NATIONAL NEWSLETTER

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In this issue

About the *National Newsletter*

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HELICOPTERS

Musings of a former pilot

AUTHOR UNKNOWN

Anything that screws itself into the sky flies according to unnatural principles. Consequently, old high-time helicopter pilots are a bundle of tightly screwed nerves.

Never sneak up behind one and clap your hands. He will instantly dive for cover and most likely whimper … then get up and smack you.

There are no old helicopters lying around airports like you see old airplanes. There is a reason for this. Come to think of it, there are no old helicopter pilots either.

You can always tell a helicopter pilot on a train, airliner, or in a car. He is the one who never smiles because he is listening for the significant sound that tells him there is a problem with the engine.

Helicopter pilots fly in a mode of intensity, actually more like "spring loaded," while waiting for pieces of their ships to fall off. Flying a helicopter at any altitude over 500 feet is considered reckless and should be avoided. In fact, flying at any altitude that precludes a landing in less than 20 seconds is downright foolhardy because you have about one second to lower the collective in an engine failure before it becomes unrecoverable. Once you've failed this maneuver, the machine flies about as well as a 20-case Coke machine. A perfectly executed autorotation only gives you a glide ratio slightly better than that of a cement building block.

When the blades of your rotor are leading, lagging, flapping, and moving faster than your fuselage, there's something unnatural going on. While hovering, if you start to sink a bit, you pull up on the collective while twisting the throttle. Simultaneously, you push with your left foot (more torque) and move the stick left to hold your spot. If you now need to stop rising, you do the opposite in that order.

When you feel a sinking sensation in your gut (low "g" pushover), you are instantly reminded that you are flying a two-bladed, under slung, teetering rotor system, and you are about to do a snap roll to the right and crash. As a matter of fact, any aerobatic maneuver should be avoided. Don't push your luck. It will run out soon enough anyway.

If everything is working fine on your helicopter, consider yourself temporarily lucky; something is about to break.

The thing is helicopters are different from airplanes. An airplane, by its nature, wants to fly, and if not interfered with by unusual conditions

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NOTICE

Beginning with the July 2004 issue, the *National Newsletter* will be available in an electronic version only. Notices will be sent to Club Newsletter Editors when each issue has been posted online. Please make sure a current E-mail address is on file at AMA headquarters. For more information, contact Sarah Greiner at sarahg@modelaircraft.org.

or by an incompetent pilot, it will fly. A helicopter does not want to fly. It is maintained in the air by a variety of forces and controls working in opposition to each other, and if there is any disturbance in this delicate balance, the helicopter stops flying. There is no such thing as a gliding helicopter.

This is why, in general, airplane pilots are open, clear-eyed, buoyant extroverts and helicopter pilots are brooding, introspective anticipators of trouble. They know that if something bad has not happened, it is about to. Remember the fighter pilot's prayer: "Lord, I pray for the eyes of an eagle, the heart of a lion, and the balls of a helicopter pilot."

from *The Cam Journal*
Central Arizona Modelers Inc.
Marvin Hinton, editor
Sedona AZ

Why do engines lean out and quit?

1) The high-speed needle valve is too lean.

2) The muffler pressure line came off.

3) The fuel filter has opened up (the halves are loose).

4) There's a split in the fuel line, usually at the fuel tank.

5) The fuel tank is foaming, causing air bubbles in the fuel line.

from *Flight Lines*
St. Croix Valley R/C Club
Lea Rasmussen, editor
Scandia MN

RECEIVERS

Powering RC radios on the bench

By PETER CARR

The following article is about building a power supply to see at what reduced voltage your receivers stop working.

Modern servos lose power on lower voltage but still operate. Receivers are not that way and will stop abruptly at about four volts. I wanted to get an idea of the lower operating limit of this equipment but needed a voltage supply.

There are basically two types of power supplies. One uses a transistor as a variable resistor to set the voltage. The discarded voltage is turned into heat so the transistor is usually mounted on the outside of the chassis with a heat sink attached.

These are called "linear" power supplies. Since they waste voltage as heat, they are not very efficient and have been replaced by "switching" regulated power supplies. These newer versions have a transistor that is turned on and off by a control oscillator. The length of time the transistor conducts sets the output voltage. Since the transistor is a switch, it doesn't produce much heat and is very efficient. The downside is that the switching frequency can appear at the output and interfere with the radio it powers.

I wanted to get an idea of the lower operating limit of this equipment but needed a voltage supply.

I decided to build a linear power supply from a diagram in a back issue of *Nuts and Bolts Magazine.* It had eight parts and took about an hour to wire up. The meter is a 0-10 volt scale from an old project. The on/off switch and voltage adjustment variable resistor are a volume control from an old radio to prevent stray noise and signals. The coax is terminated in a Deans 3-pin connector as well as a Futaba connector for the two types of rigs I used.

Maximum voltage from the supply is about 7.5 volts, which is more than any Radio Control rig will need. It is adjustable down to zero and is smooth and linear. The result is a supply that allows me to repair or tune radios without worrying about draining the Ni-Cd pack.

I tested several receivers by turning down the voltage to see where they quit working. The Hitec units stop at just over 4 volts while the new Berg radio with DSP will go down to about 3.4 volts.

I also have an FMA receiver and it quits at 4.4 volts. This is a concern so I may have a problem with that one. Some receivers stop without any servo jitter so I assume that the front end local oscillator just stops working at a low voltage. Others jitter madly so it may be the FM discriminator going unstable.

(Technical Editor's note: It is probably the decoder clocking and resetting that causes the stoppage.)

All my AM modulated rigs jitter and seem to give fair warning of a low battery.

I mentioned the power supply to my son and discussed the results. At the end, he inquired, since I was trying for the 8-hour League of Silent Flight task, had I found a really light extension cord so I could power the Sailplane with the power supply? Now there's an idea!

from *Clarence Silent Flyair*
Clarence Sailplane Society
Martin Timm, editor
Glenwood NY

HINGES

Installation tips

By FLOYD CARTER

All of our models, except for pure Free Flight aircraft, require installing hinges on elevators, rudders, flaps, or ailerons. It's essential to hinge parts for free movement without binding.

A successful hinging job permits the control surface to flop up and down with its own weight while being hand held. The nylon hinges with steel pin pivot, such as Du-Bro, and Klett, are especially good. The trouble most installations have is all the hinge lines do not quite line up. This causes binding and difficulty.

I'll describe a technique to install a hinge without binding or friction. This technique uses the Dremel cut-off wheel #409 and its arbor.

Parts to be hinged should be flat. If tapering is indicated on these parts, put the hinge slots in before tapering. Use of tapered wing trailing edges also works with this method but is more difficult. If the wing trailing edge is a rectangular piece, cut the slots before building the wing.

Chuck the cut-off wheel in the drill press and adjust the table to cut a slot exactly in the center of the balsa pieces. Mark the hinge locations on both parts. Push the balsa parts into the cut-off wheel, keeping the part flush on the drill press table. Turn each part over and repeat. This will probably widen the slot a bit, but it will ensure the hinge line is exactly in the center of the part.

