SERVO 101

Setting up the Controls for the
RCCD All Star 60

How do we Pick a Servo?

- Physical Size (.3*.5*.7)-(1.5*2.0*2.5)
- Physical Weight (5 Grams)-(150 grams)
- Output Speed (.09 Sec-.250 Sec)
- Output Torque (11.1 oz-in – 200+ oz-in)
- What you can afford $$ ($2.95 - $200)
- What you have in the workshop.

What we know from the list

- We know what size will fit our application.
  - Not going to put 150 gram servo in Foamy
  - 5 Gram 11 oz-in Micor servo doesn't go in 120mph Pylon Racer
- We know the speed we need by Style of Airplane
  - We know we don't need a really fast servo for CUB
- We know what we afford.
  - How much money can you hide from our wives?
- We normally question how much torque we need.
  - Lets find out how.

How do we figure out torque needed?

- Torque the Engineers way.

The mathematical model: t = (AMPC2LV2) / (4RT) where

t = servo torque

A = sin(S) * tan(S) / tan(s)

S = control surface angle from neutral

s = servo arm angle from neutral

M = molecular weight of air (~28.6 g/mol)

P = air pressure (1 atm)

C = average chord length of control surface

L = average length of control surface

V = airspeed

T = air temperature (~290 K)

R = ideal gas constant (82.056 atm cm^3 / mol K)

Torque the easy way (Our Way)

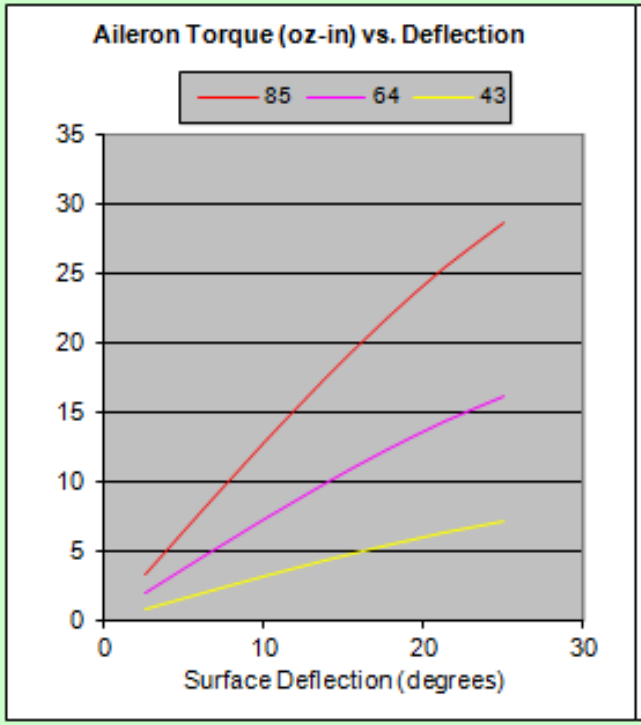
- What we need to know.
  - Size of Control surface to move. (CM or IN)
  - Control surface movement wanted. (Degrees)
  - Servo Movement to get Control Surface Movement.
  - Speed of Model. (MPH)
    - Prop Pitch In * RPM * 60 / (12*5280)
    - OS Max 61 FX With 11 * 7 = 12,300 RPM
    - 7 * 12,300 * 60 / (12 * 5280) = 81.53 Mph

