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MANEUVERS

Learning to torque roll

A mini-lesson by Mike McConville

You've seen those super-low hovers and torque rolls in demonstrations and in model magazines and you've probably wondered just how they are done.

Super human flying ability? Hi-tech gyro gismos and big, expensive models? Certainly, you say, torque rolls can't be in the flight plan of a sport modeler who likes to fly normal sport models can they? Well, actually, they can.

It takes practice and an airplane

It'll take practice, of course, and plenty of it. But saying just practice is like saying if you want to paint like Picasso, just start painting. The major stumbling block for most pilots is knowing what to practice.

And then there's the airplane**.** What kind of model do you need? Maybe you're a sport modeler and don't want an expensive Tournament of Champions model—if that's what it takes.

How they are done

Relax, because besides lots of practice and a good airplane, learning to torque roll takes one more thing: a plan. And we've got it right here. So read on and I'll let you in on how the pros became pros. It's still going to take practice, but here's what to practice and what to practice with.

The right airplane

No, it doesn't take an expensive TOC model. It doesn't even take a scale aerobatic airplane. It does take a model with some specific qualities though, but you can find these qualities in some fun, economical sport models.

The aricraft has to have plenty of elevator and rudder authority. This is important since, while in a hover, you need to be able to maintain pitch and yaw control with the only airflow over the tail coming from the propeller.

Great power-to-weight ratio is a big help, too. While learning—and even if you are a torque roll master—at times you will need to get out in a hurry. The safest direction to get out is naturally the opposite direction of our nemesis, the ground. To hang on the propeller and to blast out vertically, you need great, reliable power.

One of the best models I have seen for this task is the Hangar 9 Ultra Stick powered with the awesome Saito 1.80. The Ultra Stick is perfect. It was designed for all out fun aerobatics, so it has the elevator and rudder power needed to keep it under control while hanging on the propeller.

The Saito 1.80 is all the power the Ultra Stick will ever need, and then some. It'll get you out of trouble as fast as a rocket. Not to mention the all-out fun you'll have flying your Ultra Stick with all of its tricks and its punch.

For unbelievable vertical performance with your Saito 1.80 powered Ultra Stick, try using 30% high-performance helicopter fuel and an APC 16 x 8 propeller. Up to 30% nitro in your Saito is fine as long as the oil content is high enough. Helicopter fuel is recommended because it has the oil to keep the engine cool.

Learning torque rolls lower to the ground is much easier because you can see better and make corrections faster—but one mistake and it's that old nemesis again. CRUNCH! The Catch-22 of torque rolling is that practicing up high gives you the altitude you need to recover when you get crossed up, but it's a lot

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harder to do. So try to practice with as much altitude as you can.

Step 1:

Like learning to ski, you need to know how to fall down and get back up first. You will make mistakes, even when you have it mastered. So, don't worry about how to control the roll yet. Concentrate on learning to catch the model and fly out of mistakes without losing altitude, regardless of the attitude the model falls into. This is the key to the torque roll.

How to do it:

At a safe altitude, pull the model vertical at about one-fourth throttle and begin to hover. Use just enough throttle to pull vertical, but not enough to sustain a hover. Let the model begin to fall out; it may fall to the side, the top, bottom or any combination. Practice catching it with the correct elevator and/or rudder input, and get the throttle in it. Focus on flying out level. After you start to get the hang of it and react faster, fly out vertical.

Trickiest Part:

Don't get confused and give the wrong input. Be careful, especially when the model falls with the nose toward you. That's why we start at a safe altitude.

Step 2:

You've now crossed the biggest hurdle in learning the torque roll. You can recover no matter which way the model falls out. You have confidence that you can save the aircraft every time. Now you can concentrate on two new things. First, work on reacting with the correct rudder and elevator inputs to keep the model vertical. (The good news is Step 1 has already sharpened your orientation and reaction skills.) Second, learn to fly the throttle stick to maintain altitude in a hover.

How to do it:

Bring your airplane down to a lower altitude. Start at about 25-feet, low enough to see the model and still high enough to give you a little reaction time before terra firma.

Again pull to vertical, only this time add a little more power so the model hangs motionless in the air. Once you've got the throttle figured out, concentrate on flying the rudder and elevator to keep the model vertical.

Don't worry about ailerons; they aren't going to do much while you're hovering. This is a simply a balancing act, like riding a unicycle. The model may hover or it may begin to roll to the left. Don't worry about rolling, this happens naturally.

The model will begin to roll once it is very close to dead vertical. The better you can hold the model vertical, the faster it will torque roll.

