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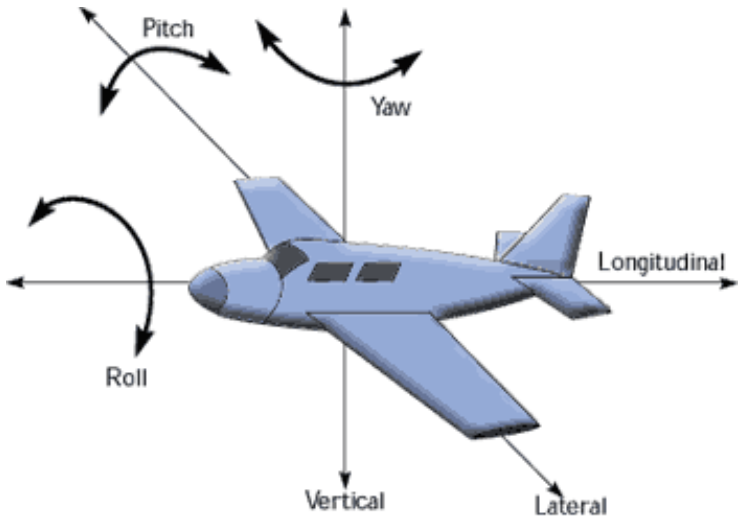
Fly the Limit

Setting Airplane and Radio for Precision Aerobatics

Seminar Outline

- General Principles
- Airplane Key Settings
- Permanent Radio Settings
- Activated Radio Settings
- Radio Flight Conditions



