1-1 You will be able to perform aerobatics more precisely with a well-trimmed airplane.

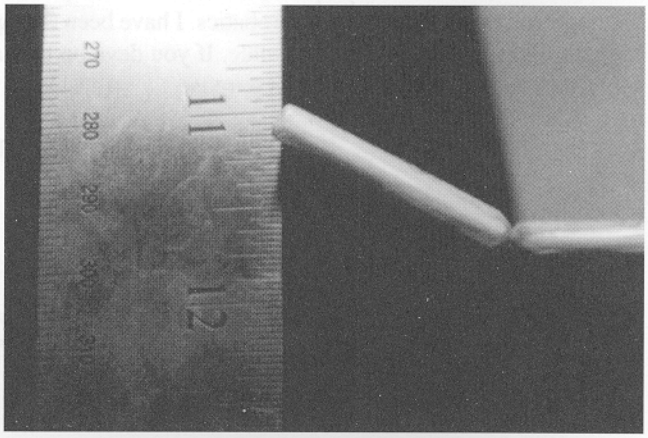
Chapter 1

Trimming Your Plane

An airplane that is properly trimmed is much easier to fly, especially when flying aerobatics. It takes a lot of time and patience to trim an airplane. If you are new to aerobatics, you should get some help from a more experienced pilot. Several maneuvers are required to test certain trim conditions and a more experienced pilot will make this easier for you. The following information on trimming is presented in an easy to understand format. We will start with initial adjustments and settings that you can perform at home. After this, several in flight checks will need to be made. After you make a change on the airplane to improve its flight characteristics, previous trim adjustments may need to be checked and reset. Please take the time and effort to go through these important steps. You will be amazed at how much better your ship flies after only a few key changes. A well trimmed plane takes off and lands more smoothly than before.

Initial set up

All of the planes that I recommend later on in this book come with excellent instructions. When building your plane, be sure to follow the instructions regarding the amounts of initial control throws. These will be described in terms of inches. For example, an airplane's elevator may need to be set so that its range of throw is ½ inch up and ½ inch down. Remember

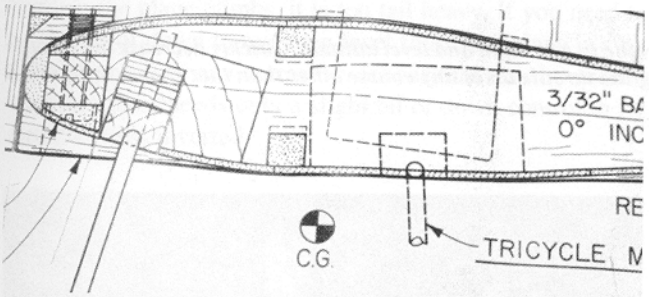


1-2 Set up the control throws on your airplane as described in the instruction manual. This will give you a safe starting point for trimming your airplane.

that these are all proven designs and that these recommendations are good to start your trimming with. After all of these surface throws are set, make sure that all of the surfaces are neutralized with the trim tabs located in their central positions.

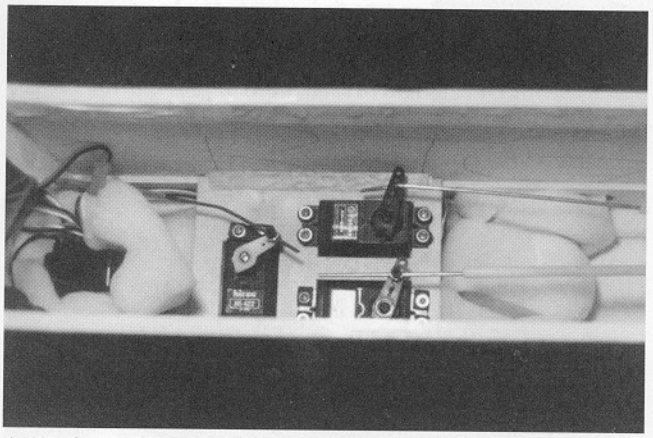
The thrust line of the engine must be properly set. All engine powered airplanes need to have the engine tilted in order to counteract for torque and other factors. Typically, the thrust needs to be directed to the right and down. Be sure that your plane has the recommended amount of thrust built in to the firewall or the engine mount.

