Two F-16 fighter jets are shown in a staggered formation against a clear blue sky. The jets are grey with black and white markings. The top jet has the number '9235' on its nose and a green light in its cockpit. The bottom jet has the number '9243' on its nose and a green light in its cockpit. Both jets have red lights on their wings. The text 'MEDIUM TURNS' is overlaid in the bottom left corner in a large, bold, red font.

MEDIUM TURNS

Turning

Aim

To teach the student how to carry out types of turn and how to turn accurately towards features and on to specific headings.

Objectives:

At the end of this briefing the student should be able to....

1. CORRECTLY STATE the relationship between LIFT and WEIGHT in a level turn.
2. DESCRIBE the causes of over banking in a turn
3. DESCRIBE the effect of turning on aircraft balance
4. DESCRIBE adverse aileron yaw and the methods used to prevent it
5. DETAIL the techniques to enter, maintain and recover from a turn

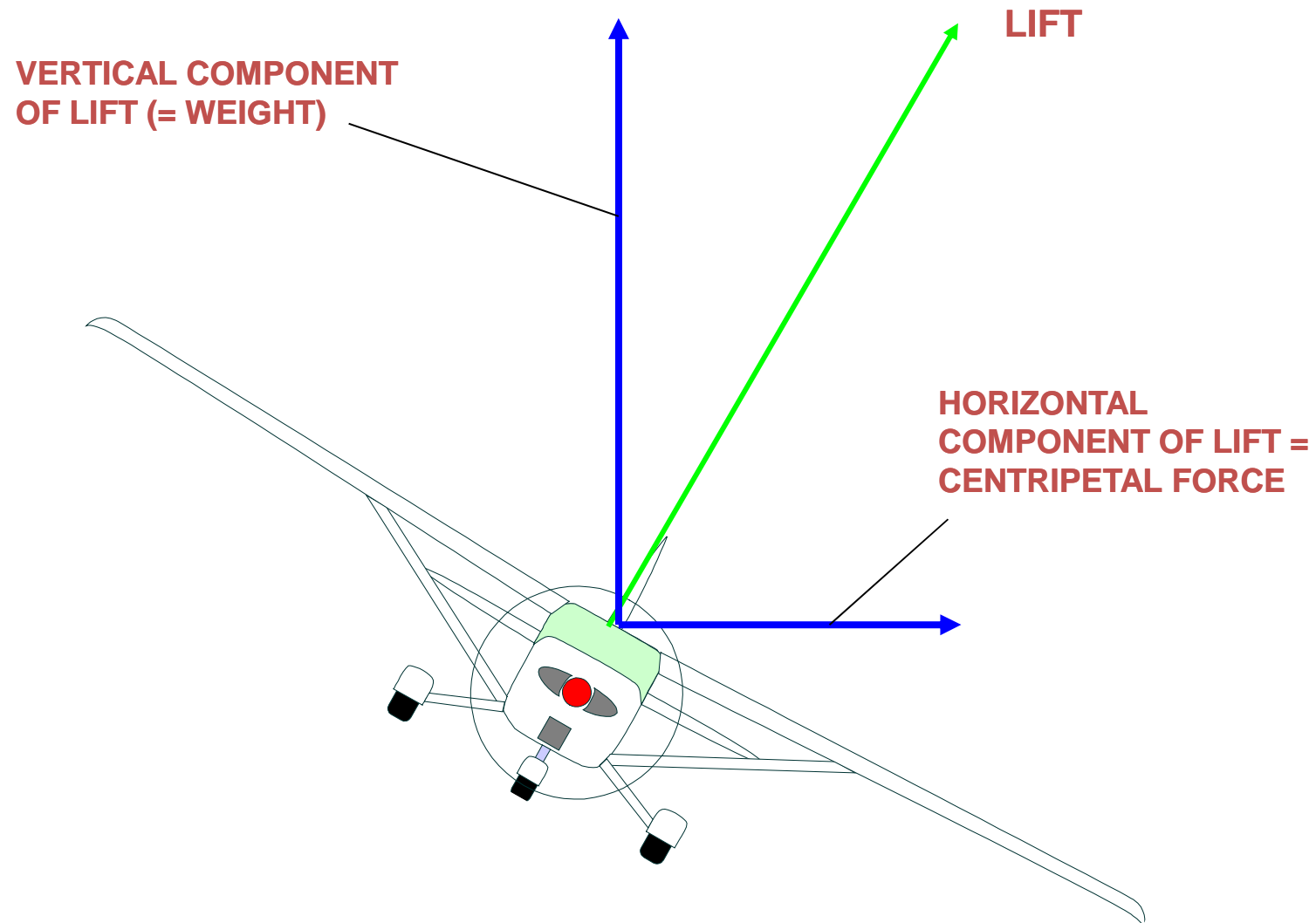
Three types of turns

1. Gentle - approx 15° angle of bank
2. Medium - approx 30 ° angle of bank
3. Steep - 45 ° angle of bank or greater

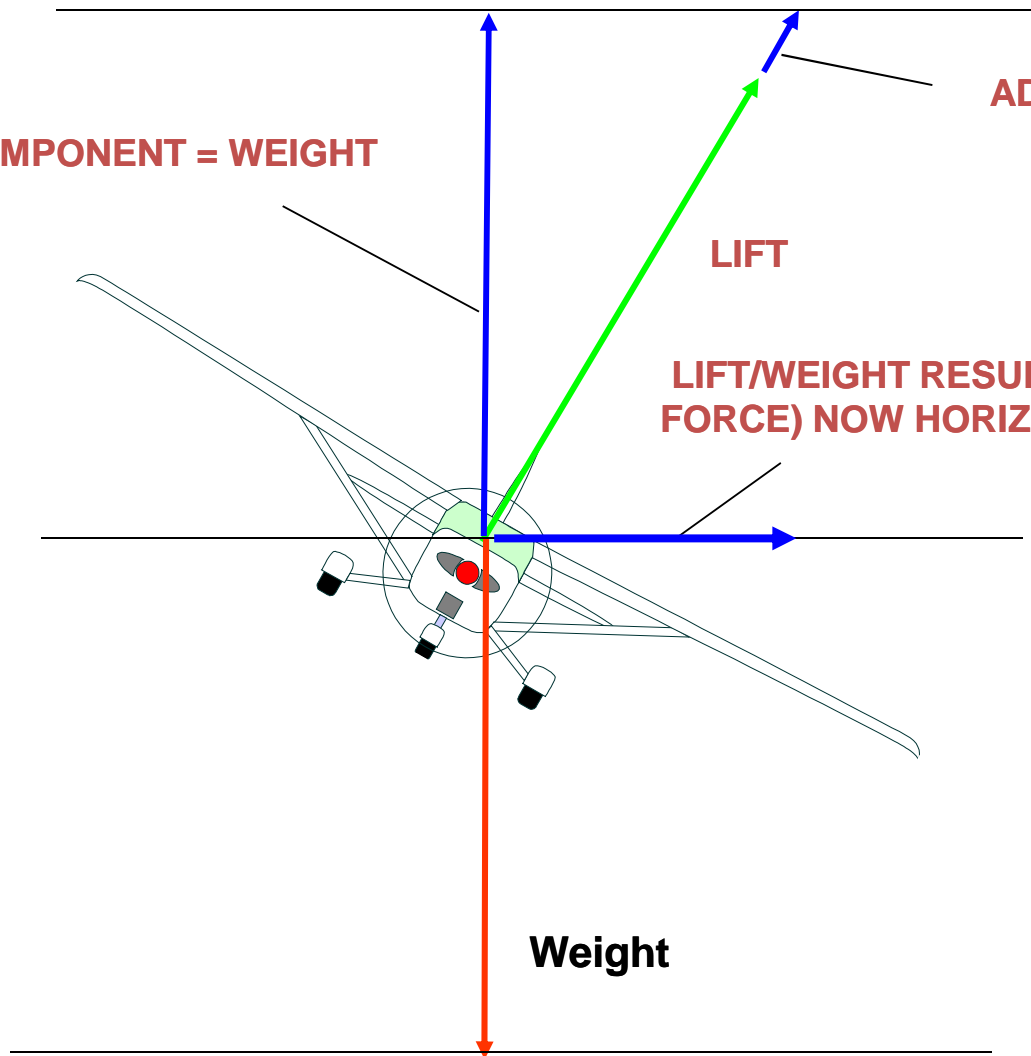
Newton's laws of motion

- A moving body tends to continue moving in a straight line at a constant speed
- To change its speed or direction a net external force must be exerted on this body