These nylon hinges require a relief notch in one of the parts to accommodate the pin hinge. A sanding tool can be made using a piece of $^1/_8$-inch balsa, $^3/_4$ x 2 inches. Glue a piece of 220-grit sandpaper to this and then glue the piece to another larger piece of balsa that acts as a sanding stop.

Using CyA to install hinges will only result in the adhesive getting into the hinge, making it impossible to get out. Titebond water-based glue is the best and will not jam the hinge line shut. Make sure that all the hinge lines are parallel with each other. Any dried Titebond in the hinge line can be picked out with a No. 11 X-Acto knife.

If you don't trust Titebond, then after everything is finished, drill a $^1/_8$-inch hole through the balsa and hinge and glue in a wood pin made from a kitchen match. This wood is soft and easily sanded smooth with the surface of the balsa parts.

from *Prop Spinner Chatter*
Eugene Prop Spinners
Mel Marcum, editor
Eugene OR

LIFE LESSONS

All I need to know to fly an airplane and other lessons in life

Compiled by LARRY BROMAN

Keep the aeroplane in such an attitude that the air pressure is directly in the pilot's face. — *Horatio C. Barber, 1916*

When a flight is proceeding incredibly well, something was forgotten. — *Robert Livingston,* Flying the Aeronca

The only time an aircraft has too much fuel on board is when it's on fire. — *Sir Charles Kingford Smith, some time before his death in the 1920s*

If you can't afford to do something right, then be darn sure you can afford to do it wrong. — *Charlie Nelson*

I hope you either take up parachute jumping or stay out of single motored airplanes at night. — *Charles A. Lindbergh to Wiley Post, 1931*

Never fly the "A" model of anything. — *Ed Thompson*

Never fly anything that doesn't have the paint worn off the rudder pedals. — *Harry Bill*

Keep thy airspeed up, less the earth come from below and smite thee. — *William Kershner*

Advice given to RAF pilots during WWII: When a prang seems inevitable, endeavor to strike the softest, cheapest object in the vicinity, as slowly and gently as possible.

Instrument flying is when your mind gets a grip on the fact that there is vision beyond sight. — *US Navy* Approach *magazine, circa WWII*

There is nothing more useless to a pilot than the sky above him or the runway behind him. — *Author unknown*

The Cub is the safest airplane in the world; it can just barely kill you. — *Attributed to Max Stanley, Northrop test pilot*

A pilot who doesn't have any fear probably isn't flying his plane to its maximum. — *Jon McBride, astronaut*

If you're faced with a forced landing, fly the thing as far into the crash as possible. — *Bob Hoover*

It occurred to me that if I did not handle the crash correctly, there would be no survivors. — *Ricard Leakey, after engine failure in a single-engine aircraft, Nairobi, Africa, 1993*

Though I Fly Through the Valley of Death, I Shall Fear No Evil, For I am 80,000 Feet and Climbing. — *Sign over the entrance to the SR-71 operating location at Kadena AB, Okinawa*

The emergencies you train for almost never happen. It's the one you can't train for that kills you. — *Ernest K. Gann, advice from the old "pelican"*

If you want to grow old as a pilot, you've got to know when to push it and when to back off. — *Chuck Yeager*

from *Flightline*
Bay Area RC Fliers
Don Bunyard, editor
Coos Bay OR

Control linkage and hinges

By RON SWIFT

The purpose of control linkage is to take the motion generated by the radio control servos and transfer it to the airplane's control surfaces and other control devices. Since this motion is mechanical, there are considerations for choosing one technique versus another.

In its simplest terms, a control linkage will include a servo control arm, push rod, control horn, a way to attach the push rod to the servo control arm and control horn, some way to adjust the position, distance of movement, and the controlled device itself. This is obvious to those of us who have been around the Radio Control circuit for a while, but for the newcomer, this is a challenging topic.

Always plan ahead and avoid mechanical interference between the moving parts. Engine vibration, inertial, and G-forces will cause our control linkages to behave erratically. These forces introduce stress and must be considered, even in a docile trainer.

Cost

The real cost of the control linkage is the price of the entire model if it were to fail doing its job! If we take into consideration the initial cost of the hardware, the time it takes to install, adjust, and lock, special tools, as well as any maintenance during the life of a model, we might want to consider using the higher initial price of carbon fiber push rods (titanium ends give you special bragging rights!), nylon brushed control horns, ball/stud clevises, etc.

The old adage, "You get what you pay for," comes into play here, especially for the Giant Scale and Speed models. Often, we use parts because they are part of a kit. We forget that the kit manufacturer makes choices based on cost—many times providing parts that "will do" as opposed to those best for the application. Some don't even provide these parts, leaving the choice to the preference of the model builder.

Precision and strength

The important measurement for the control surface is whether it will provide the proper movement, with no slop, exact mechanical repeatability, no wear, and no maintenance. It must tolerate the stress placed on it during normal, reasonable flight. It should tolerate changes in temperature and wear slowly. Parts that have been problematic over time are:

- ✔ Threaded metal clevises that can split apart and/or become stripped by vibration (Sullivan provides an interlocking design that is good)
- ✔ Nylon parts that are too soft or too brittle
- ✔ Wooden dowels that twist and warp from moisture
- ✔ Incorrect application or number of supports
- ✔ Incorrect application (i.e. braided wire for elevators … yikes!)

Size and space

These seem obvious until you consider that each model has many moving parts that may interfere with each other as they move. Some planning for the elevator and rudder push rods is required, even on Almost-Ready-to-Fly (ARF) aircraft, or problems will occur.

Some problems occur with the aileron movement, noticed only when the wing is mounted to the fuselage (parts hit items mounted in the fuselage). Sometimes the needed supports cannot be installed because the construction has already progressed past the point of making this easy (think of an ARF fuselage).

Mechanical gain and differential

Many times the control horn and servo arm have different locations for installing the push rod. If the push rods (or pull-pull cables) are installed at the same distance from the pivot center, the travel is linear.

Some modelers will install the push rods so they are in a mounting hole further from the pivot center in the servo and closer to the pivot center at the control surface. This will increase the travel. For precision, moving the push rod to the innermost hole on the servo end and the farthest from the pivot point in the controlled surface provides the greatest precision but the lowest possible movement.

Some vendors provide longer servo arms to help get the amount of travel a control surface needs.

Wear

Providing free movement for our control linkages is one of the goals. Checking that wear has not created slop is one of the routine inspections we should make. Those nylon parts will wear oval holes where they were once round. This introduces a great amount of slop. Check and replace these as needed. Make sure the parts aren't too tight. This speeds up the wear and causes repeatability problems.

Weight

Although not usually a primary factor, weight in some of the lighter models is a big thing. Building with components that add unnecessary weight is poor practice. Using composite materials such as carbon fiber rather than wooden dowels or threaded steel rods makes a difference in both weight and precision.

Usually the choice of materials is dependent on several of the factors already mentioned. A good scale (digital or otherwise) is a wise investment for the builder. Choosing parts that perform identically based on their weight is the right way to build. If a model needs additional weight for balance, why not choose the parts that will help balance the

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model rather than installing dead weight (i.e. lead) later.

Coolness

Advertisers being good at what they do, the neatest products might not be what you want in your model. Sometimes the simplest, tried and true parts are the ones to stay with. Ask your fellow modelers if they've used the new products. You might save yourself some headaches.