Hint:

Choose a calm day to practice. Wind makes torque rolls much harder. You will also need lots of control surface throw to maintain control use as much as you can get, similar to a 3-D set-up if possible. While you'll need this much control at times, it also makes it much easier to over control the model, so use some expo. I suggest 25% on rudder and 40% to 50% on elevator. Now you'll have the control power when you need it, but a soft feel around neutral so you won't over control when making little corrections.

Trickiest part:

Learning to keep up with the model's orientation as it rolls to give the correct elevator and rudder inputs is the hardest part. It takes time to get good. One wrong input and the model will fall out, but you know how to fly out of a mistake so set up and try again. Also don't over control. Even too much of the right correction will make you fall out. Flip back to low rates as the model falls out so you don't over control and stall the airplane. Use that expo feature in your radio. Once you've got the hang of it, try backing the throttle down a few clicks as you are torque rolling and slide the model down closer to the ground.

And that, in a nutshell, is just about it. So now you've got a plan and you know what kind of model, all that's left is practice, practice, practice . . .

from *Airmailer*
Benton County Radio Control Club
Jim Trump, editor
Corvallis OR

CONTESTS

Fun fly ideas

Please note that this is a fun fly and not a fierce fly, the idea is to have fun.

Taxiing Contest:

This is a timed event. Airplanes will start at a start/finish line, taxi to a turn-around line, and taxi back to the start/finish line. Fastest time wins. Two wheels must remain on the ground at all times. In the case someone enters a tail dragger, the rear wheel can come off the ground.

Hints: Make sure your steerable wheel is aligned and that your airplane will track straight on the ground. Apply full down trim to the elevator to keep your airplane from taking off. As soon as possible apply full throttle while keeping the model moving straight. Somewhere between 40 and 50-feet from the turn around, decrease the engine's power to an idle to avoid tipping the aricraft while turning around.

Keeping the model moving in a straight line with full power can be tricky; it would be a good idea to practice before the contest. You might have to apply a little down elevator to keep the model from taking off when it picks up speed.

Timed Take Off and Landing:

This is a timed event. The planes take off from beyond a start/finish line. The stopwatch starts as soon as the model is airborne. The aircraft circles the field, comes in and lands beyond the start/finish line. The stopwatch stops as soon as all three wheels are back on the ground.

Hints: Try not to gain too much altitude after taking off.

After crossing the finish line a spotter will call out *turn*. Make a sharp turn, cut power, and come in on

see CONTESTS on page 3

 continued from page 2

a short approach. Make sure you carry enough speed for the model to land beyond the finish line or that run will be disqualified.

Spot Landing:

Three circles are drawn on the field. Landing inside the small circle will count for five points, the middle circle four points and the large three points. Two attempts are permitted, scores are added and the highest score wins.

Hints: This event is not timed. I Suggest you make a long approach to the field, this will allow you to line up with the circles better. On approach, a combination of engine speed and up elevator trim will allow you to make a shallow, controlled approach at a low speed. As you near the circles decrease engine speed and drop down onto the field.

Hands-Off Event:

This is a timed event. Take off and climb to 200 to 300-feet. Put in some left or right rudder or aileron trim, just enough to make the airplane fly a wide, slow turn. Add enough up-elevator trim and engine speed to keep the airplane from loosing altitude in its slow turn.

When you are happy with the trim, put the transmitter down and tell the timer to start. Before the model hits the ground or flies out of sight pick up the transmitter and the stop watch records the total hands-off time.

Hints: You will have to adjust for any wind by starting upwind. How much engine speed you let the airplane fly with will depend on the design of your airplane. Too much speed and it will gain too much altitude. Not enough speed and you will have a short run. Make sure you have a full fuel tank.

From the Feather River
RC Modelers Newsletter
Art Devol, editor
Oroville CA

PROPELLERS

Propeller speed chart

Match your rpm on the left to your propeller diameter on top. The intersection shows your propeller tip speed in miles per hour. After proper muffler installation (and perhaps soft mounting your engine), propeller speed is the next biggest factor in reducing aircraft noise. You will want to prep your engine for tip speeds in the mid 300 mph range for quiet operation.

A red line would be anything over 400 mph. Note that the new, larger diameter propellers will present a larger challenge to keep to keep tip speed down; at 10,000 rpm your 17-inch propeller has a tip speed over 500 mph!

Bold numbers within the body of the chart represent a good target for tip speed—probably slower than you'll realistically achieve. As a side effect you will be operating more efficiently, since propeller efficiency is lowest at high rpm.

