Effect of Controls

Objective

1. To operate and experience the aerodynamic effects of moving the primary controls.
2. To operate and observe the secondary effects of moving the primary control surfaces.
3. To operate the ancillary controls and experience and observe the effect on the aeroplane in flight.

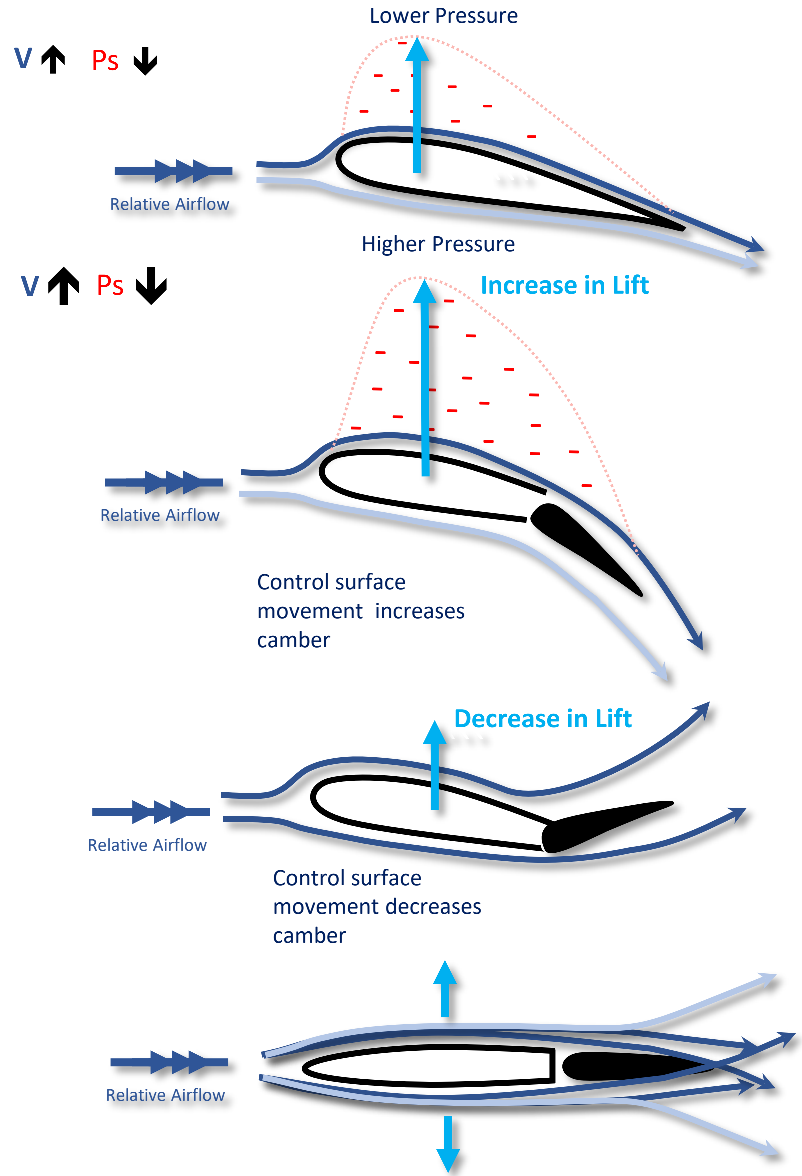
Definition

Primary Controls – those control surfaces that affect the aircraft's movement about the three axis of motion.

Ancillary Controls – those controls that supplement the primary controls supporting flight at different airspeeds i.e., throttle, trim and flaps

Principles of Flight

Bernoulli's theory of Lift **dynamic pressure + static pressure = K (constant)**



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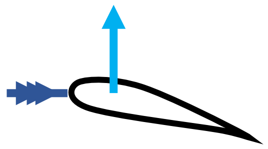
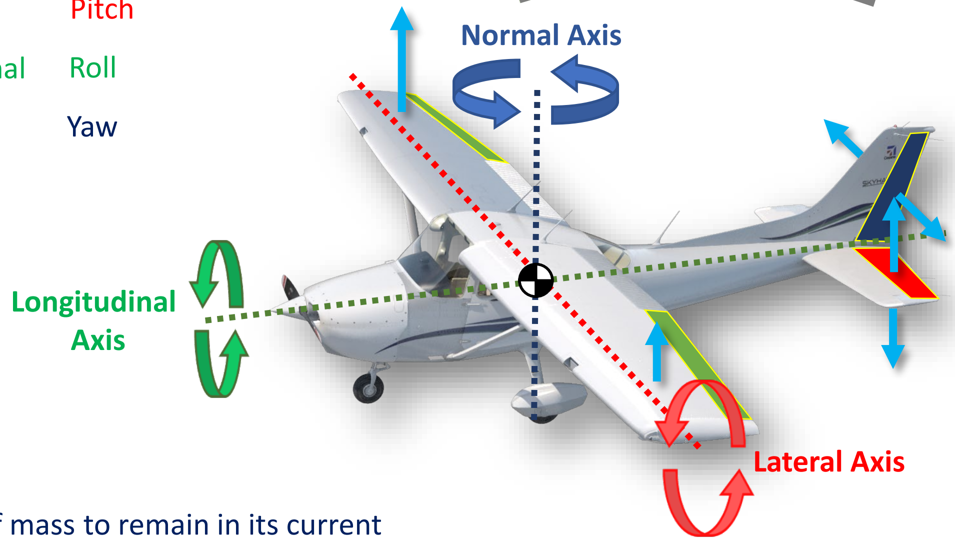


Principles of Flight

Control Movement and Axis

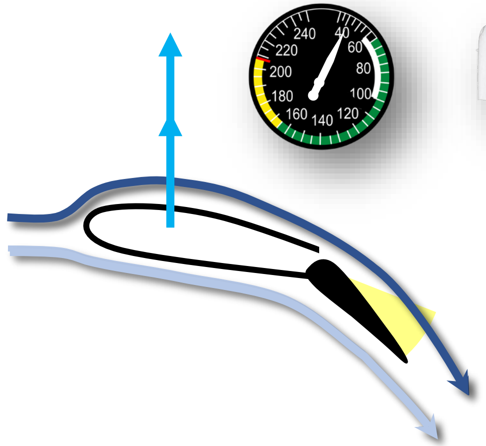
Elevator	Lateral	Pitch
Aileron	Longitudinal	Roll
Rudder	Normal	Yaw

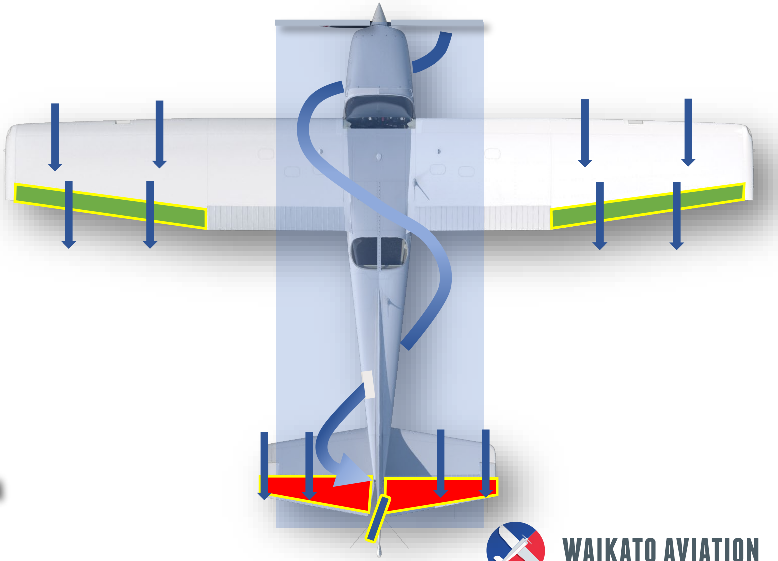


Effect of Inertia

Tendency for a body of mass to remain in its current stated i.e. at rest or when in motion

Effect of Airspeed and Slipstream





WAIKATO AVIATION ACADEMY

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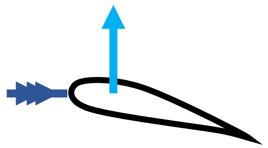

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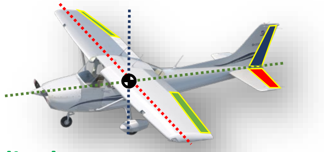
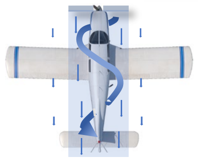


Elevator	Pitch	Lateral
Aileron	Roll	Longitudinal
Rudder	Yaw	Normal

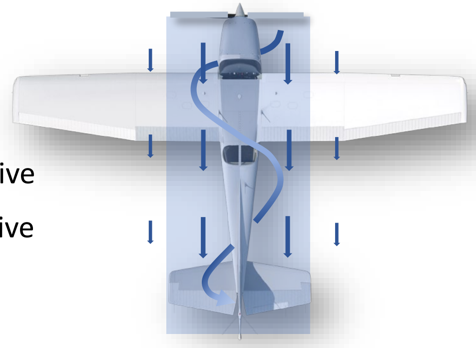
Inertia

Airspeed and Slipstream



Principles of Flight

1. Effect of Airspeed and Slipstream



Airspeed ↑ Controls – firm, responsive, effective

Airspeed ↓ Controls – sloppy, less responsive and effective

Slipstream ↑ Yaw – Left, Elevator and Rudder more effective

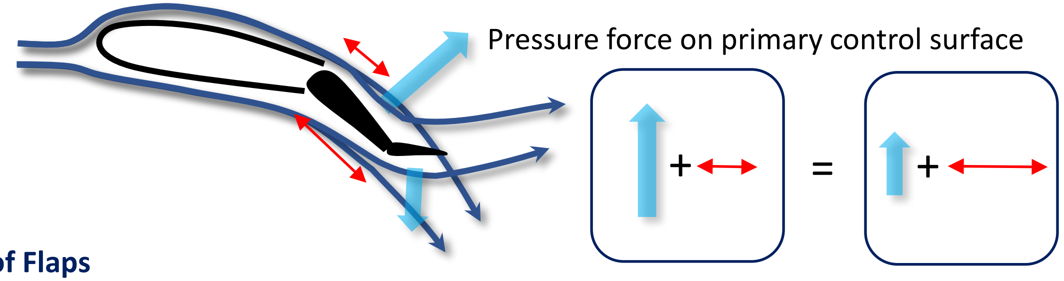
Ancillary Controls

2. Change in Power

Power ↑ Slipstream ↑ Nose Pitch ↑ Yaw ←

Power ↓ Slipstream ↓ Nose Pitch ↓ Yaw →

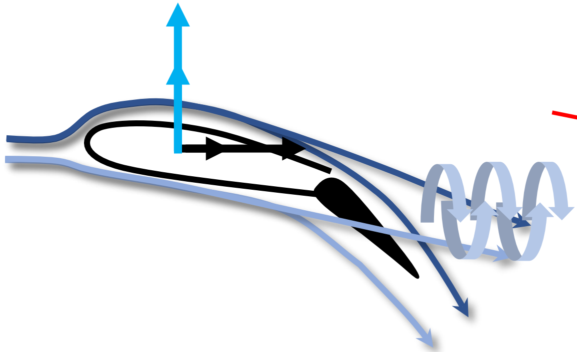
3. Effect of Trim

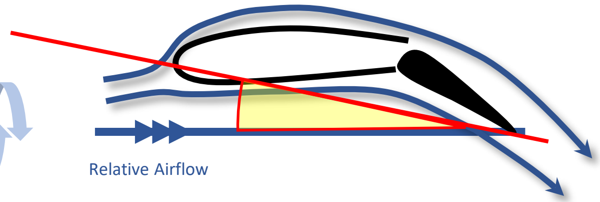


4. Effect of Flaps

LIFT ↑ Nose Pitches ↑ DRAG ↑

AOA ↑ Nose Attitude ↓ Steeper approach path





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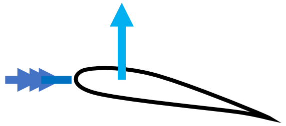

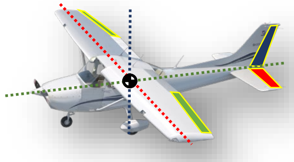

Control Movement and Axis

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Aileron	Roll	Longitudinal
Rudder	Yaw	Normal

Inertia

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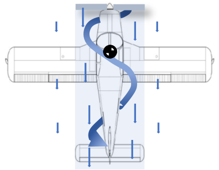
Slipstream Effect



Ancillary Controls

Power ↑ Slipstream ↑ Nose Pitch ↑ Yaw ←

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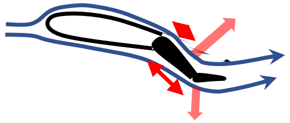
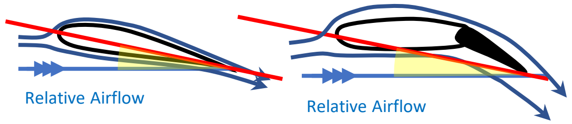
Trim - provides a force to alleviated control pressure



Flaps - AOA ↑ **LIFT** ↑ **DRAG** ↑ **Attitude** ↑



Aircraft Management

Throttle – Smooth but positive, 3 seconds

Mixture – Meters fuel into the engine
Rich – forward
Lean – move back
Idle Cut Off (ICO) – fully back

Carb Heat – **HOT** below 1900 RPM

Temperatures and Pressures – **GREEN** Range

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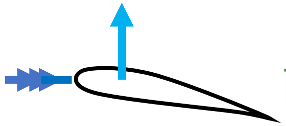

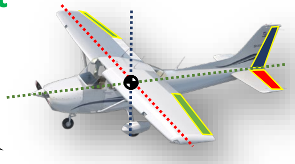

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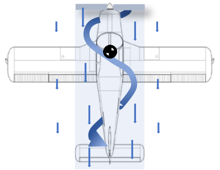

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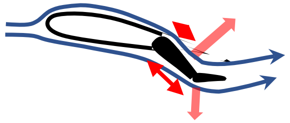

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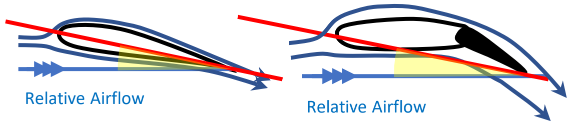


Aircraft Management

Throttle – Smooth and positive, 3 sec

Mixture – Meters Fuel, ICO, Full Rich

Carburettor Heat – Hot below 1900 RPM

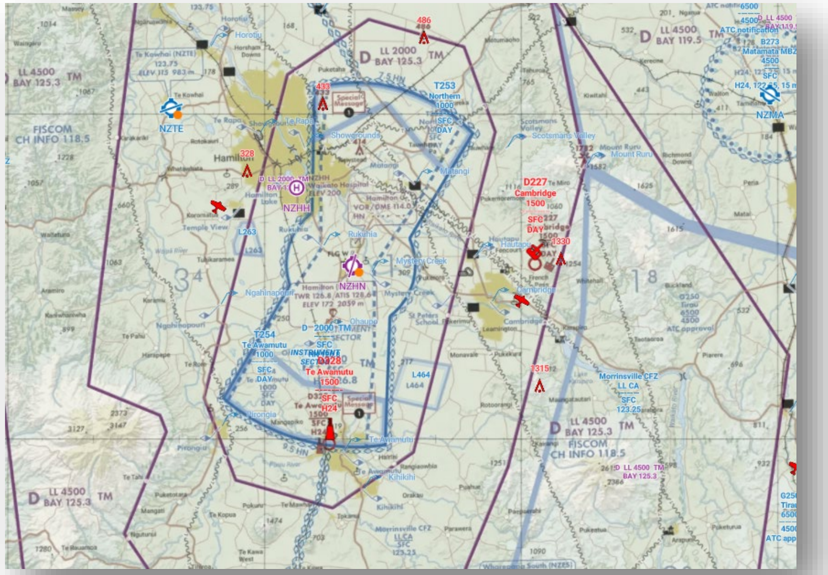
Temps and Press – Green Range

Airmanship and Human Factors

Lookout – Clock Code

"I have control" – "You have control"

Situational Awareness / VFR Training Area



I – M – S – A – F – E

Illness

Medication

Stress

Alcohol

Fatigue

Eating and Hydration

WAIKATO AVIATION ACADEMY

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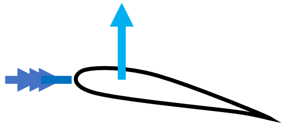

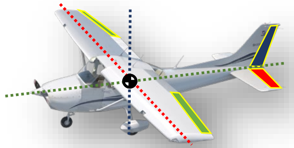

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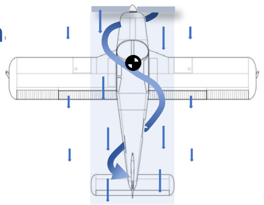

Effect of Inertia

Slipstream Effect

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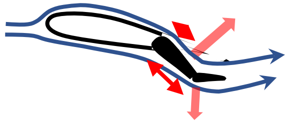
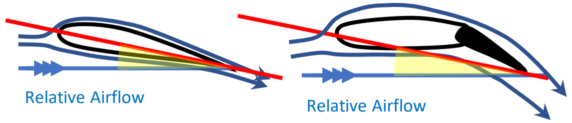


Flaps - AOA ↑ **LIFT** ↑ **DRAG** ↑ **Attitude** ↓



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Temps and Press – Green Range

Airmanship and Human Factors

Lookout – Clock Code

"I have control", "you have control"

Situational Awareness / VFR Training Areas

IMSAFE

Air Exercise

Horizon Line – Where the sky meets the sea. Datum Attitude.

First and Secondary effect of the Primary Controls

> Control functions in the natural sense

> Rate of the effect is proportional to displacement of the control

Control	Input	First Effect	Second Effect	Use
Elevator	C/C AFT	Pitch UP	Nil	Airspeed and
	C/C FWD	Pitch DWN	Nil	Altitude
Ailerons	C/C LEFT	Roll LEFT	Slip - YAW	Change
	C/C RIGHT	Roll RIGHT	Slip - YAW	Direction
Rudder	Pedal LEFT	Yaw LEFT	Skid - ROLL	Balance
	Pedal RIGHT	Yaw RIGHT	Skid - ROLL	Balance

Effect of Airspeed

↑ Airspeed — Controls Feel — More responsive and firmer = more effective

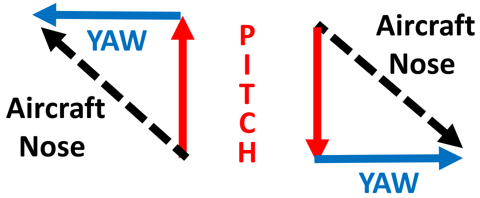
↓ Airspeed — Controls Feel — Less responsive and sloppy = less effective

Effect of Slipstream

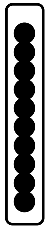
↑ Power — ↑ Slipstream — Aircraft Yaws to the LEFT > Balance with rudder

↑ Slipstream — Airspeed over elevator and rudder > controls more effective

Change of Power ↑ ↓



Trim – In the natural sense



Forward Pressure – Trim FWD

Aft Pressure – Trim AFT

Intermediate Trim – Final Trim

Coarse Trim – Fine Trim

Effect of Flap — Check < **Vfe**

Lower Flap — Nose Pitch ↑ — LIFT ↑ — DRAG ↑ — Airspeed ↓

Raise Flap — Nose Pitch ↓ — LIFT ↓ — DRAG ↓ — Airspeed ↑ - Increase power first

WAIKATO AVIATION ACADEMY

Objective

1. To establish and maintain straight and level flight at a constant airspeed, altitude, direction, and in balance
2. To regain straight and level.
3. To maintain straight and level flight at a selected airspeed or power setting.

Definition

Horizon – Line where the sky meets the sea or land. All flying references the aircraft nose to the horizon.

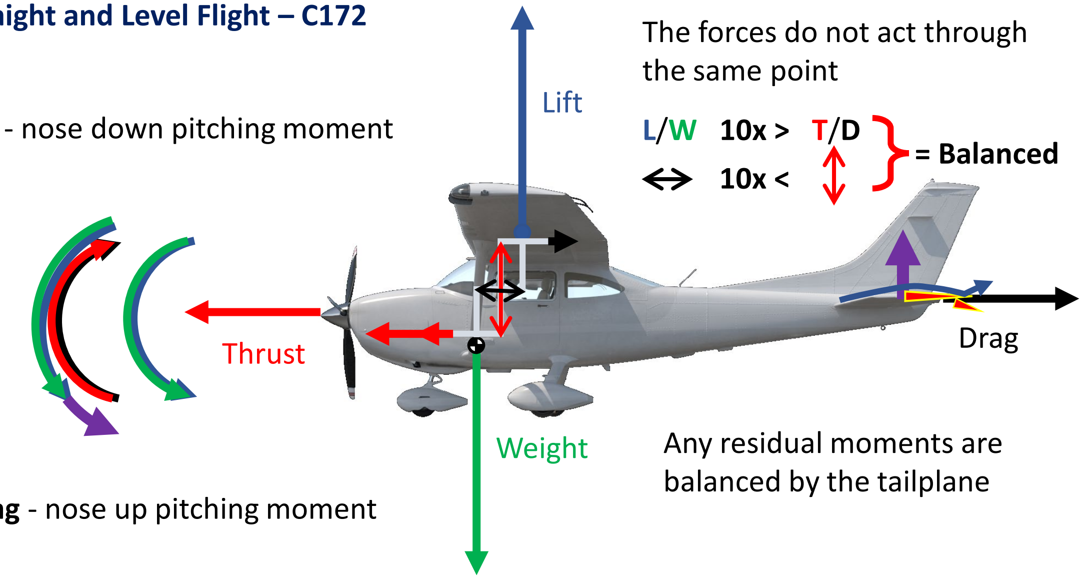
Principles of Flight

Lift = Weight
Thrust = Drag
} = Equilibrium

Forces in Straight and Level Flight – C172

Lift / Weight - nose down pitching moment

Thrust / Drag - nose up pitching moment

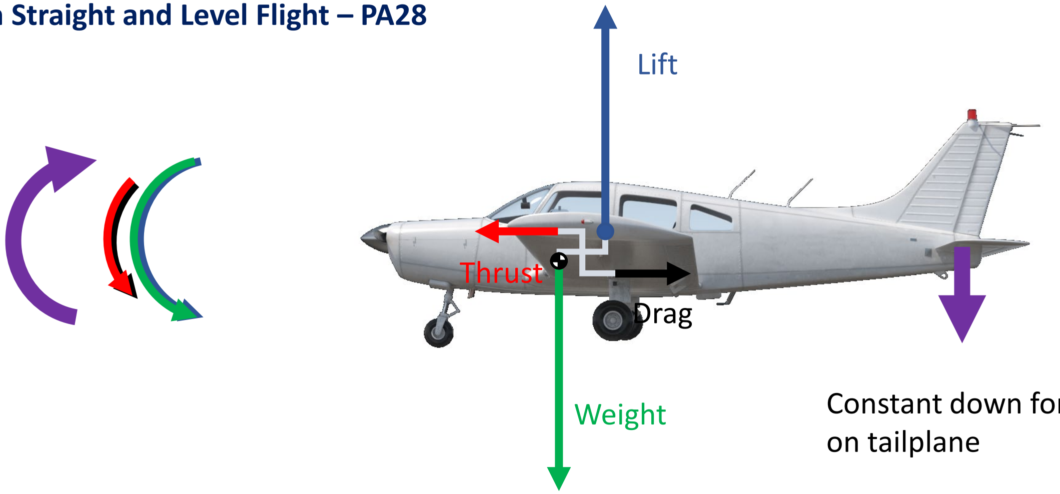


The forces do not act through the same point

L/W 10x > T/D
↔ 10x < ↕
} = Balanced

Any residual moments are balanced by the tailplane

Forces in Straight and Level Flight – PA28



Constant down force on tailplane

Straight and Level

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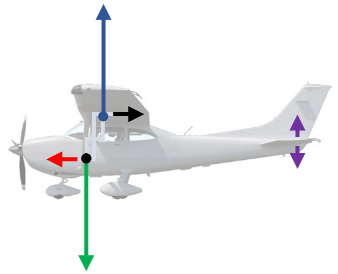

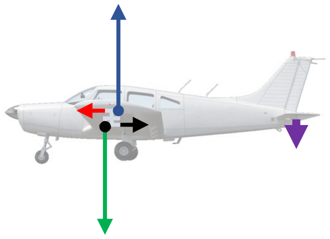

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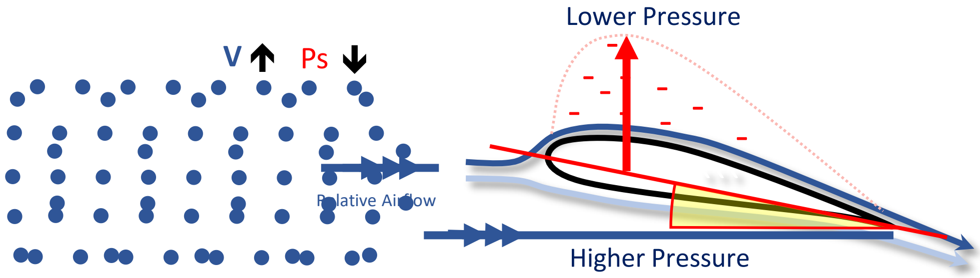
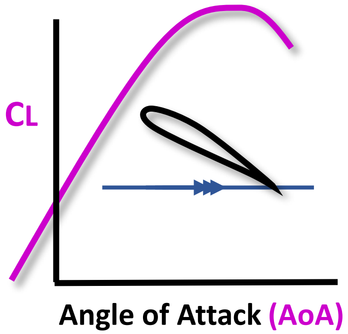


Lift Formula

$$\text{Lift} = C_L \times (\tfrac{1}{2} \rho V^2)\, S$$

$$\text{Lift} = \text{AoA} \times \text{IAS}$$



"How we Fly" Formula

Power + Attitude = Performance

Objective

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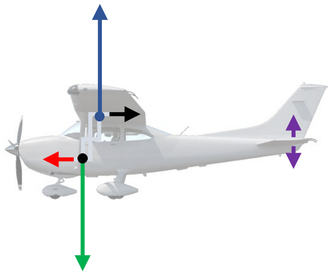
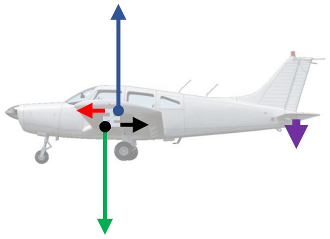
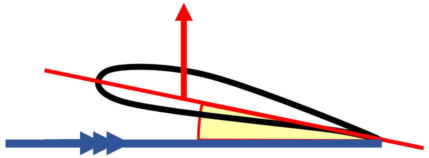






Lift = CL x (½ ρ V²) S

Lift = AoA x IAS

Power + Attitude = Performance

Aircraft Management

Throttle – Smooth but positive, 3 seconds

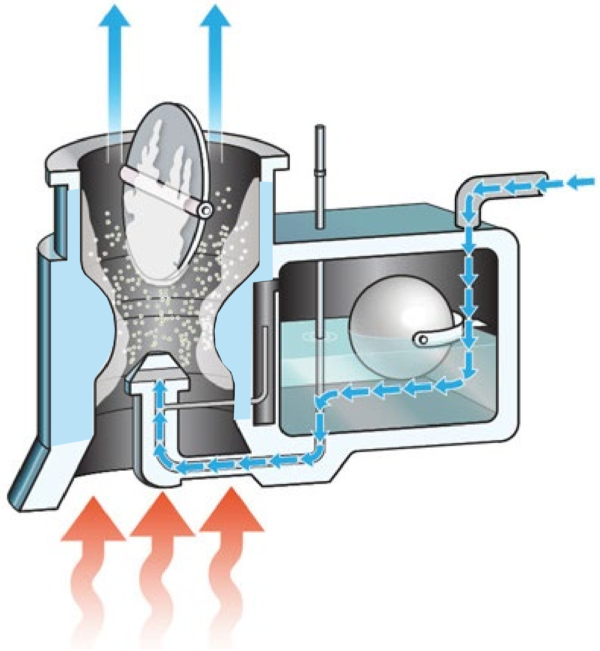
Mixture – Meters fuel, ICO, Full - Rich

Carb Heat – Hot below 1900 RPM

Temperature drops in carburettor due to

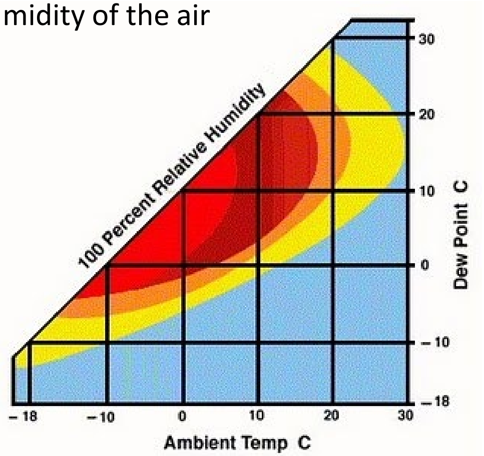
1. Venturi pressure drop
2. Atomisation of fuel

} **= Cools metal**



Degree of icing dependent on

1. Ambient temperature
2. Humidity of the air



- Light icing glide or cruise power
- Serious icing glide power
- Moderate icing cruise power
- Serious icing cruise / climb power

Temperatures and Pressures – **Green** Range

Straight and Level

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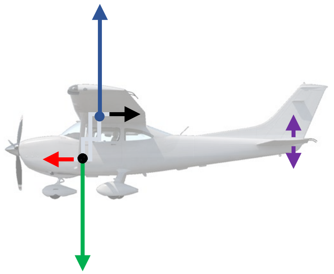

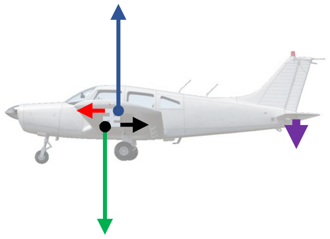

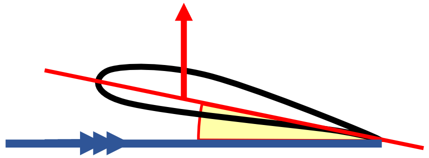

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Lookout – Clock Code

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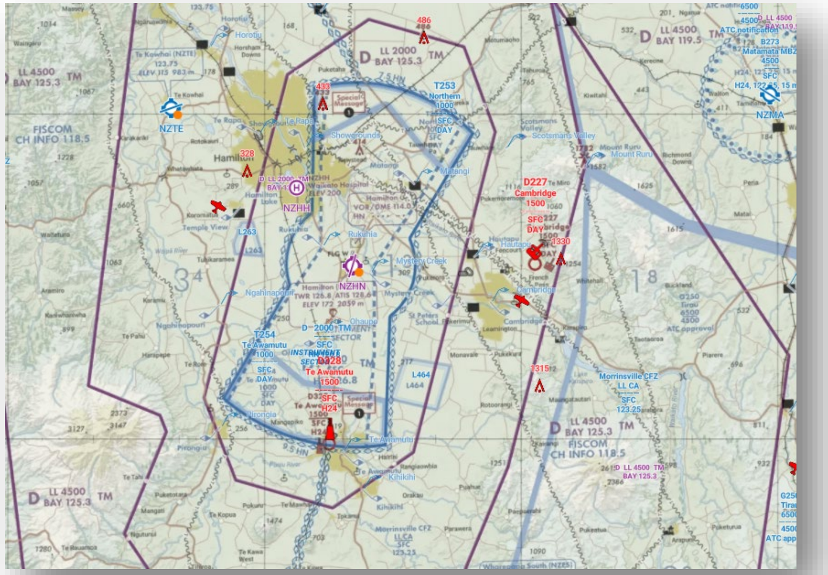
Situational Awareness / VFR Training Area



I – M – S – A – F – E

Illness

Medication

Stress

Alcohol

Fatigue

Eating and Hydration

WAIKATO AVIATION ACADEMY

Straight and Level

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Air Exercise

Identify the Horizon Line – Where the Sky meets the sea or land.