You may want to avoid:

- ✔ Clevises that have multiple parts that could get lost
- ✔ Plastic stuff that can wear (due to vibration)
- ✔ 2-56 linkages
- ✔ Parts that require a special tool to adjust might not be field-friendly

You do want to avoid:

- ✔ Metal-to-metal connections

Ease of use

Use parts in your control linkage that make adjustments easy to do and will hold those adjustments over time. Soldering clevises onto the steel wire makes a strong connection, but has no adjustment (resoldering). Sometimes, simple is best—like using wheel collars to adjust the push wires on the indoor models.

Adjustability

Make sure your choice of parts allows easy adjustment of the control surface, both center and overall throw. Being able to make adjustments from outside the model is a huge plus. Also, make sure the adjustable bits can be locked in place and unlocked for later adjustments. Some modelers CyA their threaded parts; others use lock nuts. Some use thread locker; some use safety wire. Many use a combination of these.

Ideally, we want our adjustments to stay forever; however, if we've selected less than ideal components, parts with a different coefficient of expansion (the ratio of the change in length or volume of a body to the original length or volume for a unit change in temperature), or incorrectly installed our components, the model may have very different flying characteristics from one day to the next.

A few tips

- ✔ Keep the control linkage as short as possible.
- ✔ Use mechanical adjustment to set end points and center rather than relying on a computer radio.
- ✔ Use silver solder on these types of joints. 60/40 rosin core solder (electrical) should not be used! Make sure to use flux when soldering. Clean the flux off; it is usually an acid.
- ✔ Coreless digital servos are expensive for a reason: They are fast, precise, repeatable, and strong.
- ✔ Control systems always fail at the weakest point. If you use balsa servo mounts or thin light plywood, guess where the weak link is …
- ✔ Providing bearings for push rods and attachment points for the plastic sleeve is a good thing. Depending on the load and power requirements, you may need to put one every six inches or less.
- ✔ Bending the control wires to reach the attachment points weakens the system.
- ✔ Slop causes flutter. Slop occurs in the servo output spline, control horn holes, hinges, and the push rod itself. Installing the control rods so they run straight between the servo and the control horn is best but not always possible.
- ✔ Counter balancing control surfaces (equal weight on both sides of the hinge), usually prevents flutter.
- ✔ Some ARF vendors supply 2-56 or 2 mm metric parts. Sometimes the threads are rolled; sometimes they are cut. Metric and standard (SAE) are not exactly compatible or interchangeable. Close is not good enough. Check your parts and make sure they fit correctly.

Hinges

Another area that brings modelers' opinion to the forefront is hinges. Many use the hinging techniques that have become familiar. This is all right if you are building models in the same class (size, weight, power, capability, etc.).

When you migrate from Peanut or .40-size Sport Scale to other types of models, different choices must be made. Many kit manufacturers include or at least recommend the type and number of hinges to use. Lately, the large 3-D type ARC/ARF kits do not include any reference to hinging (or control linkages). They leave it up to the modeler to use the components he or she likes.

There are several new tools available to make hinging easier. The idea is to provide a strong connection between parts that have no slop, small or no air gap, no friction or binding, and are simple and repeatable in use.

CyA: Many vendors make these, but they are not all equal. I have seen many of that type of hinge fail. When they do, it is tough to fix, often involving cutting the control surface off and re-hinging. Still, some modelers swear *by* them and not *at* them.

Non-CyA: Most of these hinges are installed with epoxy or white glue. If you use the hinges with a metal hinge-pin, before gluing these in, it is a good idea to put oil or Vaseline on the hinge-pin area to prevent glue from migrating to these areas. Pinning the hinge is a very good idea and may save your model some day.

from *Buzzard Droppings*
Barnyard Buzzards
Ron Swift, editor
Duvall WA

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Check out www.modelaircraft.org/templates/ama/newsletters.asp.
You'll find every issue of the *National Newsletter* published since 1997.
It's a great resource for construction, safety, and how-to articles, as well as hints, jokes, cartoons, and general AMA information.

Deciding on the correct construction, size, style

By JOE FINKELSTINE

The first thing I need to argue is that our propellers could be thought of as similar to the wing on our airplanes. Our wing produces lift by moving through the air, and our propeller creates lift by revolving. If you take a close look at a propeller, you should notice that they have an airfoil shape, just like a wing. At the risk of sounding elementary here, the lift produced by our propeller is more commonly referred to as thrust, and it is what provides the force to move the airplane forward.

Our hobby provides us with an enormous selection of propellers in terms of construction, size, and even style. In particular, over the past few years, I have noticed a much larger selection of propellers specifically engineered for electric flight.

I get the most questions as to what the numbers on a propeller mean. Two numbers classify all of the propellers I am aware of, one being the propeller diameter (length from tip to tip) and the second being the pitch of the propeller. The two numbers usually are listed on the propeller by diameter, then pitch. For example, a 13 x 9 propeller has a diameter of 13 inches and a pitch of nine inches.

The propeller's pitch is a theoretical number in practice. In an ideal world, where the propeller would not slip or have any drag, the pitch represents how far forward a propeller would travel in one revolution. Given our 13 x 9 propeller, the nine means that if I put in some kind of fluid or special air and turned it exactly one rotation, it would move forward nine inches.

Both the diameter and pitch are important as we decide which propeller to use on our model. It often is confusing, particularly to beginners, as to what to choose for a new model. The "right" propeller depends on a number of factors:

1) What load the propeller places on the engine
2) The model's desired forward speed
3) The model's desired acceleration
4) Noise considerations of the propeller
5) The material the propeller is made of

Every propeller will take effort for an engine to turn, and the amount of effort to turn the propeller is called load. One way to quantify the load is to multiply the two numbers (diameter and pitch) to get a "load factor." This number by itself is meaningless, but it is useful for comparisons of propellers of nearly the same size and diameter. Engine manufacturers often will list more than one propeller for an engine, and if you compute the load factors for the entire family of recommended propellers, the load factors will be clustered together. You can then see if a propeller that is not listed has a load factor in the range defined by the recommended propellers.

Our hobby provides us with an enormous selection of propellers in terms of construction, size, and even style.

The real test for load factor is what rpm the engine will want to turn the propeller at full throttle. If the propeller load factor is too small, the rpm limit of the motor may be exceeded and you'll be back at the hobby shop complaining that the engine made a big clanking sound and then quit running (the clank was your connecting rod breaking in half). On the other hand, if the load factor is too high, the engine will be overloaded, will almost certainly overheat, and will not have much pulling power. The chosen propeller must allow the engine to stay within its recommended rpm range.

Most of my experience is in four-stroke engines and for me, that means whatever propeller I choose, I must ensure my small-to-medium four-stroke engines never tach over 10,000 rpm on the ground. The wide open rpm value also is important in how much sound the propeller makes. Of all the things you think about when trying out different propellers, correct loading is the most important.

The second major issue is the trade off between top end speed and acceleration. Let me start with a generalization. Pitch affects top end speed and diameter affects acceleration. There is a direct trade off for each propeller and which one is right depends on your style of flying and the type of airplane you're flying.

