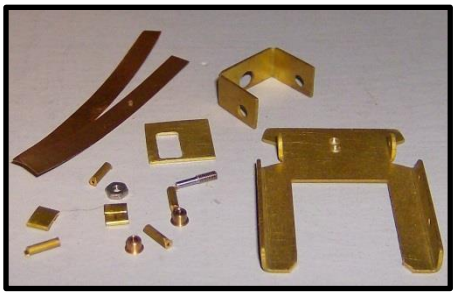
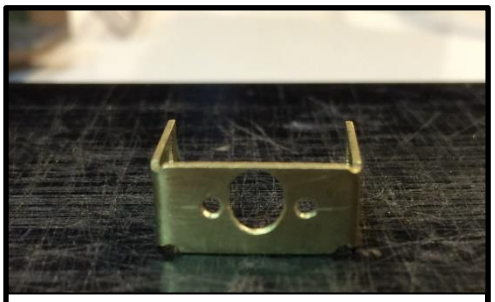
# ***LandShark Gravity Car Build*** ***by John Reimels***

One of the hardest parts in building a scratch built gravity car is fabricating the brass parts for the chassis. Without the right tools, the process can be time-consuming and frustrating. Al Thurman has a remedy for this; he's produced a great kit that reduces this work considerably. The only drawback is the kit was designed around the old Mabuchi HT50 style motor that sits a lot taller than the current M Style mini motors that are all the rage. I also like to utilize a floating pan set-up in my cars so some additional work is required to separate the side pans from the front plate. None of these changes are too difficult requiring little more than some drill bits, a razor saw, a few jewelers' files, a caliper, a good hot soldering iron (I use a 50w iron with a chisel tip) and a small drill press.



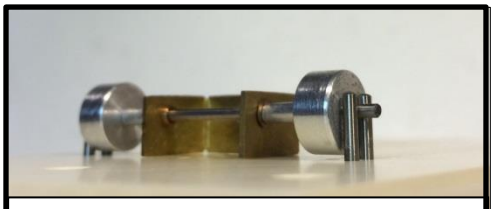
**Motor Bracket:**

The motor bracket is the most heavily modified part in the LandShark kit so I always get it out of the way first. I want the motor to sit as low as possible in the chassis so I start by lowering the motor bushing hole using a round jewelers file. Monitor your progress by trial fitting the motor to the bracket, keep filing until the motor sits flush with the bottom of the bracket. I then drill two 0.055" holes in the bracket to match the threaded holes in the motor. The use of 1.4mm x 0.3mm x 2mm screws to hold the motor to the bracket eliminates the need to solder the motor in place and the possibility of over-heating it during installation (they also just look cool). With some careful measurements, you can get the mounting holes positioned correctly. The 0.055" holes are slightly oversized so their location doesn't have to be perfect; you can always resort to opening the hole up with a jeweler's file if you miss - I know, it happens a lot.



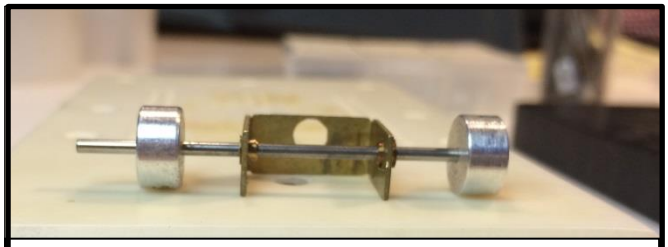
Modified Motor Bracket showing the lowered motor bushing hole, the two mounting holes for the motor and the reliefs for the main rails

Now that the motor is sitting lower, the rear axle bushings also need to be lowered. For perfect gear mesh, the axle and armature should be on the same centerline. When using the mini-motor, this would mean using rear tires that are too small to be practical and a very small crown gear. My experience shows that some offset in height between the axle and armature is acceptable without compromising the gear mesh. I've found that setting up the rear axle centerline to be 0.180" from the bottom of the chassis matches well with the mini-motor centerline of 0.156"; this combination yields a very acceptable gear mesh and



Using 0.360" Jig Wheels to determine how much to lower the bushing holes in the Motor Bracket

allows the use of 0.420” rear tires and a 21T crown gear resulting in a ground clearance of 0.030”.