Next, pay good attention to the location of the center of gravity (CG).If the CG is off, you can end up with a very unstable aircraft. The plans typically show the CG using a symbol and/or arrow. The instructions may also describe the CG range using inches from the leading or trailing edges of the wing. To correct an improperly located CG, first attempt to move radio components to different areas in order to solve the problem. Sometimes just shifting the battery is all that you need to do.



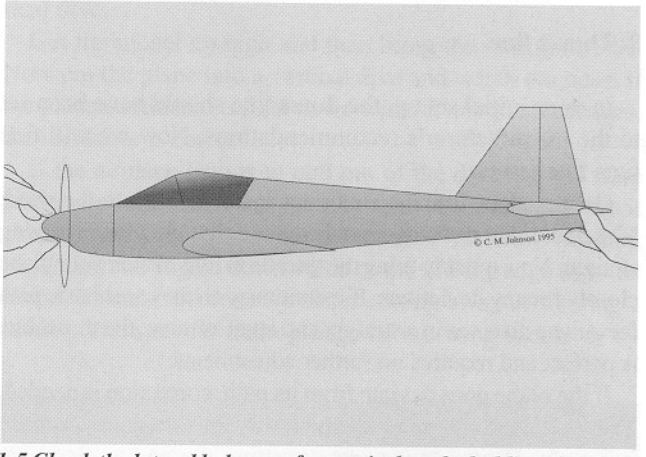
1-3 The center of gravity (CG) should be adjusted as precisely as possible before your first flight. The symbol above demonstrates exactly where the plane should balance.

After making all of the changes that you can and you still have an improperly balanced plane, you will need to add weight to either the nose or the tail. At this point you need to correct the problem using the absolute minimum amount of weight that you can. Adhesive stick on tire weights can be cut to length and attached to the horizontal stabilizer. Better yet, I recommend that you drive a few small finishing nails into both sides of the stabilizer in order to balance the model. If more nose weight is needed, you need to add it as far forward as possible. First try to obtain a heavier spinner or prop nut. Next you can add lead to the most forward portion of the fuel tank compartment. Be sure to mount it securely using glue or mounting straps so it won't become dislodged in flight and cause an unexpected change in the CG.



1-4 Before adding weight to the airplane in order to achieve the proper CG, try moving your radio components including the battery to different locations. This battery was moved from under the fuel tank to an open area behind the servos which effectively moved the CG rearward to the proper point.

Now you need to check the lateral balance. First, hold the plane by the spinner and the center of the rear most portion of the fuselage. If the wing remains level, the lateral balance is correct. If not, the heavy wing will drop. The lighter wing will need weight added to it in the form of small nails.If a lot of additional weight is needed, you may want to actually glue a piece of lead into the lighter wing tip. Keep adding weight slowly until the proper balance is achieved. Before flying, be sure to range test your radio. Also, adjust your engine according to the manufacturer's recommendations. Now you are ready to take to the air and begin your in flight testing. Be sure that there is little to no wind when you test your airplane. Also, try to get someone to assist you in observing the plane while the specific maneuvers are being flown. This way they can write down any information that is needed for you while you are flying.