This chart is a modified version of the chart that appeared in the Spring 2000 *K-Factor*

Propeller Diameter in Inches

RPM	11	12	13	14	15	16	17	18
6000	196.3	214.2	232.0	249.8	267.7	285.5	303.4	**321.2**
6500	212.7	232.0	251.3	270.7	290.0	309.3	**328.7**	**348.0**
7000	229.0	249.8	270.7	291.5	312.3	**333.1**	**353.9**	**374.8**
7500	245.4	267.7	290.0	312.3	**334.6**	**356.9**	**379.2**	401.5
8000	261.7	285.5	309.3	**333.1**	**356.9**	**380.7**	404.5	428.3
8500	278.1	303.4	**328.7**	**353.9**	**379.2**	404.5	429.8	455.1
9000	294.5	**321.2**	**348.0**	**374.8**	401.5	428.3	455.1	481.8
9500	310.8	**339.1**	**367.8**	395.6	423.8	452.1	480.4	508.6
10000	**327.2**	**356.9**	386.7	416.4	446.1	475.9	505.6	535.4
10500	**349.5**	374.8	406.0	437.2	468.5	499.7	530.9	562.1
11000	**359.9**	392.6	425.3	458.0	490.8	523.5	556.2	588.9
11500	376.3	410.5	444.7	478.9	513.1	547.3	581.5	615.7
12000	392.6	428.3	464.0	499.7	535.4	571.1	606.8	642.5
12500	409.0	446.1	483.3	520.5	557.7	594.9	632.0	669.2
13000	425.3	464.0	502.7	541.3	580.0	618.7	657.3	696.0
13500	441.7	481.8	522.0	562.1	602.3	642.5	682.6	722.8
14000	458.0	499.7	541.3	583.0	624.6	666.2	707.9	749.5
14500	474.4	517.5	560.7	603.8	646.9	690.0	733.2	776.3
15000	490.8	535.4	580.0	624.6	669.2	713.8	758.5	803.1
15500	507.1	553.2	599.3	645.4	691.5	737.6	783.7	829.8
16000	523.5	571.1	618.7	666.2	713.8	761.4	809.0	856.6

From *Servo Chatter* · Anoka County Radio Control Club
Stan Zdon, editor · Coon Rapids MN

Think you know everything...

* Two-thirds of the world's eggplant is grown in New Jersey.

* The longest one-syllable word in the English language is "screeched."

* On a Canadian two-dollar bill, the flag flying over the Parliament building is an American flag.

* No word in the English language rhymes with month, orange, silver, or purple.

* "Dreamt" is the only English word ending in 'mt.'

* All 50 states are listed across the top of the Lincoln Memorial on the back of a $5 bill.

From the Mississinewa
Skyhawks Newsletter
Dave Hecker, editor
Wabash IN

Better performance with less noise

by Brian Dorff

With the ongoing debate about the noise our little engines produce, much is being done to preserve our way of life while respecting the rights of others. At first noise reduction sounds bad for pilots. We think that reduced noise means reduced power, and conventional wisdom supports this. It is not until you fully understand how engines and propellers operate that you will realize the gains that benefit not only our neighbors but our airplanes as well!

There are four contributors to the noise made made by models: (in no specific order) muffler type, engine speed (rpm), tip speed of the propeller, and vibration.

MUFFLER

The mufflers provided with today's engines are quite good for the rpm range that they are designed to run in. Mufflers that come with internal baffles should keep the baffles in. Removing them does nothing to boost power, it increases noise, and makes the engine idle poorly due to lack of back pressure.

Pitts-style mufflers shouldn't have more exit area than the stock muffler does, and if it does, one of the ports may have to be partially or completely blocked. Again, this will help idle.

ENGINE SPEED

A large contributor of noise made by airplanes is an over-revving engine. Most modelers try to make their engines run as fast as possible, trying to obtain the rpm at which the manufacturer claims the largest brake-horsepower (BHP) number.

What they don't realize is the peak efficiency for the engine occurs at peak torque, which is usually about 65%-75% of the peak BHP rpm.

Example 1: A manufacturer of a .46 engine claims 1.5 BHP at 16,000 rpm. After break-in you find that you can turn a 10 x 5 propeller at 15,500 rpm—very close to the peak BHP, but the airplane's performance is mediocre, it is loud, and consumes way too much fuel.

Now you find the engine's peak torque is about 70% of the peak BHP rpm (.70 x 16000 rpm = 11,200 rpm).

You switch to an 11 x 7 propeller and find that the rpm is 11,500. You are much closer to peak torque now, and the airplane flies better and is quieter because the frequency of the engine firing has reduced dramatically.

The fuel also lasts longer, and the engine will last longer as well since it is not working as hard. A slower engine also helps in achieving the next goal—

PROPELLER TIP SPEED

The tip speed of the propeller is critical in quieting the airplane. The point where things gets noisy is 560-feet per second or about 380 mph. Going over 400 mph is a big no-no. Even in an airplane that is built for speed, you should be able to choose a quiet propeller.

