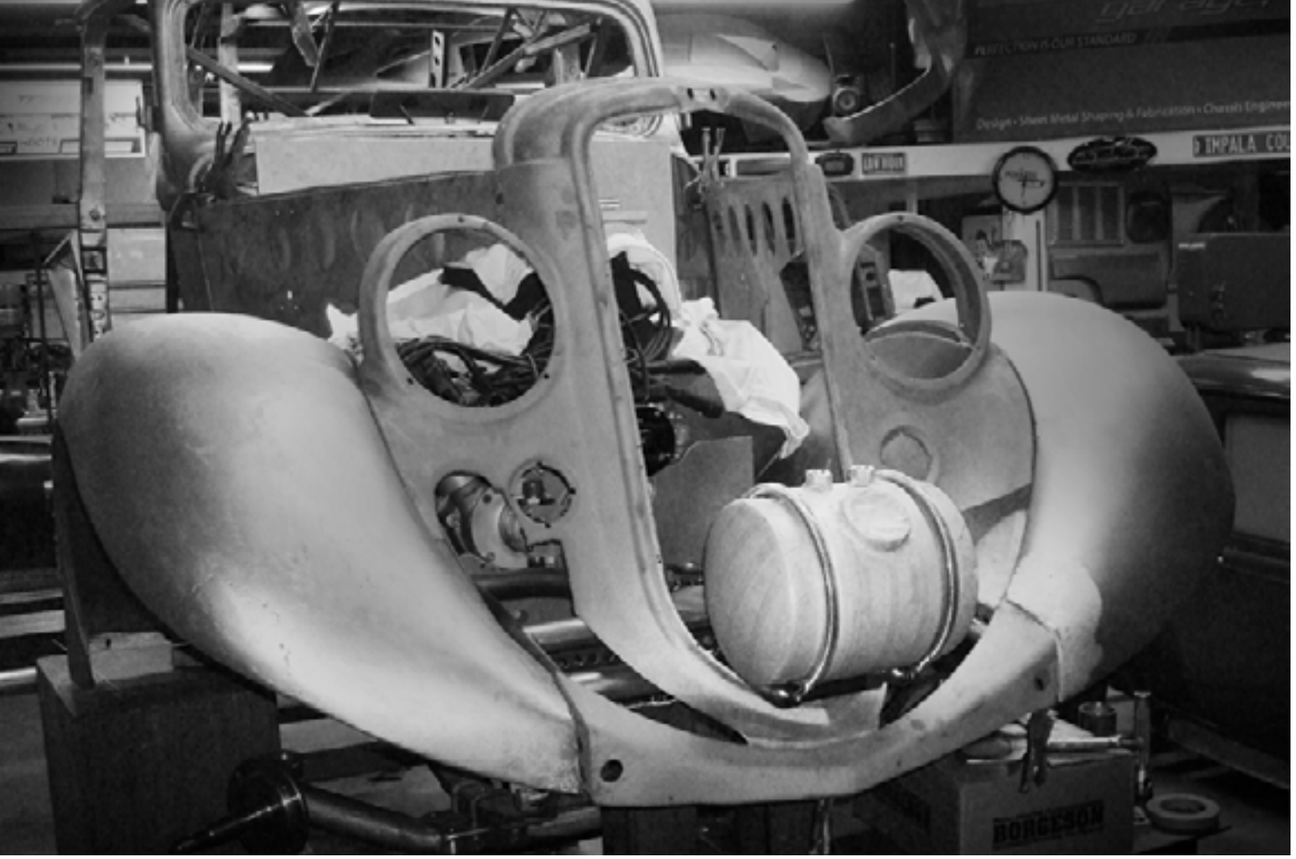
FRONT MOTOR MOUNT PLATE

Continuing the counterbored bolt theme, the mounting brackets echo the same size bolt holes as the lightening holes in the front motor mount plate. We left the mount plate oversized in case we needed to mount brackets off of it for accessories driven off of the crank.



Notice the lightening hole lines up with the motor plate bracket and with the lightening holes in the side of the frame rail.

Contemporary design for a traditional component.



If you found out what it does, we would have to kill you... It's top secret!

MYSTERY TANK

Mystery tank? What could it be? Where does it go? No gasser would be complete without a Moon Tank.

We wanted these mounting brackets to be much cleaner and less bulky than the traditional style brackets. Nesting the tank as closely to the grille and front sheet metal was critical to get the neat and tidy look of the front end we were after.

We bent up some tubes with a matching radius of the Moon tank and machined some half round end caps similar to the bumper and the front frame horns. We threaded the ends and installed cast stainless rod ends that we ground and polished smooth. We then machined some smaller in-line tube mounting brackets similar to the push bar and the sway bar mounts. This allowed us to tuck the tank really tight up against the grille and sheet metal.

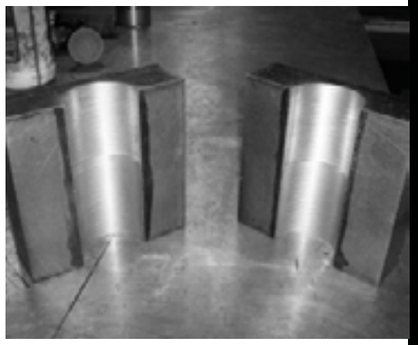
FUNDAMENTAL BLOCKS

We wanted to mimic the design of the front spring mount with the spring perch mounting. We also wanted a place to mount the sway bar link to as well as the shock mount tabs. So we engineered the mounting bracket to be wider then they typically are for this very reason.

This was another *machined manually* kind of project. This time we whittled a couple sample mock up pieces from wood just to make sure what we were envisioning what was going to work out. We used the Bridgeport vise to center and level the axle. We then ground the inside corners of the mounting pads to clear the radius of the tube in order for the brackets to fit parallel to one another. It took some time to get everything just right and to make sure that the center line of the springs were correct and parallel. After we tack-welded the spring perches, we mocked up the axle under the truck to verify fitment.

Custom tube axle spring perches.

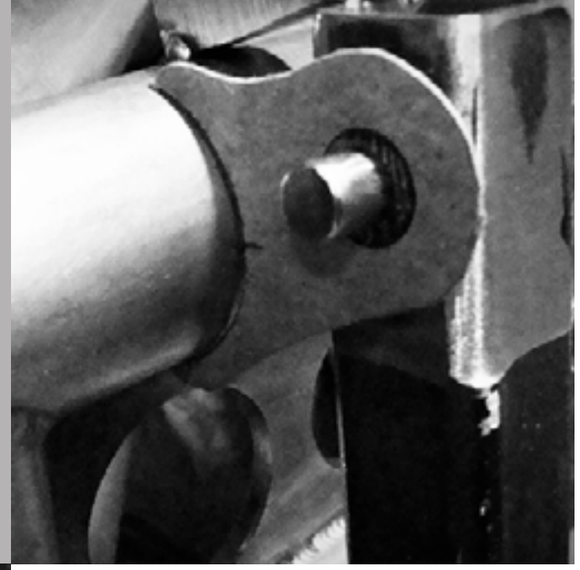
Spring perch counter-bored holes for axle u-bolts and sway bar/shock mounting bracket.



Utilizing the Bridgeport vise to locate and then tack weld the axle mounting pads to the axle.

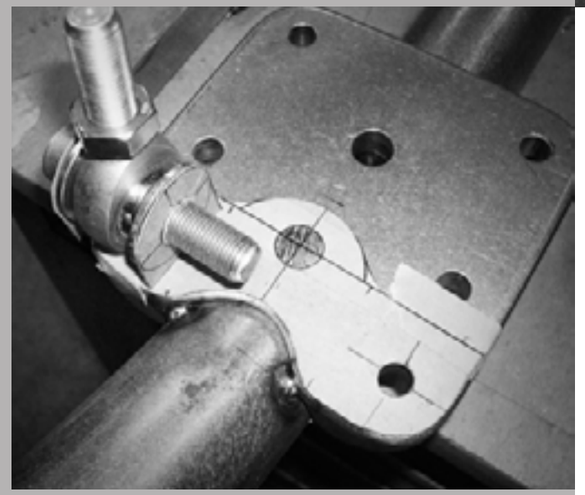
SHOCKING

Fabrication of the shock and sway bar mounting tabs: we wanted to create a bracket that looked very natural and blended off of the axle mount pad ergonomically. Figuring out just the right spacing and allowing it to bolt on through the existing flat mounting surface leads to a super clean simple looking bracket when completed. We made it removable for serviceability and flexibility to make future adjustments or modification with suspension handling.



KEEPING TABS

We fabricated the sway bar link ends from chromoly and mocked up the shock install height. Utilizing a strut made out of square steel tubing helped keep everything straight and square. A conscious effort was made for the large surface area of the brackets and how much they wrapped around the tube for strength after fully welded.

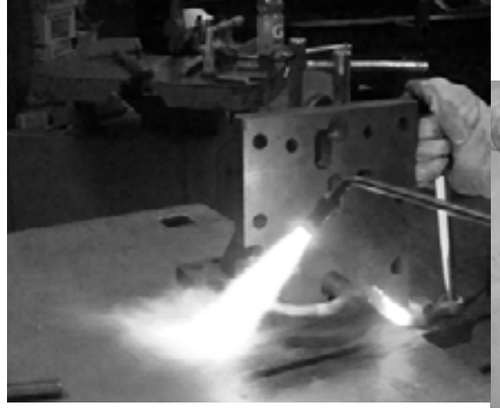


Utilizing some more counterbore fasteners in the double duty shock and sway bar link bracket. Closeup of metal fit up for weld penetration on outside welds.

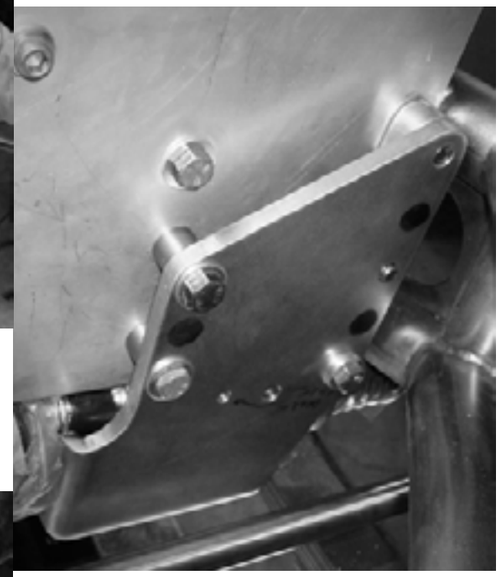
Close-up of bracket with mock-up hardware for welding purposes.

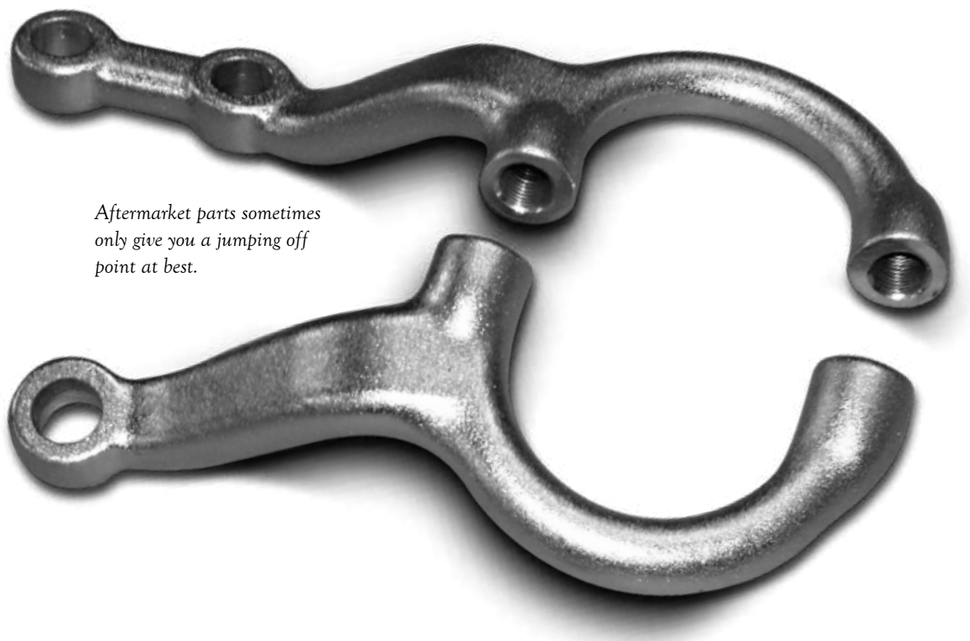
FORGED BY DESIGN

The steering arms would not fit around the top of the welded-in boss for the kingpin on the custom tube axle, so we had to weld threaded spacers to the ends and smooth the welds out to make it look like one piece. We wanted to mount the steering arms on the top rather than the typical location on the bottom so it would keep the single-sided rack and pinion up nice and tight. When we mocked everything up we thought it almost gave the illusion that there was no steering system because it was tucked up so tight to the engine and all you saw was visible was the axle. In doing so, it changed the steering axis inclination angle, so we made a fixture to move the tie rod and drag link holes over the amount of the spacers and heated the steering arms and moved them over and bolted them down to the bench while they cooled in a quickie fixture we made up. The passenger side with the tie rod and drag link was a little more difficult and it was a two step heating process to bend it one direction and them kick it back for the second hole. After the brackets cooled, we ground and polished all the casting marks out and smoothed them both for chrome plating.



Correcting turning geometry with new top mount spindle location.





Aftermarket parts sometimes only give you a jumping off point at best.

HOLDING TIGHT

Fabricating the bracket for the single sided rack and pinion: There was just enough room to wedge the rack and pinion in front of the oil pan. We engineered a bracket to properly support it off of the front of the forward engine plate.

There was fortunately just enough room to squeeze the rack & pinion in front of the oil pan.

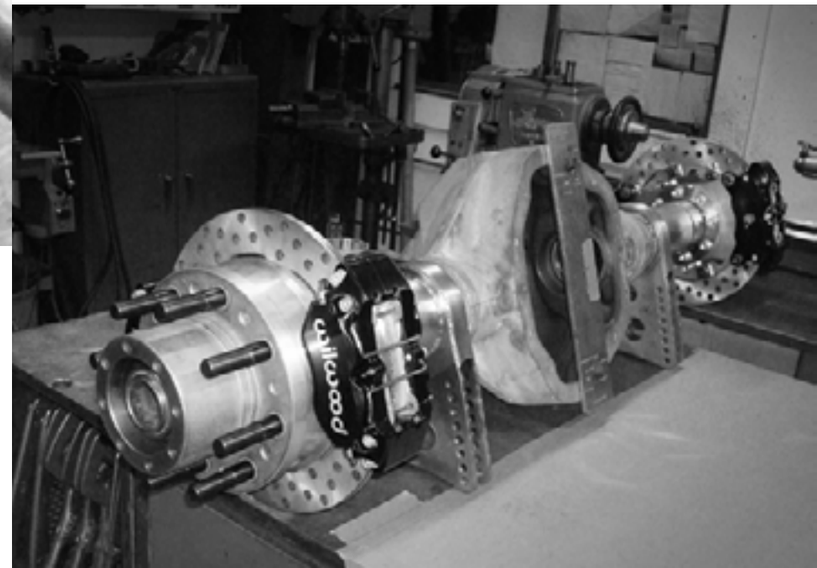
NO FRONT BRAKES

This was our inaugural project with our now established partnership with Datum Tool. We worked with owner Mike Long to figure out the necessary clearances for the caliper and getting everything to bolt up correctly. We also machined the bat wing brackets that were welded to the rear end housing. We cut down the rear end housing and mocked everything up to verify correct measurements with the brakes, hubs and wheels. We modified our narrowing fixture with some sleeves to fit inside the snout to straighten the housing after all the welding was completed.

Vintage spindle mount front wheels led to the decision to run four Wilwood four-piston calipers on both sides of the Dana 70. The original spindle mount wheels were never set up for front brakes when they were originally used. Keeping the nostalgic attributes alive with these key vintage components was important to the build and additional steps were taken to create a delicate balance of old and new.

The original spindle mount front wheels were never set up for front brakes when they were originally used. Paying homage to nostalgic drag racing from years gone by, we opted for something different.

This 8-lug Dana 70 rear end is a beast fully loaded: Full-floater, custom hubs, rotor hats, Wilwood stainless steel rotors, and four four-piston calipers are located with custom bat wing brackets to give this Willys its much needed stopping power.



SPINDLE CAPS

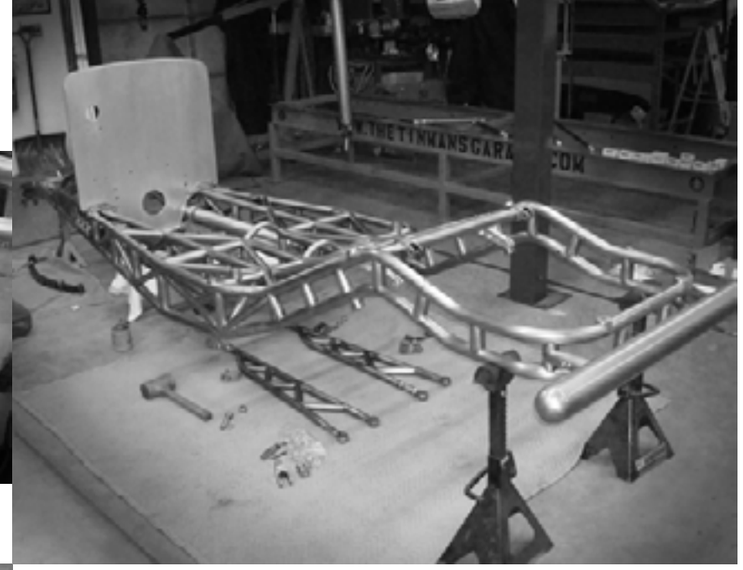
We machined the casting marks and lettering off the axle ends, then smoothed the rear axles to have a nice radius dome on the ends. We designed the front spindle dust caps to have the same look. We machined a test tube with an o-ring to find just the right sizing and snug fit. After we had a good sample, we measured it and drew up the dimensions from the sample and designed a complimenting radius to the rear axle ends that were smoothed. We had the new spindle caps CNC machined from Datum tool.

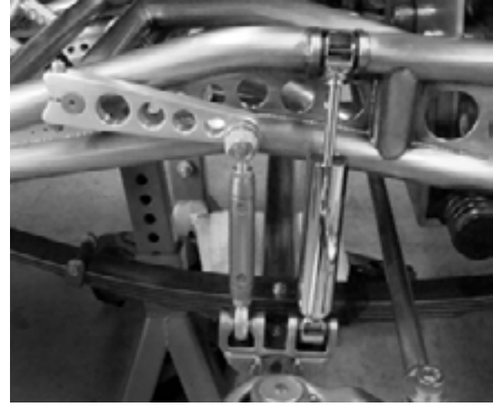
Mock up tool to test o-ring size to hold on cap when designing spindle caps for machine shop.

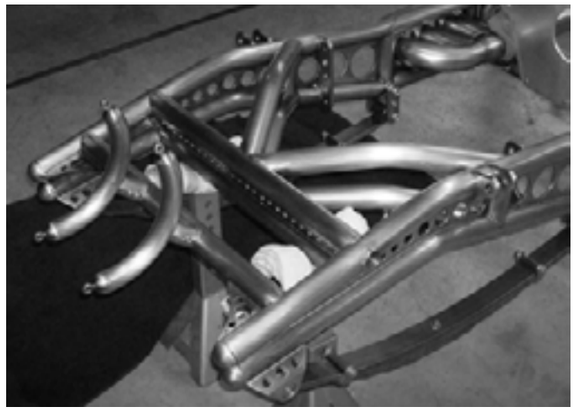
Machined spindle caps accent the Dana 70 Axles smooth dome shape.

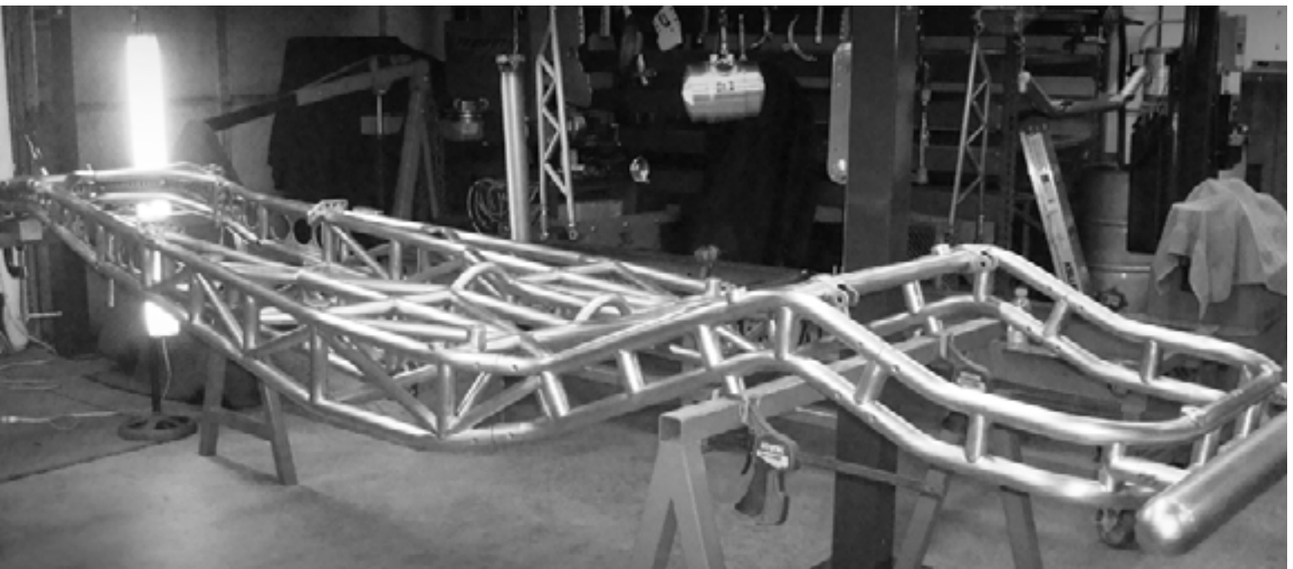
PUTTING IT TOGETHER

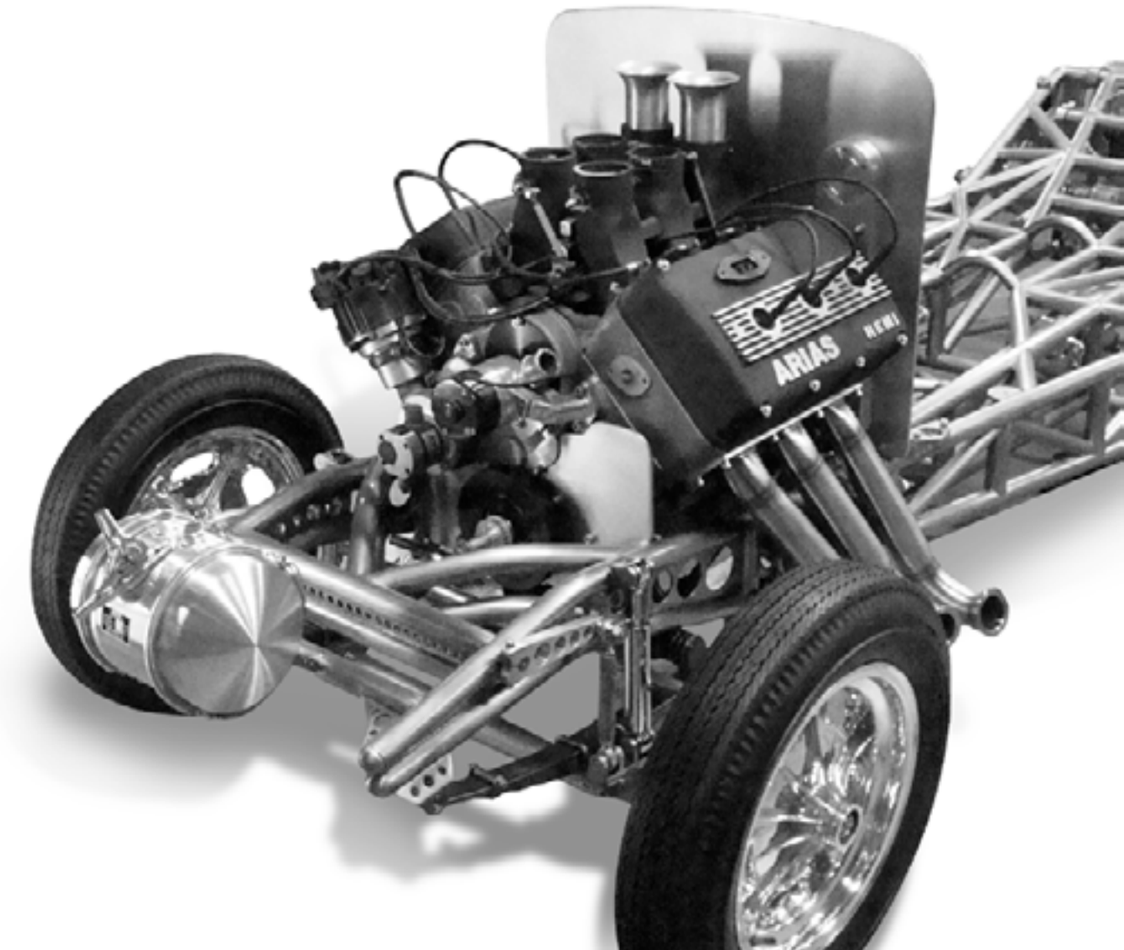
With close to 2,000 hours in the chassis build, it was time for final assembly. We cleaned everything with Scotch-Brite pads and coated the frame and all its components with Shark Hide metal sealer and assembled it. It was an exciting moment to finally see it all together for the first time and we all looked forward to getting the cab and bed going.





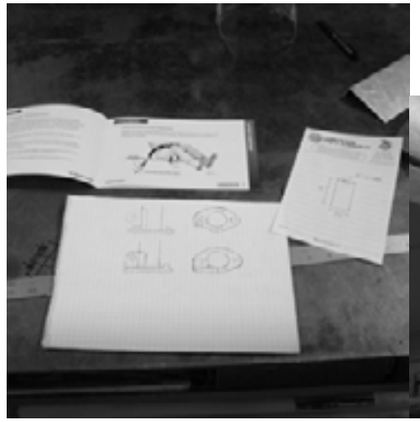




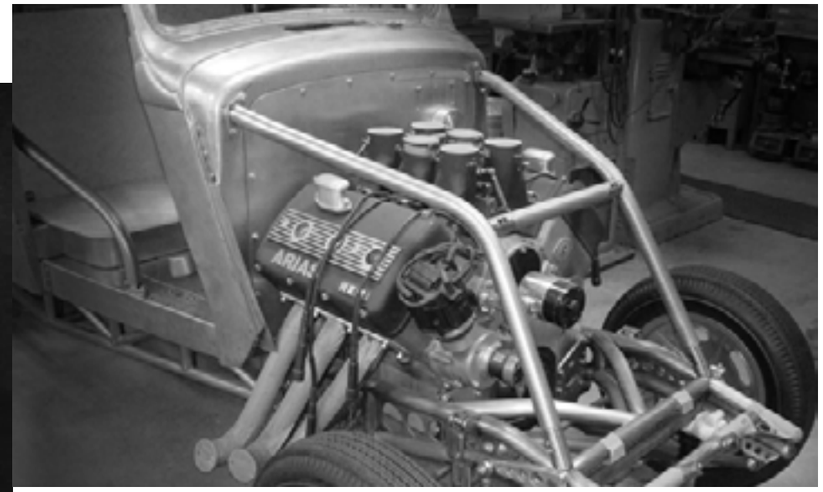


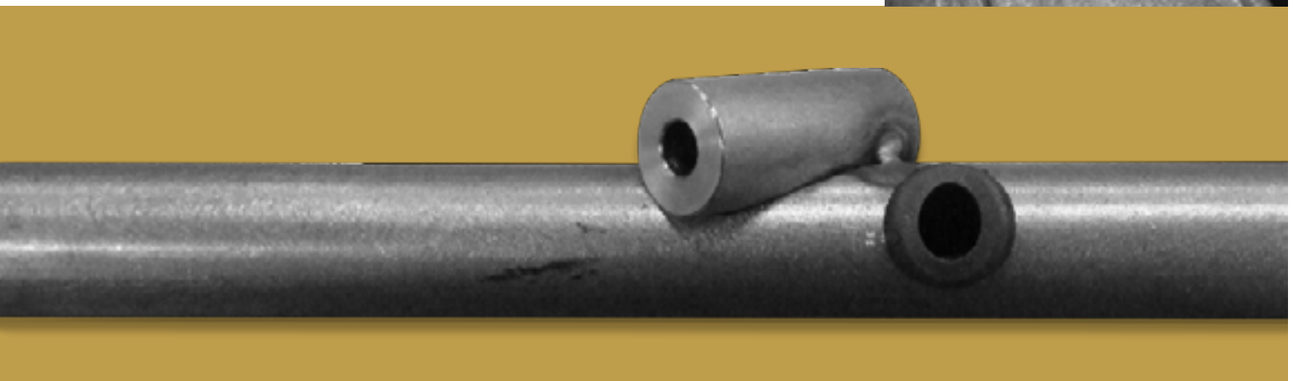
CAGING THE BEAST

Figuring out and beginning to bend the tubes for the cage and bay bars took some time. We used the same 1 5/8" .083" 4130 Chromoly that was we used to fabricate the frame. Space comes at a premium with this truck cab. If we had to guess, this is one of the smallest, narrowest production cabs ever produced in the states. Our goal was to create as much space inside the truck for the driver and their feet. We spent a lot of time mocking up the seating position, steering wheel, and pedals to ensure the driver was comfortable. Now, we did not have to put their the gas pedal above the transmission or in the passenger side foot well which is commonly found on vintage Willys gassers. Keeping this at the top of the priority list, we fit the tubes as closely to the A-pillar as possible by indexing the tubes at every bend to make it match the inside of the body. This takes a lot of time mocking up each bend and how it works with the bend in front of and behind it. After mocking it up, the next difficult thing was wrapping our minds around the number of degrees each tube rotates, then making a mirror image of the one side. We can say that we got it in one shot but the planning on paper was a real puzzle. After the main structure was formed and fit, we fabricated the brackets to bolt in the cage to the floor. The bracket was welded to the frame bolted to the underside of the floor that sandwiched the sheet metal. The bracket on the top of the floor was then welded to the sheet metal. This spacer gave us the additional needed height needed for insulation and carpet.



We had help this round from Datum Tool making the tube couplers for the cage that we originally machined for the frame manually–same dimensions, just CNC machined to speed up the process. We cut apart the cage tubes and slipped in the couplers to make the entire thing removable.

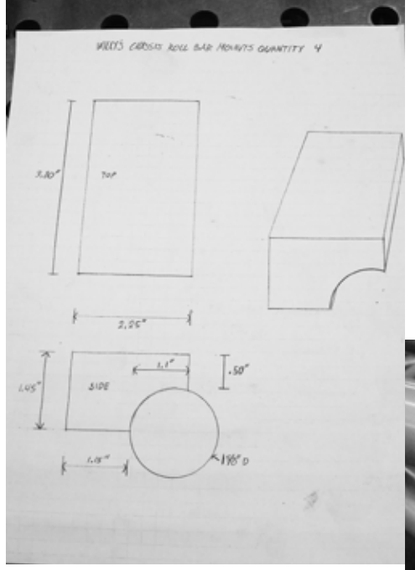




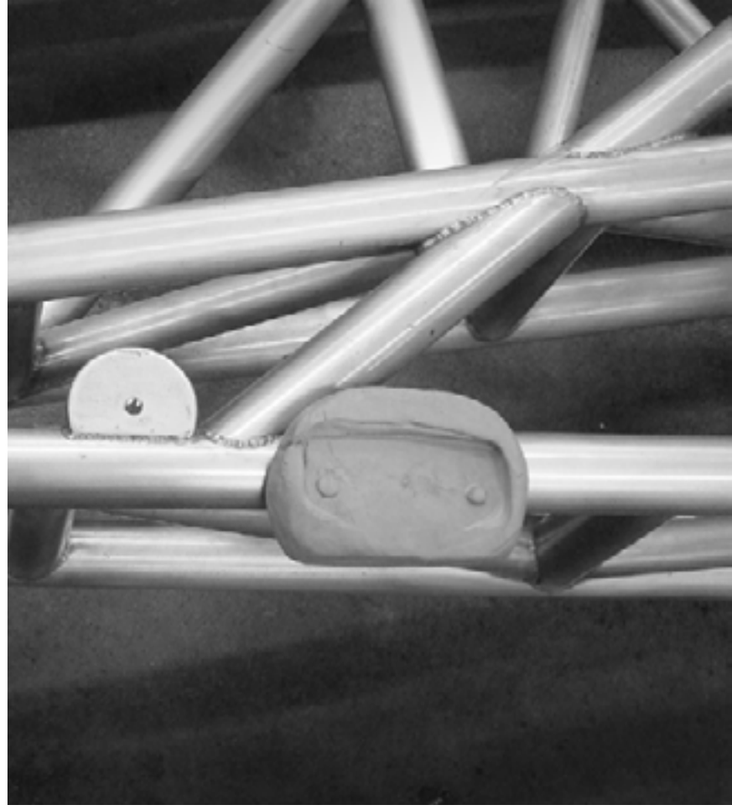
Detail of tachometer cup mounting bung and grommet for running wiring through cage.

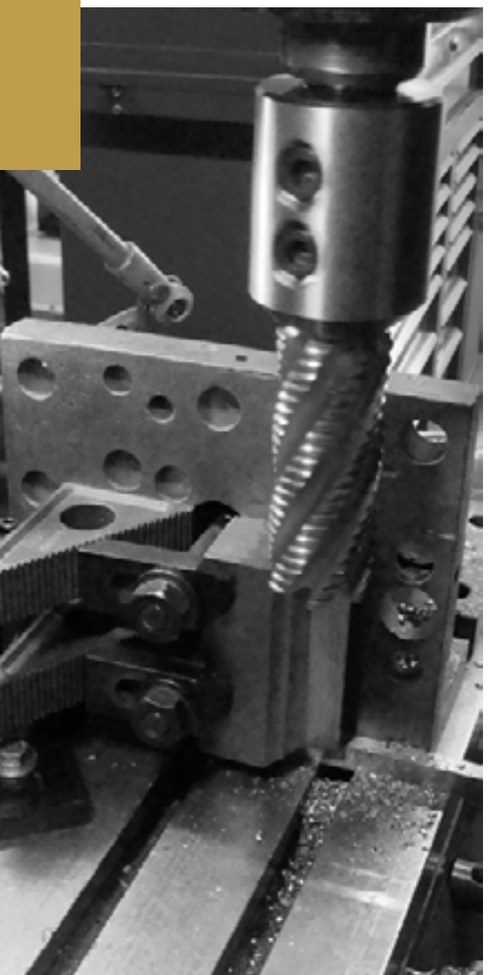
STAND-OFF ISH

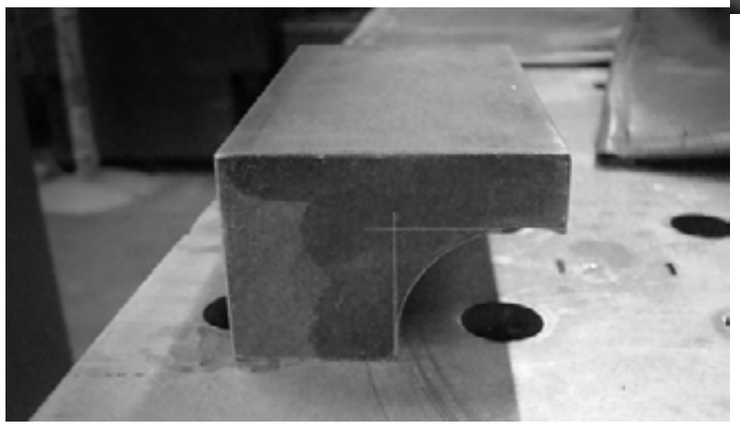
Connecting the cage to the frame with spacers: We were unable to fabricate the four rear roll cage brackets while the cab was on so we had to remove the cab and install large blocks of clay on the frame rail and then re-fit the cab and torque the body bolts down. When we removed the cab, we took those blocks of clay and cut the edges down so we could accurately measure the installed height and then we machined each stand off to that specific height. We then fit them up with the cab on and tacked them from underneath and then removed the cab again to final weld the stand-offs.