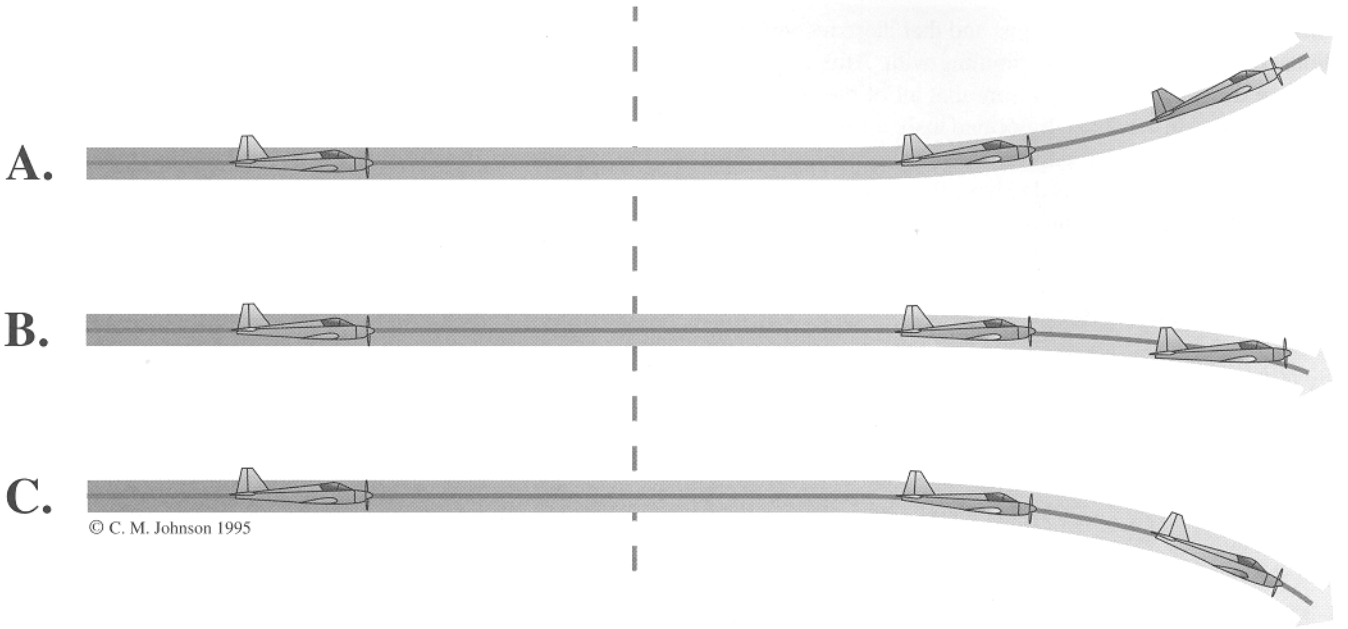
1-5 Check the lateral balance of your airplane by holding the plane in the front by the spinner. The rear of the plane can be held by a friend or may simply be set onto the edge of a sturdy table.

In-flight adjustments

1. Full power trim

With the plane flying at full speed, use your trim tabs to adjust the surfaces so that the plane flies straight and level by itself. After landing your plane, adjust the various linkages so that you can re-center the trim tabs.

Another option on the higher level radios may be to adjust the sub trim feature for each function. The trim tabs will then need to be centered. Repeat this process as needed until the plane flies straight and level at full speed with the trim tabs in their centered positions.



1-6 In order to test the thrust line of your plane, fly the plane at full throttle in a straight and level attitude. Quickly decrease the throttle to idle and observe the plane. If the path the plane takes after reducing the throttle takes any course other than that shown in figure B above, the engine will need to be offset. See text for details.

2. Thrust line

In your initial set up, the thrust line should have been set to the manufacturer's recommendations. Now we will fine tune this setting.

Get the plane into the air flying at full speed into the wind. Make sure that the wings are level and that the plane is flying straight. Now quickly bring the throttle to idle. Watch your plane closely for any deviations. If it continues on the same basic path for quite a distance in a straight and level attitude, the thrust line is perfect and requires no further adjustments.