Datum Attitude = S&L Attitude. Demonstrate high and low nose attitude.

1. Establish Straight and Level

Power	Set for Straight and Level 2300 RPM
Attitude	Elevator – ~ 4 fingers below horizon, set ton top of the instrument panel
	Ailerons – wings level, top of instrument panel parallel with horizon line
	Rudder – aircraft in balance (step on ball)
Trim	To relieve control pressure – Coarse then fine

2. Maintaining Straight and Level

Lookout	20^{o} scan every 2 seconds
Attitude	Correct, - Wings level, Bal
Instruments	Perf – Alt, DI, ASI, Bal

3. Regaining Straight and Level (minor pitch)

Attitude	Reselect S&L
Power	Check- 2300 RPM
Attitude	Confirm S&L
Trim	To relieve control pressure

4. Demonstrate S&L out of balance

Demo	Gross imbalance
Demo	Small imbalance
Correct	Wings level, balance

5. Regaining Straight and Level (pitch and roll)

Power	Low nose decr. High nose incr.
Attitude	Reselect S&L
Power	Check- 2300 RPM
Attitude	Confirm S&L
Trim	To relieve control pressure

6. Straight and Level at various Airspeeds

Change in power maintain S&L – Straight with Rudder, coordinate wings level with aileron

Power	+	Attitude	=	Performance
2300 RPM		Normal		S + L 105 kts
2600 RPM		Low		S + L 115 kts
2000 RPM		High		S + L 85 kts

Aircraft Management

Throttle – Smooth and positive, 3 sec

Mixture – Meters Fuel, ICO, Full Rich

Carburettor Heat – Hot below 1900 RPM

Temps and Press – Green Range

Airmanship and Human Factors

Lookout – Clock Code

"I have control", "you have control"

Situational Awareness / VFR Training Areas

IMSAFE

Straight and Level

Objective

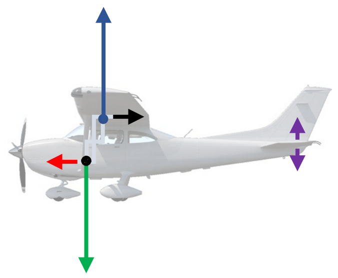
1. To establish and maintain straight and level flight at a constant airspeed, altitude, direction, and in balance
2. To regain straight and level.
3. To maintain straight and level flight at a selected airspeed or power setting..

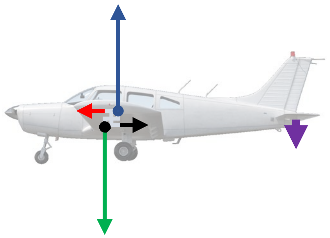
Definition

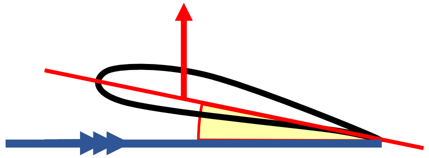
Primary Controls – those control surfaces that affect the aircraft's movement about the three axis of motion.

Ancillary Controls – those controls that supplement the primary controls supporting flight at different airspeeds i.e. throttle, trim and flaps

Principles of Flight







Lift = $C_L \times (\frac{1}{2} \rho V^2)\, S$

Lift = AoA x IAS

Power + Attitude = Performance

Aircraft Management

Throttle – Smooth and positive, 3 sec

Mixture – Meters Fuel, ICO, Full Rich

Carburettor Heat – Hot below 1900 RPM

Temps and Press – Green Range

Airmanship and Human Factors

Lookout – Clock Code

"I have control", "you have control"

Situational Awareness / VFR Training Areas

IMSAFE

Air Exercise

Identify the Horizon Line – Where the Sky meets the sea or land.

Datum Attitude = S&L Attitude. Demonstrate high and low nose attitude.

1. Establish Straight and Level

Power	Set for Straight and Level 2300 RPM
Attitude	Elevator – ~ 4 fingers below horizon, set ton top of the instrument panel
	Ailerons – wings level, top of instrument panel parallel with horizon line
	Rudder – aircraft in balance (step on ball)
Trim	To relieve control pressure – Coarse then fine

2. Maintaining Straight and Level

Lookout	20º scan every 2 seconds
Attitude	Correct, - Wings level, Bal
Instruments	Perf – Alt, DI, ASI, Bal

3. Regaining Straight and Level (minor pitch)

Attitude	Reselect S&L
Power	Check- 2300 RPM
Attitude	Confirm S&L
Trim	To relieve control pressure

4. Demonstrate S&L out of balance

Demo	Gross imbalance
Demo	Small imbalance
Correct	Wings level, balance

5. Regaining Straight and Level (pitch and roll)

Power	Low nose decr. High nose incr.
Attitude	Reselect S&L
Power	Check- 2300 RPM
Attitude	Confirm S&L
Trim	To relieve control pressure

6. Straight and Level at various Airspeeds

Change in power maintain S&L – Straight with Rudder, coordinate wings level with aileron

Power	+	Attitude	=	Performance
2300 RPM		Normal		S + L 105 kts
2600 RPM		Low		S + L 115 kts
2000 RPM		High		S + L 85 kts

WAIKATO AVIATION ACADEMY

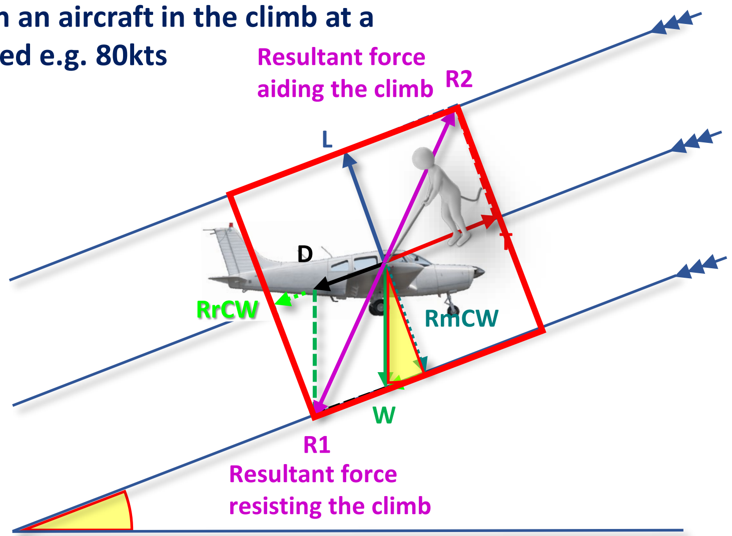
Climbing and Descending

Objective

1. To enter the climb and descend from straight & level
2. To maintain a climb/descent at a constant speed, rate & direction, while maintaining balance.
3. To level off at specific altitudes

Principles of Flight

Forces acting on an aircraft in the climb at a constant airspeed e.g. 80kts



T > D

L < W

Aircraft in equilibrium?

Resolve weight into components?

T = D + RrCW

L = RmCW

Aircraft is in equilibrium!

Factors affecting climb performance

Power	More excess power available	↑ In climb performance
Altitude	Less excess power available	↓ In climb performance
Weight	Less excess power available	↓ In climb performance
Flap	Less excess power available	↓ In climb performance
Wind	Affects climb angle and distance to climb	

Show

Climb configurations

Performance	Power	Attitude
Best rate of climb Vy	Full power	76 kts
Best angle of climb Vx	Full power	64 kts
Normal climb	Full power	**80 kts**
Cruise climb	Full power	90-95 kts

Climbing and Descending

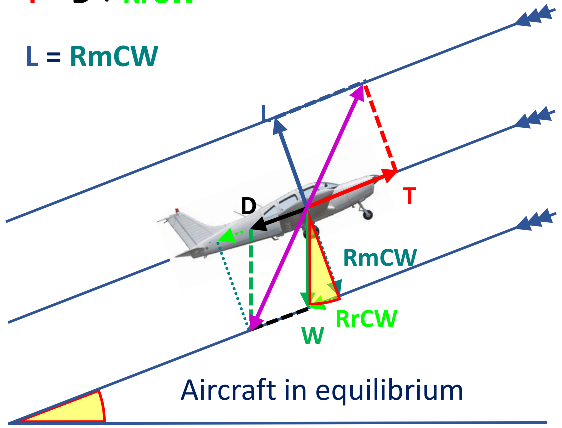
Objective

1. To enter the climb and descend from straight & level
2. To maintain a climb/descent at a constant speed, rate & direction, while maintaining balance.
3. To level off at specific altitudes

Principles of Flight

T = D + RrCW

L = RmCW

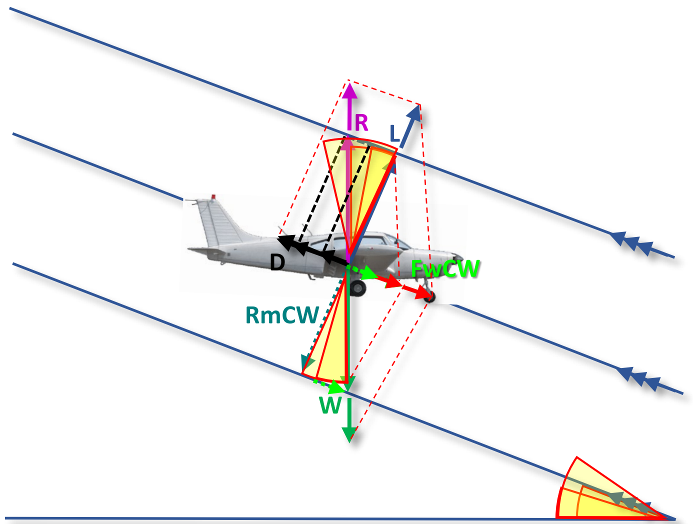


Power	↑ In climb performance
Altitude	↓ In climb performance
Weight	↓ In climb performance
Flap	↓ In climb performance
Wind	Affects climb angle

Performance	Attitude
Best rate of climb Vy	76 kts
Best angle of climb Vx	64 kts
Normal climb	80 kts
Cruise climb	90-95 kts

Principles of Flight

Forces acting on an aircraft in the descent at a constant airspeed e.g. 76kts



No thrust, flying airspeed maintained by pitching the nose down?

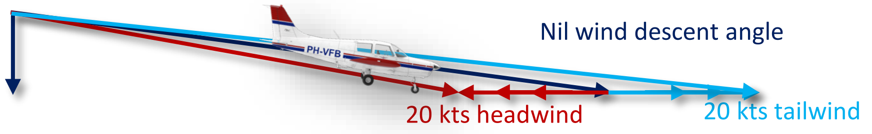
D balances FwCW

L = RmCW

Aircraft is in equilibrium!

Factors affecting descent performance maintaining 76 kts

Power	↑ Power ↓ FwCW	Flatter descent, ↓ Rate of descent
L/D ratio	↑ Lift to Drag ratio	Flatter descent, ↓ Rate of descent
Weight	↑ Weight ∝ ↑ FwCW & L/D ↑ Airspeed	O Change in descent angle
Flap	↓ L/D ratio ↑ FwCW	Steeper descent, ↑ Rate of descent
Wind	Affects descent angle and descent range	



Descent configurations

Performance	Power	Attitude
Glide descent	Idle	**76 kts**
Medium power descent	1500 RPM	76 kts
Cruise descent	2100 RPM	105 kts

WAIKATO AVIATION ACADEMY

Climbing and Descending

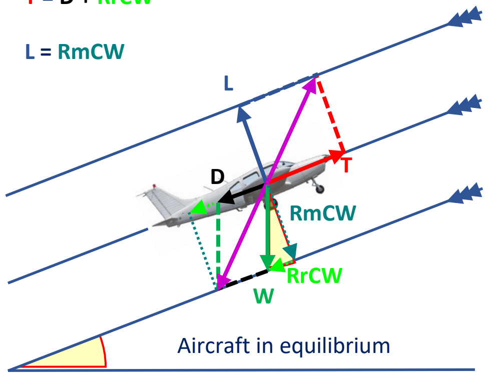
Objective

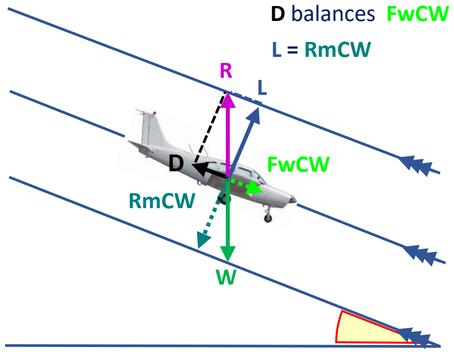
1. To enter the climb and descend from straight & level
2. To maintain a climb/descent at a constant speed, rate & direction, while maintaining balance.
3. To level off at specific altitudes

Principles of Flight

T = D + RrCW

L = RmCW





Power	↑ In climb performance
Altitude	↓ In climb performance
Weight	↓ In climb performance
Flap	↓ In climb performance
Wind	Affects climb angle

Performance	**Attitude**
Best rate of climb Vy	76 kts
Best angle of climb Vx	64 kts
Normal climb	80 kts
Cruise climb	90-95 kts

Power	↑ Flatter descent
L/D ratio	↑ Flatter descent
Weight	↑ Weight O Change
Flap	↓ Steeper descent
Wind	Affects descent / range

Performance	**Power**	**Attitude**
Glide descent	Idle	76 kts
Medium descent	1500 RPM	76 kts
Cruise descent	2100 RPM	105 kts

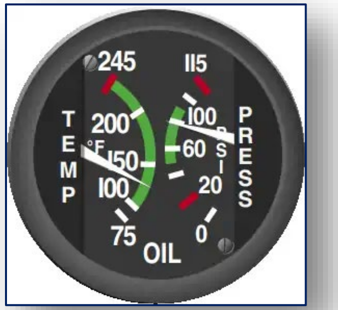
Aircraft Management

Throttle – Smooth but positive, 3 seconds

Mixture – Meters fuel, ICO, Full - Rich

Carb Heat – Hot below 1900 RPM for descent

Temperatures and Pressures – Green Range – monitor prolonged climbs

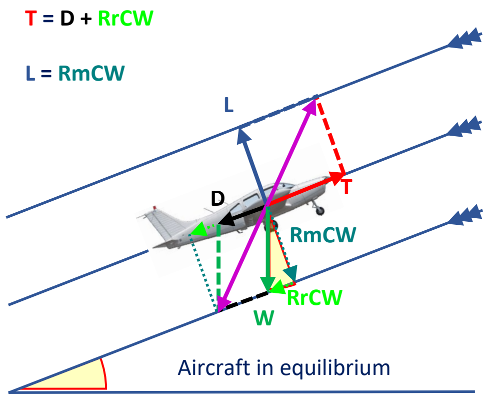


Climbing and Descending

Objective

1. To enter the climb and descend from straight & level
2. To maintain a climb/descent at a constant speed, rate & direction, while maintaining balance.
3. To level off at specific altitudes

Principles of Flight



Power	↑ In climb performance
Altitude	↓ In climb performance
Weight	↓ In climb performance
Flap	↓ In climb performance
Wind	Affects climb angle

Performance	**Attitude**
Best rate of climb Vy	76 kts
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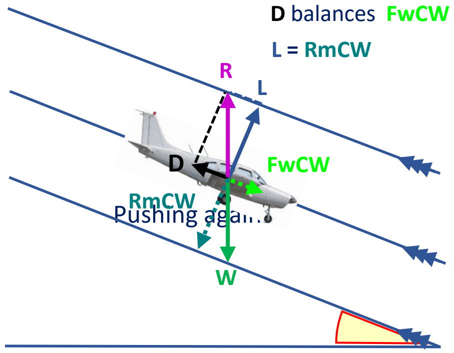


Power	↑ Flatter descent
L/D ratio	↑ Flatter descent
Weight	↑ Weight O Change
Flap	↓ Steeper descent
Wind	Affects descent / range

Performance	**Power**	**Attitude**
Glide descent	Idle	76 kts
Medium descent	1500 RPM	76 kts
Cruise descent	2100 RPM	105 kts

Aircraft Management

Throttle – Smooth and positive, 3 sec

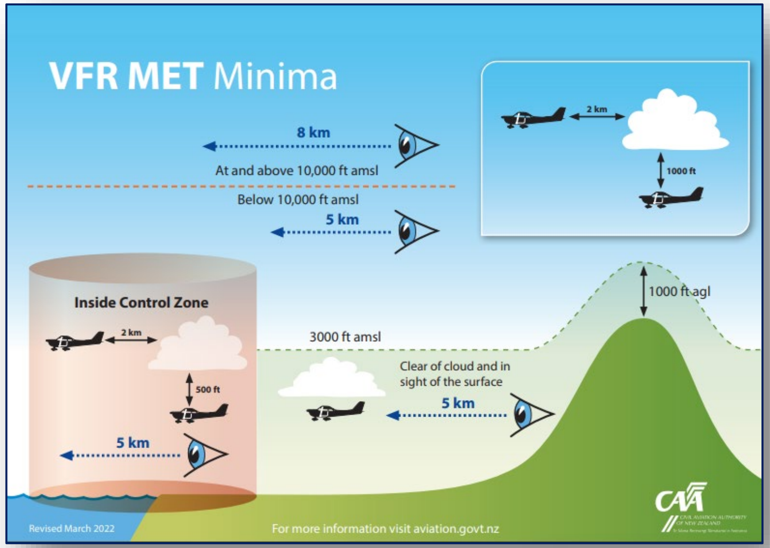
Mixture – Meters Fuel, ICO, Full Rich

Carburettor Heat – Hot for descent

Temps and Press – Green Range, monitor

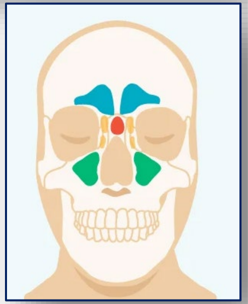
Airmanship and Human Factors

Airspace & VFR Weather minima – Confirm airspace above, distance from clouds



Situational Awareness – NUTA notice, understand and think ahead

Anatomy of trapped gases in ears and sinus – unable to equalise, worse on descent. The Valsalva manoeuvre may alleviate the discomfort.



Empty field myopia - human eyes do not receive sufficient image stimulation to be in an actively alert state. The eye struggles to focus on objects due to a low degree of contrast against a featureless background.

WAIKATO AVIATION ACADEMY

Climbing and Descending

Objective

1. To enter the climb and descend from straight & level
2. To maintain a climb/descent at a constant speed, rate & direction, while maintaining balance.
3. To level off at specific altitudes

Air Exercise

Select and Reference Point and reference altitude. Lookout above and below as applicable

Climb – Entry **Check PAT**

Power	Full (rudder)
Attitude	Climb Att, Wings Level, Bal
Trim	Relieve control pressure

Maintaining the Climb

Lookout	20^o - every 2 seconds
Attitude	Climb, Wings Level, Bal
Instrument	Height, D.I., Speed, Bal.

Exit to Straight and Level

Attitude	Select S&L Att
Power	2300 approaching 100 kts
Trim	Relieve control pressure

Check PAT **LAI**

Descent – Entry **Check PAT**

Power	Idle (rudder)
Attitude	Descent Att, Wings Level, Bal
Trim	Relieve control pressure

Maintaining the Descent

Lookout	20^o - every 2 seconds
Attitude	Descent, Wings Level, Bal
Instrument	Height, D.I., Speed, Bal.

Exit to Straight and Level

Power	Increase to 2300
Attitude	Select S&L Att
Trim	Relieve control pressure

Check PAT **LAI**

Effect of Power & Flap on Climb

Power ↓	Rate of climb ↓
Flaps ↓ DN	Rate of climb ↓

Effect of Power & Flap on Descent

Power ↑	Rate of descent ↓, Flatter glide
Flaps ↓ DN	Rate of descent ↑, Steeper glide

Aircraft Management

Throttle – Smooth and positive, 3 sec

Mixture – Meters Fuel, ICO, Full Rich

Carburettor Heat – Hot for descent

Temps and Press – Green Range, monitor

Airmanship and Human Factors

Airspace and VFR Minima

Situational Awareness

Anatomy of Trapped Gases

Empty Field Myopia

I M S A F E

Climbing and Descending

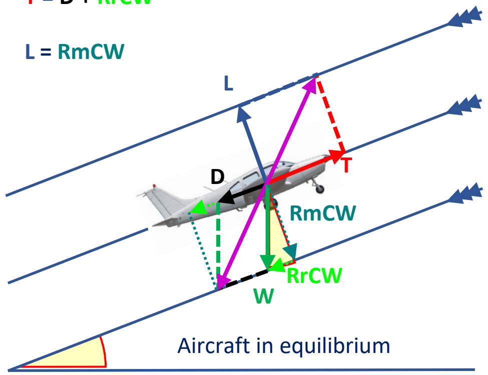
Objective

1. To enter the climb and descend from straight & level
2. To maintain a climb/descent at a constant speed, rate & direction, while maintaining balance.
3. To level off at specific altitudes

Principles of Flight

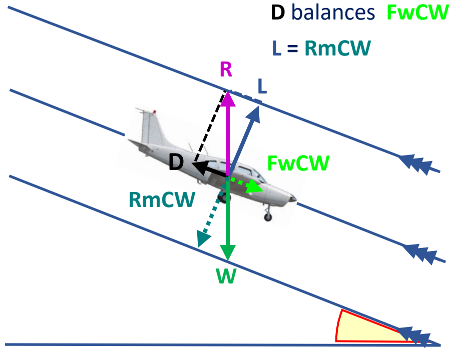
T = D + RrCW

L = RmCW



D balances FwCW

L = RmCW



Power	↑ In climb performance
Altitude	↓ In climb performance
Weight	↓ In climb performance
Flap	↓ In climb performance
Wind	Affects climb angle

Performance	Attitude
Best rate of climb Vy	76 kts
Best angle of climb Vx	64 kts
Normal climb	80 kts
Cruise climb	90-95 kts

Power	↑ Flatter descent
L/D ratio	↑ Flatter descent
Weight	↑ Weight O Change
Flap	↓ Steeper descent
Wind	Affects descent / range

Performance	Power	Attitude
Glide descent	Idle	76 kts
Medium descent	1500 RPM	76 kts
Cruise descent	2100 RPM	105 kts

Aircraft Management

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Airmanship and Human Factors

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Situational Awareness

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I M S A F E

Air Exercise

Select and Reference Point and reference altitude. Lookout above and below as applicable

Climb – Entry   Check PAT

Power	Full (rudder)
Attitude	Climb Att, Wings Level, Bal
Trim	Relieve control pressure

Descent – Entry   Check PAT

Power	Idle (rudder)
Attitude	Descent Att, Wings Level, Bal
Trim	Relieve control pressure

Maintaining the Climb

Lookout	20° - every 2 seconds
Attitude	Climb, Wings Level, Bal
Instrument	Height, D.I., Speed, Bal.

Maintaining the Descent

Lookout	20° - every 2 seconds
Attitude	Descent, Wings Level, Bal
Instrument	Height, D.I., Speed, Bal.

Exit to Straight and Level

Attitude	Select S&L Att
Power	2300 approaching 100 kts
Trim	Relieve control pressure

Check PAT   LAI

Exit to Straight and Level

Power	Increase to 2300
Attitude	Select S&L Att
Trim	Relieve control pressure

Check PAT   LAI

Effect of Power & Flap on Climb

Power ↓	Rate of climb ↓
Flaps ↓ DN	Rate of climb ↓

Effect of Power & Flap on Descent

Power ↑	Rate of descent ↓, Flatter glide
Flaps ↓ DN	Rate of descent ↑, Steeper glide

WAIKATO AVIATION ACADEMY

Climbing and Descending

80kts, 1000ft AMSL at 2200 lbs

80kts, 1000ft AMSL at 2500 lbs, or ↑ drag

80kts, 7500ft AMSL at 2400 lbs

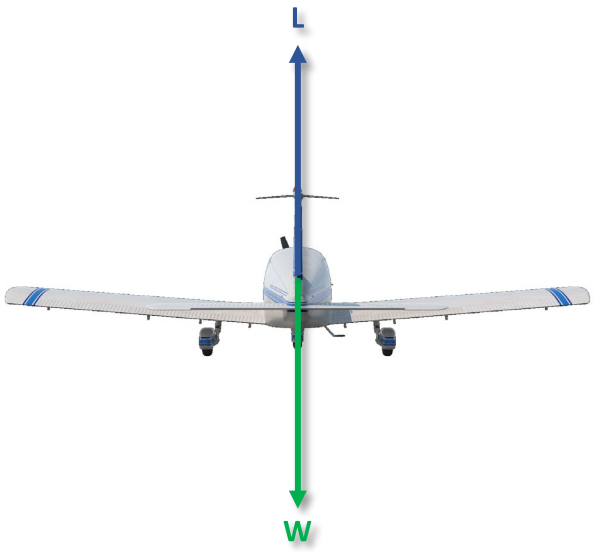
Objective

1. To change direction through 360º at a constant rate – using 30 º angle of bank, while maintaining a constant altitude and keeping the aircraft in balance.

Principles of Flight

Vertical forces acting on an aircraft in Straight and Level flight

In order to change the motion (direction) of the aircraft, we need to apply a force.



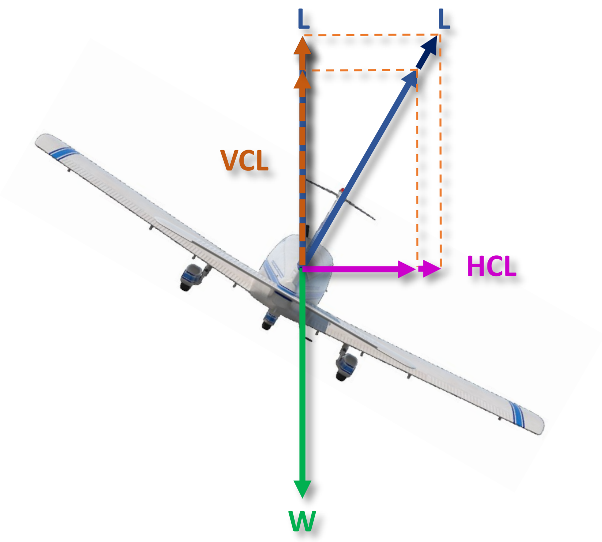
That force is created by banking the wings of the aircraft

The horizontal component of lift **(HCL)** provides that force.

The vertical component of lift **(VCL)** reduces to be less than **Weight**

More **LIFT** required. We can either increase the speed or AoA.

AoA more responsive



Objective

1. To change direction through 360° at a constant rate – using 30 ° angle of bank, while maintaining a constant altitude and keeping the aircraft in balance.

Principles of Flight

Bank to provide HCL

- ↓ VCL < Weight
- ↑ VCL = Weight
- ↑ LIFT
- ↑ AoA

Principles of Flight

Adverse Yaw

Increase **Lift** on upgoing wing creates more **drag** than the down going wing.

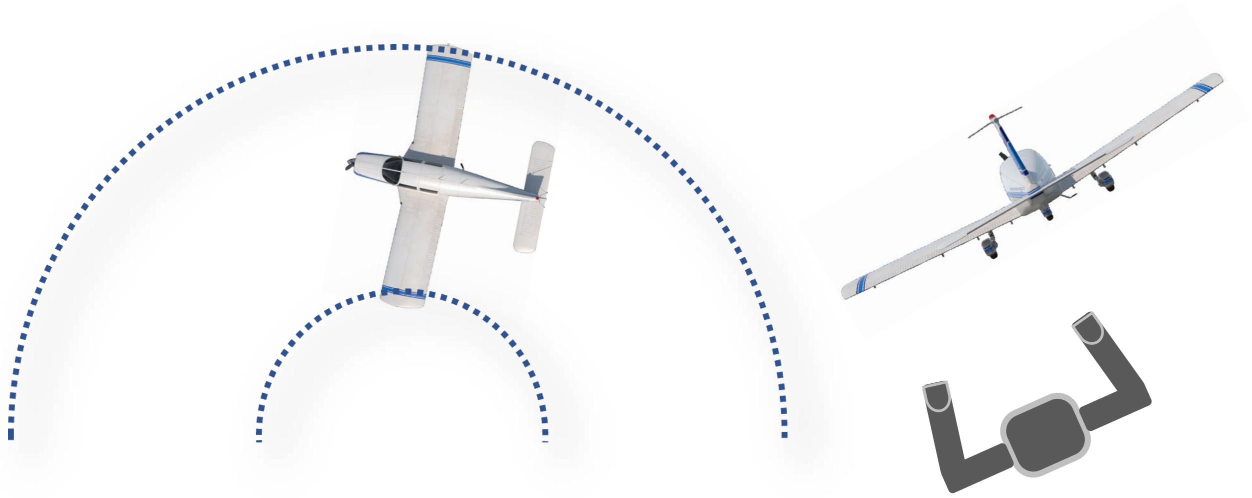
This causes the aircraft to **YAW** initially in the opposite direction of the **ROLL**, or, YAW out of the turn.

To counteract the YAW out of the turn, coordinate rudder when rolling in the direction of the turn with aileron.

Overbanking

Outer wing travels further, therefore higher relative airspeed than inner wing, more LIFT.

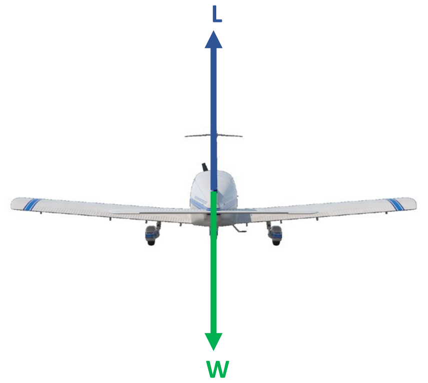
Required to hold off bank with aileron (slight reverse pressure on the ailerons)

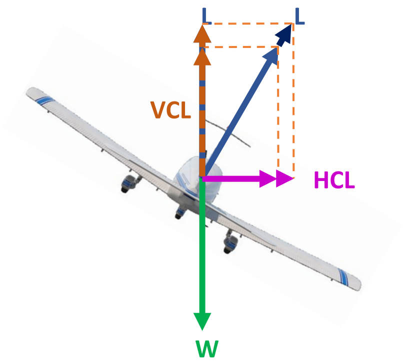


Objective

1. To change direction through 360º at a constant rate – using 30 º angle of bank, while maintaining a constant altitude and keeping the aircraft in balance.