Let's use my Dave Patrick Ultimate biplane as an example. This biplane is highly aerobatic and I spend a lot of time tumbling it through the air in and out of stall. The ability for me to accelerate from near zero to climbing speed is far more important than how fast the airplane goes at full throttle. For this reason, I chose the largest diameter propeller that the engine (a Saito 180) could handle. The fliers who like very fast models choose the other end of the spectrum and go for as much pitch as possible.

Sport models are a compromise between the two. Many of the aerobatic Almost-Ready-to-Fly (ARF) airplanes are quite specific on the maximum pitch to use because the designer made the model to be highly maneuverable and flying this type of model usually induces flutter. At the moment, I am drooling over a Dave Patrick Edge 540, and he mandates no more than an 8-inch pitch on the propeller. I will use a Moki 1.8 on this ARF, allowing me to fly an 18 x 8 propeller. I may try a 20 x 6, but I'm concerned this will overload the Moki.

If you stay with a propeller that does not overload or underload the motor, the only way I know to select the propeller for acceleration versus top end speed is experimentation. Try

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out different propellers. For smaller propellers that only cost a few dollars each, this is relatively painless. When you get into propellers with diameters exceeding 18 inches, it gets expensive, so I use the time-honored tradition of borrowing different propellers to test flight characteristics.

The last factor I use in propeller selection is noise. Unbelievably, propeller tip noise often can be the largest contributor to the noise our models make. In particular, when the tip speed of the propeller is at or over mach .75 (yes, that is ¾ the speed of sound), the tip noise generated will be quite large and over our limit almost every time. There is a simple formula for finding the rpm for a given propeller diameter at which the tip speed is mach .75 and it is rpm_{max}=190,000/D, where rpm_{max}=rpm at which the tip speed will be mach .75 and D=diameter. (Please see Table 1.)

Consider a sport two-cycle, .46-size engine. A common propeller for this type of engine might be an 11-7. A sport .46 with a recommended propeller would almost certainly never tach out above 17,273 (see Table 1), but I have seen the Pylon racers, and the original MvvS engines tach this high. For most of us who fly sport, we will not bump up against these numbers. I will comment, though, that many engines I use and swing propellers in the 20- to 24-inch range can easily reach the maximum rpm.

The final selection criteria discussed above also is concerned with the material the propeller is made of. At our field, the two most common propellers are either wood or a composite (APC). The wood propeller is a little safer. The two primary disadvantages to wood propellers are their fragility (one nose over and they're finished) and their noisiness.

Composite propellers also have advantages and disadvantages. Primarily, they are more accurate in terms of pitch, pre-balance, and efficiency. I have experimented with this on several occasions and can say that if I take wood and APC propellers of the same diameter and pitch, the APC will turn more rpm on the same engine and appear to be quieter. One of the biggest dangers of APC propellers, however, is they are razor sharp and can cause a lot more damage to your fingers. If your standard landing technique includes nosing over, the APC propellers are the way to go.

In the end, one of the best methods when you start looking for a propeller is to watch and ask. Look for a similar model at the field and observe how it flies. Ask the owner which propeller he or she is using. If it is an aerobatic model, watch how it accelerates and how it behaves full throttle. I also have found the Radio Control bulletin boards on the Internet to be helpful.

Hope you are already making balsa dust for next flying season!

from *Skywriter*
Skymasters Radio Control Club
Mark Smith, editor
Lake Orion MI

TABLE 1: PROPELLERS

Propeller diameter	Maximum rpm
7	27,143
8	23,750
9	21,111
10	19,000
11	17,273
12	15,833
13	14,615
14	13,571
15	12,667
16	11,875
17	11,176
18	10,556
19	10,000
20	9,500
21	9,048
22	8,636
23	8,261
24	7,917

ENGINES

Mount direction affects ease of starting engine

By ED MOORMAN

The direction you mount your engine—upright, sideways, or inverted—can have a considerable effect on how easy it is to start and run. I am going to discuss the pros and cons of each method, but first there is an important item that might be overlooked: the fuel tank location. Locating the fuel tank correctly could play a major part in the direction you mount your engine.

If you are not using a fuel pump or regulator (and most people don't), the carburetor jet should be at a location level with, or no more than a quarter inch below, the centerline of the tank. This will give the most consistent engine runs.

The carburetor jet

For most engines, the carburetor jet is even with the needle valve. Some carburetors have an offset, or even remote, needle, so let's use the jet.

Look into the carburetor of your engine. There should be a tube down in the throat running part or all the way across. If the tube runs all the way across, the jet is on the bottom. This jet should be even with the center of the tank. If the tank is too low, the engine will lean considerably during flight. If it is too high, the engine will tend to flood easily and run rich.

When the tank is properly located and the engine correctly set, the engine should run slightly rich for the first minute or so. Then, it should run at full power for the remainder of the flight.

Trainer maladies

Take a look at your trainer or

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another airplane with the engine mounted upright. I'll bet the carburetor jet is at or near the top of the tank. If this is the case, your engine will lean out considerably during the flight. Muffler pressure helps some but still does not cure the problem. Raising the tank is the only effective solution.

Upright mounting

An upright mounted engine is the easiest to handle. The controls, low and high speed needles, and the fuel nipple are in sight and easy to access. In addition to being the easiest to handle, this is also the safest, especially when you are just learning to fly. A hard landing usually results in nothing more than a broken propeller and bruised ego.

Balanced against this is the fact that an upright engine is easy to flood. Fuel can only run into the crankcase so you need to be careful of over-choking before attempting to start. Also, if you do not unhook your pressure line when you are filling your tank, the overflow goes into the muffler. This excess fuel can run from the muffler into the cylinder, causing flooding and a possible hydraulic lock during start.

Another possible detraction of upright mounting is many kits with upright engines have the tank mounted very low. This results in lean runs. When you are breaking in an engine and running it sloppy rich, this doesn't matter much. However, when you want the engine to scream, a low tank can mean a lean setting at the end of the tank. In the worst case, this will result in an overheated engine, a blown glow plug, or a possible engine seizure.

Side mounting

This is my favorite engine mounting direction. The engine is fairly easy to run. The main needle valve is easy to get to, but the idle needle is now underneath, meaning you have to lift the airplane or turn it over to make an adjustment. I hope you will only have to do this a couple of times when the engine is new, so this problem won't be a big concern.

It is harder to flood a side-mounted engine as excess fuel can run out of the carburetor onto the ground rather than into the crankcase. It is also much easier to get the correct tank location with side mounting. All you have to do is put the tank directly behind the engine and the proper location is assured.

A minus for side-mounted engines, especially for new fliers, is the muffler. If you make a fairly hard landing, the nose gear may bend enough for the muffler to hit the ground. I have seen cylinders torn completely off the engine and the piston hanging in the breeze after a hard landing where the muffler hit the runway.

Inverted mounting

Many people don't like inverted mounting, although it is popular for Scale and Pattern airplanes. An inverted engine is actually hard to flood—all the fuel tends to run out of the carburetor onto the ground. However, it is hard to clear a flood if you do have one. You need to turn the airplane over, remove the glow plug, or both.

