

CARF-Models AT-6 “Texan”

Instruction Manual

First Draft

Quick Guide for the important steps of installing landing gear, RC and engine

Thanks for purchasing our AT-6 “Texan” It is the latest of our line of warbirds and we are sure it is the most advanced in terms of prefabrication and attention to detail. However, there is still some important information for the installation of equipment. Unfortunately the instruction manual is always very hard work and is falling short, coming late, for the first kits delivered, so we appreciate your patience and at the same time apologize that this is maybe shorter and briefer than you wish for. However, we are sure that all necessary important information are given here and if you seriously follow these advises, you will successfully build and maiden this airplane.

We will add photos to the paragraphs as soon as they become available and get sorted. But even without, it will be no problem to complete the building and installation steps. If you have shot a few photos of your build, we would be grateful to have a look at it and maybe use them to enhance this manual step by step.

1) Landing Gear Installation

Lets start with the main gear. There are a few things to watch, especially with the first kits delivered, because the main spar, which alignment is critical for the installation of the gear, might not have that precise angle you are looking for, it was a huge challenge to get this perfectly set in production. However, it is easy to adjust and align your gear if you follow the advice below.

First lets cycle the gear with a 1 cell LiPo (or an old 4-5 cell NiCd). Create an adapter cable. You simply reverse polarity to retract or extend. We do not recommend to use the operational voltage of 2S LiPo because if you are not VERY careful in the end positions of the gear, you might burn the motors and we do not warrant burnt motors at that stage. Without the Gear Controller there is no automatic power shut off at the end positions.

You must disconnect the battery right when the gear arrives in its mechanical end position.

Now, before you install the gear, you must grease all moving parts. Use a white grease from the spray can. There are a lot of moving parts with large surfaces in this gear. Only if it is well greased it will operate reliably over a long period of time. So please grease all moving parts thoroughly before you install it. **Do it now, so that you won't forget to do it later.** Also make sure that the strut torque rod is slightly clamped in the trunnion of the gear unit, not too hard, so that you can adjust it manually, and not too soft so that it won't change by itself.

Next is an important technical information about geometry: In pilot's view, the AT-6 gear axis of rotation must be pointing 5 degrees out (away from the fuselage) and 5 degree down. Then all the angles are perfect and the strut and wheel will be in the right position retracted and extended.

Please verify that your gear mount has the wood block spacer on the rear horizontal wood. It is a 9-12 mm plywood block, approx 3" x 1/2" x 1/2" (8 x 1,2 x 1,2 cm). It might also be in your hardware package, if it isn't please be prepared to make one or contact us.

Slide the gear into the mount. Make sure you find a way to align the gear flush to the main spar. Use clamps and make sure that whatever you do next, the gear is ALWAYS aligned to the main spar and all modifications of attitude have to be in relation to this main spar. This is very important during the test fitting of the wheel in the wheel well.

You might notice now that the wheel is sitting a little too far back in the wheel well. That's due to the fact that most likely the spar in that area is not 100% perpendicular to the 5 degree, which the axis of rotation has to point outwards. This can be easily adjusted with one or two steps of thin plywood, used as a spacer on the outside of the gear unit. Tack glue these spacers to the spar, and slightly re-work the cut out of the horizontal gear mount, if necessary. A dremel with a sanding drum or a Permagrait sanding block or file will do. Always make sure that the torque rod of the strut holder is all the way in the gear unit, the rear end should be flush with the gear frame. Do not try to correct any issues by pulling this out from its original position. Corrections must only be made by changing the angle of the gear unit.

Once the wheel is aligned in the center of the wheel bay, temporarily fix the gear with 2 small self tapper screws, make sure that it is flush against the spar, or spare and spacers you installed.

Then cycle the gear so that it is extended. align the strut 100% vertical and the wheel exactly along the root rib (no toe in or out). Tighten the grab screws slightly so that it won't move by itself.