Principles of Flight

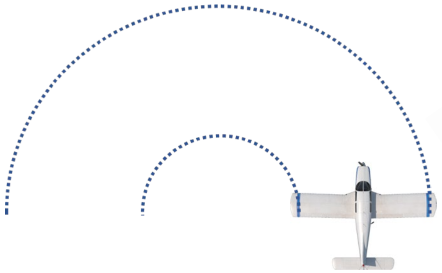




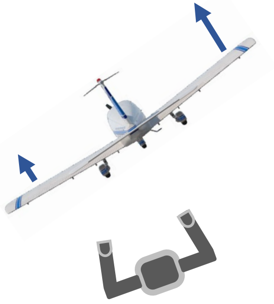
Bank to provide HCL

- ↓ VCL < Weight
- ↑ VCL = Weight
- ↑ LIFT
- ↑ AoA

Adverse **YAW**



Overbank



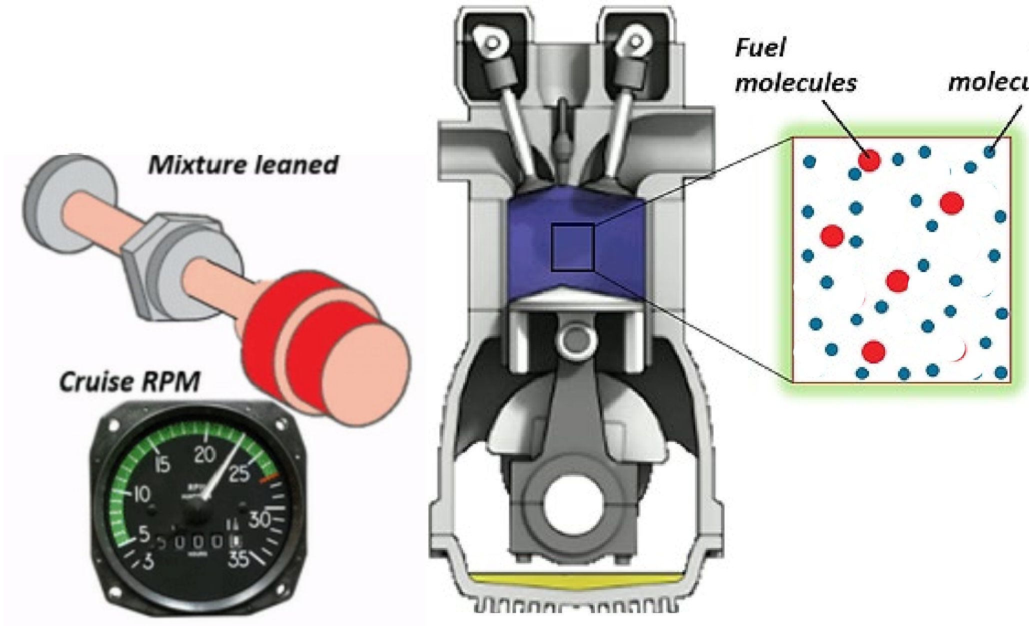
Hold off Bank

Aircraft Management

Throttle – Smooth but positive throttle movements

Mixture – Meters fuel, ICO, Full - Rich

Mixture **Full RICH** for high powered situations, e.g. Take-off, Cruise at low altitude
Mixture **LEAN** at higher altitudes (normally above 5000ft) when air density decreases, or, at lower altitudes when engine power settings are below 65%.



↑ **Altitude**
Less air density

Lean the mixture

Carb Heat – Intermittent use at higher power settings. Hot below 1900 RPM for descent

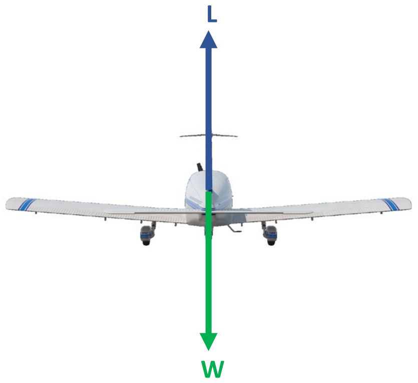
Temperatures and Pressures – **Green** Range

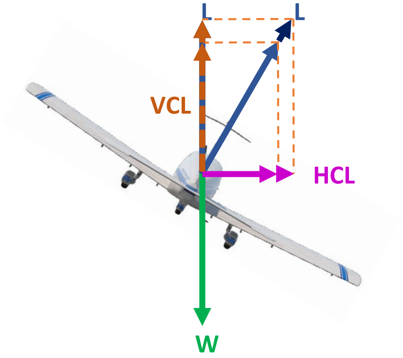
Medium Turns

Objective

1. To change direction through 360° at a constant rate – using 30 ° angle of bank, while maintaining a constant altitude and keeping the aircraft in balance.

Principles of Flight





Bank to provide HCL

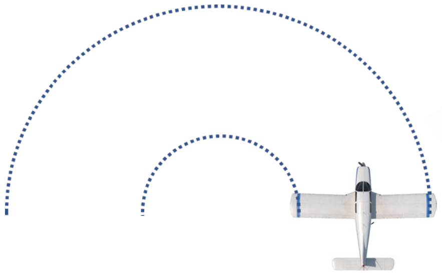
↓ VCL < Weight

↑ VCL = Weight

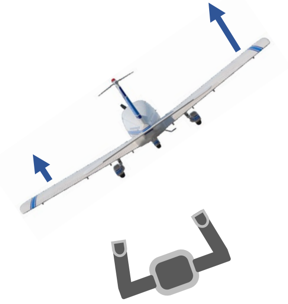
↑ LIFT

↑ AoA

Adverse YAW



Overbank



Hold off Bank

Aircraft Management

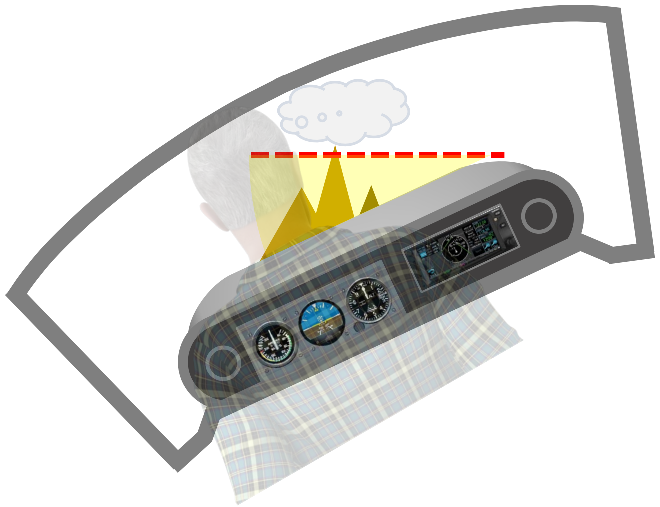
Throttle – Smooth and positive, 3 sec

Mixture – Meters Fuel, ICO, Full Rich

Carburettor Heat – Hot for descent

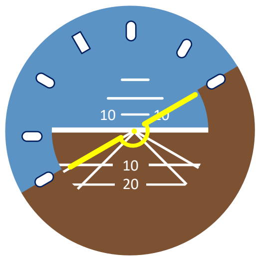
Temps and Press – Green Range, monitor

Airmanship and Human Factors



Reference Point– To minimalise disorientation.

Reference angle of Bank 30°



Turning sensation – You might want to lean out of the turn as the body want to align with the perceived vertical. Also you might feel a slight increase in weight. When every we increase LIFT such that it is greater than weight, we experience more than 1 "G".

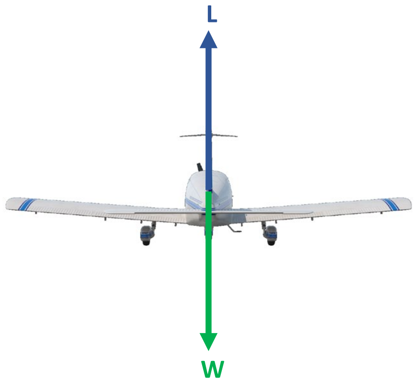
Lookout for other aircraft- As you are turning and changing direction, you will need to continue to have a good lookout before, during and after the roll out. There is a higher probability that you may come into close proximity with other aircraft.

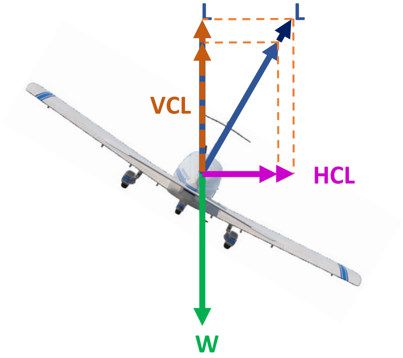
Medium Turns

Objective

1. To change direction through 360° at a constant rate – using 30 ° angle of bank, while maintaining a constant altitude and keeping the aircraft in balance.

Principles of Flight

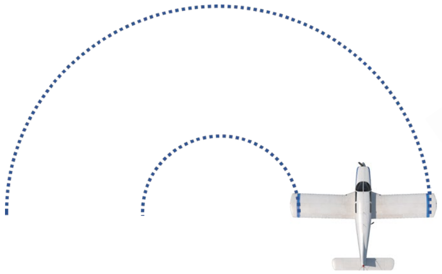




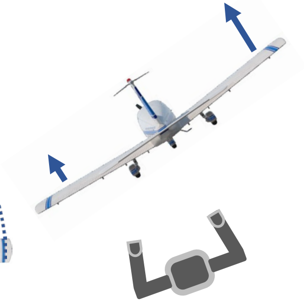
Bank to provide HCL

- ↓ VCL < Weight
- ↑ VCL = Weight
- ↑ LIFT
- ↑ AoA

Adverse YAW



Overbank



Hold off Bank

Aircraft Management

Throttle – Smooth and positive, 3 sec

Mixture – Meters Fuel, ICO, Full Rich

Carburettor Heat – Hot for descent

Temps and Press – Green Range, monitor

Airmanship and Human Factors

Reference point

Turning sensation

The leans

Lookout

I M S A F E

N U T A

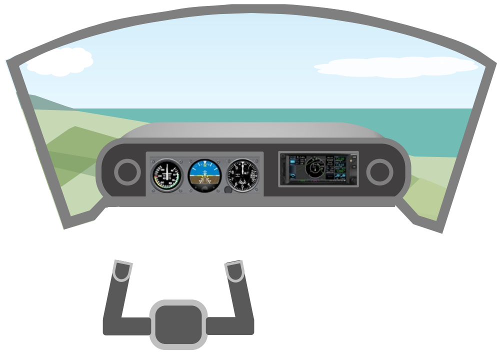
Air Exercise

Adverse YAW demonstration

Medium turn demonstration

Medium Turn – Entry

Lookout	Opposite, then in direction	
Roll	With aileron	Coordinated
Rudder	Balance	
Backpressure	Elevator to set attitude	
Hold Bank	30° to horizon	



Maintaining the Turn

Lookout	In front and in direction
Attitude	Set, Wings 30 °, Balance
Instrument	Height, Bank, Balance

Exit to Straight and Level

Lookout	Ref. point, ½ bank angle prior	
Roll	With aileron	Coordinated
Rudder	Balance	
Backpressure	Relax backpressure	
Reset	Straight and Level	
Check	PAT	

Recovery from altitude deviation

Altitude	High / Low
Attitude	Low / High
Altitude	Regained
Attitude	Reset

WAIKATO AVIATION ACADEMY

Climbing and Descending Turns

Objective

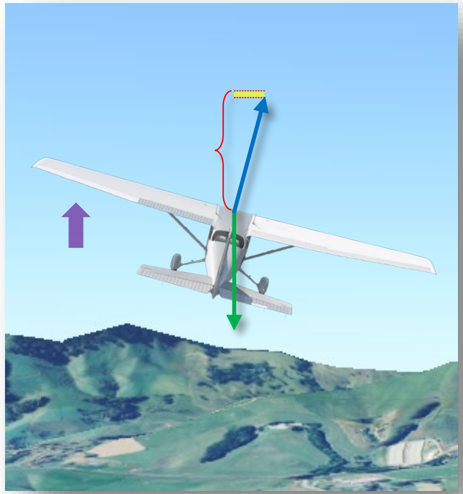
1. To change direction of the aircrafts flight path at a constant angle of bank and rate while in a climb or descent.

Principles of Flight

Angle of bank in the climb is limited to **15⁰** as a steeper bank angle will reduce the rate of climb.

Angle of bank is a descent is limited to **20⁰** as a steeper bank angle will increase the rate of decent.

Climbing Turn



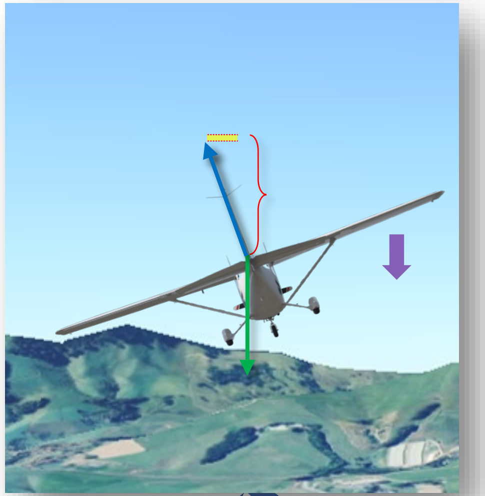
To maintain the same rate of climb in the climbing turn with a tilted lift vector at the same airspeed requires ↑ **Lift**

↑ **Lift** = ↑ **Drag**

To maintain the same airspeed a lower nose attitude is required.

Lower nose attitude = reduced Rate of climb (RoC)

Descending Turn



To maintain a controlled rate of descent in the descending turn with a tilted lift vector requires ↑ **Lift**

↑ **Lift** = ↑ **Drag**

To maintain the same airspeed a lower nose attitude is required.

Lower nose attitude = increased Rate of descent (RoD)

Climbing and Descending Turns

Objective

1. To change direction of the aircrafts flight path at a constant angle of bank and rate while in a climb or descent.

Definition

A medium turn in a climb is at an angle of 15° and in a descent 20°.

Principles of Flight

Climbing Turn - **Lift tilted**

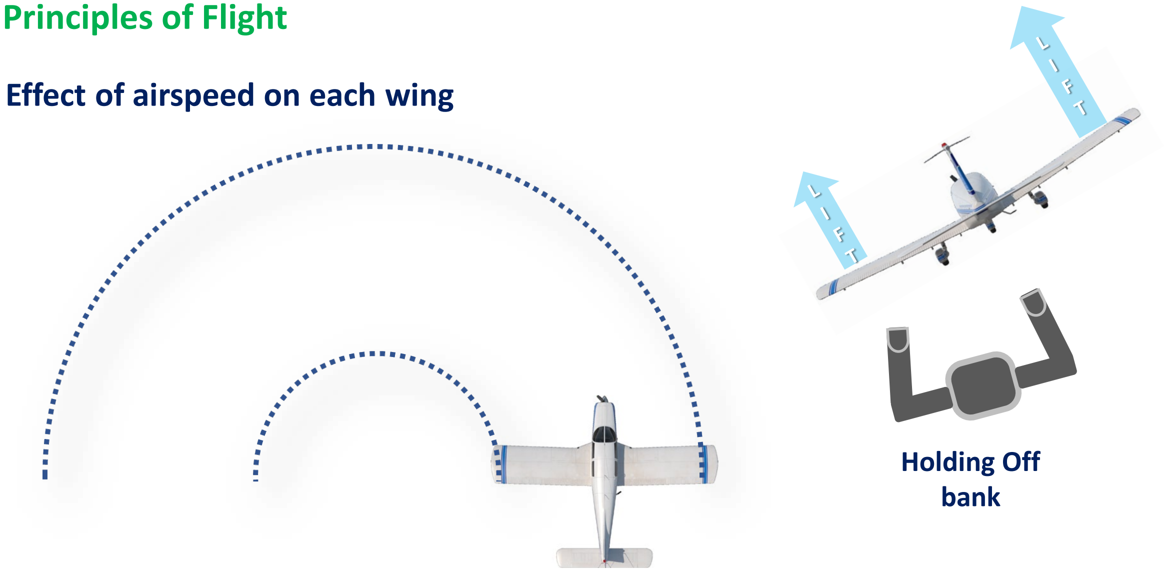
- ↑ Lift to climb and turn the aircraft at same rate of climb
- ↑ Drag
- ↓ Nose attitude to maintain same climb airspeed
- ↓ Rate of climb

Descending Turn **Lift tilted**

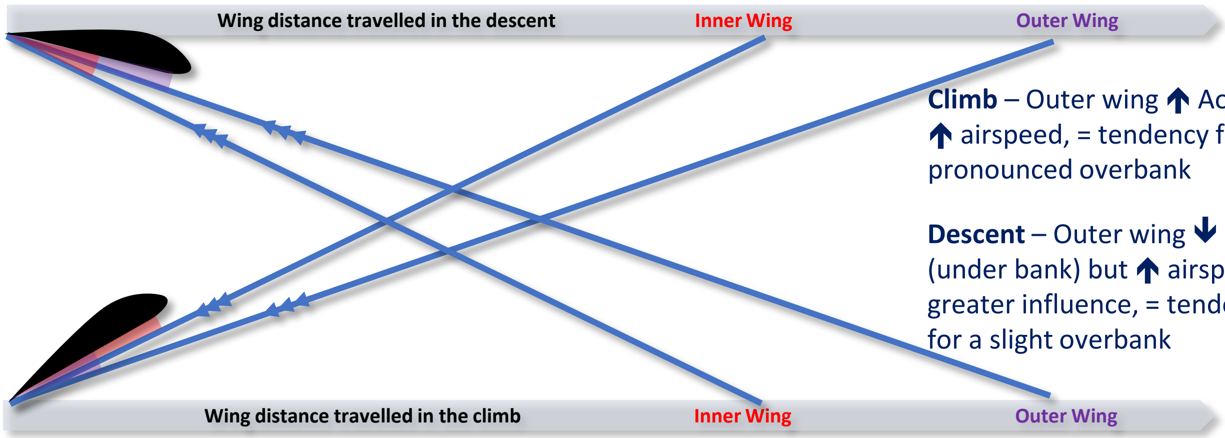
- ↑ Lift to control rate of descent
- ↑ Drag
- ↓ Nose attitude to maintain same descent airspeed
- ↑ Rate of descent

Principles of Flight

Effect of airspeed on each wing



Effect of angle of attack on each wing



Climb – Outer wing ↑ AoA & ↑ airspeed, = tendency for a pronounced overbank

Descent – Outer wing ↓ AoA (under bank) but ↑ airspeed greater influence, = tendency for a slight overbank

Climbing and Descending Turns

Objective

1. To change direction of the aircrafts flight path at a constant angle of bank and rate while in a climb or descent.

Definition

A medium turn in a climb is at an angle of 15^{o} and in a descent 20^{o}.

Principles of Flight

Climbing Turn - **Lift tilted**

↑ Lift to climb and turn the aircraft at same rate of climb

↑ Drag

↓ Nose attitude to maintain same climb airspeed

↓ Rate of climb

Descending Turn **Lift tilted**

↑ Lift to control rate of descent

↑ Drag

↓ Nose attitude to maintain same descent airspeed

↑ Rate of descent

Effect of airspeed and angle of attack on each wing

Climb outer wing ↑ AoA and ↑ airspeed, = tendency pronounced overbank

Descent – Outer wing ↓ AoA and ↑ airspeed, = tendency for slight overbank

Aircraft Management

Throttle – Smooth but positive throttle movements

Mixture – Meters fuel, ICO, Full - Rich

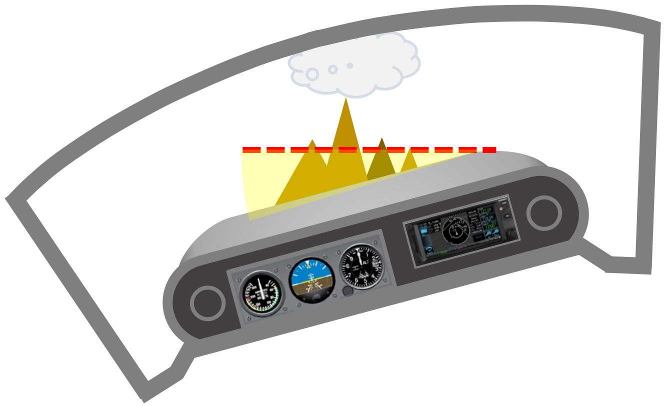
Carb Heat – Intermittent use at higher power settings. Hot below 1900 RPM for descent

Temperatures and Pressures – Green Range

Airmanship and Human Factors

Reference Point– To minimalise disorientation.

Reference angle of Bank 15^{o}



Lookout for other aircraft- As you are turning and changing direction, you will need to continue to have a good lookout before, during and after the roll out.

Situational Awareness - As you are changing direction and altitude.

Climbing and Descending Turns

Objective

1. To change direction of the aircrafts flight path at a constant angle of bank and rate while in a climb or descent.

Definition

A medium turn in a climb is at an angle of 15^o and in a descent 20^o.

Principles of Flight

Climbing Turn - **Lift tilted**

- ↑ Lift to climb and turn the aircraft at same rate of climb
- ↑ Drag
- ↓ Nose attitude to maintain same climb airspeed
- ↓ Rate of climb

Descending Turn **Lift tilted**

- ↑ Lift to control rate of descent
- ↑ Drag
- ↓ Nose attitude to maintain same descent airspeed
- ↑ Rate of descent

Effect of airspeed and angle of attack on each wing

Climb outer wing ↑ AoA and ↑ airspeed, = tendency pronounced overbank

Descent – Outer wing ↓ AoA and ↑ airspeed, = tendency for slight overbank

Aircraft Management

Throttle – Smooth and positive, 3 sec

Mixture – Meters Fuel, ICO, Full Rich

Carburettor Heat – Hot for descent

Temps and Press – Green Range, monitor

Airmanship and Human Factors

Reference point

Angle of bank

Lookout

Situational Awareness

I M S A F E

N U T A

Air Exercise

Revision of 1. Straight and Level 2. Climbing and Descending 3. Medium Turns

Climbing Turn	Descending Turn
Prior	
Establish in the Climb at 80kts Lookout Reference point and altitude	Establish in the Descent at 75kts Lookout Reference point and altitude
Entry	
Roll in with aileron 15^o + balance rudder Lower nose for 80kts	Roll in with aileron 20^o + balance rudder Lower nose for 75kts
Maintain	
Lookout **Attitude** – Attitude / AoB / Balance **Instruments** – Height, Bank, Balance, ASI	**Lookout** **Attitude** – Attitude / AoB / Balance **Instruments** – Height, Bank, Balance, ASI
Exit	
Lookout Anticipate roll out Roll out with aileron + balance rudder Raise aircraft nose to climb 80kts Enter Straight and Level – **APT** - **PAT**	Lookout Anticipate roll out Roll out with aileron + balance rudder Raise aircraft nose to descent 75kts Enter Straight and Level – **PAT** - **PAT**

Slow Flight

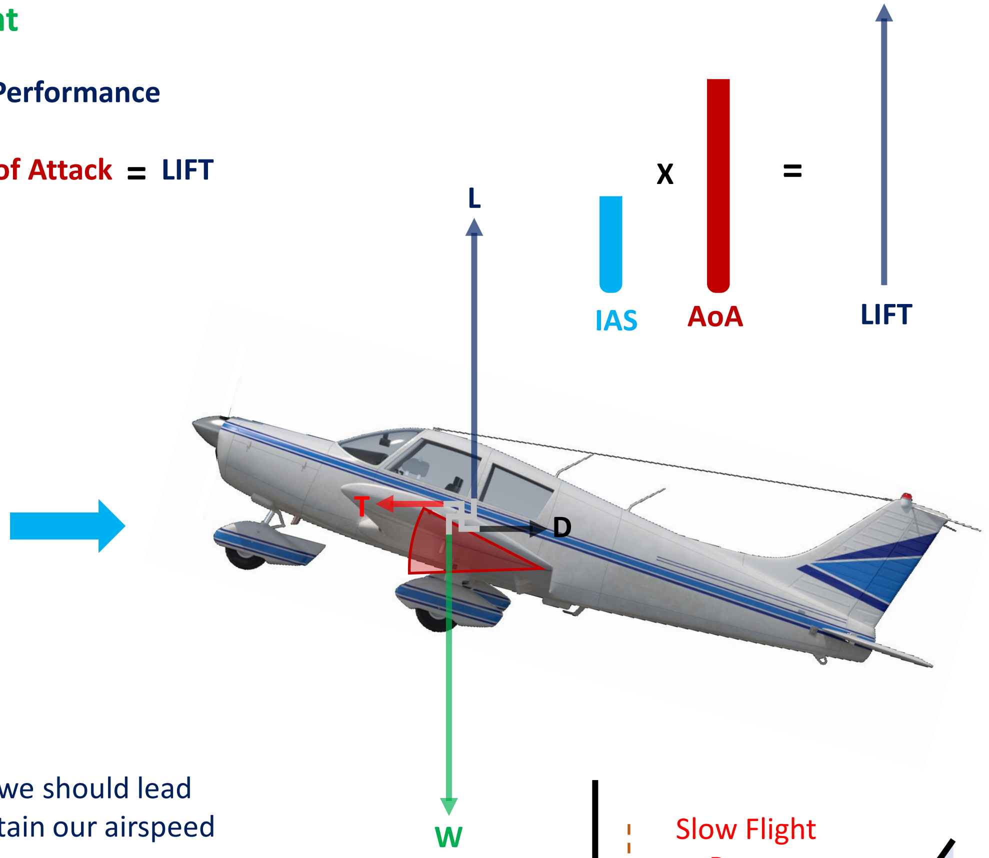
Objective

1. To slow the aircraft and maintain straight & level at a constant low airspeed > 1.2 Vs.
2. To maintain a constant altitude while turning at low airspeed.
3. To return to normal operating airspeeds.

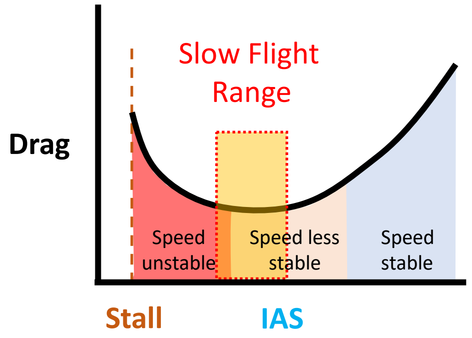
Principles of Flight

Power + Attitude = Performance

Airspeed x Angle of Attack = LIFT



Turning 20° AoB + , we should lead with power to maintain our airspeed



Aircraft becomes less speed stable. Important to select DATUM power settings and make small +/- changes from this setting to improve airspeed stability

Controls are less effective at lower airspeed, larger control movements required to manoeuvre the aircraft

Slipstream effect is less at lower power setting, rudder and elevator less effective

Slow Flight

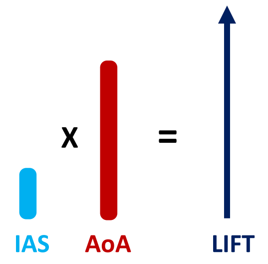
Objective

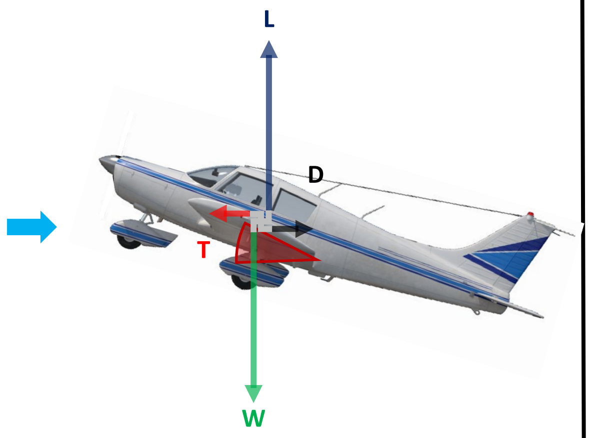
1. To slow the aircraft and maintain straight & level at a constant low airspeed > 1.2 Vs.
2. To maintain a constant altitude while turning at low airspeed.
3. To return to normal operating airspeeds.

Principles of Flight

Power + Attitude = Performance

Airspeed x Angle of Attack = LIFT



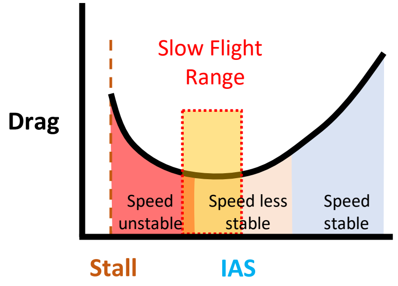


Lead with power to maintain airspeed

DATUM power setting – assist airspeed stability

Controls less effective

Slipstream less effective



Aircraft Management

Throttle – Smooth, positive but **incremental** throttle movements to account for inertia.

Datum power **PA28** 70kts 0° Flap **C172** 60kts 0° Flap ~ **1900 RPM**

Datum power **PA28** 65kts 25° Flap **C172** 55kts 10° Flap ~ **1900 RPM**

Datum power **PA28** 60kts 40° Flap **C172** 50kts 20-30 ° Flap ~ **2000 RPM**

Adjust power setting for conditions i.e. Air density and aircraft weight

Carb Heat – Intermittent use at higher power settings. Hot below 1900 RPM for slow flight.

Temperatures and Pressures – Green Range, monitor due to lower airspeeds

Flap – Only operate below Vfe for structural safety.

Select flap down at a moderate airspeed to limit pitch / trim changes with application

Select flap up with airspeed increasing to compensate for the loss of lift

Slow Flight

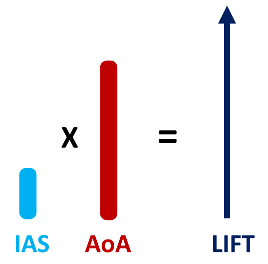
Objective

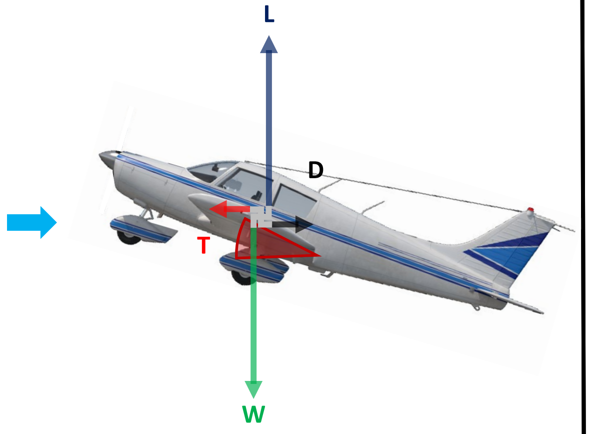
1. To slow the aircraft and maintain straight & level at a constant low airspeed > 1.2 Vs.
2. To maintain a constant altitude while turning at low airspeed.
3. To return to normal operating airspeeds.

Principles of Flight

Power + Attitude = Performance

Airspeed x Angle of Attack = LIFT



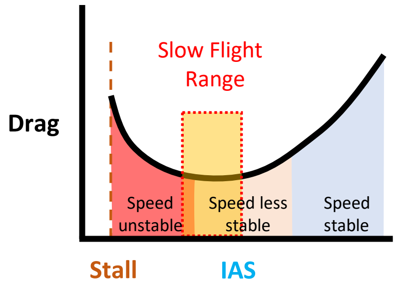


Lead with power to maintain airspeed

DATUM power setting – assist airspeed stability

Controls less effective

Slipstream less effective



Aircraft Management

Throttle – Smooth and positive, increments

Carburettor Heat – **Hot** for < 1900 RPM

Temps and Press – **Green Range,** monitor

Flap – Below **Vfe,** operate at safe airspeed

Airmanship and Human Factors

HASELL Checks – Carry out HASELL safety checks when there is an elevated risk of the aircraft entering and Undesired Aircraft State (UAS) i.e. momentarily loss of control of the aircraft.