FORCES ACTING IN A NORMAL TURN



VERTICAL COMPONENT = WEIGHT



ADDITIONAL LIFT

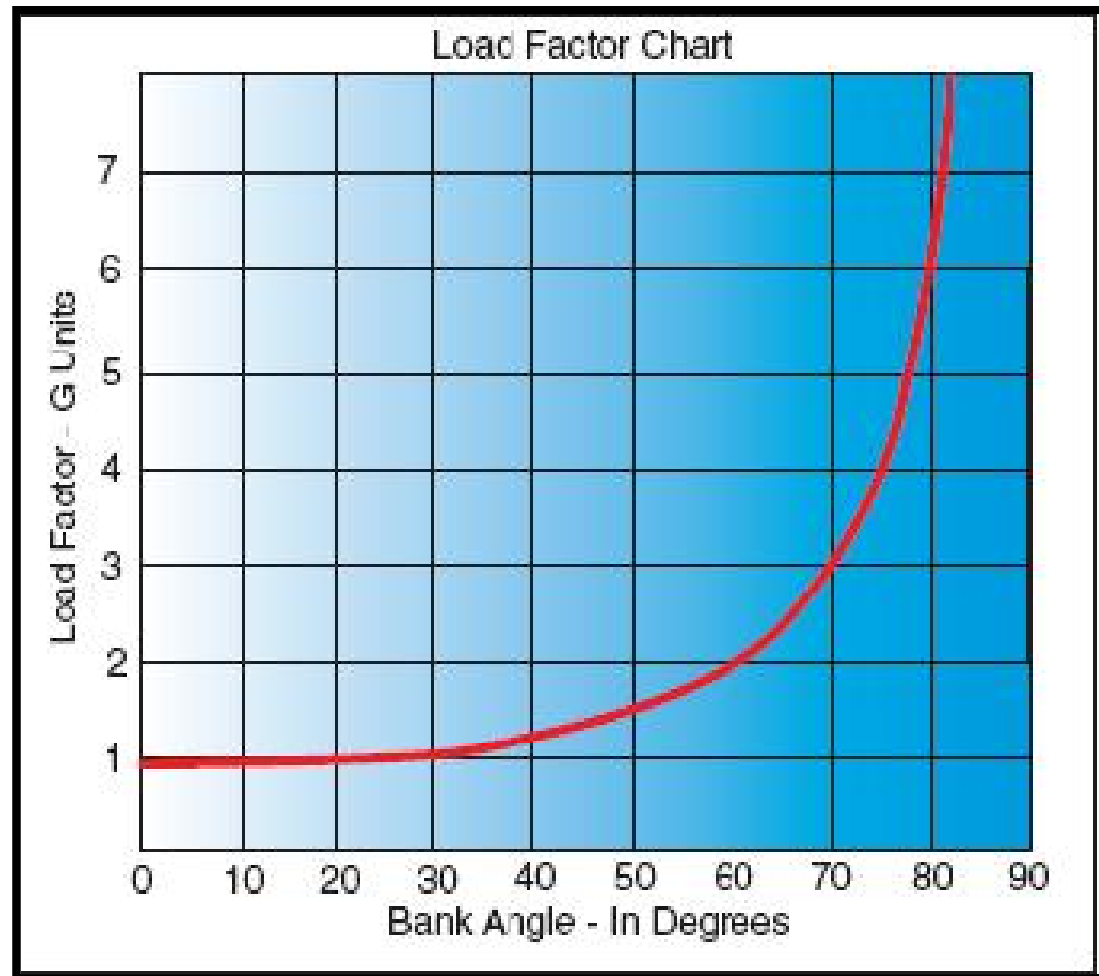
LIFT

**LIFT/WEIGHT RESULTANT (CENTRIPETAL
FORCE) NOW HORIZONTAL = LEVEL TURN**

Weight

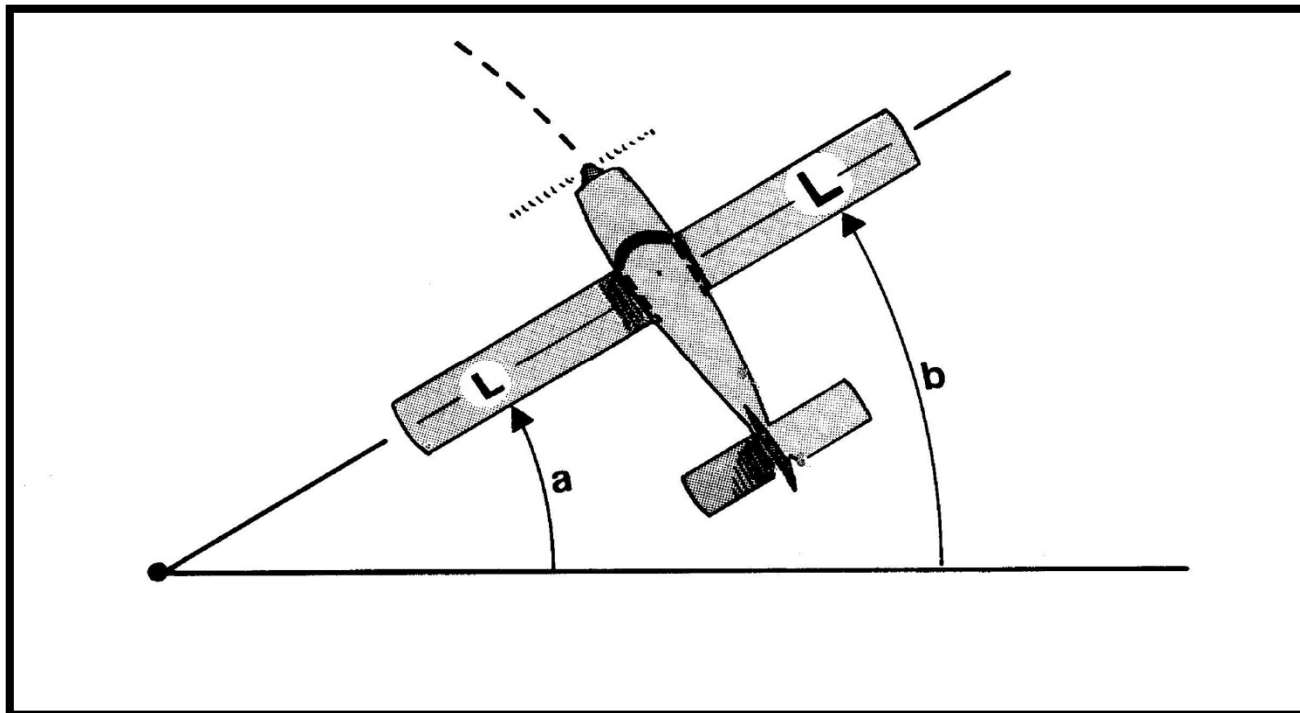
Load Factor

- S & L L = W 1.0
- 30° AOB 1.15
- 45° AOB 1.40
- 60 °AOB 2.0



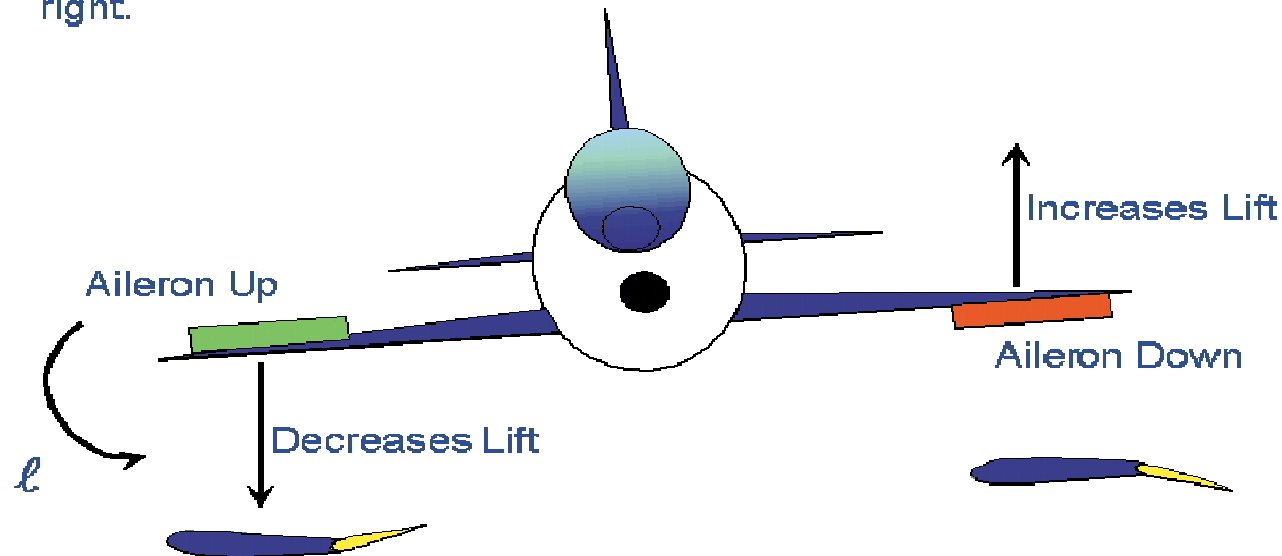
OVERBANKING

Outer wing travels further Therefore **faster** therefore **↑ lift**. MORE LIFT on the OUTER WING therefore more ROLL in the Direction of turn – Hence a need to HOLD OFF THE BANK.



Aileron Drag

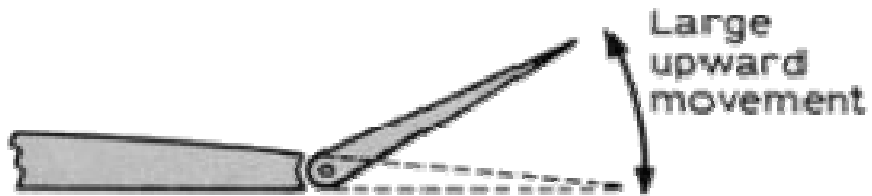
Deflecting right aileron up causes the aircraft to *roll* to the right.



Deflecting an aileron is like cambering the airfoil section of the wing: it changes the lift at the same angle of attack

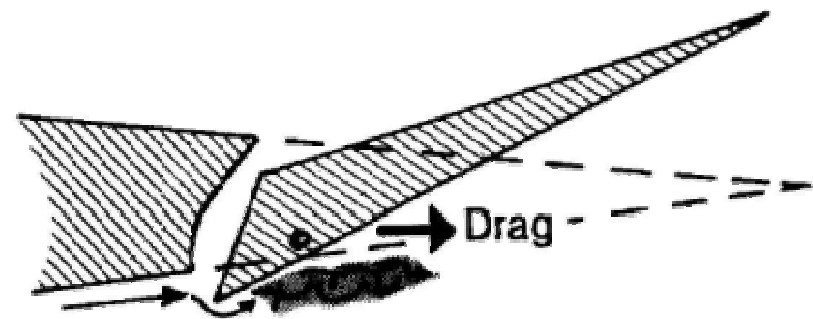
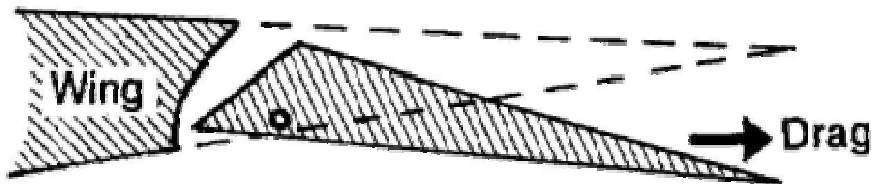
ADVERSE AILERON YAW towards down aileron (i.e. opposite to the direction of turn)