Seminar Outline

General Principles

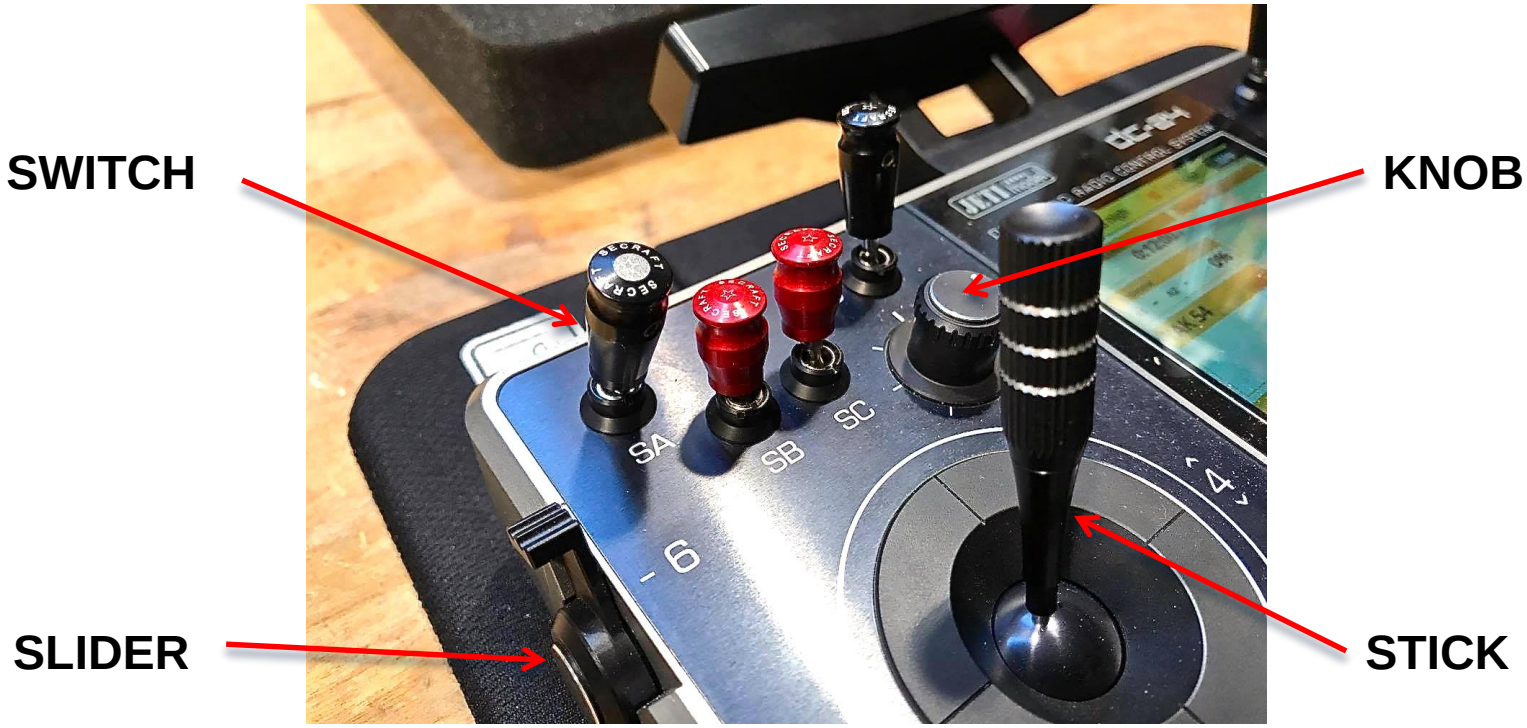
- Pilot's Attention
- Safety Solutions

Pilot’s Attention

- Never loose site of the airplane, never look to the radio.
- Think about the sequence, do not think about your switches.
- Minimize the use of sliders and switches.
- Automatize your movements.

Safety Solutions

- Implement ‘Stupid Proof’ solutions, so that anxiety or lack of attention will never result in a crash.
- Dangerous commands should go on sliders or knobs.
- Switches should activate only flight conditions.



Airplane Key Settings

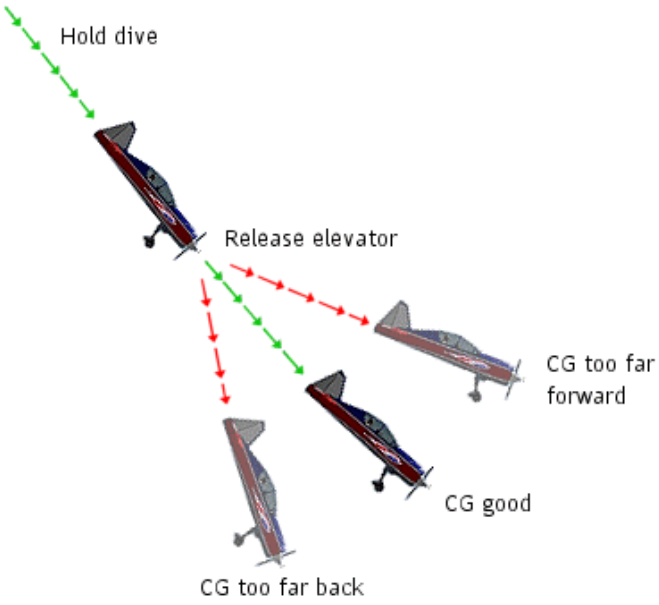
- Balance CG
- Check engine incidence
- Set throws
- Align Elevator

Balance CG

AFTER LEVEL FLIGHT TRIMMING

- **45° down line, moderate throttle, elevator centered, observe positive or negative pitch:**
  - If Negative: CG too far back
  - If Positive: CG too far forward

- **Inverted flight, full throttle, elevator centered, observe positive or negative pitch:**
  - If Positive: CG too far back
  - If Negative: CG too far forward
  - If very slightly Negative: right CG