H = Height – not less than 2500ft above terrain

A = Airframe – configured for exercise/operation

S = Security – no loose articles/objects in the cabin, harness secure

E = Engine – T's and P's normal range, mixture rich, fuel pump on, fuel sufficient and on fullest

L = Location – not over populated areas, known traffic areas including aerodromes, airspace

L = Lookout – one 180°, or two 90° clearing turns to ensure no confliction with traffic

Operational Bias – up until now you have been getting use to flying straight and level with a lower nose attitude (biased to this attitude). Now the nose attitude will need to be maintained (trimmed) at a higher attitude.

Inertia – During slow flight, the aircraft's inertia has a greater impact on changes in airspeed (slower to change) than changes in AoA. To correct for a disturbance in altitude or airspeed, you will in most cases need to lead with power and then adjust the attitude to maintain required airspeed.

Smooth coordination of controls – Primary and ancillary controls should be operated in a considered, smooth and coordinated manner.

Slow Flight

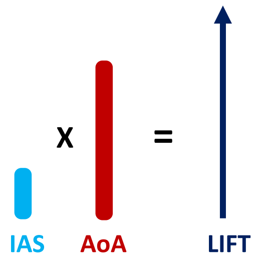
Objective

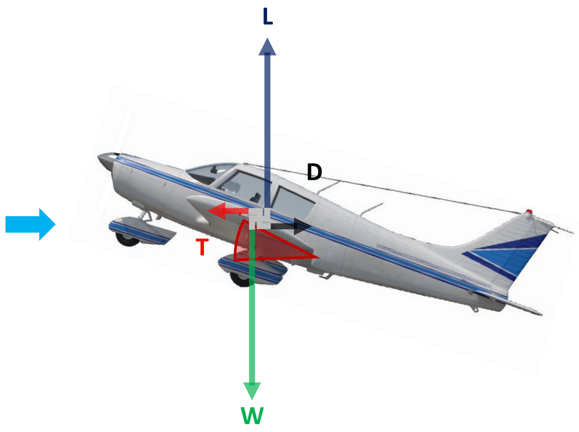
1. To slow the aircraft and maintain straight & level at a constant low airspeed > 1.2 Vs.
2. To maintain a constant altitude while turning at low airspeed.
3. To return to normal operating airspeeds.

Principles of Flight

Power + Attitude = Performance

Airspeed x Angle of Attack = LIFT



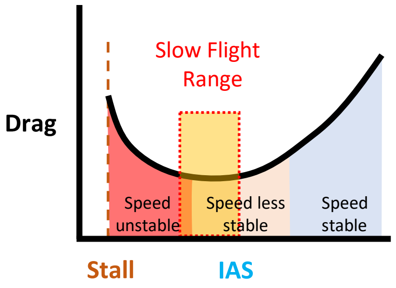


Lead with power to maintain airspeed

DATUM power setting – assist airspeed stability

Controls less effective

Slipstream less effective



Aircraft Management

Throttle – Smooth and positive, increments

Carburettor Heat – **Hot** for < 1900 RPM

Temps and Press – **Green Range,** monitor

Flap – Below **Vfe**, operate at safe airspeed

Airmanship and Human Factors

HASELL Checks

Operational Bias

Inertia

Coordinated controls

I M S A F E

N U T A

Air Exercise

Practice - Medium Turns

HASELL - Checks

Entry Slow Flight – Clean

Power	Reduce to DATUM (rudder)
Attitude	**Increase** to maintain S+L
Trim	To relieve control pressure
Check	**PAT = ~ 70 kts**

Maintaining Slow Flight

Lookout	20^o every 2 seconds
Attitude	Set, Wings Lvl, Balance
Instrument	Height, DI, Airspeed, Balance

Turning Slow - 2x 180° at 20°AoB

Lookout	Opposite - In direction
Lead	With power, increments
Entry	Controls Coord, less effective

Adverse Yaw pronounced

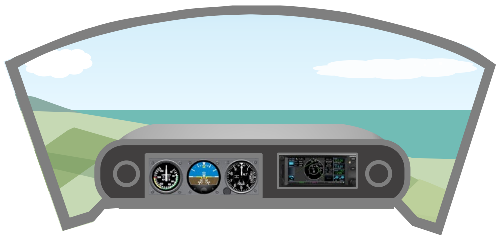
LAI	Complete
Exit	Coordinated, Reset Att. & Power

Exit to Cruise

Power	Increase to full (rudder)
Attitude	Decrease to maintain S+L
Power	2300 RPM 100 kts
Attitude	Check S+L
Trim	To relieve control pressure

Entry Slow Flight – Flap 25°

Power	Reduce to DATUM (rudder)
Flap	Vfe, moderate speed, stages
Attitude	Select to maintain S+L
Trim	To relieve control pressure
Check	**PAT = ~ 65 kts**
Check	**LAI**



Recovery from Deviation in Alt/Speed

Lead	Power - increments
Follow	Attitude changes - increments
Reset	DATUM power and attitude

Turning Slow - 2x 360° at 20°AoB

Entry Slow Flight – Flap 40°

Exit to Cruise (or climb from approach)

Power	Increase to full (rudder)	
Flap	Raise stages, incr in airspeed	
Attitude	Select S+L	(Select Climb)
Power	2300 RPM 100 kts	(Full)
Attitude	Check S+L	(Climb)
Trim	To relieve control pressure	

Objective

1. To control the aircraft to the point of the stall, recognize the symptoms of the approaching stall, experience the stall and recover with a minimum height loss.
2. To control the aircraft to the point of the stall, recognize the symptoms of the approaching stall and **recover at the stall onset** with minimum height loss.

Principles of Flight

LIFT = Angle of Attack x Airspeed

Objective

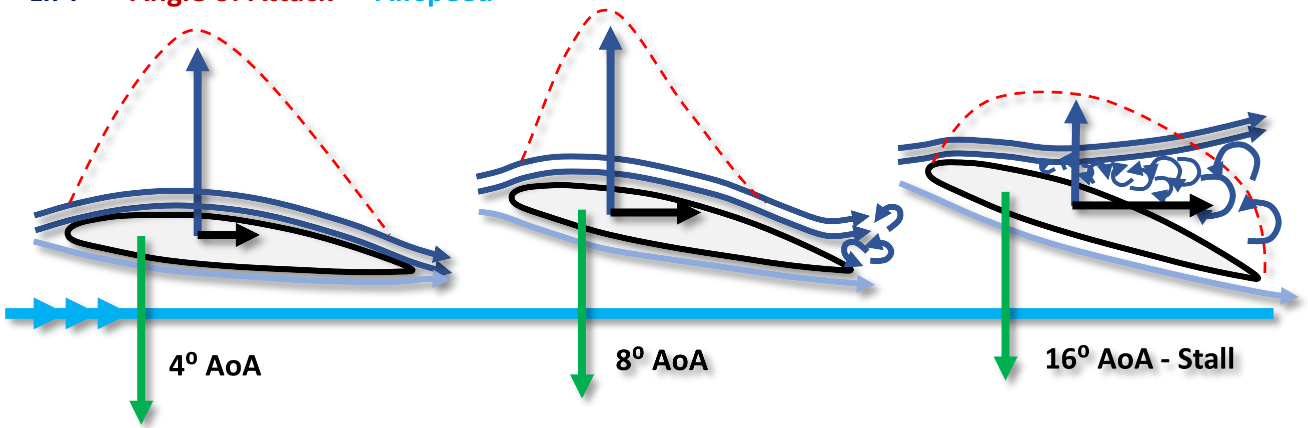
1. To control the aircraft to the point of the stall, recognize the symptoms of the approaching stall, experience the stall and recover with a minimum height loss.
2. To control the aircraft to the point of the stall, recognize the symptoms of the approaching stall and **recover at the stall onset** with minimum height loss.

Principles of Flight

LIFT = Angle of Attack x Airspeed

Principles of Flight

LIFT = Angle of Attack x Airspeed



4° AoA – smooth flow over majority of wing.

Lift acts through CoP which is located 40% along the cord

8° AoA – smooth flow over ~90% of the wing. Airflow becomes turbulent at trailing edge of wing.

Lift has moved forward to about 30% along the cord.

This is called the **unstable movement** because the nose down pitching moment reduces.

16° AoA – smooth flow over wing quickly becomes turbulent moving forward from the trailing edge. Flow becomes turbulent from point of max camber

Lift has quickly moved back to 40% of the cord at the stall angle and 50% with exceedance of stall angle.

Lift < Weight, the aircraft sinks, CoP moves aft, and the nose pitches down.

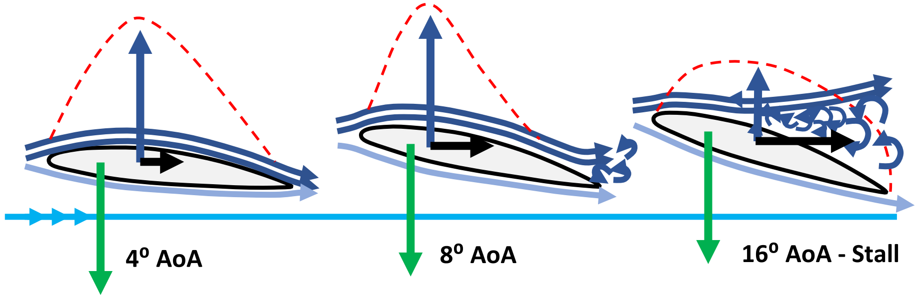
The rearward movement of Lift is called the **stable movement.**

Objective

1. To control the aircraft to the point of the stall, recognize the symptoms of the approaching stall, experience the stall and recover with a minimum height loss.
2. To control the aircraft to the point of the stall, recognize the symptoms of the approaching stall and **recover at the stall onset** with minimum height loss.

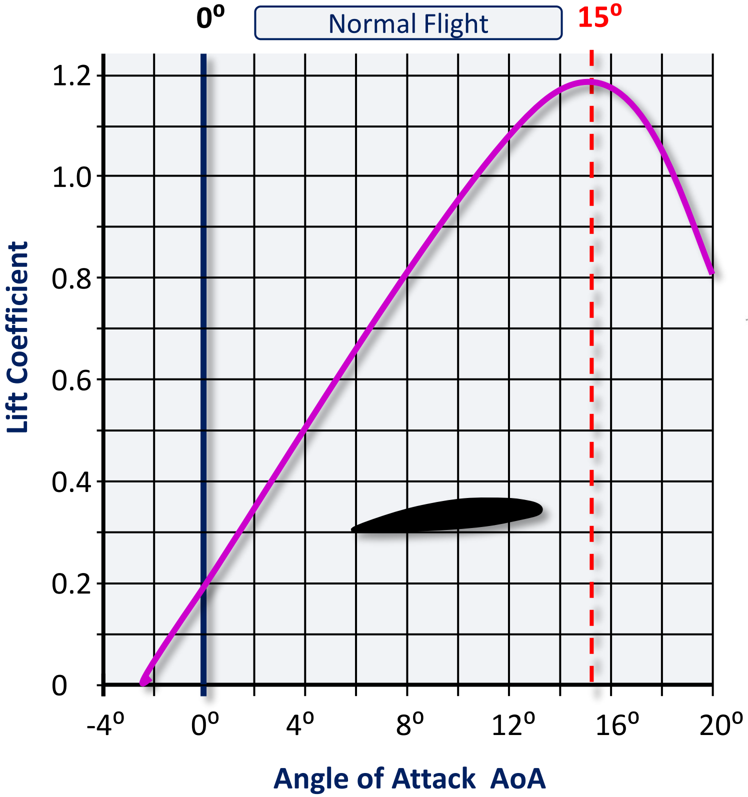
Principles of Flight

LIFT = Angle of Attack x Airspeed



Principles of Flight

Lift Coefficient and Angle of Attack



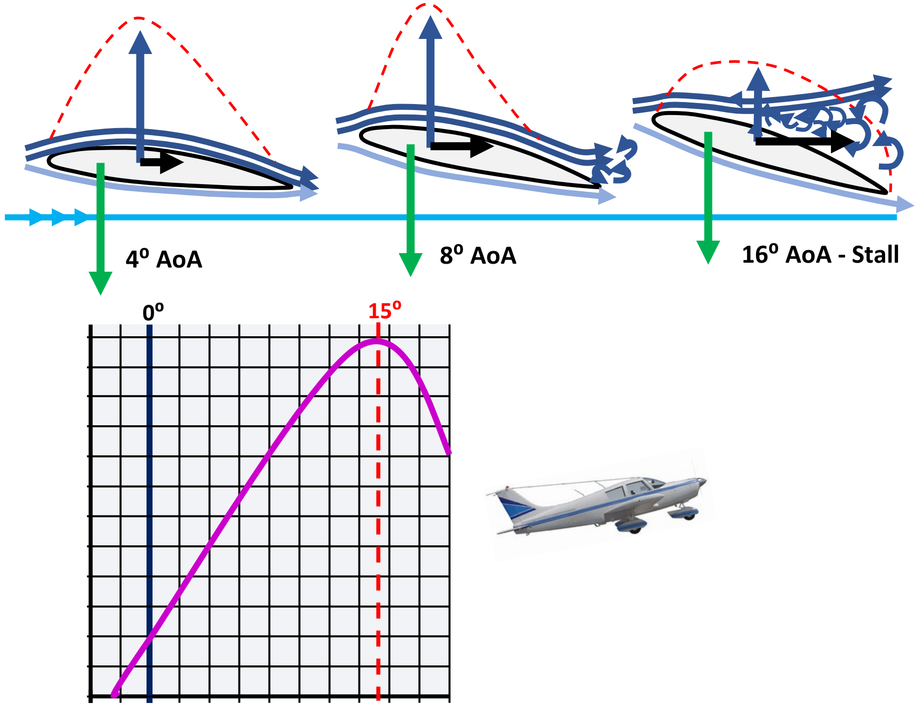
The stall occurs when the critical angle of attack is exceeded and the air is no longer able to flow smoothly over the top surface of the wing. It breaks away and becomes turbulent and as a result the lift decreases and the drag increases significantly.

Objective

1. To control the aircraft to the point of the stall, recognize the symptoms of the approaching stall, experience the stall and recover with a minimum height loss.
2. To control the aircraft to the point of the stall, recognize the symptoms of the approaching stall and **recover at the stall onset** with minimum height loss.

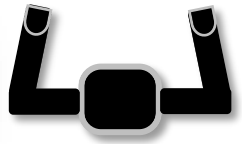
Principles of Flight

LIFT = Angle of Attack x Airspeed



Considerations

Symptoms of an approaching 1G stall



1. **Low and decreasing airspeed**
2. **High nose attitude**
3. **Quiet cabin**
4. **Less effective controls**
5. **Stall warning**
6. **Aerodynamic buffet**
7. **Stall – sink then nose pitch down**

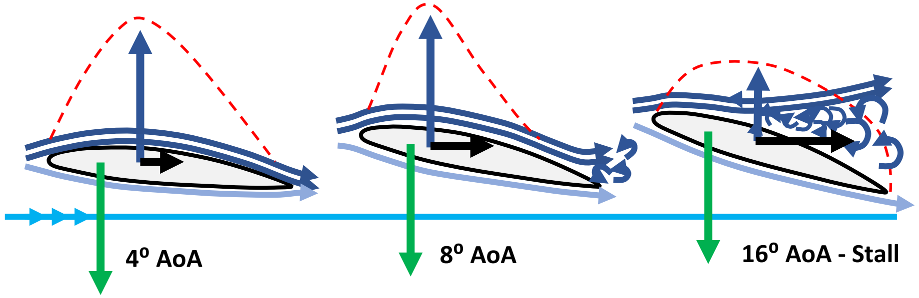
Basic Stalling

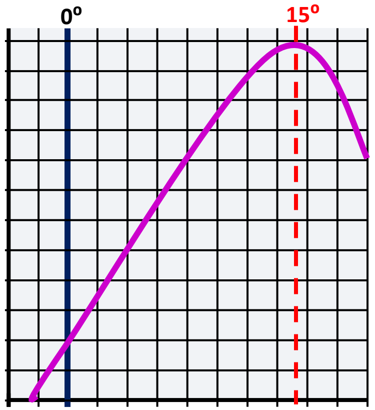
Objective

1. To control the aircraft to the point of the stall, recognize the symptoms of the approaching stall, experience the stall and recover with a minimum height loss.
2. To control the aircraft to the point of the stall, recognize the symptoms of the approaching stall and **recover at the stall onset** with minimum height loss.

Principles of Flight

LIFT = Angle of Attack X Airspeed



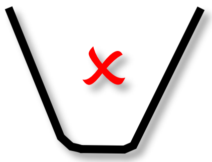


Symptoms of a Stall

1. Low decreasing airspeed
2. High Nose Attitude
3. Quite Cabin
4. Less Effective Controls
5. Warning
6. Buffet
7. Stall

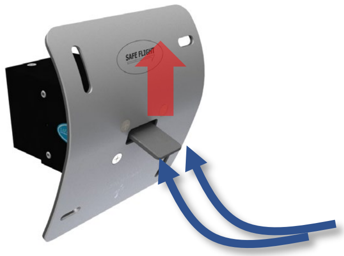
Aircraft Management

Controls – smooth and coordinated response. Smooth not jerky.



Throttle – Smooth, positive throttle movements.

Stall Warning – Must be serviceable. During a wings level and decelerating in any normal configuration, the stall warning must begin at a speed which is a minimum of 5 knots greater than the stalling speed Vs and continue until the stall occurs.



Carb Heat – On, then off prior to each stall. On prior to power reduction. Off at 65-70kts

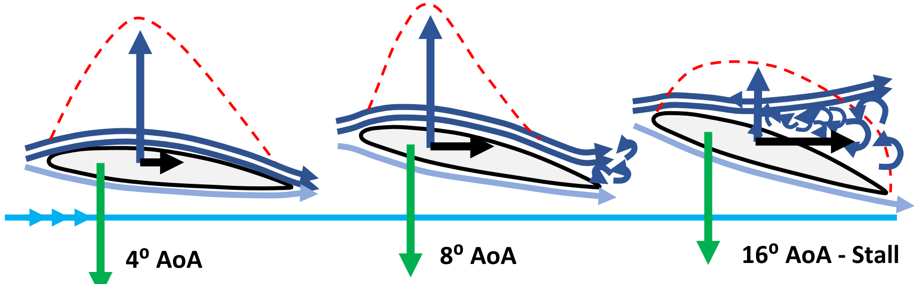
Cabin – Check for loose items/objects. If the plane has an axe or fire extinguisher, are they well secured? Flight bag?

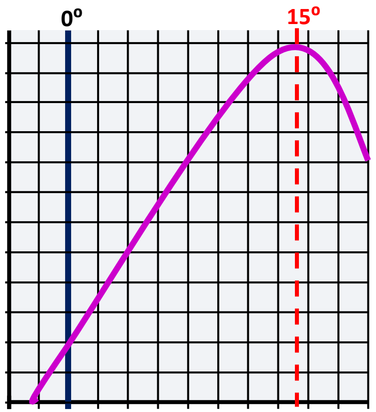
Objective

1. To control the aircraft to the point of the stall, recognize the symptoms of the approaching stall, experience the stall and recover with a minimum height loss.
2. To control the aircraft to the point of the stall, recognize the symptoms of the approaching stall and **recover at the stall onset** with minimum height loss.

Principles of Flight

LIFT = Angle of Attack x Airspeed





Symptoms of a Stall

1. Low decreasing airspeed
2. High Nose Attitude
3. Quite Cabin
4. Less Effective Controls
5. Warning
6. Buffet
7. Stall

Aircraft Management

Controls/Throttle – smooth & coordinated

Stall warning – requirements and operation

Carb Heat – operation

Cabin – Loose items and objects secure

Airmanship and Human Factors

HASELL Checks – Carry out HASELL safety checks when there is an elevated risk of the aircraft entering and Undesired Aircraft State (UAS) i.e. momentarily loss of control of the aircraft.

H = Height – not less than 2500ft above terrain

A = Airframe – configured for exercise/operation

S = Security – no loose articles/objects in the cabin, harness secure

E = Engine – Temperature and Pressures normal range, mixture rich, full sufficient on fullest

L = Location – not over populated areas, known traffic areas including aerodromes, airspace

L = Lookout – one 180°, or two 90° clearing turns to ensure no confliction with traffic

HELL – Checks to be completed between stalls with at least one 90 ° clearing lookout turn.

No passengers – are permitted when stalling. Stalling is primarily a training exercise under dual or solo practice.

Orientate– between stalls to make sure you are aware of your location and the location of other traffic. Maintain you situational awareness to your surroundings and the aircraft.

Confidence through practice– the more you practice and expose yourself to stalling the more comfortable, confident and therefore competent you will become. In the early days, you may want to check that sick bags are on board the aircraft just in case.

Symptoms– the key learning from stalling, both basic and advanced is growing your awareness of the symptoms of the approaching stall and not to every enter a stall.

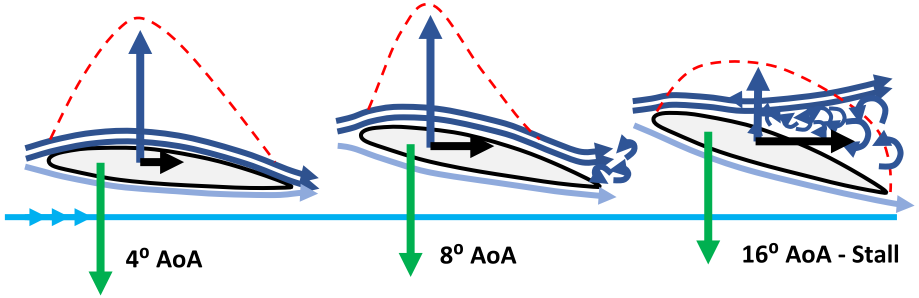
Basic Stalling

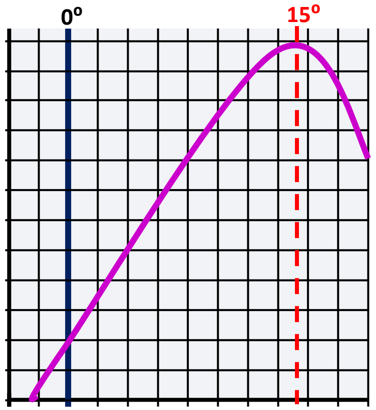
Objective

1. To control the aircraft to the point of the stall, recognize the symptoms of the approaching stall, experience the stall and recover with a minimum height loss.
2. To control the aircraft to the point of the stall, recognize the symptoms of the approaching stall and **recover at the stall onset** with minimum height loss.

Principles of Flight

LIFT = Angle of Attack x Airspeed





Symptoms of a Stall

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Aircraft Management

Controls/Throttle – smooth & coordinated

Stall warning – requirements and operation

Carb Heat – operation

Cabin – Loose items and objects secure

Airmanship and Human Factors

HASELL and HELL Checks / No pax

Orientation

Confidence and practice

Symptoms

Air Exercise

Demonstration – 1. Experience 2. Symptoms

Basic Stall – recover into glide

HASELL Select Ref point and Altitude

Power Idle – rudder direction (Carb Heat)

Altitude Maintain - elevator

Carb Heat OFF ~ 70 kts

Symptoms Identify esp warning, buffet, stall

Recover Check centrally forward

Lower nose to glide attitude

Note Altitude Loss ~ 300ft

Basic Stall – recovery with power

HELL Select Ref point and Altitude

Power Idle – rudder direction (Carb Heat)

Altitude Maintain - elevator

Carb Heat OFF ~ 70 kts

Symptoms Identify esp. warning, buffet, stall

Recover Check centrally forward

Follow with full power (rudder)

Aircraft Unstalled

Roll wings level (if required)

Select nose to just below S+L attitude

… then raise to Horizon

Airspeed approaches 80kt, set **Climb attitude**

Note Altitude Loss ~ 150ft

Basic Stall – recovery at onset

HELL Select Ref point and Altitude

Power Idle – rudder direction (Carb Heat)

Altitude Maintain - elevator

Carb Heat OFF ~ 70 kts

Symptoms Identify esp. **warning**, buffet, stall

Recover Check centrally forward

Follow with full power (rudder)

Roll wings level (if required)

Select nose to Horizon

Airspeed approaches 80kt, set **Climb attitude**

Note Altitude Loss ~ 0-50ft

Objective

1. To experience the effect of power and/or flap on the aircrafts speed and nose attitude at the stall.
2. Recognise the symptoms of a stall.
3. To stall the aircraft and be able to recover from the stall by applying the correct technique.

Definition

A stall occurs when the angle of attack of an aerofoil exceeds the value which creates maximum lift as a consequence of airflow across it.

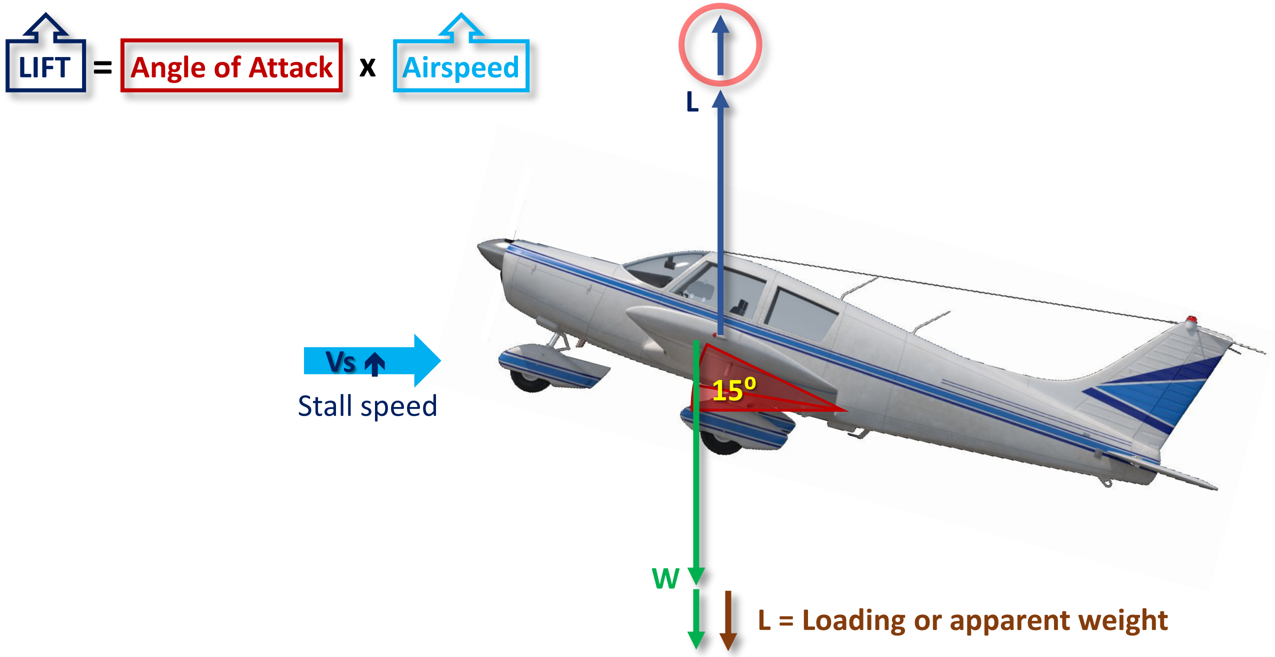
Principles of Flight

An aircraft stalls at a critical angle **but** the airspeed that it stalls at will vary with configuration e.g. power, flaps, weight etc.

The most accurate method to determine the stall is by using an angle of attack indicator. These are present on airliners but not normally light aircraft.

Manufactures of light aircraft list stall speeds for simplicity

Effect of weight / loading on Vs



When there is a requirement for ↑ **lift** to equal the aircraft weight**,** there will be a need for more airspeed at the stall AoA = ↑ in **stall speed**

The aircraft will stall at the **same** nose attitude

Objective

1. To experience the effect of power and/or flap on the aircrafts speed and nose attitude at the stall.
2. Recognise the symptoms of a stall.
3. To stall the aircraft and be able to recover from the stall by taking applying the correct technique.

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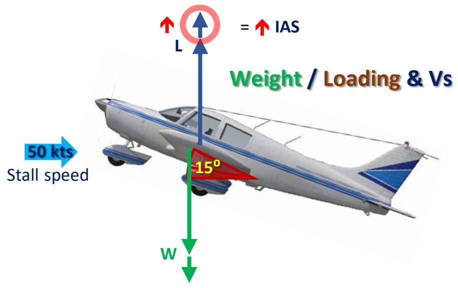
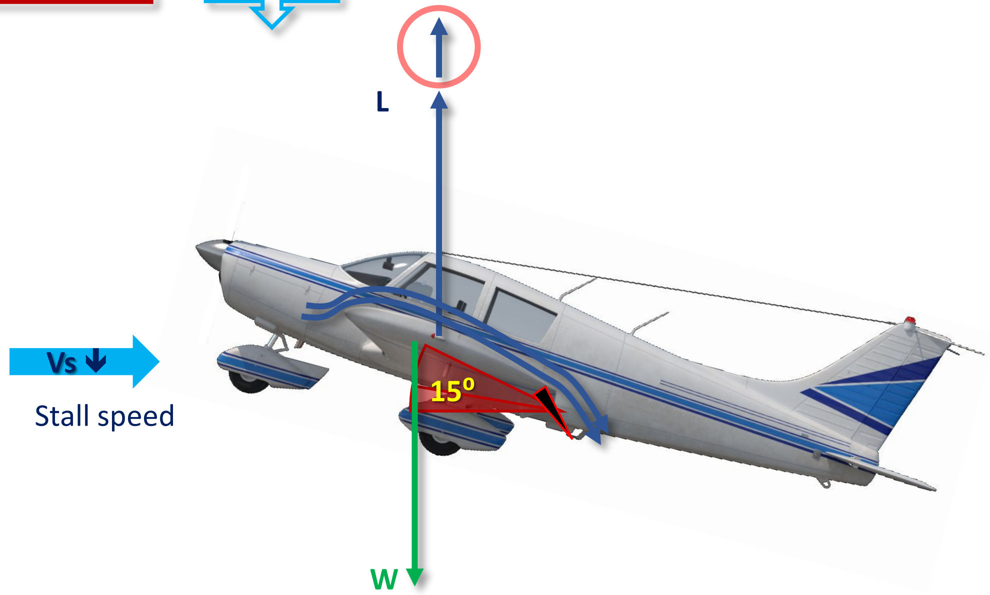


Principles of Flight

Effect of flaps on Vs

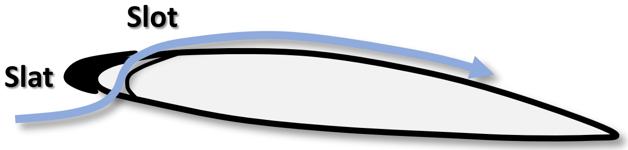
LIFT = Angle of Attack x Airspeed



When there is a requirement for ↓ **lift** as a result of lowering the flaps, there will be a need for less airspeed at the stall AoA = ↓ in **stall speed**

The aircraft will stall at a **lower** nose attitude

Effect of Slots and Slats



The slot re-energises the airflow which delays the formation of turbulent flow

Advanced Stalling

Objective

1. To experience the effect of power and/or flap on the aircrafts speed and nose attitude at the stall.
2. Recognise the symptoms of a stall.
3. To stall the aircraft and be able to recover from the stall by taking applying the correct technique.