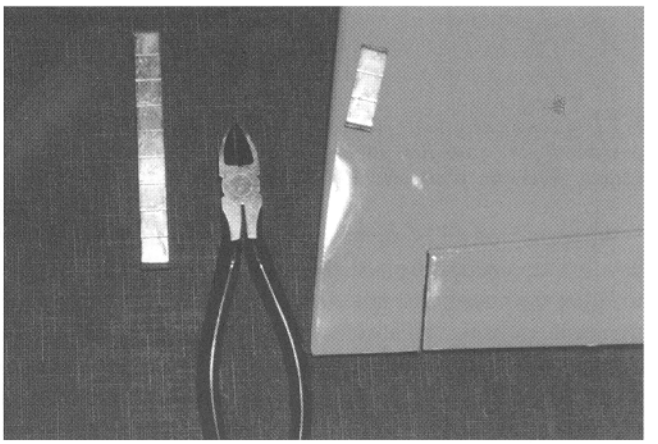
If the plane does deviate from its path, correction is needed. The easy way to remember which way the thrust line needs to be changed is by canting or offsetting the engine the same direction in which the plane's attitude deviates.

For example, if the plane immediately pitches downwards, then an additional amount of downthrust will be needed. If the plane veers off to the right, more right thrust will need to be added.

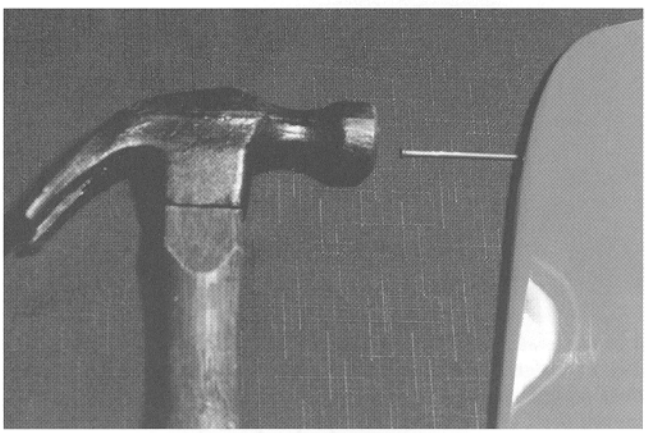
Usually a combination of thrust changes will be needed. There are a few different ways in which you can do this. The first method involves using washers as spacers that are placed behind or under the engine on the mounting bolts. These can effectively tilt the engine to a different degree.

The next method involves the use of shims. There are a couple of ready made types that you simply place to the rear of the engine on the bolts. You can also make your own out of pieces of hardwood planking. First cut these to shape and then sand or grind the proper angle into the wood and attach them like the other shims above.

After you change the thrust line, take the plane back up and perform the test again. If the plane still does not hold its course, go through the same procedure outlined above until it does.



1-7 & 8 Regular stick-on type tire weights can be used to temporarily add weight to the airframe when balancing your ship. Later on when your plane is completely balanced, remove the weights then place the same weight in small nails or pins into the surface for a more permanent correction.



3. Center of gravity

Your model should be balanced according to your instructions. Now fly your plane at full speed trimmed for straight and level flight and roll the model into a steep bank between 60 to 90 degrees. Now watch the nose.

If it pitches downwards, the plane is nose heavy. Weight needs to be added to the tail. This can be done by shifting equipment inside the fuselage rearward or by adding a small amount of weight to the tail. Small nails can be driven into the stabilizers on both sides. Be sure to add weight very slowly in order to avoid a dangerously tail heavy condition.

If the nose pitches upwards, you will need to add weight to the nose. Add weight as previously described to the front of the aircraft. Re-check the balance in flight and fine tune it as needed so that the plane drops without any change of attitude.

Now roll the plane inverted. You should only need to hold a small amount of down control in order to hold the airplane level. If the plane climbs, it is too tail heavy. If you need to hold a lot of down to maintain level flight, the plane is a bit nose heavy. Take any corrective actions that may be needed until the plane needs only a slight bit of down control to fly straight while inverted.

4. Lateral balance

While you were flying your plane inverted, you may have noticed that even though the plane was level when it was upright, it may have wanted to roll a certain direction when it was flying upsidedown.If it remained level, the lateral balance is correct. If not, you will need to add weight to the lighter wing just as it was described before. Be very careful in determining which wing needs the weight because the plane is upside down when you are checking the balance.