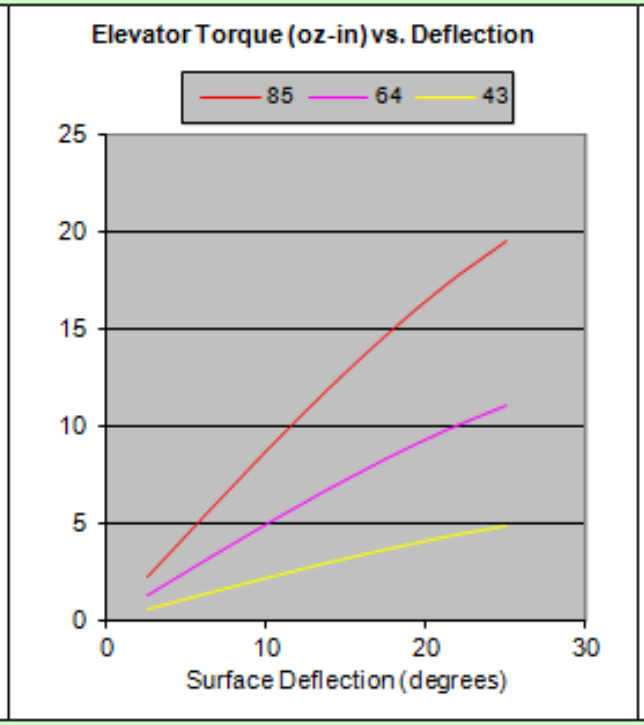
Calculate RCCD All Star Controls

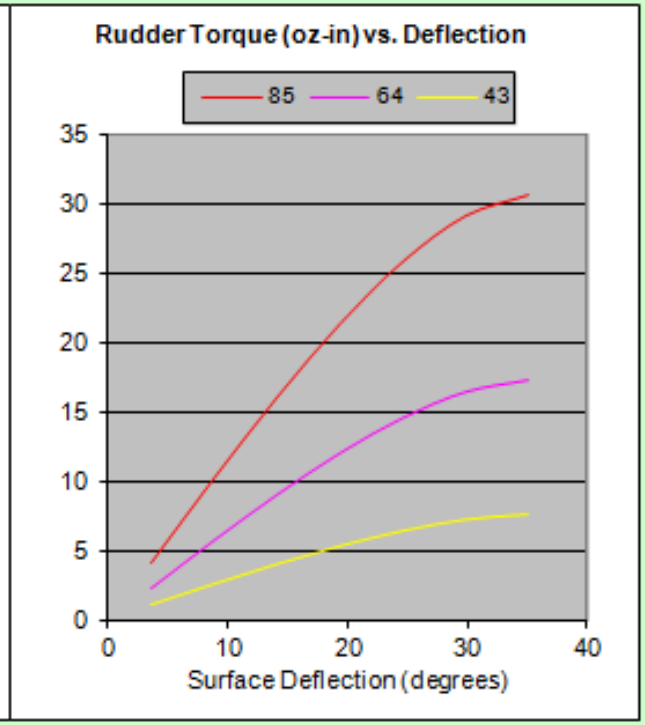
- Example Excel Sheet Demo
- Aileron Torque
  - Size 33.00 in * 1.75 in
- Elevator Torque
  - Size 11.00 in * 2.50 in
- Rudder Torque
  - Size 10.00 in * 3.00 in

Maximum airspeed (mi/hr)	85

	Aileron(s)	Elevator(s)	Rudder
Average control surface chord (cm)	4.445	6.35	7.62
Average control surface length (cm)	83.82	27.94	25.4
Optional: Maximum available servo torque (oz-in)	69	69	120
Maximum deflection of servo arm from center (degrees)	35	35	50
Maximum deflection of control surface from center (degrees)	25	25	35
Maximum required torque at maximum airspeed (oz-in)	28.6	19.5	30.5





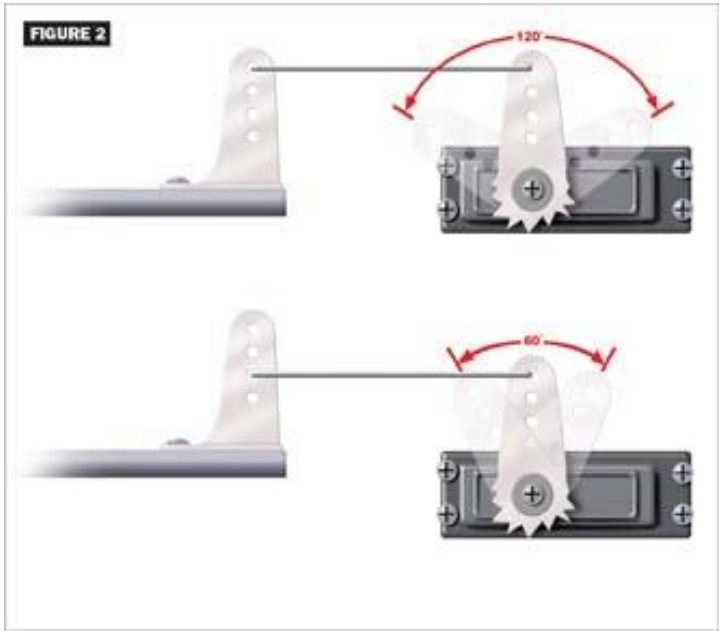


How do we get it hooked up?