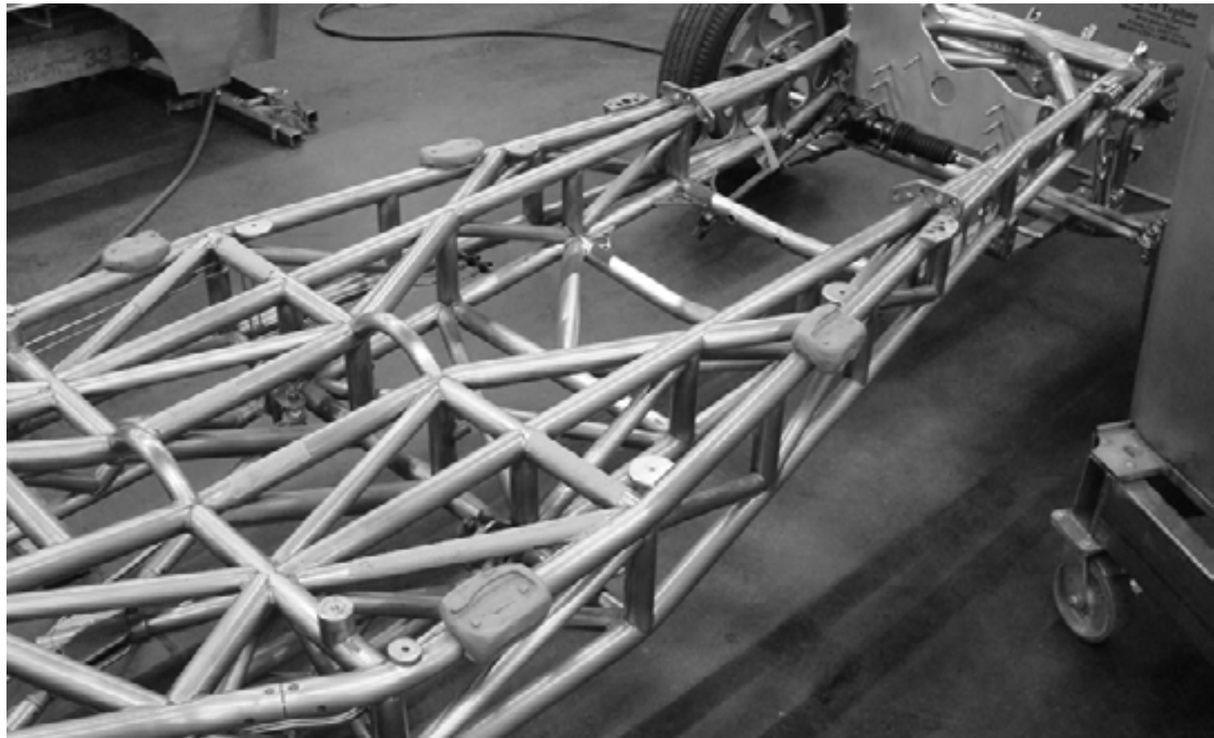


We used clay to measure the height of each stand-off and then machined the roll cage mounting brackets to weld to the frame.



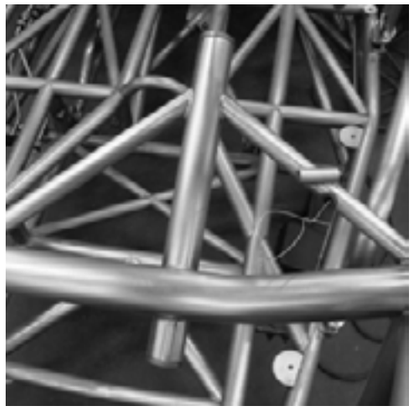


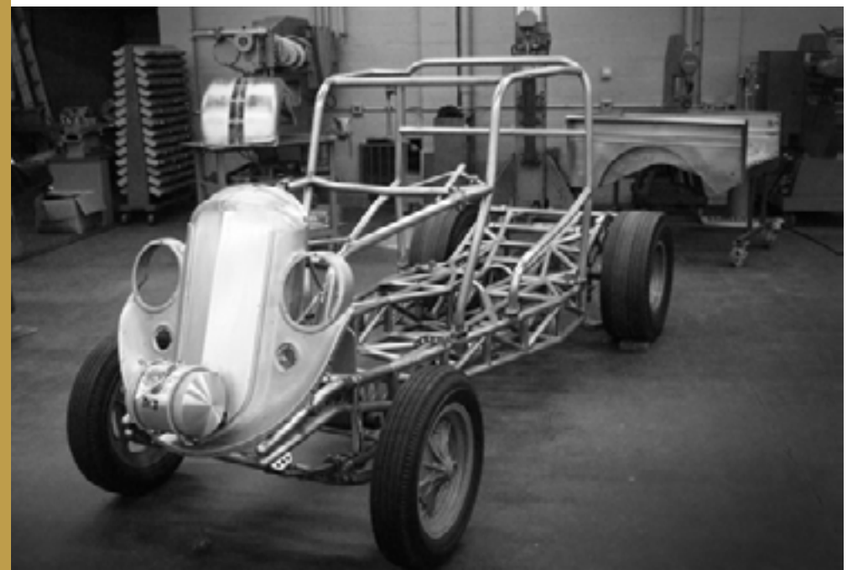




OUT OF REACH

When the bed was off we removed the cab and reassembled the cage to final weld some of the steering support system that there was no access to with it in the cab. We also added some additional tubes to the main hoop behind the seat for some triangulation while were finishing up those hard to reach welds.





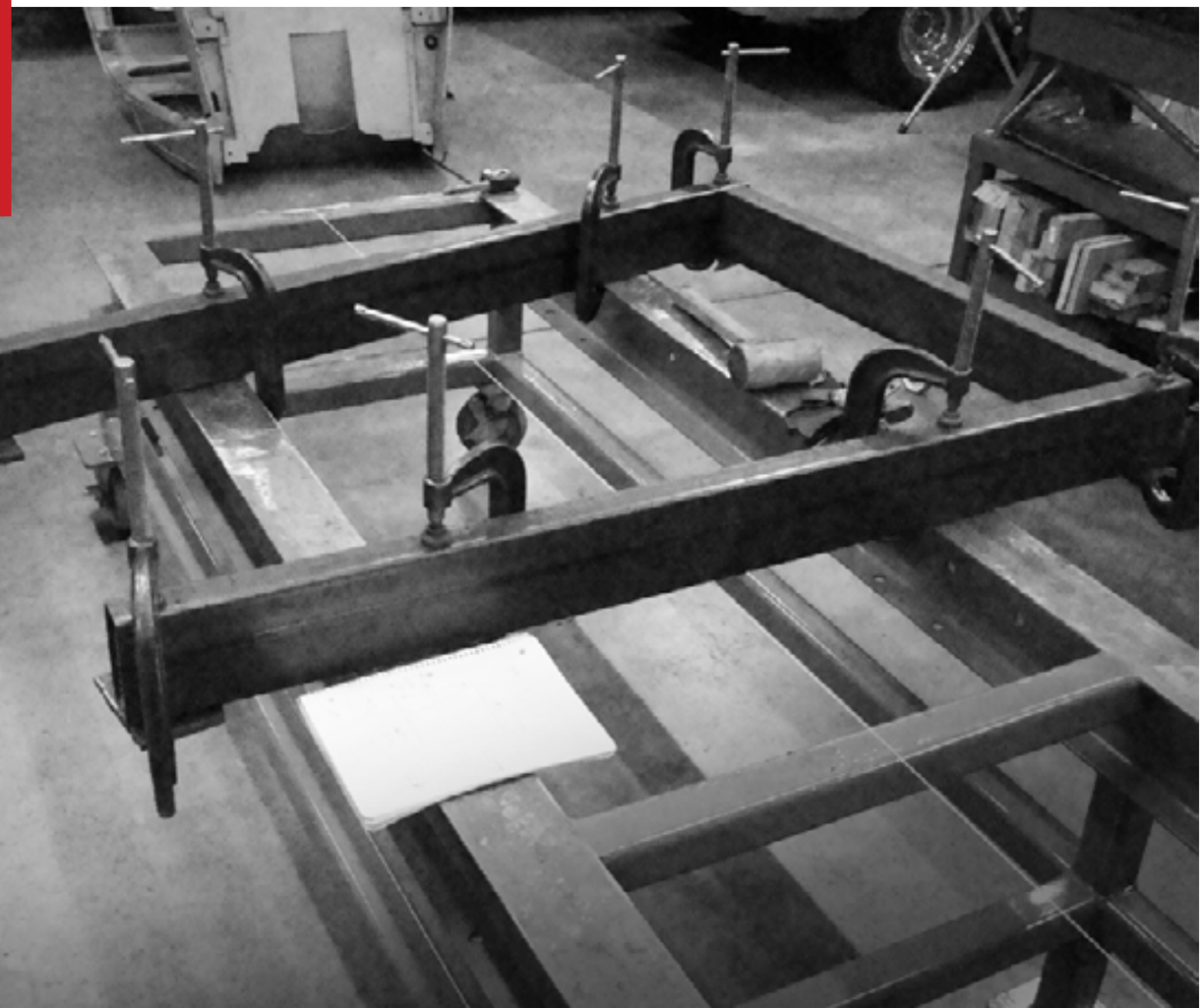
It was neat to see the cage on the chassis without the cab when we were final welding those hard-to-reach weld areas on the cage.

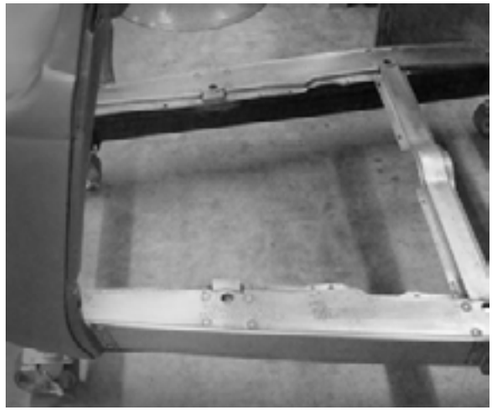
BODY

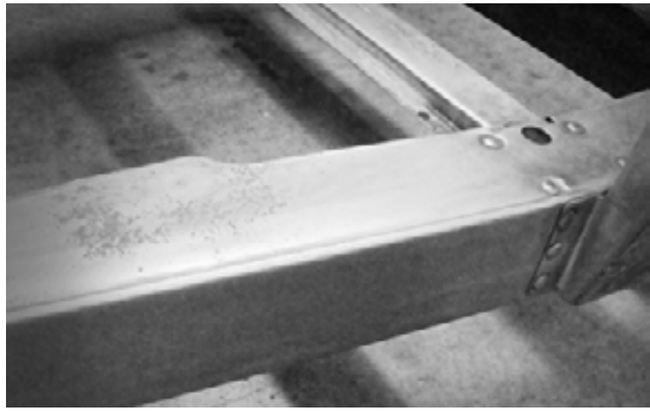
DIALING IN THE CAB

Starting things off square, we made a sturdy flat, level cart to mount the cab to and begin rebuilding it. The 1/8" thick firewall was cut out and all the edges were cleaned up. We repaired a lot of little things at this stage on the cowl and windshield area regarding cracks, dents and any types of damage. After everything was held in place, final welding was done.

Unfortunately, the wood was rotted and none of it was usable and we set out to remake everything in steel and redesign and shape all the exterior body panels.





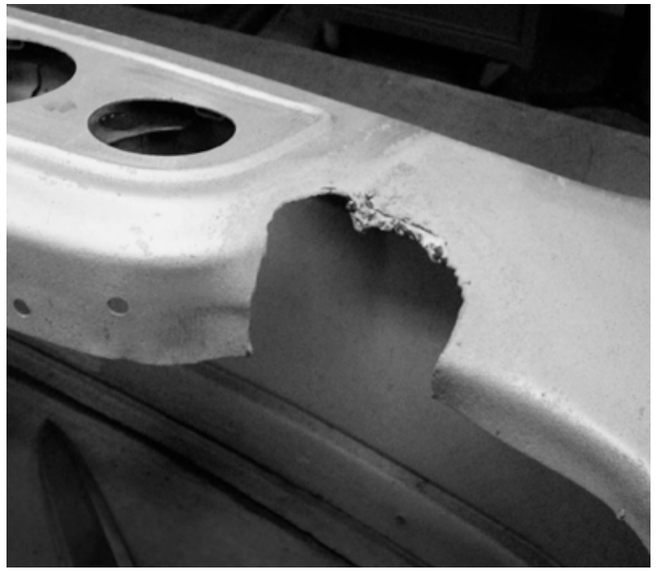


The body was not aesthetically pleasing from the factory. It looked like they took a bunch of left over scrap metal and nailed it to some wood and called it done.

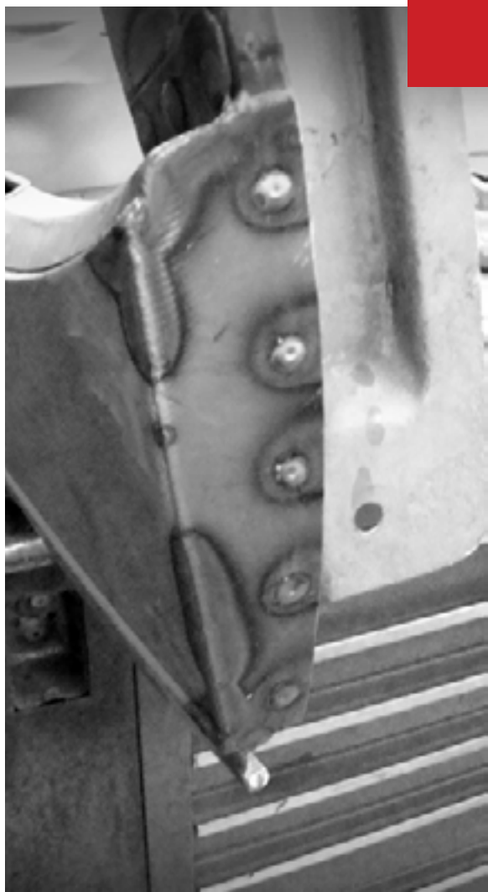
HEAVY METAL

The original sheet metal that was left on the cab and the doors was a little rough. We dealt with rust, damage, and stress cracks around every corner and edge. We first began repairing or cutting out these problem areas and cleaning everything up to begin with a new pallet. We then repaired front lower cowl, door jambs, dash, windshield frame and floor bracing.

The lower edge of the dash was also cleaned up and trimmed. It originally connected to the firewall and was hacked out as well with a torch.

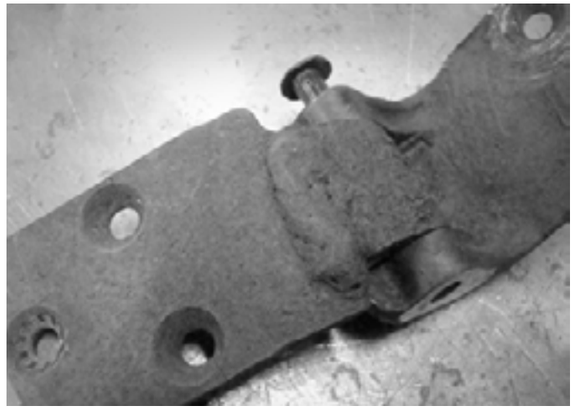


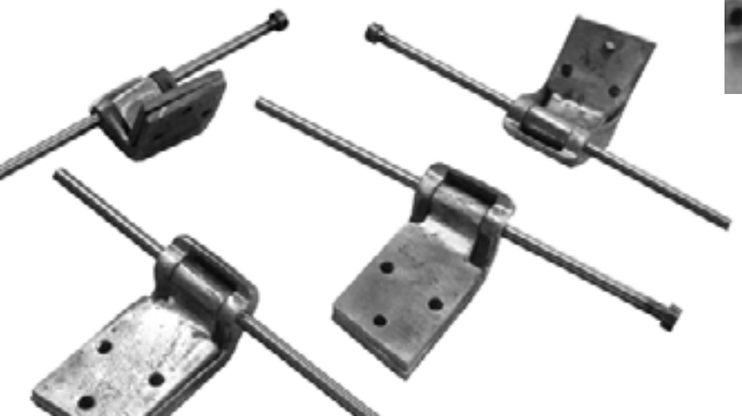
Making small patches for where the steering column hole was hacked in the dash with a torch and the other side there were multiple random holes, dents and damage.



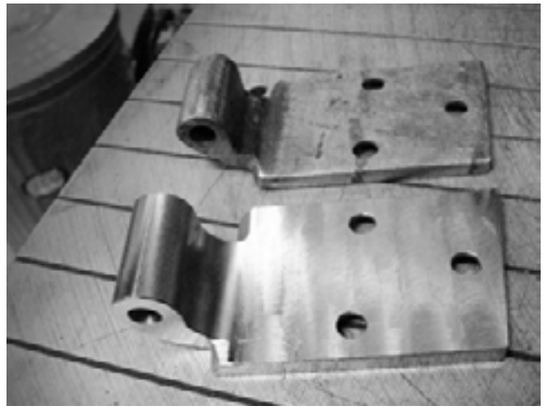
HINGE WORTHY

We begin every large re-body with a good overhaul on the doors hinges. Making sure the hinges are not wore out and are fitting nice and snug is important to make sure all the inner structure is in its appropriate location before shaping and aligning any exterior body panels. These door hinges and door hinge mounting areas on the doors were additionally complicated for multiple reasons. The first reason is their original overall condition was very bad, worn out and sloppy; the second reason is that after-market replacement parts are sub-par. We ended up brazing up all the edges and holes that where oblong and hand-sanding and filing the flat surface areas back and re-machining the original holes. There were no available oversized hinge pins available so we found long stainless ejector pins and machined the heads down to the correct radius. After each hinge was hand filed, machined, and fit to ensure there was zero play in the hinge we were ready to mount them back to the cab and doors after the necessary sheet metal was repaired as well. These doors had zero adjustment from the factory making this process critical so the hinges are positioned in the same location every time.





These original hinges were cast and are somewhat brittle now, and they don't like being bent.



"We had to deal with a broken hinge and decided to replace it with a new one that was CNC machined exactly like the original."

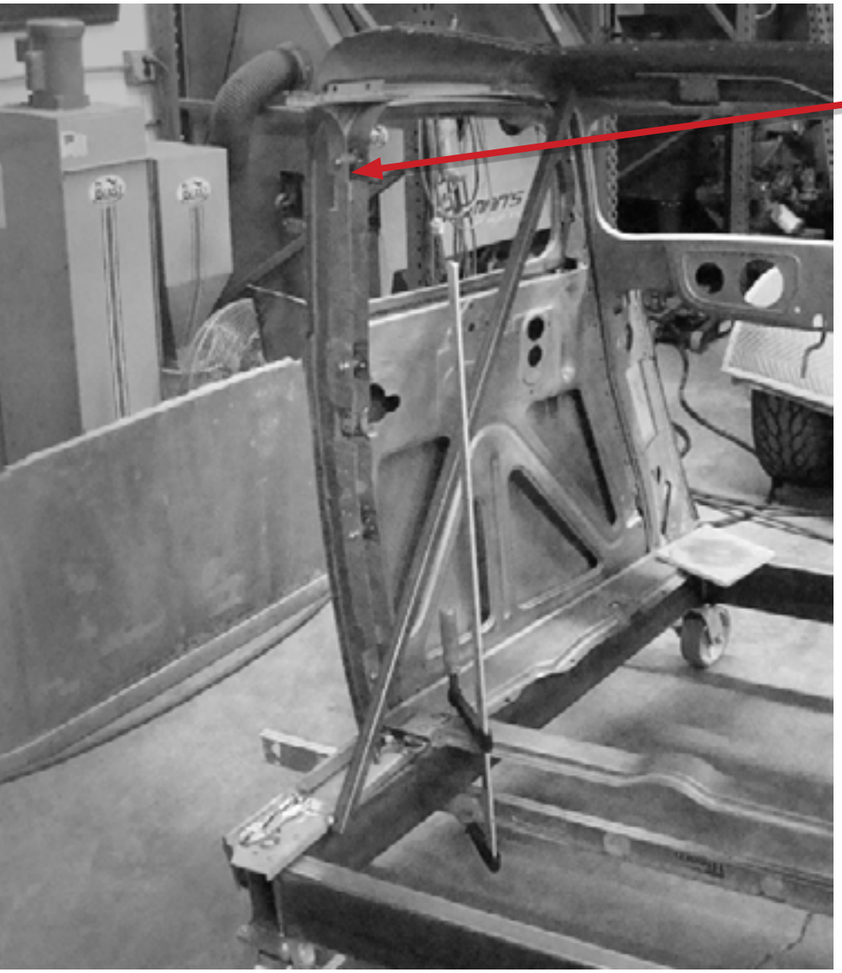
HANGING THE DOORS

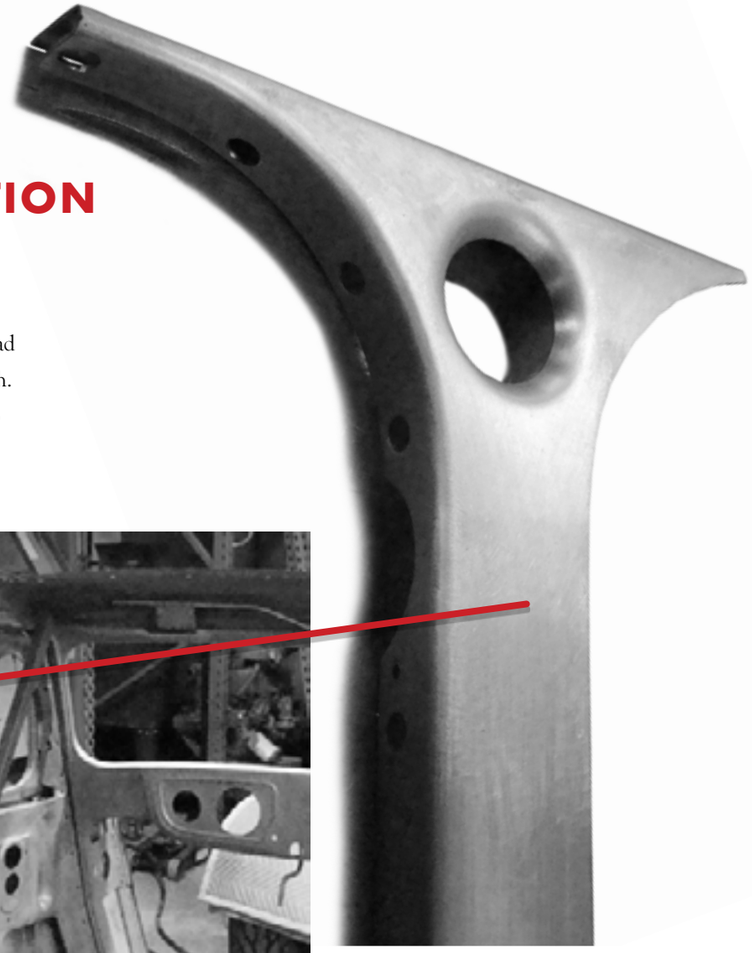
After the hinges were completely rebuilt and better than new, we fit up the doors and hinges and made any possible adjustments and tweaks we could, and fit the leading edge door gaps. We machined wedge shim plates to weld in the doors to correct gaps as well as made a tool to help us heat and bend the hinges as much as possible without cracking the cast iron.

These doors are more difficult to work with than other vehicles. There is literally zero adjustment.

B-PILLAR FABRICATION

Fabricating the inner B-pillar from 18 gauge steel: We sleeved the B-pillar so we could use flat head allen head bolts in the jambs and stamped the head recesses so the new machine screws would be flush. After the new jamb was fabricated we welded it to the original b-pillar.





Notice the back of the b-pillar in the image to the left: this is the same pillar used in a four-door car. You can see the area for the dovetail for the rear suicide doors. The same pillars and rockers were used on the coupes, sedans, and trucks. That is why the rockers sticks out slightly behind the cab.

We began by bracing the front of the cowl/windshield area. This located the door frame and allowed us to get into the B-pillar to rebuild it out of steel instead of using wood.

We then used a torch to heat those areas and make a recessed hole for a flat head bolt to retain the original look of the jambs.

Machined sleeves that were fit in the B-pillar jamb to fill the void of the original wood.

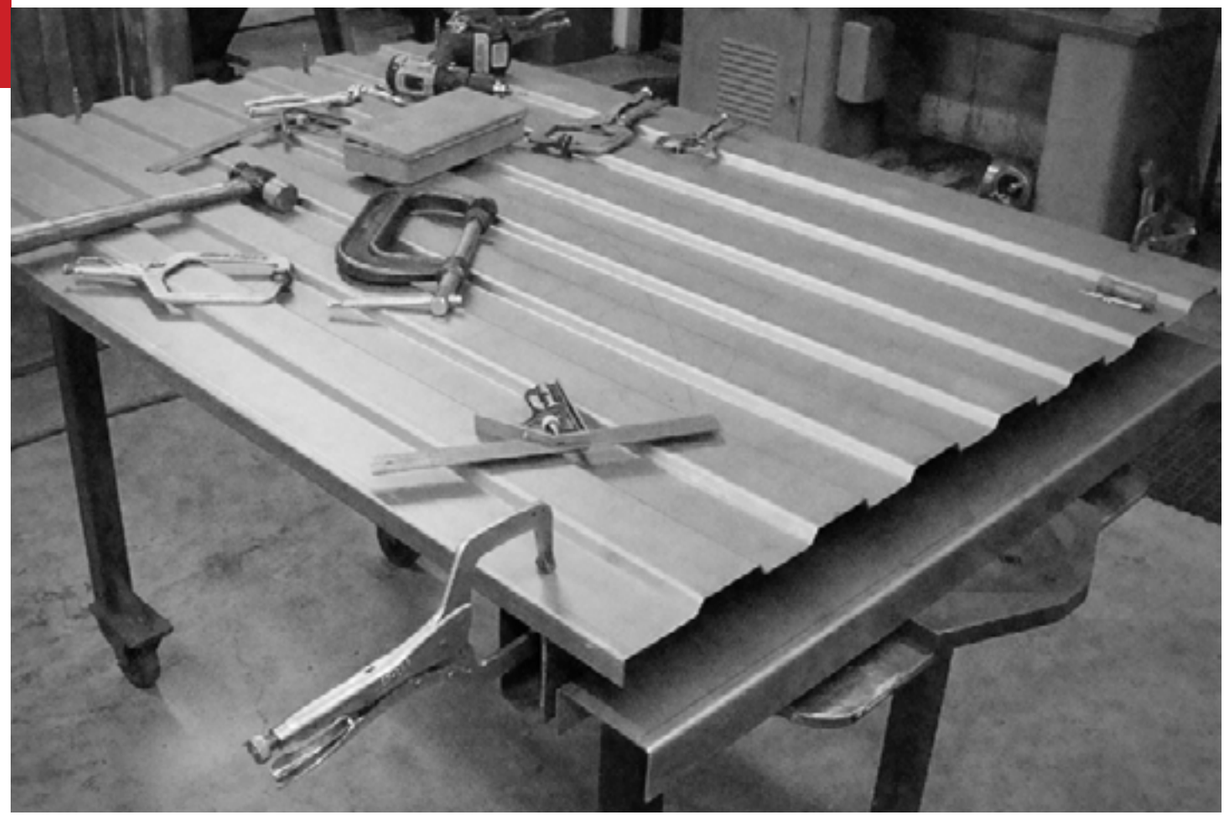
Mapping out some general design concepts with 1" square tubing to create a stake pocket design.

MAKING THE BED

The original bed was in really poor condition. Every panel was completely beat up and cracked. The time it was going to take to rebuild the original would have outweighed making a new one. With the addition of making a new bed, we could clean up the design and make it look nicer while still keeping the original dimensions. The original design was single sided on the front and rear with a lot of exposed angle iron. We came up with some ideas to make it double sided and to box or cap the ends. This concept would make it look a lot more contemporary and modern and less like a utilitarian farm truck

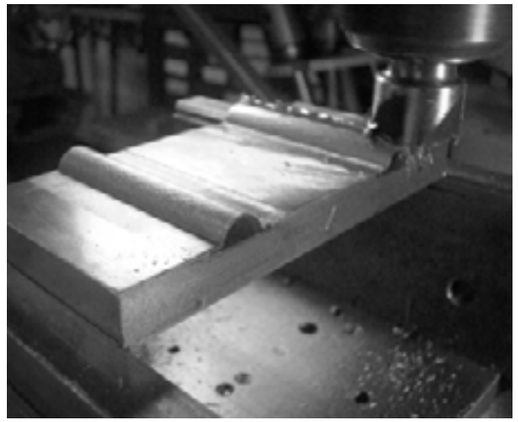
BED FLOOR

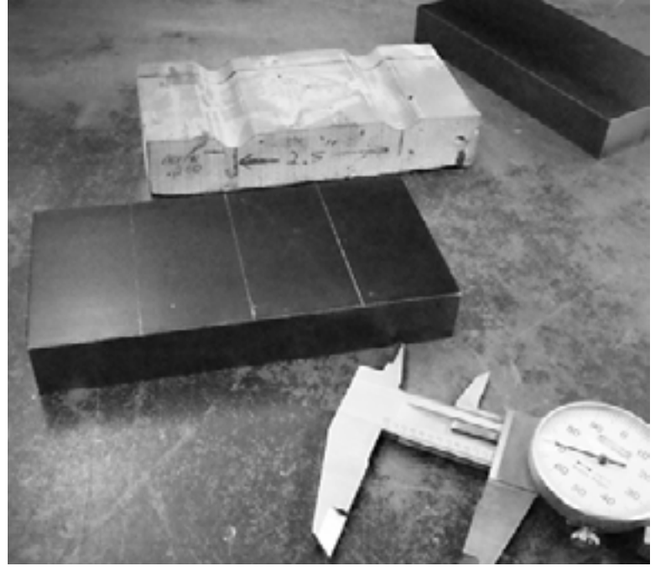
We measured up the original bed and drew out all the rough dimensions for all the blanks. We found a local fabrication shop that does some really nice work with a press brake and had them bend up all the panels including the ribbed bed floor just like the original. We built a fixture on a work bench to level and square everything up. We rough fit, trimmed, and assembled almost every piece of the bed but left it so it could still come apart to replicate the original double bead detail.

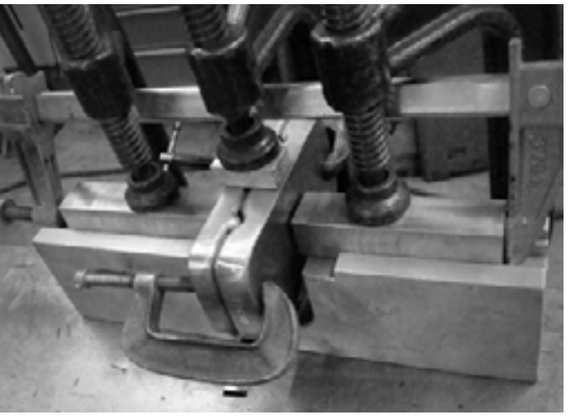


DOUBLE BEAD DIES

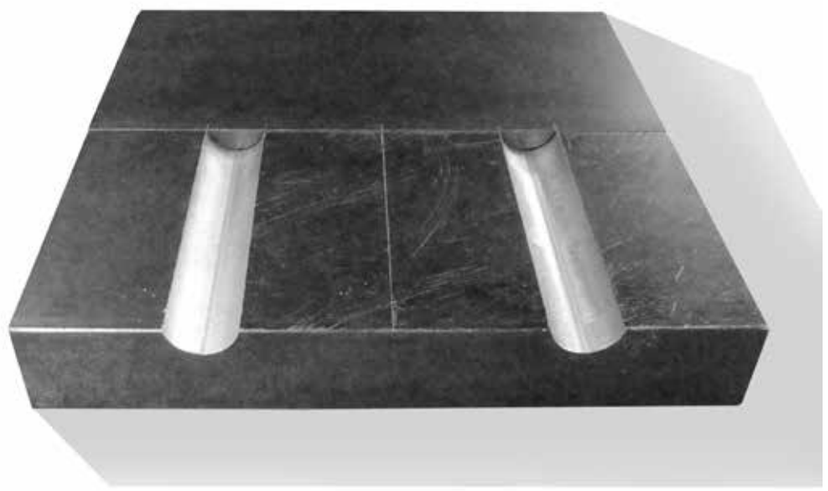
We made a mold of the original bead detail with thinned out plastic filler to aid in figuring out how to machine a set of dies. We then machined the dies to form the double bead detail in the 16 gauge bed sides and the front and rear bed panels. We had to modify a couple different corner round radius end mills to get the install height needed to replicate the profile exactly.





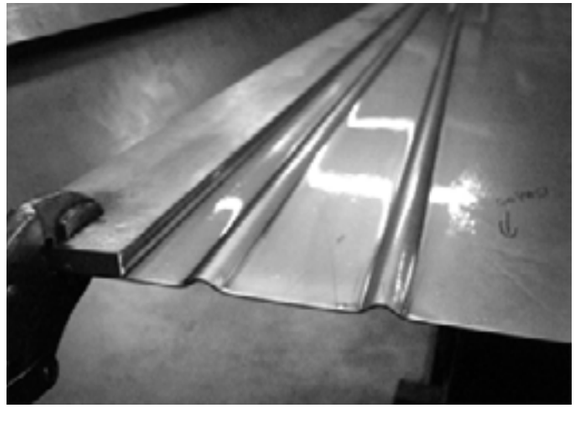


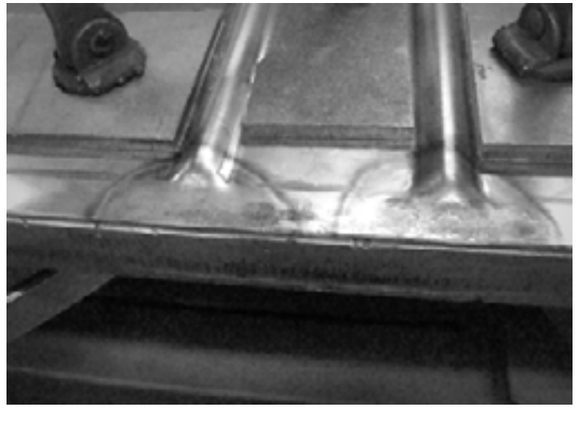
"The success of any project is determined during the planning stage before starting."

