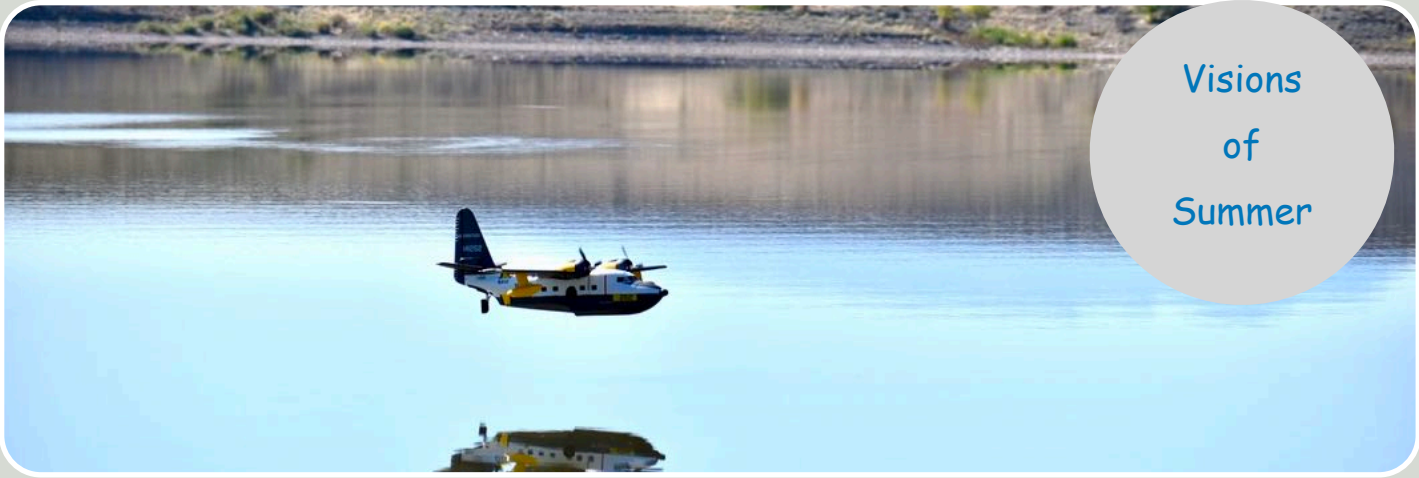
January 2021 Volume 32 Issue 1

TURBULATOR

Newsletter
of the Rio Rancho Radio Control Flying Club

AMA Club #2770

WATERMAN FIELD ELEVATION 5840 FEET 35° 17.2'N 106° 44.8'W



PRESIDENTS CORNER

"Da Prez Sez"

Happy New Year RRRCC members and guests. Jan and I hope you had a good Christmas. Maybe Santa, Visa or MC brought you a new project.

For those who have family dealing with Covid or the after issues our thoughts and prayers remain with you. Our family in CA and AZ also face serious concerns, needing oxygen, clots, phenomena, heart and the rest of the gamut unfortunately. Jan and I are well and remain grateful for those helping so many. Be well!

Just as a reminder if you visit the flying field. 1) If you are present at the field please respect distance of 6-10 feet if anyone else is present. 2) Hand sanitizer is in the locked container if you do not have your own. 3) Review all AMA

Coming Events

1. Jan 4th 7pm Zoom Mtg Join Zoom Meeting
https://unm.zoom.us/j/7625363505
Meeting ID: 762 536 3505
Passcode: j3cub

field guidelines, especially sharing food etc. (available online) 4) Be guided by state guidelines (These are in a constant state of change) Masks are recommended unless you are flying alone or with family (your option). 5) If you have any symptoms or feel ill please stay home. Please don't share a Cold, Flu or other Ick. (Recommend by your Club Officers)

Our January club meeting will be held again on Zoom. (Available on desktops, phones, and tablets) See details below and Don's emails. You will also have a final reminder email prior to the meeting Monday January 4th at 7pm.