- Smooth and Bind Free

Correct setup of linkages

- Servo travel to Max for wanted Movement.
  - Example Demo



Servo Horn and Control Horn Rules

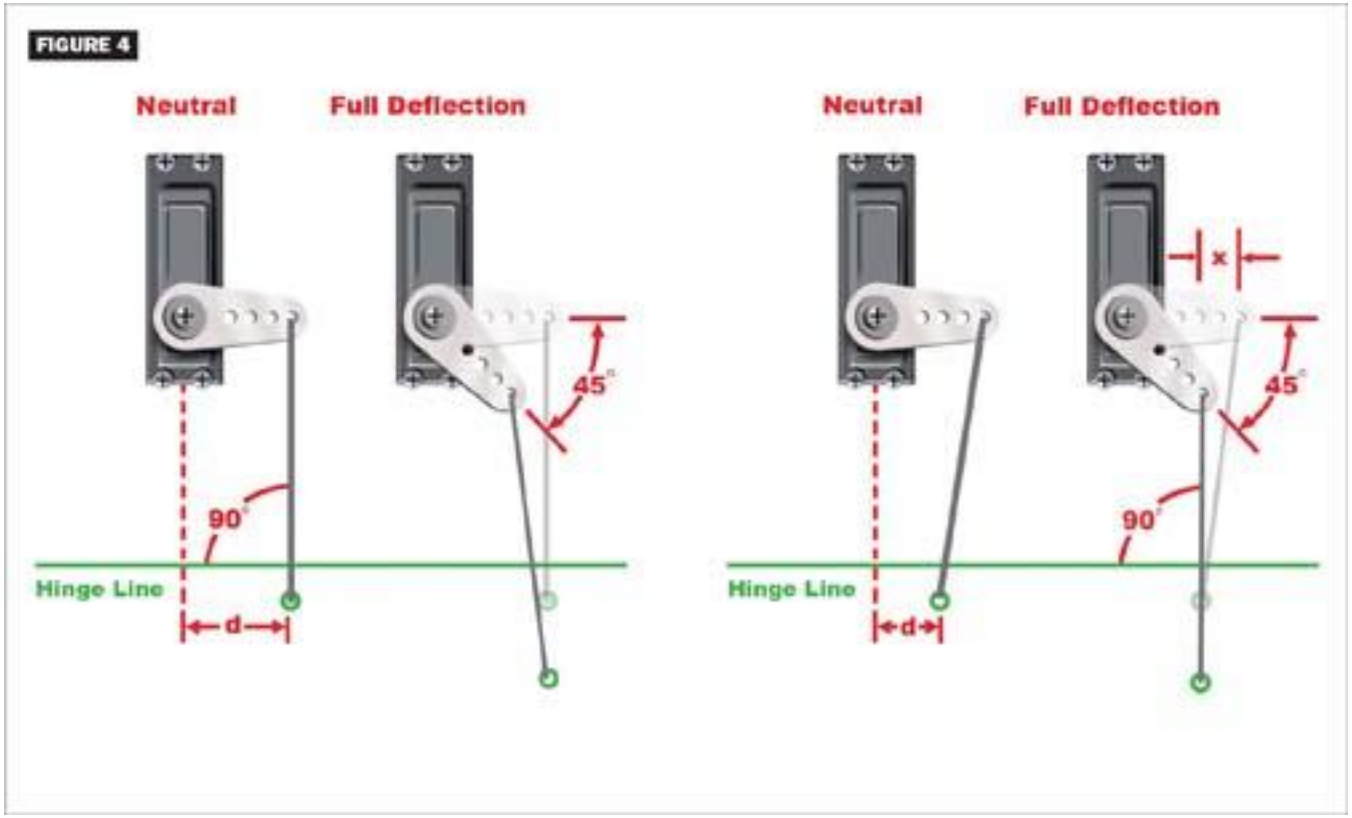
- **Servo** Horn
  - Inside Hole closest to the center for the smallest movement
  - Outside Hole for the greatest movement
  - Move Out to increase throw
  - Move In to decrease throw

Servo Horn and Control Horn Rules

- **Control** Horn
  - Inside Hole closest to the control C/L greatest movement.
  - Outside Hole for the smallest movement.
  - Move Out to Decrease throw
  - Move In to Increase throw.