Now cycle the gear in. Make sure that the motor pulls the brass slider all the way to the end position. If the gear is retracted, the wheel should not touch the upper skin of the wheel well. If it does, it will create tension on the gear and it might not unlock reliably in the air, when you try to put your gear down. This must be avoided. So: The wheel must turn freely when gear is retracted.

Do this for both gear, right and left.

Now there can be two things: The wheels are not aligned to each other, or the wheels touch the upper skin of the wheel well.

a) If the wheels are not aligned to each other:

Don't rotate the strut in the strut holder. As long as you have confirmed that the alignment of the wheel is correct when extended, this should not be adjusted anymore! You should now adjust the gear unit, using very thin spacers at the top or the bottom of the front retract frame (the aluminum plate) until the wheels are aligned to each other.

b) If the wheels do not retract all the way, or they hit the top skin of the wheel well:

You need to lift up the gear unit in the mount, there is still some room to the bottom skin of the wing and gear door, you can most likely add another 3 - 6 mm plywood on that spacer block. At least try to get close, if you are not 100% successful you should then extend both gears, loosen the grab screws in the trunnion and move the strut 1-2 degree outwards. Maybe you did not align them 100% perfectly vertical the first time, in any way, if the strut is pointed 1-2 degree out, it will not be noticeable when the plane sits on the ground.

Cycle the gear a few times and make sure it travels smoothly, locks and unlocks without binding.

Now, when your geometry is right, you will have to drill two holes in the spar in the right position, in order to mount the front frame to the spar. That is a little difficult task, but it is only foam and a small carbon plate. what works is a 4 mm steel, bent 90 degree and heated with a torch. Burning the hole through the spar is a little smelly, but the easiest option.

Last but not least, the brass bushing needs to get a support against the spar, and therefore you mix some 30 min resin with milled fibre and/or microballon. Then you wax the bushing and put the thickened resin under the bushing. Make sure that the resin doesn't squash over the bushing, as you will have to be able to remove the gear and bushing for maintenance at any time. This step is not crucial, the gear unit itself has considerable strength, but if you do it, it helps to carry a hard bounce better into the center wings structure and takes load away from the two bolts in the front through the spar.

