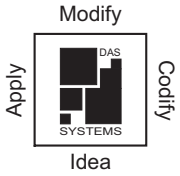
Introduction



While modern technology has expanded airplane capabilities, declining understanding of the fundamental setup principles that are essential to achieving a good flying airplane in favor of emphasizing advanced programming has made the setup process exponentially more complex and subject to error. The aim of this book is to bridge the gap and explain/revive the most important fundamental airplane setup principles, the role that advanced computer capabilities play in helping to fine tune the setup, and the tradeoffs.

In the past, when the fundamental principles of C.G., physical control surface setup, engine thrust, etc., were handed down and commonly understood by the majority of R/C flyers and manufacturers, a typical test flight consisted mostly of fine tuning the last few percent of the setup. In recent times, the process of trying to improve airplane handling and performance has become more challenging primarily because people fail to appreciate that in order to take advantage of the radio capabilities that have become the focus of modern airplane setup, the setup must be fundamentally sound to begin with. That is, no amount of advanced programming can rectify a fundamentally flawed setup! Hence, the additional challenge of setting up airplanes today is seldom due to a lack of programming expertise, but stems from neglecting to put enough emphasis on first getting the fundamental setup correct, which is the foundation to effectively work on fine tuning the radio setup. Indeed, every year thousands of perfectly good airplanes are lost or faulted because their owners dislike the way they handle (esp. the landing) simply due to too much elevator or aileron travel, but they fail to make the proper (obvious) diagnosis because they presume that the solution lies in more advanced programming.

The crux of airplane setup is therefore identifying the correct areas to target when working to improve handling and performance, as well as not falling for the setup trends aimed at improving a certain condition or maneuver that come at the cost of making everything else the pilot does more difficult. The first step is understanding that 95% of an airplane's handling and performance is determined by the basic airplane setup. Most of the advanced programmable features that get so much attention today are there mainly to help perfect an otherwise good flying airplane. Consequently, if you're unable to quickly achieve a high level of handling comfort, you need to look for deficiencies in the basic setup, e.g., moving the C.G. or increasing or decreasing travels for example. However, if the handling is very good, but you want to make it a little better, the answer likely lies in fine tuning the programming. At the same time, guard against making the cardinal setup mistake of sacrificing overall handling comfort trying to improve an isolated condition or maneuver, or you may just find yourself leaving the plane at home or selling it as so many pilots end up doing each year.

Lastly, since no other subject invites more varied opinions than how to best set up an airplane, some readers will no doubt feel that certain nuances been have been left out, and some will be upset because the advanced principles and formulas that are the stock and trade of professional aerodynamicists are not included when describing optimum C.G. location and wing incidence for example. However, the objective of this book is not to try to cover every obscure exception or teach aerodynamics, but to condense the essential airplane setup principles into simple fool proof rules-of-thumb applicable to 99% of the airplanes in the sport that the average pilot can wrap his head around and thus optimize his airplane for success.

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About the Manual

The intention of this manual is to present the information in a logical sequence that can be quickly accessed at home or at the flying field, hence, each page can stand on its own and most pages feature a summary Key Point To Remember (KPTR) at the bottom to aid retention.

This manual features the fundamental airplane and radio setup checks that have proven during 1st U.S. R/C Flight School's Primary through Advanced Precision Aerobatic training courses to be essential for achieving the best results in the least amount of time with the least effort. In most cases, the emphasis at the school on optimizing each airplane for precision flying was not motivated by pilots' desire to compete, but to promote the sense of control, accomplishment, and flying with purpose that only precision flying offers. That is definitely the type of flyer that this manual is aimed at, as well as those looking to compete and win! While the setup principles covered are mostly aimed at optimizing precision aerobatic handling, the majority of the information also applies to primary trainers and more sedate sport models to achieve the most predictable handling possible.

It must be noted that 3D stunt flying involves a vastly different mind-set and airplane/radio setup compared to precision flying. Recognizing that everything in aviation is a tradeoff, the most important step before setting up an airplane is therefore deciding whether it will be used primarily for precision flying or extreme 3D stunt flying. I.e., a true precision setup prohibits all or most 3D maneuvers, whereas a 3D setup makes flying with precision far more difficult due to trading off smooth handling in order to achieve the extreme control deflections necessary to fly 3D. There's no in-the-middle, and those who try to set up an airplane for both end up with an airplane that, by definition, does neither as well as it could. Understand, if it were possible to optimize one airplane for both, or fix a flawed airplane with the radio, and thereby make the author's flight school and airshow operations more efficient, this manual would explain how. But the reality of unintended consequences (tradeoffs) always prevails. Of course, there are pilots who can fly precision aerobatics with an airplane setup for 3D, but it takes exceptional finesse, practice, and always being at the top of their game or flying instantly becomes jerky.