Definition

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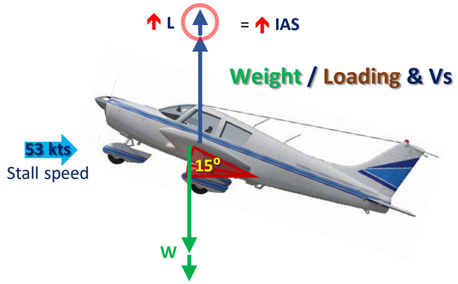
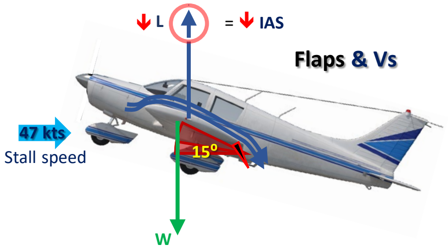
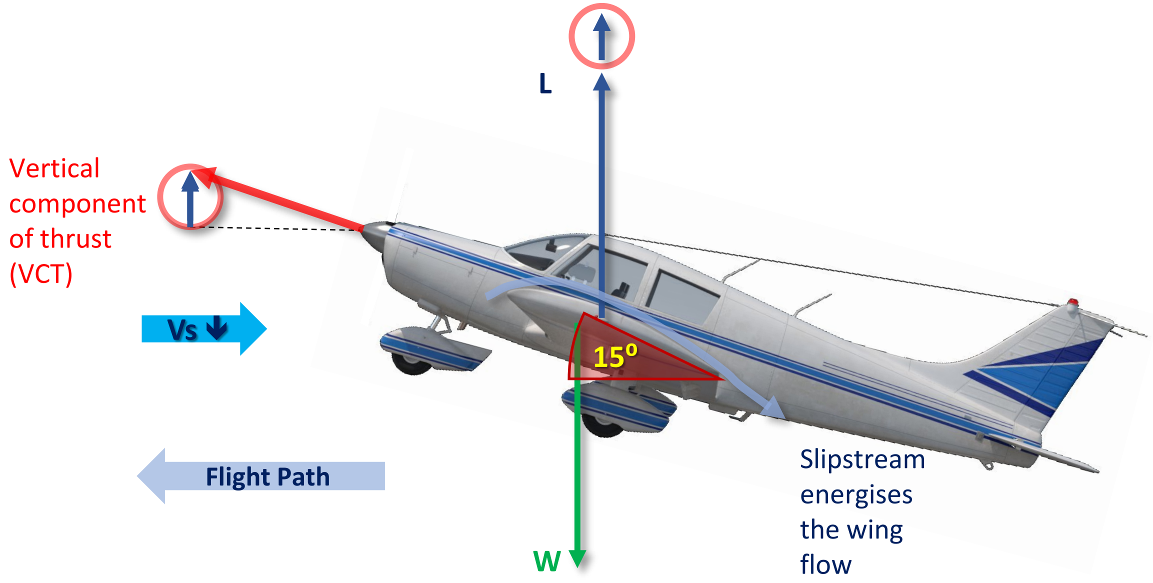




Principles of Flight

Effect of an increase in power on Vs

LIFT = **Angle of Attack** x **Airspeed**



When there is a requirement for ↓ **lift** as a result of the vertical component of thrust, there will be a need for less airspeed at the stall AoA = ↓ in **stall speed**

The aircraft will stall at a **higher** nose attitude

WAIKATO AVIATION ACADEMY

Objective

1. To experience the effect of power and/or flap on the aircrafts speed and nose attitude at the stall.
2. Recognise the symptoms of a stall.
3. To stall the aircraft and be able to recover from the stall by taking applying the correct technique.

Definition

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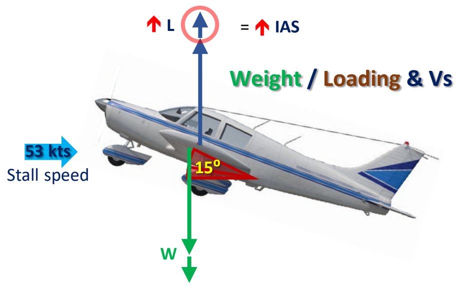
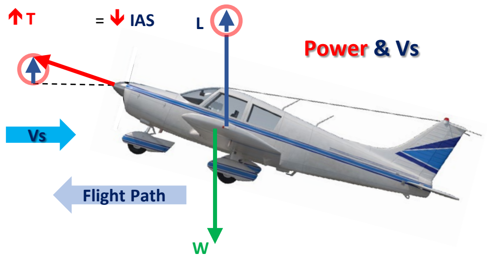
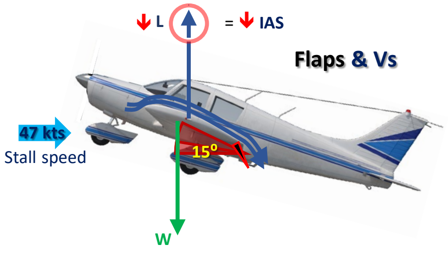


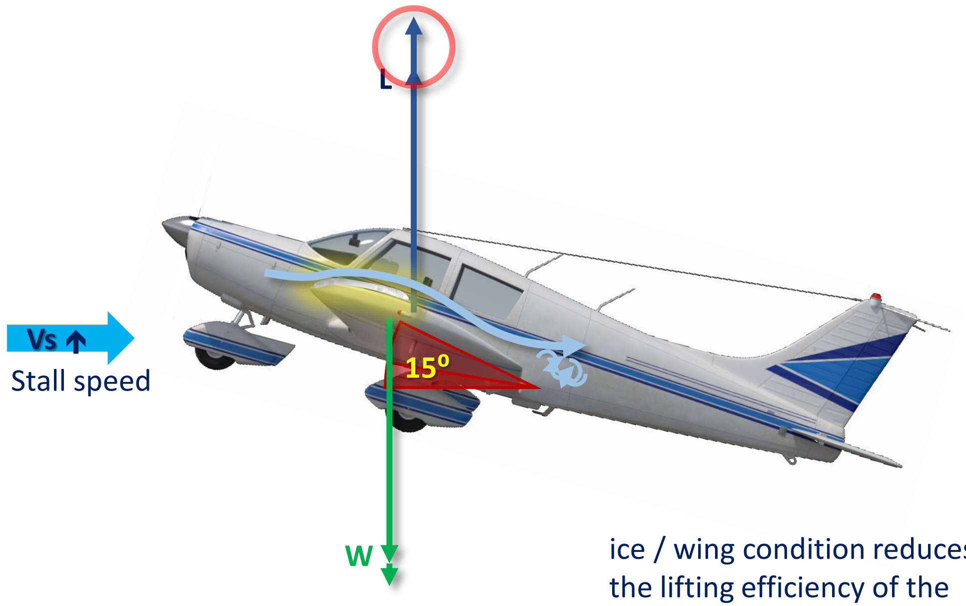




Principles of Flight

Effect of– icing / wing condition on Vs

LIFT ↑ = Angle of Attack x Airspeed ↑



ice / wing condition reduces the lifting efficiency of the wing and ice can also add weight

When there is a requirement for ↑ **lift** due to a disturbance of laminar flow over the wing, there will be a need for more airspeed at the stall AoA = ↑ in **stall speed**

The aircraft will stall at the **same** nose attitude

Objective

1. To experience the effect of power and/or flap on the aircrafts speed and nose attitude at the stall.
2. Recognise the symptoms of a stall.
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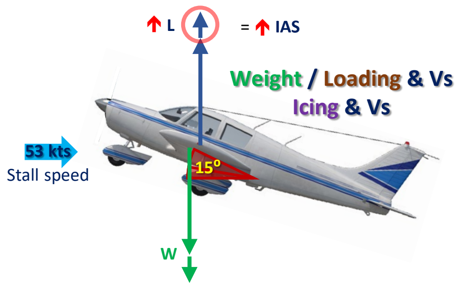
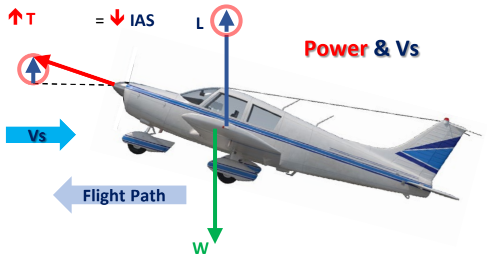
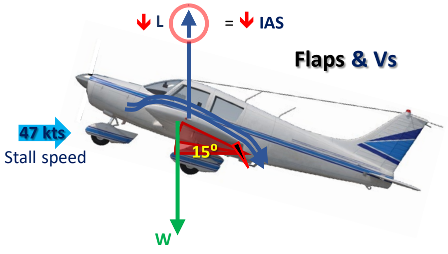






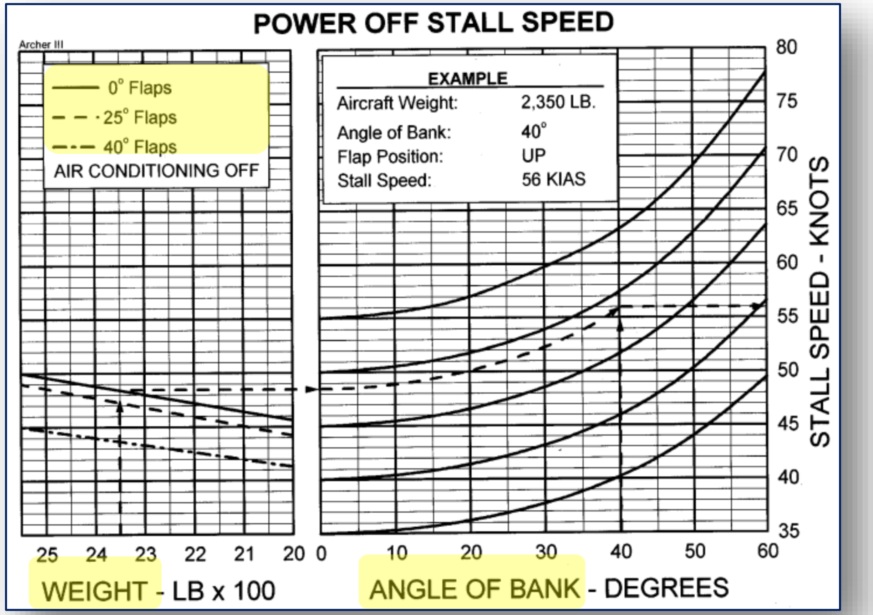
Principles of Flight

Summary of factors affecting the stall speed

Weight	↑ Weight	↑ Vs	Same nose attitude
Loading	↑ Apparent Weight	↑ Vs	Same nose attitude
Flaps Slots Slats	↑ Flap	↓ Vs	Lower nose attitude
Power	↑ Power	↓ Vs	Higher nose attitude
Ice Damage	↑ Turbulent flow ↑ Weight	↑ Vs	Same nose attitude

Aileron	Down going wing ↑ AoA above critical AoA ↓ L and ↑ D → continued roll	Ailerons nuetral

Stall speed calculation from Aircraft Flight Manual



Advanced Stalling

Objective

1. To experience the effect of power and/or flap on the aircrafts speed and nose attitude at the stall.
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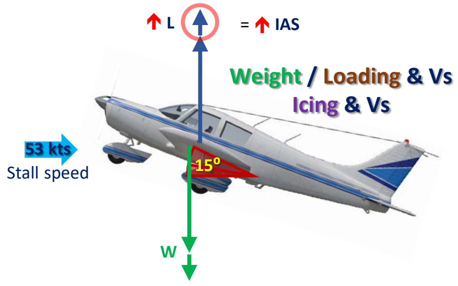
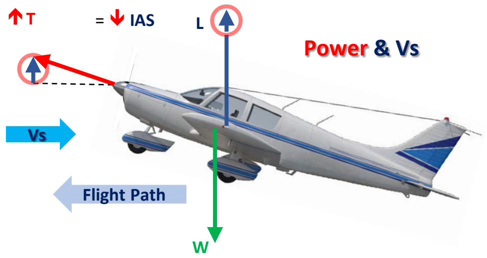
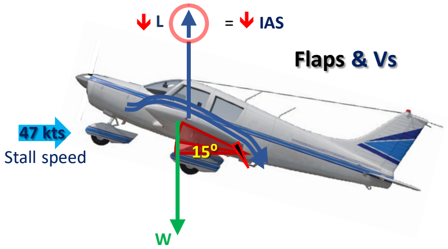


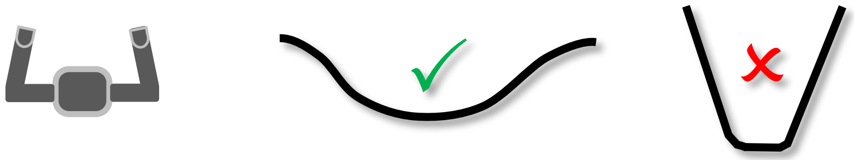




Weight	↑ Weight	↑ Vs
Loading	↑ Apparent Weight	↑ Vs
Flaps Slots Slats	↑ Flap	↓ Vs
Power	↑ Power	↓ Vs
Ice Damage	↑ Turb flow + Weight	↑ Vs
Aileron	↑ AoA ↓ L and ↑ D	→ cont roll

Aircraft Management

Controls – smooth and coordinated response. Smooth not jerky.



Throttle – Smooth, positive throttle movements.

Flaps – Select flaps below Vfe, at a moderate airspeed to limit pitch forces

Carb Heat – On, then off prior to each stall. On prior to power reduction. Off at 70kts

Temperatures and Pressures – Green Range

Advanced Stalling

Objective

1. To experience the effect of power and/or flap on the aircrafts speed and nose attitude at the stall.
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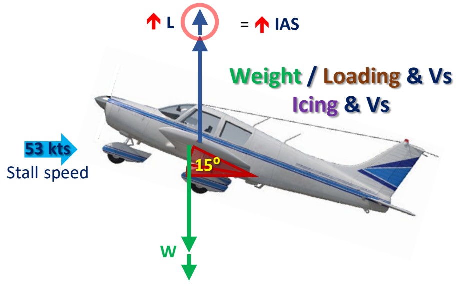

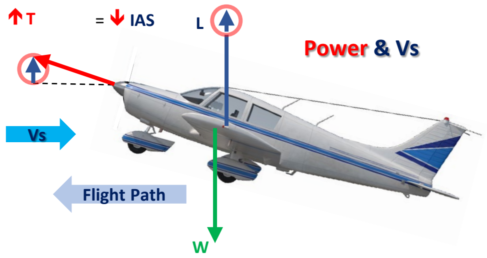

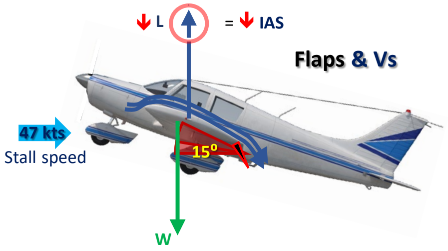

Weight	↑ Weight	↑ Vs
Loading	↑ Apparent Weight	↑ Vs
Flaps Slots Slats	↑ Flap	↓ Vs
Power	↑ Power	↓ Vs
Ice Damage	↑ Turb flow + Weight	↑ Vs
Aileron	↑ AoA ↓ L and ↑ D → cont roll	

Aircraft Management

Controls/Throttle – smooth & coordinated

Flaps – Vfe, moderate speed

Carb Heat – operation

Temperatures and Pressures

Airmanship and Human Factors

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Advanced Stalling

Objective

1. To experience the effect of power and/or flap on the aircrafts speed and nose attitude at the stall.
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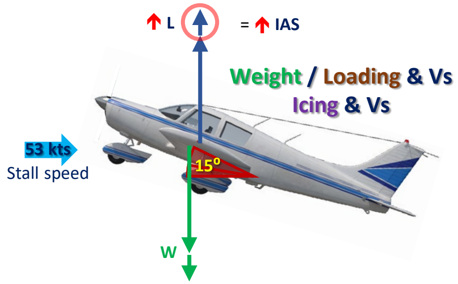
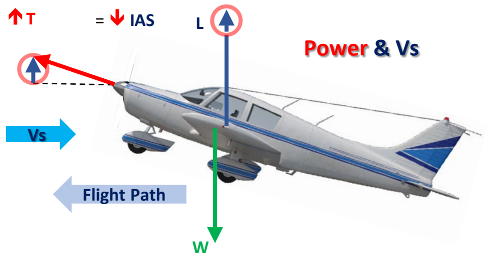
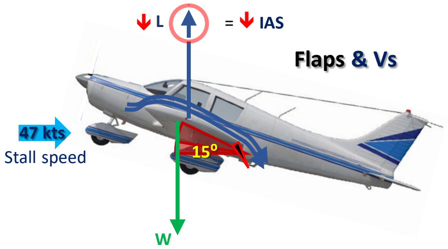






Weight	↑ Weight	↑ Vs
Loading	↑ Apparent Weight	↑ Vs
Flaps Slots Slats	↑ Flap	↓ Vs
Power	↑ Power	↓ Vs
Ice Damage	↑ Turb flow + Weight	↑ Vs
Aileron	↑ AoA ↓ L and ↑ D	→ cont roll

Aircraft Management

Controls/Throttle – smooth & coordinated

Flaps – Vfe, moderate speed

Carb Heat – operation

Temperatures and Pressures

Airmanship and Human Factors

HASELL and HELL Checks / No pax

Orientation

Confidence and practice

Symptoms

Air Exercise

Demonstration – 1. Stall with Power

Demonstration – 2. Stall with Flaps

note: – Stall speeds and attitudes

Adv Stall – recovery after stall

HASELL	Select Ref point and Altitude
Power	1700 RPM –direction (Carb Heat)
Altitude	Maintain - elevator
Flaps	< Vfe approx. 90kts
Carb Heat	OFF ~ 70 kts
Symptoms	Identify esp. warning, buffet, **stall**
Stall	**Aircraft sinks, nose pitches down**
Recovery	**Check CF to ↓ S+L Attitude → S+L**
	Follow with full power (rudder)
	Aircraft Unstalled
	Roll wings level (if required)
	ASI ↑ - Check ROD ↑
	Retract Drag Flap
	ASI ↑, ROC + ↑ and safe speed
	Slowly raise nose to Horizon line
	Retract Lift Flap in stages
	Select **Climb attitude**

Adv Stall – recovery at onset

HELL	Select Ref point and Altitude
Power	1700 RPM – direction (Carb Heat)
Altitude	Maintain - elevator
Flaps	< Vfe approx. 90kts
Carb Heat	OFF ~ 70 kts
Symptoms	Identify esp. **warning**, buffet, stall
Recover	**Check CF to Horizon line**
	Follow with full power (rudder)
	Aircraft Unstalled
	Roll wings level (if required)
	ASI ↑ -Retract Drag Flap
	ASI ↑, ROC + ↑ and safe speed
	Slowly retract Lift Flap in stages
	Select **Climb attitude**
	Climb to ref alt and enter S+L

Objective

1. To take off and fly an orderly pattern around an aerodrome in accordance with published procedures avoiding conflict with other aircraft
2. To carry out an approach and landing using the most suitable runway.

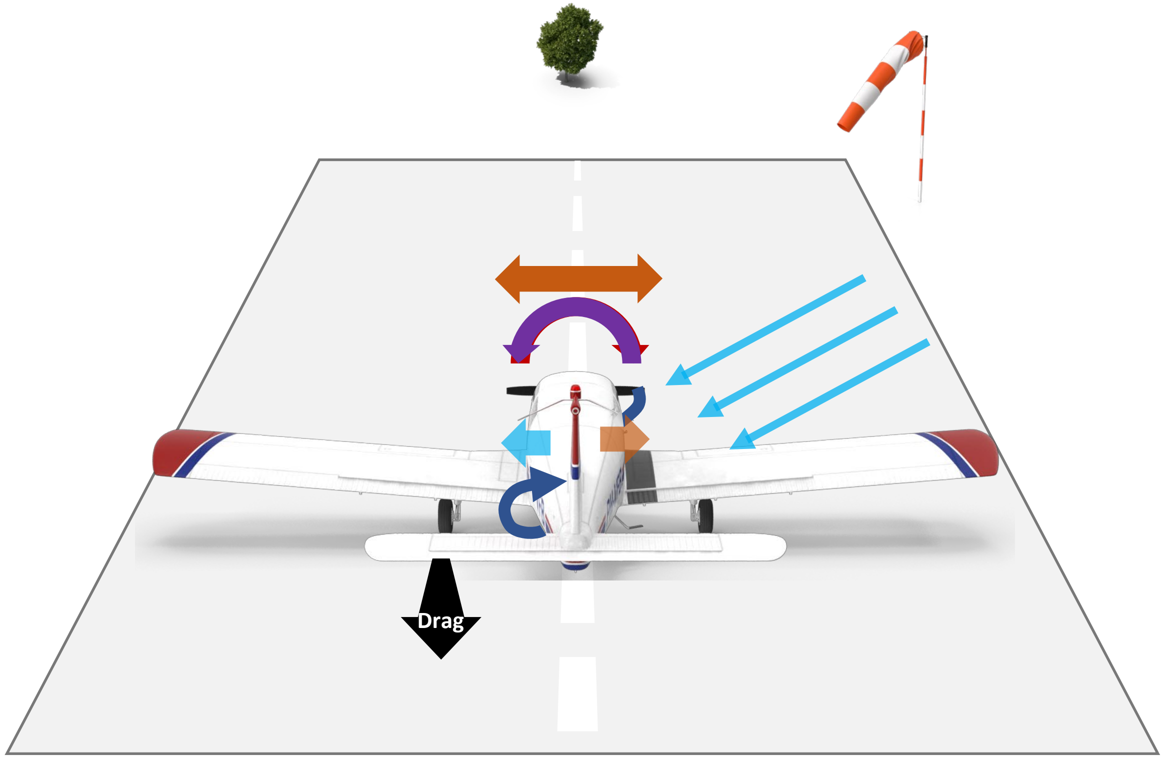
Considerations

Take-off – directional control

Slipstream effect ▶ Aircraft Yaws Left ▶ Right Rudder

Torque effect ▶ Aircraft Yaws Left ▶ Right Rudder

Crosswind effect ▶ Aircraft weather cocks into wind Right ▶ Left Rudder



Maintain directional control by selecting a reference point.

One at the end of the runway

The other in the sky taking into account crab into wind

Objective

1. To take off and fly an orderly pattern around an aerodrome in accordance with published procedures avoiding conflict with other aircraft
2. To carry out an approach and landing using the most suitable runway.

Considerations

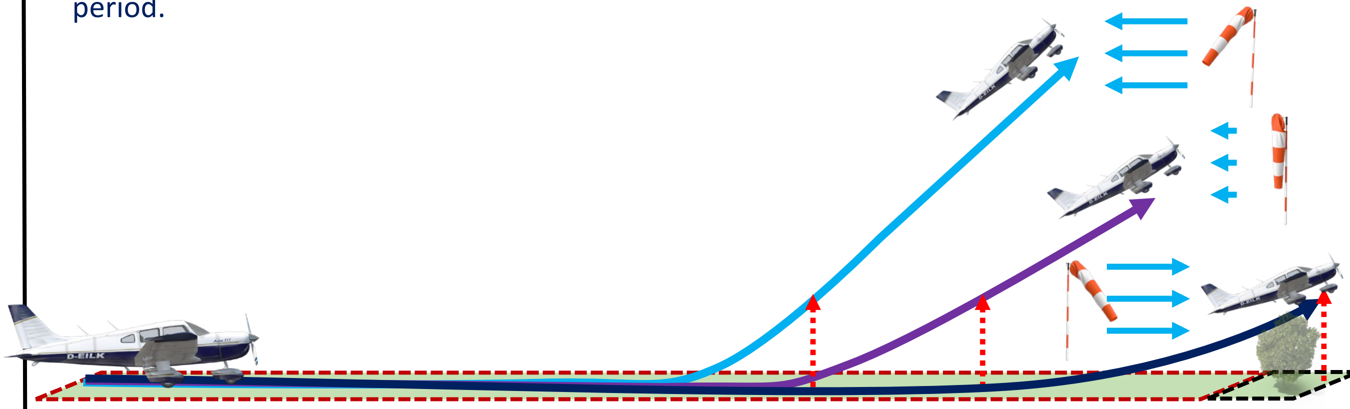
Take-off – performance

Nil wind ▶

Headwind ▶ ↓ take-off roll and ↑ climb angle

Tailwind ▶ significantly ↑ take-off roll and ↓ climb angle

Take-off into wind to maximise climb angle and minimise ground roll and distance airborne to 50ft. Both are affected. Note: the approximate positions of the aircraft after the same time period.



Power ▶ Full power for maximum thrust and take-off performance, reduced ground roll and steeper climb out angle

Flap ▶ Depends on aircraft wing design (L/D ratio) and type of take-off technique required e.g. soft field take-off. Normally with light aircraft, either no flap, or first stage only.

Runway length ▶ Calculated length for take-off is in **meters.** Requirement for Part 91 operations is that the aircraft must be at 50ft before reaching the end of the airstrip except if there is a recognised clearway.

Objective

1. To take off and fly an orderly pattern around an aerodrome in accordance with published procedures avoiding conflict with other aircraft
2. To carry out an approach and landing using the most suitable runway.

Considerations

Take-off – performance

Nil wind ▶

Headwind ▶ ↓ take-off roll and ↑ climb angle

Tailwind ▶ significantly ↑ take-off roll and ↓ climb angle

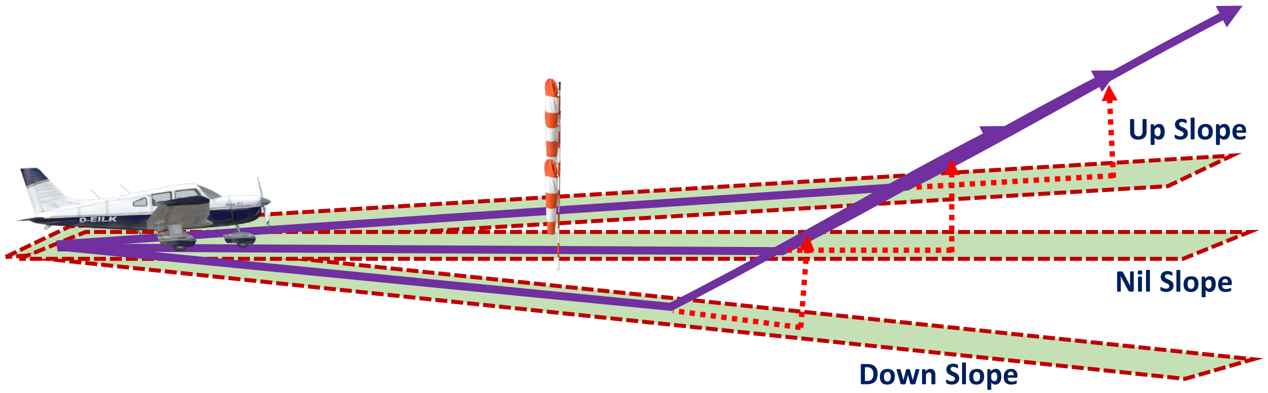
Take-off into wind to maximise climb angle and minimise ground roll and distance airborne to 50ft. Note: the approximate positions of the aircraft after the same time period.

Power ▶ Full power for maximum thrust and take-off performance, reduced ground roll and steeper climb out angle

Flap ▶ Depends on aircraft wing design (L/D ratio) and type of take-off technique required e.g. soft field take-off. Normally no flap, or first stage only for light aircraft.

Runway length ▶ calculated length for take-off in **meters.** Requirement is that the aircraft must be at 50ft before reaching the end of the airstrip except if there is a recognised clearway.

Slope ▶ Downslope decreases take-off roll and distance to 50ft. Upslope increases take-off roll and distance to 50ft.



Objective

1. To take off and fly an orderly pattern around an aerodrome in accordance with published procedures avoiding conflict with other aircraft
2. To carry out an approach and landing using the most suitable runway.

Considerations

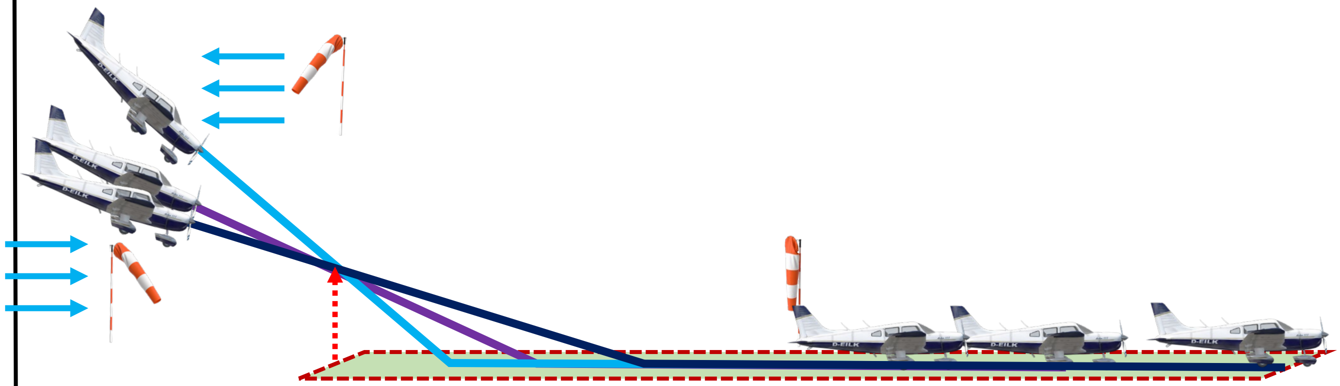
Landing – performance

Nil wind ▶

Headwind ▶ ↑ descent angle and ↓ landing distance from 50ft and ↓ landing ground roll

Tailwind ▶ ↓ descent angle and ↑ landing distance from 50ft and ↑ landing ground roll

Land into wind to maximise descent angle and minimise landing distance from 50ft and ground roll



Objective

1. To take off and fly an orderly pattern around an aerodrome in accordance with published procedures avoiding conflict with other aircraft
2. To carry out an approach and landing using the most suitable runway.

Considerations

Landing – performance

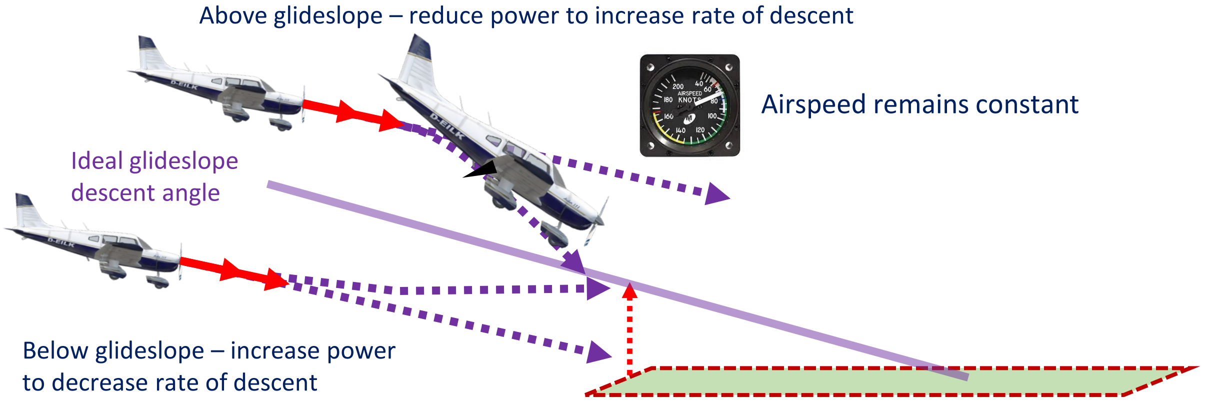
Nil wind ▶

Headwind ▶ ↑ descent angle and ↓ landing distance from 50ft and ↓ landing ground roll

Tailwind ▶ ↓ descent angle and ↑ landing distance from 50ft and ↑ landing ground roll

Land into wind to maximise descent angle and minimise landing distance from 50ft and ground roll

Power ▶ Controls the rate of descent and provides more airflow over the elevator and rudder



Flap ▶ Increases Lift and Drag and lowers the stall speed. This allows steeper descents at a slow airspeed which is ideal for landing.