Blessed New Years. Doug

Aileron-Rudder Mixing Explained
"Building Good Habits for a Better Future"
By Dave Scott. Instructor, 1st U.S. R/C Flight School Illustrations by Dave Scott

The following article details the use of programmable Aileron-Rudder mixing to eliminate "adverse yaw". While primary aimed at eliminating adverse yaw on a primary trainer, the descriptions and explanations should help cement your grasp of a subject that few in the sport understand, even through all pilots experience the effects of adverse yaw every time they fly.
Introduction
Nearly 100% of computer radios today feature Aileron-Rudder (A/R) mixing to reduce adverse yaw, i.e., the inherent opposite yaw or skid that is especially pronounced during aileron deflections on flat-bottomed wing aircraft, such as those used for primary flight training.
As the name implies, adverse yaw is an adverse or unfavorable condition that, among other things, inhibits progress. Traditionally, struggling and committing to many hours of practice before soling has been the assumed normal burden of the novice pilot until his or her skills improve. However, they have unknowingly been fighting the additional challenge of flying with adverse yaw as well. Indeed, pilots have always assumed that the lack of correlation between their control inputs/intentions and the response of the plane to be strictly the need for more practice, and sometimes wind, when in fact adverse yaw has been a big reason!
It's probably safe to say that most of the people reading this learned to fly by trial-and-error or at the side of a recreational flyer/instructor with little
pre-flight preparation. As a result, most pilots learn to fly by "reacting" to what the plane does. Consequently, many pilots naturally think that getting better at making corrections, good reflexes, and more stick-time are the keys to becoming a better flyer. Thus, rarely does adverse yaw or the advantages of A/R mixing when learning to fly ever come up. However, if you where to objectively compare the results achieved training with A/R mixing versus without, you would discover an immediate improvement in consistency and therefore the rate of learning. In fact, as you will soon see, learning to fly with A/R mixing can be credited for helping to instill proper control habits that actually accelerate future progress.
Adverse Yaw
Space does not permit going into all the aerodynamics involved during aileron deflections, so put simply; adverse yaw is caused by the wing with the down aileron generating more lift and therefore more drag than the wing with the raised aileron (figure 1). The drag differential causes the airplane to yaw/skid in the opposite direction that the ailerons are applied while banking into turns, making course corrections, exiting turns, etc.. Pilots therefore have to hold in the aileron longer to overcome the adverse skid, thus increasing the potential for over-controlling, as well as deal with a lack of consistency caused by the out-of-sync relationship between their control inputs and the response of the plane. Adverse yaw is most pronounced on high lift flat-bottom wing aircraft and gets worse at slower airspeeds and/or when making larger aileron inputs. (Adverse yaw is so severe on a scale Piper Cub for example, that when flown near stall speed it will actually turn left when right aileron is applied, and vice- versa.) Also, since the principle effect of wind is exaggerating deviations that would otherwise be minor on calmer days, adverse yaw creates a whole slew of problems when trying to fly a trainer in windy conditions.

Some common approaches to reduce the effects of adverse yaw in R/C have been: Flying at higher speeds; making the trainer less stable and more maneuverable by lessening wing dihedral; differential aileron travel (more up aileron travel than down); avoiding wind; accepting it as how trainers fly; and continued reassurance from club members that the student will eventually get it with more practice -- all of which only help to small and varying degrees.

Aileron-Rudder (A/R) Mixing

The logical solution to counter adverse yaw is with the surface that controls yaw, i.e., the rudder (figure 2). Coordinated rudder deflections along with and in the same direction as the ailerons prevent the plane from skidding in the opposite direction while banking into and out of turns, making course corrections, rolling, etc.. Most importantly, with adverse yaw eliminated, the airplane response more closely matches the inputs and intentions of the pilot!

Be clear, the function of the rudder here is not to turn the airplane. Rather, the purpose of the rudder is strictly to prevent adverse yaw in order to achieve a precise “axial” bank and roll response. 1st U.S. R/C Flight School trains its students on planes setup to automatically coordinate the rudder with the aileron through the A/R mixing function in the radio. Radio manufacturers have in fact been providing A/R mixing for the purpose of countering adverse yaw since the 1980’s, but since most people are inclined to keep passing down the way they were taught, it is still not widely used or even understood in R/C.

Those who learn to fly an honest trainer set up to more accurately reflect the control inputs they make are obviously

going to learn proper control earlier. However, as a bonus, A/R mixing also expands the aerobatic capabilities of a primary trainer airplane by helping aileron rolls remain axial and on heading throughout. Furthermore, the improved control achieved with A/R mixing permits flying in winds that would normally ground most trainers. E.g., The main challenge of flying in wind is that it tends to exaggerate deviations, however, the positive control achieved with A/R mixing makes it possible to more precisely and promptly correct deviations before the wind has a chance to exploit them. Thus, even experienced sport flyers have good reasons to utilize this setup on their flat-bottom wing planes.