Aileron types



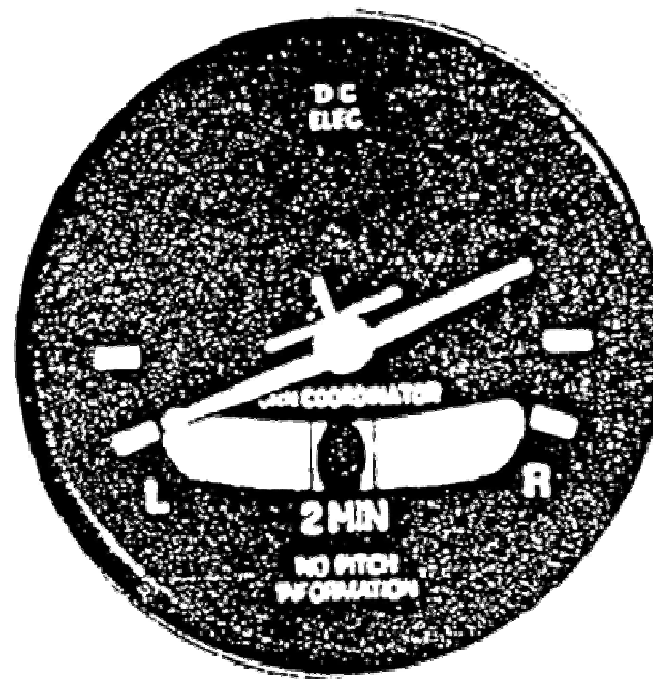
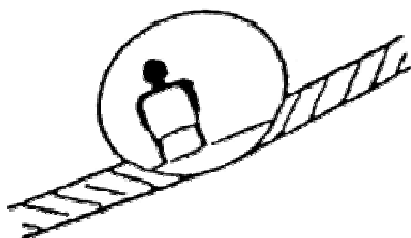
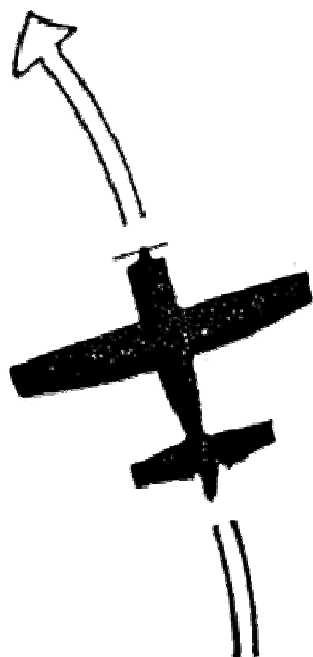
Differential Ailerons

Frise Ailerons



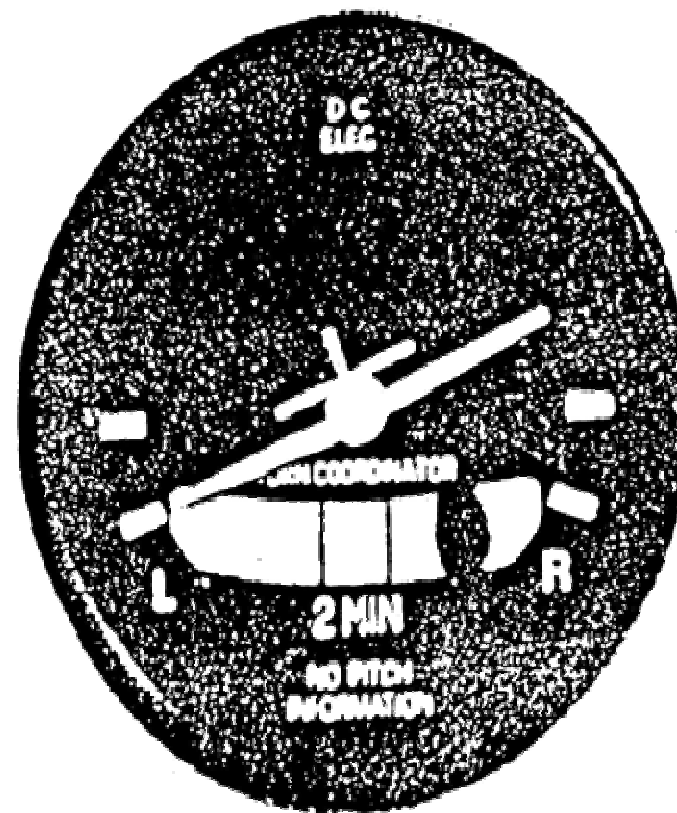
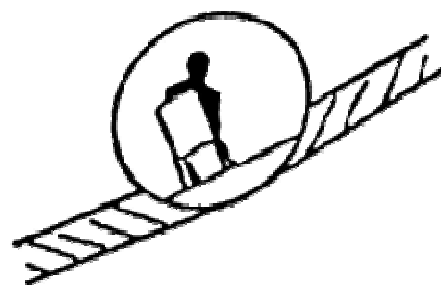
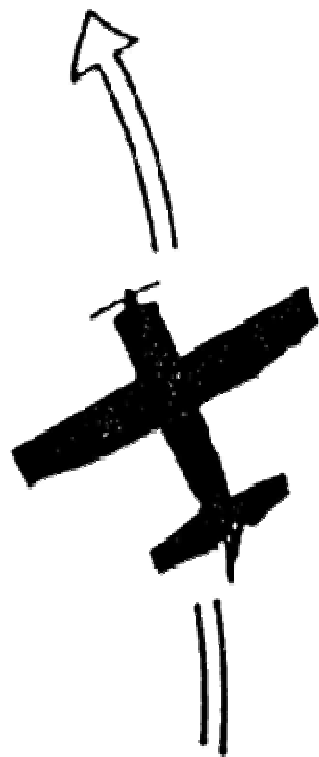
Balance