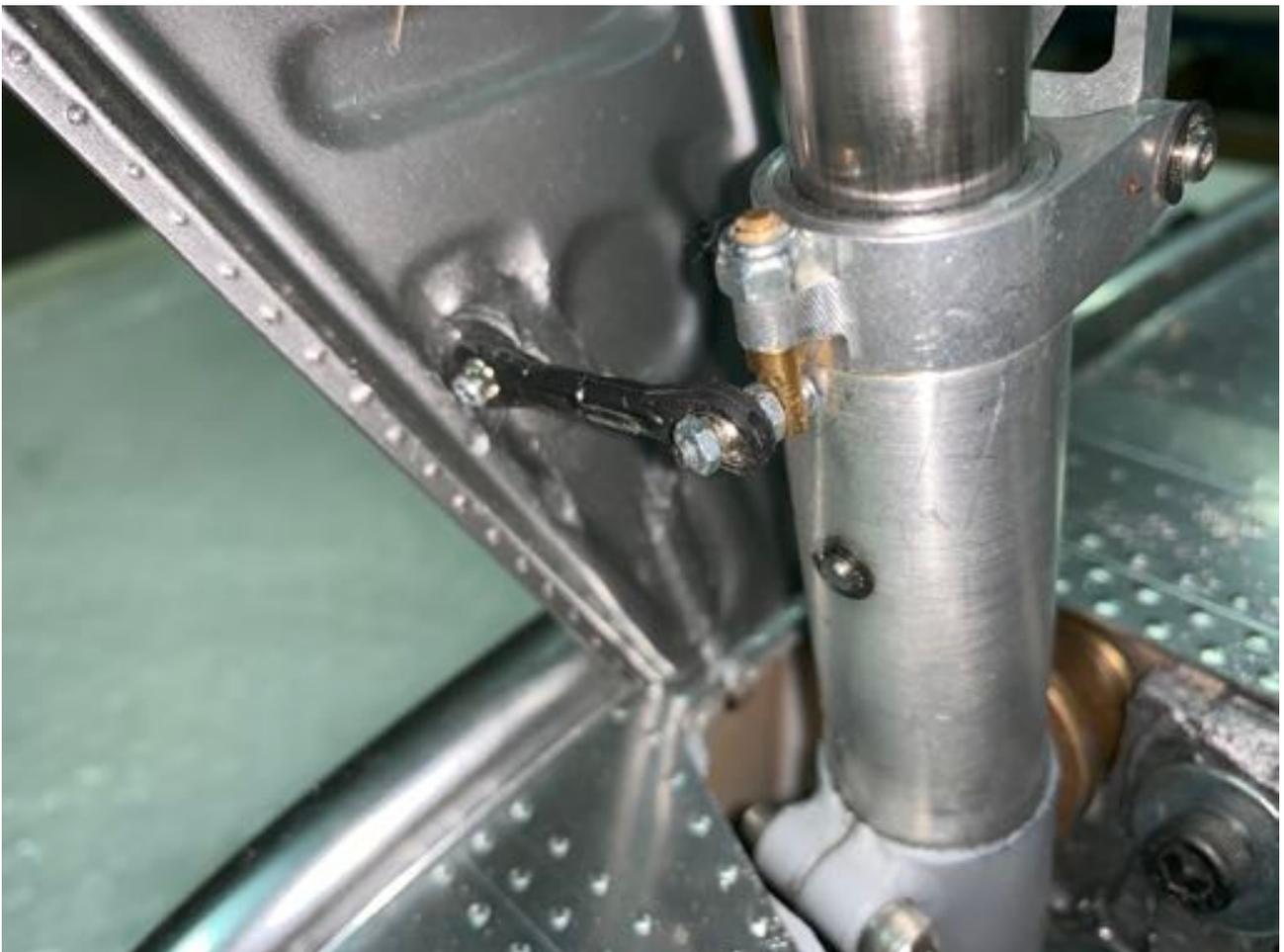
Then you can permanently mount the gear with the two M5 bolts through the spar and the self tapping sheet metal screws into the rear horizontal board. The screws have to be long enough

that they penetrate the main horizontal gear mount, not only the wood spacer! For the M5 bolts through the spar you should use large washers, or even a piece of carbon plate, which should be glued to the front surface of the spar. In later models there is a milled carbon plate in the kit for this purpose.

Now cycle the gear once more and make sure that it runs smoothly from end point to end point. Once you are satisfied with the movement, retract the gear, fully tighten the grab screws, put the drill bit included with the gear unit in a battery drill and then drill all the way through the trunnion and torque tube. You can do that in the plane, if you make sure that you can't drill through the upper wing skin... Or you remove the gear and do this in a drill press. Once the hole is cleaned from burr, push the rolled pin in. Please be assured that this work step and the final step of your gear installation is **ABSOLUTELY CRUCIAL!** If you do not pin this connection, the strut hold might shift in the trunnion at a less than perfect landing with side load on the gear. Consequences will be that the wheel, after the next retraction process, will hit the wheel well, put tension on the gear mechanics and it will **NOT UNLOCK** anymore when you try to put the gear down for your next landing. This always results in airframe damage!

Installation of the gear controller should be in the center wing. The gear battery (2S LiPo, 800-1000 mAh will be enough for a whole weekend and more) should also be mounted right close to the gear controller. There is no programming necessary, as long as you have your gear channel set to +/- 100%. You should unplug the battery if you store the plane for more than a few days, since the controller has a very little amp draw also when switched off.

Connect the gear doors to the strut's eyelet in the front of the strut, at the bottom end of the outer oleo tube.



2) Tail Gear Installation

The tail gear installation is very simple, as long as you follow a few very important instructions. The former in the airplane is already prepared for the gear. So, it can be installed with the bolts and T-Nuts right away. The most important message here is that the steering cables must be fed through the 2 holes right where it swivels on the pin for spring and damping action. Otherwise the cables loosen when the tail gear spring compresses and that will be the cause of beautiful donuts on the runway. This we don't want. As long as the cables are run through the former right where the tail gear rotates during spring action, the cables will stay as tight as they are set by you.

