

HOW TO SET UP AND TRIM A MODEL AIRCRAFT

By
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Aims of the Talk Tonight

- ❑ What are we trying to achieve
- ❑ How to set up a model prior to flying for the first time
- ❑ What to look for on your first flight
- ❑ How to trim a model to correct problems

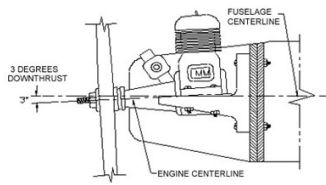
What are we trying to achieve

- ▣ Hands off Straight and Level Flight
- ▣ No coupling between the controls
- ▣ Control – Enough for what you need, but not too much to cause problems.
- ▣ Controls give Predictable and Repeatable results.
- ▣ A model which is easy to fly any way up.

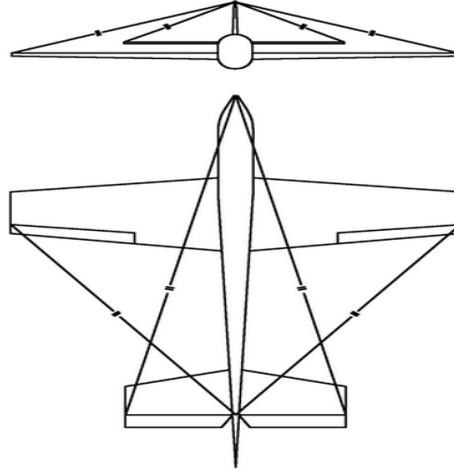
Model setting up and trimming is always a compromise

How to set up a model prior to flying for the first time

Airframe Alignment



Engine Down and Side Thrust



Airframe Alignment

Centre of Gravity Testing

- ❑ Different aircraft have different C of G requirements:-
 - 3D - Towards tail heavy
 - Pattern - Neutral to slightly tail heavy
 - Sport - Neutral to slight nose heavy
 - Trainers - Nose heavy
- ❑ When to check it?
- ❑ How to check Longitudinal C of G
- ❑ How to check Lateral C of G

Important:-

- C of G too far forward - Model flies badly,
- C of G too far back - Model flies only once

Centre of Gravity

Manufacturers Stated Value:- Between 15 and 16 cm back from Leading Edge

C of G Calculator

http://adamone.rchomepage.com/cg_calc.htm

- 5 % SM 15.44 cm
- 10 % SM 13.71 cm
- 15 % SM 12 cm

Aircraft Center of Gravity Calculator

Analytic Center (AC), Mean Aerodynamic Chord (MAC), Quarter Chord (QC), Wing Root (WR) and Mean Arm (MA) - Enter the values of all using the same units for all entries.

For an aircraft to be stable in pitch, its CG must be forward of the Neutral Point (NP) by a safety factor called the Static Margin, which is a percentage of the MAC (Mean Aerodynamic Chord). Static Margin should be between 5% and 10% for a good stability.

Wing Root Chord (AC)	44.5
Wing Tip Chord (FT)	22
Wing Sweep Distance (D)	8
Wing Half Span (YS)	80
Stabilizer Root Chord (AS)	21
Stabilizer Tip Chord (BT)	13
Stabilizer Sweep Distance (SD)	4
Stabilizer Half Span (YS)	11
Distance between both LE's (D)	80
Stabilizer Efficiency (EM)	70
Enter Static Margin, %	10
Mean Aerodynamic Chord (MAC)	34.52
Sweep Distance of MAC (E)	1.55
Fores Root Chord to MAC (G)	35.49
From Wing Root LE to AC	12.55
From Wing Root LE to NP	11.11
From Wing Root LE to CG	13.71
Wing Area	5320

Low Static Margin gives less static stability but greater elevator authority, whereas a higher Static Margin results in greater static stability but reduces elevator authority. Too much Static Margin makes the aircraft nose-heavy, which may result in elevator stall at take-off and/or landing. Whereas a low Static Margin makes the aircraft tail-heavy and susceptible to stall at low speed, e.g. during the landing approach.

*Choose Low Stabilizer Efficiency if the tail is close to the wing's wake

Internet

Manufacturers C of G is too far back, General opinion is it should be 14 cm back from Leading Edge max.

What size Servo do you need?

Yak 54

Maximum airspeed (mi/hr) **80**

	Aileron(s)	Elevator(s)	Rudder
Average control surface chord (cm)	7	7	10
Average control surface length (cm)	67	48	28
Maximum deflection of servo arm from center (degrees)	30	30	30
Maximum deflection of control surface from center (degrees)	20	20	35

Maximum required torque at maximum airspeed (Kg/cm) **2.8** **2.0** **7.6**

300 Extra

Maximum airspeed (mi/hr) **50**

	Aileron(s)	Elevator(s)	Rudder
Average control surface chord (cm)	6.5	5	8
Average control surface length (cm)	50	40	24
Maximum deflection of servo arm from center (degrees)	30	30	30
Maximum deflection of control surface from center (degrees)	45	45	45

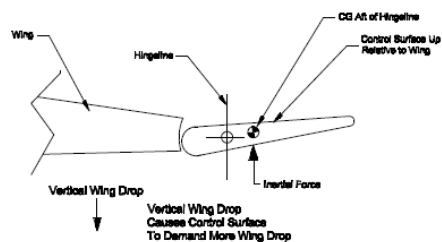
Maximum required torque at maximum airspeed (Kg/cm) **4.0** **1.9** **2.9**

Pushrod, Snake or Pull-Pull connections

- ☐ Requirements
 - Slop Free
 - Strong Enough to carry the forces
 - Flutter Free
- ☐ Types
 - Pushrods
 - Pull Pull Controls
 - Snakes
 - Torsion Bars