Correct setup of Linkages

- Put the right angle at the right time.



Servo Horn FYI

What type of Servo and Control Horn connectors to use?

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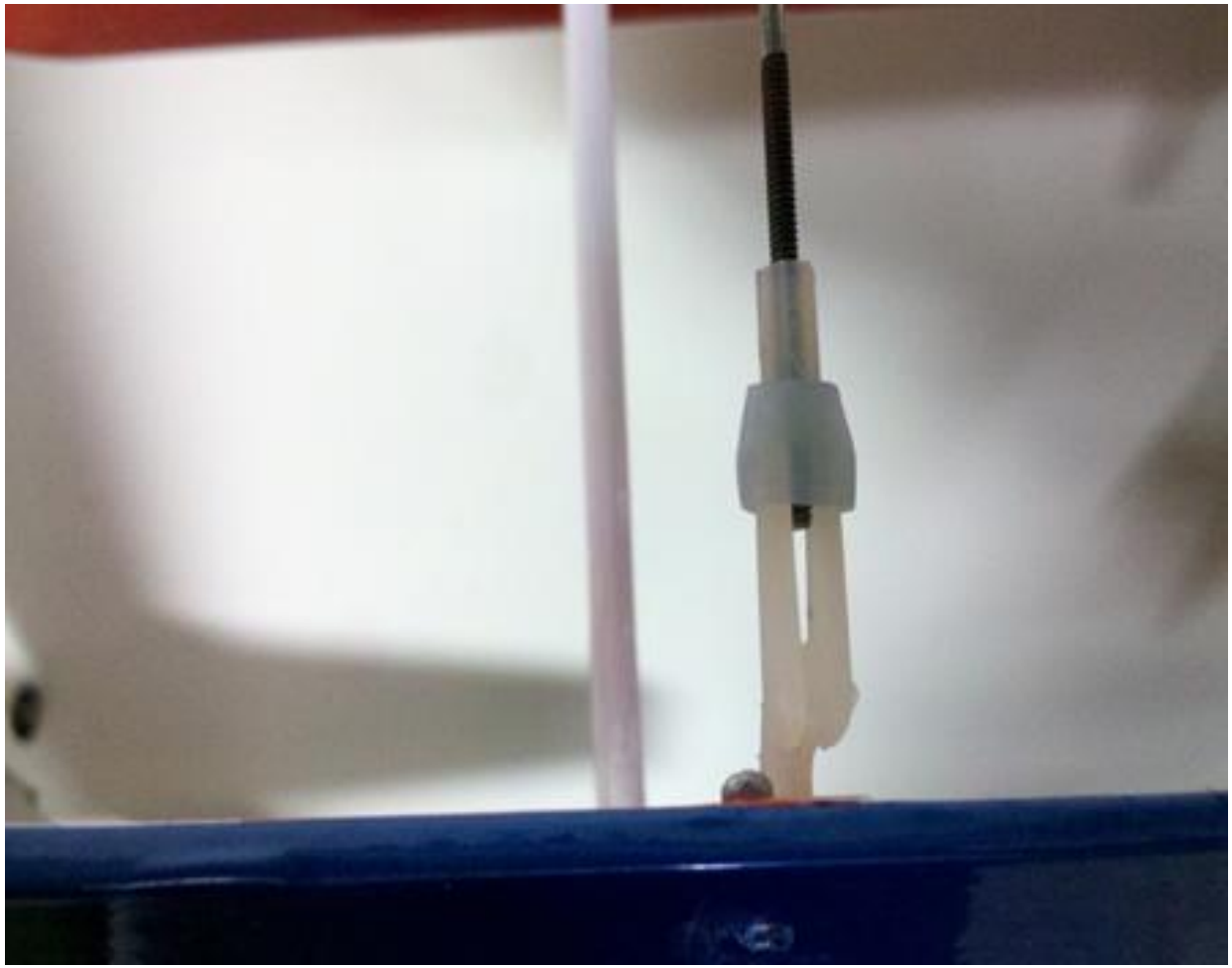