Inverted engines also are harder to start by hand until you master the technique. Many people turn the airplane over in a cradle to start the engine the first time. For subsequent flights, the engine should start easily.

The tank should be placed lower in the airplane since the carburetor jet is lower. This can be a problem for some designs.

Inverted mounting is the most streamlined, especially when using a rear exhaust engine. If you have not used a rear exhaust engine before, talk with someone in your club who has one before you go out and buy one. Nearly all rear exhaust engines are pipe-tuned and do not come with mufflers.

Well, there you have it: the whys and wherefores of engine mount direction.

from *TRCC Noise*
Tucson Radio Control Club
Chuck Brooks, editor
Tucson AZ

BALANCING

Tips for balancing a new airplane

Here's a neat idea for balancing your new airplane in "all directions at once."

A model airplane has one point of balance where the wing's center of gravity (CG) and the fuselage centerline intersect. That's where the secret lies, and here is how you can use that point to get a perfect balance for your new airplane.

When you build the wing, install a light plywood block at this intersection (your plans will show the recommended CG). For a high-wing model, the block should be installed on the top of the wing. On a low-wing model, the block should be installed on the bottom of the wing. Mark the center of the CG on the block and leave the wing uncovered so any unnecessary weight can be added for lateral balance.

When you are ready to balance, install a small screw eye into the block and hang the assembled airplane from the eye bolt. Fasten sufficient (use as little as possible) weight to the main spar of the wing to achieve lateral balance. Now, move the battery, receiver, or weight as required to attain proper balance, from front to back. This simple system will result in an accurately balanced model.

from *The Cam Journal*
Central Arizona Modelers Inc.
Marvin Hinton, editor
Sedona AZ

LANDINGS

Touch-and-go or bounce-and-go?

By GLYNN MOUNT

"Touch-and-go" is a great way to practice landings. It's a sure way to rapidly improve your technique. Even the best of us, however, will bring one down a little too hard once in a while, and the inevitable result will be a bounce.

The size of said bounce will be in direct proportion to how enthusiastically your airplane meets the runway. If unattended, of course, the first bounce will be followed by a second, and if the second bounce doesn't break your propeller, you might be lucky enough to dribble to a stop before running off the runway.

This type of landing often will bring an enthusiastic response from the critics sitting on the sidelines.

There are, however, a couple of ways you could recover from a bad bounce and keep your dignity in tact. One is to maintain "full back pressure" on the stick (i.e. full up elevator) in the hope that there is enough flying speed to cushion the second bounce. If the bounce is more of a high speed "skip," this method works well.

The second method is to immediately apply power and return to level flight.

I've tried both methods, and a "bounce-and-go" with quick application of power will usually result in a more positive recovery from a bad bounce. If performed with finesse, you might even make it look like you did it on purpose.

The best landing procedure is to hold the aircraft off the deck a foot high with idle power and try "not to land." The airplane will slow and "sink in" in spite of you, giving you a smooth transition from air to ground.

from *The Cam Journal*
Central Arizona Modelers Inc.
Marvin Hinton, editor
Sedona AZ

COMMENTS ON LIFE

A clear conscience is usually a sign of a bad memory.

Change is inevitable, except from vending machines.

Plan to be spontaneous tomorrow.

Always try to be modest, and be proud of it!

If you think nobody cares, try missing a couple of payments.

How many of you believe in telekinesis? Raise my hand ...

What's the speed of dark?

How do you tell when you're out of invisible ink?

If everything seems to be going well, you have obviously overlooked something.

When everything is coming your way, you're in the wrong lane.

Hard work pays off in the future. Laziness pays off now.

Everyone has a photographic memory; some just don't have film.

If Barbie is so popular, why do you have to buy her friends?

Eagles may soar but weasels don't get sucked into jet engines.

What happens if you get scared half to death twice?

I used to have an open mind but my brain kept falling out.

I couldn't repair your brakes so I made your horn louder.

Why do psychics have to ask you for your name?

Inside every older person is a younger person wondering what happened.

from the newsletter of the
Mississinewa Skyhawks Inc.
Dave Hecker, editor
Somerset IN

FLYING TIPS

Accomplishing a safe, straight takeoff

To make a safe, straight takeoff, it helps to think of it as a transition from driving to flying. The first part of any takeoff is simply to taxi straight down the runway while gradually increasing the throttle to pick up speed—much like driving a car down the road. Steering is done with the rudder stick to turn the nose or tail wheel while they are on the ground.

At slow speed, the flight controls, especially the ailerons, have little effect. As speed increases, they become more and more able to keep the airplane on a straight and level path. As the wing generates lift at higher speed, the wheels eventually leave the ground and the flight path is completely controlled by the flight controls.

If every part of the airplane is perfectly aligned and trimmed, and with no wind, a pilot would merely need to advance the throttle and allow the airplane to gain speed and lift gracefully into the air. But we don't live in a perfect world.

Usually nature provides some wind, often a direct crosswind. It is difficult to keep the steering wheel and the rudder perfectly aligned. A grass field is not absolutely smooth or level, and the grass varies in thickness and height. All of these are trying to upset the desired straight, level takeoff.

Line the airplane up on the runway centerline (and use plenty of runway—the runway behind you is of no value). Gradually advance the throttle and use the rudder stick to steer straight down the road. This is driving, not flying. As the airplane reaches flying speed, it may lift off by itself. If not, apply a little nose up with the elevator stick. With a tail-dragger, some nose up is all right from the start and helps to keep the tail wheel on the ground.

As the airplane lifts off, it is now flying and the steering wheel is no longer controlling its track. That has now shifted to the rudder. But if the wheel and rudder are not perfectly aligned, the airplane may begin to turn and bank. As soon as it is flying, bring the rudder stick back to neutral and keep the wings level with aileron. Hold a little nose up for a gradual climb—about 30°.

Crosswind requires help from the ailerons from the start. Apply roughly half stick to bank the airplane into the wind. As the aircraft gains speed and the ailerons become more effective, gradually reduce the aileron stick more toward neutral. Use just enough aileron to keep the wings level.

Now the airplane should be in a moderate climb, straight and level. Continue until at least 50 feet high before beginning a turn. This sounds simple but requires using both sticks in concert for all three directional controls along with throttle. Practicing this up in the air is much easier on the airplane than practicing real takeoffs.

from *The Aero-Shaft*
The Aero R/C Club of Flint
John Hice, editor
Flint MI

ENGINE IDLE

Setting a slow, reliable idle

A month seldom goes by in which I don't receive letters from readers experiencing idle problems. As this seems to be a common problem, let's take a look at setting up an engine's idle. It isn't really all that difficult.

To start with, many idle problems with non-pump equipped engines can often be traced to an improperly positioned fuel tank or a fuel tank that is too far from the engine. The centerline of the fuel tank should never be any higher than the centerline of the fuel jet and preferably 1/4 to 3/8 inches below. This helps decrease the siphoning action with a full tank of fuel.

The make of the glow plug also plays an important role. Any older design, cross-flow scavenged (ported) two-stroke engine should use an idle bar glow plug. Most of the newer Schnuerle ported two-stroke engines do not require an idle bar plug, but if idle problems are experienced, an idle bar plug should be used. If you aren't sure whether the engine is cross-flow or Schnuerle ported, just look into the exhaust. If there is a baffle on the far side of the piston, the engine is cross-flow ported. If there is no baffle, it is Schnuerle ported. Some engines do have better idle characteristics than others due to differences in porting, timing, compression ratio, etc.