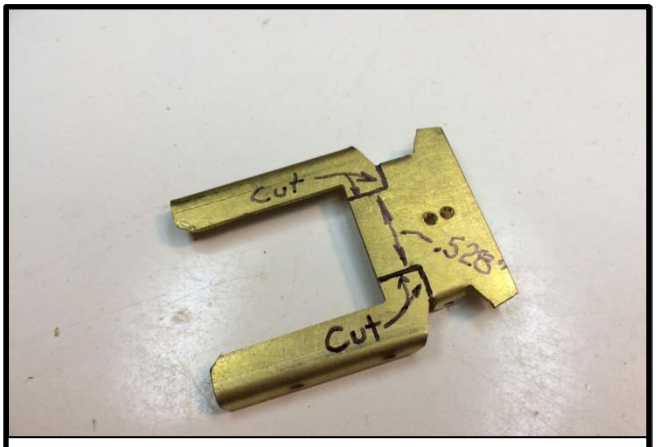


Modified Motor Bracket showing Jig Wheels flush against flat surface

There are various ways of monitoring your progress as you lower the rear axle bushing holes. You can use a caliper to measure your progress side to side or you can get some 0.360” jig wheels and keep filing the holes downward until both jig wheels sit square when placed on a flat surface – they’re also perfect for holding the bushings in the correct position for soldering but more on that later. Scale Engineering makes a series of jig wheels that are perfect for our application, unfortunately the jig wheels are designed for use with a 0.0625” axle, the bushings in the LandShark kit are designed for a 0.0595” axle. I prefer the 0.0625” axle made from a drill blank so I simply open up the bushing with a 1/16” drill bit, if the axle fit to the bushing is too tight use a #52 drill to open the bushings up to 0.0635”. Now back to the bracket, when opening up the bushing hole in the bracket, be careful not to make the hole too wide. You should end up with a slot little wider than the original hole diameter. You want as much material side to side as possible so the flange of the bushing has enough material to be properly soldered to. The next modification is the addition of two small 0.062” holes to allow the rear pan brace to pass through the bracket and under the motor pinion. To provide clearance for the main rails, these holes are centered 0.0625” from the bottom of the bracket and 0.0625” back from the motor mounting surface of the bracket. The final modification is filing reliefs in the lower corners of the bracket to allow the main rails to be soldered to the inside edges of the bracket. After all the cutting and filing, check the squareness of the bracket with a T-Square. Tweaks are usually required to get it as square as possible.

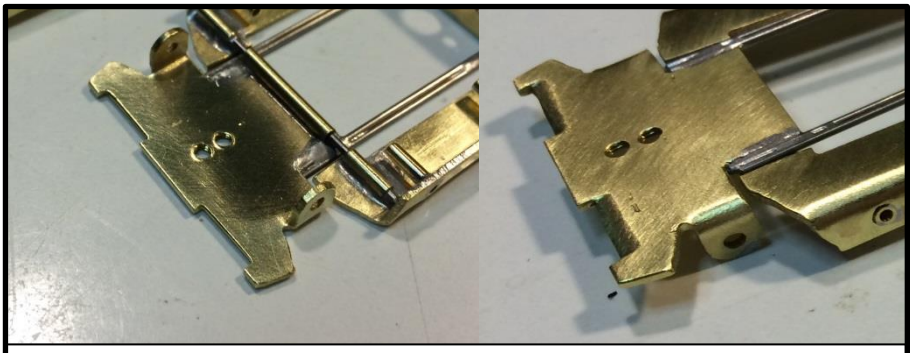
**Front Plate:**

I like to utilize floating pans versus a solid pan in my builds. For the LandShark kit, I cut the side pans off the center section just behind the front axle tabs extending in toward the center of the chassis. I want to create a good soldering surface for the main rails, so I leave a portion of the front plate at the proper width to keep the main rails parallel running from the inside of the motor bracket to the front plate. The exact width of this portion of the front plate will depend on the size of the main rails used and the inside dimension of the motor bracket. I’m using 0.031” piano wire for the main rails and the inside dimension of the motor bracket is 0.590” so where the main rails attach to the front plate should be approximately 0.528” wide to keep the rails




Stock center section showing where to cut to form the front plate and the side pans