Runway length ▶ Calculated length for landing is in **meters.** Requirement for Part 91 operations is that the aircraft must be at 50ft over the landing threshold.

Brakes ▶ Apply only when the aircraft has landed and all wheels are on the ground. Maximum effectiveness is achieved when you apply your brakes early after touchdown.

Circuits Introduction

Objective

1. To take off and fly an orderly pattern around an aerodrome in accordance with published procedures avoiding conflict with other aircraft
2. To carry out an approach and landing using the most suitable runway.

Considerations

Take-off

Slipstream	Strikes the tail and yaws aircraft LEFT
Torque	↑ Friction drag left wheel – aircraft yaws LEFT
Crosswind	Aircraft weathercocks into crosswind
Headwind	↓ take-off distance, steeper climb angle
Tailwind	↑ take-off distance, shallow climb angle
Power	Full power to maximum performance
Flap	Up or first stage depending on aircraft type
Slope	Significant impact on take-off and landing performance

Landing

Headwind	↓ landing distance, steeper descent angle
Tailwind	↑ landing distance, shallow descent angle
Power	Controls rate of descent, rudder/elevator effective
Flap	↑ L and ↑ D, ↓ Vs, lower nose attitude
Brakes	On ground once all wheels in contact

Aircraft Management

Throttle – Smooth but positive throttle movements.

Carb Heat – On for approach when RPM is below 1900 RPM and off on short finals.

Temperatures and Pressures – **Green** Range, check as part of after take-off checks

Flap – Only operate below Vfe (check before operation).

Select flap down at a moderate airspeed to limit pitch / trim changes with application

Select flap up with airspeed increasing to compensate for the loss of lift

Standard Checks in the Circuit – by phase

After take-off – configuration set, engine normal, lights as required

Pre-Landing – undercarriage, brakes, mixture, pitch, fuel, harnesses and doors, lights

Finals – flaps, pitch, stable, clearance

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Flap	↑ L and ↑ D, ↓ Vs, lower nose attitude
Brakes	On ground once all wheels in contact

Aircraft Management

Throttle – smooth & coordinated

Carb Heat / T's and P's

Flap – below Vfe

Checks in the circuit

Airmanship and Human Factors

Lookout and Listen out – Traffic and instructions from ATC

Right of Way Rules – Learn and apply but be cautious

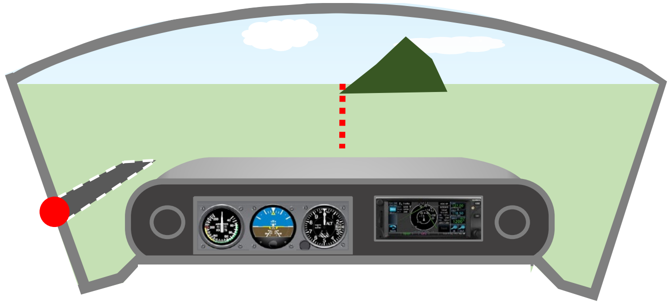
Workload prioritisation – **Aviate** (Power x Attitude = Perf e.g. PAT, APT select, hold, Trim)

Navigate (reference points and distances in the circuit)

Communicate (ATC but also your instructor)

Orientation and Wind – Reference points from outside, reference points from inside .

- Awareness of wind and impact on track of aircraft.



WAIKATO AVIATION ACADEMY

Circuits Introduction

Objective

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2. To carry out an approach and landing using the most suitable runway.

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Aircraft Management

Throttle – smooth & coordinated

Carb Heat / T's and P's

Flap – below Vfe

Checks in the circuit

Airmanship and Human Factors

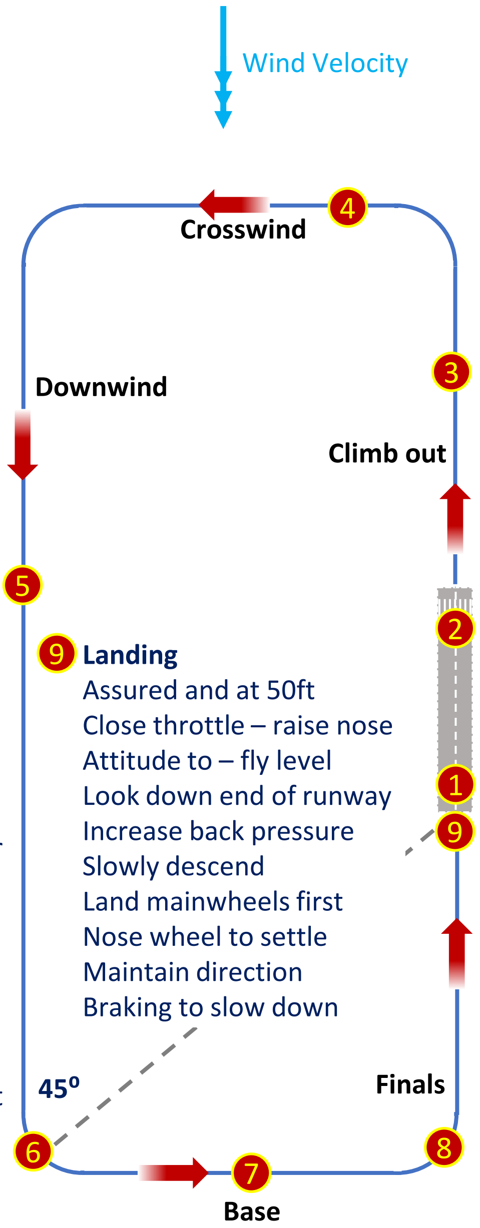
Lookout and Listen out

Right of Way Rules

Workload prioritisation

Orientation and impact of wind

Air Exercise



1 Take-off
Line up checks
Reference points
Full power/right rudder
Performance checks

2 Rotate
At speed
Raise nose to climb att.
Wings level
Eyes out

3 Climb out
After take-off checks
Heading on reference
Turn at 500ft agl

4 Crosswind
Heading on reference
Turn downwind – correct width

5 Downwind
Heading on reference
Downwind call
Pre-landing checks
Spacing

6 Base turn
Lookout / Reference
Carb heat
Power to 1700 RPM
Flap first stage
Turn
Heading onto reference
Attitude for 75kts

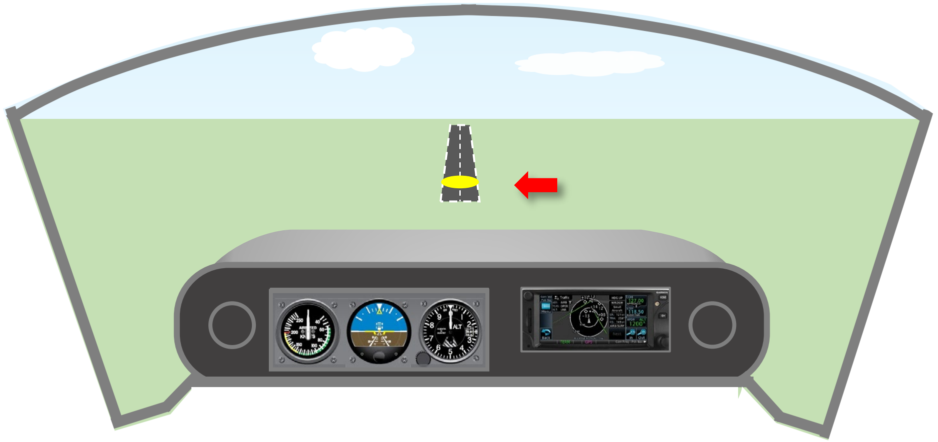
Show

7 Base leg
Heading on reference
Flap – second stage
Attitude – airspeed
Power - gate (600ft)

8 Finals
Anticipate turn
Aim Point
Attitude IAS Powe ROD
Finals check – carb heat

9 Landing
Assured and at 50ft
Close throttle – raise nose
Attitude to – fly level
Look down end of runway
Increase back pressure
Slowly descend
Land mainwheels first
Nose wheel to settle
Maintain direction
Braking to slow down

WAIKATO AVIATION ACADEMY



On profile

Low of profile

Return

High of profile

Objective

1. To continue circuit training.
2. To carry out the touch and go and go around procedures.
3. To understand the procedures when a deviation from the normal circuit is required.

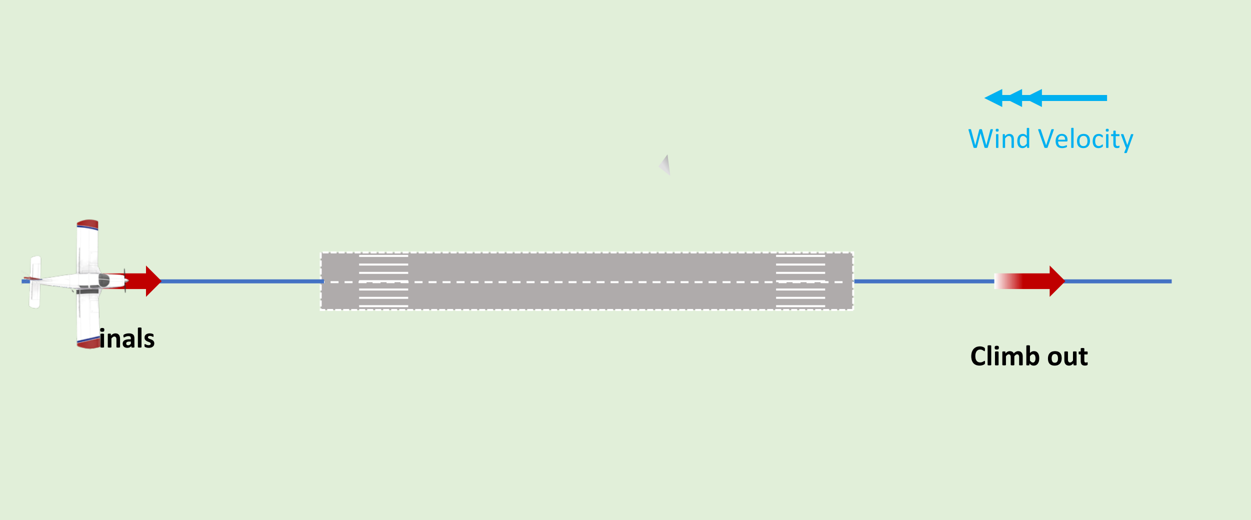
Considerations

Touch and go

On runways of adequate length, the "touch and go" manoeuvre allows the aircraft to land, for the flap to be then retracted and then full power applied permitting the aircraft to take-off within the runway length

The touch and go manoeuvre saves time and allows more circuits to be flown within a period of time.

- After landing maintain centreline and regain directional stability
- Select flaps to take-off setting
- Smoothly apply power
- Rotate at correct airspeed (Vr will occur quickly)
- Do not continue if you are at 50% of runway length prior to applying full power.



Objective

1. To continue circuit training.
2. To use the touch and go and go around procedures.
3. To understand the procedures when a deviation from the normal circuit is required.

Considerations

Touch and Go

- Only on runways with adequate length.
- Flaps to T/O, smooth power (rudder)

Considerations

Go around

For any reason the approach should be abandoned, the pilot may elect to go around, or, may be instructed to do so by ATC.

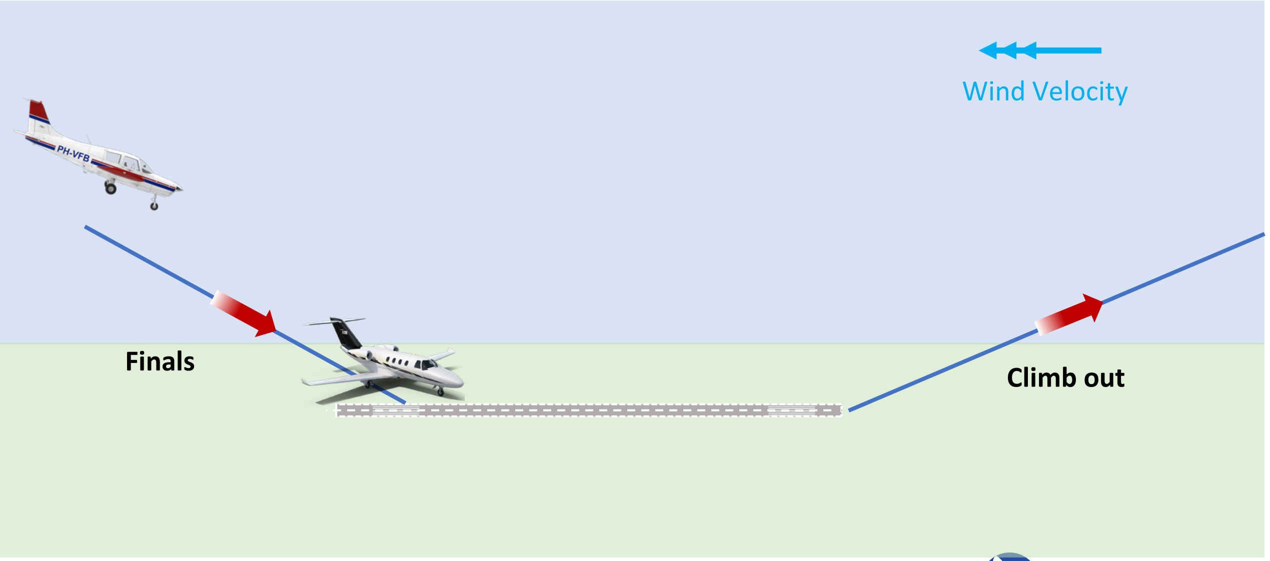
To go around

Aviate – Navigate - Communicate

- Full power (carb heat off), aircraft nose to horizon – retract drag flap straight away, then retract lift flap in stages as airspeed increases, raising nose to climb attitude.
- Radio call – **"WKF going around"**

Reasons

- Too high on approach, landing too long into runway (aim point moving down windscreen)
- Too fast or slow on short finals or approach not stable
- Traffic confliction



WAIKATO AVIATION ACADEMY

Circuit Considerations

Objective

1. To continue circuit training.
2. To use the touch and go and go around procedures.
3. To understand the procedures when a deviation from the normal circuit is required.

Considerations

Touch and Go

- Only on runways with adequate length.
- Flaps to T/O, smooth power (rudder)

Go around

- If the landing needs to be abandoned
- Full power, Flaps up in stages as airspeed increases, straight ahead

Considerations

The orbit

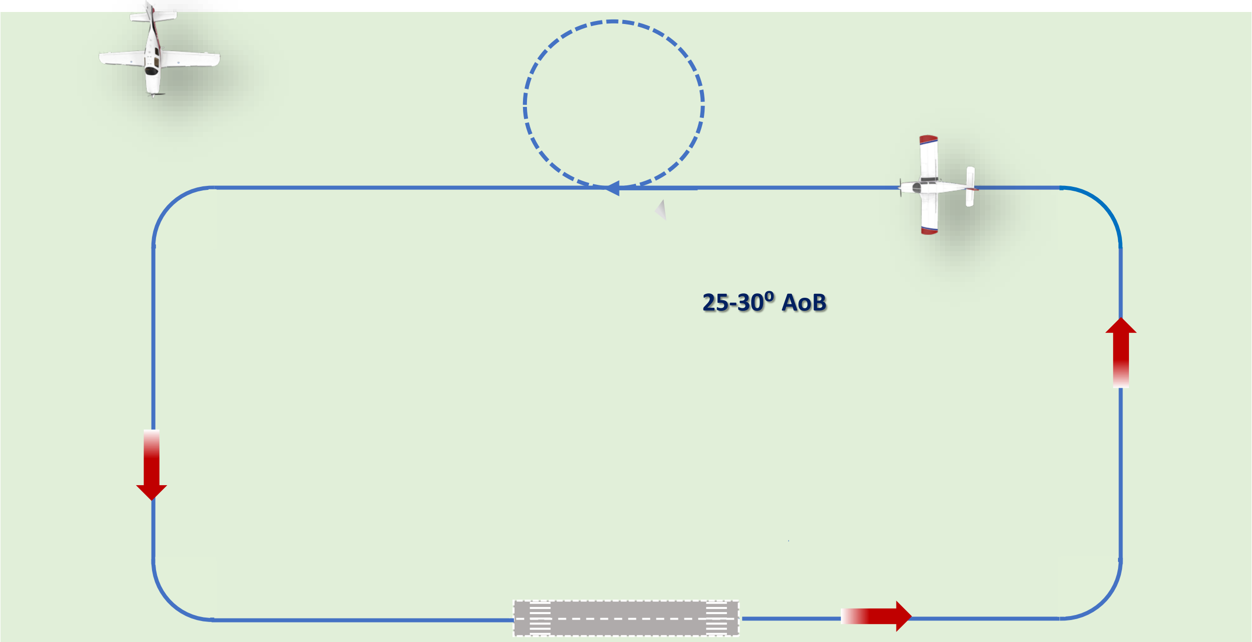
Used primarily by ATC to adjust spacing between aircraft in the circuit, or aircraft in the circuit and those aircraft joining straight into land, or, to hold aircraft for delays.

Commonly done on the downwind leg of the circuit

Not recommended at uncontrolled aerodromes (disorientation)

Reasons

- Aircraft in the circuit and passenger aircraft making straight in instrument approach
- Aircraft converging to be at the same position in the circuit, one aircraft instructed by ATC to orbit to maintain safe separation
- Instructor asks to orbit to provide separation so that a particular training exercise can be completed.



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Considerations

Touch and Go

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- Flaps to T/O, smooth power (rudder)

Go around

- If the landing needs to be abandoned
- Full power, Flaps up in stages as airspeed increases, straight ahead

Orbit

- 360° turn at 20° AoB
- Used to apply separation normally on downwind leg.

Considerations

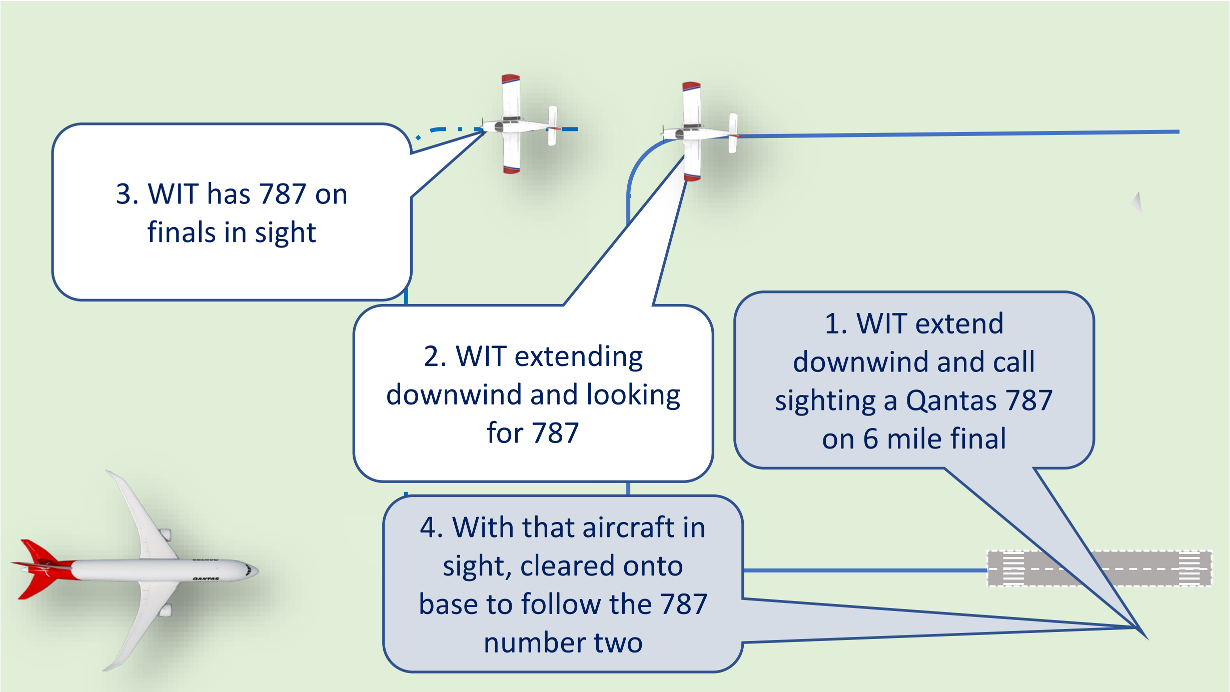
Extend Downwind

Used primarily by ATC to maintain aircraft separation.

Normally ATC will ask you to extend downwind and either

1) turn onto base when instructed, or,
2) call sighting the aircraft on finals.

ATC wants to make sure you can visually maintain separation and follow behind the aircraft on finals **BEFORE you are cleared to turn onto base leg.**



Circuit Considerations

Objective

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Considerations

Touch and Go

- Only on runways with adequate length.
- Flaps to T/O, smooth power (rudder)

Go around

- If the landing needs to be abandoned
- Full power, Flaps up in stages as airspeed increases, straight ahead

Orbit

- 360^o turn at 20^o AoB
- Used to apply separation normally on downwind leg.

Extend downwind

- Used for separation

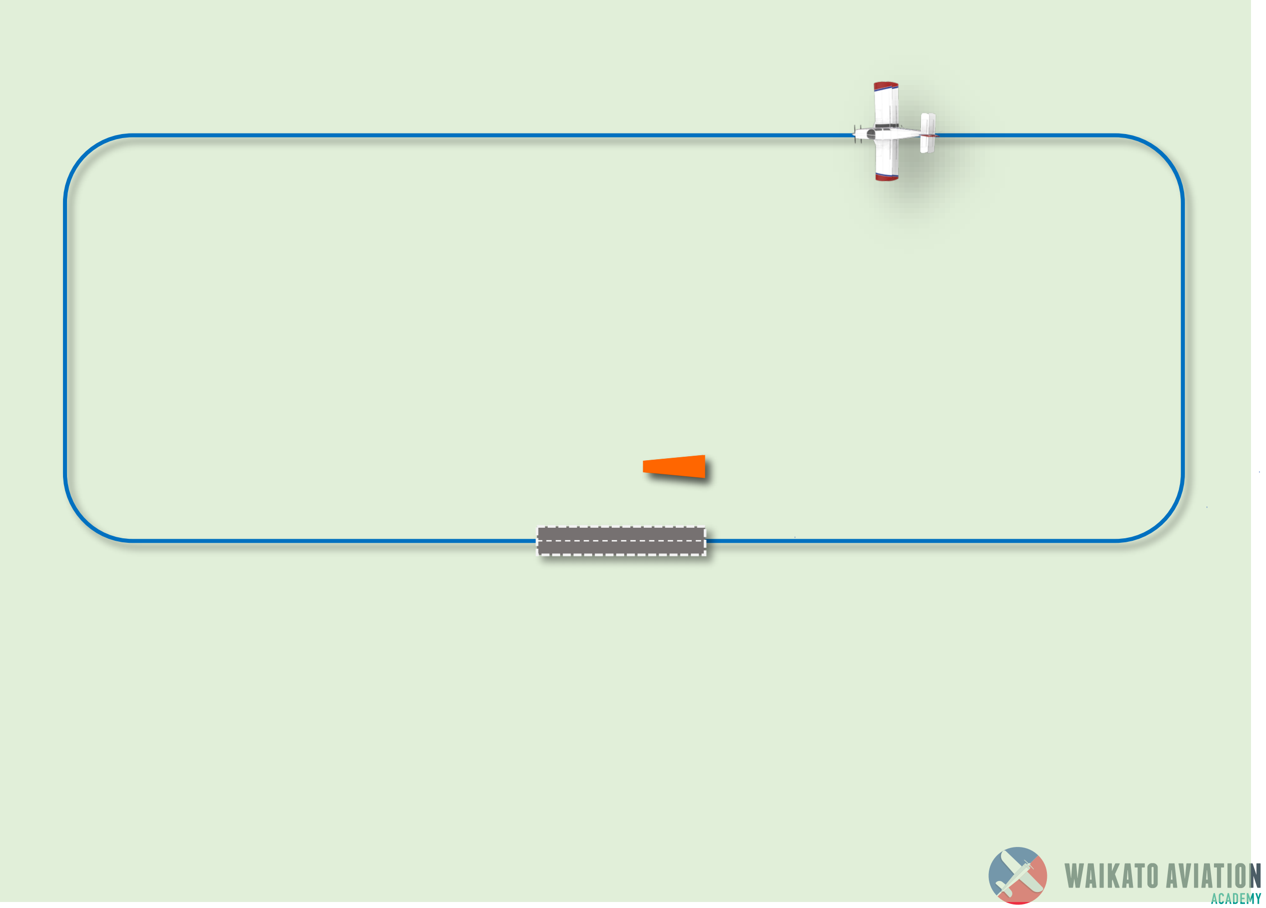
Considerations

Repositioning

Used primarily by ATC when there is a change in runway due to a change in wind direction

Normally ATC will reposition the aircraft from mid downwind at which point the aircraft will carry out a 180^o turn (turning out from the circuit) and fly a right-hand circuit until re-established into the left-hand circuit.

Conversely, ATC may direct you to cross over the middle of the runway and position you downwind left hand for the opposite runway.



Circuit Considerations

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- Only on runways with adequate length.
- Flaps to T/O, smooth power (rudder)

Go around

- If the landing needs to be abandoned
- Full power, Flaps up in stages as airspeed increases, straight ahead

Orbit

- 360⁰ turn at 20⁰ AoB
- Used to apply separation normally on downwind leg.

Extend downwind

- Used for separation

Repositioning

- Used when there is a change of runway. Aircraft normally repositioned from downwind

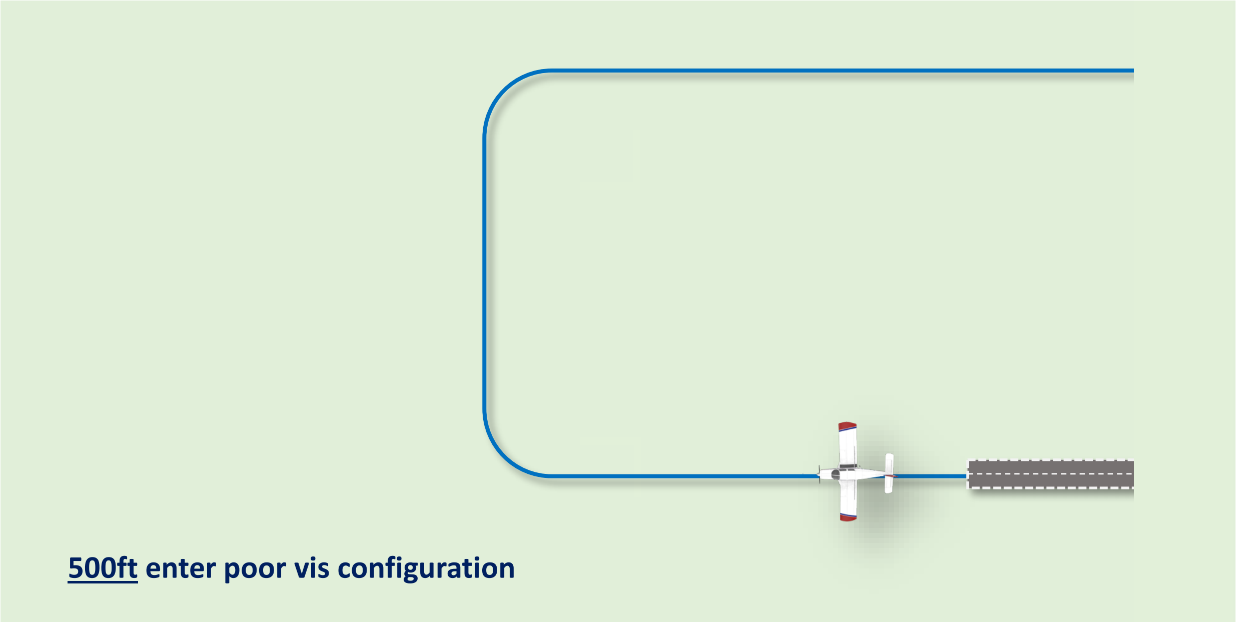
Considerations

Dumb-bell turn – advanced manoeuvre

Change of circuit direction by 180⁰ from the climb out, positioning back around onto finals.

Until experienced, minimum 500ft agl, enter poor visibility and straight and level and complete a 30⁰ AoB turn and reposition 180⁰ onto finals, and then further reconfigure for finals approach

Not to be carried out solo unless flown competently with an instructor and student has completed poor visibility low level circuit training.



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Go around

- If the landing needs to be abandoned
- Full power, Flaps up in stages as airspeed increases, straight ahead

Orbit

- 360^{o} turn at 20^{o} AoB
- Used to apply separation normally on downwind leg.

Extend downwind

- Used for separation

Repositioning

- Used when there is a change of runway. Aircraft normally repositioned from downwind

Dumb-bell turn

- Re-circuit to land in opposite direction from the climb-out. Minimum 500ft, enter bad vis

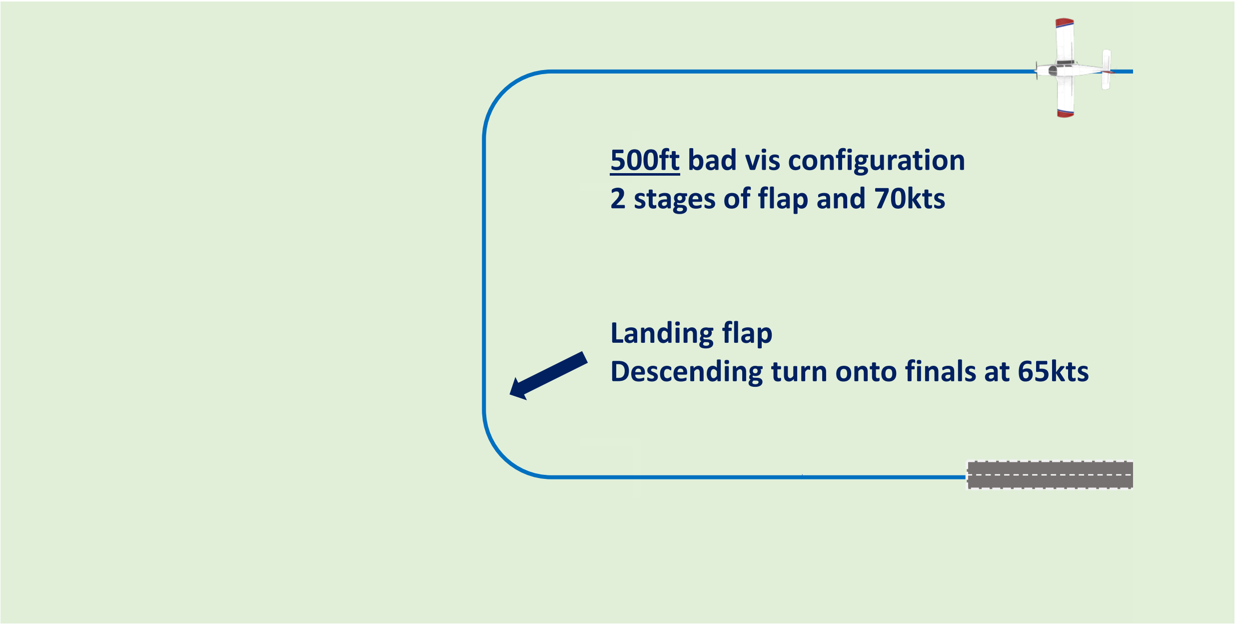
Considerations

Low-level circuit – advanced manoeuvre

Normally carried out at 500ft agl with the aircraft transitioning into the bad visibility configuration. Maintain 500ft agl on base leg, full flap and start a descending turn onto finals

Practically used if after take-off the actual cloud base and visibility is much lower than anticipated and a safe repositioning to land is required.