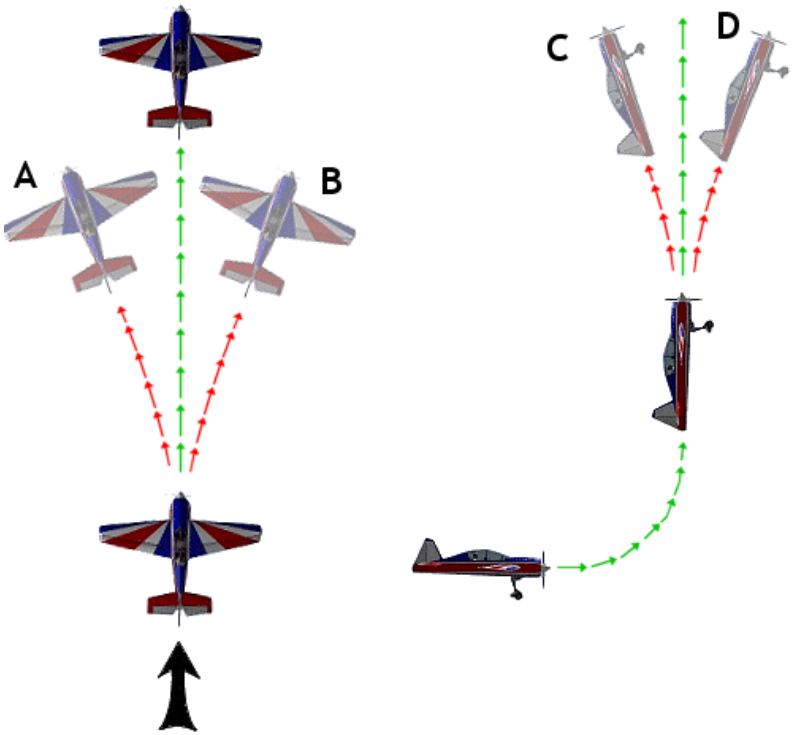


Outcome is determined by the trimming required to maintain level flight at full power

Check Engine Incidence

BEFORE LEVEL FLIGHT TRIMMING

- **Vertical up-line at full throttle, rudder and elevator centered, observe a significant right or left yaw:**
  - Modify engine incidence accordingly.
- **Vertical up-line at full throttle, rudder and elevator centered, observe a significant up or down pitch:**
  - Modify engine incidence accordingly.

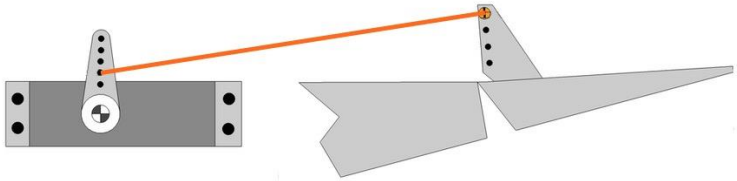


A = insufficient right thrust
B = too much right thrust
C = insufficient down thrust
D = too much down thrust

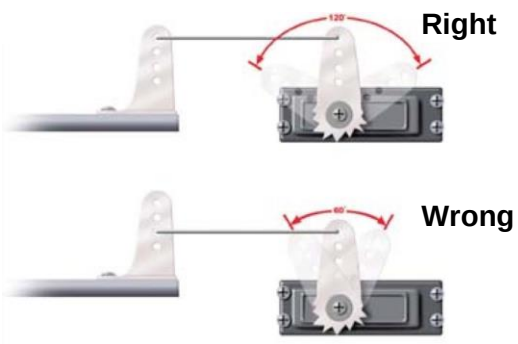
Set Throws

PRECISION AEROBATICS REQUIRES SENSIBILITY

- 20-30° movement for ailerons and elevator is enough.
- Do not de-multiply servo strength installing very long arms on servo and moving surfaces: 1 to 1.5 inches is enough
- Maximize the use of all servo 180° pixel range.
- If throws are too large, reduce them using ATV or Dual Rates



