

# Maximum rate turns

## ADVANCED MANOEUVRES

### Objective

To carry out a balanced, maximum rate, level turn using full power.

### Principles of flight

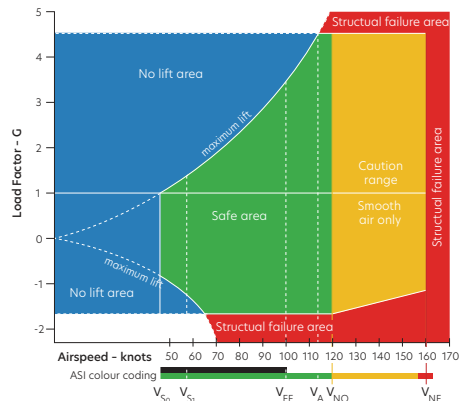
- To change direction at the highest possible rate – maximum degrees in minimum time

#### Maximum lift

- $L \propto \alpha$  and Airspeed
- Max  $C_L$  at start of stall warning or edge of buffet

#### Airspeed

- Max rate turns limited by  $V_A$
- $V_A$  is the speed at which you can make abrupt and extreme control movements and not overstress the aeroplane's structures
- Found in Flight Manual
- Affected by weight



#### Definitions

$V_A$ Design manoeuvre	$V_{S0}$ Stall speed - flaps extended
$V_{NO}$ Normal operating speed	$V_{S1}$ Stall speed - clean
$V_{NE}$ Never exceed speed	$V_{FE}$ Maximum speed with flap extended

#### Rate of turn and radius of turn

- Rate of turn = rate of change of direction - °/min
- Radius of turn = size of the arc made by the aeroplane
- Slow speed - high rate of turn
- High speed - low rate of turn
- Turning at max rate requires max CPF and max lift
- Rate of turn  $\propto$  velocity therefore power is limiting factor in a max rate turn

#### Angle of bank

- Between level and 90°

#### Structural limit

- For this aeroplane is \_\_\_\_\_ G

#### Limiting angle of bank

- ↑ in AoB requires ↑ in AoA to ↑ lift, associated ↑ drag → decrease in airspeed
- Power available limited therefore airspeed will reduce as AoB ↑
- Stalling speed ↑ as the √ load factor
- Maximum AoB limited by the amount of power available

### Considerations

#### Entry above $V_A$

- Smooth roll in, delay power until decelerated to  $V_A$

#### Entry below $V_A$

- Lead with power or at same time as roll in

### Air exercise

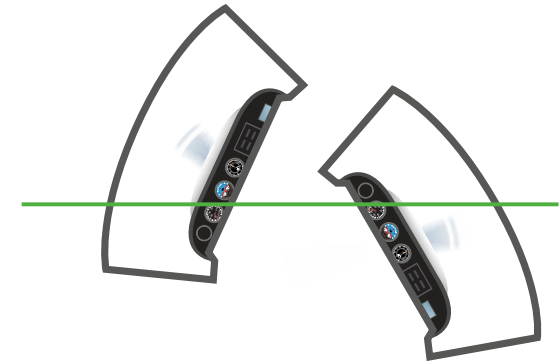
#### Entry

- Choose reference altitude and prominent reference point
- Check speed relative to  $V_A$
- Apply full power, roll in smoothly, balance with rudder - will need more rudder than usual

- Through 30° AoB increase backpressure to maintain altitude
- Stop at the stall warning (light buffet)
- Check ailerons and rudder
- Maintain backpressure and AoB

#### Maintaining

- LAI
- Attitude differences due side by side seating
- Maintain first note of stall warning with backpressure
- Altitude maintained with AoB
- With stall warning sounding if altitude is being gained or lost, alter AoB



#### Exit

- Anticipate roll out by 30°
- Smoothly roll wings level with aileron, balance with rudder, and relax the backpressure to re-select the level attitude
- Delay power reduction
- Through \_\_\_\_\_ kt, reduce power to cruise RPM

### Airmanship

- $V_A$  is \_\_\_\_\_ kt
- Smooth control movements
- Minimum altitude

### Aeroplane management

- RPM limit
- C of G limits

### Human factors

- 360° turn to minimise disorientation
- Physical G limits during turn, generally  $\leq 2G$