It comes down to most 3D pilots are motivated by wanting to be on the extreme cutting edge for all to see and are willing to put aside most everything else in that pursuit. Those who gravitate to precision aerobatics tend to prefer more variety, steady improvement every time they fly, and the personal satisfaction that comes from the pursuit of a job well done. Which do you think is more your style?

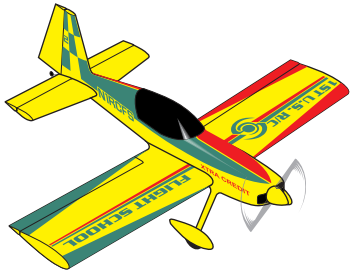
Those aspiring mainly to 3D are advised to check out 1st U.S. R/C Flight School's Park Flying 1-2-3D manual for detailed 3D setup instructions.

KPTR: To maximize your potential, choose either a dedicated 3D setup that excels at 3D, a dedicated precision setup that excels at precision aerobatics, or setup two different airplanes (one for each style of flying).

Utilize the ☑ Check boxes to track progress.

Aerobatic Airplane Considerations

Sport Aerobatic
- Constant-chord shoulder wing
- Symmetrical airfoil
- Minimal dihedral



Intermediate-Sport Aerobatic
- Constant-chord mid or low wing
- Symmetrical airfoil
- Minimal dihedral

Advanced Precision Aerobatic
- Tapered mid or low wing
- Symmetrical airfoil
- Minimal dihedral

Precision aerobatics is unarguably the most engaging and rewarding forms of flying available to the R/C pilot. A key component in that pursuit is securing a "neutral" airplane that flies like it's on rails and does only what you tell it to do.

Together with the physical size and travel of the control surfaces, how each model flies is primarily determined by the shape of the wing, the wing's location on the fuselage, and balance. As you already know, an airplane's wing generates the "lift" required to support the plane's weight. A wing positioned on top of the fuselage places the lift support above the plane's center of gravity (C.G.), resulting in an inherently more stable airplane that favors flying upright. Wing dihedral further enhances upright stability by angling the wing higher above the plane's C.G.. While a high wing airplane with ailerons is capable of some aerobatics, it's more of a struggle to do so. Mastering aerobatics is much easier with an airplane designed for aerobatics, or to be specific, one with a lower wing placement, a symmetrical airfoil, and little or no dihedral.

Mid and low wing airplanes, and most biplanes, with minimal dihedral locate the wing(s) closer to the plane's C.G., and thus, combined with a symmetrical airfoil, are more "neutral", i.e., prone to staying in the attitude the pilot puts it in. This type does not necessarily require any special flying skills, but since it is more maneuverable and will do whatever the pilot tells it to do, there's less margin for error and therefore pilots must more accurately control this aircraft type.

Once you've graduated to a tapered wing airplane like an Extra, Edge, MX, Cap, Sukhoi, Yak, etc., they are all equally capable, and except for the size of the control surfaces, any differences that are not setup related are so minor as to be undetectable to all but the most expert flyers. The practical consideration when shopping for the ideal aerobatic airplane comes down to whether it features conventional (non-oversized) control surfaces that will provide smoother control responses better suited to precision flying. Or, does it feature oversized 3D control surfaces more suited to extreme maneuvers, but then also increasing sensitivity and making it harder to fly precisely. (You can be almost certain that an airplane has over-sized control surfaces when references to "3D" occur in its name or advertising. Of course, that means that nearly every aerobatic airplane available today has oversized surfaces!)

Lastly, flat-plate and thin airfoil "foamies" tend to be unstable and difficult to trim, and therefore require more effort to fly in general. Consequently, flat-plate airfoil foamies are not recommended for precision aerobatic training (although, they are perfect for 3D training). Thus, if you ever see a pilot flying a foamie smoothly, he's no doubt, extremely skilled!

KPTR: Sport airplanes are easier to fly, but a tad harder to fly precisely.
Advanced airplanes offer more precise handling, yet demand more attention.