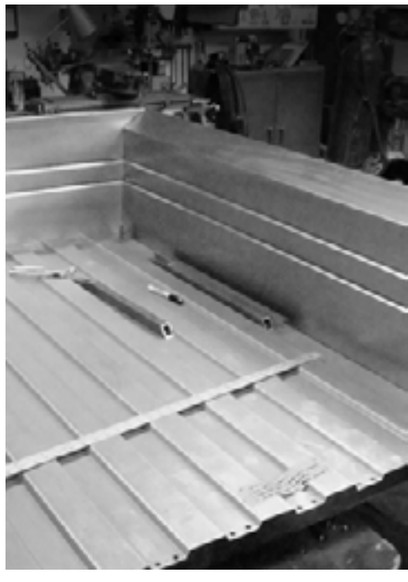


TWO-BEAD DUTY

We laid out the double bead details and bolted on a back stop to ensure straight tracking when running through the P9 Pullmax. After the beads were formed we heat shrunk the ends and used caulking hand tools to radius the ends and clean them up for the tailgate fit up. After the sides were completed, we made a pattern of the front to get it to fit into the bead details as much as possible to make it look like a continuous line all the way around the inside of the bed. The front is double-walled to have the bead detail match on the outside and the inside. We installed the inside panel bead details that ran all the way around the interior of the bed then moved to the front on the bed. We altered the bead detail dies to taper and match the angle of the bed stake pocket area.



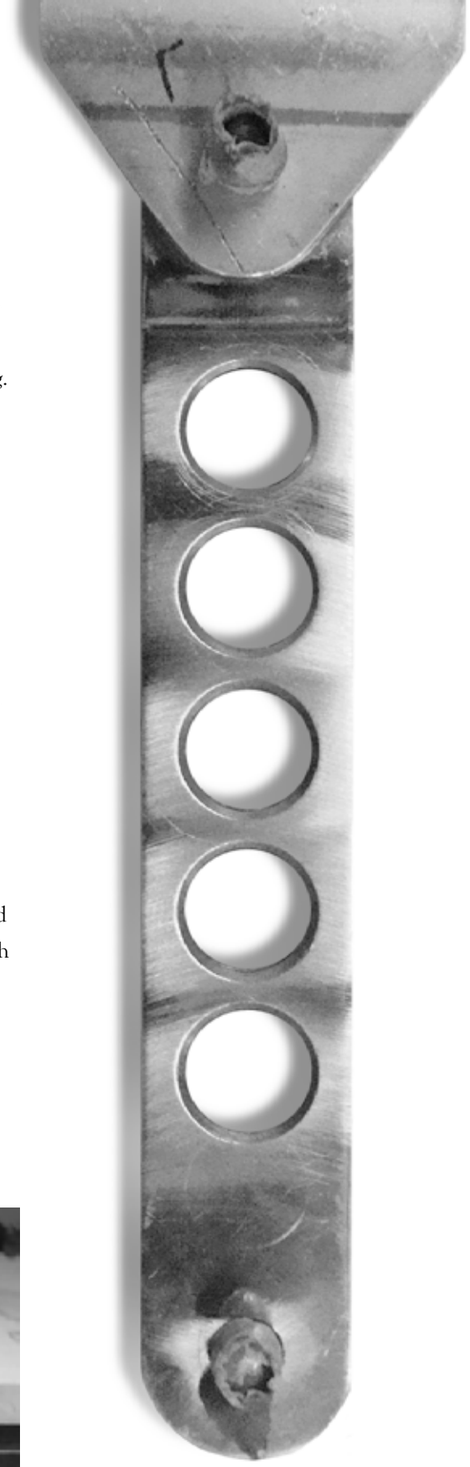




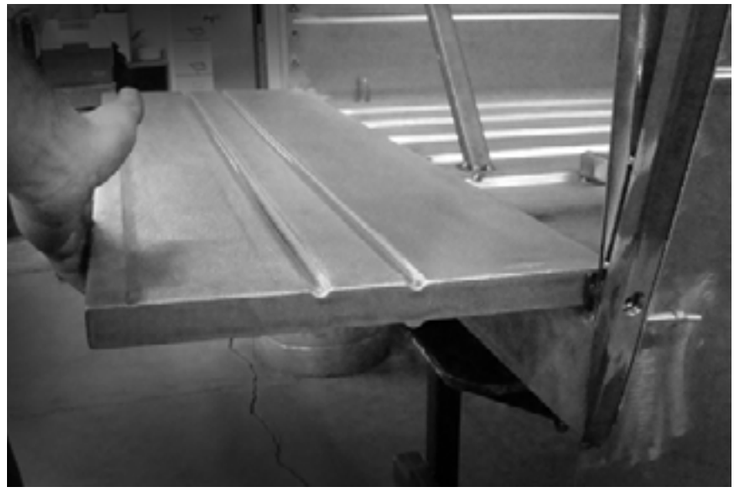
There is more than meets the eye making the bead details line up around the entire inside and outside of the bed when completed.

MAKING THE BED

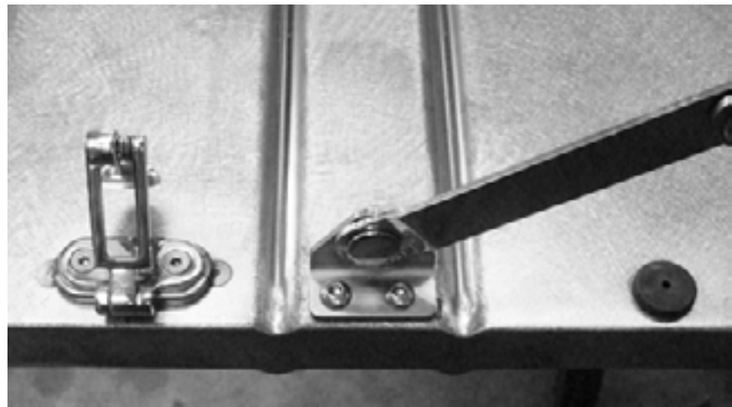
The bed sides and front panel were plug-welded and then the welds sanded smooth. We then turned out attention to the tail gate and the rear of the bed. We began making the hinge for the tail gate by machining a hinge pivot that welded in the end of a 1" square tube. We then machined two recessed bungs for shoulder bolts to hide inside the bed stake pocket. After we had the hinge cross tube mounted, we made the remaining areas of the tailgate with the same 1" square tubing. We then capped the front and back of the tailgate with the double bead detail panels—the outside bead facing out and the inside bead facing in. After the tailgate was fully welded and sanded, we turned our attention to the outside stake pocket areas and began with the tailgate strap modifications. We started with an aftermarket stainless steel over center latch mechanism. We shortened the straps to the correct length for correct operation. We than made stand-offs or plateaus to mount everything to so there would not be any through bolts and give it some additional detail to accent the perimeter of the investment cast stainless latches. We engineered some stops to locate the tailgate and make contact with an adjustable little rubber snubber to push against the latch and not the tailgate itself. We located and installed some rubber bumpers to keep the stainless straps from swinging into the tailgate when closed. We completed the tailgate straps by adding some carefully laid out lightening holes. We took care to make sure that the holes lined up with each other when the tailgate is closed so anyone can see through the holes as they are perfectly in line and not overlapped in the closed position. We finished off the rear of the truck bed by welding small trapezoid pieces of sheet metal we cut out and welded in each section. We sanded all the welds smooth to give it a factory appearance.



We wanted the bead detail to stop on the same angle as the angle of the stake pocket so we took our original double bead detail tooling and machined a little bit off the lower corners of the die to match the angle of the stake pocket.

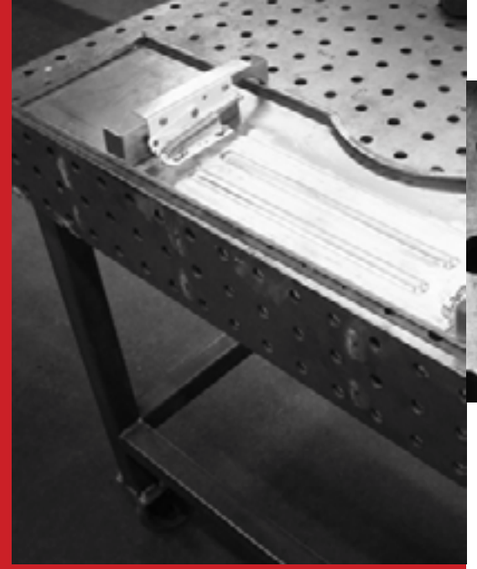


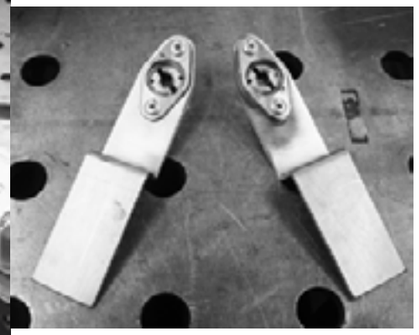
Figuring out the correct length to make the tailgate straps so the tailgate is parallel with the bed floor when open.



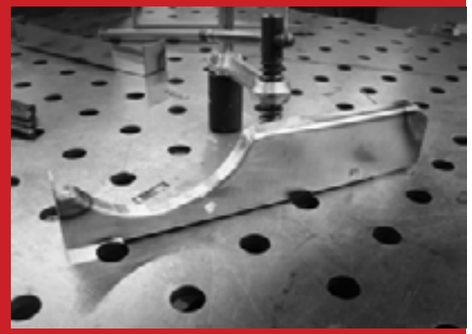
CUSTOM BED

Trying to figure out where to hide the wiring and some other electrical components for the license plate frame that would be added to the bottom of the bed was a challenging project. We mocked up the concept with cardboard to have the rear section enclosed with two hatches on both sides to get to the wining and to disconnect the wires from the fuel pump and sender and to remove the bolts to remove the bed. The front hatch we decided to make open with hinges so someone can reach their hand up in the chassis to get to the front bolts as well as get to the main wiring connection to unplug it and remove the bed. There was also room for the screws and sliders to go through the bed floor for the license plate. The bed floor ribs were capped on both sides to allow wiring to run front to back. Everything was then fabricated from sheet metal. We utilized the same cam lock or miniature Dzus fasteners that we used in the hood sides to remove the rear two hatch panels. The front hinge panel works with spring assisted hinges that help hold the panel up when open and close when shutting.



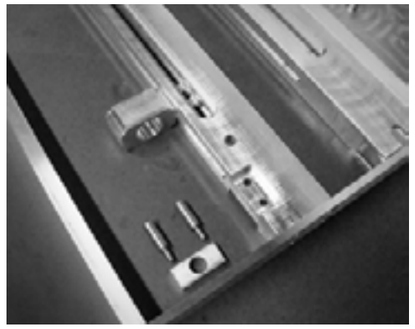


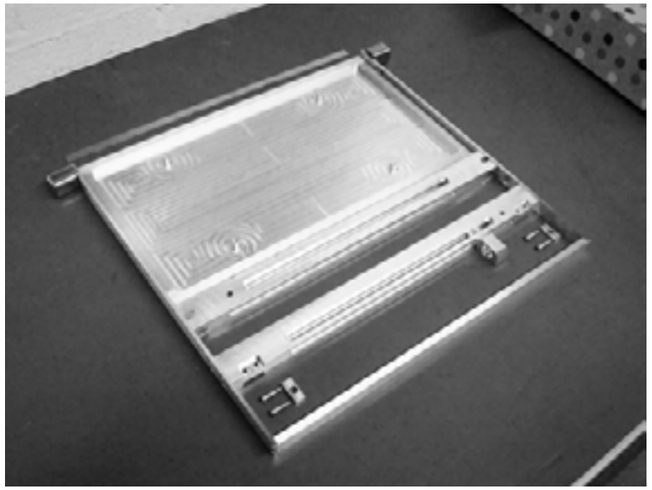
Spring-assisted hinges for front hatch close-in panel hold panel when open and help adding closing assistance.

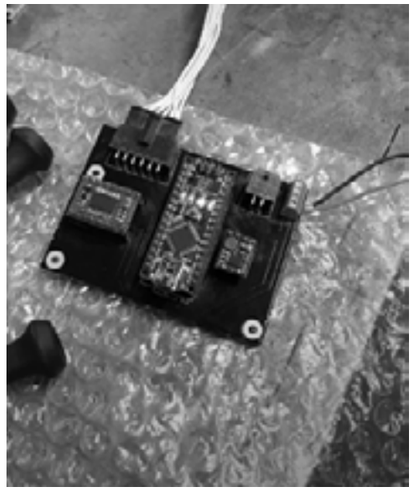


HIDDEN IDENTITY

There was no good place to mount a license plate on the back of the truck. The tailgate wouldn't work because of the bead details running through the center. Mounting it off the fenders didn't look right and under the bumper didn't look great either. We opted for a hidden option. We worked with Eric Mueller from FlexFacture to engineer and build this powered license plate frame to operate in a very small space. The width of the front of the bed is approx. 1" thick. The entire assembly slips in a ¾" wide slot that we cut in and added mounting tabs to the bed to bolt in the license plate frame. It operates from a small computer that can adjust the height when it stops at well as some other parameters for instances when the key turns off in the middle of cycling. It is wired into the trucks ignition circuit to open when the ignition is on and the truck is running. When the truck is turned off it will automatically close. It is controlled by two small electric motors in a gear box with a screw drive lead screw. The plate frame hinges on scissor hinges and also incorporates LED lighting when the headlights are turned on.







Tidying up and adjusting the gaps after everything is installed and operational with some TIG welds and sanding.

BACK TO THE CAB

After the completion of the chassis and a big shop move, we began on the cab, fitting the original sections back up to the cab inner frame work to get some basic dimensions and idea of the changes we knew we wanted to make.

Rolling the truck outside to size it up visually before getting going on the large redesign and coach built cab project.

Starting with a blank canvas is great if there are improvements to be made during the process. Our goal was to do a redesign and make everything appear that it could have come that way from the factory to those who are not familiar with these old Willys. However we wanted to try and satisfy the purists as well keeping all the original nuances that make these Model 77's so unique.

This small section of the cab and the doors is the only remaining sheet metal from the original cab bolted to the frame.

We mocked up the remaining bits of cab sheet metal and took some rough measurements and made mental notes of specific things we thought we could improve on regarding the general design of the panels and bead detail configurations.

SHAPING UP

We used polyethylene insulation and glued together a large block to cover the corner of the truck cab. We marked the profile of the door to the foam as well along the roof. We cut these areas out with a Sawzall and with other pneumatic sanders and saws. We kept creeping up on the shape and as we got closer started using sanding blocks to get the transitions just right and start detailing the body reveals. Once we had the cabs shape dialed in, we played with the back "quarter" window. The factory just made it drop off into nothing on the cab and just melted some lead in there. The transition looked terrible because there was not one as well as the second belt molding joggle never went around the entire cab either. We spent some time studying the relationship of these bead details and came up with some ideas to make them all flow and look natural as if they came from the factory and they had a design department. Imagine that.

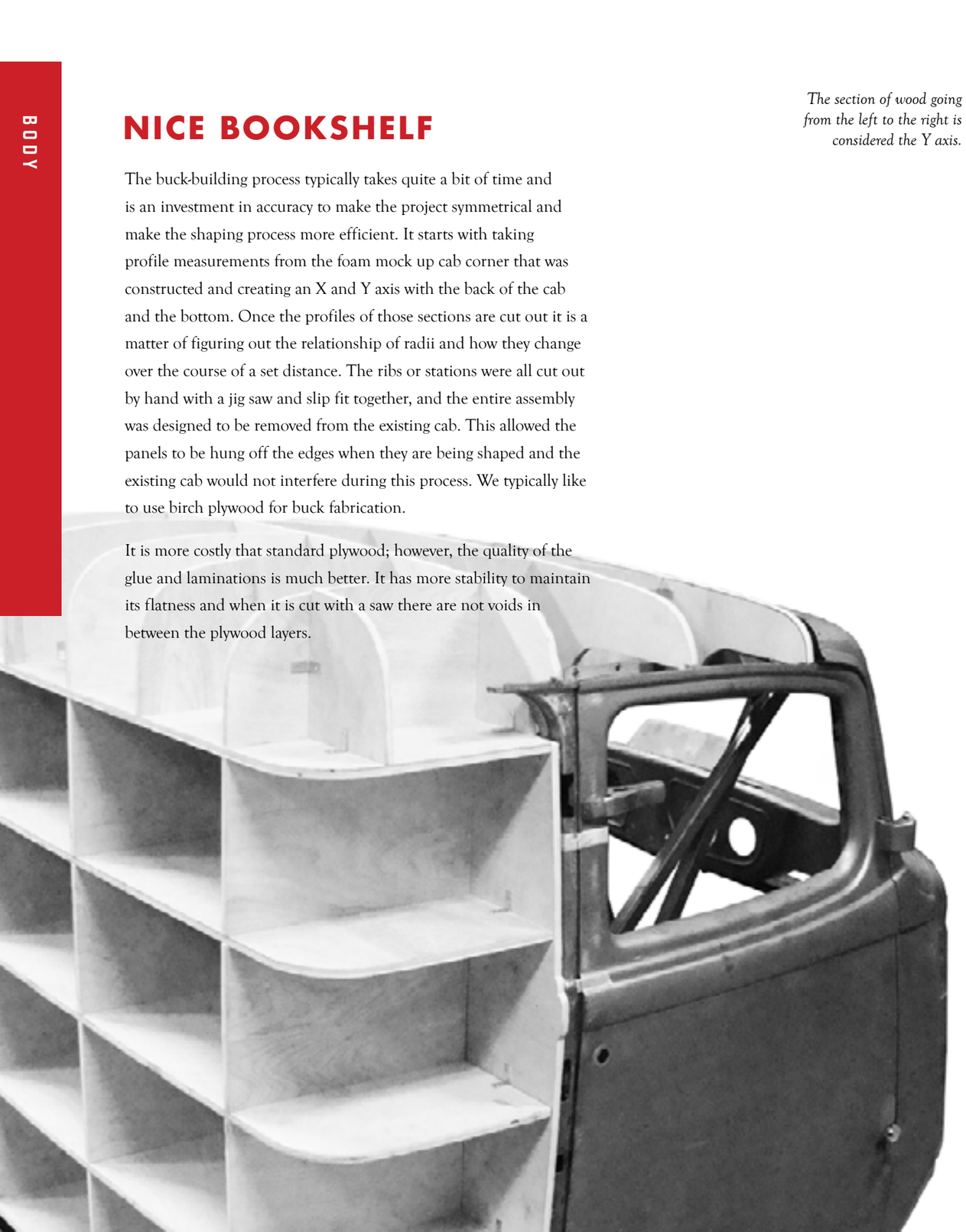
"At this moment we realized how it must have felt to be Michaelangelo after completing David."

(insert studio audience laughter)

NICE BOOKSHELF

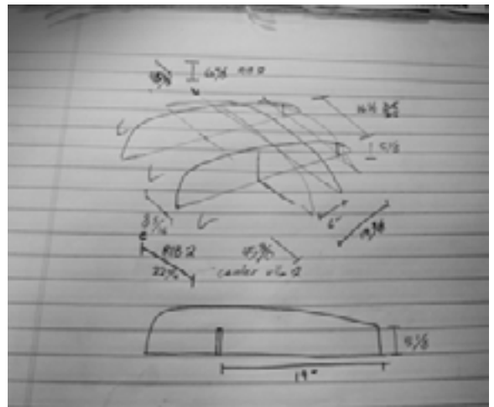
The buck-building process typically takes quite a bit of time and is an investment in accuracy to make the project symmetrical and make the shaping process more efficient. It starts with taking profile measurements from the foam mock up cab corner that was constructed and creating an X and Y axis with the back of the cab and the bottom. Once the profiles of those sections are cut out it is a matter of figuring out the relationship of radii and how they change over the course of a set distance. The ribs or stations were all cut out by hand with a jig saw and slip fit together, and the entire assembly was designed to be removed from the existing cab. This allowed the panels to be hung off the edges when they are being shaped and the existing cab would not interfere during this process. We typically like to use birch plywood for buck fabrication.

It is more costly that standard plywood; however, the quality of the glue and laminations is much better. It has more stability to maintain its flatness and when it is cut with a saw there are not voids in between the plywood layers.



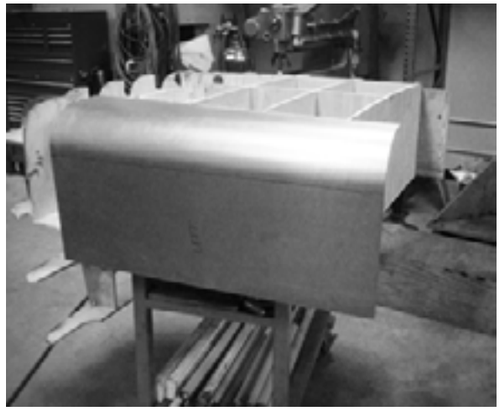
The section of wood going from the left to the right is considered the Y axis.

The station coming out perpendicular is considered the X axis.



FORM FITTING

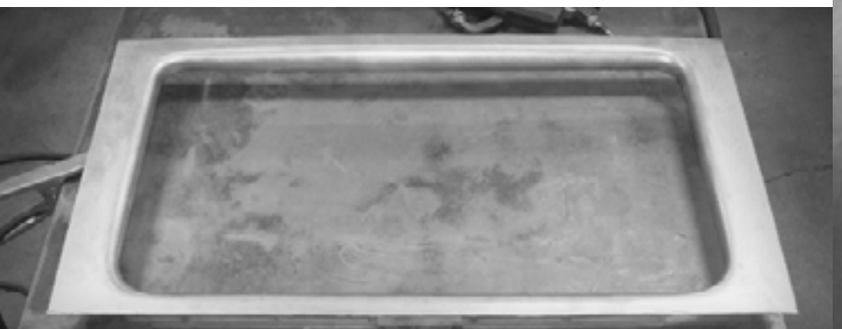
This lack of clamps indicated a properly formed and shaped piece of sheet metal. If clamps are used to force areas to fit it is typically an indicator that the form needs to be altered. If clamps are used and it makes other areas spring out, that is an indicator that the shape needs to be altered in a panel.

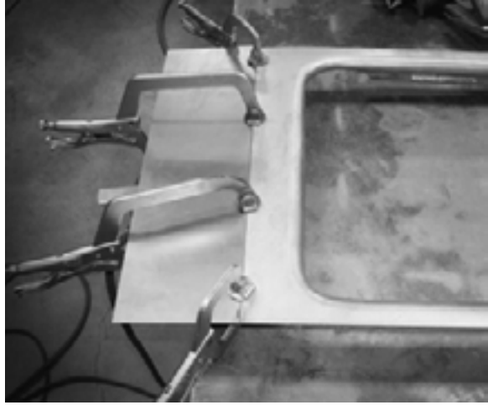


Shaping the lower section of the cab in three separate pieces: The sides were both shaped and fit to the buck and then the center was shaped.

SPARE PARTS

Shaping the roof skin and the trailing edge was the next step. We luckily had a spare rear door from a 4-door to cut a door bottom repair panel off another ‘36 sedan project we had in the shop. We cut the window frame out of it and straightened some damage to the opening and welded up the couple hinge pocket holes. Then we added some filler sections to extend it to make it as wide as the other panels on the top and bottom.



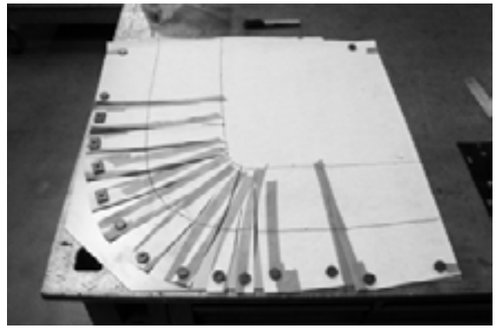


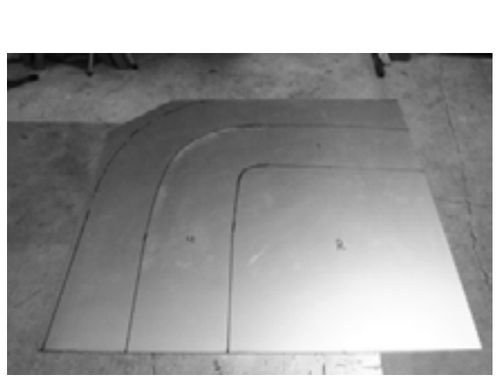
Cannibalizing a ‘36 Willys Rear Door for the trucks back window. Utilizing this OEM sheet metal with the roll up window run channels allowed us to make the back window roll up and down like a door typically would.

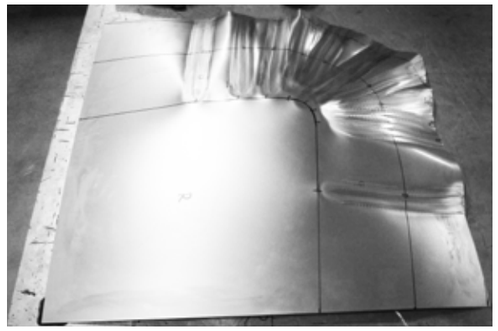
CORNERED

Starting most metal shaping panels with a paper pattern to help determine how to make the panel: the pattern helps us figure out where the form is in the panel and where the shape is. It also indicates where things start and stop. It is the most valuable piece of information before starting any complex metal shaping project.

Shaping the upper cab corners: creating the cab corners tested our shrinking dies to their limit. In the upper corner; after we were done shrinking we measured the material thickness at .078". The material that we used was 19 gauge which is .042". Knowing that we almost doubled the material thickness to 14 gauge is crazy think about!

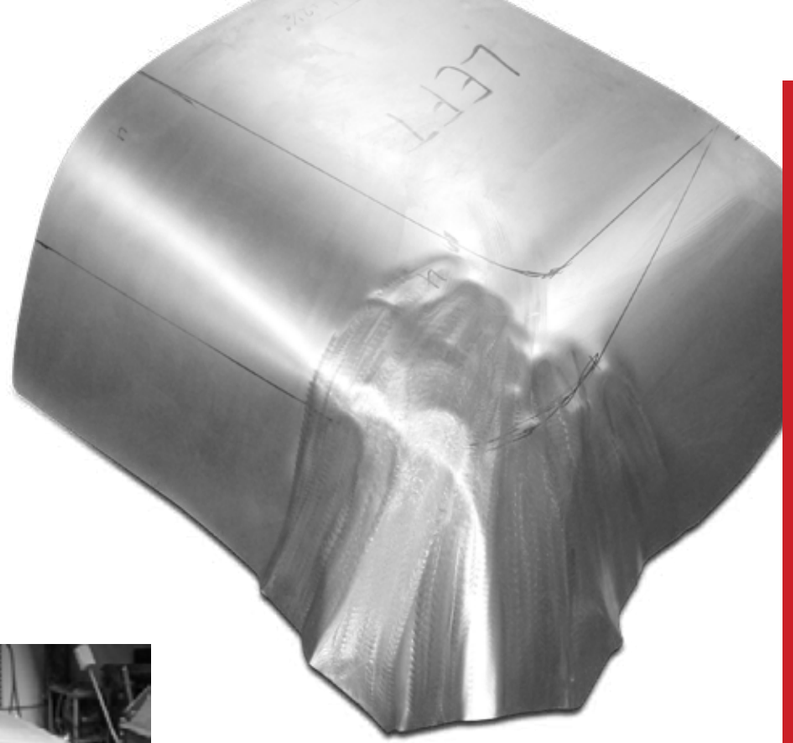


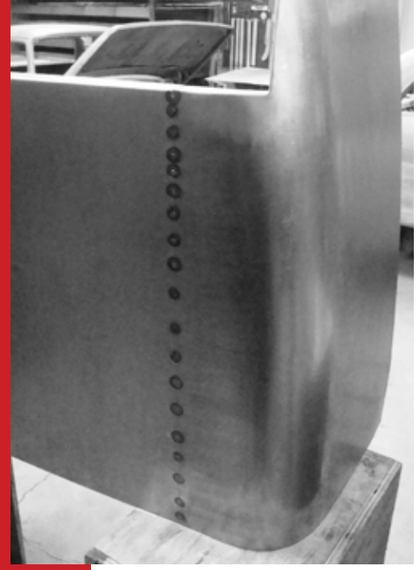




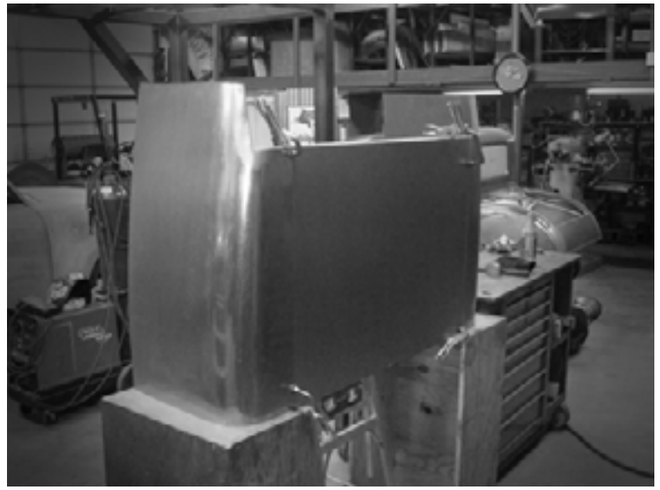
Beginning stages of shrinking: working on shrinking the inner most areas first and then working our way out towards the edge.

Incredible amount of shrunken material in these upper cab corners: it was close to double the thickness when completed.





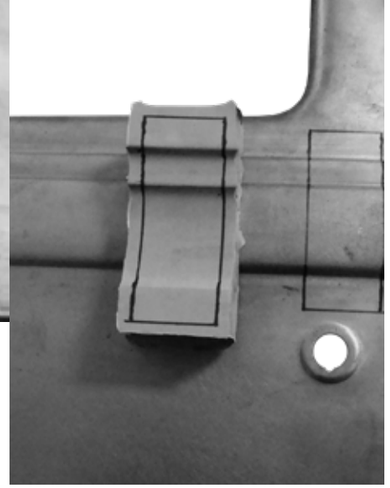
I believe the back of this truck cab gets the award for the lowest crown panel we have ever shaped.



SEAMLESS

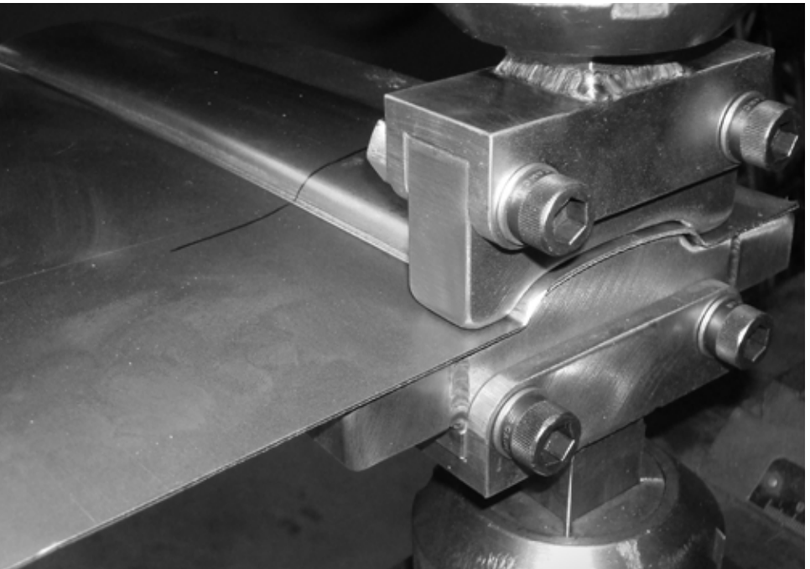
The next step is welding the bottom three piece together. We TIG welded the two main seams and smoothed all the welds out and metal finished both seams. After the metal finishing was completed, we fit the lower rear cab assembly onto the buck and used the laser level to locate the bead detail off of the lower belt molding on the door.

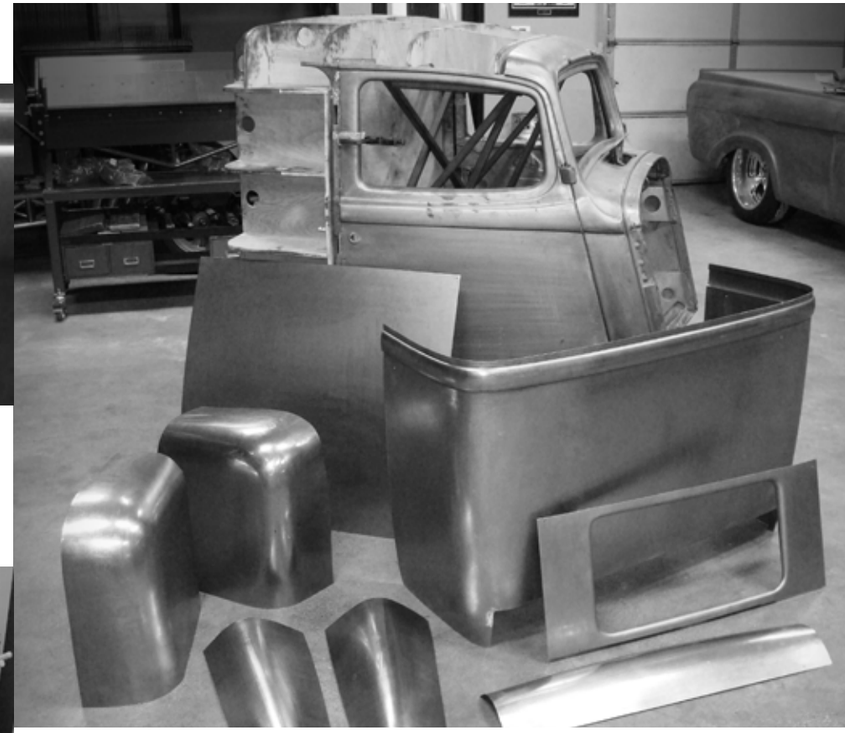
Welding the three halves together off of the truck and finishing them allows for the most access for metal finishing and fine tuning. This is the step before installing the belt molding bead detail.



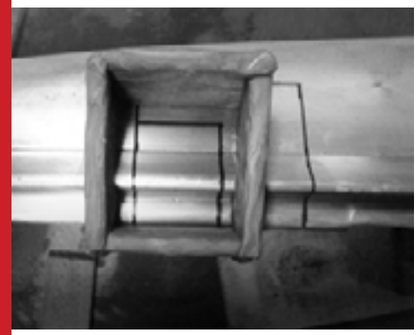
BELTING IT OUT

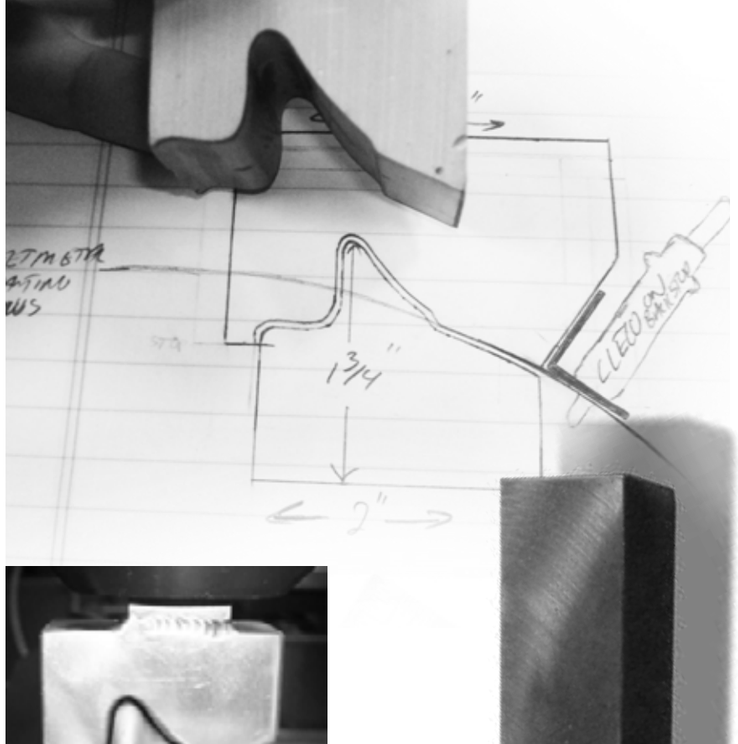
Adding the belt molding around the back of the lower cab assembly: we took a mold of the belt line on the door using clay and plastic filler. Then we engineered a set of dies in a removable holder and made some test pieces. We also added some wings to the lower die to eliminate tool marks that were noticeable during testing. We made a large flat back stop for the Pullmax to butt the cab up against which located the line from the trimmed edge. We pre-stretched the panel in the power hammer and worked back and forth adding form and shape as it was needed in the corners. We were able to put the entire bead detail in one shot through the entire assembly. We also had to block up the Pullmax itself to get the necessary ground clearance. Since then, we have never taken the blocks of wood out because we prefer the taller height positioning.