When it comes to the actual adjustment, there are two basic methods. The first is to start with the fuel tank half full and the idle speed set in the 2,500-2,700 rpm range. This is where a good tachometer comes in handy and is something every toolbox should contain, not just for setting idle speed but for proper richening of the top end as well. Then, use the "pinch test" (i.e. pinch the fuel line). If the engine dies immediately, the idle mixture is too lean and needs to be opened in 1/8-inch increments. If the engine speeds up and the idle improves, the mixture is too rich and the adjustment should be turned in or leaned.

If the engine is cowled in and the fuel line to the carburetor is not easily accessible, with a tricycle gear ship, lower the tail. If the engine dies immediately, the mixture is too lean.

Please see **ENGINE IDLE** on page 11

ENGINE IDLE continued from page 10

If the idle improves, the mixture is too rich. Remember to always make any idle mixture adjustments in 1/8-turn increments—not one or two turns at a time.

With a tail-dragger, make the mixture adjustments with the tail raised to a level position, being careful not to go so high as to have the propeller hit the ground. Then, lower the tail following the same procedure as with the tricycle gear model.

For the final check, accelerate the engine to full throttle. If it slows and sags and has a weak sound, the mixture is too lean and needs richening. If the engine sputters and spits out a lot of smoke, the mixture is too rich and should be leaned.

After a satisfactory idle and acceleration have been established, you can try lowering the idle speed to the point where the engine will remain idle for a prolonged period with good acceleration to full throttle. Again, the idle speed should be set with a tachometer and not by ear.

Many cases of an engine dying at idle are simply because of pilots who try to idle the engine too slow. It is nice to watch an engine tick over at 1,800 rpm, but an idle speed in the 2,200-2,500 rpm range is more practical and reliable.

Also remember, the heavier the propeller and the larger the diameter, the better the flywheel action. Increased flywheel action is always beneficial to a slow and reliable idle.

from *Prop Talk*
Riverside Radio Control Club
Jim Bronowski, editor
Riverside CA

BATTERIES

Flight safety is no accident

By JERRY GILES

Editor's note: Information contained in this article should not be applied when charging Lithium Polymer (Li-Poly) batteries. Please refer to the "What's New" section of www.modelaircraft.org for information on risks associated with Li-Poly batteries.

Flight safety is crucial to those who fly full-scale airplanes for their livelihood so why should it be any different for those of us who fly miniature airplanes for fun? The answer is obvious: it isn't.

Our hobby stops being fun when accidents occur, people are injured, and airplanes are damaged. Safe flights are the result of careful preparation and attention to detail. Safety begins well before we arrive at the flying field and doesn't end until we are safely home.

The sound airframe is basic to safe flight. This means that control surfaces are properly attached and the linkages are secure. Don't assume—check! The control system includes the moveable surfaces as well as the receiver, servos, wiring, and battery. All of these are capable of failing, usually at the most inopportune time. I suspect that battery failures occur more frequently than all others combines.

By definition, a battery is two or more cells connected together. Like a chain, a battery is only as strong as its weakest cell. Batteries are rated in volts and in milliampere hours (mAh). For example, a typical receiver battery is usually rated at 4.8 volts and 500 mAh. This means when it is fully charged, it is capable of providing 500 milliamps for one hour or some other combination of mA and hours.

Poor charging techniques are a major cause of battery failure. Batteries also can get old and no longer accept and hold a charge equal to their rated capacity. Proper charging is the most critical part of battery maintenance. There are two basic methods of charging batteries—slow charge and fast charge. When done properly, both methods are reliable.

Several types of batteries are available today, the most common being Ni-Cd batteries. These batteries are well suited to being fast charged, and this method is commonly used. The fast charge method requires relatively expensive equipment and may not appeal to newcomers or someone on a tight budget.

Good news! The slow charge method is inexpensive, is entirely satisfactory, and can be just as convenient. It uses the charger supplied with the radio and an ordinary household timer, such as one used to turn lights on and off. Cost is less than $20.

I know the instructions that came with the radio told you to charge batteries overnight. What they don't tell you is this: overnight charging is for the initial charge cycle when the battery is new and the cells are completely discharged.

After the initial charge cycle, it may not be a good idea to charge overnight unless the battery is completely discharged. If used routinely, this practice may result in an overcharged condition, and sooner or later, it might damage one or more cells, destroying the battery and possibly your aircraft. Overcharging can cause excessive heat and result in a condition known as "venting" one or more cells, limiting its ability to properly store a full charge.

How can you avoid this? The charge on a Ni-Cd, like other types of batteries, "bleeds off" over time

Please see **BATTERIES** on page 12

THINK YOU KNOW EVERYTHING?

Rubber bands last longer when refrigerated.

Peanuts are one of the ingredients of dynamite.

There are 293 ways to make change for a dollar.

The average person's left hand does 56% of the typing.

A shark is the only fish that can blink with both eyes.

There are more chickens than people in the world.

from the newsletter of the
Mississinewa Skyhawks Inc.
Dave Hecker, editor
Somerset IN

BATTERIES continued from page 11

because of internal leakage. This condition accelerates as the battery ages. It is normal and should be expected. For this reason, batteries should be brought to full charge before each flying session or should be kept in a fully charged condition.

If you own a peak detector quick charger, no problem. This can easily be done using the charger that came with your radio and a timer. First, bring the batteries, transmitter, receiver, and glow driver up to full charge. To do this, you need a reasonable estimate of the amount of battery energy used. The transmitter uses about 200 mAh, the receiver and servos about the same, and the glow driver is difficult to estimate.

Your charger produces 50 mAh, so you'll need to charge four times the number of hours used. To keep the batteries fully charged, plug the chargers (transmitter, receiver, and glow driver) into the timer.

Set the timer to charge about two hours twice a day (every 12 hours) and connect it to an AC receptacle. Your equipment will always be fully charged and ready to use. Simple, inexpensive, reliable, and equally important, you won't forget to charge batteries.

In conclusion, batteries are the component of your system most prone to failure. If there is any doubt about the serviceability of the battery pack, discard it! They cost much less than the price of an airplane and are certainly not worth the risk of a crash.

from *The Propwash*
San Antonio Prop Busters
Hoyte Fregeau, editor
San Antonio TX

SAFETY

Sage safety sayings about propellers

By VIC BUNZE

Propellers! Those cute things spinning on the front of the airplane. They put food processors to shame. Those whirling beauties can do a number on you, and if you are alone at the time, there is a danger of passing out or worse.

Here are some tips. An entire class of accidents can be avoided by properly restraining your airplane. It's best to have someone hold the airplane. Short of that, get a restraining gizmo from your local hobby shop.

Why? One way an accident can occur is because the transmitter is sitting on the ground. You are cranking away to start the engine and the throttle is set on low, as it should be. The engine starts and Murphy strikes! The transmitter falls over and the throttle goes to "full on." The airplane lunges forward and gets you. It happens.