BALANCED TURN



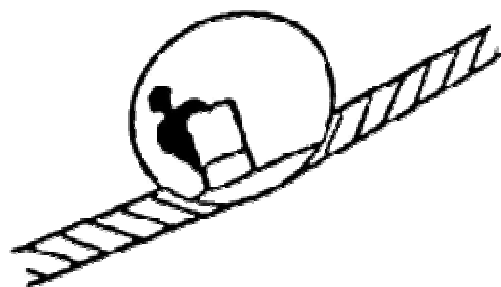
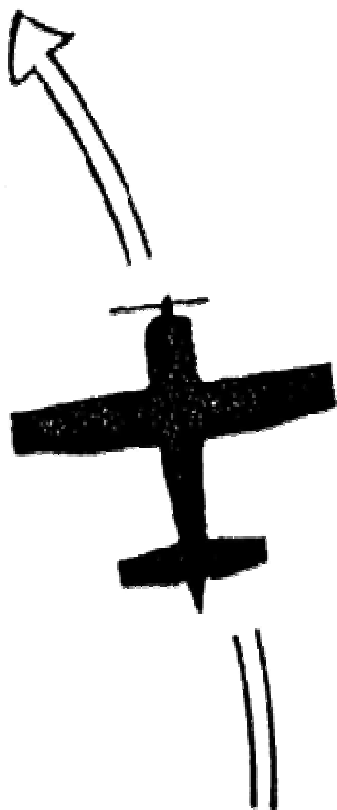
Balance