Example 2: Same setup as the last example, the 10 x 5 propeller is at 15,500 rpm and the 11 x 7 propeller is at 11,500 rpm. The formula for tip speed in miles per hour is:

$$\frac{\text{(Diameter in inches)(3.1416)(rpm)}}{1056}$$

The number 1056 is a constant that converts inches per minute to miles per hour. A 10 x 5 propeller at 15,500 has a tip-speed of 461 mph (a no-no).

$$\frac{(10)(3.416)(15500)}{1056} = 461$$

We want our tip speeds no faster than 400 mph and it should be less than 380 mph if you want to keep your flying site.

The 11 x 7 at 11,500 rpm has a tip-speed of 376 mph.

$$\frac{(11)(3.1416)(11500)}{1056} = 376$$

The tip speed is now down to a moderate level. But how do these propellers compare in performance? You can calculate airspeed by using the propeller pitch and the rpm of the propeller. The pitch of a propeller is the second number in the propeller designation. This is the distance in inches that the propeller will travel through the air in one revolution. Multiplying the pitch by the rpm and dividing by 1056 will give the calculated speed of the model.

5 x 15,500 / 1056 = 73 mph
7 x 11,500 / 1056 = 76 mph

So your airplane will actually be traveling slightly faster with the 11 x 7 than with the 10 x 5, while turning 4000 rpm slower. This reduces engine noise, propeller noise, fuel consumption, wear and tear on the engine, etc. without compromising performance.

Propeller loading Factor (PLF): How do you know what to expect switching propellers? Being able to compare propellers before you run them is the key to optimizing your airplane's performance and getting rid of the noise. Say you are happy with the rpm that your engine is turning with the 11 x 7 propeller, but you want to try other propellers to see what you like best for flight performance.

Right now you are at the middle of the road, slightly fast and passable vertical performance, but what if you want more vertical?

First we solve the PLF of our existing propeller, and then we compare it to others.

PLF= D x D x P
(D = diameter, P = pitch)

The ll x 7s PLF would be 11 x 11 x 7= 847 PFL (compare with the 10 x 5s or l0 xl0 x 5 = 500 PLF)

Now let's see what else is out there. To increase vertical you should either increase diameter, decrease pitch, or both.

To keep a PLF close to the same you will have to do both. If you are trying to raise the rpm—decrease pitch—and if you are trying to slow the motor, increase diameter.

Propeller	PLF
12 x 5	720
12 x 6	864
12 x 7	1008
13 x 5	845
14 x 4	784

I would try the 12 x 6 first and then the 13 x 5. They have close PLFs. This is for comparison only. Switching propeller brands or not balancing a propeller,

see **REDUCING NOISE** on page 5

REDUCING NOISE continued from page 4

among other things, can vary your results.

VIBRATION

How does the vibration of your model relate to the sound it makes in the air? Well, sound *is* vibration.

Imagine your beautiful model—a nice wooden structure covered in drum-tight plastic covering. Think of it as a percussion instrument. The piston is traveling up and down like a drumstick pounding away at your model. And your model echoes every stroke it makes. The same thing happens with an out of balance propeller. Noise!! It's everywhere! Your new mission: get rid of all vibration.

Start at the Propeller: It moves 300+ mph at the tip—balance it! It will remove noise because all that vibration won't exist in your airframe. Our neighbors will thank you and your receiver crystal, your servo pots, fuel tank, and Ni-Cds will thank you as well. You will be rewarded with much greater reliability and a longer airframe life span. Also consider a high-quality spinner. They are better balanced and look nicer.

Back to the other cause of vibration—the engine. It is not possible to balance a engine dynamically at all speeds, so some vibration will forever be present, especially with four-strokes. The only thing that you can do about it is to isolate the vibration from the aircraft, making less noise in the process. Iso-mounts vary in type and price; from rubber grommets between the firewall and the mount, to specialized mounts for specific engines and planes that cost $100 or more. A popular one is made buy Dubro and is for any 40-90-size 2c or 4c engine. It sells for $20-$30. Well worth the investment!

While it may not be feasible to make every one of these criteria work on your aircraft, it is important to keep these points in mind when getting your airplane ready to fly this spring. If we all do a little, we can make a big difference. Remember, a 3 dB difference in sound and the intensity doubles. If you can make your airplane even 3 dB quieter, you have made a huge cut in the noise that everyone around us has to hear. (Although the sound energy is halved for every 3 dB drop, it takes a 10 dB drop for the human ear to perceive the sound being half as loud. A 10 dB drop results in one-tenth the original sound energy.)

From *Servo Chatter*
Anoka County Radio Control Club
Stan Zdon, editor
Coon Rapids MN

Truthisms

* Always try to keep the number of landings you make equal to the number of takeoffs you've made.