Less control surface movement, more precision and maximum leverage

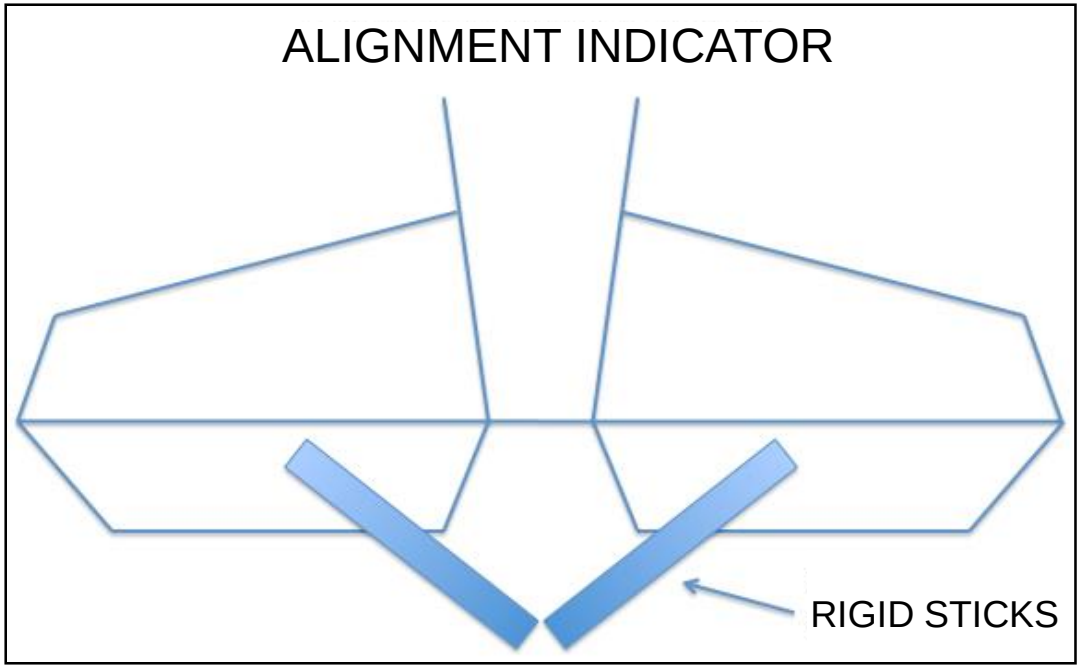


Maximize the use of your radio sensibility

Align Elevator

PREVENT CLIMBS WITH A JAW TO CORRECT

- Check alignment of elevators:



However, if your wings are not level when you pitch, you will still experience the need to correct yaw during vertical climb

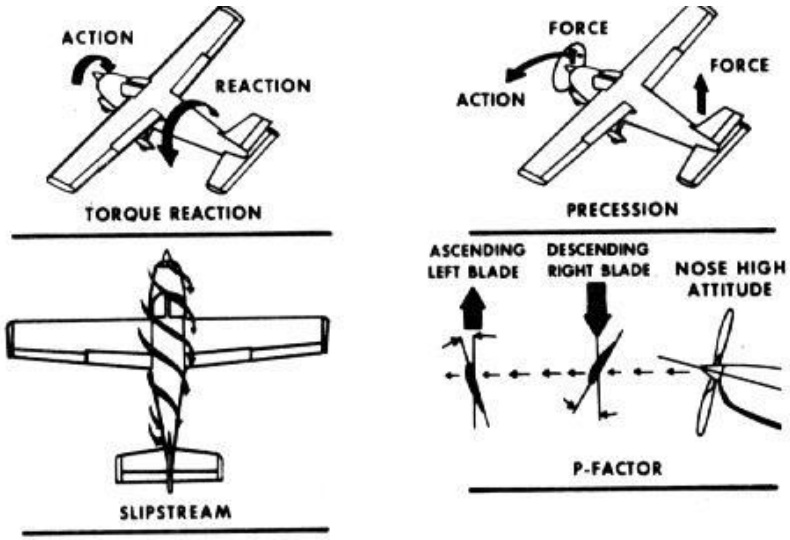
Permanent Radio Settings

- Left Turn Tendency
- Down Line Positive Pitch
- No Straight Rolls
- No Power Progression
- No Straight Knife Edge