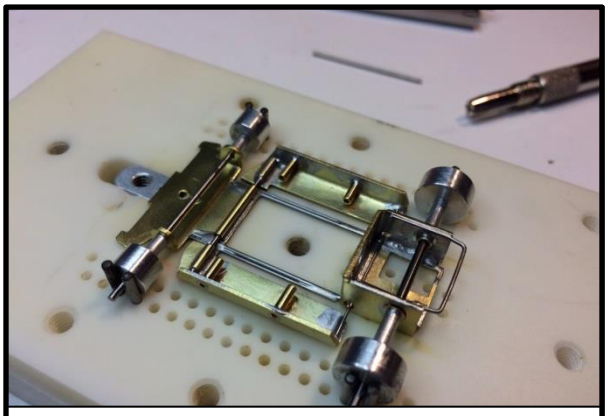
parallel. This doesn't have to be perfect, solder can bridge small gaps and the main rails don't have to be perfectly parallel either. Rough cut the front plate using a razor saw, set aside the pans and finish filing the front plate to the correct dimensions with a file. The other modifications to the front plate are the notches for the wipers. I like to have the notches about 0.040" deep and 0.25" wide centered over the track rails, this affords some protection for the wipers in the inevitable crash. To make wiper adjustment easier, file reliefs on the bottom of the chassis aligned with the notches. This is a trick I learned from Joel Pennington and simplifies wiper adjustments significantly.



Photos showing top and bottom view of the wiper reliefs

**Center Section:**

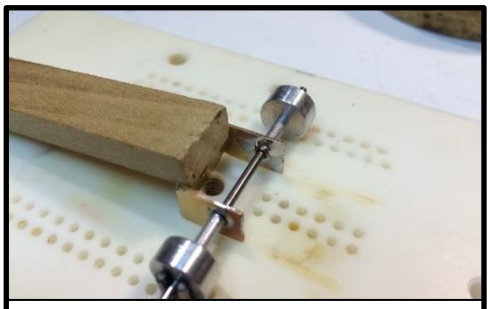
It's time to start building, break out the soldering iron. But before you plug it in, you'll need a way to hold parts in place while soldering - I use a chassis jig made by R-Geo. While it's not listed on Rick's website (www.rgeoproducts.com) I understand he's still making the jig upon request. I highly recommend this jig, it's versatile and durable – I've built over 20 chassis on it and it's still going strong. The other useful tools are the jig wheels mentioned earlier, they hold the rear axle at the right height and square to the ground. To center the assembly on the jig, I use equal lengths of 3/32 aluminum tubing slipped over the axle between the jig wheels and the motor bracket to remove the side to side play. It's important to use aluminum tubing, solder doesn't stick to aluminum; the first time I tried this trick I used brass tubing and ended up soldering the whole thing together – what a mess… The important thing is to hold the parts in their proper location during the soldering process leaving at least one hand free to handle the soldering iron. Without the chassis jig and jig wheels, you'll need something else to hold the parts in place. I've seen folks use graph paper, a piece of flat hardwood and push pins, others use handmade jigs from counter top material and super glue. The important thing is find something that leaves your hands free for



The R-Geo Chassis Jig with Jig Wheels holding everything square and flat while soldering. The aluminum centering spacers can also be seen on both the front and rear axles.

soldering – don't try short cutting this step – you'll quickly get frustrated and end up with burnt fingertips or worse… Trust me, buy a chassis jig, it will serve you well.

Once again I start with the motor bracket, I install the bushings so the flanges are on the outside but I apply the solder from the inside of the motor bracket allowing the solder to wick into the joint between the motor bracket and the bushing. I use solder flux made by Lucky Bob's (buy some when you order the LandShark kit – it's the best stuff around). Be careful when applying the flux to the bushings, don't let it get between the axle and the bushing, if you do, you'll end up soldering the axle to the bushing. A small drop of light oil applied to the axle / bushing joint goes a long way to prevent this from happening. Since we're soldering a round piece into an oval hole, don't panic if you can't get the solder to fill in the top of the bushing; getting a good joint around ¾ of the perimeter is good enough. I haven't had a bushing come loose yet using this method.



Using the Chassis Jig with Jig Wheels to hold the bushing in the exact location for soldering.

After the bushings are installed, I set up the front plate and the motor bracket so the front and rear axles are parallel to each other and square to the centerline with a wheelbase of 1.5" I cut two lengths of 0.031" piano wire so they run the length from the front plate to the end of the motor bracket. I then solder the rails to the inside of the motor bracket and the outside of the rear of the front plate. Be sure to clean the piano wire thoroughly before soldering, most piano wire has a lot of oil on its surface that prevent it from rusting. It also prevents a good solder joint. Again, Lucky Bob's flux is your best friend but it can't overcome everything. Clean the piano wire with motor spray or a good solvent, the solder should then flow nicely.

For this build I'm trying something slightly different with the main rails. In the past, I've found the 0.031" rails are too wimpy and 0.039" rails too stiff. For this build, I'm adding a 0.025" rail to the outside of each main rail. This rail only runs from the front of the motor bracket to the front plate. I've tacked this rail to the 0.031" rail only at the ends so I can easily unsolder if I don't like the way the chassis handles. That's the joy of brass car building, each car can be made slightly different in search of the perfect car for a given track condition.