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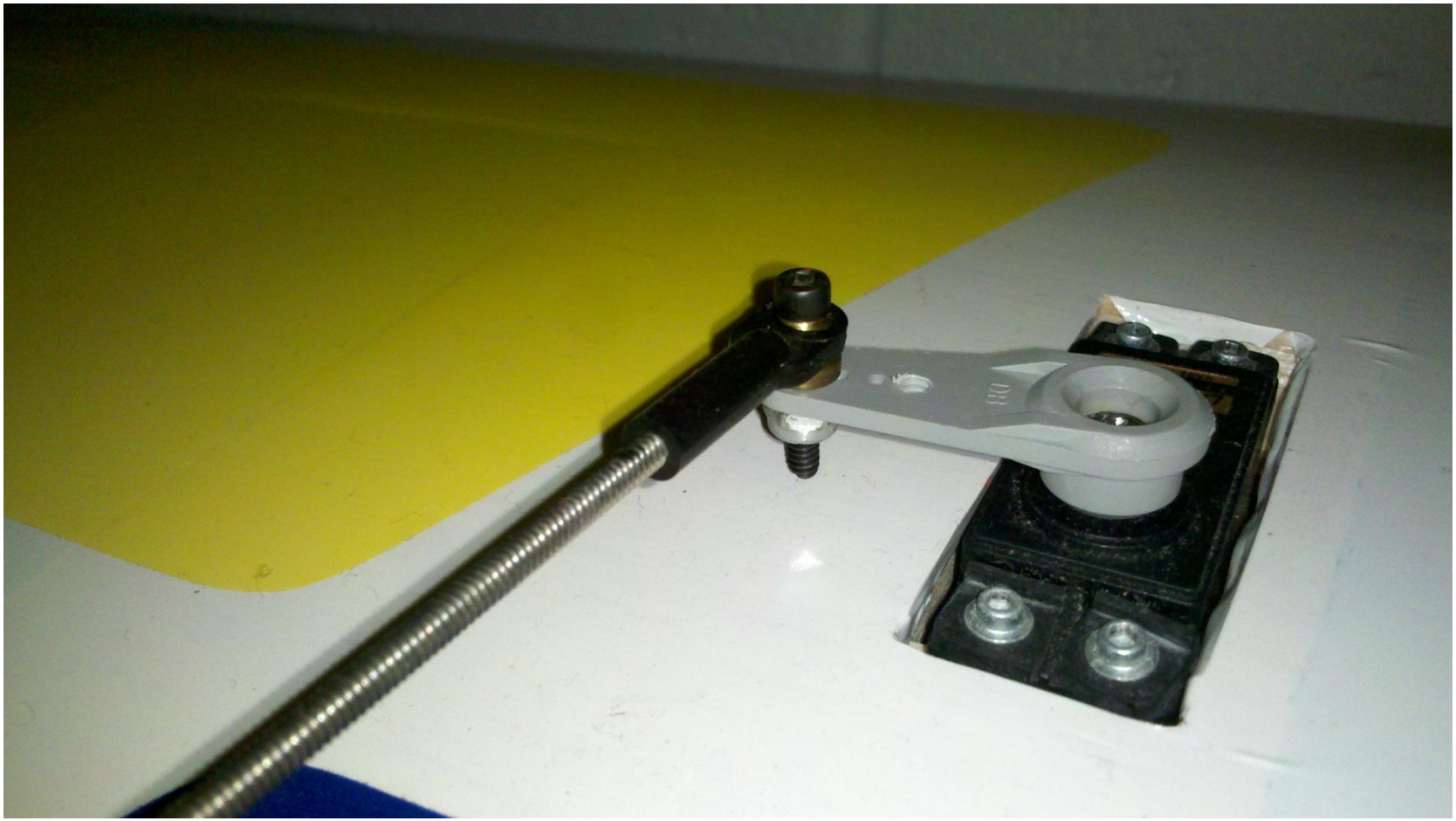