* There are three simple rules for making a smooth landing. Unfortunately no one knows what they are.

* You start with a bag full of luck and an empty bag of experience. The trick is to fill the bag of experience before you empty the bag of luck.

* Good judgment comes from experience. Unfortunately, the experience usually comes from bad judgment.

* Remember, gravity is not just a good idea—it's the law and it's not subject to repeal.

* It's always a good idea to keep the pointy end going forward as much as possible.

* In the ongoing battle between objects made of aluminum going hundreds of miles per hour and the ground going zero, the ground has yet to loose.

From *Space City Crash*
Space City RC Club
Mike Crotts, editor
Houston TX

HINTS & TIPS

An inexpensive locator for models

by Greg Lee

The sound generator of a musical greeting card has some specifications that make it a good locator for lost aircraft—especially electric models.

It has the following characteristics:

1) It only weights .2 oz or six grams.

2) It only requires .15 mA at 1.5 VDC. This allows a theoretical use of 2.2 years from a receiver pack.

3) The sound level is 55 dB at one meter—audible to the undead at 100-feet.

4) It is only 1 - 1/8-inch in diameter and 1/4-inch thick.

5) They only cost $0.10 per resistor, $0.35 per capacitor, and one servo plug.

6) It's simple—if it has power, it has music.

Most greeting card sound boards are powered by 1.5 VDC, but some might use three-volt-batteries. By adding a resistor you can step the voltage down for your receiver pack.

You will also need a .1 F capacitor to smooth out the pulsation from the different tones.

To calculate the values for the resistor just follow this formula below where V1= receiver pack voltage, V2= sound board voltage I avg= is the average current (amps)

R= (V1 - V2)/I avg
example: R= (4.8 - 1.5)/.00015
R= 22,000
or the closest standard value.

from *Planaphonre*
Rockland County Radio Control Club
Louie Triozzi, editor
White Planes NY

Computer transmitter programming

by Oscar Weingart

In order to achieve the desired flight characteristics in an RC aircraft, you may need to adjust, fine-tune, or dial-in the responses of your servos and control surfaces to your commands (stick or switch positions) at the transmitter.

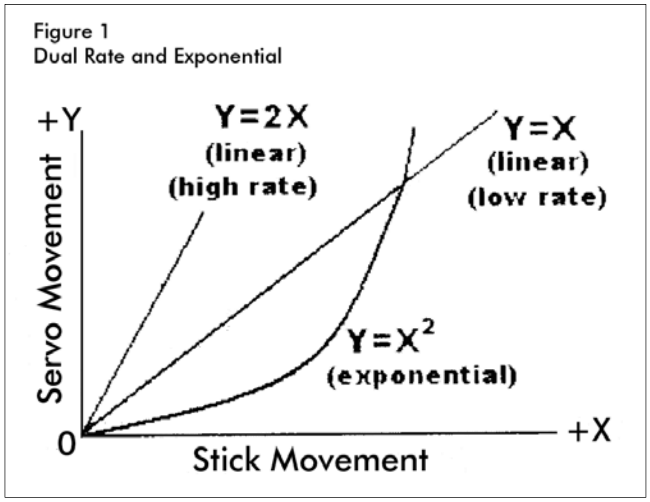
With the early plain vanilla radios, most of adjustments could be achieved by mechanically changing the servo linkages, but the response of the servos themselves could not be changed. Add-on electronic and mechanical gadgets could provide functions like servo reversing, flaperons, v-tail, and elevons. In many modern basic radios, the non-computer transmitters have switches and potentiometers for adjusting things like servo reversing, servo travel limits, and dual rates.

Computer transmitters have made life simple for us, because most of the required responses can be achieved simply by programming. Sophisticated mixing of control responses, like v-tail, elevons, or flaperons are easily programmed; where Rube Goldberg mechanical devices were used in the past.

Unsatisfactory flight characteristics can be adjusted out with simple programming functions like exponential and differential aileron. I would like to discuss some of these programmable functions in this column.

I have five programmable transmitters, an Airtronics Infinity 660, a JR 8103, a Futaba 9CAP, and two Futaba 9VAPs.

The Infinity is a 6-channel, the JR is an 8-channel, and the Futabas are 9-channel. All, except the 9VAPs, are programmed differently—I mean so differently that knowing one is little help in programming another. But all five have the basic programmable functions we use the most. So perhaps the best way to discuss programmable transmitters is to talk about the features and functions they have in common, rather than the specific buttons pushed and keystrokes for programming any particular transmitter.



High and Low Rates

In figure 1, I have plotted three types of servo response (Y) to stick position (X).

In linear response, the servo moves proportionally to the stick position. So we can say Y = k(X), where k is some constant, like 1 or 2.