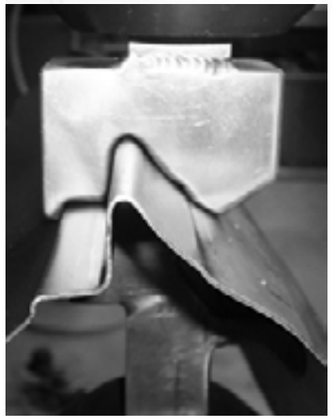




Finished panels ready for more fitting and welding to make sub assemblies.





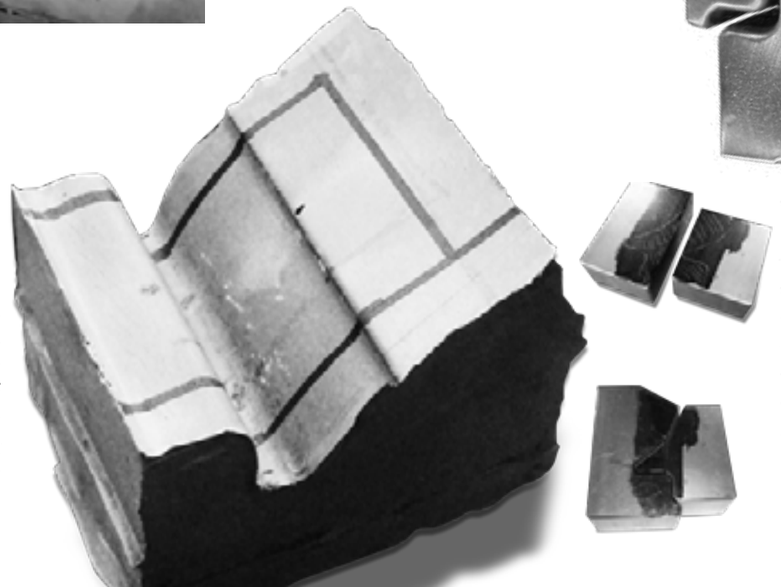


Initial test piece for tuning die details.

NEW BEAD

This was one of the most challenging set of dies we have made. There is so much going on and trying to test/adjust and then control what was happening. It was a daunting task. That one little tiny joggle detail was the last to go in and if it was off, we would have to make an entire panel to recheck it again after every change. The other thing we were trying to control was the secondary amount of curve that was generated from installing such a deep detail and not pre-stretching the panel. At this time, we also re-worked the leading edge of the roofs original drip rail detail by cutting it and moving it down to correct the much-too-wide gap from the factory.

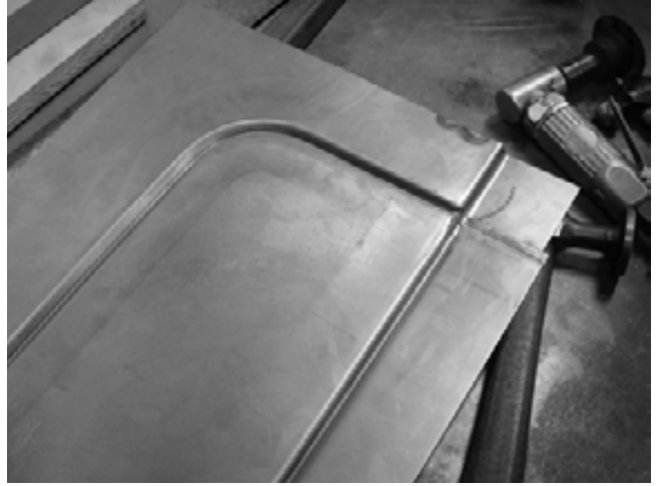
Took about a day of testing and tuning to feel confident with the profile shape and having control of the secondary curve.

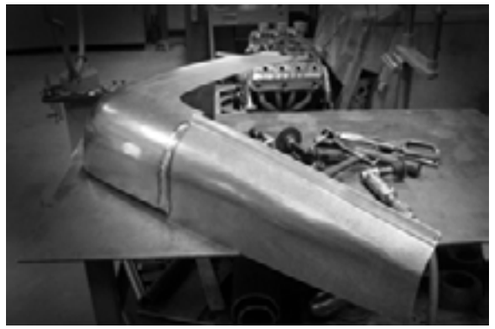


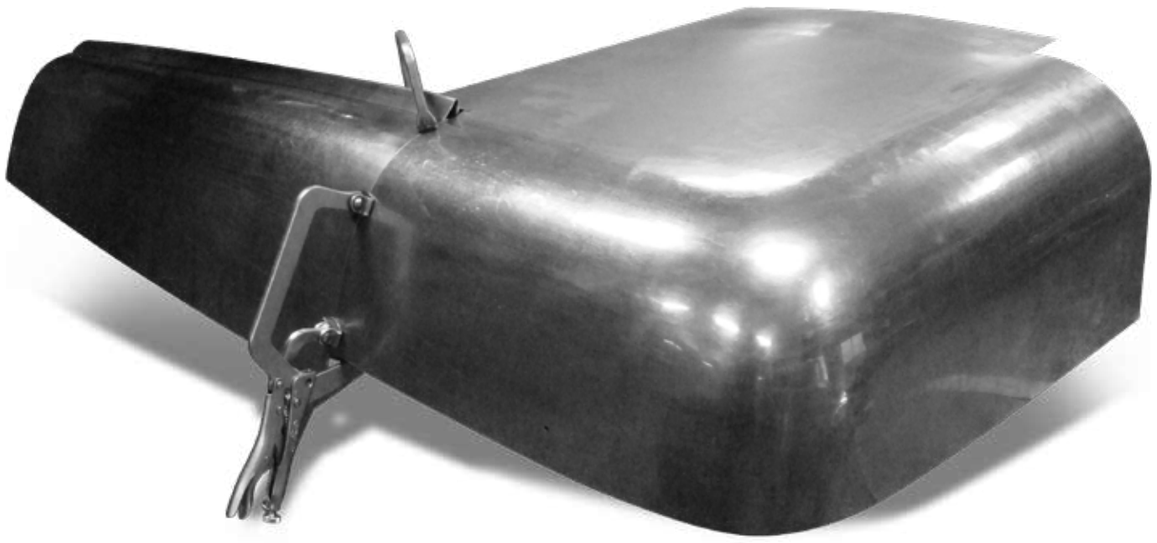
We first made a mold of the bead detail and then drew out the general concept of the backstop guide and how it was going to work with all the suspected clearances.

CORRECT ELEVATIONS

It was time to work on grafting the drip rail panel to the rear upper cab corner and finish the body line that surrounds the perimeter. We made a separate piece and created a back stop to bolt to the panel that we could run through the Pullmax with a set of modified joggling dies. The joggle down was installed for the door to sit flush. Originally, these cabs were designed for the door to overlap onto the quarter panel like a Model A. We wanted to improve the design, so we decided to make them sit flush. There was quite a bit of hand-work in the corner to get all the elevations correct due to the changes of the additional step bead details. Another small piece of plywood was cut and bolted in place to aid in hammering the flange offset. We then used hand tools to hammer the tapered fade out of the drip rail into the radius. All the pieces were test fit and welded together. After everything was welded, it was fit back onto the truck and the buck. All the final metal finishing was completed as an assembly.







THE REAR WINDOW

Not a typical a fan of chopped cars when they chop the back window the same amount as the sides. They always look way too small in the back. Feeling this way, we initially chose to leave the back window the full size. After looking at it completely together we felt it would look more original if the back window was a couple inches shorter. So we mocked it up with cardboard to confirm the proportions and then cut the back window and removed the couple inches it needed to look correct. We then added a small filler strip to the bottom of the assembly and fully welded it to the roof assembly and planished the weld seams.

Shortening the height of the rear window opening 2" to retain more OEM style proportions.

CONNECTING THE PIECES

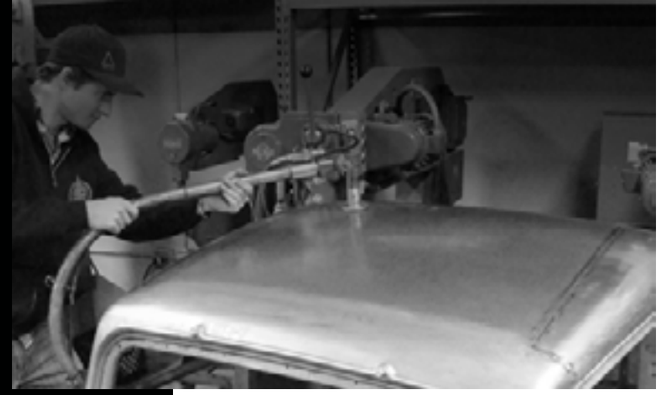
After all of the main panel assemblies were completed, everything was test fit one last time. We strategically planned out the final welding process of which seams to do first in order to obtain best access for metal finishing. We checked and confirmed the panel fitments and scribed the lines for the first weld seams that needed to be trimmed for final welding.

Looking at everything together and finally seeing what we had envisioned in foam was truly a great feeling. Seeing how well all the pieces fit together with just a handful of clecos is like receiving a silent pat on the back for a job well done as a metal shaper.

Final inspection of major assemblies before final welding.

FINISHING THE SEAM

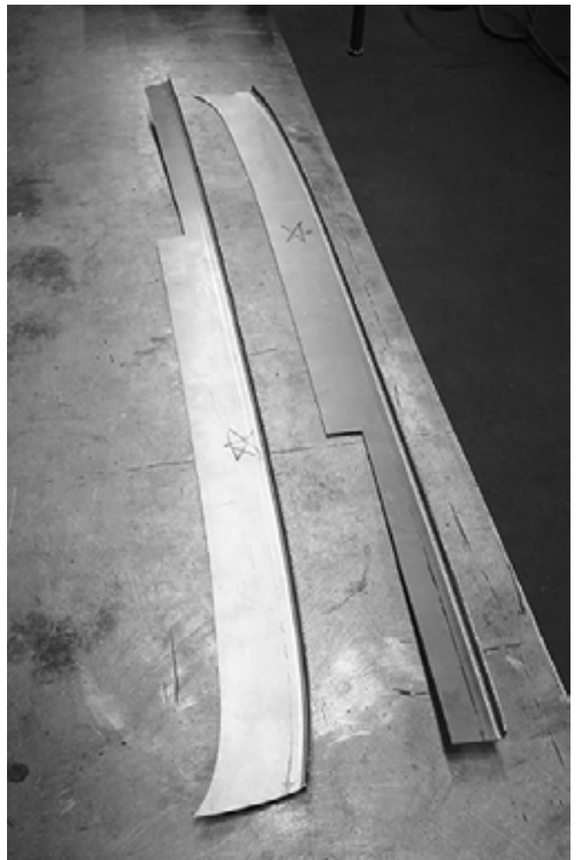
Final tack welding of all the large assemblies and final welding of the four major sections: after everything was welded together the entire cab shell was removed and the sheet metal was straightened and any areas were touched up that needed any fine tuning. In the couple images you can see some shrinking with a shrinking disk on a sander. The seams and jambs were then all sprayed with zinc weld through primer. Then the entire assembly was re-fit and the weld seam behind the windshield was completed and the remaining perimeter was spot-welded in the jambs.

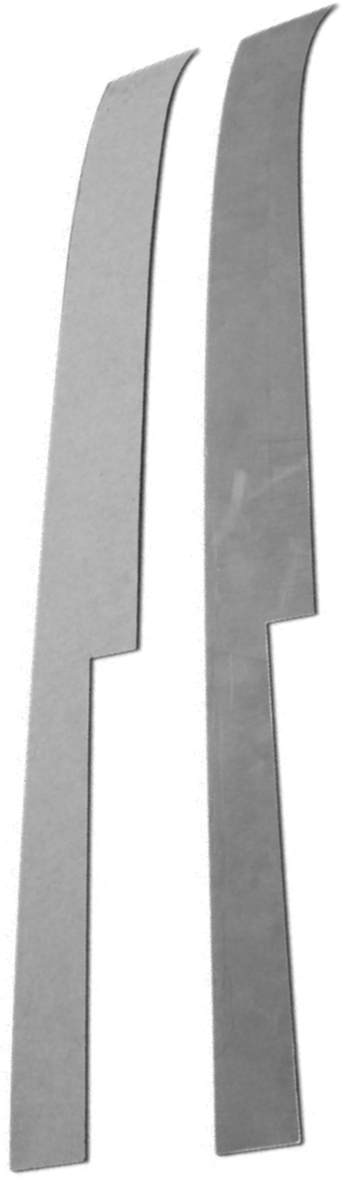


There was a lot of time spent welding and metal finishing the major seams before the entire assembly was permanently affixed.

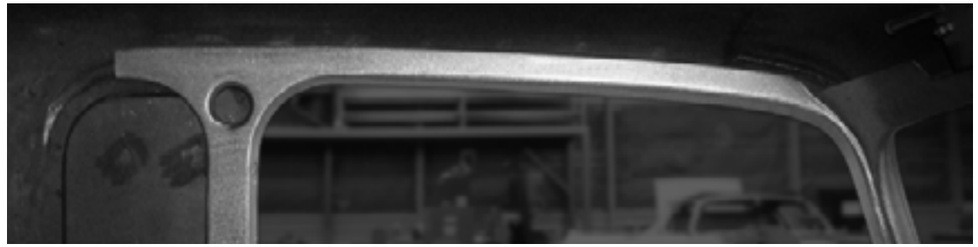
FILLING THE GAPS

We needed to button up the header top on the truck cab connecting the A-pillar to the B Pillar. We then fabricated a bolt in removable panel to gain access to the windshield wiper transmission motors. We fabricated some small filler panels to cap the top of the door openings. We made some cardboard patterns and cut them out of sheet metal and flanged both edges on the Erco flanger and then welded them into the cab and sanded all the welds. We blended them into the vertical B-pillar pieces to make them appear as one piece.



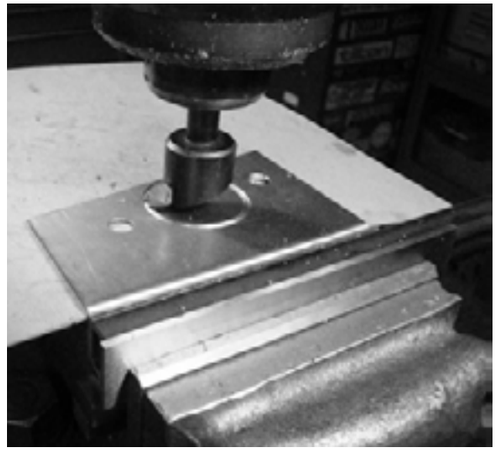


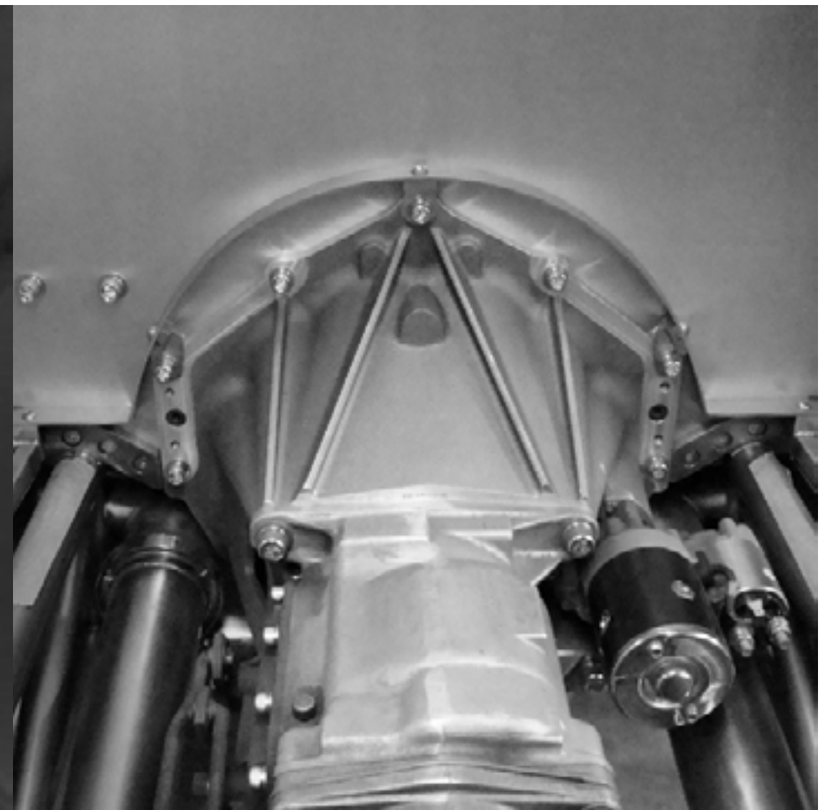
Fabricating filler panels to fill the void of the removed original wood.



ABOVE AND BEYOND

We began fabricating the perimeter of the cab structure corners to connect the sheet metal floor to the transmission tunnel. It was set-up to be removable so one could remove the transmission out from the top. Brackets were made to bolt to the transmission bell housing and are indexed and located by nesting the three brackets on the bell housing. There were corners machined to nest tight against the mid plate/firewall and flush mount the metal strip that the floor will spot weld to. The strip became part of the floor pan. The front roll cage mount hole and plate was added and spliced in the current location to bolt directly to the frame.



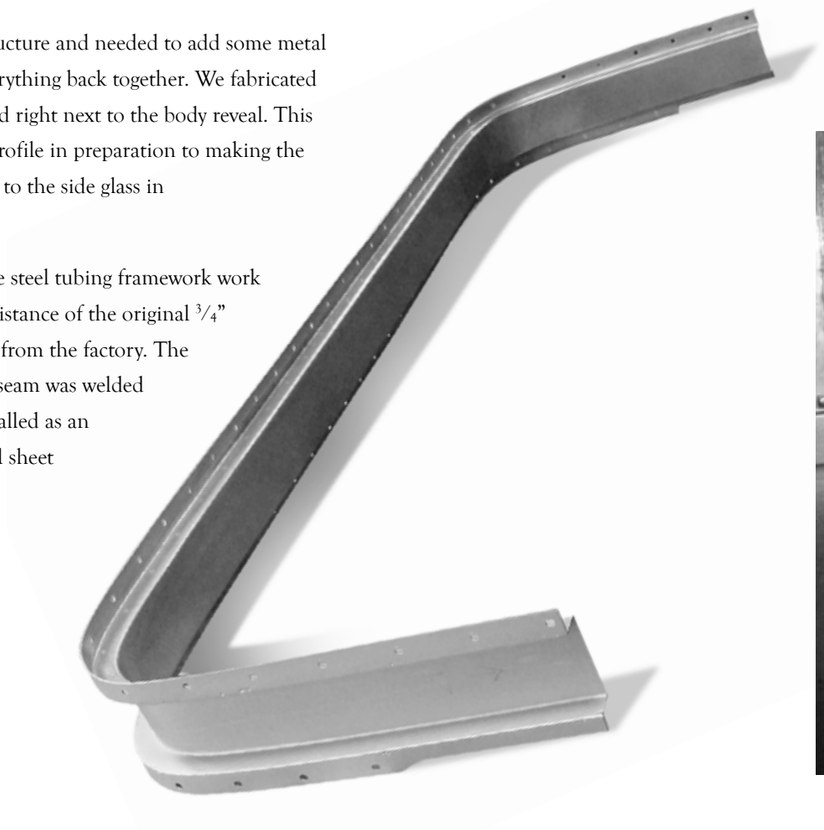


Space is at a premium in this small narrow cowl. Precise filler pieces were machined to weld in place to make everything fit correctly.

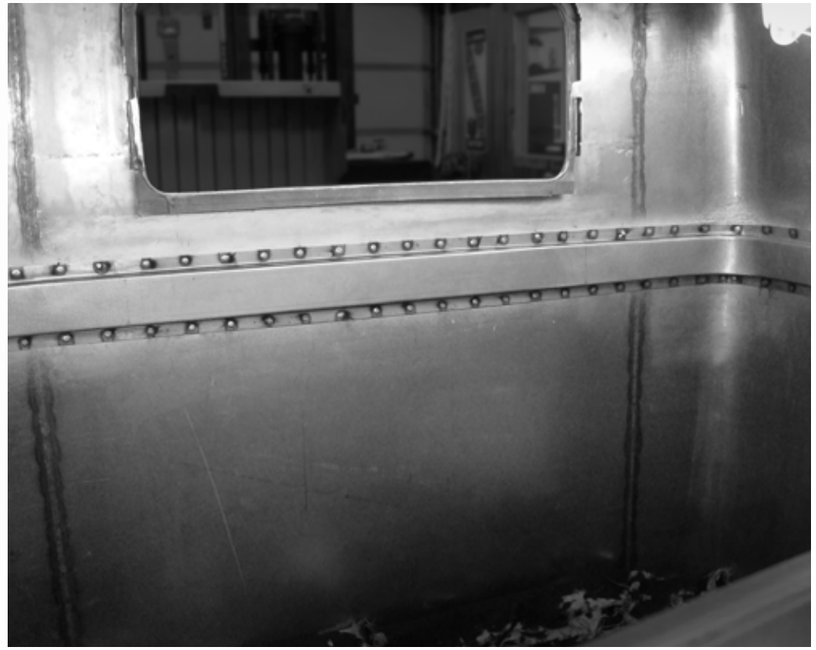
TIP OF THE HAT

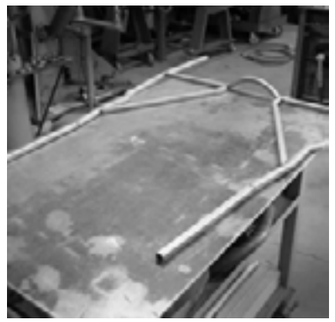
We removed all the wood inner structure and needed to add some metal inner structure to the cab to tie everything back together. We fabricated an inverted hat channel to plug-weld right next to the body reveal. This brace also needed to be fairly low profile in preparation to making the rear view window roll down similar to the side glass in the doors.

There was a small amount of square steel tubing framework work that was fabricated to take up the distance of the original ¾" plywood floor which was originally from the factory. The framework was removed and every seam was welded and fully sanded. It was then reinstalled as an assembly and welded to the original sheet metal stamped rockers.



Fabrication of the inverted hat channel brace before it was final welded to the new cab.





Steel tubing was used to fill the void of the original plywood floor. The new removable sheet metal floor was bolted to this framework.

FIRE PROTECTION

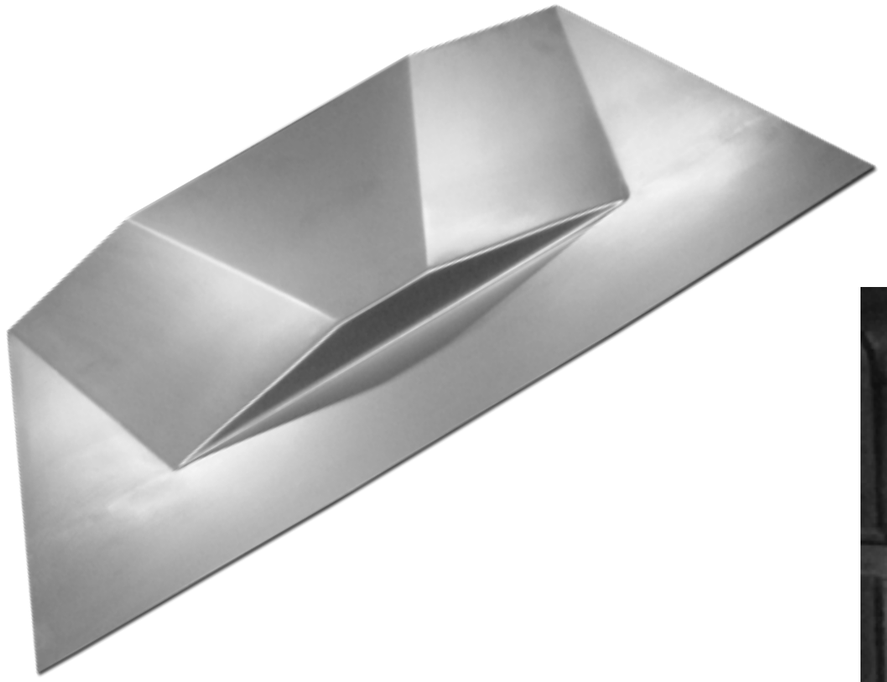
We fabricated a new firewall with a simple radius around the edges. We joggled the firewall to flush mount the engines mid-plate so it appears to be on one solid plane. We plug welded a ¼" steel strip to the back side of the flange which allows the mid-plate to bolt to the firewall and keeps everything from bowing when bolted up tight.

The cab was removed and placed on a forklift and rotated in various configurations to gain access for final welding, patching, cleanup and misc. fabrication. The top of the firewall was also final metal finished with it off the chassis to gain more access.

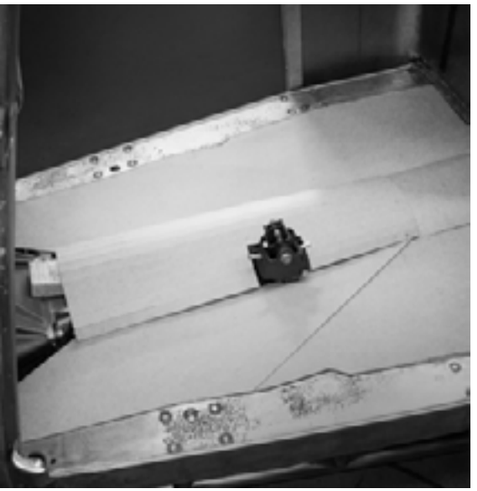
Finishing weld seam across the top of the cowl with the cab off to gain more accessibility for hammer and dolly work.

EASY ACCESS

Making the rear window operable was no small task. The entire assembly has to be removable in a way that will allow the glass to come out from the bottom vs. out the top of a conventional door frame which is the industry standard. We created a frame work from ¾" steel tubing and located the correct glass angle and welded the structure to the floor and window frame. The angle is different from the original angle in the door so we had to pie-cut the perimeter of the original door frame we used and had to add a tapered strip up the side and top to make the angle match correctly for the necessary operating angle. After that, we measured the glass run channel and determined the amount of compression and simulated that with pieces of cut cardboard. The steel run channels had to shimmed with spacers to get just the right alignment to keep the channels parallel, so we machined four different shims and welded them to the channel to permanently locate everything correctly. After we had the electric brackets made, we designed a cover to keep the dust and debris out of the interior as well as a drain tube to let any water run out the tube through the floor.

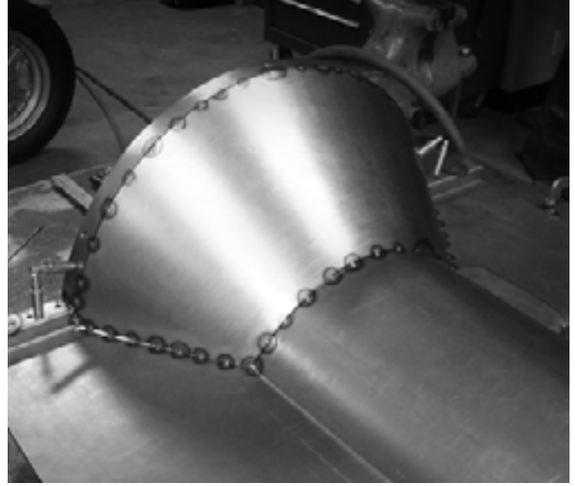


Completed roll down rear glass assembly with power window regulator cover being located and mounted.

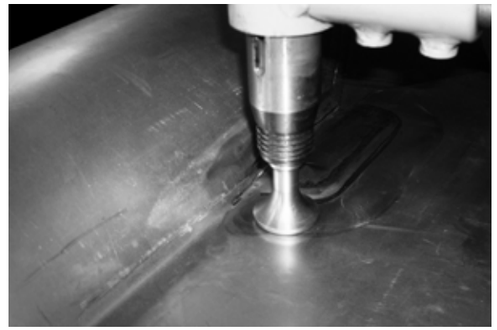


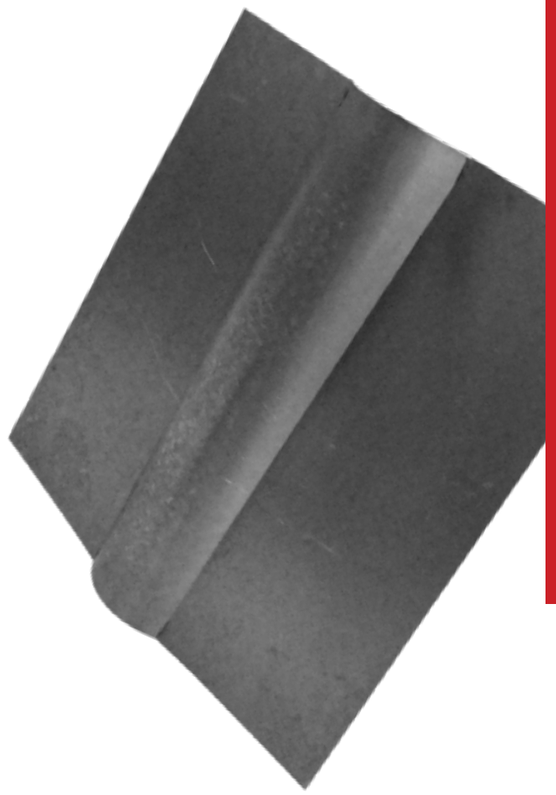
FLOOR IT

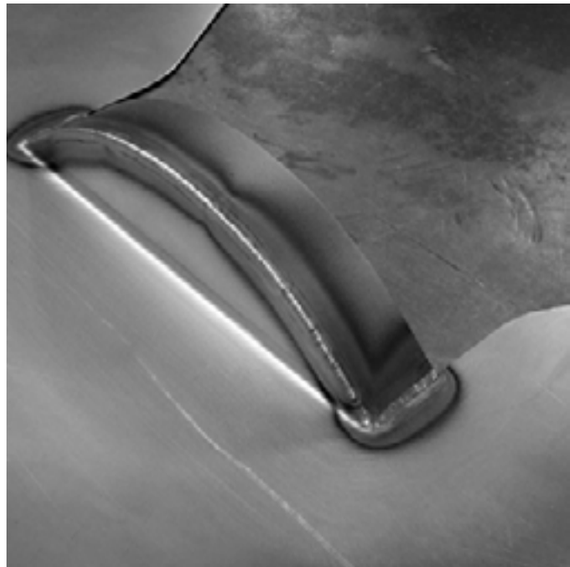
We mocked up everything first in cardboard and started to fabricate the floor pans beginning with the rear floor pan first. We welded in a separate piece to fit over the driveshaft hoop. The front section that goes over the transmission was formed in one piece and excess trimmed away. We joggled a small section to give additional room for the starter mounted on the back on the bell housing. We then formed the bell housing panel and welded the center floor pan to the 1" mild steel strip that bolts into to the top of the bell housing and mid-plate. The rear section was then plug-welded to the frame work and original sill/rockers.



Final welding the 1" steel mounting strap to the removable transmission tunnel.







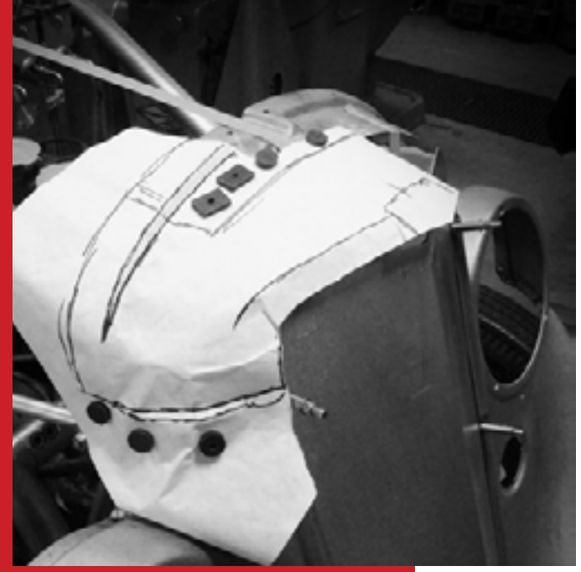
EMBLEMATIC

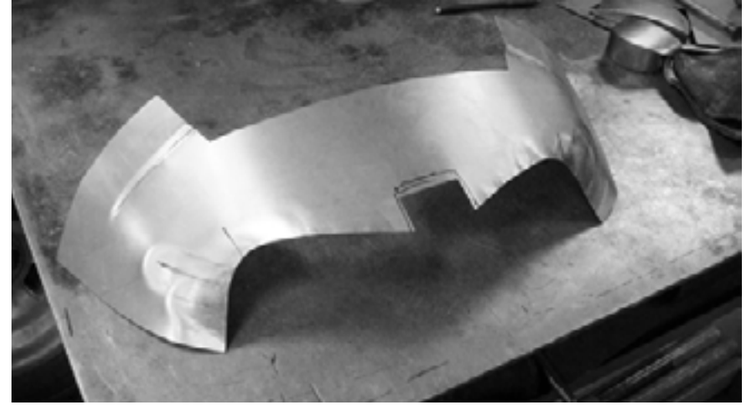
We lined up the two halves of the hood tops with a laser to make sure they looked correct with the cabs moldings. Then we cut the original hinge areas out and welded in a filler panel. We cut the original molding that was in the top of the grille shell out and grafted it into the front of the hood top to make it more conventional. This allowed the hood gap to be more consistent. We then took a look at the original Willys 77 hood emblem and saw how much extra mass it had and how much it protruded out of the hood. It also originally blended into the leading edge of the piano hinge of the 4-piece hood. Since we removed the hood hinge down the center the trailing edge of the hood ornament looked awkward as well. We cut the back side off the lower section of the emblem and machined a new rear section from scratch to blend with the original front section. We fabricated new sheet metal to french in the entire hood ornament to make it look as smooth and flush as possible while not completely loosing the original design. Just making it more modern and contemporary.

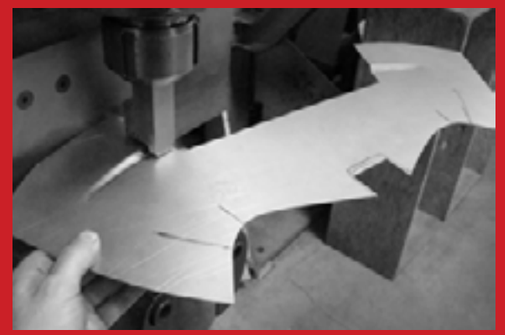
Going to extremes to make the original hood emblem design cleaner and ultimately more simplistic.