Of course, when A/R mixing is being used, pilots still have independent

Rudder deflecting in the same direction with the ailerons prevents the nose from skidding to the left.

rudder control on the left stick for left- hand ground steering and maneuvers requiring independent rudder. In fact, learning to use independent rudder on the left stick proves easier after learning to fly with A/R mixing because much of the right stick control will have become routine or automatic thanks to the consistency achieved with the mix.

Aileron-Rudder Mixing

Setup Rules-of-Thumb

Upon activating A/R mixing, you need to confirm that the rudder moves in the same direction as the aileron (rudder moves toward the up aileron). The rule-of-thumb on a flat-bottom wing airplane is to adjust the A/R mixing percentage so that the degree of rudder deflection matches the degree of aileron deflection 1-to-1 (figure 3). At 1st U.S. R/C Flight School we simply

Original flight path

Axial

Lift

gauge the degree (angle) of aileron deflection visually, and visually match

anequaldegree(angle)ofrudder. Iffor some reason we are unable to set a 1-to-1 relationship, we’ll get it as close as we can, knowing from experience that a few degrees more or less is not going to make any appreciable difference.

Wethencheckthesetupby flying the airplane directly at or away from us while banking left and right to confirm that the banks are axial and the fuselage stays pointed in the same direction throughout.

Of course, if you are hesitant to use A/R mixing, you can always start with less, and then keep increasing it until the bank and roll response is finally axial. Although, you can be confident that after applying the 1-to-1 rule-of-thumb to a flat-bottom wing airplane adverse yaw will be virtually undetectable: Banks, corrections, and rolls will be smooth and axial, and you will feel more connect-

ed to the plane when you fly. By comparison, adverse yaw is minimal during aileron deflections on fully-symmetrical wing airplanes (except during slow flight), and therefore fully-symmetrical wing airplanes require little or no A/R mix. That means that a semi-symmetrical wing (in-between flat-bottom and fully- symmetrical) requires approx. half as much rudder deflection as aileron to eliminate adverse yaw.

Differential Aileron

If your airplane utilizes 2 aileron servos, you can program a small amount of differential aileron travel (more up aileron deflection than down) to help further reduce the chances of adverse yaw occurring, particularly at slower airspeeds.

While differential aileron travel is a common practice used to reduce adverse yaw, its effect is slight, and the only way to fully eliminate adverse yaw is with simultaneous rudder. Note that if you did attempt to reduce adverse exclusively with differential, you would end up with so much up aileron travel that the airplane would be unduly prone to dropping at the start of turns and rolls. Thus, a little differential is good, just don't get carried away.

A/R Mixing for the Future

Many new flyers eventually go on to enjoying the "flying on rails" handling and increased capabilities of symmetrical wing aerobatic models.

On a flat-bottom wing airplane, adjust the A/R mix percentage so that the degree of rudder deflection matches the aileron deflection 1-to-1. On a semi- symmetrical wing plane, setup the A/R mix so that the rudder deflects half as far as the ailerons. Using A/R mixing on a fully-symmetrical wing plane is optional, and typically no more than a degree or two when activated.

Once again, symmetrical wing airplanes require little or no A/R mixing because adverse yaw is negligible with this type (until slowed).

Those who learn to fly a flat-bottom wing trainer with A/R mixing will actually find the transition into symmetrical wing models easier than most. That's because the control habits learned flying an A/R mixed basic trainer are the same techniques used to fly symmetrical wing airplanes, since in both instances pilots are flying

Full deflection

Right wing

1-to-1 equal degree aileron-rudder deflection

Semi-symmetrical

2-to-1 aileron-rudder deflection

Fully-symmetrical

Minimal aileron-rudder mix

Symmetrical wing airplanes exhibit minimal adverse yaw and remain almost perfectly axial while banking and rolling (except when the airspeed is low), and thus there is little or no need for A/R mixing with this type.

Flat-bottom wing airplanes exhibit significant adverse yaw and thus require significant A/R mixing to achieve an axial bank/roll response.

In short, learning to fly a flat-bottom wing trainer utilizing A/R mixing leads to learning the same control habits used to fly a symmetrical wing aircraft, thus making the transition easier because pilots are flying without adverse yaw in both cases.

without adverse yaw and maintaining a direct correlation between their inputs and the response of the plane (figure 4). Conversely, those who learn to fly with adverse yaw (un-mixed) will have to re- train their habits when flying an aerobatic model without much adverse yaw. Thus, the aim of A/R mixing a primary trainer is not only to facilitate learning to fly, but ultimately to compliment the transition into higher performance airplanes that require little or no A/R mixing.