If the servo moves exactly the same angle as the sick moves, then Y = X. If Y = 2X, the servo's angular movement is always twice the stick movement. The graph of such movement is a straight line, such as the lines Y = X and Y = 2X in figure 1. The line Y=2X is said to have a greater (more vertical) slope than the line Y=X. The servo therefore moves at a higher rate, (higher sensitivity), but still proportionally to the stick movement.

In most computer transmitters, we can program two different rates such as these and assign them to a switch. This allows us to switch between high and low rate response of ailerons, elevator and sometimes rudder, for landing and aerobatics. Some transmitters even have three rate positions instead of two, and some allow all three controls to change rates with one common switch.

The down side to all this is that finding these switches and placing them in the proper position during flight, is confusing and may mean taking your hands off the sticks and looking away from the airplane during critical times such as the landing approach.

Exponential

What should you do if you don't want to find and reposition switches but you want the servo to move in a nonlinear way so you effectively have different rates at different stick positions? For landing or straight and level flight, where precision control is needed, we might want the ailerons and elevators to move only a little when the stick moves a small angle off center, (low rate). For aerobatic maneuvers, you may want large control deflections for small stick movements near the extremes of stick travel (high rate). What if you want less sensitive control near center and more sensitive control near the ends of the stick movement? This type of non-linear response is called exponential.

There seems to be a lot of misinformation about exponential. Even the word exponential is often mispronounced.

If $Y = X^2$, (the same as saying Y = X x X), the superscript, "2", is the exponent, hence the name exponential.

In figure 1, the plotted movement of $Y = X^2$ forms a curve, so it is a non-linear, or exponential response. Note that the slope of the curve is low near X=0 and high near the end of stick movement.

The representation of exponential in some transmitters is not always in accordance with the above discussion, but you can easily learn your own transmitter's peculiarities. For example, what I think of as positive

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SERVOS continued from page 6

exponential, as graphed in figure 2, must be programmed as negative exponential in some transmitters.

Most programmable transmitters offer a range of exponential between 100% and +100%. The greater the percent exponential, the more curved the response graph is, hence the greater the difference in rates along the curve. Note in figure 2 that you get linear movement with 0% exponential. Positive exponential produces the effect usually desired, with less sensitivity near stick center and more at the extremes of stick movement.

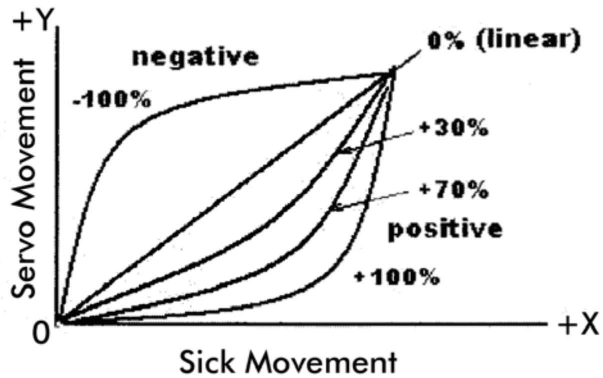


figure 2
Exponential Responses

I find myself usually needing what I call +30% to +50% exponential on elevators and ailerons. But in some of my units this must be programmed as -30 to -50%. What I call negative exponential causes more control sensitivity near the center of stick movement and less at the extremes. This is generally not a desirable condition, but if your airplane or flying style need it, go for it!

Note that the total movement of the stick, X, and servo, Y, is the same in all cases shown in figure 2, but exponential determines the path of how you get there. If you want the total servo movement or sensitivity to increase/decrease over the full stick movement, while still retaining our desired exponential or linear response, you can use dual rates with servo travel limits.

A tip on using exponential:

The throttle response on many RC airplanes is nonlinear. On several of my models, all the power change seems to happen in the first half of stick movement, from idle to mid-position. From mid-position to full throttle, power seems to change very little. So the throttle response curve seems to look like the negative exponential curve in figure 2.

The throttle is over-sensitive near idle and not sensitive enough near full throttle. This effect is due to the geometry of the throttle linkage and also to the design of the throttle itself. To straighten out the throttle response curve for more linear results, you can program positive exponential into the throttle channel. This positive curvature will counteract the existing negative curvature in the throttle response curve, and give you a more desirable linear throttle feel.

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

WEATHER TIPS

Flying in the cold

Now that the cold is here again, here are a few reminders about flying in freezing weather.

1. Keep the batteries in your flight box, ni-start, and radio equipment well charged. The cold cuts back on the efficiency of batteries. They don't hold their charge as long as in summer. Leave your radio, flight box, etc., inside your car or somewhere warm when not in use (as long as you leave your car running like almost everyone does).