SKIDDING TURN



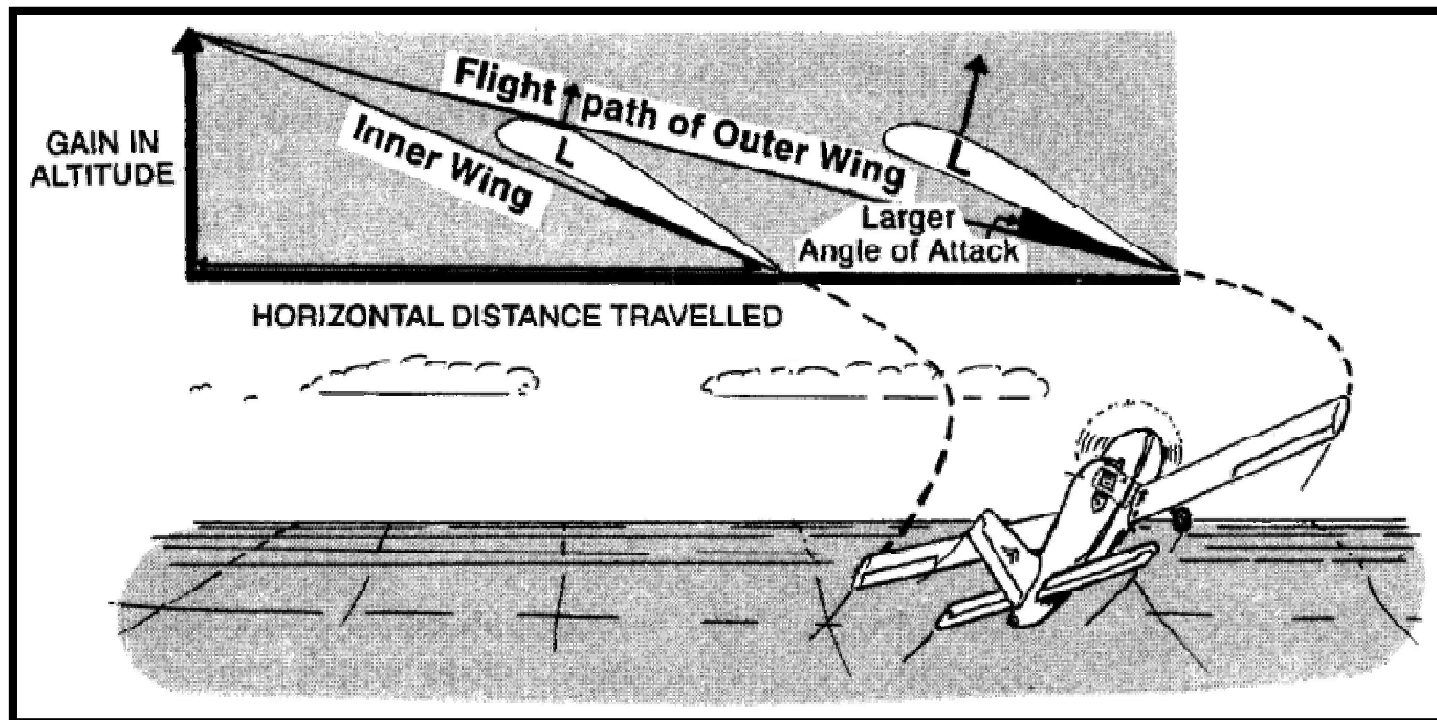
Balance

SLIPPING TURN



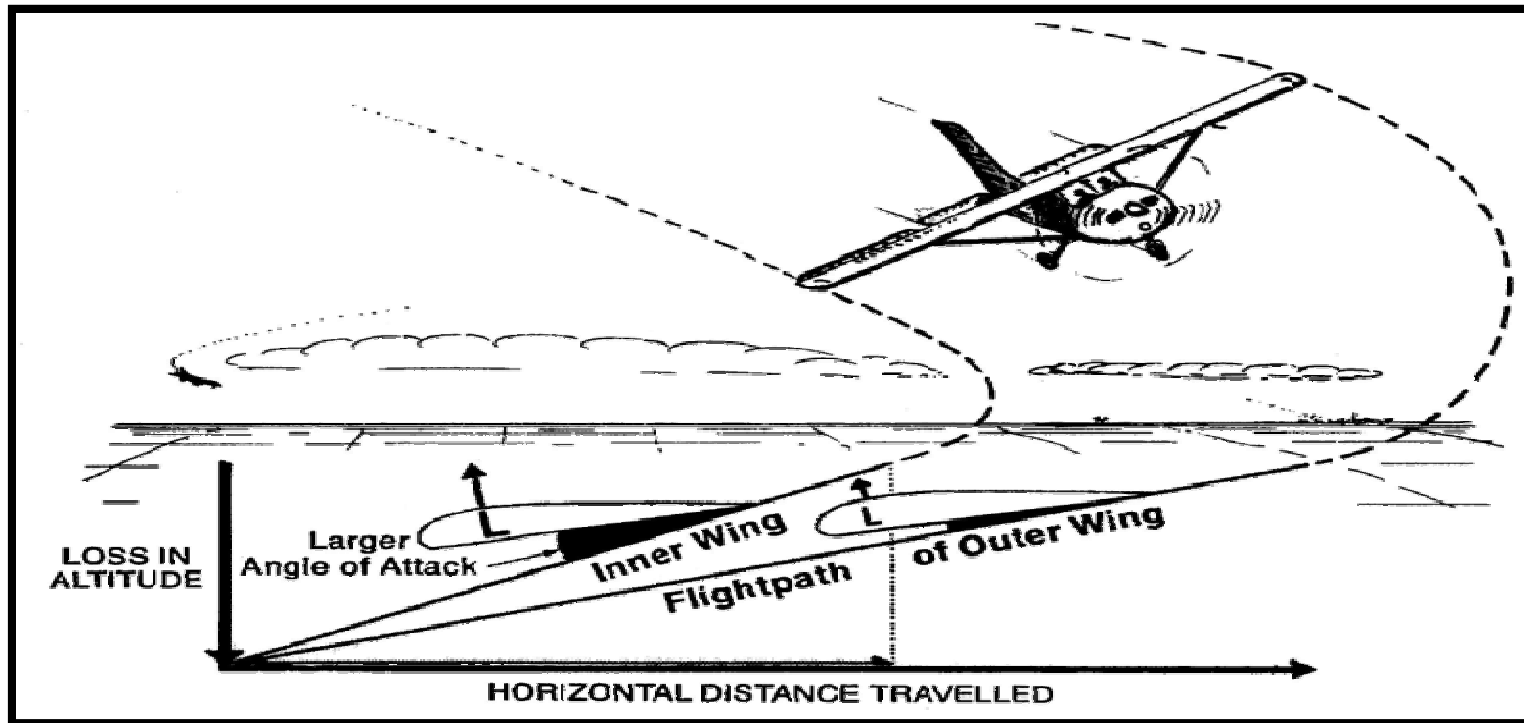
Climbing Turns

- **LIMIT TO 15° AOB**
- Increased Drag, therefore reduced ROC
- there is an **OVERBANKING TENDANCY** in a climbing turn



Descending Turns

- 30° AOB
- Increased Drag, therefore increased rate of descent
- There is **LESS tendency to OVER BANK** in a descending turn



APPLICATION

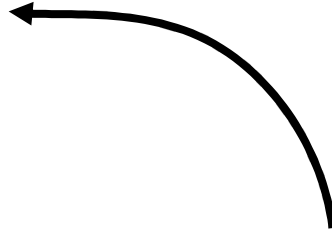
TURN ENTRY

ENTRY TO THE TURN

Application – Entering the turn

- **TRIM** the aircraft for STRAIGHT & LEVEL FLIGHT
- DO NOT trim in the turns
- **CHECK** ALTITUDE for a reference
- **LOOKOUT** in direction of turn, raising and lowering wing
