Hangar Talk

The “Lightning” Newsletter

Volume 4, Number 8
August/September, 2011

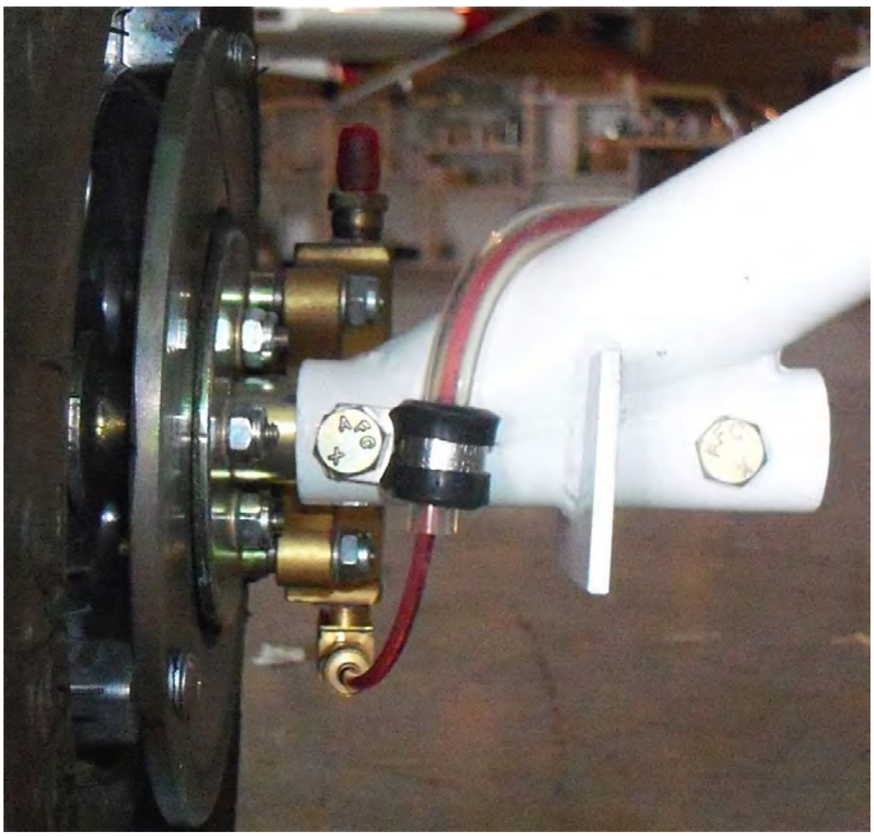
Florida Lightning dealer Maxim Voronin captured this unusual view during his ride on the Bell C47 overhead tour of EAA Oshkosh

Editor's note: The August/September Hangar Talk *features two construction method updates from Lightning's Nick Otterback and Pete Krotje's recent article on tuning the Bing carburetor. Also appearing is the first of several installments from homebuilder Bernardo Melendez, who offers a wide array of helpful hints for the building process.*

Please submit material or ideas for future issues to John Jenkins at jjenkins@chorus.net.

Re-Routing Brake Lines

Nick Otterback



We have started re-routing the brake lines on the SLSA Lightnings and EABs built with the build assistance program. This was done to ease bleeding of the brakes and to eliminate any stress on the brake line at the compression fitting.

Our brake lines are routed down the aft side of the leg, requiring that the line be wrapped around to the front side and down to the fitting (see photo). We use a #6 Adel clamp to hold the brake line in place, with a piece of clear tubing on the line for anti-chafe. The brake fitting should point straight forward, with the bleeder installed in the top of the caliper. With the bleeder on top all air can escape from the caliper.

This arrangement allows the brake caliper to float freely side to side while the brake line is under little if any stress. Prior installation practice had the brake fitting on top and pointed at the gear leg. This can put the line under stress. The caliper needs to float in and out, and with the prior installation method this is somewhat limited.

