

Effect of Controls

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Eurofox 3K 24-7771

- Primary effects
 - Demonstrations at slow speed, 4500rpm, 75-80KIAS
 - First show only primary effects
 - * pitch
 - “nose high attitude”
 - * yaw
 - counter with aileron to ensure only yaw
 - “nose attitude moving laterally across the horizon”
 - * roll
 - counter with rudder to ensure only roll
 - “attitude shows we are in a roll”
- Secondary effects
 - Demonstrations at slow speed, 4500rpm, 75-80KIAS
 - pitch
 - * no secondary effects, but does have “side effects”
 - decaying airspeed
 - increasing altitude
 - “nose high attitude”
 - yaw
 - * “outside wing has an increased speed and therefore secondary roll effect”
 - roll
 - * roll to AoB
 - * slip effect of roll
 - * the slip effect of roll changes direction of relative airflow giving the fin an AoA, leading to secondary yaw
- Adverse yaw
 - Demonstration at slow speed, 4000rpm, 65-70KIAS
 - “adverse” meaning undesirable
 - “a yaw in the direction to the opposite of the roll”
 - demonstrate using aileron only, no rudder
 - caused by
 - * many pilot manuals talk only about additional

- drag caused by downward deflected aileron
- * there is also a change in relative airflow direction experienced by each wing, which has a greater effect i.e. in a right roll, the left (upward) wing experiences air from directly above, thereby changing the relative airflow to point slightly upward
 - this change of direction of RAF results in: decreased effective AoA experienced by the left wing (right, increased AoA), lift vector slightly aft experienced by the left wing (as lift is perpendicular to RAF), lift vector slightly forward experienced by the right wing
 - the effect relates not to the bank angle, but rate of roll i.e. faster rate of roll -> more adverse yaw
 - "therefore we use both aileron and rudder to turn the aircraft, keeping coordination"
- Spiralling slipstream
 - Demonstration at slow speed, 4000rpm, 65-70KIAS
 - "caused by the clockwise (from our view) rotating propellor"
 - "under power, strikes the fin of the aircraft to cause a left yaw moment"
 - apply full power, pitch up
 - remove hands from controls to demonstrate left yaw
 - regain coordinated flight
 - idle power
 - remove hands from controls to demonstrate right yaw
- Demonstrations at
 - 4200rpm, 80KIAS
- Ancillary
 - Demonstration at slow speed, 4200rpm, 70-80KIAS
 - show choke, cabin heat, brakes, carb heat, throttle
 - show flap
 - * "increases lift and induced drag, allowing us to fly at a slower speed; for example, when landing"
 - * "aircraft flies with the nose lower, giving a better view of the ground; for example, when landing"
 - trim
 - * "we control attitude with elevator"
 - * "trim is used relieve pressure on the controls once we have selected the desired attitude"

* exercise

- aircraft level and trimmed
- give student control
- "hold this nose attitude"
- put aircraft out of trim (pitches up without any elevator input)
- ask student to put aircraft back in trim
- ghost control and ask them to release control stick to observe if aircraft is trimmed
- repeat with opposite trim if student is comfortable