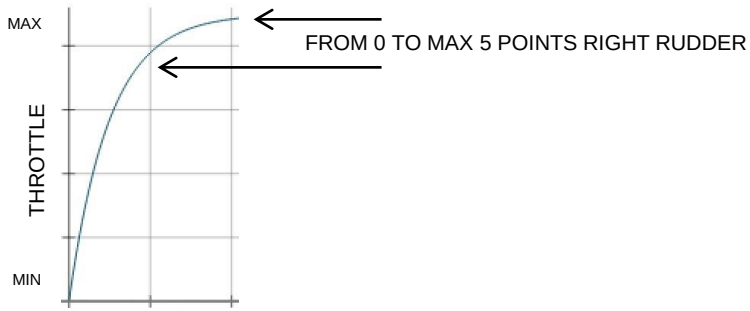
Left Yaw Tendency

AFTER PROPER ENGINE INCIDENCE SETTING

- **Vertical up-line at full throttle, you may notice a slight left yaw tendency:**
  - Introduce a master-slave permanent mix:
    - Master: Throttle – Slave: Rudder
    - Moving versus max throttle introduce from 2 to 5 points right rudder
    - Check servo monitor versus stick position
    - If more then 5 points are needed, check engine incidence



This tendency is originated by several aerodynamic factors that are often summarized as 'Torque Effect'



Down Line Positive Pitch

AFTER PROPER CG SETTING

- **Vertical down line at zero throttle, you may notice a positive pitch tendency:**
  - Introduce a master-slave permanent mix:
    - Master: Throttle
      Slave: Elevator
    - At minimum throttle introduce 2 to 4 points negative pitch
    - Check servo monitor versus stick position
    - If more then 4 points are needed, check elevator incidence versus wings

No Straight Rolls

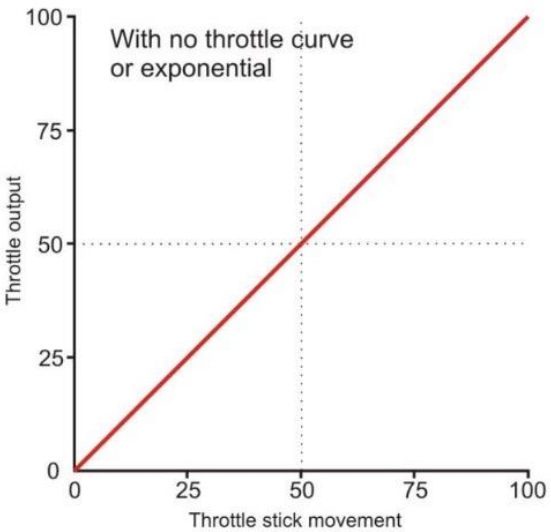
- **45° Up line, full throttle, sequence of rolls versus left: notice the tendency of flight path to turn right (or vice versa):**
  - Introduce Aileron Differential:
    - Reduce down aileron throw versus up aileron throw by 5 to max 15%
    - If more is needed check wings and elevators incidences

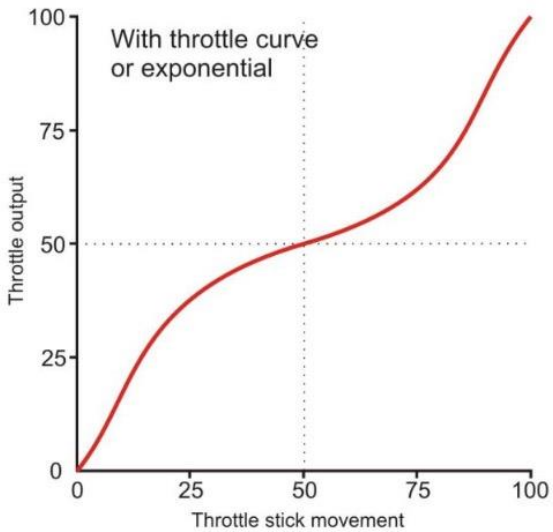
Adverse yaw occurs because a downward deflected aileron causes more drag then the upward deflected aileron. This drag pulls the airplane out of flight path during rolls in a direction opposite to roll versus

No Power Progression

- **Do you experience a 90% power position?**
- **Do you feel a cruising speed at 60% power?**
- **Do you experience a slow approach at 30% power?**

SET A THROTTLE CURVE





- **If you do not, then set a throttle curve:**
  - Normally throttle is less sensitive at intermediate ranges, because our carburetors and engine torque curve do not provide a linear power progression, as we would expect from our linear throttle stick