- **LOOKOUT** in opposite direction and behind
- Select **REFERENCE** POINT to roll out
- Roll **IN** with **AILERONS** and **BALANCE** with **RUDDER**
- **ESTIMATE** the bank angle using natural **HORIZON** (select 30°)
- Slight **BACK PRESSURE** on control column to maintain height
- Maintain continual **SCAN** in turn & make slight adjustments as needed
- Commence **ROLL OUT** at **half AoB**.

**CONTROL WHEEL
LEFT TO TURN IN
THIS DIRECTION**



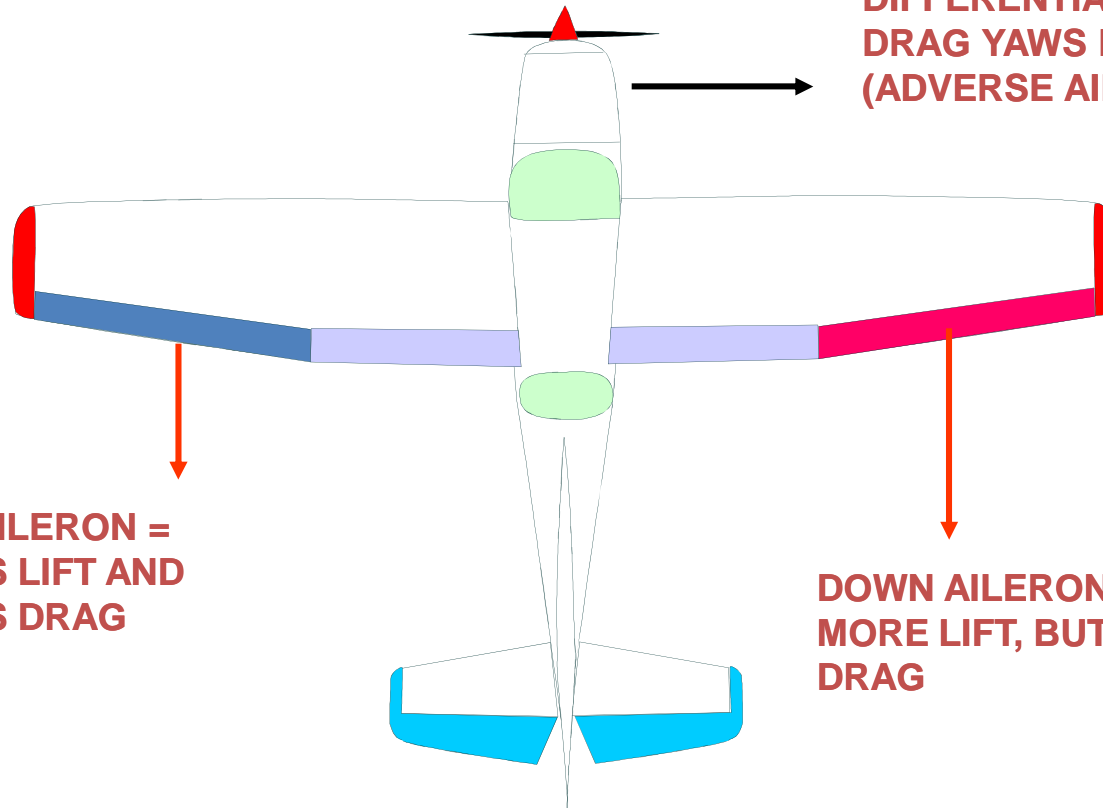
**DIFFERENTIAL AILERON
DRAG YAWS NOSE RIGHT
(ADVERSE AILERON YAW)**



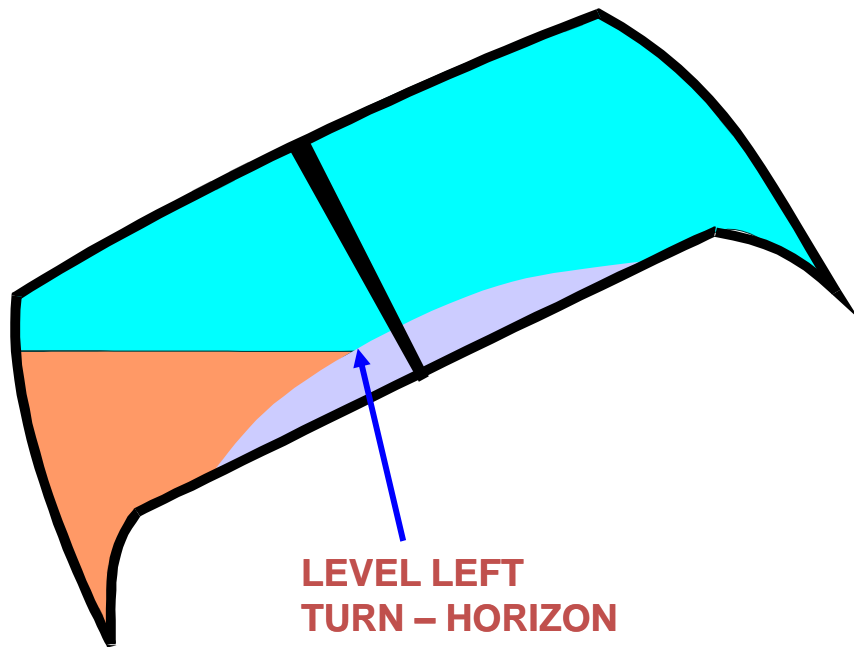
**UP AILERON =
LESS LIFT AND
LESS DRAG**