Canopy Layup Method

Nick Otterback

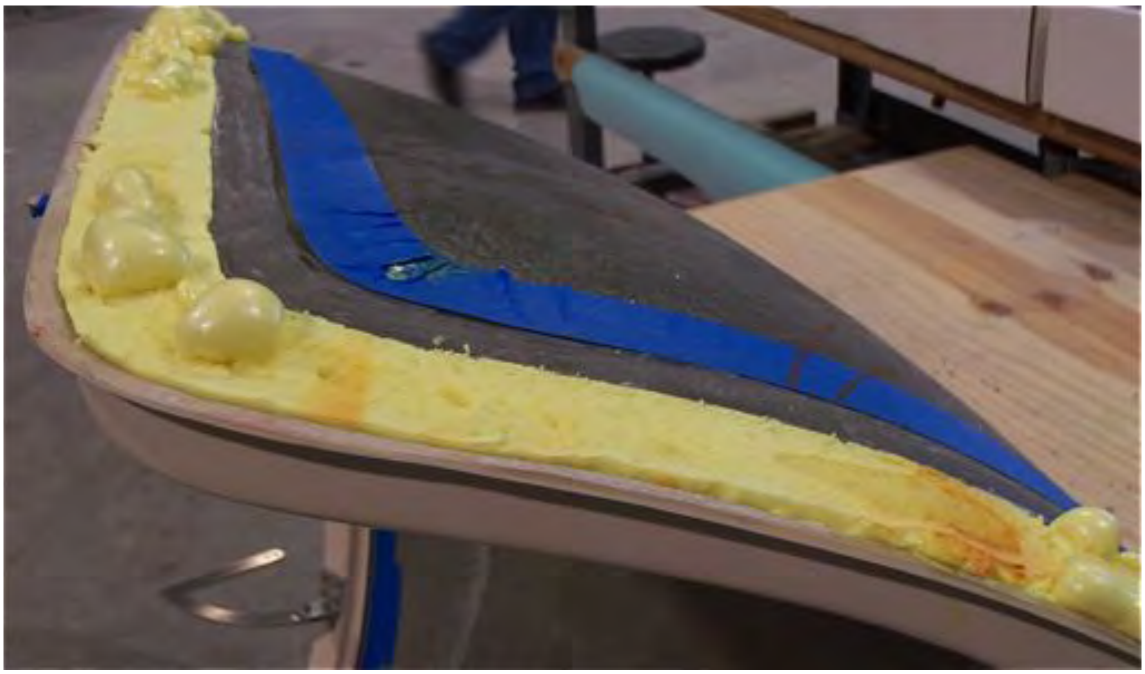
As some of you with new kit orders may have noticed a part is missing from the kit. The build manual explains how to install the canopy frame skins, which are no longer provided. We decided to eliminate the pre-fabricated skins from the kit because we found that an alternative method to be described here was easier and less time consuming. The revised method is described below.

First, complete the canopy assembly as written up to the skin installation portion.

Next you will need about two cans of Great Stuff. Use the “Stuff” in the blue can. It is a much denser foam than the standard product. The purpose of the foam is to give you a solid surface to lay up four plys of glass tape to complete your skins.

Filling the canopy frame takes a few steps to get it right. First, with the canopy upright as normal, fill the back frame just over the top. Do not go down the sides—the foam will just drain out if you do. Also fill the front part of the frame. This will now have to cure. Come back the next day and stand the canopy on it side. Fill this in as well. Again, let it dry for another day and finally do the last side the same way. Using this method, the foam will nicely fill the cavity.

Once the foam has fully cured, come back with a hack saw blade and carefully cut the foam flush with the canopy bubble and lower frame flange. Careful and slower is better. If you cut to quickly or don't wait for the foam to cure, it will sink in and leave a wallow or shallow spot in the skins that you will have to fill later. I am sure you know how we came about this little bit of insight.



You may find air pockets as you cut. Just fill them in as shown in the picture. When happy with your foam you will need to mix up a small amount of epoxy—maybe 2 ounces or so—to seal it well. Apply this to the foam as if prepping a surface for glass layups. Let this cure for 24 hours. Not only does this seal the foam, it also prevents the use of excess epoxy during the layup process. Again, we know this from experience.

Prep the fuselage with some masking tape around the cockpit opening, then overlap with clear packing tape. This will keep the canopy from bonding itself shut and you making an entry hatch in the belly.

The kits now have glass tape provided for this project. There should be enough glass cloth to apply 4 layers of glass on the canopy assembly in place of the per-fabricated skins. You should mix epoxy accordingly and lay up the glass as you have done on any other part of the kit.