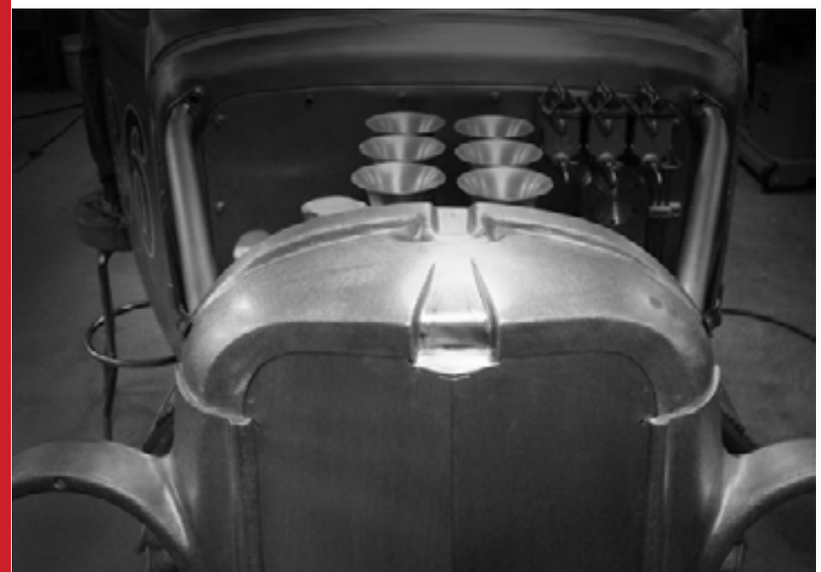
SHELL GAME

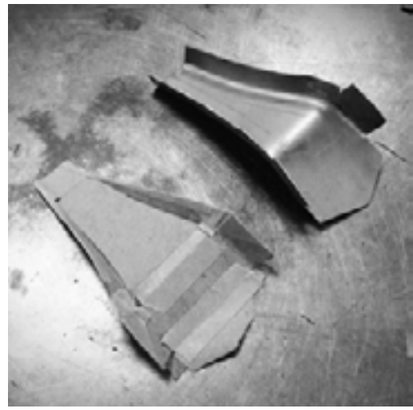
The top of the grille shell needed to be reworked because we moved everything around on the hood top configuration so much. We made a paper pattern of the new panel and began by installing the tapered offset with the Pullmax joggling dies. The form was then installed around the entire panel. Then the leading edge was shrunk with the thumbnail shrinking dies in the Pullmax. Those areas were then smoothed, and additional shape was added to the center of the new panel. After the panel was completely shaped, it was grafted into the original top section that originally retained the weather stripping. We then fabricated a recessed area for the hood ornament to nest into. That section was then welded into the assembly and sanded smooth.





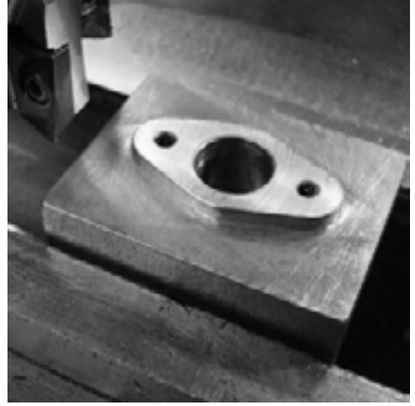


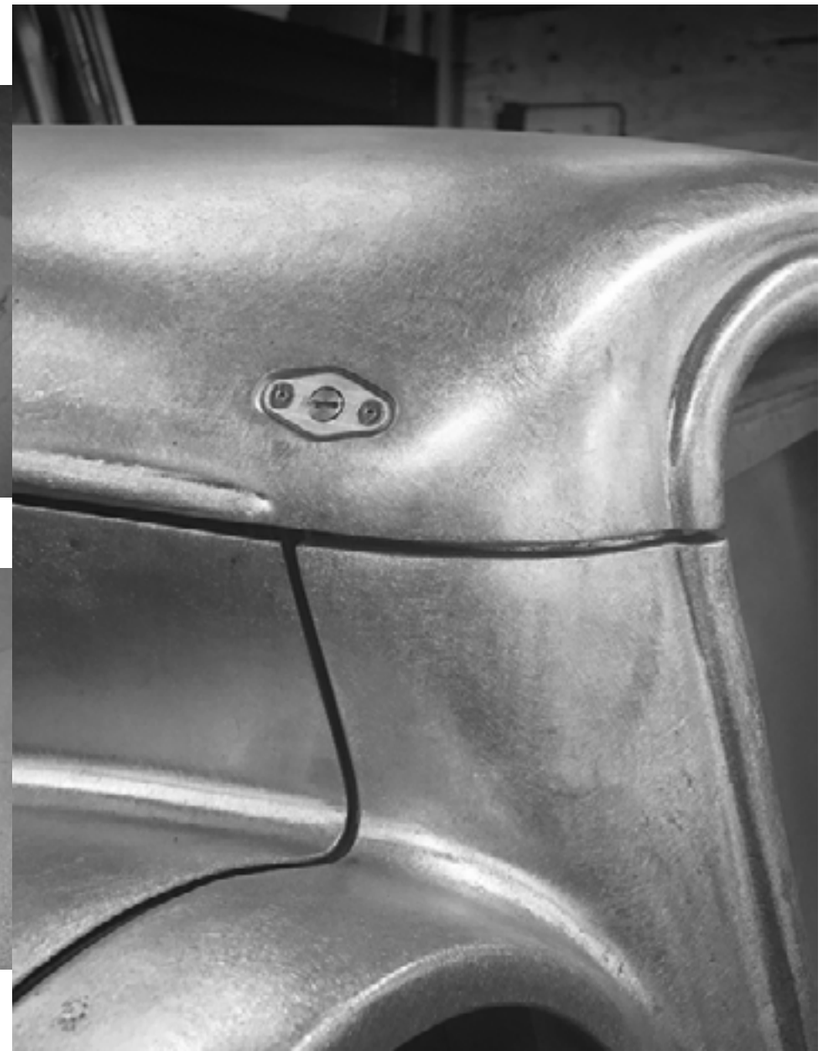


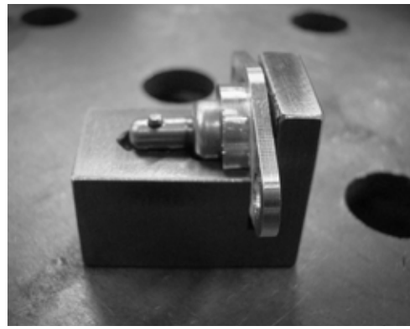


NOT A DZUS

We found some aviation barrel-fasteners that work similar to dzus fasteners. The thing that made these cam lock fasteners so much better than the regular old dzus fastener is that the barrel that they lock into is infinitely adjustable within its range. There are no spring clips that need to be bent and moved during final assembly for fine tune adjustments. Another nice feature is that they are much smaller in general. Unfortunately, they just fit in a barrel and we wanted them to emulate a traditional dzus fastener so we had adapter plates machined that the barrels fit into. They basically look like a down-sized dzus fastener. We also had nut tab plates machined to they can be bolted to the sheet metal. We then manually machined a male and female press tool so we can make the entire assembly flush-mounted into the hood top panels. This was the machining and testing process of the stamping dies as well as the assembly fixture we made up to install and remove the pins.







Another fixture was machined to install the cam lock fasteners retaining pins. There was no easy way to take them in and out to change the length of the barrels so we came up with this handy little tool that makes it super easy.

GRILLIN' OUT

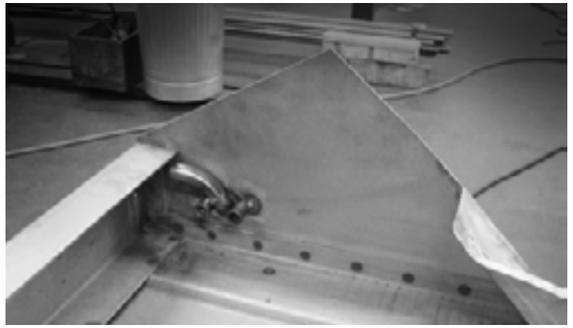
We fabricated a simple filler panel to start the mock up of the new grille. We notched it out around the bottom of the Moon tank mount brackets. We also added some oblong holes to fit the lines through the grill. We drew out a similar pattern to the original with an edge trim ring to make it look more finished rather than like it was just hacked off and bolted in. The grille insert was programmed from our pattern and water jet cut by Ed Kirk the owner and operator of Kirco Precision Tool. He made us a mock up one out of steel first for us to check and make any slight modifications or changes to before cutting and bending the actual one out of 304 stainless steel.

We also fabricated some strips that bolt behind the grille to pull the grille itself as tightly and evenly up against the shell.

LIGHTING

Reworking the ‘37 Ford taillights and fabricating the standoffs with hidden wiring to run through the bed side. The original mounting surface is on the bottom of the light housing so we had to fill the original holes and rotate the mounting surface to the inside. Some pieces of tubing were squeezed in the vise and reworked with a t-dolly and hammer. They were then welded together and fit to the taillight housings. Small pieces of tubing were slip fit inside the standoff for the wires to pass through. A fixture was made up to keep the housings and the standoffs square. The entire assembly was then welded and sanded smooth. We machined bungs for socket heads and they were welded into the inside of the bedside to mount the taillights. There was also a piece of tubing fit within the bed side wall to route the wiring through to the underside of the bed to hide any wires. The panels were fully welded enclosing the tubing that will route the wiring into the back channel of the bed.

Designing and fabricating an elegant stand off for a pair of ‘37 Ford taillights. We also installed a piece of tubing to route the wiring through so there would be no exposed wiring on the backside of the bed.



Small pieces of exhaust tubing were squeezed in a vise to get their oblong shapes and welded together to create the base of the standoff.

WHEEL WELLS

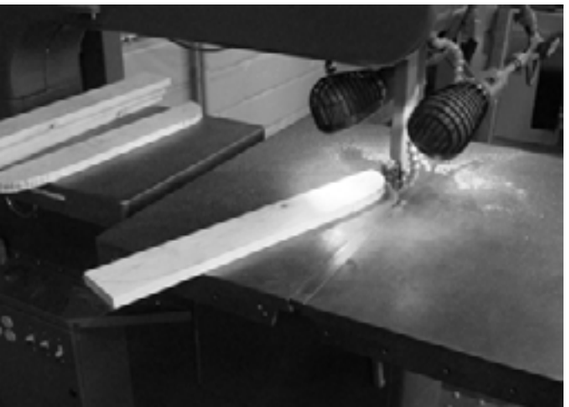
We took a profile pattern of the fender opening and the profile of the outside of the fender. We modeled these more after a sedan or coupe fender. The factory originals looked more like trailer fenders. After we were satisfied with the profile, we removed the bed and made an additional pattern so that the inner tube would flange back into the frame and allow a consistent gap around the top of the frames upper tube. We fabricated an inner and an outer wheel tube. The reason for this was so that the caged nuts would be inside both tubs and so there would be no exposed fasteners sticking through the inner tub when bolting on the rear fenders. We also fabricated a 1"x ¼" strip of steel that will weld to the fenders edge to add the rigidity and allowed us to countersink the strip/strap for countersunk bolts to mount the rear fenders.

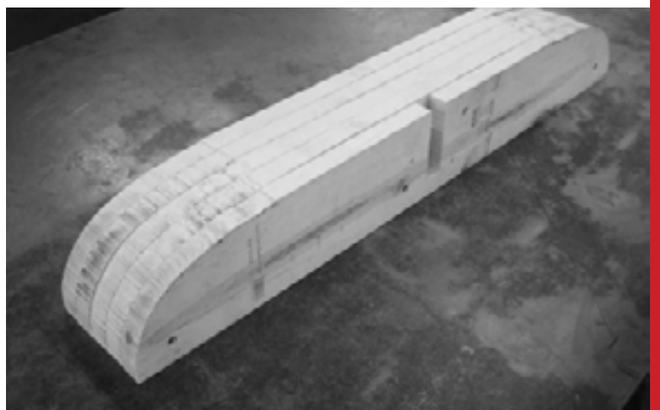
Cardboard profile templates were taken of the outside of the fender to begin fabrication of the double walled wheel tubs.

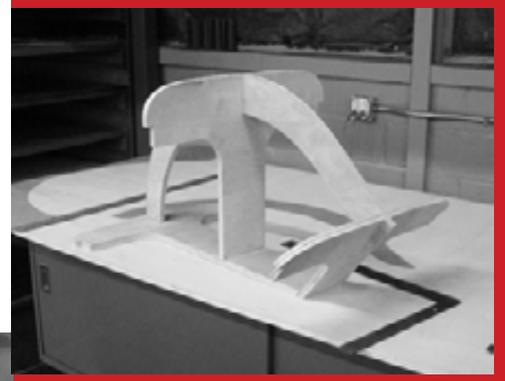
Our adjustable angle stationary roll sander was utilized to add a consistent radius around the entire strip edge of the fender doubling strap and then drilled with countersunk holes for the flathead allen fasteners.

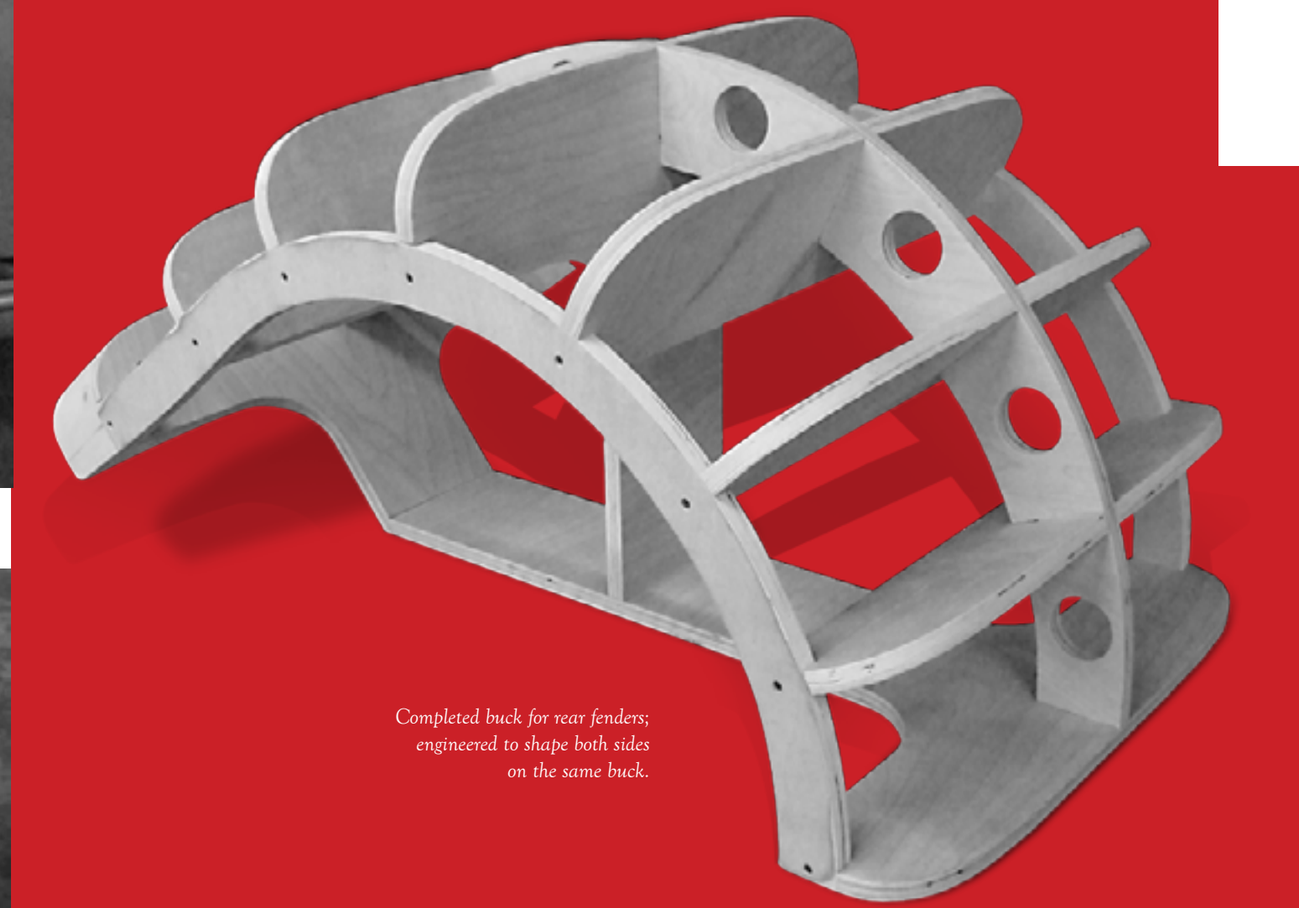
TAKING SHAPE

The rear fender buck was created from the profile patterns we made of the fender opening. Starting with building the main spine and then adding the ribs or *stations*. This buck was built using ½" & ¾" ash plywood similar to the buck that was build for the cab and was created so both fenders could be shaped simultaneously.





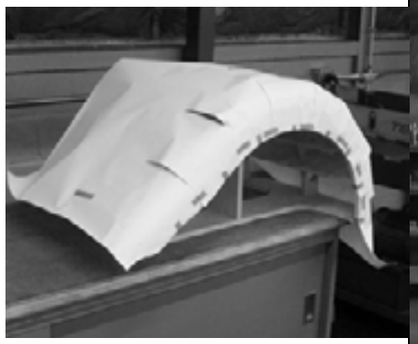


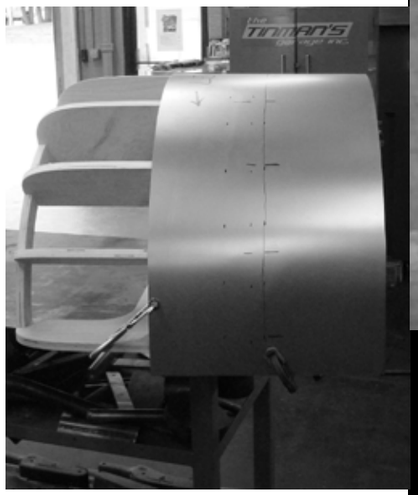


Completed buck for rear fenders; engineered to shape both sides on the same buck.

FENDERED

After the buck was completed, it was first used to create a paper pattern. This paper pattern was used to determine the shrink areas as well as the patterns to cut out the pieces to shape the fenders. The blanks were cut out of a sheet of 19 gauge steel. The form was first installed in the fender to go around the spine of the buck. Then the edge was shrunk to draw the material over the edge. The fender was then stretched slightly in the center to add some crown and then worked its way around the edge of the wheel opening. Both of these rear fenders were shaped from one piece of sheet metal.

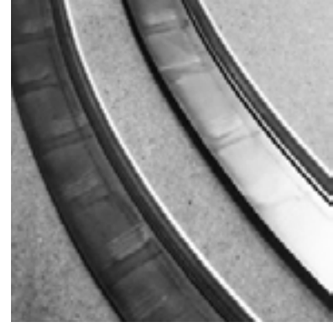


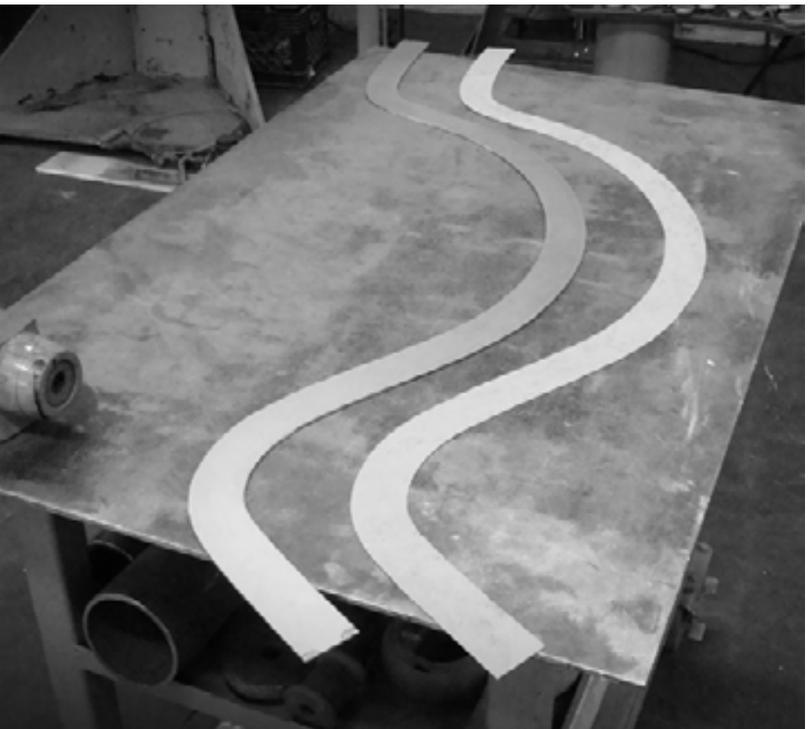


The final shaped rear fender made from one piece of 19 gauge steel clamped to the buck.

FLANGER MAGIC

We made a cardboard pattern for the rear wheel openings. These fenders were bobbed and the openings were made to match the outside diameter of the tire similar to the way they use to cut the openings on gassers for needed tire clearance. We took those patterns and transferred them to long strips of sheet metal and cut them out. We then used the Erco flanger to flange the outside edge to 90 degrees with a 3/32" edge radius. We then switched the dies to a set that turns the edge to 180 degrees. A solid wire rod was then formed and slip fit into the 180 degree flange and then a set of dies for the P9 Pullmax were used to final-crimp the rod into the sheet metal strip. The three-step forming process manipulated the form or profile of the strip in comparison to the original cardboard pattern, so there was some shrinking and stretching in order to get it to conform and match the profile pattern. After it matched up, the front and rear corners were formed and fit.

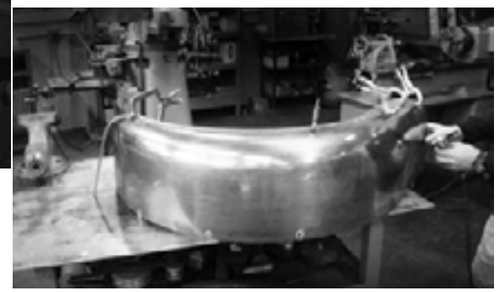


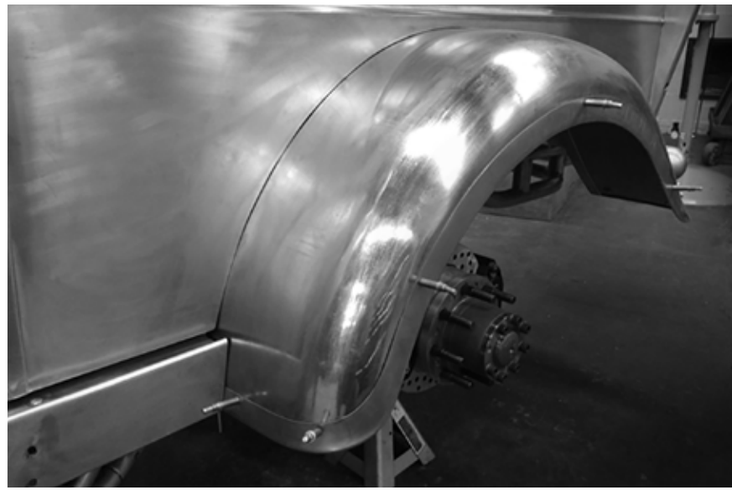


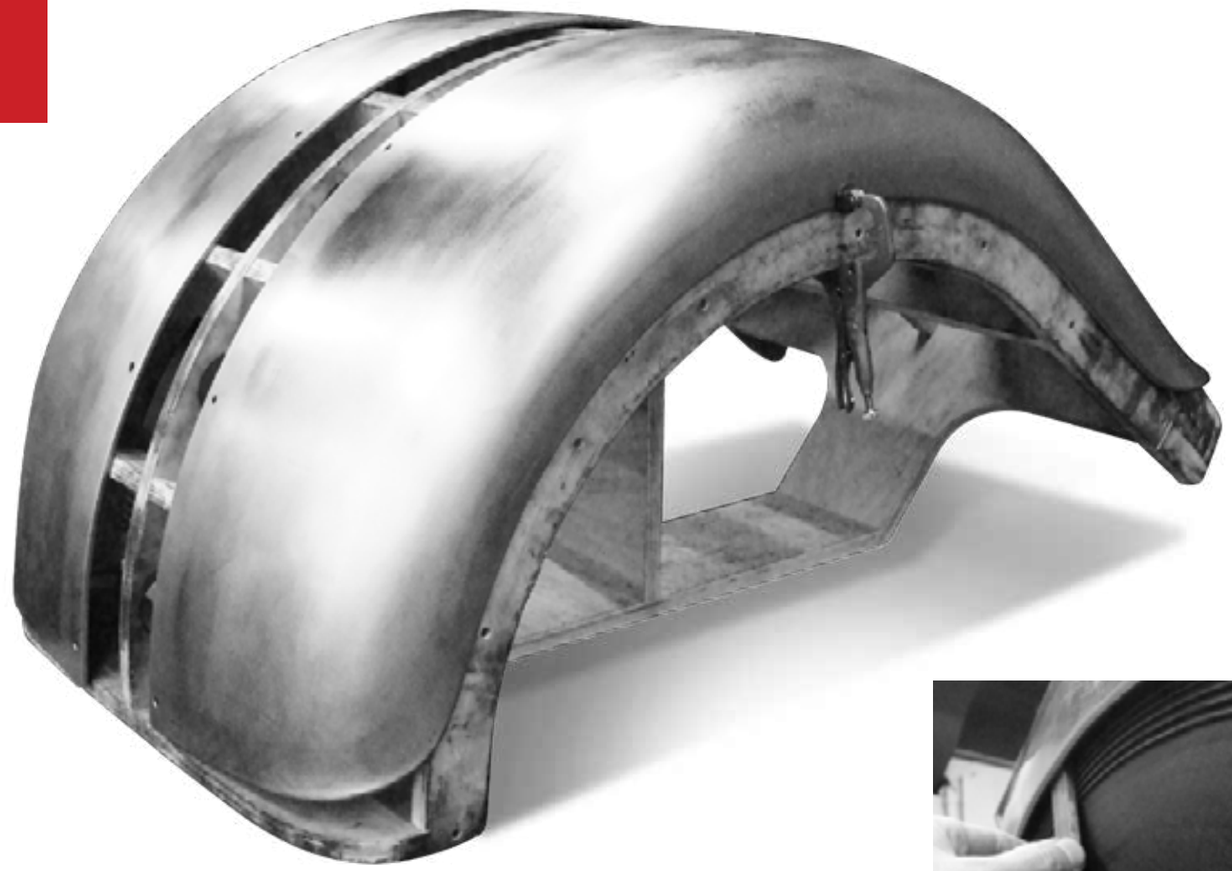
The cardboard pattern and metal strips that were cut out in the correct shapes to install the wire edges.

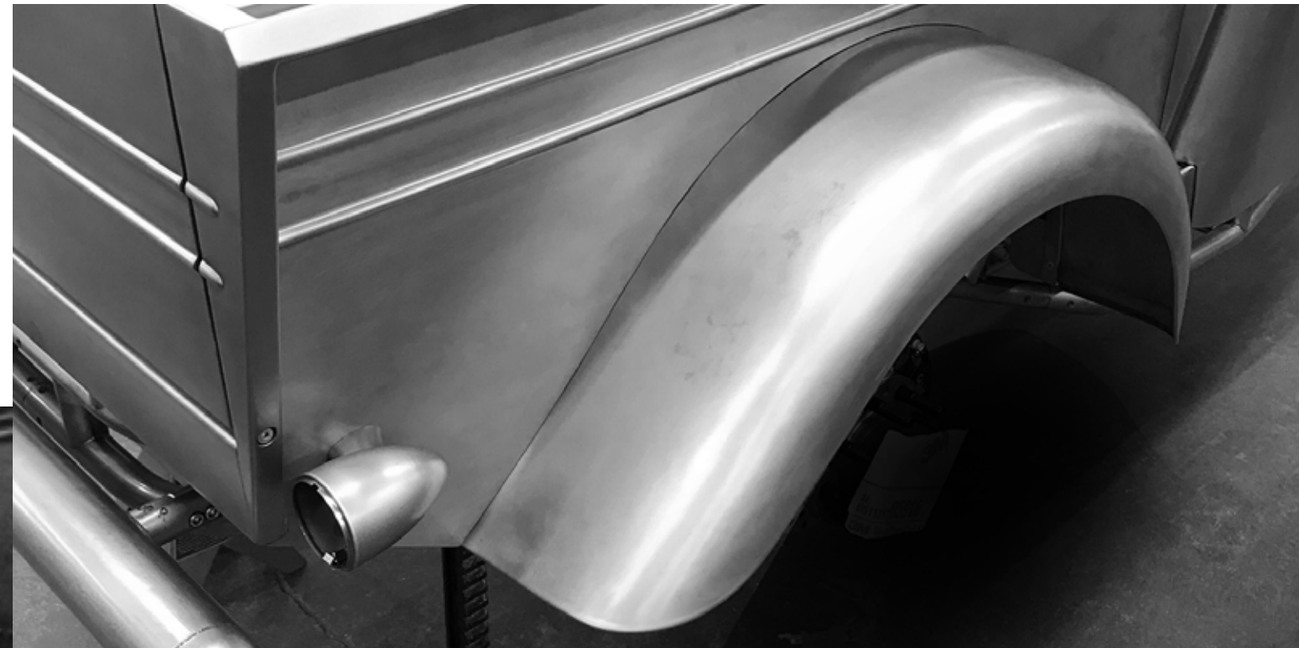
FINAL FLANGE

Finalizing the location in and out of the fenders and welding it to the mounting flange. We wanted to get the edge of the fender as close as possible to make it look like it will almost rub. We jacked the rear suspension up and articulated it with the springs out and there was a 1/4" of space which is as close as we feel comfortable getting it. We trimmed the scribe line from the wired edge piece and TIG welded the entire wired edge strip on the fender. We then hammered the welds with a planishing hammer to stretch the weld back out and remove shrinking and warpage. When we were all done, we removed the bed off the chassis and final welded all the plug-welds to the mounting strips.



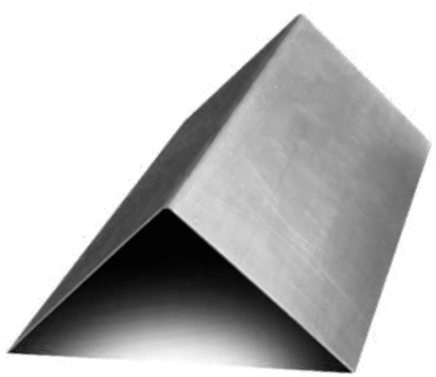


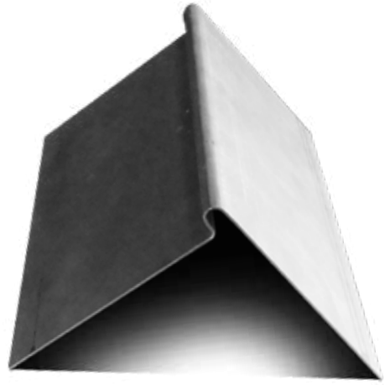


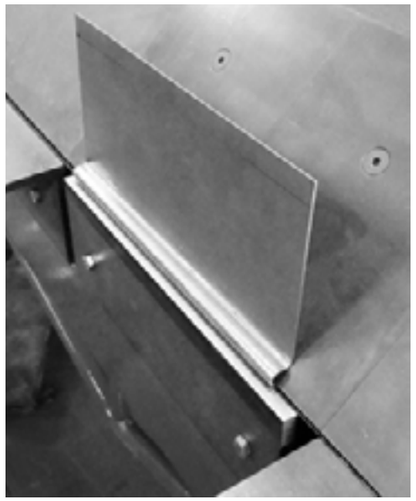


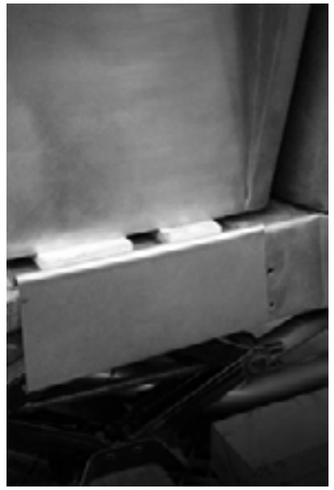
EXTENDED ROCKER

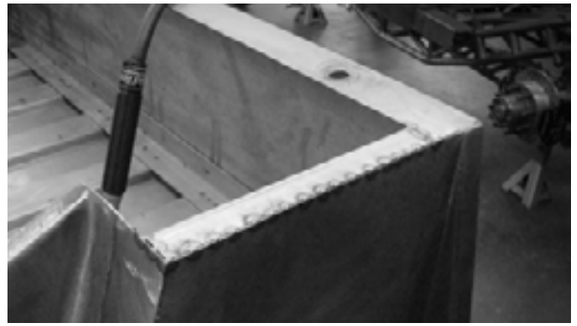
Before mounting the fenders, we had to address the trailing edge of the rocker. The original design from Willys was that the rocker stuck out the rear of the cab and that was the mounting flange for the fenders. So the original wheel base is much shorter and we thought it would look awkward with the wheel base up that close and having that much bed hanging over the axle centerline. The same rocker was used on all models of cars including the coupe, sedan and truck. In fact the B-pillar, door, rocker and cowl are all the same and they just grafted different Sheet metal depending on model. We extended the original rocker to meet the new location of the fender. We cut off a portion of the rocker and spliced in the new section we fabricated. We then removed the bed and fabricated some corner sections to button everything up before final mounting the fenders to the mounting strip.











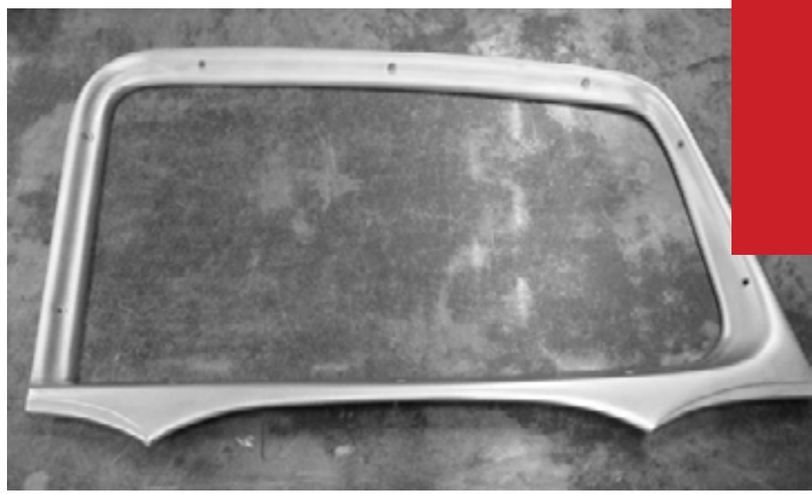
Extending the original rocker to make it line up with the new fender location and wheel base.

THE WINDSHIELD

We made an aluminum pattern for the windshield so that we could flush mount the glass by gluing it in. The aftermarket windshield gasket rubber for these fits terribly. We also installed the wipers at this point and checked the operation and made adjustments to the timing.

We also reworked the garnish moldings to improve the gaps around the door edge and jamb when looking inside the truck. The original were beyond horrendous. We spliced and moved the edges around to get them to fit the edge of the door correctly and be evenly mounted off the doors surface height as well.

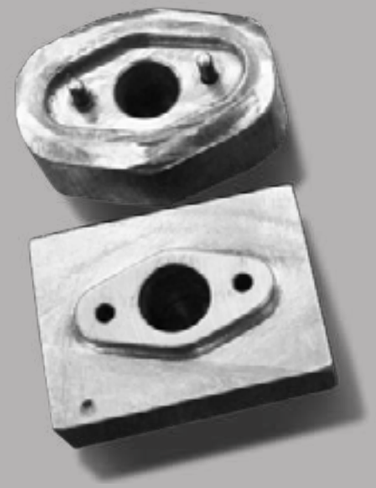
Locating the template for the flush-mount windshield so we didn't have to use the ill-fitting OEM style rubber.