Flutter Prevention

- ☐ What Causes Flutter



- ☐ How to prevent it
 - Slop Free Linkages
 - Mass Balancing Control Surfaces

What to look for on your first flight

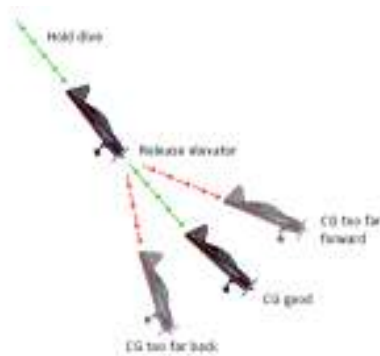
Centre of Gravity Initial check - 45 degree Dive Test

Step 1 - Trim the model for a nice hands free
glide with Engine on tick over.

Step 2 - Put the model into a 45 degree dive

Step 3 - Neutralise the elevator and watch what
happens

What to look for



Note: Repeat test near end of flight when fuel tank is low
(i.e. C of G as far back as it will get during the flight)

C of G Lateral Test

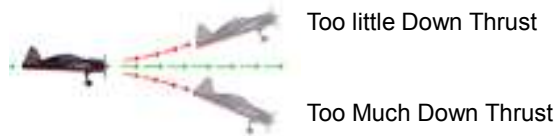
- ❑ Trim the model for hands free glide
- ❑ Push the nose down into a vertical dive
- ❑ Neutralise the controls
- ❑ Pull up elevator (careful not to add any aileron)
- ❑ Watch what the model does
- ❑ Model should fly with wings level.

Engine Thrust Adjustment

Down Thrust

Step 1 - Trim model for hand free flight at Cruise throttle setting

Step 2 - Open Throttle and watch what happens to model

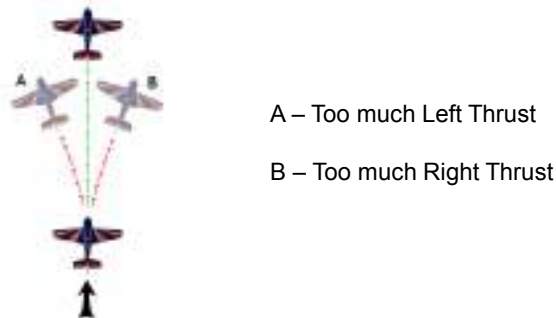


Engine Thrust Adjustment

Side Thrust

Step 1 - Fly the model flat then pull up into a vertical climb with throttle set to Full.

Step 2 - Watch what happens to the model



Centre of Gravity – Fine Adjustment

Inverted Flight Test

- Step 1 - Trim the model for level flight at cruising Speed
 - Step 2 - Roll Inverted and see how much Down Elevator is required to continue flying level.
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- ☐ C of G too far back - Up elevator or no elevator required
 - ☐ C of G about right - A little Down elevator required
 - ☐ C of G too far forward - A lot of down elevator required

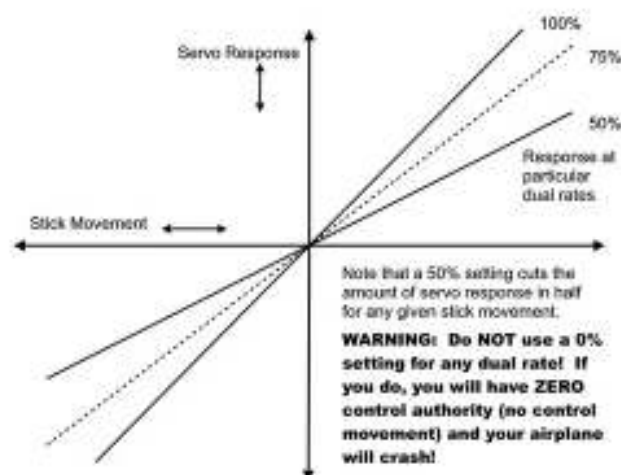
Computerised Transmitters

- ☐ Servo Reversing
- ☐ End Stop Adjustment
- ☐ Mixing
- ☐ Dual Rates
- ☐ Exponential

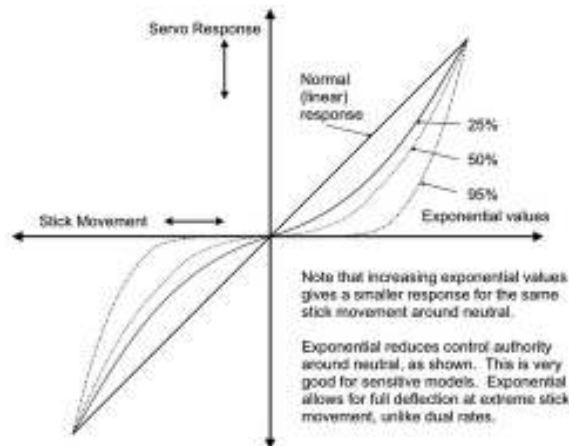
Mixing

- ❑ The ability of one function to affect another.
- ❑ Most common mixes are:-
 - Rudder - Aileron - To correct rolling action on applying rudder.
 - Rudder - Elevator - To correct diving action on applying rudder
- ❑ How much do I need?

Dual Rates



Exponential



Example of the Computer settings on my Wot 4 XL

	Low Rates		High Rates	
	Exponential	Rate	Exponential	Rate
Rudder	40%	60%	40%	100%
Elevator	30%	75%	30%	100%
Aileron	40%	75%	40%	100%

Rudder Mixes	Left	Right
Rudder - Aileron	-19%	-19%
Rudder - Elevator	7%	7%