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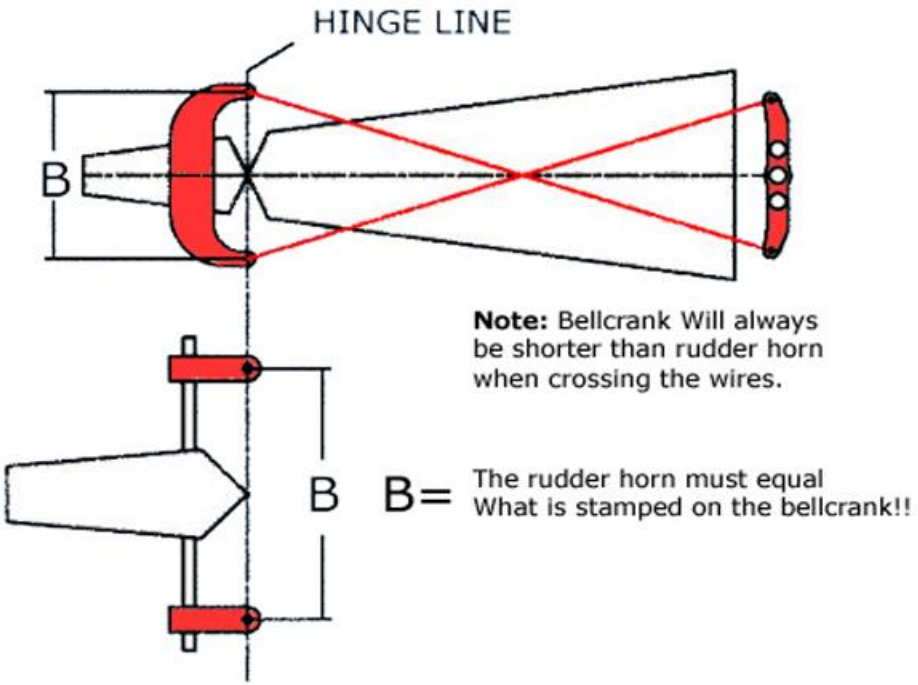
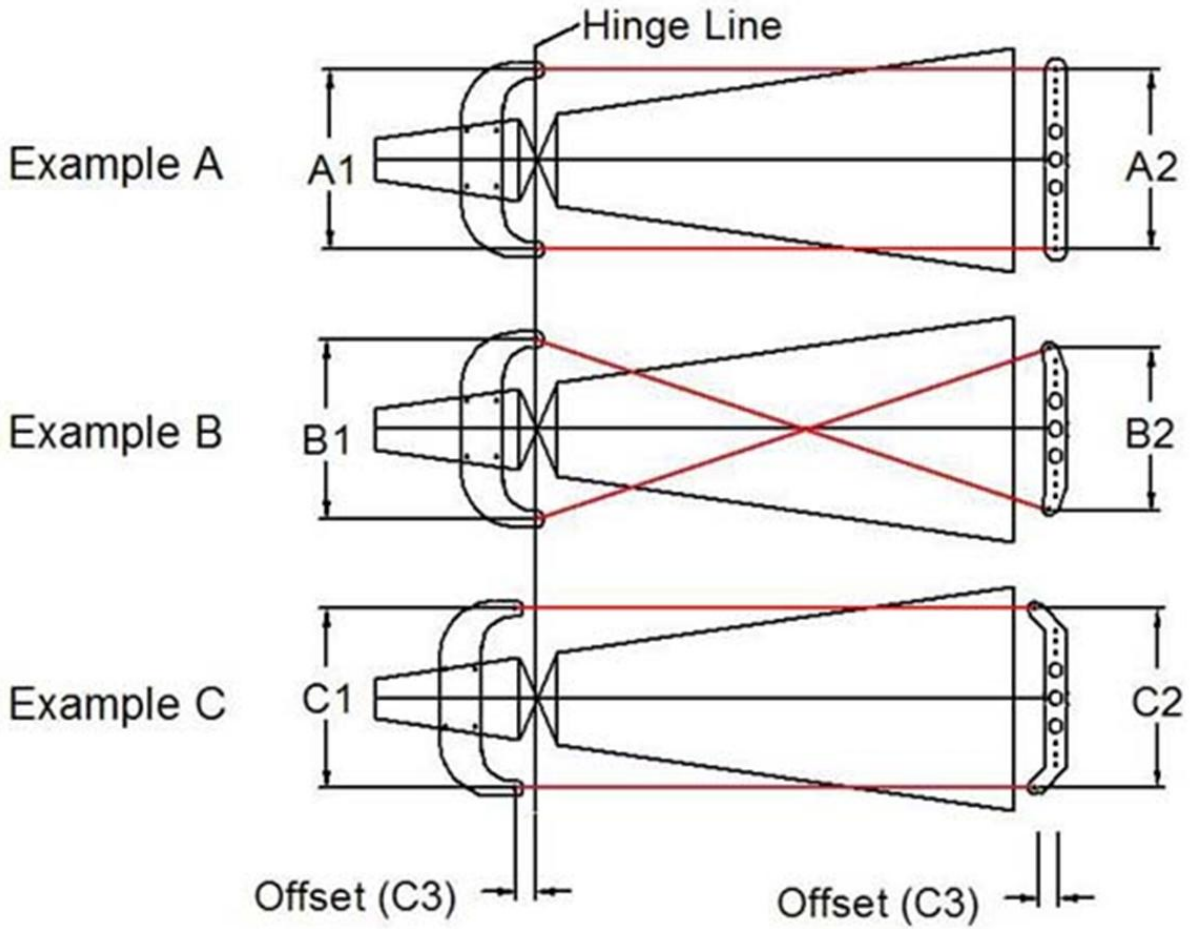
Pull-Pull Control Setup