2. Switch to a higher nitro content in winter (15%). The engine will run better because of the higher operating temperature. Keep your fuel warm too, if possible.

3. Keep your airplane in a warm place. It usually is the difference between getting your engine started and ready to fly or just going for a nice drive. A trick to try—set your airplane under the engine of your car if you have the ground clearance to do so.

If you keep your airplane in your car with the skis on, make sure when you bring it out you immediately push it around in the snow until the skis are cold, otherwise the snow sticks to the skis and the airplane won't glide well.

4. After you get your engine running, leave the ni-start or plug lead on for a little while. Let the engine run until it warms up. You don't need to rev it up or stab at the throttle. Just let it run for a few minutes. You'll probably have to set the idle speed up slightly higher, even after the warmup period.

5. In the winter, you can also connect an exhaust tube to the muffler in order to keep the fuel from freezing to your airplane. If fuel freezes to the muffler, it is difficult to remove until you warm up the airplane. Then it runs all over. You'll probably have to richen the engine some, but it's nice having a clean airplane to take home. For tubing, I use a piece of clear plastic fuel line that can be purchased in any auto store. A hose clamp will hold the tubing on, and to keep the clamp from coming loose due to vibration, Hot Stuff or epoxy works well.

from the Twin City Flyers Newsletter
Dan and Yvonne Twomey, editors
Festus MO

RIGGING

Advantages of elastic thread

by Allan Schanzle

There are several materials that I have used for rigging on models. Three that come to mind are monofilament fishing line, regular sewing thread, and elastic thread. Each of these has its advantages. Monofilament fishing line can be purchased in almost any thickness, which facilitates selecting the proper size for the specific model being built. It can also be colored as desired by simply using a wide-tip permanent felt marker. Cyanoacrylate glues work well to hold these in place.

Normal sewing thread also works well and is available in a wide variety of colors and diameters.

These two materials are great for rigging between wings or on the tail surfaces. The only disadvantage is that they don't give when landing in a field that has prickly grass or weeds. That makes them less desirable for rigging that is likely to get caught on ground materials. This is exactly the situation with the Spartan C2-60, where there is an abundance of rigging below the wing and around the landing gear. This feature led me to choose elastic thread for the rigging.

I bought my elastic thread at Jo-Ann Fabrics (I think is a nationwide chain). I purchased both black and white spools.

They can be unbraided if necessary, but one strand will be rather kinky, while the second strand appears normal and is good for simulating smaller diameter rigging. I used the smaller size for the rigging on the tail surfaces.

Some elastic thread I've used in the past works well, but after six months or so, it may loose its elasticity and become saggy. It is this characteristic that led me to use Elmer's white glue to attach the end of the elastic rigging whenever possible. This particular glue has several advantages:

1. Even after drying, it can be dissolved with water, allowing you to repair saggy rigging. Simply soften the glue at one end of the thread with water, remove the thread, cut, and replace. You have to be patient and let the water soften the joint.

2. The hazy film of glue around the joint can be removed with a Q-tip soaked in water. This is a distinct advantage over acetone-based glues, such as Ambroid, where softening the glue usually ruins the finished surface around the joint.

3. It dries clear, avoiding the visual appearance of a blob of junk holding the rigging in place.

(An unrelated benefit to Elmer's is to use it as a means of tack-gluing tail surfaces for initial flight testing. If you're like me, you won't remember where you put the small spots of glue, so simply use a small paint brush to apply water all around the joining surfaces—such as the stabilizer to the fuselage—and wait a few moments. As the glue softens, the joint turns opaque, allowing you to see exactly where the glue has been applied.)

Here is the approach I developed for rigging the Spartan.

1. When building the framework, glue small sheets of balsa to the substructure where thread is to be anchored.

2. After covering the model, make holes through the covering and into the balsa structure where the ends of the rigging will be attached. Use a small drill or a typical pin, which I found to be the perfect size for the thread I used.

3. Pick two points where rigging will be attached and cut a piece of elastic thread about three-fourths of the distance between the two points.

4. Apply a light coating of cyanoacrylate glue over approximately ½-inch at each end of the thread. This will stiffen this portion of the thread and make it relatively easy to insert into the drilled holes.

5. To produce the illusion of turnbuckles on a very small scale, dip about 3/8-inch of the ends of the thread in the appropriate color paint. It may take several coats to build up a little thickness, but the earlier use of cyanoacrylate makes the thread less porous and helps to minimize the coats of paint.