Another variation is the airplane is new and the throttle is reversed. You think it's on low but it's wide open. When the engine is cowled, you cannot see inside.

When the airplane is restrained by the elevator, it is possible that the thrust is so great that the tails pulls loose and the rest of the airplane comes at you. That's why I prefer to have someone hold onto the aircraft, with fingers wrapped around the leading edge of the wing. This is a must when working with large gas engines with enough power to pull stumps out of the ground. Don't count on the tail to hold that airplane in place when it's being pulled by an eight horsepower engine swinging a 26-inch propeller. Use a helper.

What else? Propellers come loose and fly into space. Backfiring four-stroke engines are known for throwing propellers, especially when too lean. Don't throttle up until the area in front of the propeller is clear. Keep people from standing in line with the propeller arc. When you throttle up, you need to be behind the airplane and others should be behind you.

APC propellers are a wonder of efficiency. They really cut through the air and perform. They are also very nasty if you get in the way. They have sharp edges and are stiff and strong. They won't break away like a wooden propeller.

Sometimes you just put your hand into the propeller. How? You could be fiddling with a needle valve or something and you touch a hot muffler. Bingo! You jerk your hand back and your fingers hit the propeller.

Be safe and fly like you mean it—often and with proper care, abandon, and élan.

from *Flight Lines*
The Spirits of St. Louis
R/C Flying Club, Inc.
Walt Wilson, editor
St. Louis MO

CONSTRUCTION

Tap drill size chart

Here is the flip side of the "Drill size chart could be useful," which was featured in the March 2004 issue of the *National Newsletter.* (from the newsletter of the RAMS Aero Model Society, Jim Golla, editor, Rochester MN)

TAP DRILLS: HOLE SIZE LIMITS AND RECOMMENDED DRILL SIZES FOR DIFFERENT LENGTHS OF ENGAGEMENT CLASS 2B THREAD

THREAD SIZE	BASIC MAJOR DIA. "D" DIA.	LENGTH OF ENGAGEMENT Above 1/3 TO 2/3D		Above 2/3 TO 1 1/2D		Above 1 1/2 TO 3D	
		Max. hole	Drill size	Max. hole	Drill size	Max. hole	Drill size
2-56	.0860	.0724	.0700	.0737	.0700	.0737	.0700
2-64	.0860	.0740	.0700	.0753	.0700	.0753	.0730
3-48	.0990	.0825	.0785	.0845	.0820	.0846	.0820
3-56	.0990	.0848	.0820	.0865	.0820	.0867	.0820
4-40	.1120	.0916	.0890	.0939	.0890	.0947	.0890
4-48	.1120	.0949	.0890	.0968	.0938	.0976	.0938
5-40	.1250	.1041	.1015	.1062	.1040	.1077	.1040
5-44	.1250	.1060	.1040	.1079	.1040	.1097	.1065
6-32	.1380	.112	.1094	.114	.1110	.117	.1130
6-40	.1380	.117	.1130	.119	.1160	.121	.1160
8-32	.1640	.137	.1285	.139	.1360	.141	.1360
8-36	.1640	.140	.1360	.142	.1405	.144	.1406
10-24	.1900	.154	.1495	.156	.1520	.159	.1540
10-32	.1900	.162	.1570	.164	.1590	.166	.1610
.250-20	.2500	.204	.1990	.207	.2031	.210	.2055
.250-28	.2500	.218	.2130	.220	.2130	.222	.2188
.312-18	.3125	.262	.2570	.265	.2610	.268	.2610
.312-24	.3125	.275	.2720	.277	.2720	.280	.2720
.375-16	.3750	.318	.3125	.321	.3125	.325	.3160
.375-24	.3750	.338	.3320	.340	.3320	.343	.3320
.438-14	.4375	.372	.3680	.376	.3680	.380	.3750
.438-20	.4375	.391	.3860	.395	.3906	.397	.3906
.500-13	.5000	.430	.4219	.434	.4219	.438	.4219
.500-20	.5000	.454	.4375	.457	.4531	.460	.4531
.562-12	.5625	.486	.4688	.490	.4844	.495	.4844
.562-18	.5625	.512	.5000	.515	.5000	.518	.5000
.625-11	.6250	.541	.5312	.546	.5312	.551	.5312
.625-18	.6250	.575	.5625	.578	.5625	.581	.5625
.750-10	.7500	.658	.6406	.663	.6562	.668	.6562
.750-16	.7500	.693	.6875	.696	.6875	.700	.6875
.875-9	.8750	.773	.7656	.778	.7656	.785	.7656
.875-14	.8750	.810	.7969	.814	.7969	.818	.8125
1.000-8	1.0000	.884	.8750	.890	.8750	.896	.8906
1.000-12	1.0000	.924	.9062	.928	.9219	.933	.9219

Contest fun from the Meroke Radio Control Club

Loop and land

Pilot must take off, do five loops, and land in a designated area on the runway. If the airplane fails to land in the designated area, the pilot will be disqualified.

Climb and guide

Timer starts when wheels pass the front line of the box. Climb for 15 seconds, cut engine, and glide to runway. Airplane must touch runway. Longest time wins.

Hit the marks

Three circles are placed on the runway worth 3-2-1 points (inner-middle-outer). The pilot performs two touch-and-gos, each time trying to hit a circle. In the event of a points tie, the fastest time wins.

Deadstick loops

Pilot takes off, climbs for 15 seconds, cuts the engine, and performs as many deadstick loops as possible before landing on the runway.

Split S, loops, landing

Take off and turn downwind. At end of runway, Split S and do three loops. At other end of runway, Split S and land.

from *Smoke Signals*
Meroke Radio Control Club
Joe Di Prima, editor
Franklin Square NY

WORKSHOP ASSISTANCE
HINTS & TIPS FROM FELLOW MODELERS

TOP TIP

Pulling oil out of wood

Sometimes the firewalls and engine areas of older airplanes get soaked with oil from the fuel. This weakens glue joints to the point where an aircraft could fall apart in midair.

Try using CyA kicker (catalyst). You just have to spray it on and wipe it off. It pulls the oil right out of the wood. Several treatments may be necessary. This also works if a fuel tank develops a leak, and the fuselage gets soaked with fuel.

from *Evergreen Flyer*
Evergreen Radio Modelers Association
Tim Shea, editor
Marysville WA

Joining balsa sheets
from John Nooyen

When joining balsa sheets together with CyA glue, join the sheets along their sides, then wick the CyA into the joint. Sand immediately while it's still wet. The sawdust from sanding will fill in any gaps in the joint. When joining balsa sheets with white glue, sand the edges so the butt joint is nearly perfect. Then, dust the pieces off and lay them flat on a bench. Now tape (masking tape works well) the two sides together and lift from the bench. Gently fold open and run a bead of your favorite glue in the joint. Next, lay the joined sheet on the bench, taped side down, wipe off excess glue, and join with tape on the opposite side. Leave the sheets to dry; you may weight them slightly. When dry, remove the tape and sand to a reasonable finish.

from the newsletter of the
Northern Virginia
Control Line Association
Arlington VA

Sharpening brass tubing

Often, using a brass tube sharpened on the end to cut holes (or grooves) in balsa provides a much cleaner and more accurate hole than would a regular drill bit. The sharpening procedure below works on any size of hobby tubing.