The fiberglass fairing has to be cut and installed to the lower components of the tail gear. A few little scrap balsa pieces and some Silicone will hold it in position.

The rudder servo is mounted right behind the firewall. This is done for CG reasons and it should stay that way. Cables to rudder and to tail wheel can be prepared with the hardware provided with the kit. Please always loop the cable TWICE through the crimp tubes to prevent it from slowly sliding out. There is an elevated stand for the rudder servo, in order to keep the cables as low and as close to the wing as possible with the fitting of the full size cockpit in mind.



Then mount the cover with the self tapping screws. In case you need a bit lead to compensate for the CG, this is the place to stick some lead from the inside. Up to 150-200 gram, if no cockpit installed, is expected. But with the cockpit, which ends up at approx. 900 gram plus one or two pilots, this lead definitely can be removed.

3) Engine Installation

The engine installation, as long as you chose a Moki 250, is as easy as it gets: Bolt it on!

The 3 M6 T-nuts are already pressed in, so that you can really bolt on the engine. Just the right thrust should be set with washers, before you permanently fix it. In a warbird too much right thrust looks awkward, so we went with a small amount of maybe 1.5 degree. That, however, is enough for the 2-bladed props flown on this airplane. Just make sure that the prop shaft is right in the center of the cowl.

The openings for the linkages of throttle and choke are already milled in the firewall. The servos for choke and throttle are mounted in our milled plywood side mounts, which then are bolted on the base plate under, and beside the rudder servo with 2 M4 bolts each.

the cowl mount is already done in the factory, it is just highly recommended to use a thread locker compound to make sure the cowling bolts don't come loose during flight.

The fuel tank and the smoke tank (if you opt for the mess) are placed on top of the central shelf right behind the firewall. That means, when the fuselage is laying on its back, BELOW the central wood shelf. Stuff them with medium density foam. For the fuel we used a 40 oz Dubro tank, for the smoke 32 oz. Both tanks fit in these compartments.

Do not worry about the fuel being a little in front of the CG. It is much better than causing the engine to run lean because of long fuel lines. Also you need all the space around the CG for the cockpit later.

There is a special CARF AT-6 ring muffler available from Moki/Airworld. They manufacture it especially for this airplane. You can order your engine with this ring muffler right away, or you can order the muffler as an upgrade package. You just need to cut an opening into the side of the fuselage, right where the firewall has the half round cutout. Measure with your engine how far you have to cut back.

Plumbing the tanks, rigging the linkages for the servos, installing the engine and the cowl should be something you've done before, so we do not anticipate any difficulties at all here.

For cooling of the engine we recommend to use the Airworld/Moki cooling baffle (it is highly effective) and to cut a few holes in the firewall to allow a bit more exit air. The ring behind the cowl is very narrow, and the additional openings at the bottom of the fuselage are marginal. 2 2" diameter holes in the firewall, where they fit, will help discharging cooling air. Now, of course, you have to make sure that the air can exit the fuselage, so you need to see that the fuselage has openings at least twice the opening surface as the holes in the firewall. We have cut exit holes in the wheel wells, where nobody sees them.

4) Flap Servos

The flap linkage is quite unique, but very difficult to adjust. it can take a factory worker several hours, to adjust the linkage so that it doesn't bind and runs the flaps symmetrically. Do not re-adjust anything if not absolutely necessary! The factory setting is basically exactly what works best. All parts are movable, there is a reason that the threaded ends, for instance, are loose in their threads. The only thing you should do is put a little grease to where there is movement.