- Dual positive control Movement.
  - Vs. Normal Compression and Tension movement



Pull-Pull layout



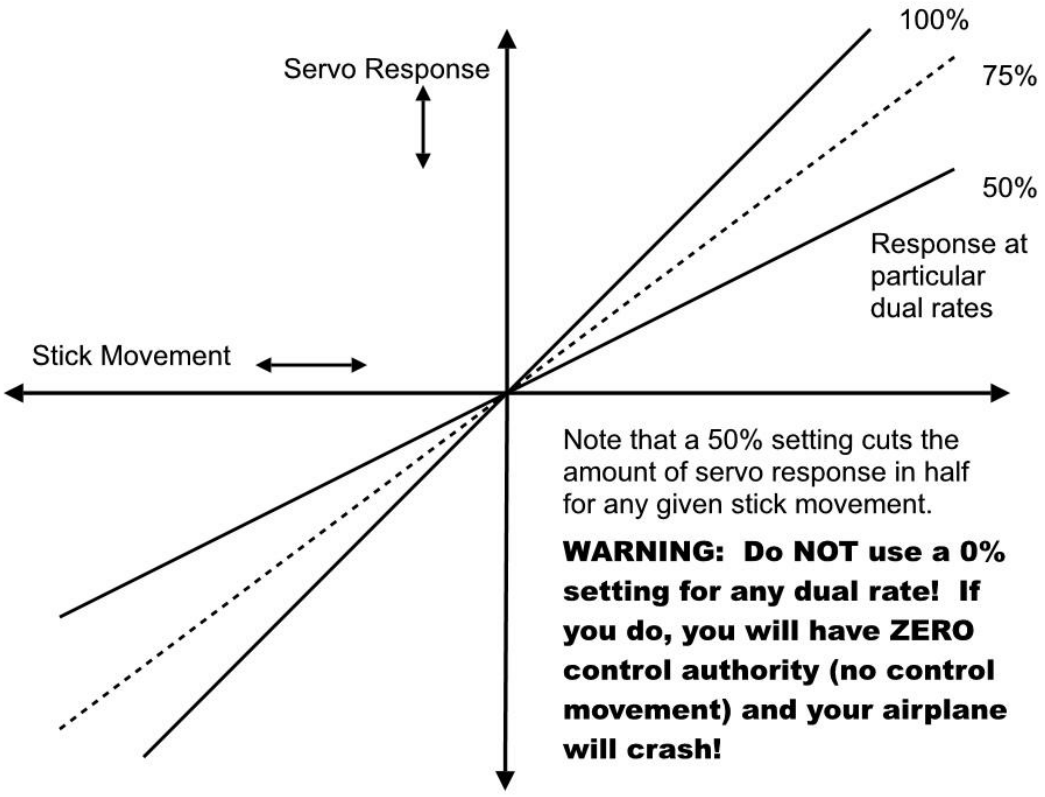
How do I make it all Work Smooth?