Axial

It's important to note that if you're inclined at some point to switch off the A/R mixing on a flat-bottom wing airplane, expect to need a lot more control inputs to overcome the sloppier responses (something that you do not want to make a habit of if you also plan to fly less encumbered aerobatic models). Of course, you could physically coordinate the aileron and rudder control sticks using 1-to-1 movements to eliminate adverse yaw,

but remember that technique only applies to flat-bottom wing airplanes and would not be appropriate when flying symmetrical wing airplanes.

Conclusion

As stated, maintaining a direct correlation between control inputs and the response of the plane is instrumental to developing optimum control habits. Consider that when the initial control inputs are applied correctly, the need for additional

corrections may not even exist. That's when a pilot becomes free to think ahead of the airplane and more efficiently take on new challenges.

MINUTES

Minutes from the December 2020 Club Meeting

Calling of meeting to order at 1900. 15 Members present.
Pledge of Allegiance

Minutes: Accepted as Published

Treasurer's Report: Accepted as presented

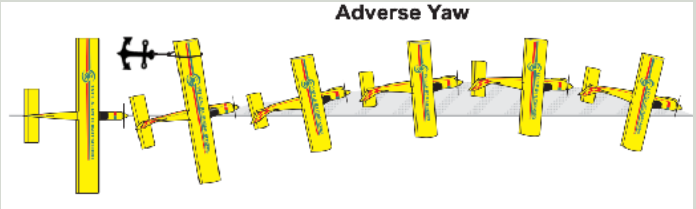
Membership report: 30 Paid 2021 Members

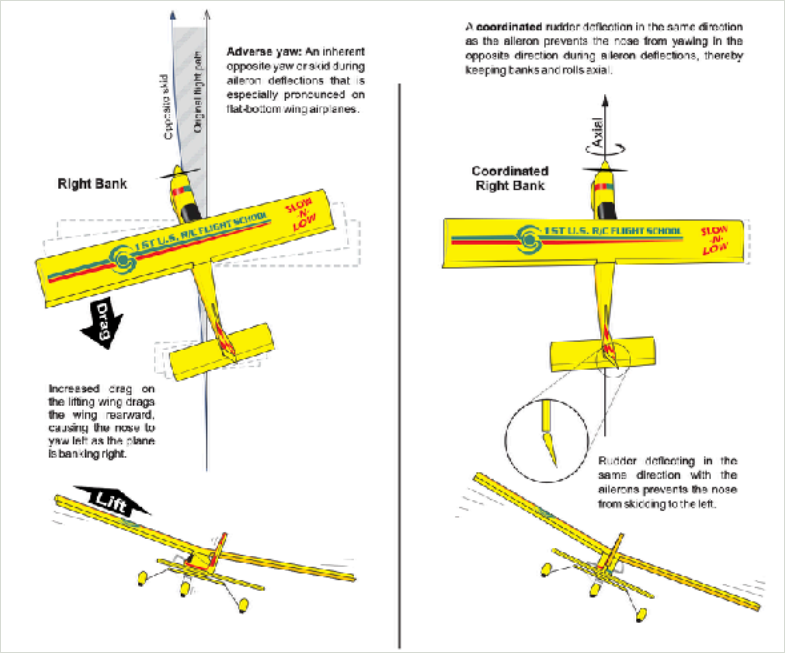
Field Report: Field is usable, roads clear. Noted 1 small crack in new repairs.
Safety: No Issues noted
Completion of unfinished business:
Nomination of officers. Unanimous vote to keep the current officers.
Flying in the afternoon is good….
3. Planes bought for Christmas Party will be raffled at the spring BBQ event.

New Business: 1. January meeting will be a zoom meeting.

The meeting adjourned 7:44

Thus, by removing the obstacle of adverse yaw, A/R mixing proves to be one of the most effective tools to ensure thatpilotslearnpropercontrolfromthe start and therefore continue to enjoy steady advancement and a more successful future. Happy flying!





Turbulator:
Editor Don McClelland
We are always looking for articles, pictures and your input!

For comments, or suggestions Please Email Don at macmoke1@gmail.com

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Next Club Meeting
January 4th 7:00pm in the Internet via Zoom