After you get the plane flying level without any trim changes in both upright and inverted positions, you need to fine tune the lateral balance. Fly the plane directly into the wind with the wings level and perform a tight loop. Use only up elevator during the loop and make no corrections with either the ailerons or the rudder.

When the loop is finished, check to see if the wings are level. If they are, the lateral balance is correct. If one wing consistently drops during the loop, the other wing will need a small amount of added weight.After adding some weight, recheck the balance and repeat this procedure again if needed until the wings stay level throughout the loop.

5. Rudder trim

Rudder trim can change through various phases of flight. For example, after a takeoff and during a climb to altitude, most planes need a little right rudder held to keep the nose straight. When the plane is up to speed, this right rudder trim is no longer needed. This section deals with the technique that is used to set the proper amount of rudder for performing stunts. Fly the plane into the wind and perform large gentle loops. Watch the nose of your plane closely. If the nose of the plane stays straight throughout the loop, then the rudder trim is correct.

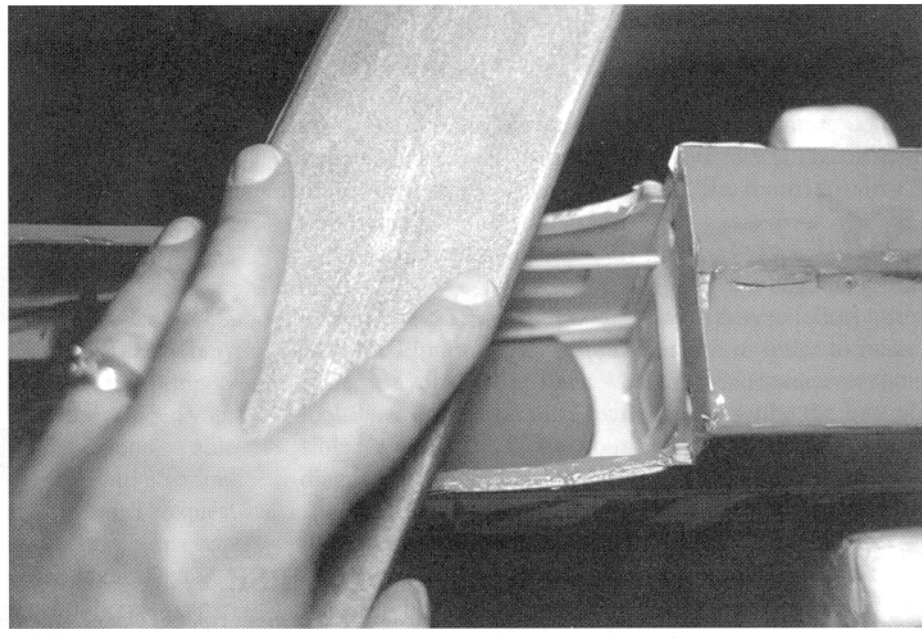
If the nose yaws to the right during the loop, then you need to add left rudder trim. If it yaws to the left,add right rudder trim. When you add the trim, be sure to turn the rudder clevis in or out as needed. Continue with this until the nose tracks straight through the loop.

6. Wing incidence

Wing incidence is the angle at which the wing rests against the fuselage. There are several ways that can be used to check this alignment. The easiest method involves the use of a vertical dive.

Get the model up high and then bring the throttle to idle. Now put the plane into a vertical dive and watch the nose. If the plane continues straight down without any pitch changes, the incidence is correct.

If the airplane begins to pull out of the dive and the nose pitches upwards, the wing needs to have less incidence than it already has. This means that the front of the wing (leading edge) must be angled downwards or the trailing edge must be raised. This can be done by either cutting away or sanding a small portion of the trailing edge of the wing saddle or by



1-9 Sanding away a portion of the wing saddle can gradually change the wing incidence. Small wood shims may also be used in some cases.

shimming up the front area. Repeat this as needed until the plane stays on course during its dive.

If during the dive the plane has the opposite reaction and tends to tuck under, the reverse corrective measures must be taken. Simply either shim up the rear area of the wing saddle or sand or cut a portion of the front area away.