Tuning the Bing Carburetor on Jabiru Aircraft Engines

Pete Krotje

The Bing 94 CV (constant velocity) carburetor found on Jabiru aircraft engines is designed to deliver a fuel/air mixture to the engines that is appropriate for the load demand on the engine and the operational altitude. The carb generally does this job quite well and very efficiently. However, the carburetor must be properly configured to provide the desired results.

The mixture that the carburetor provides to the engine is highly dependent on the load placed on the engine. Loading comes from airframe drag and propeller diameter and pitch. The more load the richer the engine will run. Conversely, lighter load delivers a leaner mixture. This phenomenon can be easily demonstrated with an adjustable propeller. Setting the prop for a low pitch (climb prop) yields higher rpm at any given throttle setting and a lean mixture. Increasing the pitch (on the same airframe) will result in lower rpm per throttle setting and a richer mixture.

Properly tuning the carburetor requires installing the correct jetting and/or propeller pitch so that normal operating parameters can be achieved. Normal operating parameters mean rpm on climb out at normal climb attitudes within the 2750 to 2900 rpm band. These climb rpm's give the best combination of HP and torque to achieve best all around performance. There may be a few airframe combinations that cannot achieve these numbers as normal but most will fall in the range.

Tuning is an exercise in trial, adjustment and retrial until the best combination of jetting is achieved. While engine monitors that report all CHT and EGT are not required for a tuning exercise to be successful, full engine monitoring is highly desireable and makes tuning much more precise. Tuning will require more information than can be provided by a single EGT probe. Here is how we tune carburetors at Jabiru USA:

1. Make sure the propeller will allow proper rpm. We check this by observing rpm as we are rolling down the runway at take off power. We do not do static run ups as the information we need can more easily be obtained while the aircraft is on the go and we don't have to worry about overheating and other tie down issues. The minimum target in this phase is 2650 rpm with 2750 desirable.
2. Then we observe rpm in a normal climb out at or around Vy. The minimum target here is 2750 rpm with 2900 rpm as the desired result.

3. During the climb out phase at full throttle we observe EGT's. The target for the center of the range is 1225. We might expect to see one cylinder near 1150 and another near or even above 1300 but the center of the range would still be 1225.
4. After reaching a safe cruise altitude we set rpm at cruise power at 2850 rpm (the range can be 2750 – 2950 but we find that on Jabiru aircraft with 3300 engines that 2850 is about right). We again observe EGT's after temps stabilize in cruise. For 2200 engines the rpms should be 100 rpm higher than mentioned here.
5. We then reduce throttle as we observe EGT's to find the peak EGT rpm. Usually EGT's should increase as throttle is reduced and at a certain throttle setting will begin to decrease. We expect peak EGT's to occur at 2600 – 2700 rpm.
6. One final observation involves comparing EGT's at cruise power from the left side of the engine to those from the right side - cylinders 2, 4 & 6 VS cylinders 1, 3 & 5 on the right.

Once back on the ground we change jets in the carburetor or adjust pitch setting in an adjustable propeller to try to achieve the targets mentioned above.

1. Climb out: Since the amount of fuel delivered to the engine at throttle settings of ¾ open or more are controlled by the main jet, we make a change in the main jet to come closer to our target of 1225. If climb our EGT's are higher than target, the mixture is too lean and a larger main jet is indicated. If EGT's are lower than target, the mixture is a bit rich and a smaller main jet should be tried. Remove the main jet to see what size is in the engine. Main jet sizes are a three digit number and most likely 255 for a 3300 and 245 for a 2200. Adjust up or down by 5, i.e., 255 to a 250 or 250 to 255.
2. Cruise: At settings of ¾ throttle or below the limiting factor for fuel delivery is the needle jet. Cruise flight should be at settings at or below ¾ throttle in most cases. The target for the center of the range for cruise flight throttle settings is 1325 F. Based on your EGT observations in cruise flight install a larger <u>*needle jet*</u> if temps are above the target or a smaller <u>*needle jet*</u> if temps are below target. Needle jet sizes are numbered in x.xx format. You may find a 2.85 needle jet in your carburetor and will need to try perhaps a 2.88 if temps are a little high or a 2.90 jet if temps are quite high. If cruise temps are too low, then a smaller needle jet is indicated. Since cruise power setting is where the aircraft will spend most of its time make sure you take the time and make the effort to get cruise mixture settings right!
3. Balance: If you have observed a consistent difference in temps from side to side (cruise flight only), EGT's can be adjusted from side to side by tilting the carb a few degrees with the bottom of the carb rotating toward the hotter side. This