Installing the Servos is very straight forward. Any Standard size servo should fit in the side mounts. If there is a little rework, please do that carefully and precisely. Once the servos are finally installed and everything is working, take them out one more time and use a few drops of silicone on the servo side to help holding it in place and avoid even the slightest movement in side mounts, which only clamp the servo tight. Servo horns should be aluminum, with ball links, they should be installed so that they can get the linkage 100% load free when the flaps are retracted. It might require a little pressure to close the flaps against some tension of the 2m long flap hinge

and push rod. The servo should be definitely load free when the flaps are RETRACTED. In the extended position of the flaps, the connection rods inside the flap mechanics are angled in a way that they remove already at least 2/3rd of the servo load by geometry, when the flaps are fully deflected. No servo is at risk of being overloaded and burning in the fully deflected position, but in the fully retracted position, it is possible. Thus, choose the geometry of your servo horn so that the servo is load free when flaps are fully retracted (flaps up).

5) Aileron and Elevator Servos

There is not much to say about servo installation of aileron servo and elevator servo. It is straight forward, standard work. On the ailerons you might notice a stainless steel outer hinge. That is so that a donut on the runway, where usually the wing tip is scratching over the asphalt, will never damage your outer aileron hinge...

6) Placement of misc. Equipment

With today's radio systems, and with a warbird with moderate control surface size, a Powerbox or any other special power supply has become obsolete. A good receiver will handle the currents in this airplane just fine. A gyro is recommended, we have experience with the Jeti Assist system (REX-12 Assist) or of course with the best of them all, a Cortex Pro.

The Gyro should be placed on the board where the throttle servo and the rudder servo is attached to, this board is perfectly aligned. Batteries can be installed on the smaller board a little lower, right behind the firewall, or if the CG allows, on the fuselage sides with Velcro.

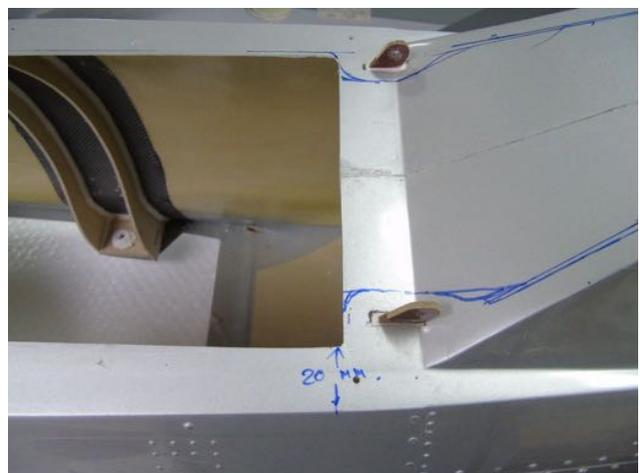
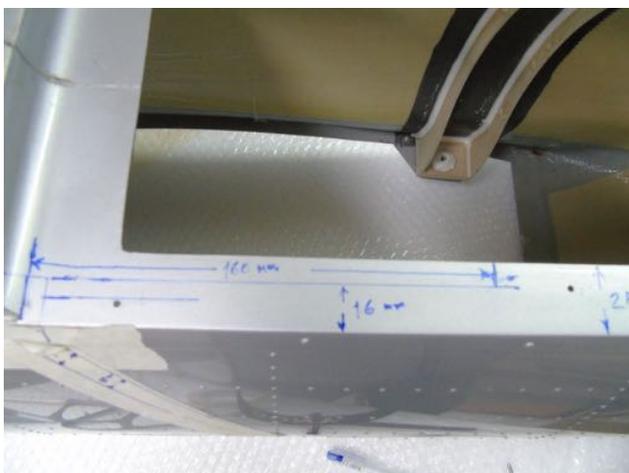
The receiver also can be strapped or taped to the fuselage side - except you are using a receiver with Gyro, this must be aligned perfectly.