- How can I make the model not so sensitive?
  - Dual Rates
  - Expo In the Radio
  - Reducing Control throws
  - Slow Down

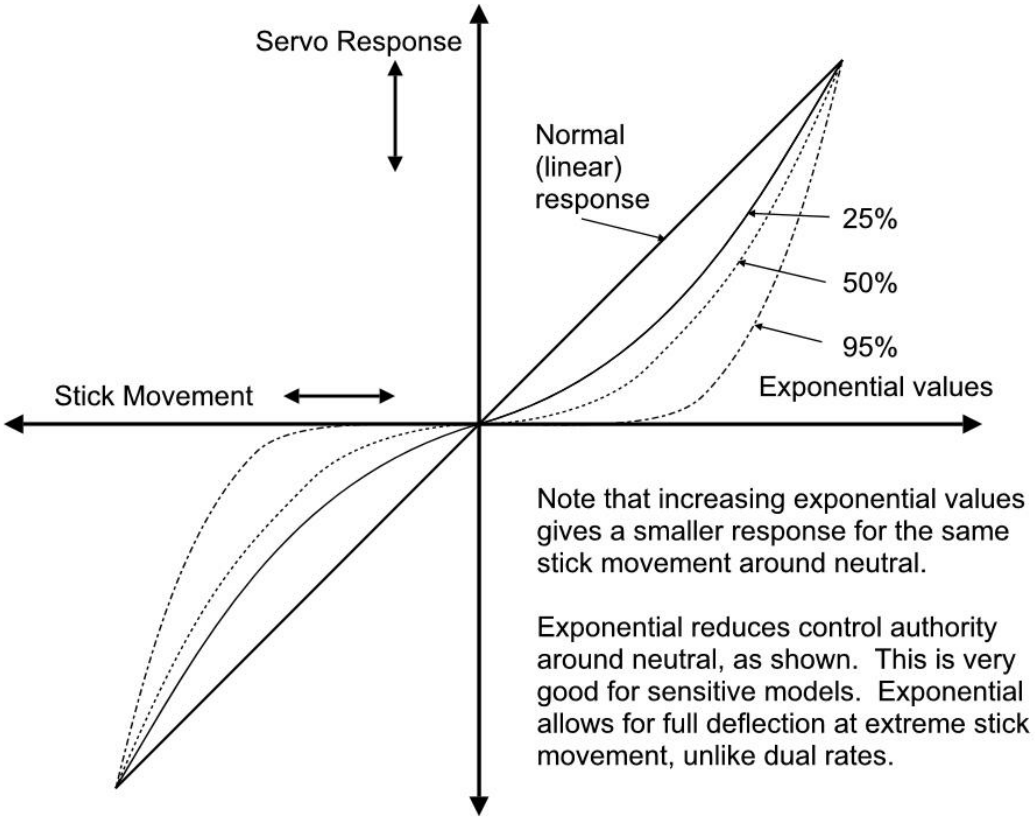
What is Dual Rate and Expo?

- Dual rate is a function (Switch) that changes the control throws during flight.
  - Some Radios have multiple switches and can control multi dual rates functions.
    - 80%, 60%, 100% . Takeoff, To Much, To Little
- Expo is a function that softens the controls around the center movement of the radio stick.
  - Same control movement at end stick travel, less control movement around center. Softer feel.

Dual Rate


Servo Response
100%
75%
50%
Response at particular dual rates
Stick Movement
Note that a 50% setting cuts the amount of servo response in half for any given stick movement.
WARNING: Do NOT use a 0% setting for any dual rate! If you do, you will have ZERO control authority (no control movement) and your airplane will crash!

Expo



Note that increasing exponential values gives a smaller response for the same stick movement around neutral.

Exponential reduces control authority around neutral, as shown. This is very good for sensitive models. Exponential allows for full deflection at extreme stick movement, unlike dual rates.

Dual Rate and Expo

- Demo Dual Rate
  - 80%, 60%, 100%
- Demo Expo
  - 0%, 50%, 90% (30%-40%)

Q&A

- Thank You