procedure helps correct for a spiraling airflow through the carb. Fuel is picked up into the airstream at the bottom of the carb throat. As the flow speeds into the intake manifold it is split left and right by a symmetrical airfoil called a diffuser. If, for instance, the airflow spirals in a clockwise movement as it progresses through the carb throat, it will pick up fuel at the bottom of the throat and begin moving the fuel to the left. Before the fuel is evenly spread through the incoming air stream the flow hits the diffuser and splits left and right. The result is that the fuel/air mixture delivered to the left side (cylinders 2,4,6) has more fuel in it (richer) than that delivered to the right side (1,3,5). The left side will be leaner – therefore hotter EGT's. By rotating the bottom of the carb toward the right (hot side) you move the fuel pickup toward the right. The spiral is still there but as the flow is carried to the left the fuel distribution is more centered as the flow hits the diffuser and splits. Carb rotation is limited by space between the distributor caps but differences of up to a 100 degree F average difference can be corrected.

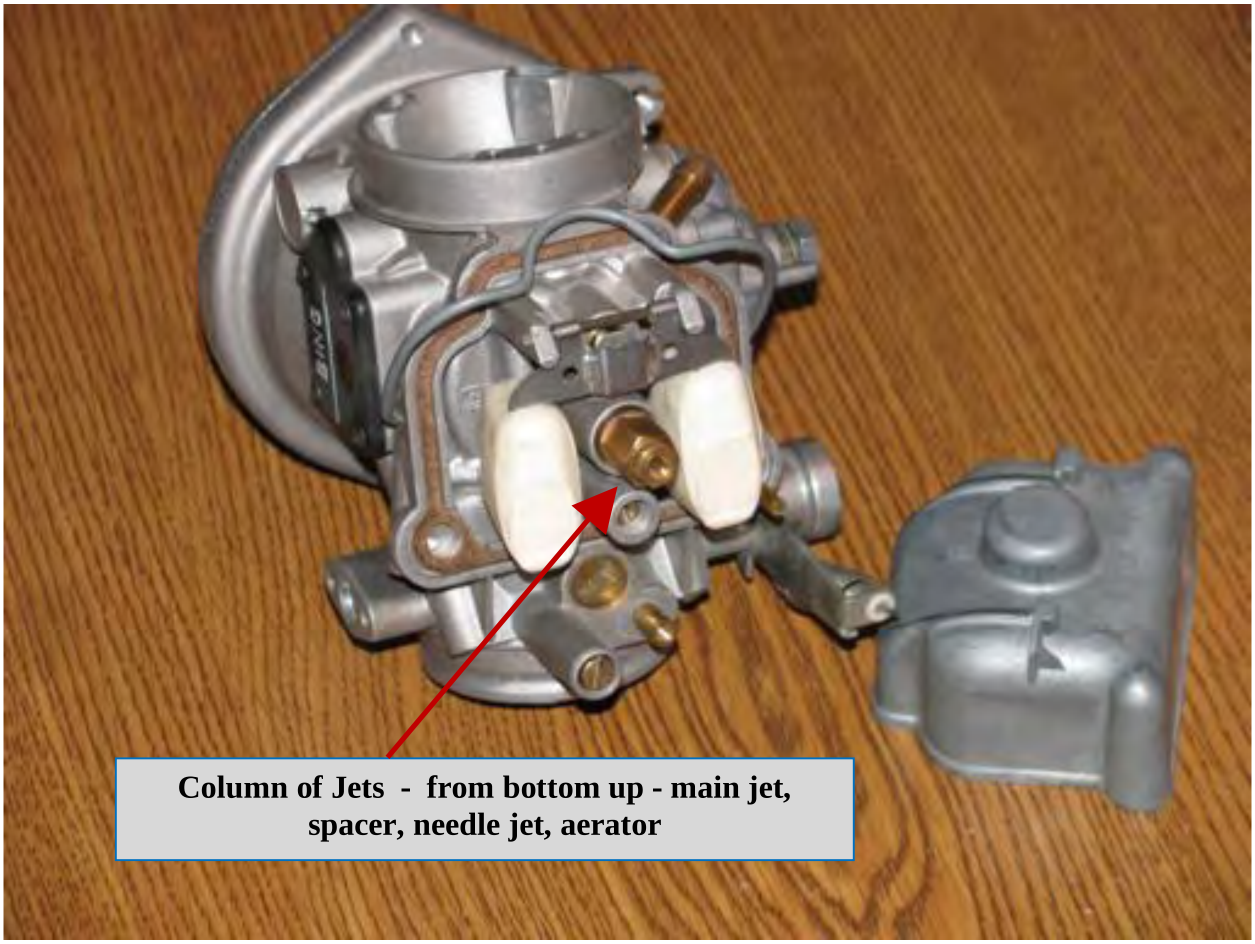
4. Next step is to go fly and repeat the observations listed in steps 1 – 6 at the beginning of this advisory and making additional changes if warranted.