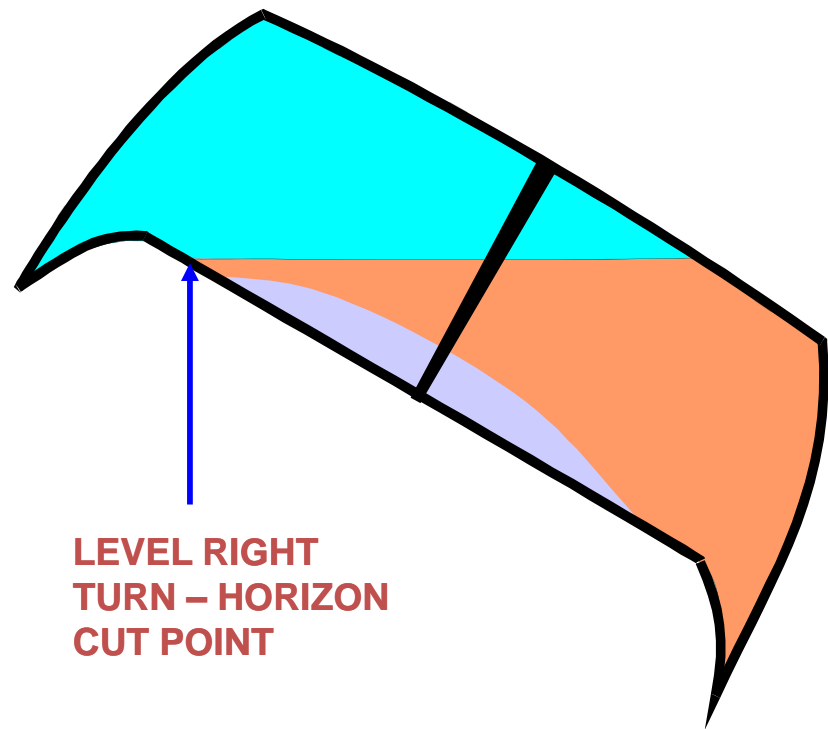
**DOWN AILERON =
MORE LIFT, BUT MORE
DRAG**



OFFSET SEATING



LEVEL LEFT
TURN - HORIZON
CUT POINT



LEVEL RIGHT
TURN - HORIZON
CUT POINT





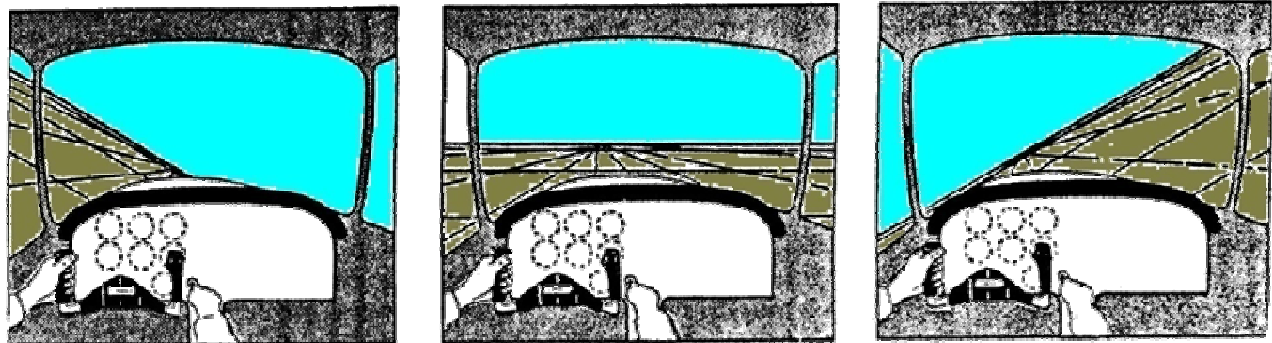
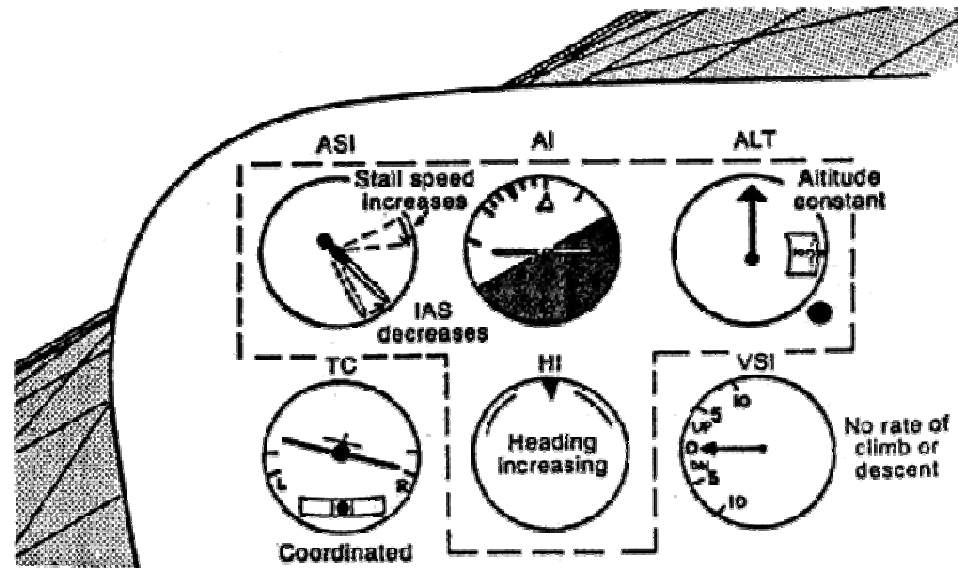
MAINTENANCE OF THE TURN

Work Cycle

Lookout

Attitude

Balance



Note the horizon relative to the cowl has changed in both left and right turns.