1) Sharpen the outside of the tube using a fiber reinforced cutoff wheel or a metal file. Roll the tube between your fingers to sharpen the opening all the way around. If using a cutoff wheel, be certain to use the reinforced variety and always wear safety glasses.

2) Use a hobby knife with a No. 11 blade to sharpen the inside of the tube by rolling it on a wood block.

3) When it's time to use the tubing to cut the holes, you can either turn the tube by hand or use an electric drill. After the hole has been cut, the material usually sticks inside the tube. The balsa "plug" can be removed with a wire or the next size smaller tube.

from the newsletter of the
Odessa Propbusters R/C Club
Keith Conrad, editor
Odessa TX

Masking tape

To remove masking tape from your model without damaging the covering, first heat it a bit with a heat gun. Don't get it too hot, just warm it up. Then, pull the tape back over itself. You can remove decals the same way. If you need to reuse them, place them on wax paper.

Instrument panels

To make cockpit instrument panels, use stain samples available from paint or home improvement stores. They are usually large enough to cut out an instrument panel. Sometimes they are even real wood. If you are lucky enough to find a photograph of a panel in a magazine, cut it out and mount it on a piece of balsa backing. If it's not the exact size and you know your way around a computer, scan it and scale it to the correct size before printing it.

Repairing dings

If you use spackle or balsa filler to repair a ding in a wing, use a drop of thin CyA on it after it has been sanded. The CyA will harden and make it more durable.

Landing gear

If your wire landing gear has lost its spring and seems to have gotten weaker, place it on a cookie sheet and heat it in the oven at 450° for one hour. Turn off the oven after an hour but do not remove the gear until it cools. Don't try to speed up the process and remove it too soon! This heating/cooling process re-tempers the wire and should put new life into it. Don't be concerned about solder joints on the gear. Solder won't melt until about 700°.

Threading wires

Use kite string or fishing line to thread servo wires through a wing. Place a Shop-Vac near the servo bay and drop the string or line into the exit hole. Be sure to hold onto the end of the string and to turn on the Shop-Vac.

Removing glue

To remove parts that were glued with epoxy, use a heat gun along with a scraper, knife blade, or screwdriver to carefully pry them apart.

Storage ideas

Use your old prescription bottles to store nuts and bolts. Peel off the label and you'll have a see through storage container to keep in the shop or in your field box.

Save the plastic tops from spray paint cans, deodorant cans, or something similar. Keep them on your workbench for screws or other small parts. They also are good for holding bolts when disassembling an engine.

Cowls

To keep cowls from cracking, drill the screw holes a bit larger and use a small, $^{1}/_{16}$-inch piece of fuel tubing as a washer in the hole. The washer will compress and protect the cowl from the screw head. For even more protection from cracks, before you drill the new holes, reinforce the area where the screws will go.

from *Smoke Signals*
Meroke Radio Control Club
Joe Di Prima, editor
Franklin Square NY

Loose exhaust deflectors

If you have ever lost a silicon rubber exhaust deflector from your muffler in flight, try putting a small bead of J-B Weld or epoxy around the end of the outlet pipe to form a lip. Now you can push the deflector on and tie wrap it ahead of the lip. This will hold it securely in place. It also should work with tuned pipes.

from *The Aero-Shaft*
The Aero R/C Club of Flint
John Hice, editor
Flint MI

Tiny touch ups

Got a little spot on your new airplane that requires a touch up and all you have is an aerosol can of the proper color? Don't panic. Carefully spray a little paint through a drinking straw into a small container. There will be very little spray and you can control the amount used. Now, dip in your tiny paint brush and go at it.

Clogged aerosol cans

The manufacturer recommends inverting the aerosol can and pressing the tip until the paint stops flowing and only propellant comes out. Sometimes that works and sometimes it doesn't, and it wastes a lot of paint. Here's another method.

After spraying, pull the tip off the spray can and press it into the top of a WD-40 spray can and give it a little squirt. The WD-40 cleans the paint out of the tip and leaves it ready for the next job. Replace the tip on the aerosol can carefully to avoid ejecting more paint into the tip. Before using the paint in the future, give it a squirt first to clear the tip of any WD-40.

from *The Cam Journal*
Central Arizona Modelers Inc.
Marvin Hinton, editor
Sedona AZ

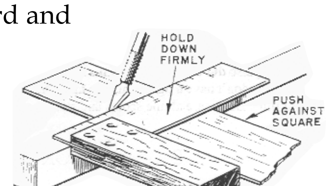
Control Line visibility

After much frustration of people stepping or tripping on my control lines in the pits, I hit upon a simple solution. A length of high visibility chalk snap line from the hardware store did the job. Put a loop or connector on one end to attach the line to your tool box and a storage spool at the other end heavy enough to prevent the wind from blowing the line around. The fluorescent pink is the most visible on the blacktop or grass. For blacktop only, try the fluorescent yellow. Put some black (felt tip marker) tick marks at the line lengths you use. At the contest, just hook it to your box and roll out the length needed. Roll out your control line(s) near the high visibility line. Knowing where to walk your handle to in the pits after flight is another advantage.

from *Direct Connection*
Knights of the Round Circle
Frank Martin, editor
Norco CA

Straight edges

A small carpenter's square is a valuable aid for cutting straight edges across sheet balsa. Lay wood flat on cutting board and lay metal edge flat on wood against cutting board edge as shown. On thicker wood, make a series of light cuts rather than trying to do it all at one slice. This will prevent tearing the wood.



Gaskets

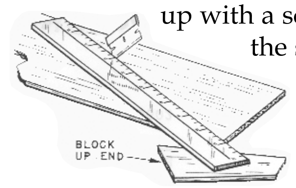
In a pinch, an ordinary playing card makes a good gasket material. Trace the shape of an old gasket and cut out with a razor blade.

Glide performance

Glide performance of elementary rubber-powered models can be greatly increased when a free-wheeling propeller is used. A simple free wheeler can be made by notching and cutting a short length of aluminum tubing of about ¼-inch outside diameter.

Cutting guide

When cutting long, straight tapers or diagonals on sheet balsa, use a metal-edged or metal ruler to guide your cutting tool. When a ruler is close to the edge of the sheet, block up with a scrap of sheet of the same thickness. Hold down firmly and mind those fingers!



from *Brainbuster Newsletter*
Brainbuster Free Flight Club
Abram Van Dover, editor
Newport News VA

Clamp racks

Clamp racks are nice because they hold many types of clamps and are simple to build. The rack is made from ½-inch metal electrical conduit pipe and two 3-foot pieces of 2x6. All the parts are available at a home improvement store for about $5. Cut three pieces of conduit into 32-inch lengths and drill ¾-inch deep holes into the wood sides. These dimensions ensure that the wood sides can be mounted directly to wall studs that are 16 inches on center. If you live in a home built to some other standard, adjust the conduit length accordingly. The pipes are spaced so they are three inches from the wall and evenly spaced along the 2x6. When you are finished, it will look like a ladder mounted to the wall. To store clamps, just attach them to the rungs.

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for the Great Plains
Bob Furr, editor
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