6. Now try inserting the thread into one of the holes. If the hole is too big, simply apply another coat or two of paint until you get a tight fit. I found that with a bit of work, I could get the thread inserted into the holes at both ends in the stretched position and it would hold itself in place without glue. This makes it easy to apply a small drop of Elmer's at each end of the thread using the point of a pin.

from *Max Fax*
D.C. Maxecuters
Allan Schanzel, editor
Washington DC

MODIFICATIONS

Washout: advantages and disadvantages

"Every airplane needs washout, even a biplane," said Claude McCoullough, the famous designer for Sig.

I'm not sure that every airplane needs washout, but most do, especially the scale airplanes that Claude designed.

Washout is a twist in the wing from root to tip. This twist is usually three degrees but in rare cases can be more.

Washout forces the wing near the fuselage to meet the air at a more positive angle than the tip. As the model pulls its nose up and increases the overall angle at which the wing meets the air, it will eventually achieve the stall angle at which lift ceases.

With washout, the inner wing will stall first and gradually progress towards the tips. This is desirable because the loss of lift at the center will lower the nose and prevent further stalling. Meanwhile, aileron control is maintained even though the wing is partially stalled.

But there's much more. Consider the typical World War II fighter. A fighter will have a wing incidence at the root of about 2-degrees and a washout of about one and a ½-degree. At top speed, the incidence angle of the tip is 0-degrees. Drag at the tip is minimized and there is very little loss of lift by air creeping around the wingtip—very efficient for maximum speed. In addition, the up-going aileron causes the same drag as the down-going aileron, so that roll causes no yaw. Yawing with the rudder does not change the lift at the tips, so yaw does not induce roll. This is just what the fighter pilot needs for gun aiming, and what the modeler needs for precise scale flight.

Washout is a must in airplanes with long, thin, or pointy wings. Some can't fly without it. Next time you are at the airport, notice the washout of the airliners there. It's huge for safety and fuel efficiency.

Most biplanes don't need washout because one wing is typically set at a higher incidence angle, and one wing will stall before the other. Ailerons must therefore be on the wing with the lower incidence angle.

Washout has a dark side; it can interfere with aerobatic performance. In inverted flight, washout becomes washin and all the bad things that washout prevents in upright flight become worse in inverted flight. Snap rolls and spins, which require the wing to stall on command, can be difficult to start and control. Adverse yaw varies with airspeed. Scale models of fighters are only mildly aerobatic. Fully aerobatic airplanes generally do not include washout.

Summary: Washout improves aileron response at all airspeeds, reduces adverse yaw and softens the stall, but only in upright flight.

from *Flare-out*
Twin City Radio Controllers
Jim Cook, editor
Minneapolis NM

WORKSHOP ASSISTANCE HINTS & TIPS FROM FELLOW MODELERS

Light tissue over dark colors

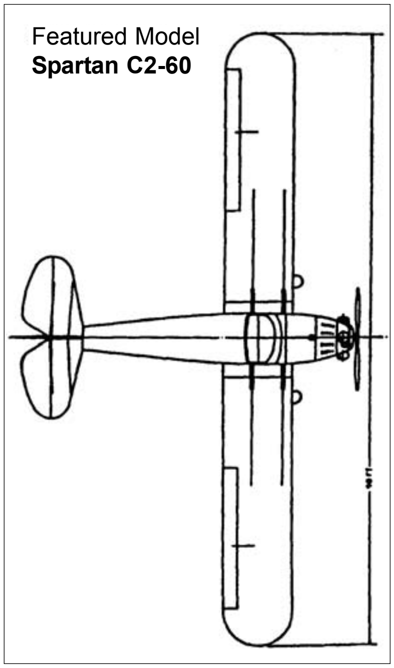
The fuselage of the featured model is black with a trim stripe that is orange and outlined in white. If you use orange tissue for the trim strip, the black will show through and distort the orange color. To make the orange tissue opaque, simply paint the back side of a piece of orange tissue (slightly larger than necessary) with white paint. To add the white edge to the orange stripe, use a white ball point pen to create the edge or use an old fashioned drawing pen along with white paint to create the edge.

Cut the tissue to shape, wet the stripe, place it on the fuselage, pat dry with a paper towel, and hold in place with thinned white glue applied just to the edges of the orange tissue.

Mounting windshields

A trick I used to help glue the windshield to the fuselage of the Spartan is cut a piece of scrap 1/8-inch thick balsa into a triangular shape. Make one of the angles correspond to the tilt-back of the interior of the windshield. Tack glue this piece of balsa with Elmer's along the centerline of the fuselage. Locate the proper fore-and-aft location so that the forward point corresponds to the windshield location on the centerline.

Hold the windshield in place and put a small drop of Elmer's at the base of the windshield along the centerline—dry completely. The balsa scrap will now hold the windshield at the proper angle while you bend the windshield and place additional drops



Featured Model
Spartan C2-60

From *Max Fax* · D.C. Maxecuters · Allan Schanzel, editor · Washington DC