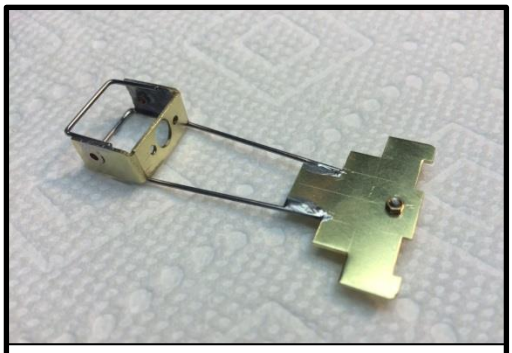


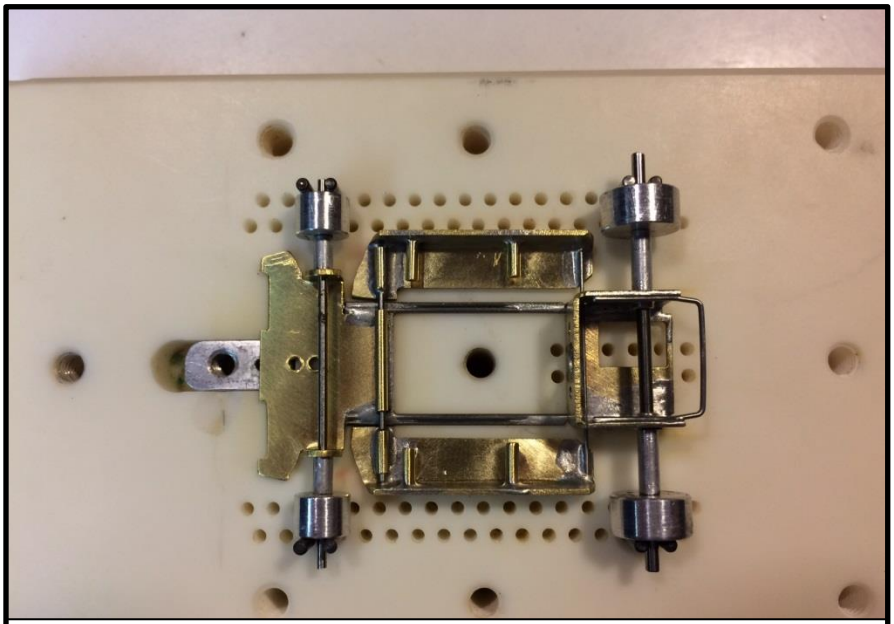
Photo from a prior build showing the motor bracket and front plate soldered together with the main rails

Al's kit also includes a piece of brass that fits inside the motor bracket. It needs to be narrowed because it was designed for the main rails to be placed outside the motor bracket; I like to solder them inside to allow the use of wide tires. A few minutes with a file will allow the plate to nestle between the main rails inside the motor bracket. When soldering, be careful, a lot of heat is required to get a good solder joint, this can start to unsolder the rear axle bushings. Again, a good jig that holds everything together while soldering is a life-saver. If

you're using a 0.025" motor bracket (Al makes both 0.025" and 0.031" brackets) you may want to add an upper brace to keep the bracket from bending during a wall shot. I make mine from a piece of 0.025" piano wire bent in a "U" shape sized to nestle inside the bracket. Make sure to leave clearance for the crown gear which extends beyond the bracket. After soldering, it's a good time to clean up the center section removing any excess solder especially on the bottom of the chassis. Keeping the bottom of the chassis flat is important as we go, we want everything to sit as flat as possible throughout the build. I've found an old toothbrush with an abrasive kitchen powder cleaner is wonderful for cleaning up after soldering. It removes the flux and gives a nice sheen to the brass making it obvious where the solder needs to be removed. A sharp knife and an abrasive wheel can clean up the worst solder joint.