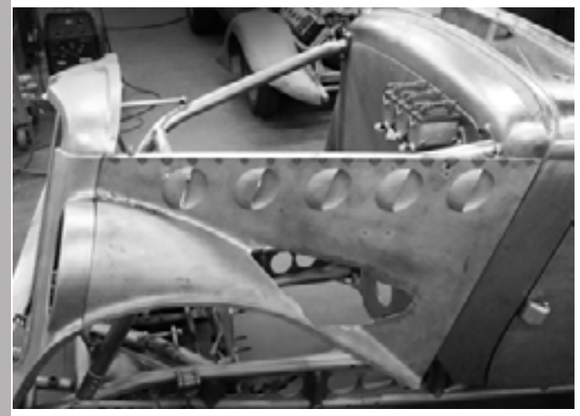


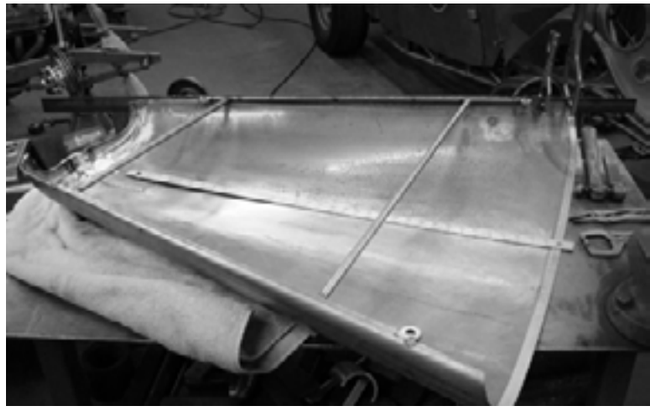
Reworking the garnish molding so they fit the door top better and the edges were more flush.

REMOVABLE NOSE

The hood side and top locating pins were quite the challenge. We first located the front and rear pins and added small brackets to the front radiator support and the rear down-bar cage bracket. Then a flat-flanged edge was welded to the hood sides and the pin locates the hood sides first. Then we machined a bushing for the hood top and welded it to a support rod and then grafted that into the lower section of the hood belt molding. Now the hood also locates on the same pin. Once everything was determined, the best place for the cam lock/dzus fasteners was in the hood top. We tested the stamping tool on a radius that is as tight as the front of the hood shape. After we knew it wouldn't distort the area we drilled a pilot hole and used our press tooling to stamp the recess in for the retaining ring. Then the retaining female barrel was machined and welded into the cowl and the radiator support. Then the under side/rear of the hood inner structure needed to be removed for the nut plate to fit up tightly. A special pilot bushing was machined to drill the first layer of sheet metal along with a roto-bit.







NEW SET OF EYES

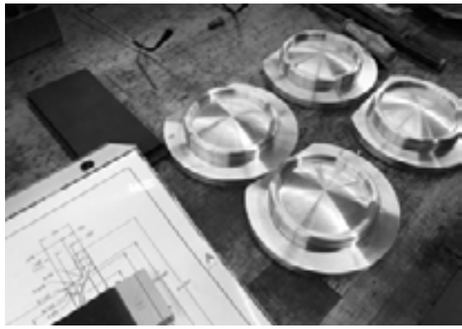
The original headlight rings fit terribly. The gap was really inconsistent around the lenses and there was no bucket that came with the lenses that was worth using. There were also a bunch of random mounting holes in the trim rings surface that didn't look so nice as well. We had the lenses scanned and then designed a trim ring that matched the lenses outside oval diameter perfectly. After that, we engineered a new mounting system for the aftermarket halogen headlight conversion buckets. We also had a hammer form machined to fit in the small area so we could re-flanged the original opening so that the gap looked really consistent and clean. Some small standoffs were fabricated with studs that we welded in and then the assemblies were welded to the grill surround so there will be no exposed fasteners on the exterior of the sheet metal giving it a much more contemporary look.

The original fit and condition of the headlight trim rings left much to be desired.

RE-PURPOSED

Recreating the horn covers to look like the originals but function as turn signals. Keeping the original look was important but adding function was also just as important. We found amber lenses from an old Ford cowl lamps and worked with Datum Tool to CNC machine the aluminum horn grilles with a recess for the lenses to slip in from the back and sandwich inside. We machined some items to make the whole fastener less system work. The one ring with the studs was welded to the grill shell and the other piece is the retaining ring to hold in the lenses. The socket we came up with was utilizing a dust cap from a heavy duty trailer axle that we hammered flat over a piece of tubing and a dolly and then pressed it into the outside retaining ring.

We utilized axle caps from a utility trailer and hammering flat spots to clear the grille shell supports. We mounted the light socket in the lower half.

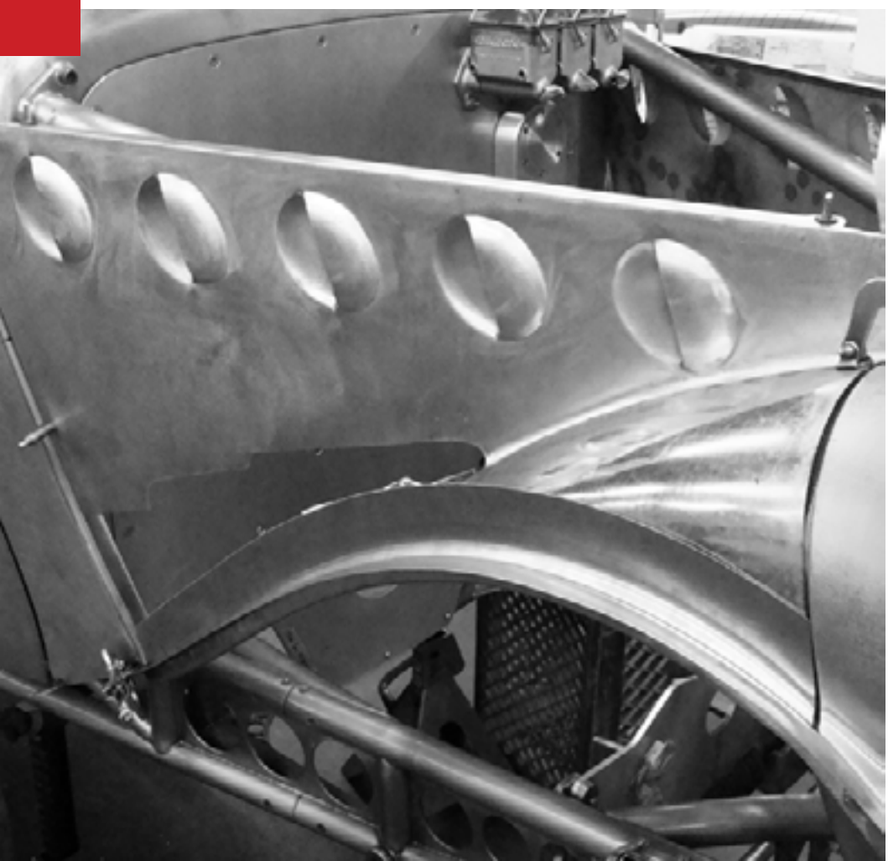


Our goal was machining multiple pieces to make this assembly sealed and have no exposed fasteners on the outside of the truck.

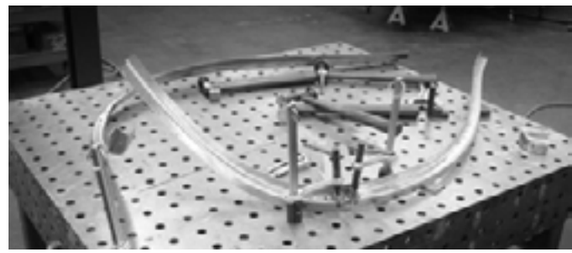
NEW CHANNEL

Fabricating new inner fender delete channel: the original hood side mounting design was a U-channel that the side simply slipped in. This was a really simple great design from them and we wanted to retain that unique design. We removed all inner fenders because they simply were not necessary anymore. We created a channel that bolted the new flange to the fender that can support the weight of having no inner fender and also doubles as the hood side mounting flange with the incorporated U-channel. This new structure also allowed us to butt-weld the original sheet metal to the support and hammer weld the entire seam to metal finish it.

Now without inner fender panels, new structural channels were fabricated to locate the hood sides and add rigidity to the front end sheet metal.



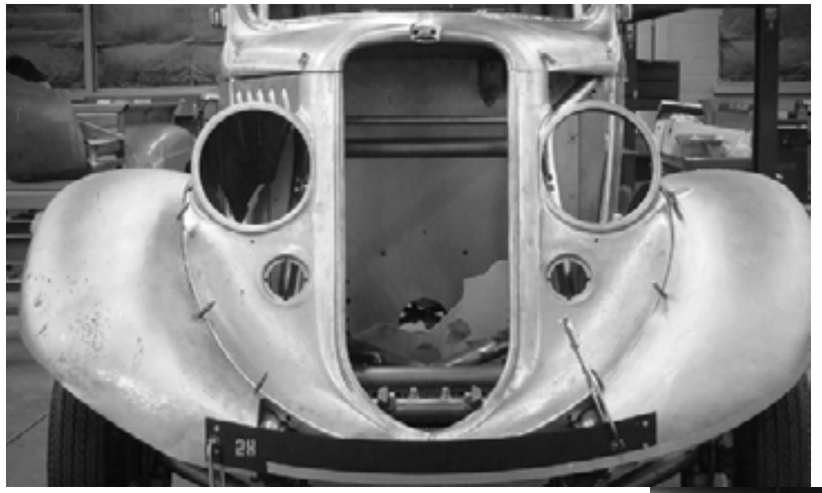
Making everything fit and flow together seamlessly with new transitions modeled after the original design.

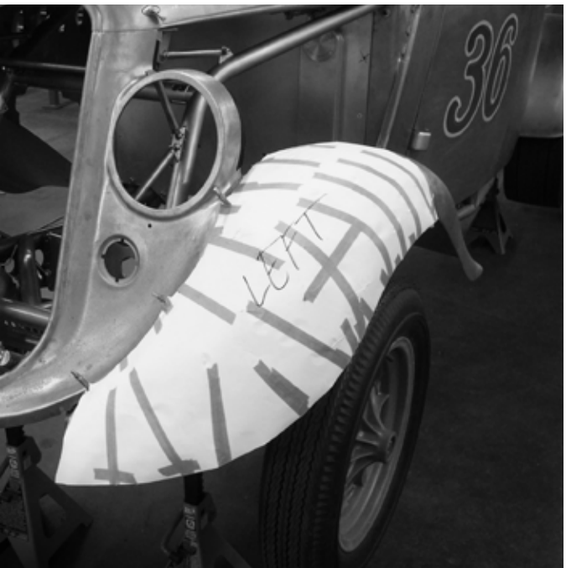


REDUCING THE WINGS

Re-working the front fenders: the first major thing we did is take some width out. The front fenders looked like large wings so we took 1" out of each fender by cutting the entire inner edge off and moving them in towards the grille shell. We narrowed it 2" overall making it look much slimmer and aesthetically pleasing. The next major modification we did was move the back of the rear fender up to mate with the cowl. Originally, there was a filler panel or apron in there. Knowing we are not going to run running boards we moved the trailing edge of the fender up to streamline the fenders and make them look more part of the body. We didn't want them to look awkward being bobbed and out of place. We wanted someone to look at the truck and not even notice they were bobbed at first glance. We wanted it to take a minute to figure out something was different. We also spent a lot of time straightening out old damage, taking another front fender and grafting it into our good rear fender on the passenger's side, cutting out the bad areas and shaping new replacement panels to repair those areas. We also spent a lot of time reshaping the fenders to make them symmetrical. It was crazy how different they were from left to right and wanted to make sure they were right before finalizing everything.

2" of width was removed out of the front fenders along with multiple other slight adjustments to the leading and trailing edges.

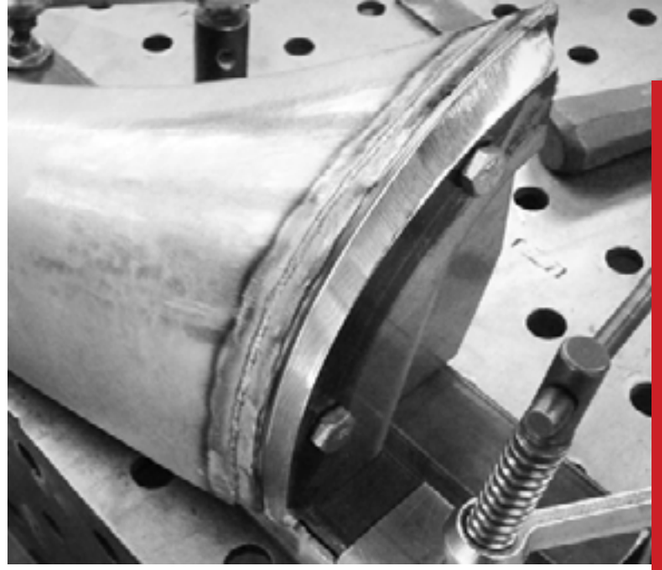


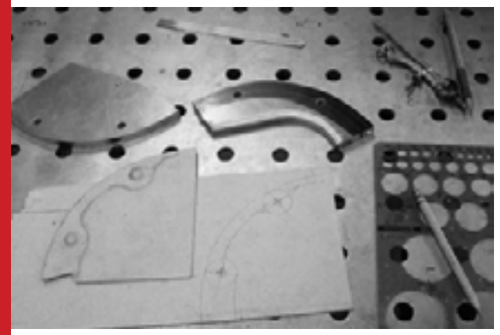


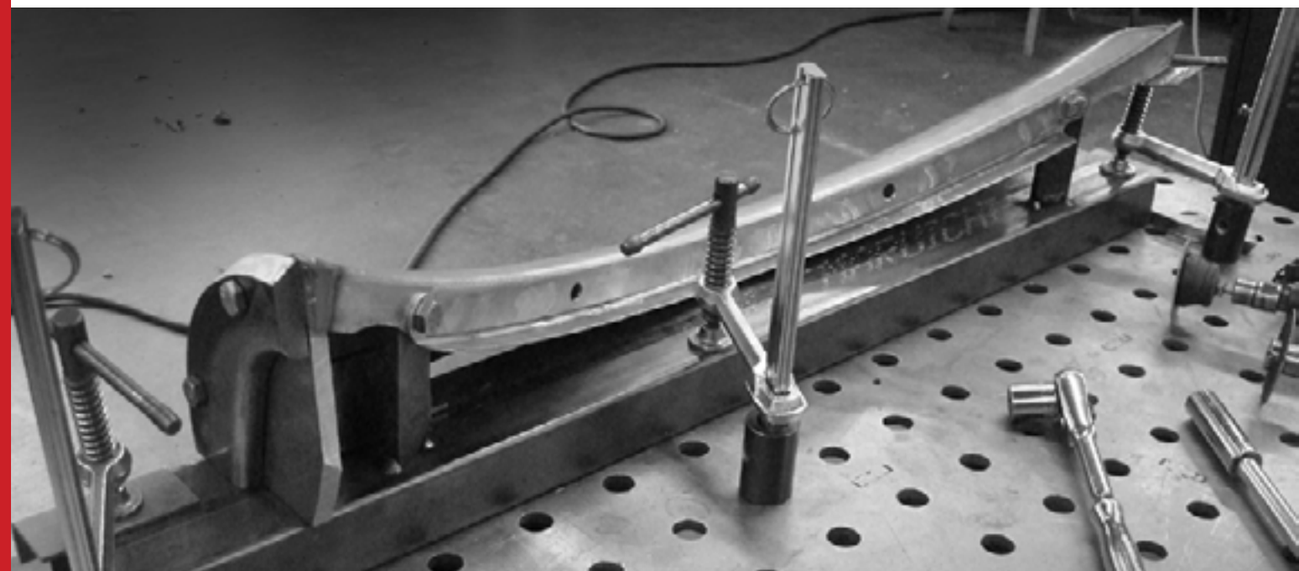
TAKING IT ON THE CHIN

Redesigning the front chin/filler panel: the original didn't quite look right and didn't flow very well. We re-designed the lower leading edge to smoothly blend into the radius and the reverse curve shape flows more with the fenders. We shaped the new panel and cleco'd it to the new channel that was fabricated similar to the fender support channel. This made the fit up to the original grille shell seamless. We made a hammer form to create the four pieces allowing the chin piece to bolt the fenders together seamlessly. These were tricky because of all the angles, but the finished result when everything bolted together is super tight and each body panel flows elegantly into the next.

Lots of detail fabricating and fitting to get everything to line up correctly from both the top and bottom and still have an original appearance.







DIFFICULT CORNERS

Fabricating rear fender mount supports: we wanted everything to be super clean and go unnoticed. We designed the shape of these brackets to mimic the corners of the cowl and to blend into the sheet metal U-support channel for the front fenders. Making a plate to cap the bottom of the cowl with incorporated caged nuts. The mounting plate was plug-welded to the front fender and become a permanent part of it. Welding, machining and grinding to blend all of the areas make these look right at home when they were completed. Notice the countersunk fasteners match the way the rear fenders and tubs were mounted.

Front fender mounting bracket is designed with a ergonomic appearance and function with its surroundings.

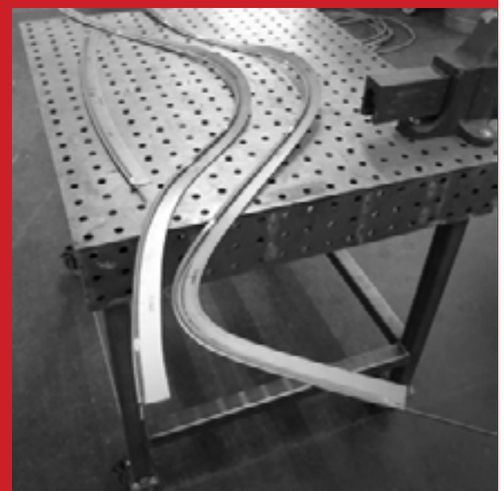
FINAL FIT

After the fenders were dialed in, they were final fit, leveled and scribed for final weld to the inner fender support channels. They were also final fit and tuned were they attach to the chin grille shell panel. The other half of the hammer formed corner was trimmed, fit and TIG welded. The last 10 percent is always the most difficult. All the corners, edges and mounting flanges have to be just right. It seemed with even the best fine-tune planning, the fenders come on and off more times than one can count on both hands.

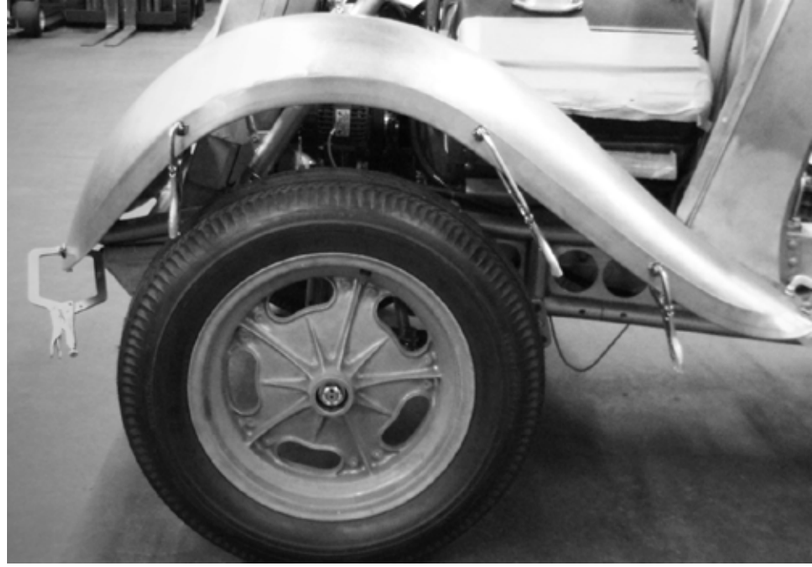
The areas on the fenders that were not heavily repaired was in-turn, heavily modified in one way or another for a cleaner look. Welding what is remaining of the original front fenders to the new inner fender support and hood side channel.

WIRED

The last step for the fenders was to fabricate the wired edge. We made a pattern of the shape of the opening with a piece of cardboard and cut out those strips of metal. The edge was then flanged on the ERCO to a 90 with the correct inside edge radius. The dies were then swapped out and it was formed over to 180 degrees. The wire was then formed and fit inside the fender. The last step was to crimp the wire in the sheet metal channel with the Pullmax. After the wire edge was installed, the edge was then formed with a hand shrinker/stretcher to get it to fit the wheel just right where it will be welded. It was then tack and final welded. After the majority of the metal finishing was completed on the drivers side, a pattern was made to transfer it to the passenger side. This allows us to easily make them symmetrical. Once the pattern was made, the passenger side was completed in the same fashion as the drivers side. The front chin/grille shell filler panel was also completed by welding on the wire edge.



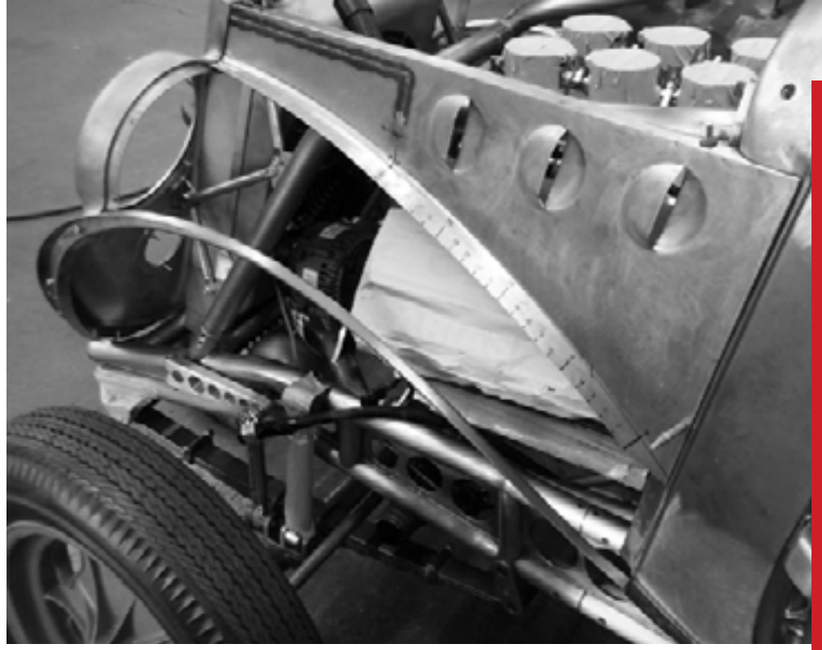
Final fit and locating the symmetrical wheel opening on the front fenders took some patience to get it right.

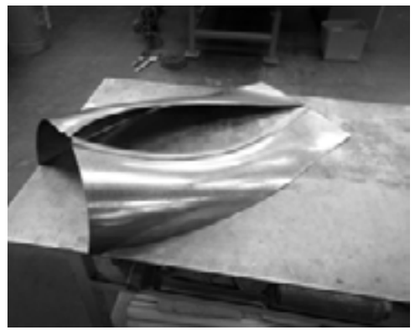


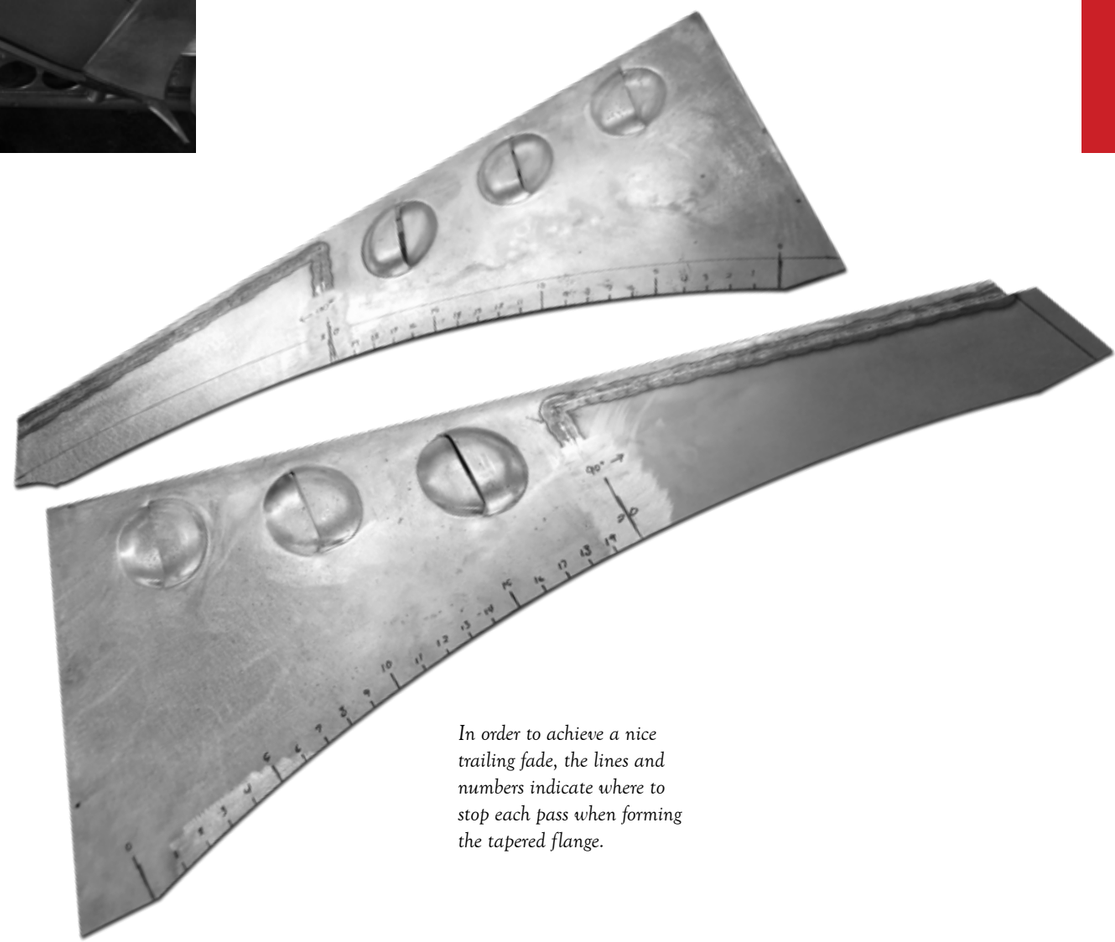
REVERSE CURVE

We designed the hood sides to clear the valve covers but still be reminiscent of the original design with the headlights flowing into the hood side. This large reverse curve was a challenge. There was a lot going on with them to make them fit just right in a relaxed state. We removed the first two louvers from the leading edge of the hood sides to make room for the start of the reverse curve. Only *three* factory louvers remain which goes along with the *three* injection stacks on each side and the *three* zoomie tubes for the V6 Hemi Arias engine.

We removed the first two louvers for a larger sweeping radius on the hood sides to clear the valve covers.



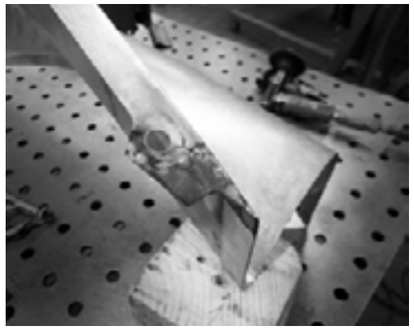




In order to achieve a nice trailing fade, the lines and numbers indicate where to stop each pass when forming the tapered flange.

CLEVER SIDES

To finish up the hood sides, all the detail work had to be completed. First, we figured out all the weather-strip seals and fitting. Then the hood sides were gapped and the hemmed edges were welded on the front and the lower corners towards the rear. There were some other details adding material back to make the gapped area fit nicely to the grille shell. The headlight openings were treated in the same fashion. We also added material back for a smooth, consistent, better-than-factory flange.

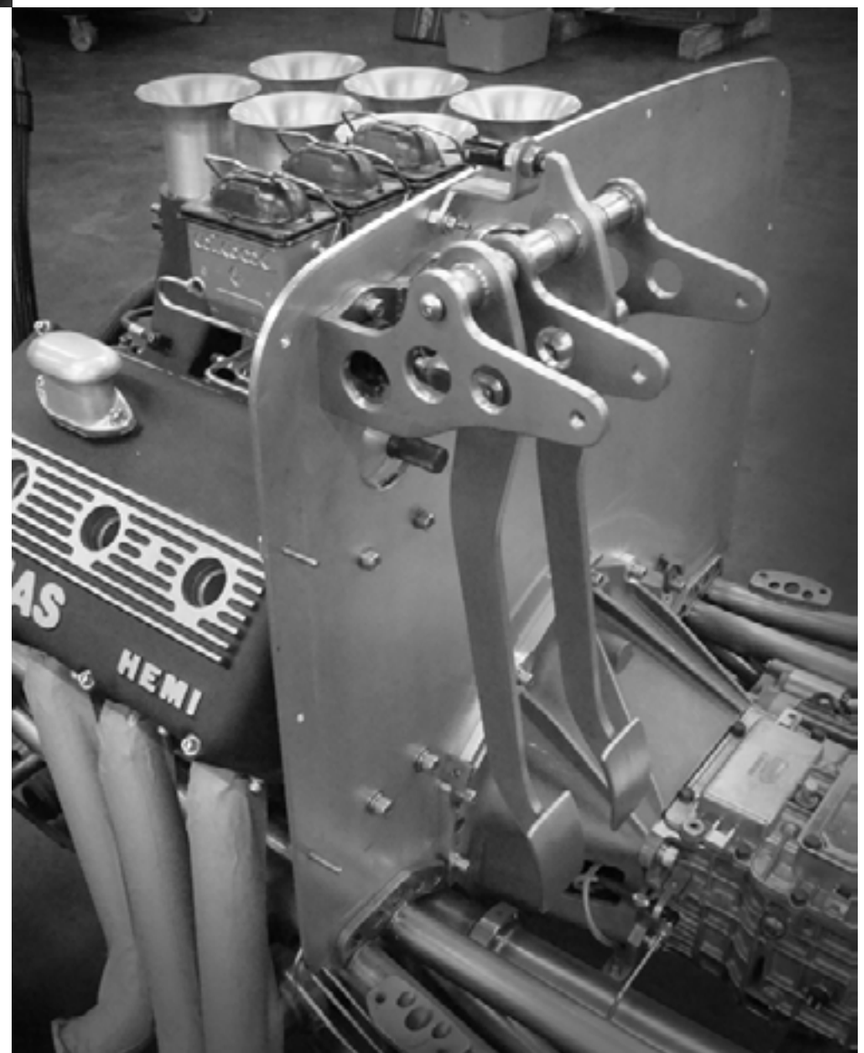


ENGINE

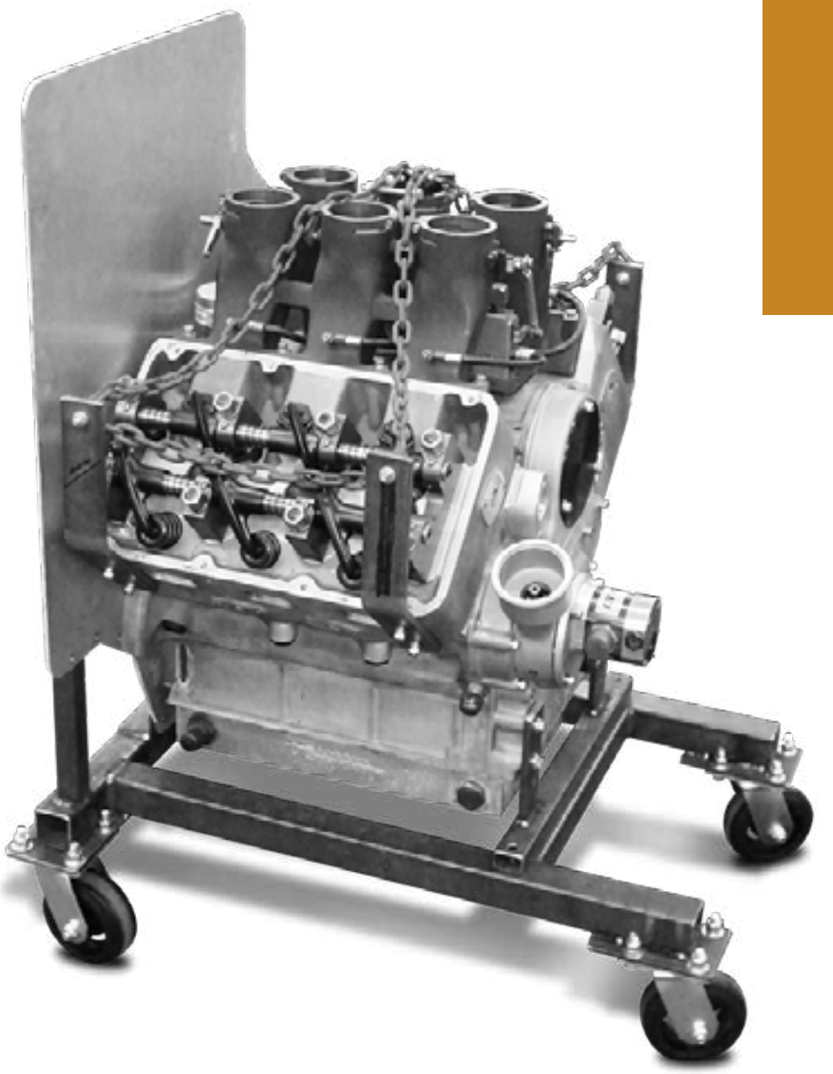
Master cylinders and pedal assembly from a bird's eye view.

HEART TRANSPLANT

Removing the cab and bed: finalization of a few items and then pulling then engine. We fabricated a one off cart and mid plate to transport the engine and run it as a test stand. Then we sent it off to the machine shop. It was neat seeing everything on the engines mid-plate with the cab off and how it all incorporates so nicely when it is all bolted together as an assembly.

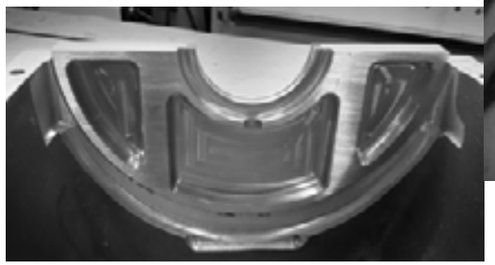


It is much easier to see the details in the brake and clutch pedal assembly on the mid plate with the cab off.

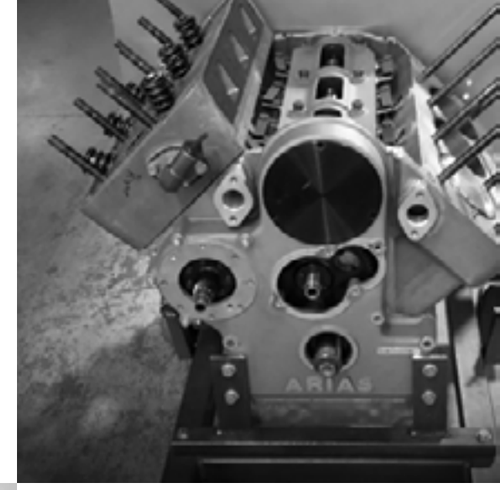


ARIAS V6

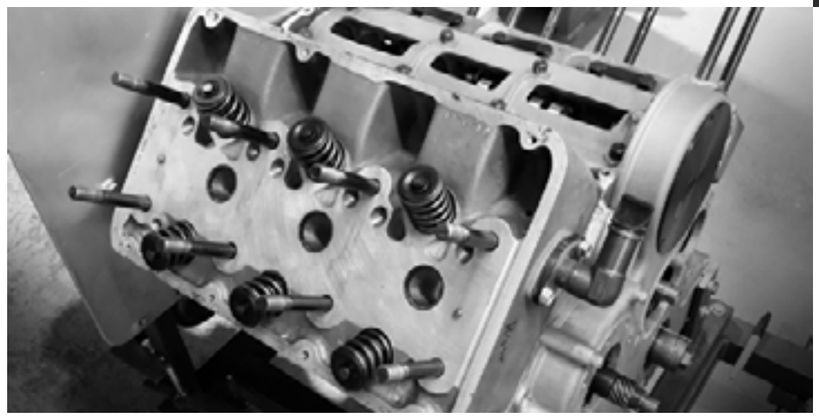
Building the engine with a modern twist. Steve Lanius, owner/operator of Missile Engineered Racing Components began by disassembling the monster 498 Cubic Inch Arias V6 Hemi engine. This engine is one of five that were ever built by Nick Arias Jr. His goal was originally to prove he could make as much power with a V6 as a V8. He cut down one of his 572 blocks and cast a handful of V6 blocks. Nick's experience building engines and developing pistons for over 40 years led to an extremely unique and powerful package with this all aluminum Hemi V6.