No Straight Knife Edge

- **Positive or negative pitch on knife edge:**
  - Introduce a master-slave permanent mix:
    - Master: Rudder Slave : Elevator
    - Add positive or negative elevator in presence of rudder input

PITCH AND ROLL TENDENCY

- **Right or Left Roll on Knife Edge:**
  - Introduce a master-slave permanent mix:
    - Master: Rudder Slave : Ailorance
    - Add right or left roll in presence of rudder input

Many Pilots prefer this correction as part of a 'Rolling Circle' Condition

Activated Radio Settings

- Throttle Cut
- Choke

Throttle Cut

MAKE SURE YOU CAN KILL ENGINE AT ANY TIME

- **Set up a Slider to control Throttle Cut.**
  - Throttle can be cut by reducing gasoline injection below idle level
  - Much safer to use an electronic throttle kill switch

THROTTLE CUT ON A SWITCH IS DANGEROUS

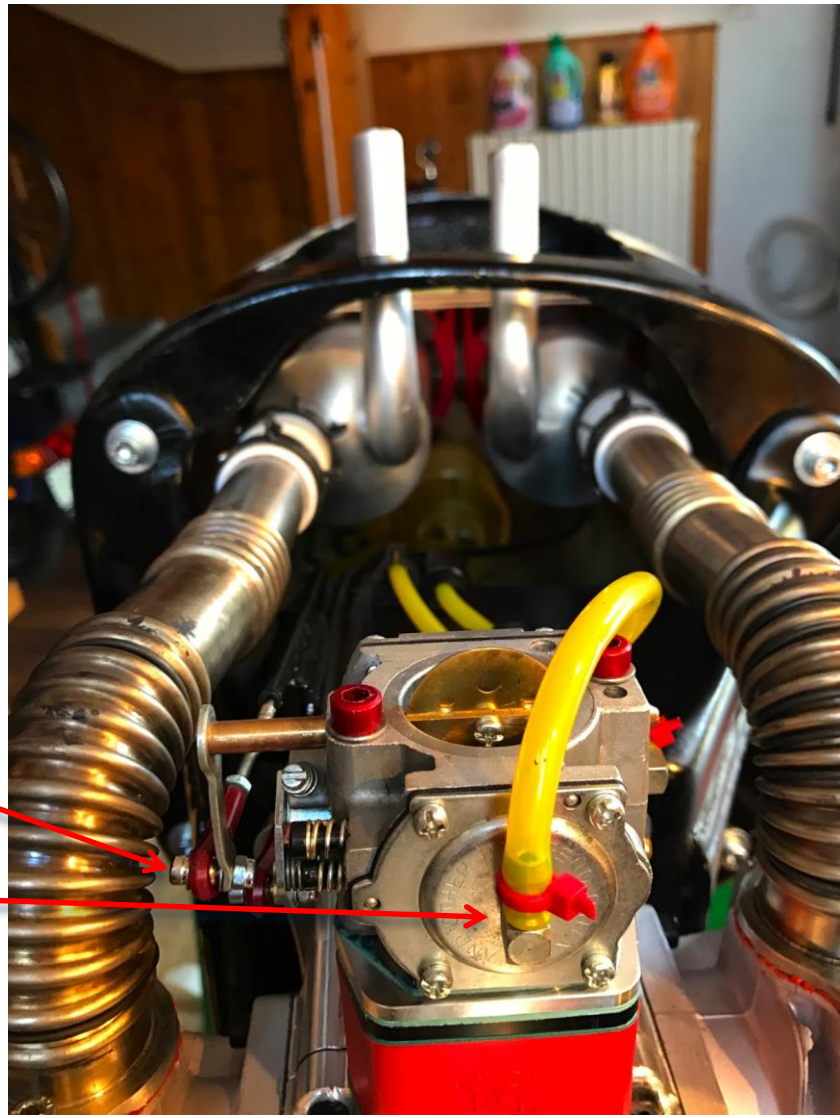
ELECTRONIC KILL SWITCHES

Choke

- **Set up a Slider to control Choke**
  - On large airplanes it is handy to install a servo to control choke
  - Many Pilots prefer a manual set up because it is lighter