An advanced circuit that should be incorporated after low flying has been flown where the bad visibility configuration can be applied.



Circuit Considerations

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Go around

- If the landing needs to be abandoned
- Full power, Flaps up in stages as airspeed increases, straight ahead

Orbit

- 360º turn at 20º AoB
- Used to apply separation normally on downwind leg.

Extend downwind

- Used for separation

Repositioning

- Used when there is a change of runway. Aircraft normally repositioned from downwind

Dumb-bell turn

- Re-circuit to land in opposite direction from the climb-out. Minimum 500ft, enter bad vis

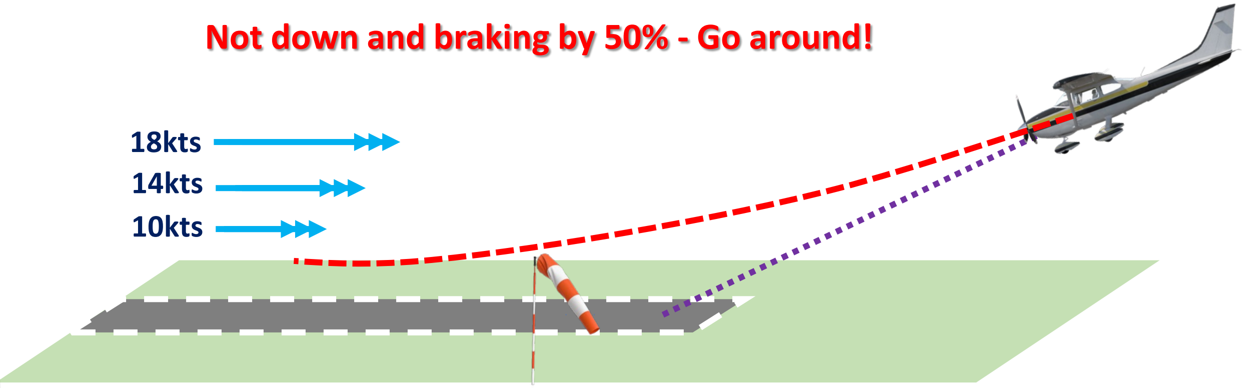
Low-level circuit

- 500ft circuit in bad visibility

Considerations

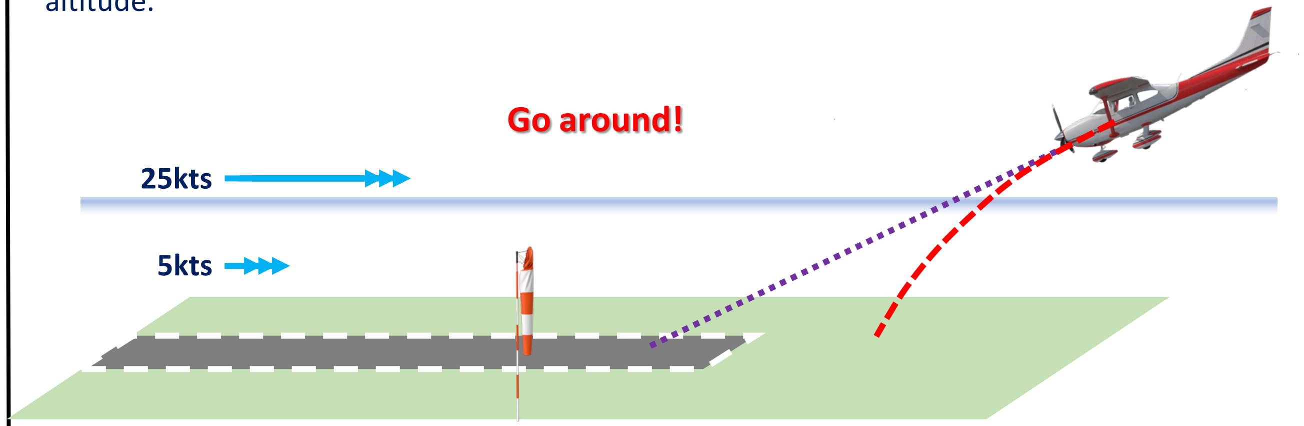
Wind Gradient

Gradual decrease in wind speed near the ground due to surface friction.



Windshear

Sudden decrease in wind speed or direction near the ground which can result in a loss of airspeed and therefore lift. This combined with the aircraft's inertia can lead to a rapid loss of altitude.



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- 360° turn at 20° AoB
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Extend downwind

- Used for separation

Repositioning

- Used when there is a change of runway. Aircraft normally repositioned from downwind

Dumb-bell turn

- Re-circuit to land in opposite direction from the climb-out. Minimum 500ft, enter bad vis

Low-level circuit

- 500ft circuit in bad visibility

Wind Gradient and Windshear

- Alters finals flight path. Severity dependent on degree of wind shear

Considerations

Wake turbulence

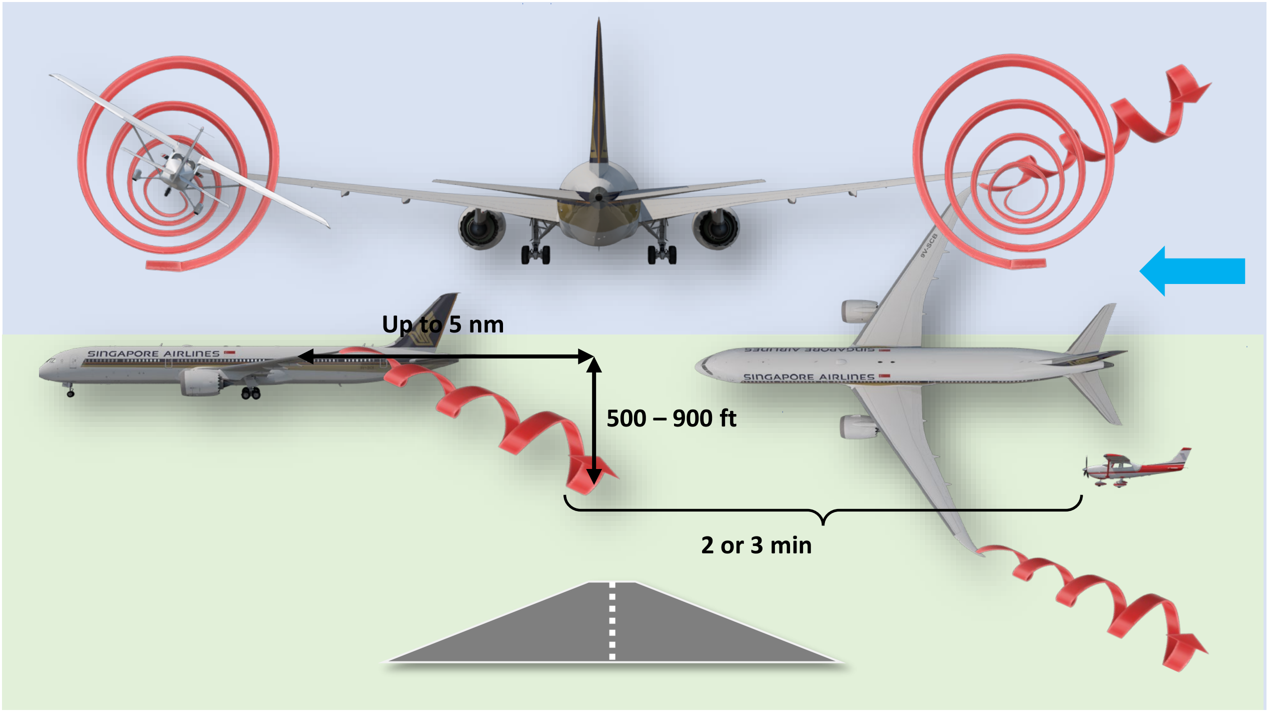
Disturbed air caused by wing producing lift. The disturbed air “swirls” as rotating vortices from the aircrafts wing tips. The heavier (larger) the aircraft the more powerful is the vortices.

The vortices migrate out and down from the aircraft.

Avoid by keeping a safe distance (time 2-3 minutes) from larger aircraft in front. ATC will normally manage separation by delaying take-off and providing greater separation.

If encountered, the roll can be significant. Control the roll and then go around.

The vortices can remain stationary with a crosswind.



WAIKATO AVIATION ACADEMY

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- Wings produce swirling vortices from wingtips. Degree proportional to weight of aircraft.

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Temperatures and Pressures – **Green** Range, check as part of after take-off checks

Flap – Only operate below Vfe (check before operation).

Select flap down at a moderate airspeed to limit pitch / trim changes with application

Select flap up with airspeed increasing to compensate for the loss of lift

Standard Checks in the Circuit – by phase

After take-off – Flaps up, T's and P's, Lights and Fuel Pump - OFF

Pre-Landing – undercarriage, brakes, mixture, pitch, fuel, harnesses and doors, lights

Finals – flaps, pitch, approach stable, clearance

WAIKATO AVIATION ACADEMY

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Aircraft Management

Throttle – Carb Heat – T's and P's

Flap – below Vfe

Checklists by memory

Airmanship and Human Factors

ATC clearances – Make sure you understand otherwise "say again"

Workload prioritisation – **Aviate**

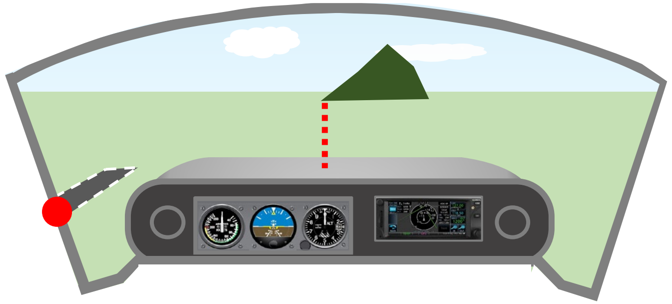
Navigate

Communicate (don't continue without clarity of instruction)

Orientation and Wind – Reference points from outside, reference points from inside .

Confirm orientation with key reference points referencing outside or from inside the aircraft

Awareness of wind and impact on track of aircraft.



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Aircraft Management

Throttle – Carb Heat – T's and P's

Flap – below Vfe

Checklists by memory

Airmanship and Human Factors

ATC clearances

Workload

Orientation and impact of wind

Air Exercise

Touch and Go

- Only on runways with adequate length. Full power before 50% of runway remaining
- Full power when nose wheel is on the ground. Note aircraft should be close to Vr

Go - around

- Any time a safe landing cannot be guaranteed, e.g. approach is unstable

Aviate – Navigate – Communicate

- This is a normal procedure and should be the norm not the exception when safe landing not guaranteed

Procedure

Full Power (rudder)

Nose attitude to Horizon line

Then retract Drag Flap

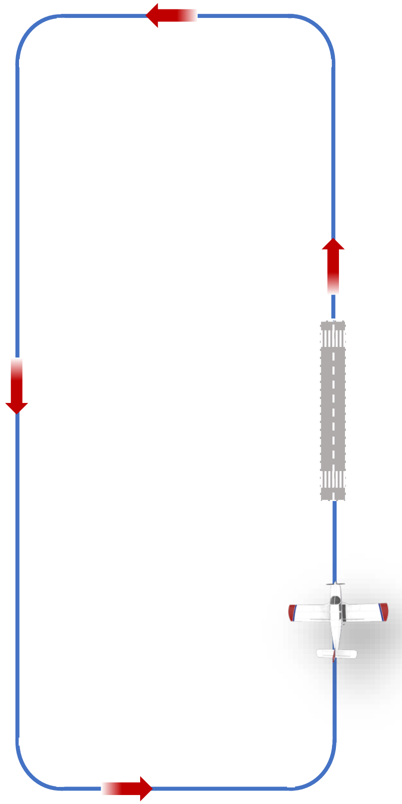
ASI ↑, ROC + ↑ and safe speed

Retract Lift Flap in stages

Select **Climb attitude**

Continue climb to circuit altitude and normal cross wind turning point

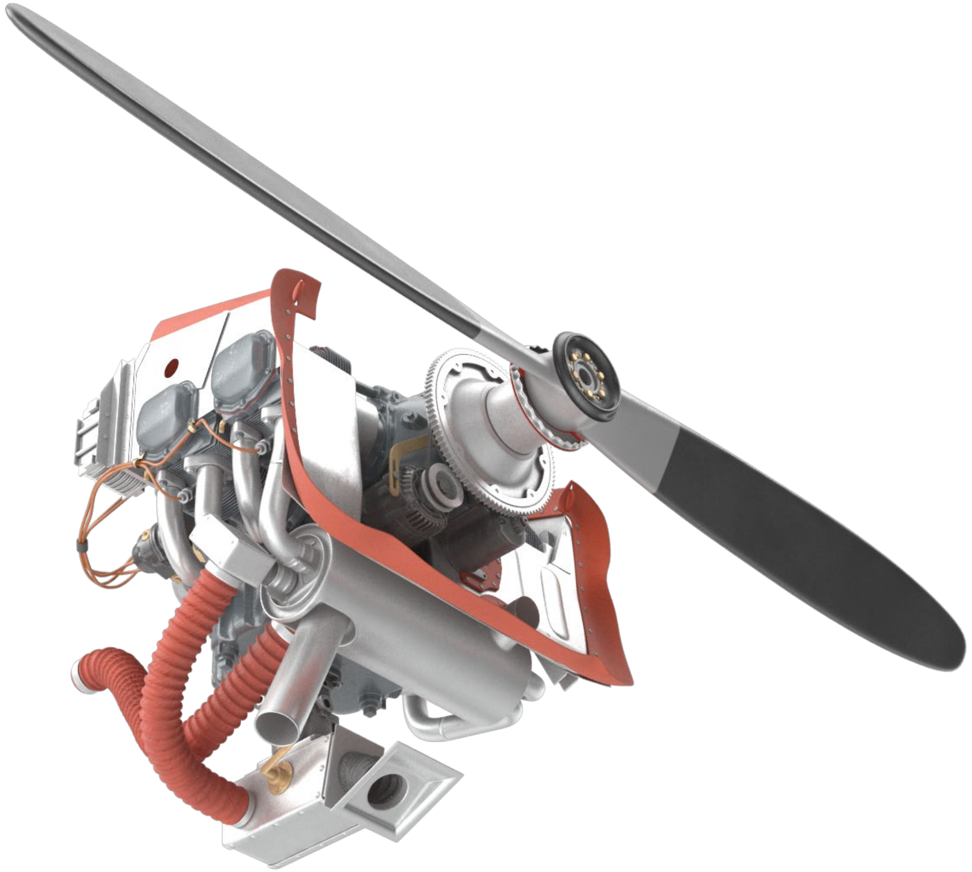
Advise ATC "XXX is going around"



WAIKATO AVIATION ACADEMY

Objective

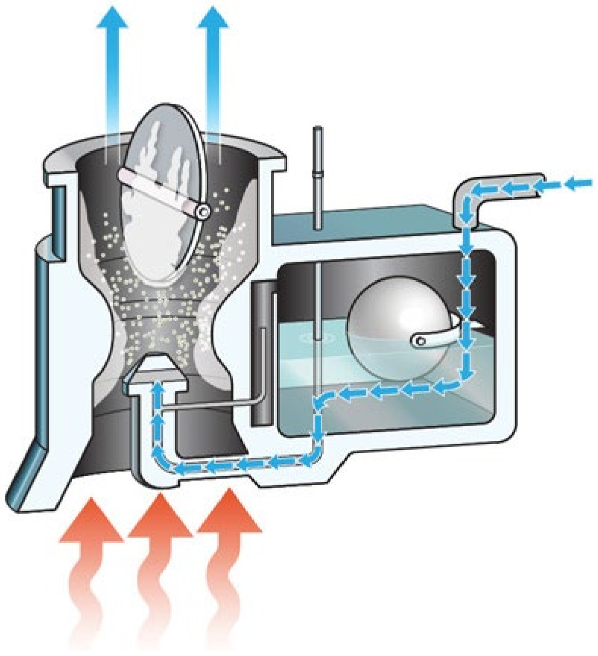
1. To apply the recommended procedure in the event of an engine failure at low level (below 1000ft AGL).
2. To demonstrate timely and effective decision making.

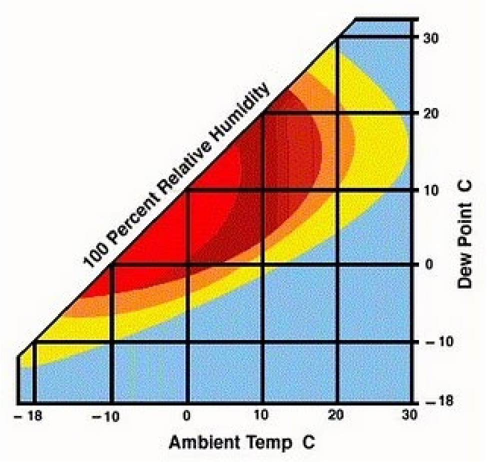


Considerations

Causes of an engine failure

Cause	Prevention
Carb Ice	Be aware of temperature and humidity Carb heat HOT as required especially when RPM below 1900 Pre-flight run-up





Light icing glide or cruise power

Serious icing glide power

Moderate icing cruise power

Serious icing cruise / climb power

Objective

1. To apply the recommended procedure in the event of an engine failure at low level (below 1000ft AGL).
2. To demonstrate timely and effective decision making.

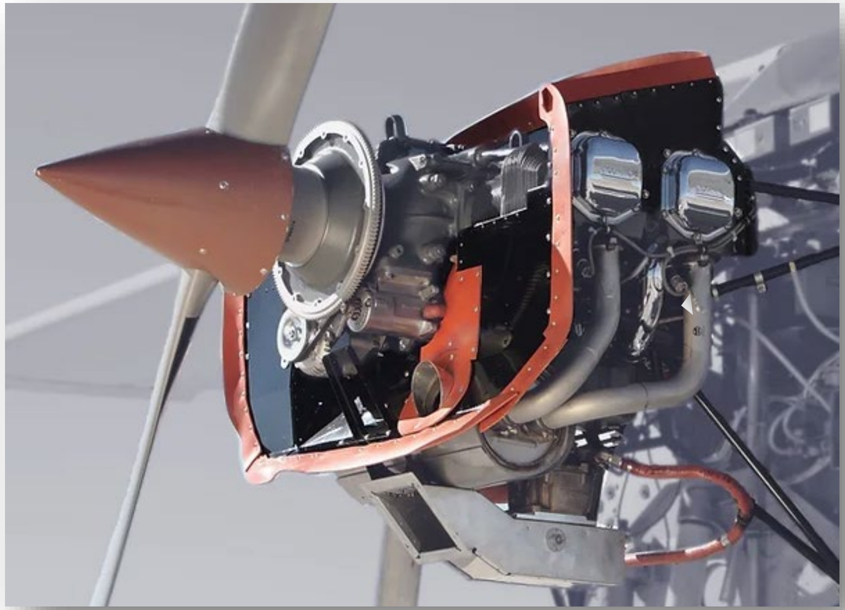
Considerations

Carb Ice	Be aware of temperature and humidity Carb heat HOT as required especially when RPM below 1900 Pre-flight run-up

Considerations

Causes of an engine failure

Cause	Prevention
Air Blockage	Impact Icing or grass (seasonal) Alternate Air Pre-flight inspection of air filter / intake



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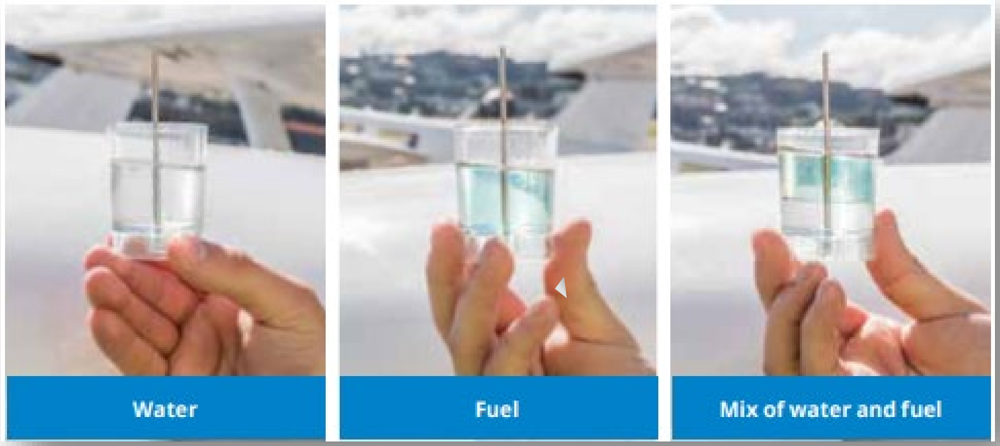
Carb Ice	Be aware of temperature and humidity Carb heat HOT as required especially when RPM below 1900 Pre-flight run-up
Air Blockage	Impact Icing – Grass (seasonal) Alternate Air Pre-flight inspection of air filter / intake

Considerations

Causes of an engine failure

Cause	Prevention
Fuel contamination	Water or solid particles in the fuel and microbial growth Pre-flight fuel check



Circuit Emergencies - EFATO

Objective

1. To apply the recommended procedure in the event of an engine failure at low level (below 1000ft AGL).
2. To demonstrate timely and effective decision making.

Considerations

Carb Ice	Be aware of temperature and humidity Carb heat HOT as required especially when RPM below 1900 Pre-flight run-up
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Considerations

Causes of an engine failure

Cause	Prevention
Fuel starvation	Wrong fuel tank selected, fuel vent system blocked, fuel pump Pre-flight runup
Fuel exhaustion	Run out of fuel in flight Pre-flight planning, inspection and in flight management

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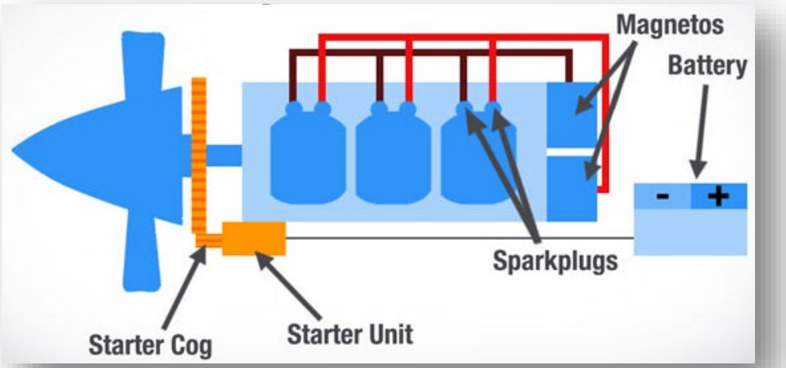
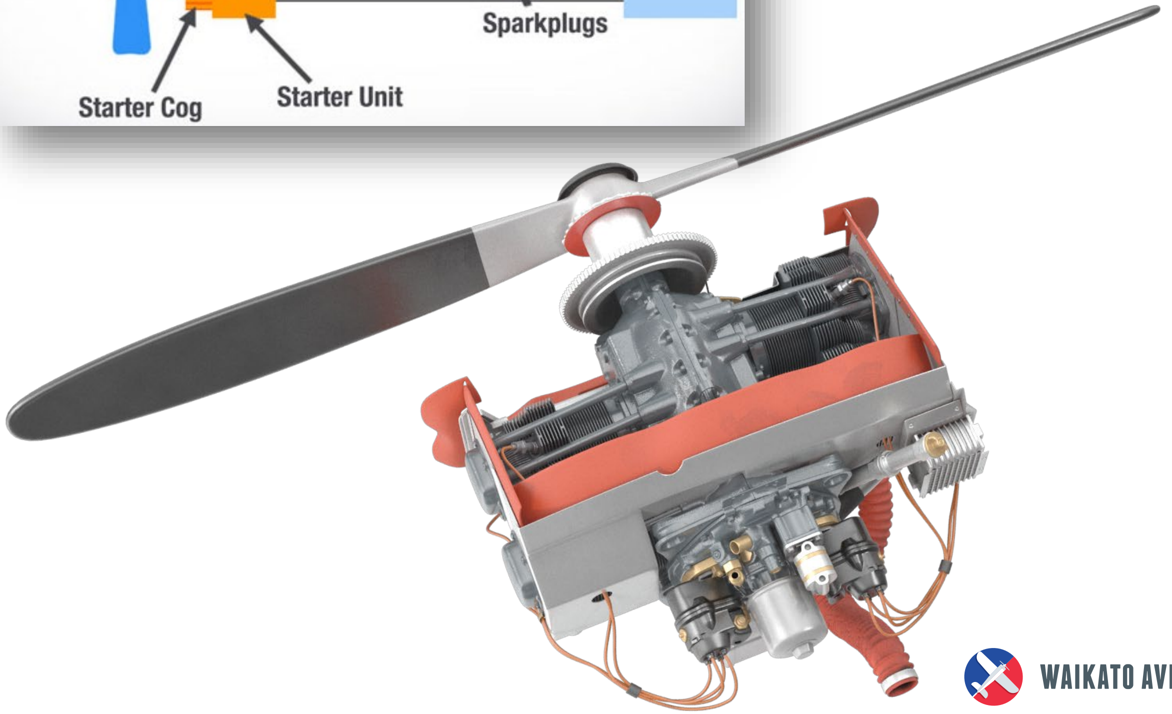
Considerations

Causes of an engine failure

Cause	Prevention
Irregular or intermittent spark	Pre-flight inspection and run-up





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Irregular or intermittent spark	Pre-flight inspection and run-up

Considerations

Definitions

Initial reaction checks – Carb heat and electric fuel pump

Trouble checks – Fuel, mixture, ignition, instruments and electrics

Shutdown checks – Fuel, mixture, ignition, master

Management of engine failures

Take-off emergency brief - actions in the event of an emergency

1. Pilot elects to abort on the runway
2. Pilot elects to abort airborne with runway remaining
3. Pilot is forced to abort airborne with runway not remaining

Two components

1. Memory items verbalised
2. Motor skills actioned

Aborted take-off

1. Close throttle
2. Maintain direction (centreline of runway)
3. Braking as required
4. Control column back

Engine failure after take-off

AVIATE – keep the aircraft flying as a first priority. Lower aircraft nose Vglide and close throttle

NAVIGATE – Select the most suitable landing area ahead and lower flap

COMMUNICATE – Inform ATC and traffic and V2 track.

Circuit Emergencies - EFATO

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Irregular or intermittent spark	Pre-flight inspection and run-up

Take-off emergency brief – verbalisation and motor actions

Aborted take-off – close throttle, maintain direction, braking, C/C back

Engine failure after take-off - **AVIATE, NAVIGATE COMMUNICATE**

Aircraft Management

Smooth throttle movements

Don't gloss over your checks. Remember normal readings, sounds and vibrations. If something does not look, sound of feel normal, be very vigilant and investigate closely

Know your emergency drills by memory and motor skill

Timely response of your emergency checks means … that you should not prioritise your checks over Aviate or Navigate, and they should not be rushed.

Circuit Emergencies - EFATO

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Take-off emergency brief – verbalisation and motor actions

Aborted take-off – close throttle, maintain direction, braking, C/C back

Engine failure after take-off - **AVIATE, NAVIGATE COMMUNICATE**

Aircraft Management

Throttle – Smooth

Vigilant with checks and observations

Know your checks and don't rush them

Airmanship and Human Factors

Aviate – Navigate - Communicate

Pre-take-off emergency brief. As per Waikato Aviation standard brief.

All **simulated emergencies** will be introduced by the instructor saying "simulating engine failure" so that there is no ambiguity.

Touch checks only – except **throttle** and **flaps.** Otherwise, point to the system selector and state what you are doing with it e.g. mixture lean, fuel selector off, ignition off etc.

The only "trouble checks" carried out with the EFATO are the "**initial reaction checks**" i.e. carb heat on and fuel pump on. The initial reaction checks address the more likely causes of an engine power loss.

Carry out the **shutdown checks** only when (1) you are established on your profile and you are assured of making the landing area, and … (2) you have altitude and time available.

1. Fuel - **OFF**
2. Mixture - **ICO**
3. Ignition - **OFF**
4. Masters - **OFF**

Avoid mindset and bias. For each EFATO select the best landing area specific to your position and altitude and in consideration of the wind velocity. It is good to be aware of landing areas available but consider them relevant to each situation.

Circuit Emergencies - EFATO

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Take-off emergency brief – verbalisation and motor actions

Aborted take-off – close throttle, maintain direction, braking, C/C back

Engine failure after take-off - **AVIATE, NAVIGATE COMMUNICATE**

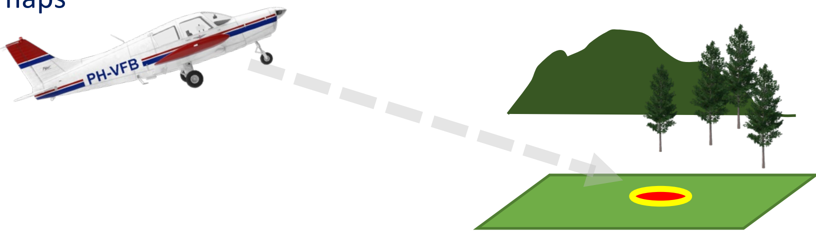
Air Exercise

Aborted take-off

1. Close aircraft throttle
2. Apply even brakes
3. Control column - full aft
4. Inform ATC or other aircraft

Engine failure after Take-off

1. Lower the aircraft nose to glide attitude and close aircraft throttle
2. Select the best landing area available within the windscreen (don't turn back)
3. Carb Heat – **ON** and Fuel Pump - **ON**
4. Position aircraft onto profile with flaps to make landing are
5. MAYDAY and V2



With altitude and time

1. Fuel – **OFF**
2. Mixture – **ICO**
3. Ignition – **OFF**
4. Masters - **OFF**

Start exercise at 5-800ft agl, lower to 3-400ft agl, land on runway

Aircraft Management

Throttle – Smooth

Vigilant with checks and observations

Know your checks and don't rush them

Airmanship and Human Factors

Emergency Brief – verbal and motor actions

Emergencies "simulating" with touch checks

Watch out for mindset and bias

WAIKATO AVIATION ACADEMY

Circuit Emergencies – Glide Approach

Objective

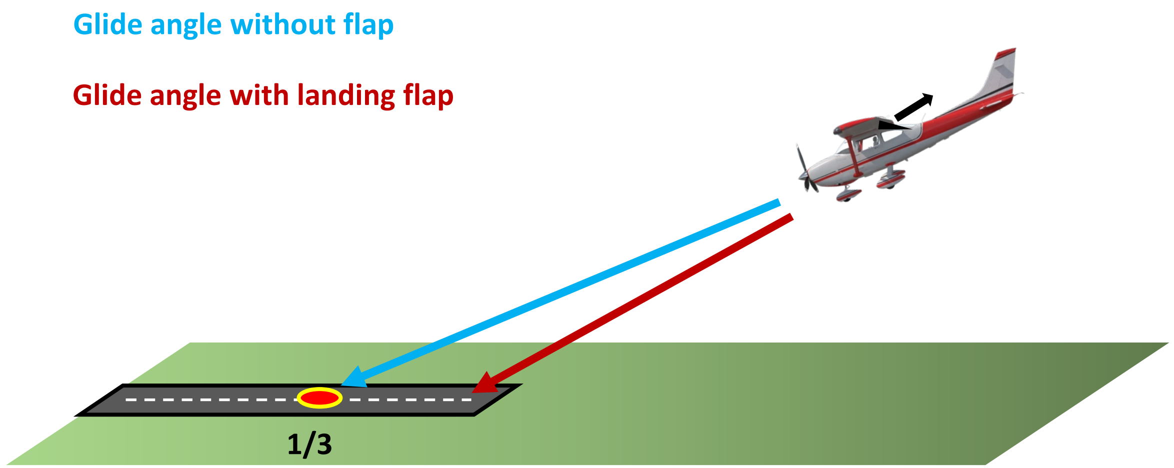
1. To complete a landing without engine power from the 1000ft downwind position.
2. To demonstrate timely decision making.