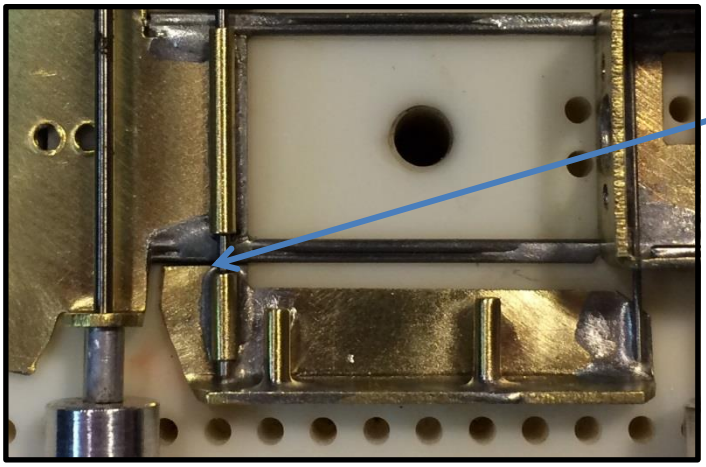
**Side Pans:**

We're in the final stretch for the chassis assembly; all we need to do is add the side pans. There are many configurations used for the side pans, the traditional 1/24 brass cars had pans that hinged independently off the main rails. Others hinge off the front plate allowing the rear of the pans to lift independently. For this build I'm going to use a simple, robust floating pan concept sometimes referred to as a rattler. I make the pans float as an assembly by tying the pans together with two cross members; the front running through a tube attached to the front plate, the rear running though the motor bracket below the motor pinion. This allows the pan assembly to float independently from the center section. For the front, I use 0.031" piano wire running through a piece of 1/16 tubing soldered to the front pan. I open up the tubing with a #64 drill bit (0.036") so the pans can float freely. I use 0.020" piano wire for the rear cross member, the smaller wire size gives more clearance with the pinion. I space the pans so they're parallel to the centerline of the chassis with a side to side float between 0.010" and 0.020". Side to side motion is set by the gap between the front of the pans and the main rail. I first solder the front tube to the center section making sure it sits square to the centerline. I make the tube 0.50" long and solder it to the rear of the front plate. I then set everything up on the chassis jig trial fitting the pans to ensure the side to side float is correct before soldering the cross



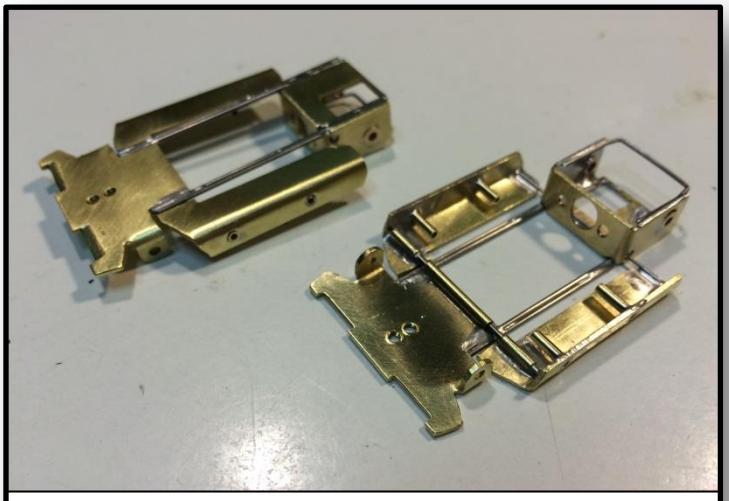
Picture showing front and rear cross members attached to the side pans allowing the assembly to float on the center section

members to the pans. For the front cross member I use small lengths of 1/16" tubing on the ends of the cross member to eliminate the gap between the cross member and the pans. These tubes get soldered to the pan then soldered to the cross member. I suppose you could eliminate these and simply bridge the gap between the cross member and the pans with solder but I feel using the short lengths of tubing make for a much stronger joint. Another alternative is to bend the ends of the cross member so they touch the pans without the need for the short pieces of tubing – your choice. The 0.020" piano wire



The float between the center section and the side pan assembly is determined by this gap

rear cross member simply passes through the holes drilled in the motor bracket with the ends soldered to the rear of the pans. The last step is to add the pin tubes to the side pans. I like to open up the pin tubes with a #60 drill (0.040") so I can use the standard aluminum body pins available from various manufacturers. The tubes can be soldered to the pan and then be opened up with a drill afterwards. I use a length of 0.031" piano wire running through the left and right pin tubes to hold them in place while soldering. This holds the tubes parallel to the ground and square to the centerline. I also have the tubes extend slightly beyond the outside of the pans to help prevent solder from wicking inside the tubes; I then use a flat jeweler's file to blend them into the pan profile afterwards.



Finished Chassis Assembly! Ready for final assembly.

This completes the chassis assembly, all that's left is to clean up the chassis as described before and sand the bottom of the chassis flat using a piece of 600 wet / dry sand paper on a flat surface. After clean-up add a few drops of light-weight oil to the front cross member to prevent the piano wire from rusting inside the tubing. Congratulations – all that's left is the final assembly.