Common faults during the turn

GAINING HEIGHT

Incorrect nose attitude
Bank angle too shallow
Back pressure too great



TO FIX

Lower the nose
Increase angle of bank

LOOSING HEIGHT

Incorrect nose attitude
Bank angle too steep
Back pressure insufficient



TO FIX

Decrease angle of bank (1st)
Raise nose

AEROPLANE UNBALANCED



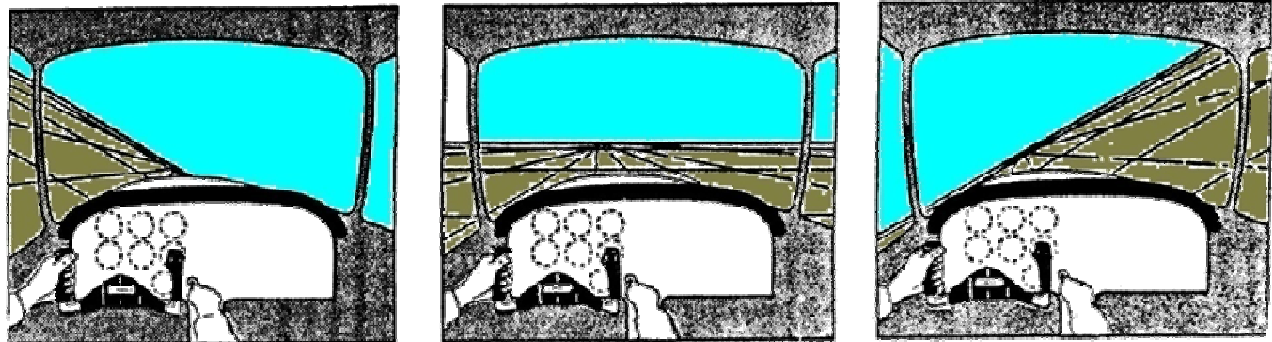
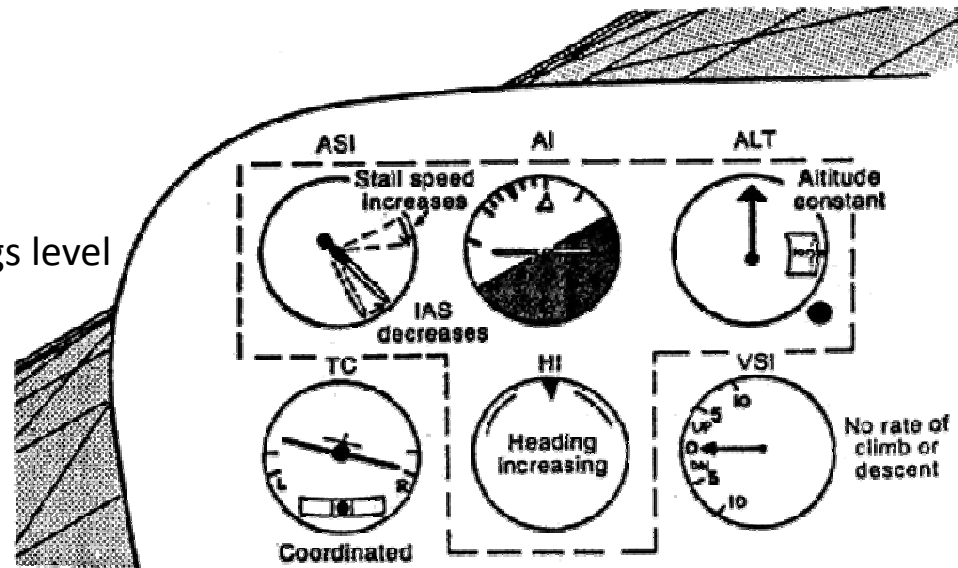
TO FIX

Use rudder
"Foot to ball"
Ball in the centre

RECOVERY FROM THE TURN

Work Cycle

1. Lookout
2. Anticipate reference point by approximately 10°
3. Roll off bank with ailerons to wings level
4. Balance with rudder
5. Release back pressure



Note the horizon relative to the cowl has changed in both left and right turns.

CLIMBING AND DESCENDING TURNS

Climbing & Descending Turns

CLIMBING – max bank 15 degrees

- Climbing turn essentially same as level turn except ASI confirms nose attitude 67 Kts
- Over banking tendency (may need to hold off aileron)

DESCENDING – Bank 30 degrees

- Descending turn same as level turn except ASI confirms attitude 60 Kts
- Less over banking tendency

Remember!!!

Power

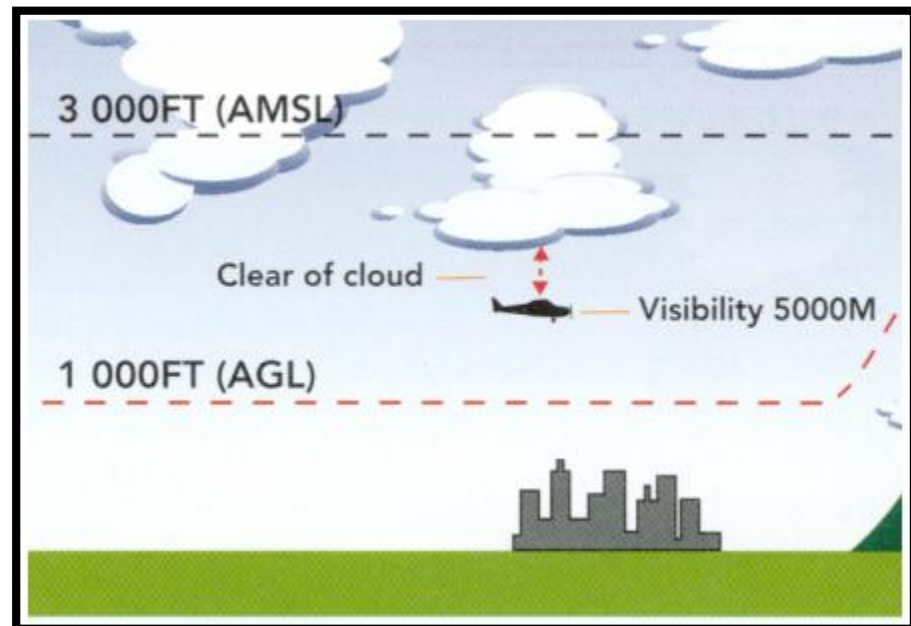
Attitude

Trim

AIRMANSHIP

- Cloud Clearance
- Smooth operation of controls
- Handing over / taking over
- **Look out** 90% Visual 10% Instruments
- Clear nose every 500' / Warm engine every 1000'
- Recover by 1000' minimum
- Calculate fuel required

Class G



Turning

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