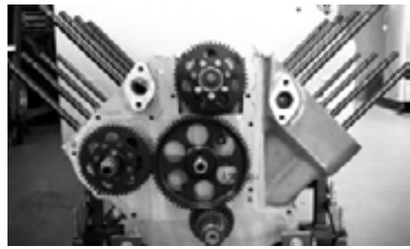


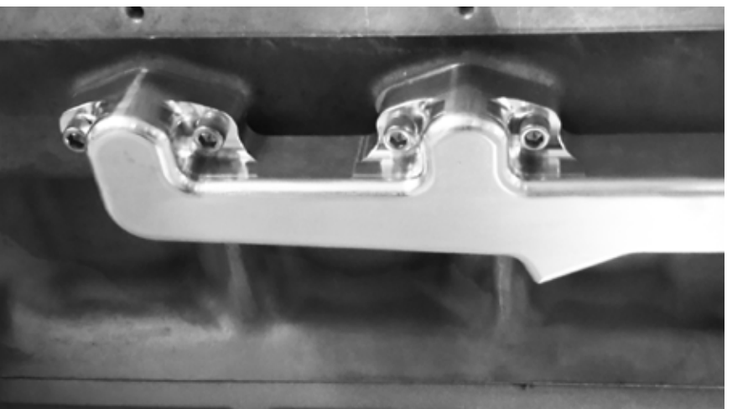
Disassembly and Inspection.

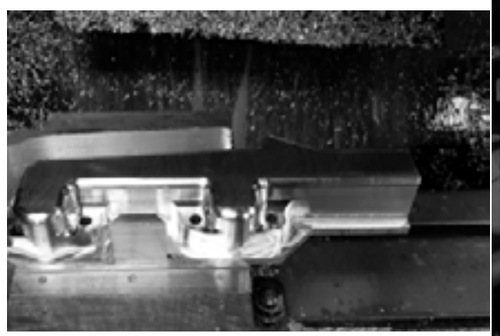


Machined side block water manifolds were shot peened to resemble the cast look of the rest of the engine







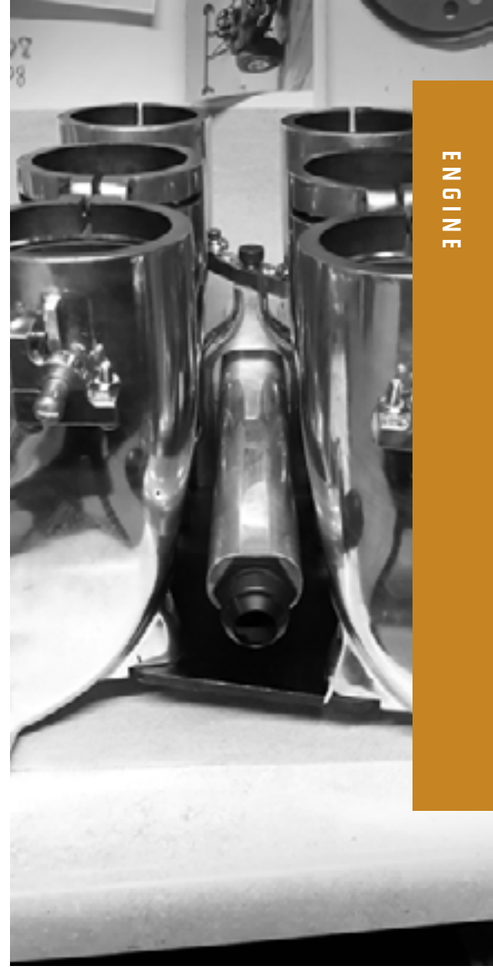


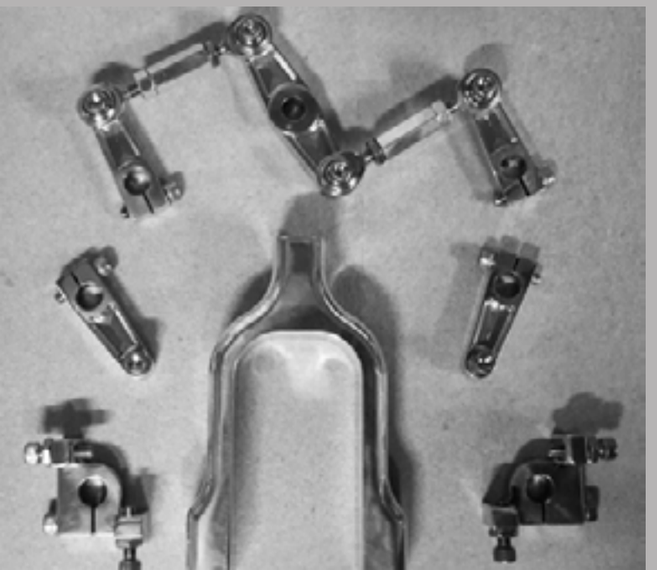
Custom Cast aluminum oil pan designed to match casting of aluminum engine block.

HILBORN INJECTION

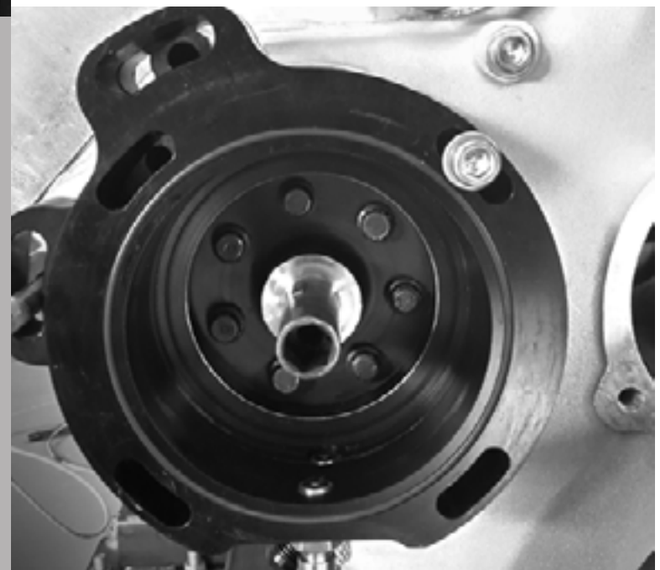
Steve reworked the original Hilborn mechanical injection intake manifold. By welding some custom machined injector bungs to the underside of the runners, it kept things well hidden. He then did some sanding and blending to make it all appear originally cast. He also engineered a custom built vacuum tank to fit under his one-off machined fuel rail. To keep everything sealed up nice and tight to the engine block, some machining was done on the intake mounting flanges to install O-rings.

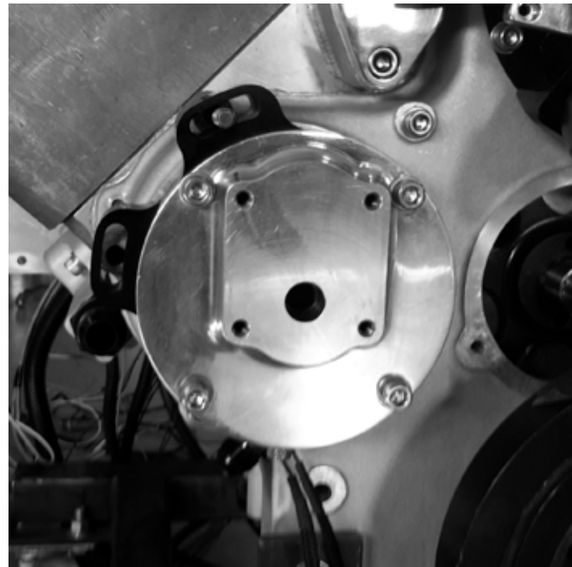
The throttle linkage was also re-engineered with a saddle style standoff to fit over the fuel rail. New levers, links and throttle stops were machined to keep the throttle blades in-sink.





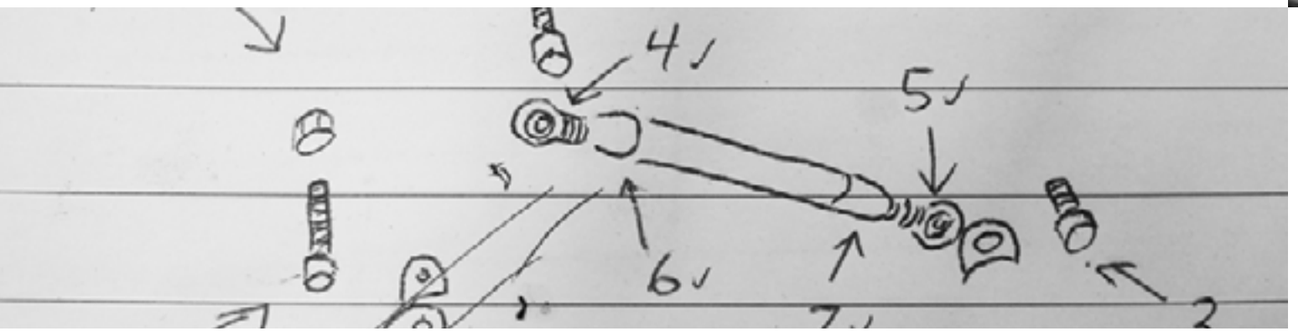
Missile engineered a unique setup to get rid of the original distributor the engine was running and convert to a more modern coil over plug design. A new case was machined to house two trigger wheels that operate the magnetic pickups for the crank and cam sensors. After the mag-pickup case was sealed up it was topped off with a Missile Engineered Single Stage Gear Oil Pump.



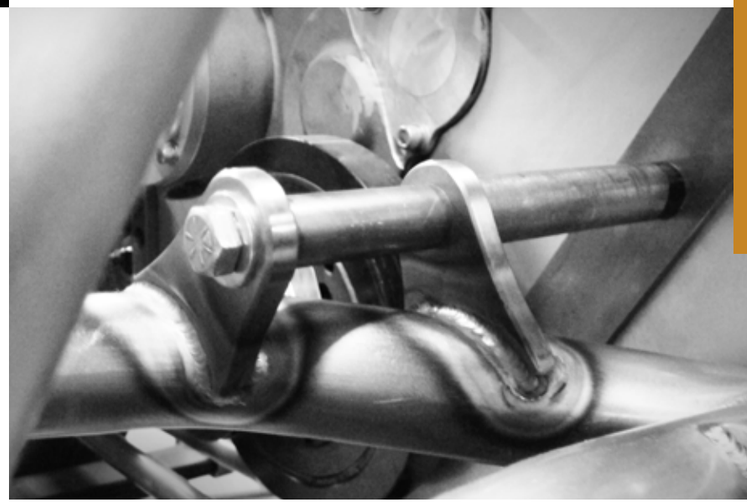


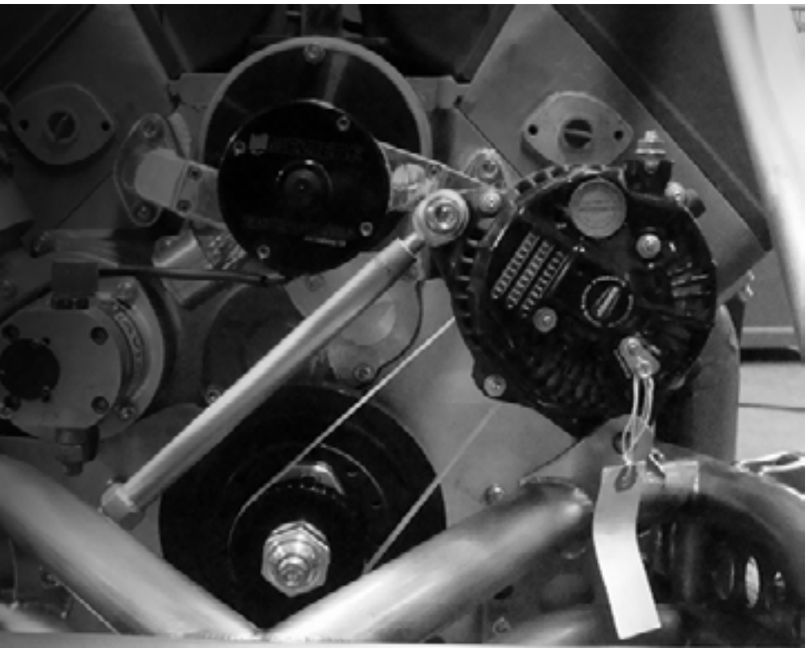
ALTERNATING CURRENT

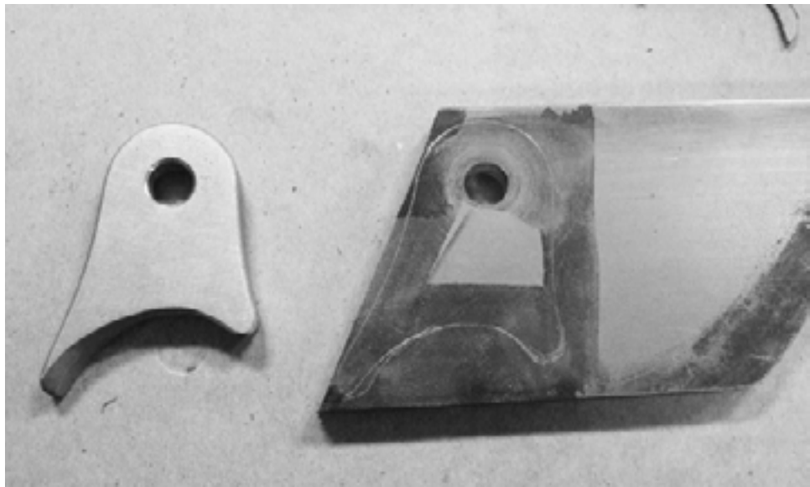
We used a Jones Racing small, lightweight alternator with only enough amperage needed for the limited number of circuits. We had to reverse-mount it due to the limited space available. We fabricated some simple double-shear brackets to mount on the front top crossmember tubes and squared them up off the front of the engine block. We fabricated the tension adjuster and mounted it to the other side of the crossmember to add the right amount of tension off the crank pulley.



Double shear bracket welded on the frame that the alternator bolts to. The sleeves were machined and bolted to the front engine plate as a welding fixture to keep everything straight and parallel when the welds cooled.

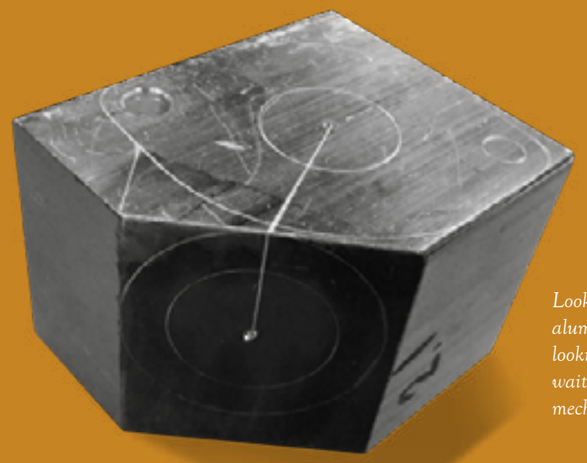






SMALL & CRITICAL

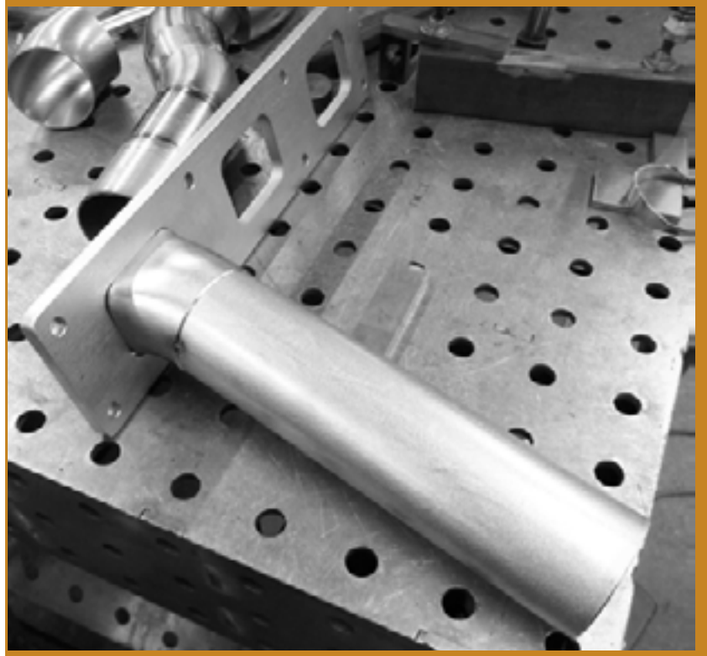
Mocking up the water manifolds with AN male fitting utilizing clay and wood: starting with a block of 6061 aluminum, all the necessary holes are machined, boring out all the passages to connect one to another. After they were all bored the AN male fittings were welded to the manifolds. Then all the smoothing and blending took place making them appear cast. We then made up the hoses with Brown & Miller Racing Solutions AN hoses and fittings.



Looking at this block of aluminum like a sculptor looking at a block of marble waiting to be chiseled into mechanical art.

ZOOMIES

These individual tubes are 2 ½" in diameter. We had Kirco Precision Tool water jet cut the ⅜" stainless flanges for us. We fabricated an expander tool to make the end of the tube rectangular by tightening up the bolt and opening the end up to make it the correct shape. The customer designed the cool swept back parallel tubes. We made a fixture to duplicate the location of the tubes and where they exit so they are the same from side to side. This is always difficult because the one right head is always further back that the left on most V-engine configurations.



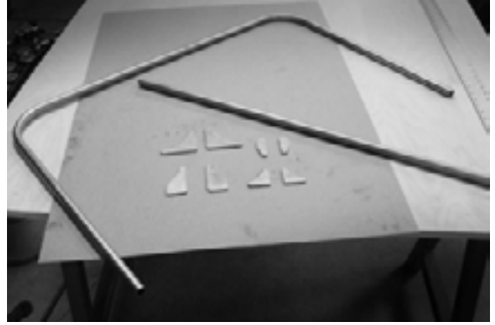
The tack welds holding the tubes to the flange will be cut loose and final welded and polished before being final welded to the flange.

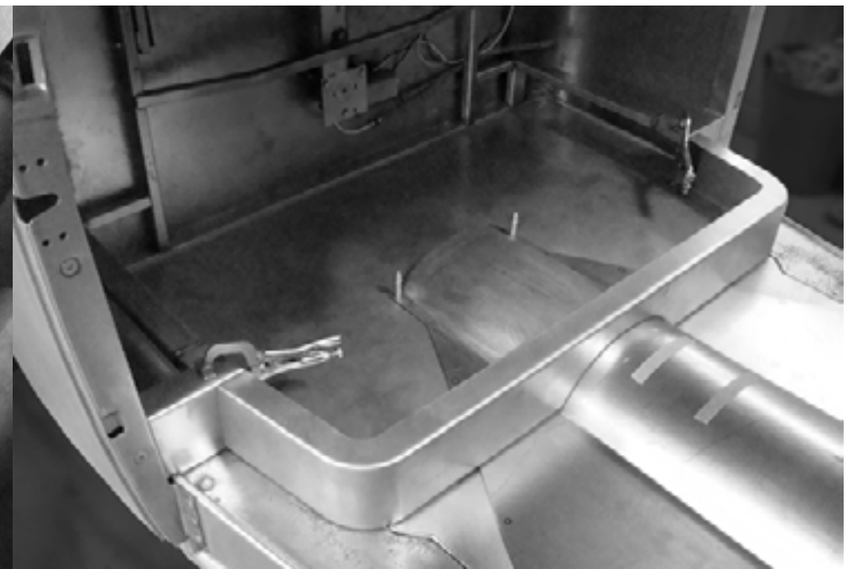
INTERIOR

WELL SITUATED

We mocked up the seating position for building the seat and its riser. When the correct height, back rest angle and location were found, we then fabricated a metal seat riser that unbolts and is removable in order to access the front floor pan and pull the transmission. There is a separate area in the back of the seat riser that will locate and house all the electrical components including the fuse panel, relays and computers.

We made the seat bottom frame partially removable with a simple ash plywood seat back and bottom. The framework simply slides down on French cleat-style locators machined from delrin and the bottom bolts in with a couple simple brackets. The base simply presses into place using the top of the opening to locate itself.





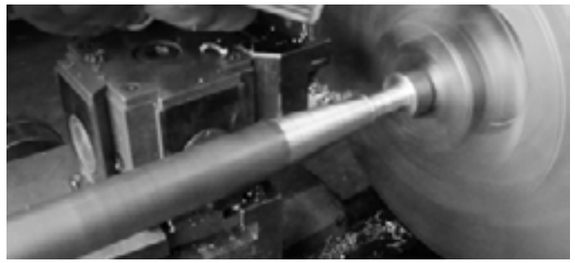
Final mock up of seat riser to mark and drill bolt holes for mounting.

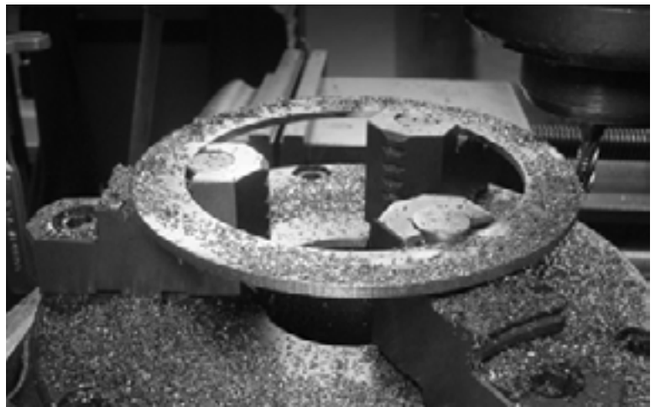
THE SHIFT

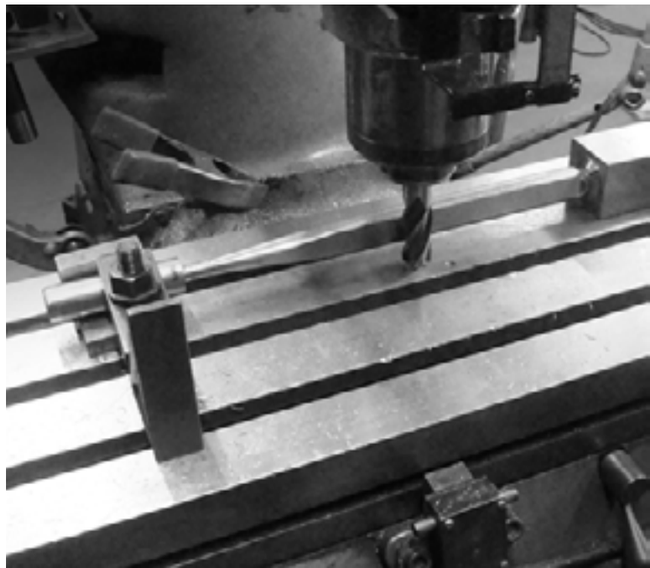
Machining the shifter boot trim ring: we didn't want to use one of those flimsy chrome trim rings because they don't match the surface that they are formed to. So, we did what we do best: make it from scratch. We machined one from $^{3}/_{16}$" plate on the mill. We added a consistent $^{1}/_{16}$" radius around the perimeter of the trim ring and then countersunk the mounting holes for it as well. This trim ring will hold its shape when it bolted to the transmission tunnel.

Machining the new shifter arm mimicking the original Hurst shifter that was a little too short. We manually machined the taper from a piece of round stock and then machined the flats on the edges. Then it was cut apart and the threads were installed and the holes drilled for mounting.

Machining the shifter handle and the boot bezel from scratch.





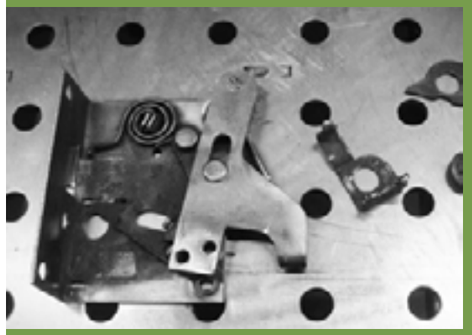


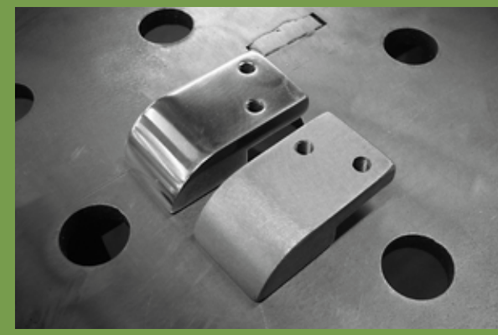
IN A JAMB

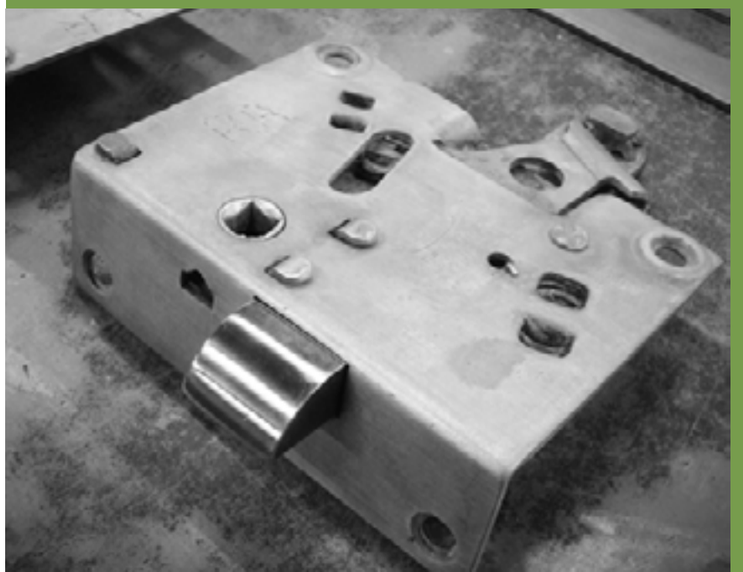
Cleaning up and rebuilding the original door latches: we stated by gapping the edges around the latch itself in the jambs. While it was bolted up in the original holes and operated just fine, it did not fit the joggled edge in the jamb. So we welded up the edges and sanded them down so it fit the jamb bead detail. Then we disassembled the entire latch and machined new strikers from 304 stainless and polished them. Originally, they where just mild steel and they would rust after time and obviously painting them would not be a good idea so we made them in stainless.

We had the original stamped dovetails duplicated and CNC machined from H-14 stainless. We also had the door catch replicated from the same material. The dovetail receptors we machined from 6061 aluminum so they were a little softer similar to the original pot metal ones so they wore more than the stainless. We didn't want the stainless getting chewed up having a similar hardness material when it was operating against one another.

We blended and smoothed all the corner radii before sending all these components out for final polishing to make them look like cast pieces rather than machined.





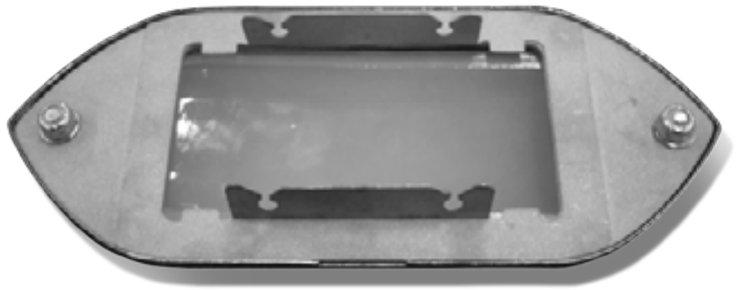


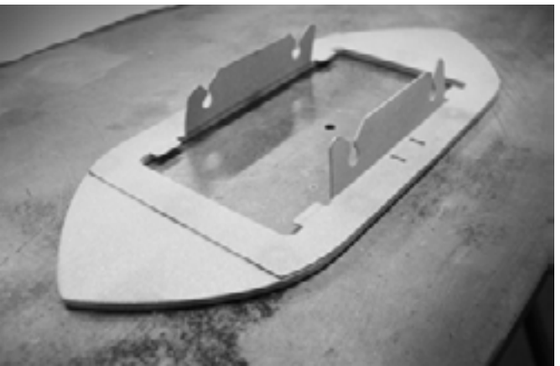
Rebuilding the original door latch mechanism and replacing the latch with new ones we machined from 304 stainless steel.

INSPIRED SHAPE

We found this neat milk glass dome light and we re-worked the mounting, worked out some other details and incorporated it into the rear window surround retaining ring. After mounting the dome light, we fell in love with the shape of the lenses itself and we decided to duplicate that same size and shape in the rear-view mirror. We machined the mirror from scratch from a thick piece of 6061 T6 aluminum and re-worked an after-market stainless arm mounting bracket to tuck everything up tighter and utilized the pivoting ball mounting guts with our new oval shaped mirror assembly. Notice the front of the mirror has an elegant slight tapered from the center of the mounting stud hole out to the edges of the perimeter.

The rear view mirror was machined from scratch after being designed to mimic the vintage milk glass dome light. An after-market standoff bracket was heavily re-worked to get the mirror tucked up as close as possible to the top of the windshield opening.





THE VENT STAYS

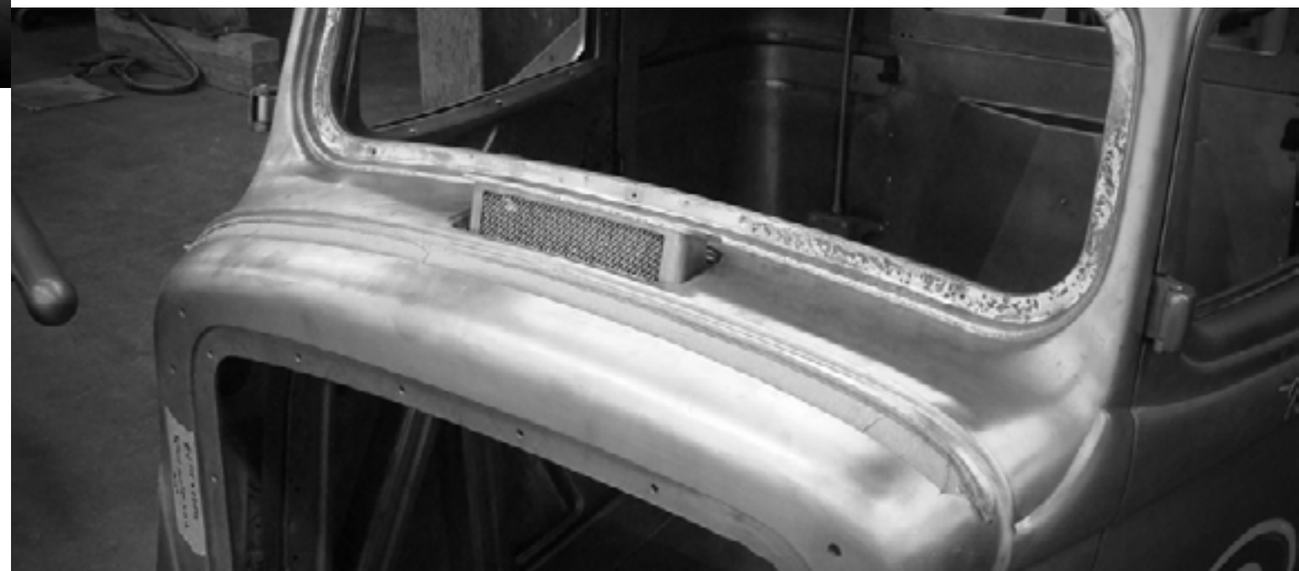
All of us here in the shop love cowl vents and feel it's a crime when people fill them. This is nostalgic air conditioning at its finest! After we restored the original twisted mangled cowl vent and replaced the original handle that was cut off with a torch; we added a small loop to the end and tucked it up close to the cage so it didn't hang down under the dash as much as it did from the factory.

We made multiple repairs brining it back to original condition before making any modifications improving the fit and aesthetics.

FRESH AIR BUG-FREE

We obviously kept the original cowl vent but needed to add a bug deflector or "bug-killer" to the front of it. One of the major issues with these vents is that there was never any provision to kill the bug or at least have it not enter the cabin of the vehicle when driving. The last thing we would want would be a bee flying around the inside of the truck all pissed off when your going down the road at 60 mph. So we engineered this flapper or deflector with some rollers to keep the needed tension on it holding forward. This consists of a spring and a couple urethane rollers. We mocked it up in cardboard with a rubber band to check the concept. After confirming it would work we fabricated all the components. We added a stainless screen to allow the necessary air flow.

After the major modifications to the hinging insert with rollers a simple stainless screen was permanently welded to the insert from the backside.



SITTING PRETTY

Setting up the steering wheel positioning, seating position and foot pedals for the throttle, clutch and brake: we also checked to make sure the tach cup location was visible with both hands on the steering wheel. We also checked out the feel of the 4-point belt system to make sure everything felt comfortable and correct with both hands on the wheel and also figured out the height and location of the shift handle and knob front to back.

Final seating position and customer's comfort is our number one priority with every build we do.

GOOD FOOTING

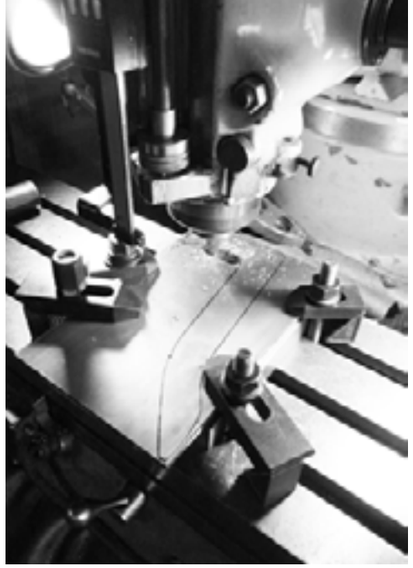
Engineering the brake pedal assembly and fabricating: we attempted to use a Wilwood set-up for the brake pedal assembly. The pedal lengths were too short to get down to the floor and the master cylinders can only fit on the mid-plate/firewall in one location which is saddled over the Steer Clear box drop. We engineered the entire pedal assembly to bolt up and be removable and were planning on chrome plating everything from the beginning, so extra time went into the design and the details of all the edge radii and the lightening holes.

One-off fabricated and machined components make up the entire brake and clutch pedal assembly.

LINKAGE

Engineering a mechanical linkage gas pedal setup: the throttle plate rod was extended to go through the mid-plate firewall with a brass bushing. A double shear bracket was machined to bolt to the mid-plate holding the pedal. The pedal itself was then cut out of flat plate and a bushing installed in the end. We added an additional return spring on the pedal. We then machined a bell crank arm to mount on the throttle shaft and to operate with the throttle pedal. A similar, smaller-sized pad was fabricated to match the brake and clutch pedal pads and welded to the arm.