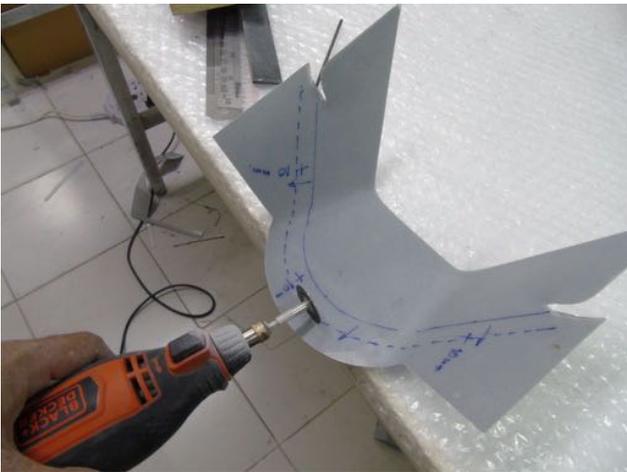
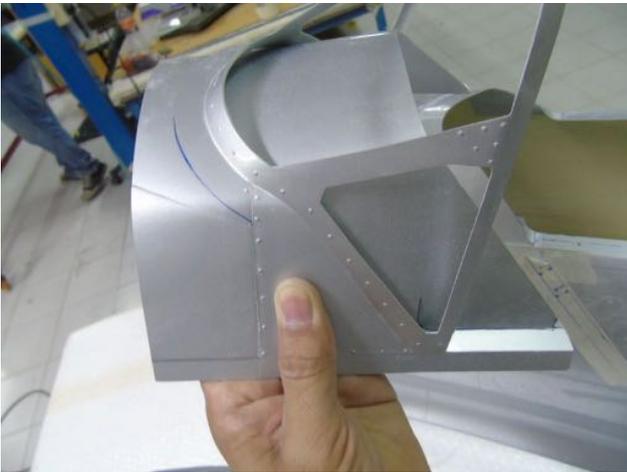
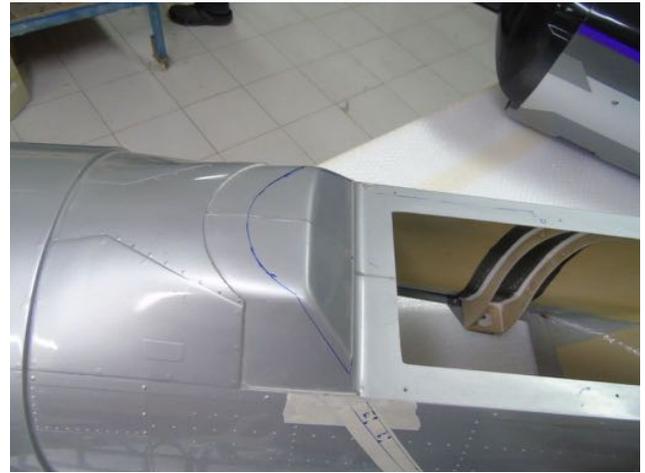
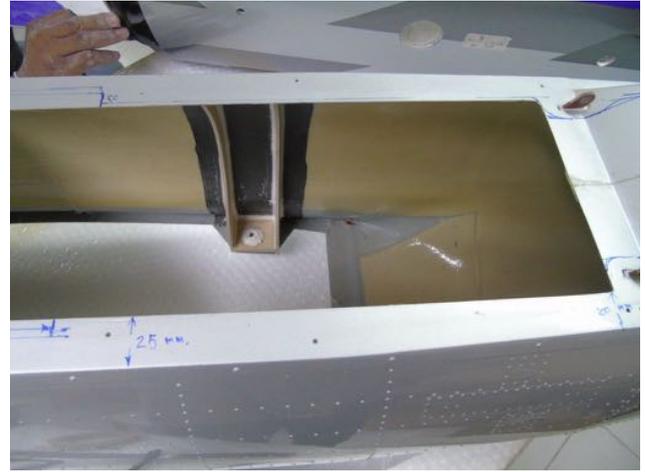
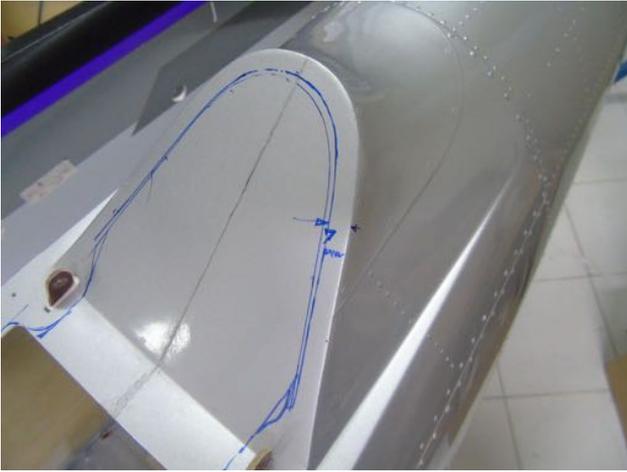
We use also an RC ignition switch, which should be installed following the manufacturer's instructions. Please note that the Moki Ignition is a 7.4V system!