CHOKE CONTROL ARM

On some engines the calm air intake helps mid-range stability



Flight Conditions

- Create Flight Conditions
- Spin
- Rolling Circle
- Snap
- Land
- Organize Radio Deck

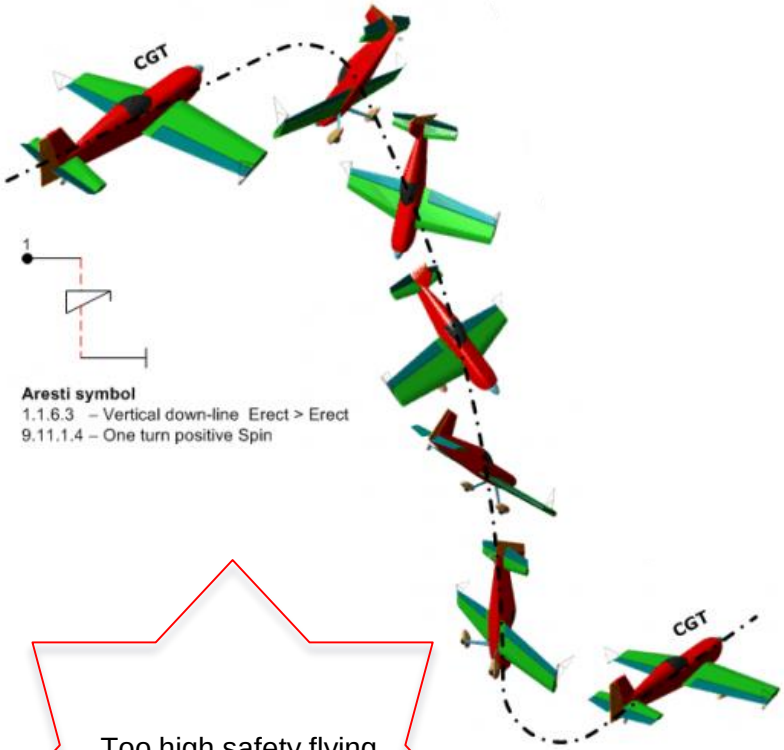
Setting Flight Conditions is very subjective.
It depends on Pilot's preferences and airplane performance. Therefore, the following are just 'Food for Thought' ideas.

Create Flight Conditions

- **'Fly' = Default Condition**
  - **No switches activation – Default**
  - Small throws to perform smooth aerobatics (1-1.5 in. servo arms and 20-30° throw)
  - Safety Flying idle set in this condition
- **Create a New Condition**
  - Add it to the list
  - Name it
  - Set a Switch to control it
  - Then activate the Condition with the switch
  - Then set the changes you desire
  - At the end check servo monitor for appropriate activation
- **Set Priorities among Conditions**

Spin Condition

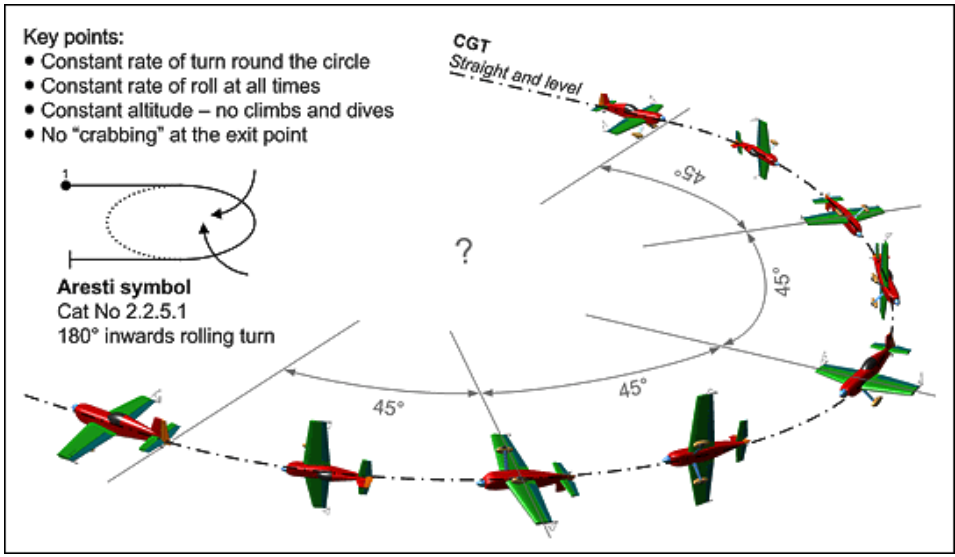
- **Activate Spin condition on a switch:**
  - Increase elevator throw (+30%)
  - Increase rudder throw (+20%)
  - Set specific throttle idle level
    - Mind cylinders cooling danger