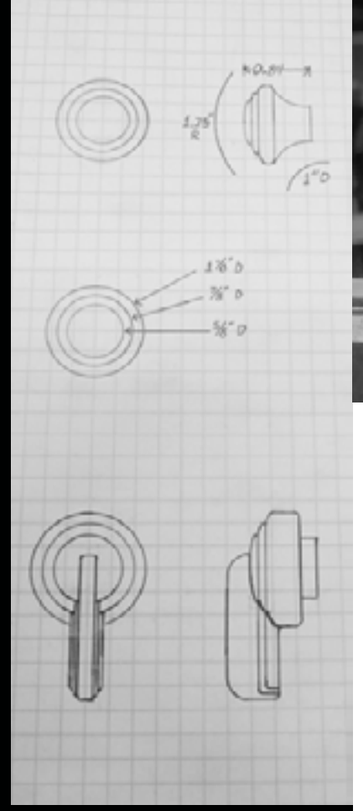
The last few photos are of the throttle bellcrank arms for the linkage. We had these machined from 304 stainless with a similar design as the other bracketry fabricated for the build and had them polished.

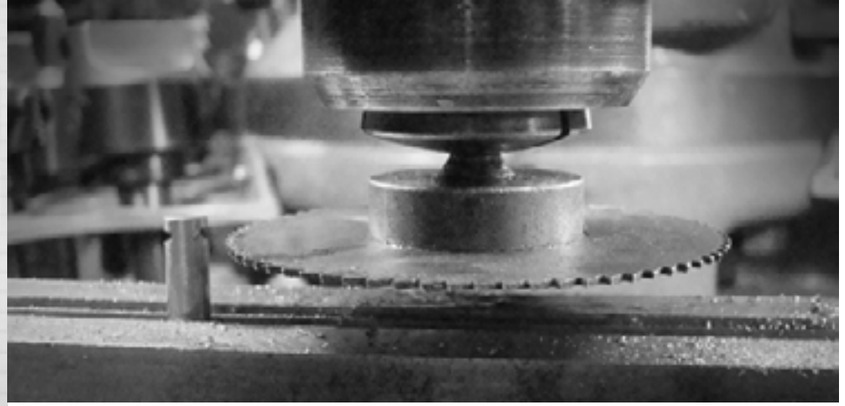


Detail of the throttle pedal bell-crank during the machining and fabricating process.

HIT THE SWITCHES

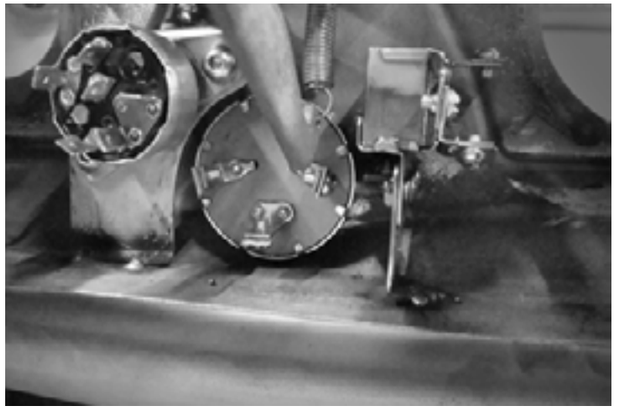
We looked for inspiration from the original interior and exterior door handles that have a ribbed design along the edges. We designed the knobs first and found their location where they looked correct in the dash. We designed the center knob with a downward lever to aid in the use of a momentary switch to operate a timed turn signal. The windshield wiper control for the knob on the right and a headlight switch with the bright switch built into the switch on the left. The issue is getting the switches in their desired locations and for the bodies of the switches to not interfere with one another behind the dash or the vent window handle. Disassembling the switches, machining new shafts to extend and relocate and make everything so it can be assembled easily and also making sure there is room to install wiring when final installed took a lot of time and engineering getting everything just so. We even went to the extent to machine stainless trim bezels that match so everything looks symmetrical on the face of the dash with the new knobs.





After disassembling the switches; new shafts were machined at different lengths to get the switch bodies to clear one another behind the dash.

Finished knobs machined from 304 stainless steel.



After welding all the original holes up we began figuring out the layout and function for all the necessary switches. Our goal was to make them appear that they could be original and untouched from the factory.

COIL-OVERS

We wanted to make a coil cover that would resemble a traditional Hemi spark plug. We worked with Eric Mueller to develop a cover that would snap on over the coil. He 3D printed the cover using a blend of polycarbonate and ABS. The polycarbonate increases the heat deflection temperature. He hand sanded each individual cover and painted them. We found some rubber hose that allowed us to run the coil wires through and look just like plug wires when they are assembled on the engine.

COMPLETELY WIRED

Prewiring the entire truck was a necessity. We wanted to keep all the major components under or behind the seat to keep the underside of the dash super clean so the pedal assembly is the only thing you are drawn to looking at. We spent more time laying everything out and routing it in the fabricating stage to make it really clean and simple. The two batteries, main fuse panel, computers, and a dozen or so relays are all carefully laid out and mounted before the truck is disassembled for the body shop.

We designed a switch box to mount to the top of the roll bar. This switch box incorporates a push button starter, and the other necessary switches for operation. We found some stainless steel switch guards as well as some vintage light jewels to use for the red indicator start light, high beams and the two turn signal lights in the dash. We wired them up with LED lights behind the lenses. The jewels give the interior that vintage original feel.

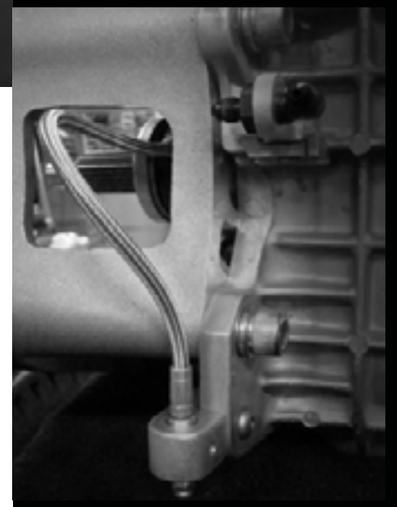
HIDDEN

TRICKY CURVES

Plumbing the fuel lines, brake and hydraulic clutch bleed line for the TKO T-5 transmission with stainless steel hard lines.

Making all of the plumbing look smooth and natural takes lots of planning. Figuring the shortest distance from point A to B sometimes doesn't look natural with its surroundings. The master cylinder lines were all formed so they remain parallel to each other throughout. Making the fuel lines go from back to front along a frame that has a ton of road blocks at every turn has challenges all of its own. Special distribution blocks were machined to get the rear brake caliper lines over the axle so that both flexible brake whips would run parallel with each other throughout their transitions from front to rear.

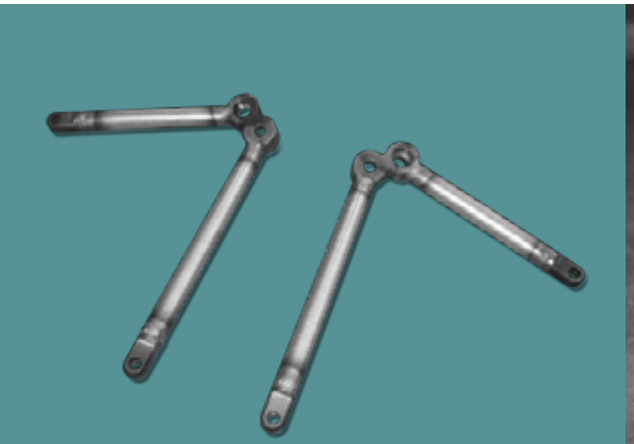
Some details of the well thought out plumbing of multiple systems, distribution blocks, special one-off clamps and mounting brackets.



FRONT AND CENTER

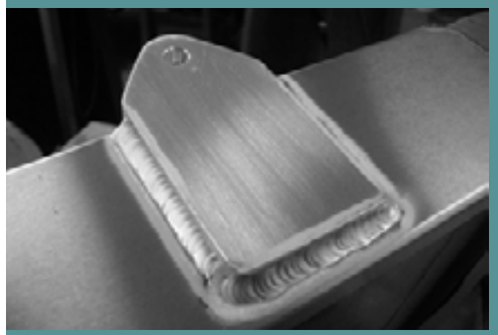
Mounting the radiator was more of a challenge on this vehicle than normal because everything is exposed so much. We needed the radiator to be free floating in a way that the front clip would not pull on it if it flexed or twisted. We also wanted the front clip to be easy to install with as few bolts as necessary to gain access to work on the engine when needed. We machined these bungs that allow the shoulder bolts to be mounted through and remain flush. We then fabricated standoff tubing with double shear clevises to attach to the bay bars. We machined some pegs that were welded onto the radiator tank and then machined some bungs for a rubber bushing to fit in so the tank will nest and drop onto the rubber for a clean look with no mounting brackets or hardware visible on the bottom of the tank. After the radiator was completely mounted, the upper grille shell mounting tabs were fabricated. We needed to make a strange offset in a $^{3}/_{16}$" plate with an abrupt angle. A set of dies were machined to fit the P9 Pullmax and it formed the thick plate like it was butter. The mounting hole locations were transferred and we cut the brackets out on the bandsaw and did all the detail hand work before final plug welding them to the original grille shell.

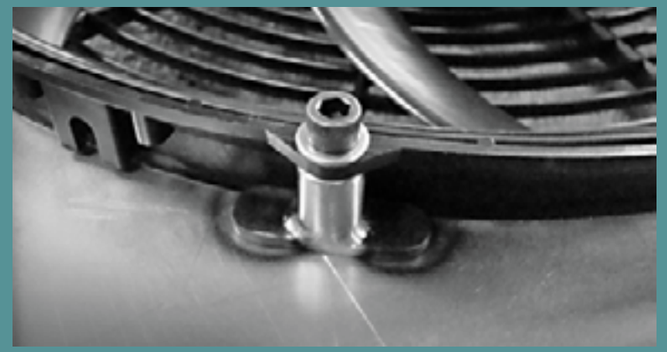
Detail of flush mount rubber insert under radiator tank incorporated into the front frame cross member.



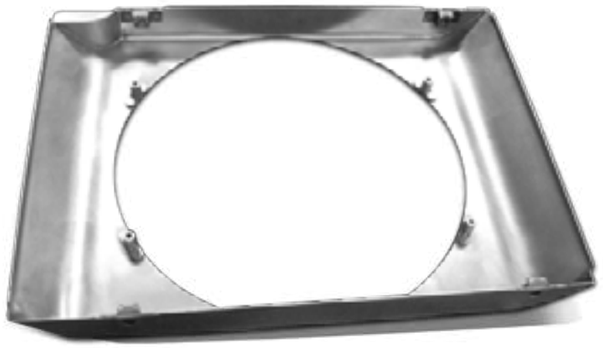
SLIM BREEZE

We mounted the electric fan in a way that was as clean as possible: we also wanted it to still look like it was for a race car so keeping the Spal fan itself with the cage was something we wanted to include. We decided to mount the fan from underneath so there would be no exposed fasteners and the cage would be basically flush mounted to the sheet metal surface. We made a pattern for the basic fan shroud and fabricated some small aluminum tabs to weld to the side of the radiator. Cage nuts were used inside the shroud. Small little stand off brackets were machined to plug weld to the inside of the shroud and mount the fan from the inside of the shroud for a super clean look when installed.



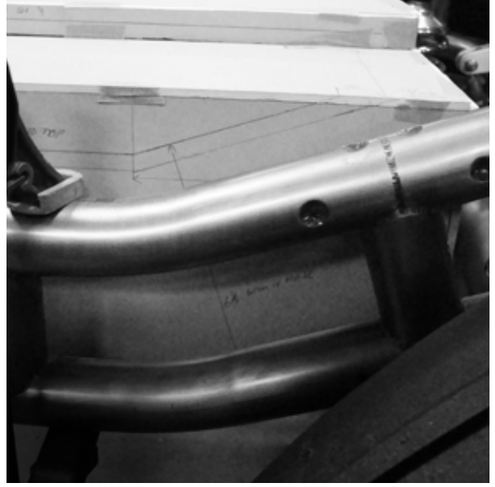


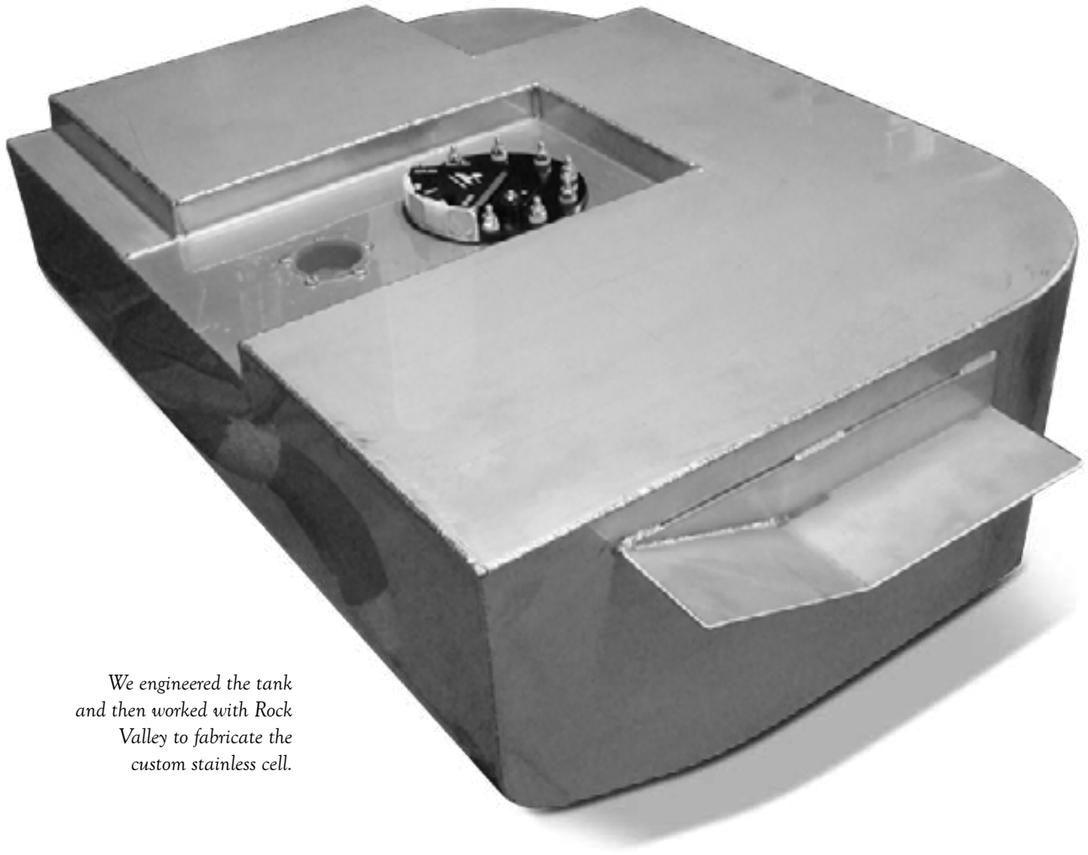
Backside of the fan shroud that mounts the flush mount electric fan.



FUELED UP

We mocked up the fuel tank with foam core board and figured out the location of the fill neck in relationship to the flush mount fill neck in the bed floor. We also figured out the correct fuel pump that will be necessary for the engines electronic fuel injection. Machined standoffs were fabricated to mount directly to the top of the frame. The bottom of the tank has a matching radius to the bottom of the frame to insure it does not hang down at any point and blends in with its surrounds.



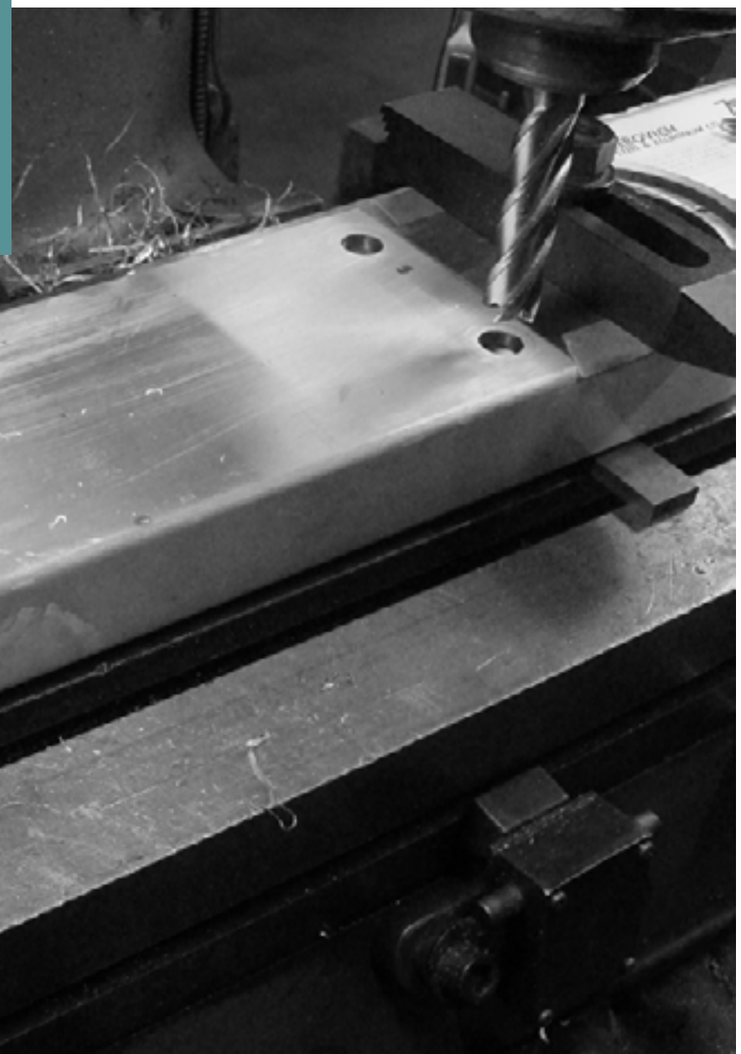


We engineered the tank and then worked with Rock Valley to fabricate the custom stainless cell.

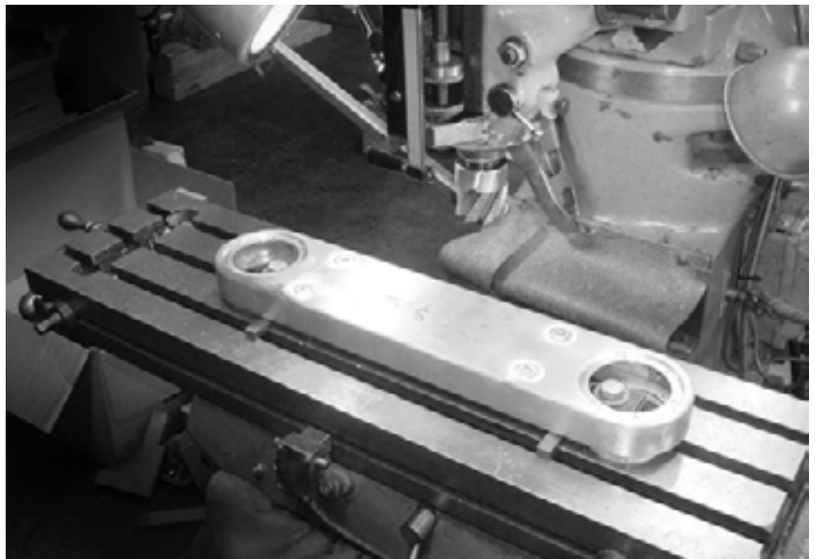
Flush mount gas filler from Matt Hotch Designs welded seamlessly to the bed floor.

TIGHT STEERING

Modification to the steer-clear box to have no exposed fasteners on the firewall: we drilled out the original mounting bungs and machined some blind threaded aluminum shoulder bungs. We had to keep the box from moving during the welding process so we used the Bridgeport table to hold securely in place. Then additional machining and modifying as done to the delrin idler inside for necessary clearances.



Machined bungs that locate the steer-clear drop box with shoulder bungs instead of bolts.



CAUSE FOR CELEBRATION

With the truck at the final fit and assembly stage, we decided to take it to a nearby abandon warehouse—former site of the Werlitzer Piano Factory—called up Robert McGaffin from Wheel Hub Magazine and had him go nuts with photos to help celebrate this huge milestone.

Robert McGaffin - Photographer

Robert McGaffin - Photographer

Robert McGaffin - Photographer

Robert McGuinn - *Photographer*

FINALE

PLATING

Advanced Plating handled pallets full of chrome plated parts for us with ease. Working with us on our specific time frames for each strategic batch and were accommodating to every special request. Not only does the plating look great but the shear volume of what they can keep up with is mind blowing.

We felt like children on Christmas morning getting huge shipments in every other day of chrome plated goodies for weeks on end.

ZOOMIES

Each header tube was individually gone over with a fine-tooth comb to adjust the transition areas to one another by hammering some areas up and others down. The tubes were purge welded to ensure nice clean welds all the way through. After each tube was welded and the welds carefully ground down with a pneumatic sander, then a DA was used in the locked position so DA sand paper could be utilized. The sanding steps were 80, 120, 180, 320, 400, 600. 800 & then 1,000 grit. Each step was done thoroughly to remove the last grits sanding scratches. After all the tubes were sanded they went through the polishing process. Three different wheels and four different compounds to get a mirror finish.

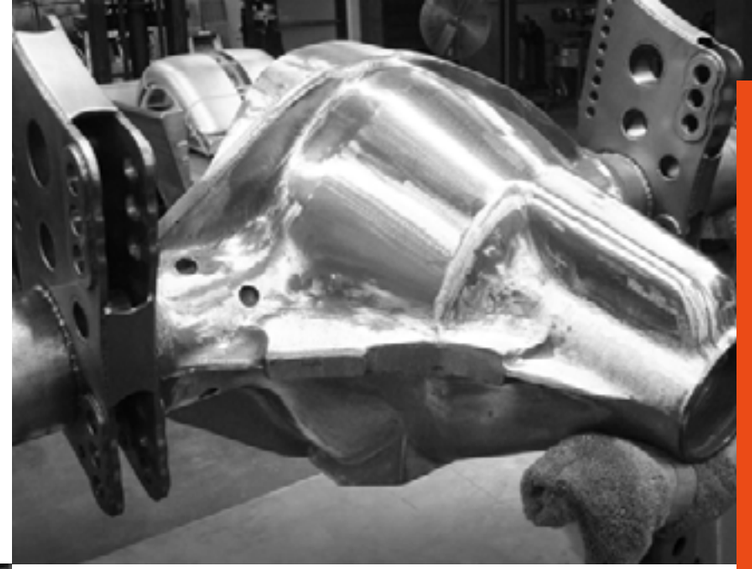
Fully polished 2 ½" diameter 304 Stainless steel zoomies.

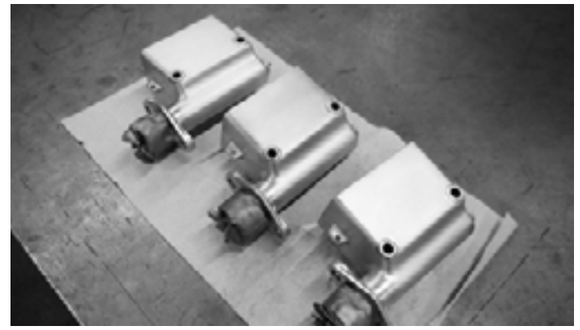
After all the tubes were polished they were fit back in the welding fixture and final welded.

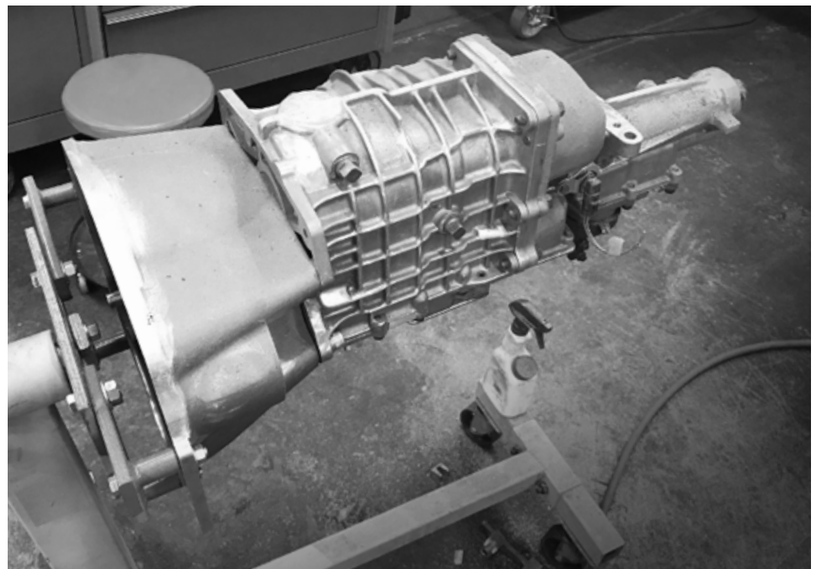
ALL IN THE DETAILS

Detailing hundreds of parts before everything gets shipped out for chrome plating, polishing, anodizing, painting and powder coating: the engine block and transmission were treated to some smoothing and then we went over those areas with a needle scaler to make them appear to have the original casting marks. This process also helped make the casting markings look more consistent and uniform. There was a lot of smoothing and detailing of parts before they were sent off to Advanced Plating. Getting every little nook and cranny more consistent and to make every edge radius match the surrounding parts: the rear end was smoothed out almost to the point of finishing for shipping it out for chrome plating. The machined stainless dovetails and striker plates looked "too machined," so we blended and dressed all the edges to make them appear cast like the originals before sending them out for polishing.

This photo was taken during the first stage of smoothing the rear end housing casting with 50 grit. We took the rear end to 120 grit sanding everything smooth and blending it so it looked like glass before handing it off to the body shop for paint.







MECHANICAL FINISH

After the preparation was done, all necessary smoothing, blending and casting mark preparation were then painted with the same color bronze matte finish as the interior.

The only person brave enough to attempt and pull off applying color to the frame is Mitch Wehrli from Wehrli Custom Fabrication. He and his crew did an amazing job applying the metallic gold powder coat to the jungle gym of frame tubes along with the roll cage and a handful of other small components giving them a strong and durable finish.

ROSSO MUGELLO

The Refinery By Adam Krause, Inc. is responsible for the body & paint. The talented brothers Adam and Tyler took care of doing all the body work and painting of all the sheet metal. They began by tackling the underside of the cab doing all the necessary body work. Once the body work was complete on the exterior of the cab and all the front clip sheet metal, the jambs of the doors and the back sides of all the front end sheet metal were body worked, everything was primed and then tediously block sanded for countless hours until everything was just right. All of the surfaces were leveled to one another and all the bead details were consistent. Once things were perfect, it was time to apply the final color and the cab was rolled back into the booth.

PPG Rosso Mugello Ferrari Red was the color of choice. The individual panels were all painted first along with the cab to allow access and paint the jambs. The doors were hung, and the sheet metal mocked up in its final location. Then everything was shot with two coats of color to ensure an exact match and followed by 6 coats of clear. There was lots of planning beforehand of the exact process that was going to produce the best results.

Color sanded & polished

After the body and doors were color sanded and polished, the interior of the truck cab and the jambs were painted with Audi Marrom Bronze that matches the drivetrain color.

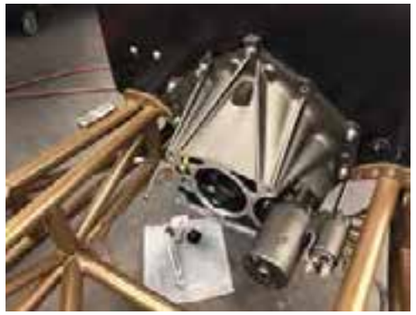
The firewall was also treated to some matte flatting clear coat to match the back side of all the inner fenders, hood and hood sides.

ASSEMBLY

Beginning Assembly: marrying major components like the engine, mid-plate and transmission started to get the ball rolling. This was also the time we installed the fuel tank and routed all the stainless fuel and brake lines through the frame before we set the body on.

Stainless fuel tank installation along with stainless plumbing.

Clutch and bell housing installation



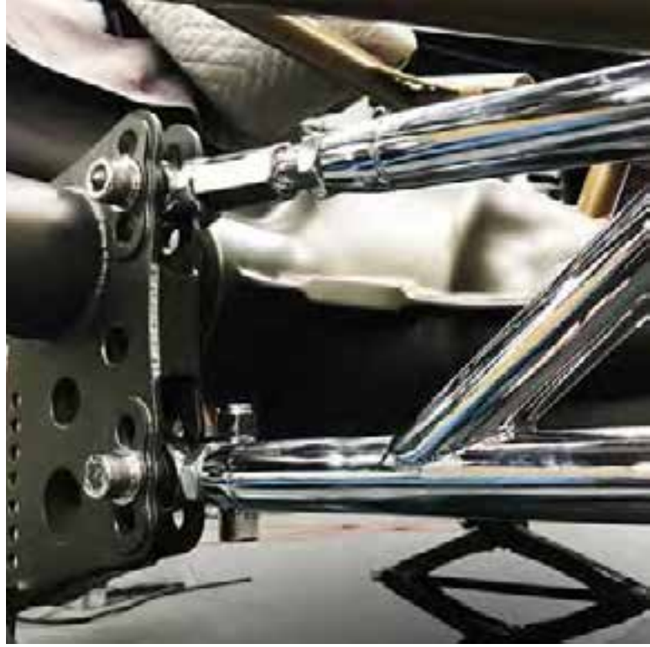
Tremec TKO 5-speed transmission installation

Multi colored mid engine plate.

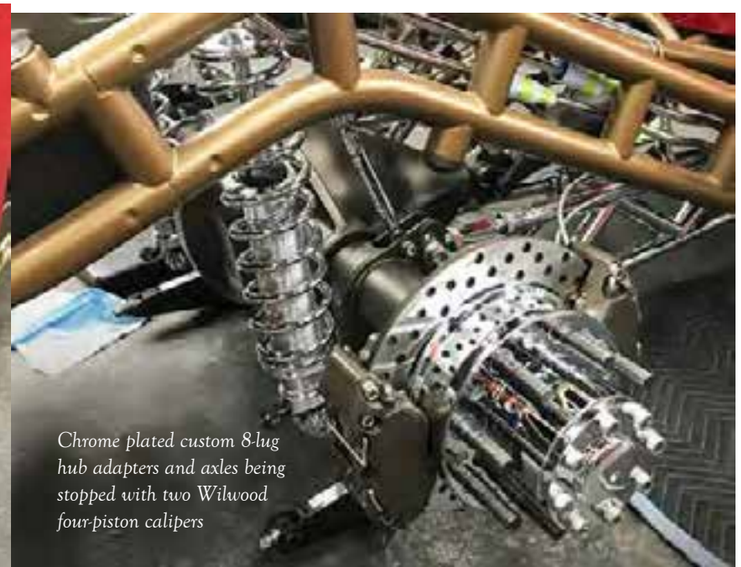
Engine Installation

CAB AND REAR END

Assembly of the rear end and suspension components: as soon as the parts came in from chrome plating, painting, polishing, anodizing and powder coating, they strategically went on the truck and we waited for the next scheduled batch.



Rear end assembled with chrome plated ladder bars and X-locater.



Chrome plated custom 8-lug hub adapters and axles being stopped with two Wilwood four-piston calipers

INTERIOR REFINEMENT

Close up of gold cage contrast with bronze jamb, Note the chrome plated dome light switch bezel. Close up of Classic Instruments gauges with custom chrome plated bezels and chrome plated dash knobs.

Everything has a place and it's in its place. Wiring all hidden under the bench seat, batteries, fuse panels, computers, relays etc. all engineered to fit so nothing is mounted under the dash.

Shot of overhead switch panel final installation. Engraved typeface matches gauge typeface, vintage red jewel for ignition matches green vintage turn signal indicators in dash. Chrome plated push button starter bezel and finger guards.

Battery cut off switch on driver's side seat riser We had the On/Off bezel engraved with typeface that matches the typeface used on the gauges and the switch panel.

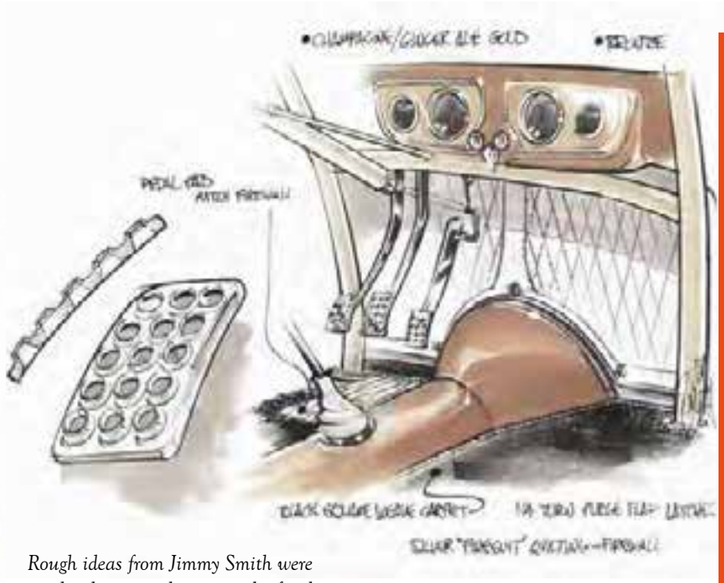
TRANSPLANT

The tension builds before the first initial startup of the engine now in the truck. The Engine builder and tuner Steve Lanius from Missile came to our shop to help get everything fired up for the first time in it's final resting place. Hooking up to the computer to verify correct signals from all the sensors and ultimately tuning and adjusting the injection linkage once it was running.

The engine was setup and ran on a test stand to get everything precisely adjusted and tuned. This beast has a compression ratio of 12.5:1 and after the engine is installed in the truck and tuned on a chassis dyno will easily produce over 800 HP with 800 Ft. Lbs. of torque. Keeping this much power under control in a truck with a narrow track width, short wheelbase and weighing under 2,500 pounds is going to make a seriously fun or crazy driving experience.

INTERIOR

We dropped the truck off with someone who I know could do a top notch stitch job on the interior, Dave Schober is the owner operator of Schober's Custom Hot Rod Interiors.



Rough ideas from Jimmy Smith were utilized to start discussing the final design of the interior. Some elements were utilized in the final design.

VICTORY AFTERGLOW

Jeremy Cliff - Photographer

Jeremy Cliff - Photographer

Jeremy Cliff - Photographer

Jeremy Cliff - Photographer

Jeremy Cliff - Photographer


Jeremy Cliff Photographer


ARIAS
HEMI


HEMI


WILLYS
77


ARP
Automotive Products


ARP
Automotive Products
Al Slonaker Memorial Award Winner


ARP
Automotive Products

We would like to take the time to thank everyone involved in this build.
For without you, this build would have never happened.

The Tin Man's Garage, Inc. Crew;

Brian & Stephanie Limberg

Jason Knobeloch

Austin Monk

Chris Talbert

Chris Tapp

Nick Vierke

Paint- The Refinery By Adam Krause, Inc.

Engine- Missile Engineered Racing Components

Upholstery- Schober's Custom Hot Rod Interiors

Powder Coating- Wehrli Custom Fabrication

Chrome Plating- Advanced Plating

CNC Machining- Datum Tool & Manufacturing

License Plate & Coil Covers- Flexfacture

Polishing- Mirror Look Refinishing

Waterjet- Kirco Precision Tool

Glass- Glass Guy Chicago

Pin Striping- Andrew Askeland

Special Thanks- Randy Heintzelman