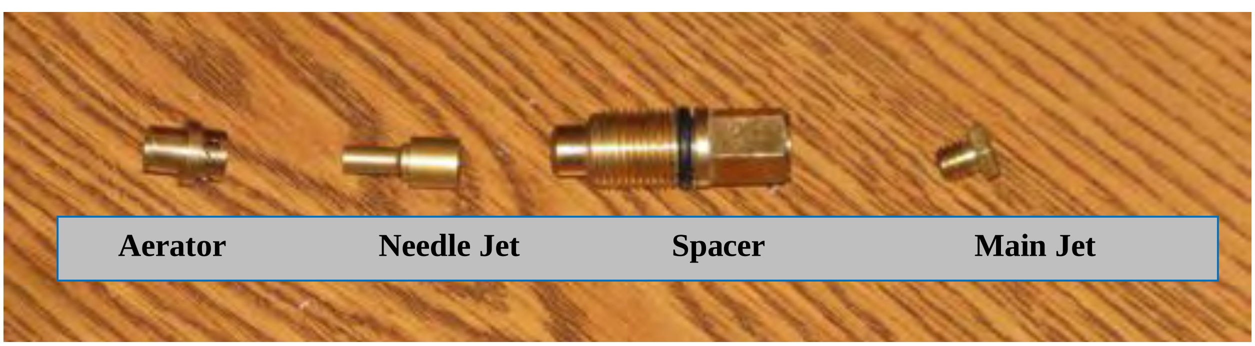
Some airframes are more difficult to tune and some of the rpm parameters do not apply. An **Arion Aircraft Lightning**, for instance, will not achieve the desired rpm on the take off roll. Since it is such a clean airframe a low enough pitch prop to give 2750 rpm on the take off roll will allow a prop over speed at full throttle in level flight. Conversely a Zenith 701 is so draggy that a 2900 rpm setting on the takeoff roll will result in a full throttle level flight rpm of only 3050. However, most airframes will fall in the usual range.

If your aircraft cannot achieve rpm in the normal range, a change of prop may be required before you can really tune the engine.

Why bother to tune? Engines last longer and produce more power if they run smoothly. Uneven fuel distribution causes uneven power production from the cylinders, causing a rougher running engine. Wear effects on valves can increase on cylinders that run lean. Ring seal problems and sticky rings can be caused by a too rich cylinder. For a longer lasting more reliable engine take the steps needed to optimize your installation and tune it to your own individual combination of airframe and propeller.

Visit www.bingcarburetor.com for carb technical info or to order carb parts and jets. See the Jabiru engine manuals for carb cutaway drawings.


Column of Jets - from bottom up - main jet, spacer, needle jet, aerator


Aerator
Needle Jet
Spacer
Main Jet

Small Lightning Mods

(first in a series of email messages addressed to the editor)

Bernard Melendez, Jr.

Here are a number of photos of my project that you may want to include in your newsletter. I hope that other builders may find some of the modifications helpful.