Too high safety flying idle setting is the most common cause for stalling difficulty

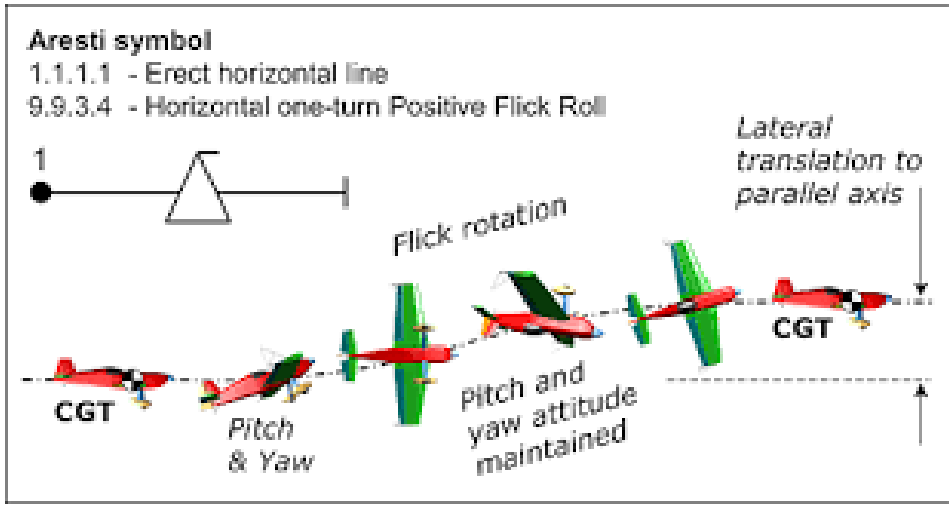
Rolling Circle

- **Activate Rollin Circle condition on a switch:**
  - Reduce aileron throw (-10%)
    - Reduce exponential (max 5-10% level)
  - Reduce elevator throw (-15%)
    - Reduce exponential (max 5-10% level)
  - Reduce rudder throw (-20%)
    - Reduce exponential (max 5-10% level)
- **Activate Knife Edge mix previously determined**



Snap

- **Activate Snap condition on a switch:**
  - Slightly Increase Aileron Throw (+5-10%)
  - Significantly Increase Elevator Throw (+20-30%)
  - Significantly Increase Rudder Throw (+20%)



- **Activate logical switch on throttle stick:**
  - Set three snap level conditions automatically activated on the basis of throttle level:
    - Snap switch ON
    - Throttle level High-Mid-Low each allowing for a specific condition setting

Land

- **Activate Land condition on a switch:**
  - Increase Elevator Exponential (+10%-20%)
  - Set low idle condition.
  - Higher safety flying idle is therefore set within the default Fly Condition

TAXI

- **Activate Taxi condition on a switch:**
  - Max Throw on Elevator
  - Max Throw on Rudder

Organize Radio Deck

- **Switches, Sliders and Knobs all activated in the same direction**
  - All In or All out
  - Clock wise or counter
- **Flight Conditions Switches all in the same deck area** (aileron hand)
- **Dangerous functions on sliders or knobs**

MODE 4