7) Sliding Canopy

The sliding canopy is factory built and functional. It aligns with a few very small carbon pins. It will be of great advantage if you trim your cockpit opening along the edge, so that the cockpit will fit perfectly later.

The photos here give you good guidance how to cut to make sure the cockpit will fit later.





Cut the glass and glue it in from the inside. The small portions of the canopy make this job fairly easy. There are several techniques, and you might have done it before and have a preferred way to do it. We like to use a special canopy glue, and a few very fine drops of CA to hold the clear glass in place while curing. Small magnets are used by others to hold the canopy in place while the main glue dries.

Two small magnets installed in the front frame will work nicely to keep the front canopy closed, the rear canopy does not need any help to stay closed in flight and the rear gunner glass can be either fixed permanently, or also held down with a single magnet in the frame.

When the canopy frame is finished, glass glued in, functionality confirmed, then glue the frame rails on the fuselage. The small pins will align it nicely to make the job easy. Then glue the front glass and dash board (see next chapter) as well as the two rear fairings to the fuselage. Of course, during all this work you will have to be very careful not to damage or mess up the nice in-the-mold color scheme you might have ordered with your kit.

8) Cockpit

The cockpit will be installed from the bottom opening of the fuselage, it is a one-piece design, plus the front dash board with instrument panel, which is fixed in the front area of the fuselage. The front dash board will have to be trimmed as shown in the photos above. It is part of the kit and not part of the cockpit set. A rear dash board is also included in the kit, for the ones who do not want to install the full cockpit. As soon as the first cockpits become available, a more comprehensive guide will be added here.

9) CG and Throws

The CG is at **29%-30%** of the center wing chord. That equals a distance of 17-17.5 cm from the leading edge. A tail heavy AT-6 is one of the worst beasts to fly, so please do not experiment before you have made a few flights with this CG setting. Set this with empty tanks.

Control throws are pretty conservative. 40-50 mm on elevator, 80 mm on rudder, and 25 mm on aileron are a good starting point. Please use one dual rate switch each on elevator and aileron with 65%-70% of your high rates. If you feel that the given deflections are a bit hefty for you, simply switch to the lower rates, but do attempt your first take off with the high rates. All recommended throws are measured at the point of the largest chord of each control surface.

The AT-6, if a little nose heavy, needs quite some elevator to flare for landing. Also, the tail surfaces in general are quite small at any AT-6. The fuselage is short, this gives the CARF-Models AT-6, just like the full scale, its characteristics. And everybody knows, that an AT-6 is not the absolute easiest plane to land. Any full size pilot will second that. Most of you will use a gyro to help, but this gyro might alter the feel of the plane, make it feel much softer than with direct control without gyro. However, if you stick with the recommendations in this manual, you will have no problems to take off, fly and land this wonderful airplane.

A small tip for landing: The AT-6 wants to be landed with full flaps. It should be flown on to the ground, which means, the main gear should touch down first, with the fuselage still fairly level. We recommend to program a 2 stage idle switch, so that the approach and touch down can be done with a higher idle. This allows the air to flow freely over the tail surfaces. As soon as the tail also touches down, and the tail wheel takes over the steering, you flip the low idle switch.

For the moment of touch down, it has proven to be helpful to let one wing slightly drop lower than the other. That means, the two main wheels do not touch down at the exact same time. This will be a 90% help to avoid any landing bounces.

So far so good... It's time now to experience the great flying characteristics of this marvelous scale plane, this legend of the skies, by yourself.