Please note that these corrections dealing with the wing saddle have to do with low wing aircraft only. If you are trimming a high wing model, you will have to shim or cut away the opposite areas of the saddle in order to achieve the correct wing incidence.

7. Aileron differential

Differential is used to describe that amount of throw a surface moves in one direction versus the other. When an aileron is moved downwards, it creates more drag than when it is moved upwards. The result of this drag is that the plane yaws away from the turn. For example, if a plane is rolled to the right, the left aileron deflects downwards. The result of the drag on that side causes the nose of the plane to yaw to the left. This phenomenon is called adverse yaw.

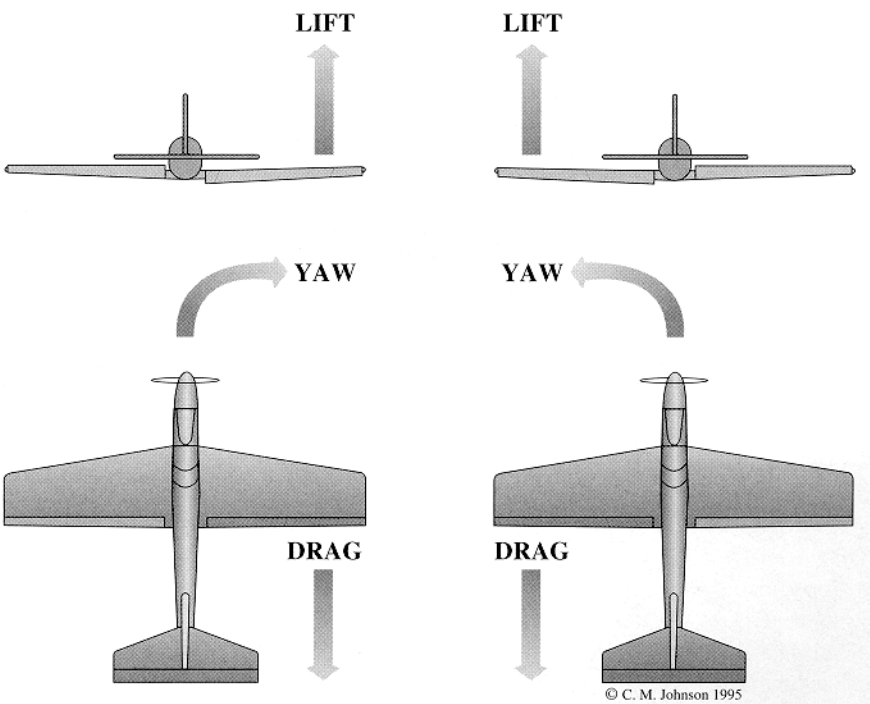
To test your plane for adverse yaw you need to roll your plane. This can be done easily. This method first involves flying towards yourself and then pulling up into a vertical climb. Now roll the plane only for one half of a roll and look at the nose. If it is pointed straight up, then the aileron differential is set up well.

If the nose of the plane is yawed away from the direction of the roll (ie. nose is pointed left after rolling right), then more differential is needed. This means that the ailerons need to be adjusted so that each one goes up more than down. Set up the differential by either using the linkages on the servo wheel or by using a programmable radio feature if yours has it.

If the nose of the plane yaws into the roll direction, then less differential is needed. Make sure that the aileron movements are then set so that more total down throw is available. This will help to correct this particular condition.

Conclusion

If you take the time to perform these fairly simple procedures as outlined above, you will find that your plane will fly more smoothly through all modes of flight and actually becomes much easier to fly. Once you have gone through this routine with one plane and see the results, I'm sure that this will become a routine for you to use in all of your planes. As an instructor, I have found that a few simple trim adjustments on a beginner's airplane can turn a difficult plane to fly into a docile trainer.



ADVERSE YAW

1-10 Adverse yaw is frequently encountered in many types of planes. When a plane is in a left turn, the right aileron moves downwards. This creates more induced lift and drag on the right side of the plane. The increased drag then causes the nose of the plane to yaws in a right direction.