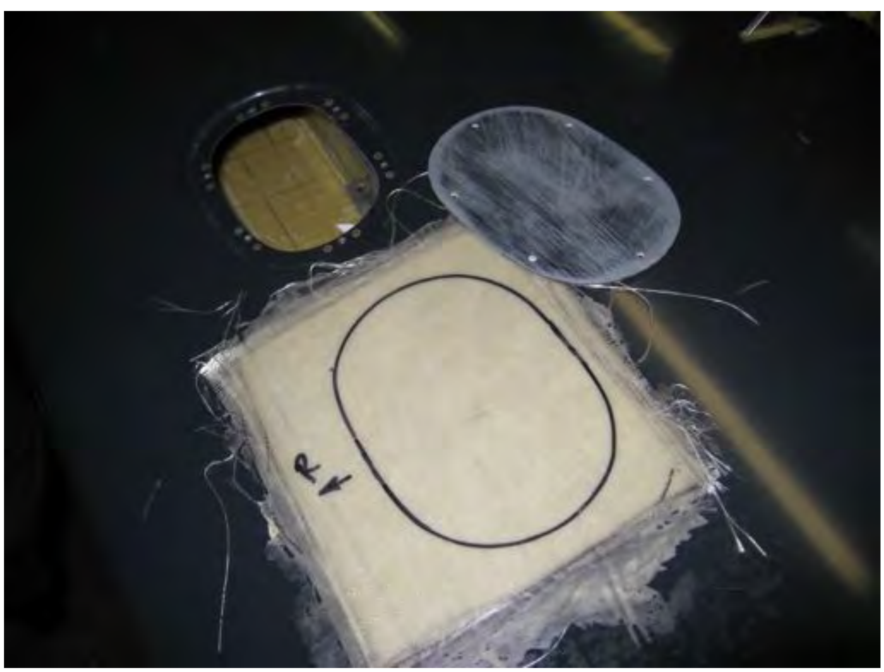
The first pic shows yours truly sanding the outboard aileron hinge attach area where I added 6 plies of 8 oz. cloth. This is for reinforcing this area because I plan on extending the ailerons about 9" outward, or longer.

In the next two pics I am sanding and adding the glass cloth.

Next are a couple of wing tie downs I designed that attach to the spars, at the tips. There's enough spar that extends past the last rib where they could be attached. Weight is only 1 1/2 oz each! But I also designed wing tie downs, plan "B," which I'll send in a later email. I like those better, anyway.

The next shot shows the horizontal tail fairings.

I was not happy with the aileron bell crank cover plates, since they are flat, with no curvature at all to match the underside of the wing, so ... I had to make my own. I did the same for the cover plates that go under the horizontal stabilizer tail sections.

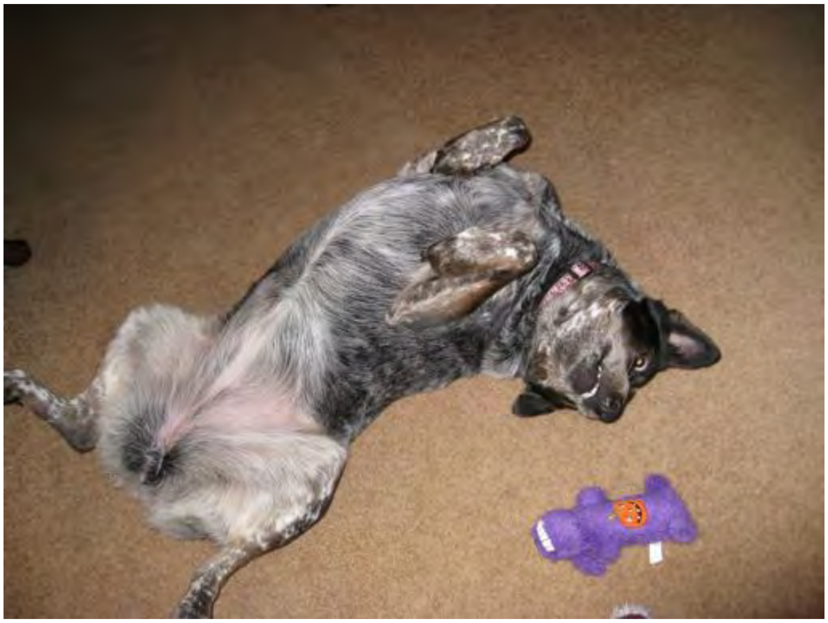


Then again, I'm a glutton for punishment. I just had to build my own wing boarding steps. That's also known as "El Cheap-o."

If anybody wants detailed drawings of any of my mods, they can send me a SASE and I'll send them a copy. My email is n45bm@yahoo.com. There's more to come next email to you. Hope this is helpful.

Best regards,
Bernardo Melendez, kit #110

P.S. Attached is a pic of my loyal hound, Molly, in the workshop. She's a blue heeler, an Australian cattle dog. Also, another pic of my current steed, Estrellita, my Corby Starlet.



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