Considerations

Aiming point selection – 1/3 of runway length

Places the aircraft high on approach but with potential energy in reserve.

Normally when assured of making the aim point, flap is extended which then reduces the lift/drag ratio, steepening the glide descent while maintaining the same approach airspeed.

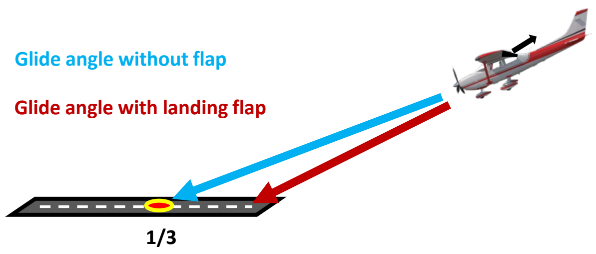


Objective

1. To complete a landing without engine power from the 1000ft downwind position.
2. To demonstrate timely decision making.

Considerations

Aiming point selection

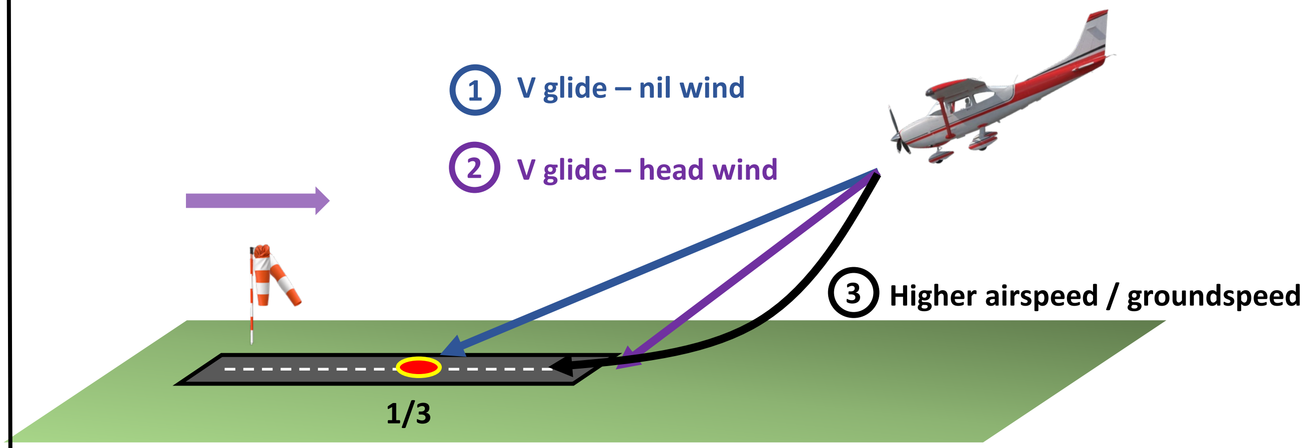


Considerations

Headwind on final

Strong headwind produces a low groundspeed and steepens the descent. Increasing the rate of descent to limit exposure to the headwind (low groundspeed) provides better penetration into the wind.

- Lower nose and increase airspeed ~ (+10 kts) and therefore ROD
- Delay application of flap



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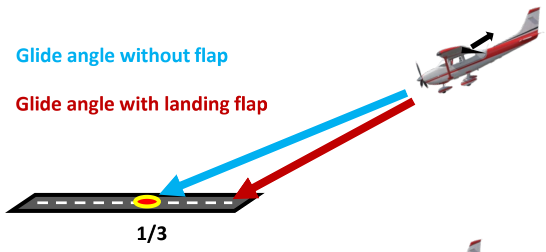
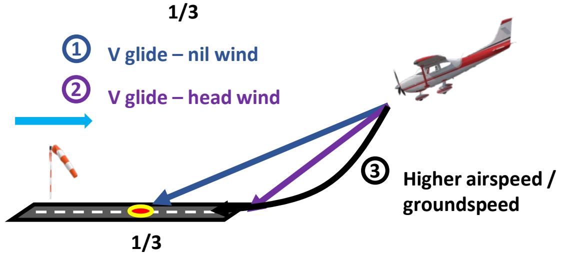
Considerations

Aiming point selection



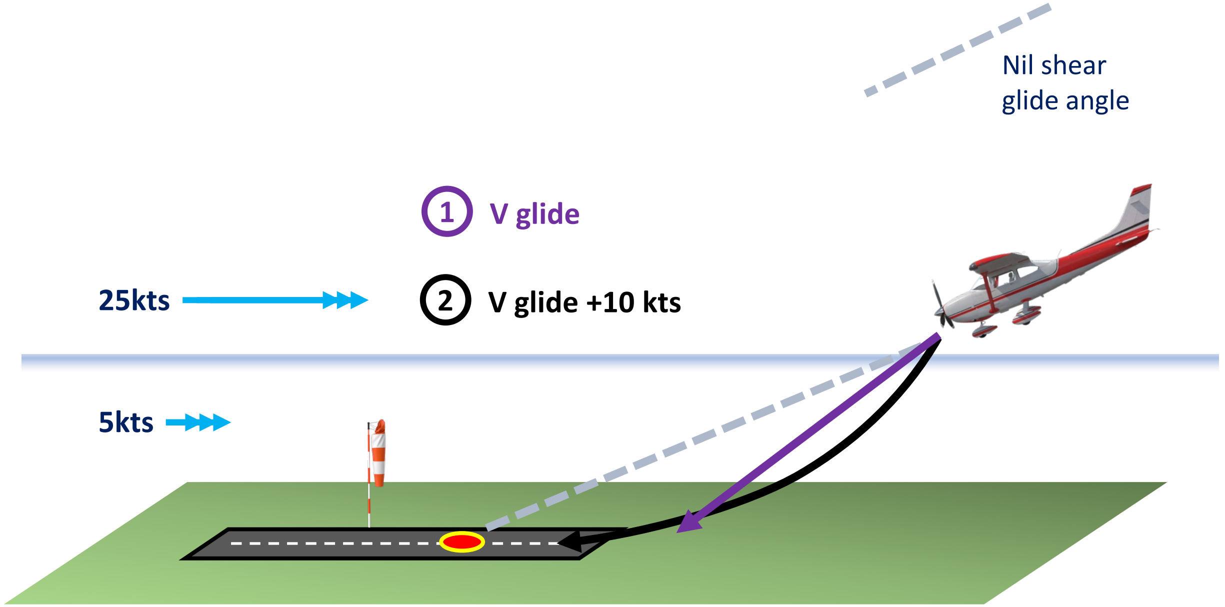
Headwind



Considerations

Windshear on final

Only option of countering windshear on final when without power is to increase airspeed. This counters the loss of lift as a result of airspeed loss as the aircraft descends through the shear layer.



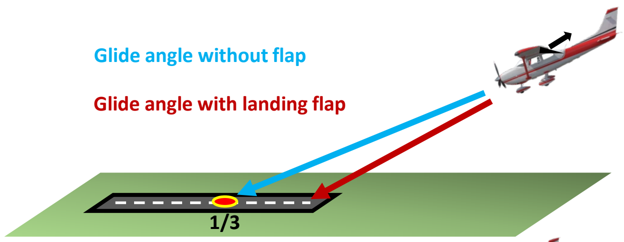
Circuit Emergencies – Glide Approach

Objective

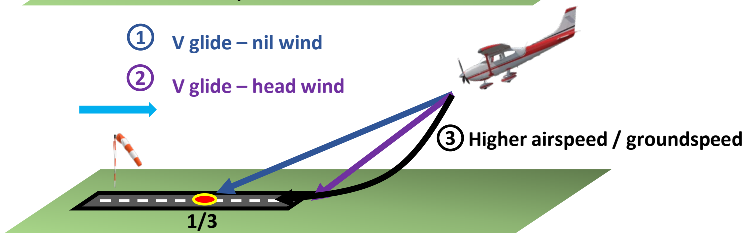
1. To complete a landing without engine power from the 1000ft downwind position.
2. To demonstrate timely decision making.

Considerations

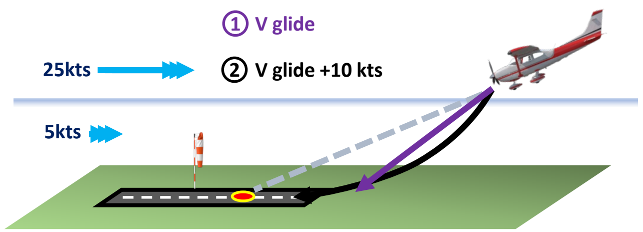
Aiming point selection



Headwind



Windshear

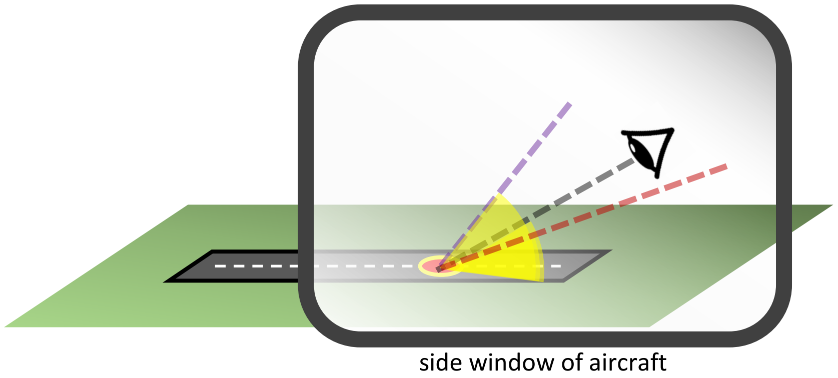


Considerations

Moving the aiming point forward towards the threshold

- **Flaps –** Best option as flaps increase drag effectively but also lower the stall speed
- **Airspeed –** A good option to combine with flaps, as increase in airspeed with an increase in drag has a marked effect on steepening the descent angle. Best used early on during the finals descent so that the airspeed can be reduced again prior to touchdown
- **S turns –** increases track distance, tilts the lift vector and increases drag therefore reducing L/D ratio. Not that effective on modern aircraft and de-stabilises final approach due to aircraft inertia and less effective controls. Only to be used to correct poor judgement.
- **Sideslip –** aircraft controls are crossed, left aileron and right rudder. Modern aircraft rudders are not that effective and so full rudder is normally required. Flying with a sideslip can blanket the controls and reduce control effectiveness and upset aerodynamic forces e.g. tailplane. If sideslip is used, critical that airspeed is increased.

Sight line angle



Angle **increases** – turn out and extend flap earlier

Angle **decreases** – turn in and extend flap later

Similar to runway aiming point – maintain a constant angle to the aiming point as you carry out a continuous descending turn onto finals from the downwind position

Circuit Emergencies – Glide Approach

Objective

1. To complete a landing without engine power from the 1000ft downwind position.
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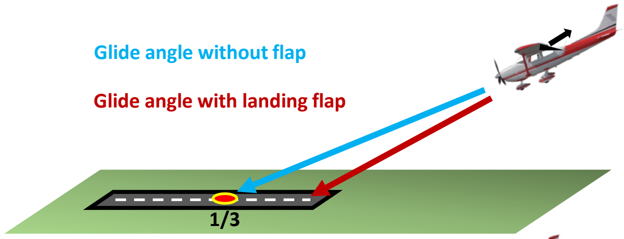
Considerations

Aiming point selection



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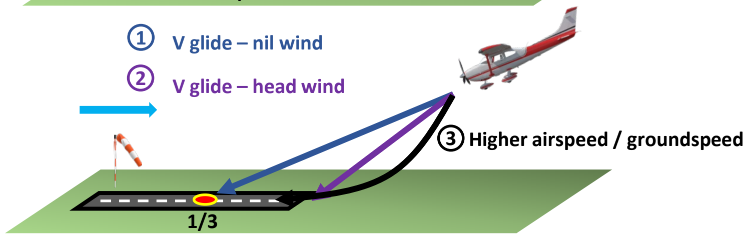

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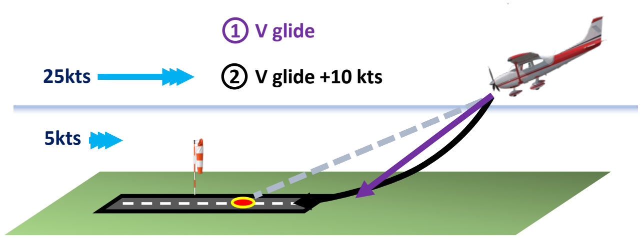

Moving the aiming point forward – Flaps, Airspeed, S turns, Sideslip

Sight line angle – ↑ > turn out extend flap earlier, ↓ > turn in and extend flap earlier

Aircraft Management

1. Carb Heat
2. Flap down, hold nose down
3. No engine warms

Airmanship and Human Factors

1. Safe operations in doubt (usually getting too low and turning) **go around.** Note without power, the aircraft's inertia is more pronounced especially when turning.
2. **No passengers** should be carried during this exercise
3. Focus on **successful outcome** and learning from previous glides to make adjustments for wind velocity and the correct angle (picture) from which to apply flaps.
4. The glide approach needs to be **planned well** in terms of other traffic in the circuit. The exercise does not give you priority over other traffic.
5. If landing onto an upslope, additional airspeed should be carried into the flare ~ 5-10kts

WAIKATO AVIATION ACADEMY

Circuit Emergencies – Glide Approach

Objective

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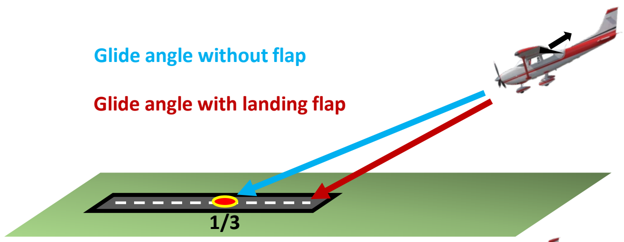
Considerations

Aiming point selection



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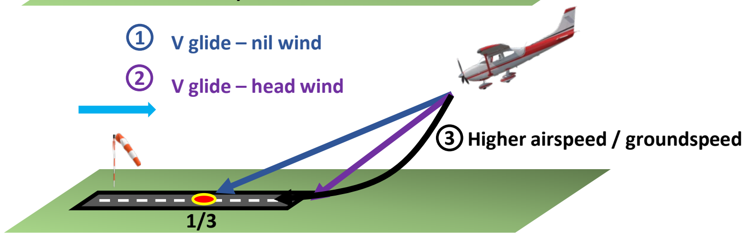

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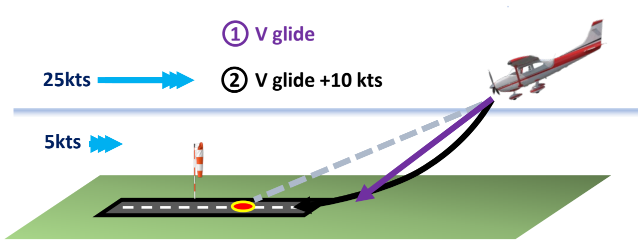


Moving the aiming point forward – Flaps, Airspeed, S turns, Sideslip

Sight line angle – ↑ > turn out extend flap earlier, ↓ > turn in and extend flap earlier

Aircraft Management

Carb heat

Flap down, nose down

No engine warms

Airmanship and Human Factors

Go around if approach is unsafe – inertia

Focus on adjusting to improve accuracy

Plan the exercise well in the circuit

Air Exercise

Downwind

- Confirm spacing downwind

Approaching 1000ft point

- "Simulating" with reduction in power.
- **AVIATE** - Maintain height and trim for Vglide
- **NAVIGATE –** Select landing area, aiming point.
- **COMMUNICATE** – MAYDAY x3

Base (1st half)

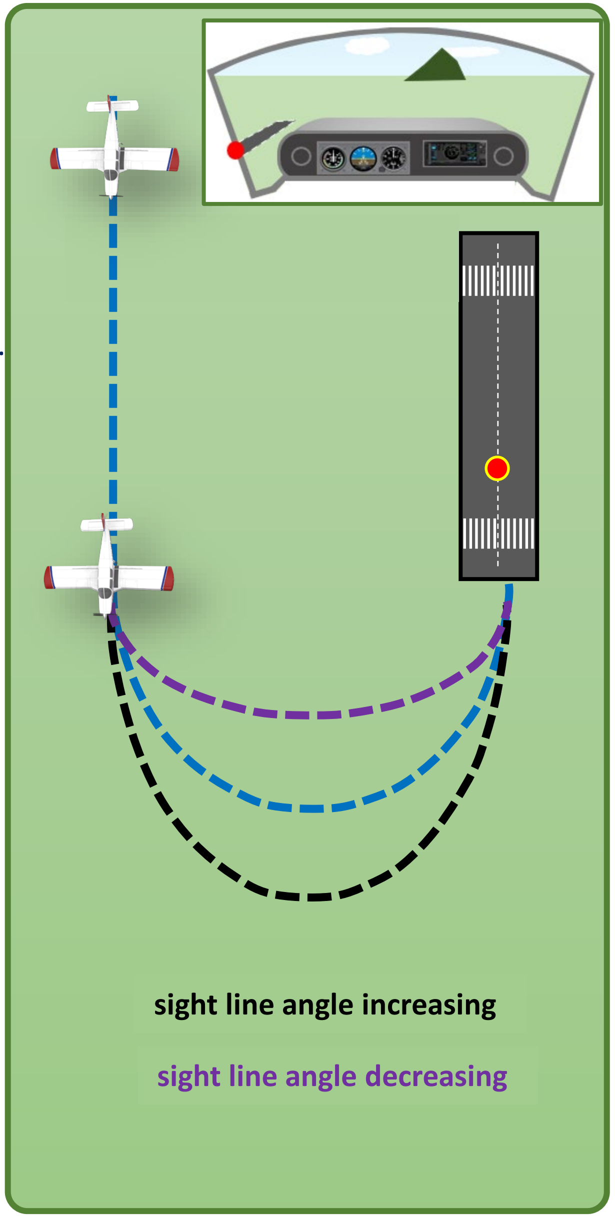
- Establish sight line angle to aiming point and turn to maintain
- Initial reaction checks FP and CH - **ON**
- Adjust track to maintain sight line angle

Base (2nd half)

- Aiming point assured
- Lower flap in stages – hold nose down
- Move aiming point towards threshold

Final checks

- **V2** Emergency
- Fuel – **OFF**
- Mixture – **OFF**
- Ignition – **OFF**
- Masters - **OFF**



WAIKATO AVIATION ACADEMY

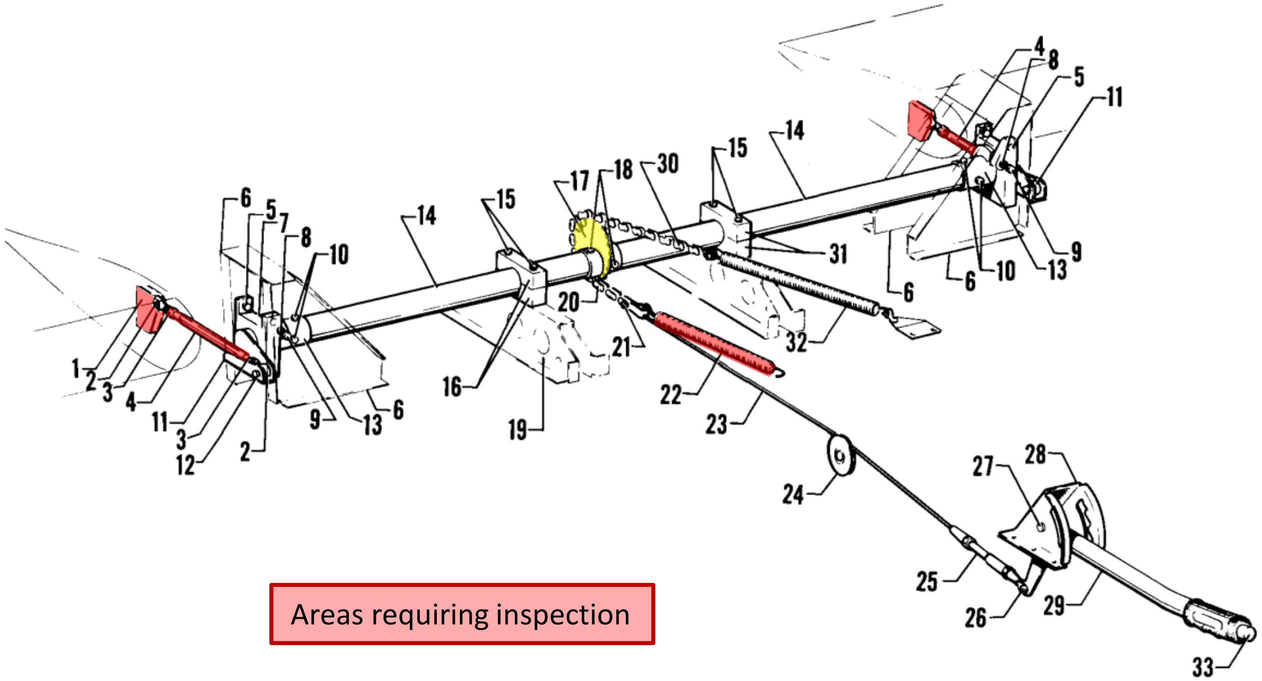
Objective

1. To safely carry out a flapless approach and landing
2. To demonstrate good airmanship and decision making.

Considerations

Causes of a flap failure

Cause	Prevention
Mechanical linkage failure Piper PA28	Effective maintenance programme Operating flaps below Vfe, select smoothly



Circuit Emergencies – Flapless Approach

Objective

1. To safely carry out a flapless approach and landing
2. To demonstrate good airmanship and decision making.

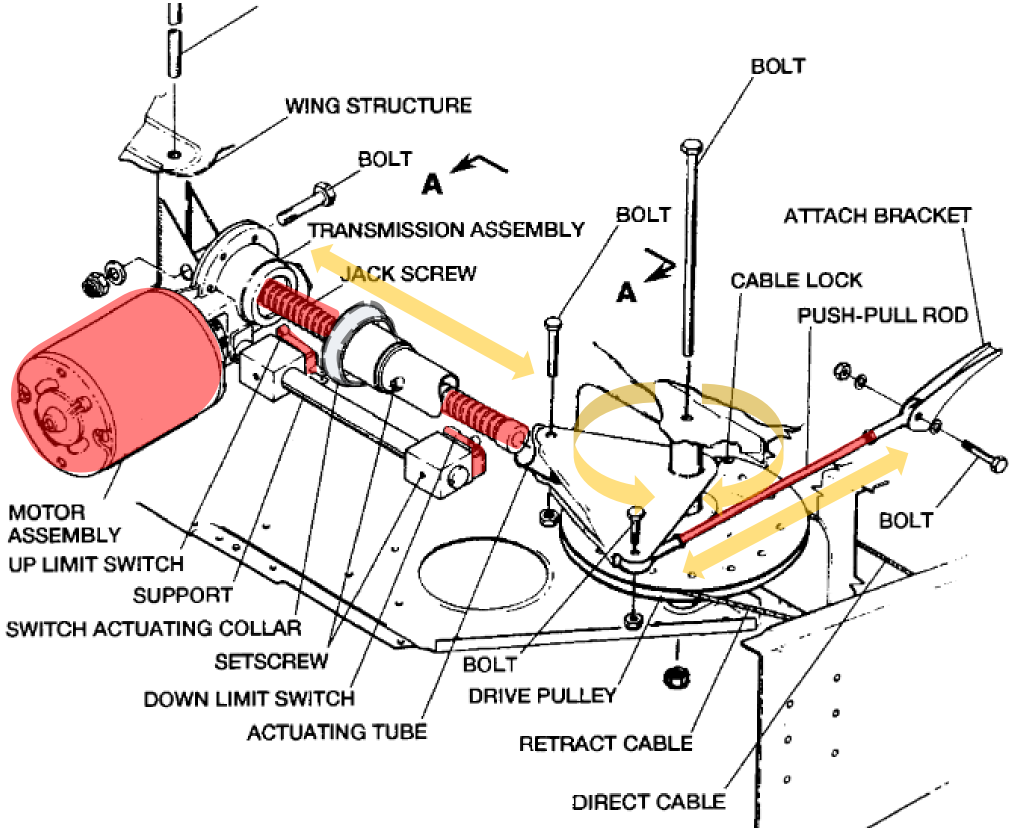
Considerations

Mechanical linkage failure	Effective maintenance programme Operate flaps below Vfe, operate smoothly

Considerations

Causes of a flap failure

Cause	Prevention
Electrical flap motor failure Cessna C172	Effective maintenance programme Operating flaps below Vfe Electrical system knowledge and awareness



Circuit Emergencies – Flapless Approach

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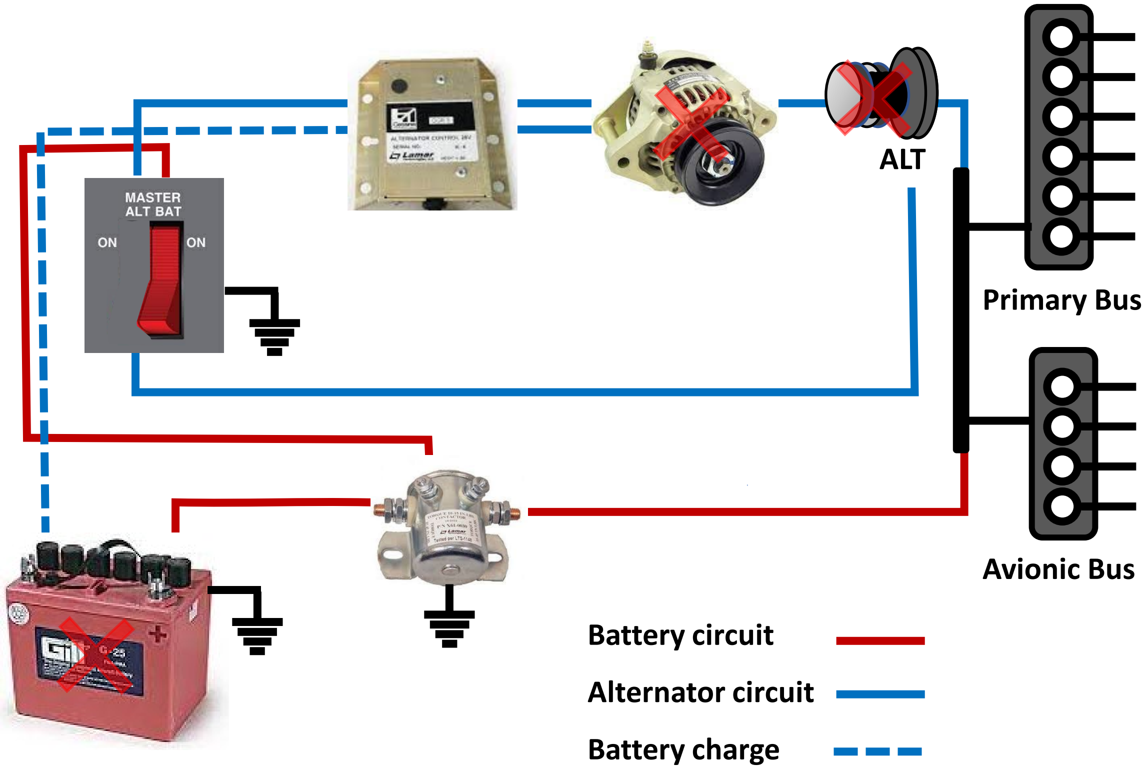
Electrical flap motor failure	Effective maintenance programme Operate flaps below Vfe Electrical systems knowledge

Considerations

Causes of a flap failure

Cause	Prevention
Electrical current failure	Effective maintenance programme Pilot monitoring of systems Pilot knowledge of systems



WAIKATO AVIATION ACADEMY

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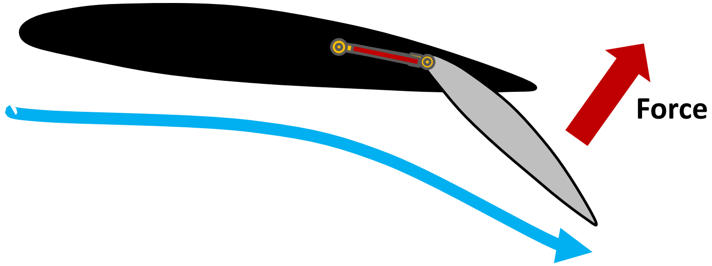
Electrical flap motor failure	Effective maintenance programme Operate flaps below Vfe Electrical systems knowledge
Electrical current failure	Effective maintenance programme Pilot monitoring of system Pilot knowledge of system

Considerations

Causes of a flap failure

Cause	Prevention
Aerodynamic overload (Overspeed)	Remain well within Vfe airspeed when operating the flaps **Limitation – Operation – Indication (LOI)**



Good practice to operate flaps below Vfe and at a moderate airspeed to reduce pitching forces and aerodynamic forces on the flaps.

If you select flaps down and experience uncontrolled roll, **reverse flap selection immediately**

WAIKATO AVIATION ACADEMY

Circuit Emergencies – Flapless Approach

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Mechanical linkage failure	Effective maintenance programme Operate flaps below Vfe, operate smoothly
Electrical flap motor failure	Effective maintenance programme Operate flaps below Vfe Electrical systems knowledge
Electrical current failure	Effective maintenance programme Pilot monitoring of system Pilot knowledge of system
Aerodynamic overload	Remain well within Vfe when selecting flap Limitation, Operation, Indication

Considerations

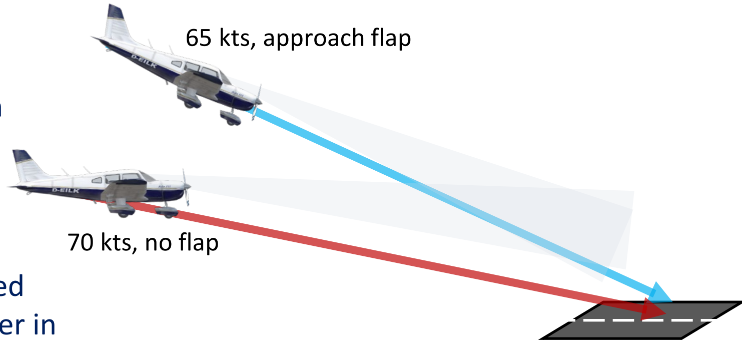
Precautions

1. Thorough pre-flight inspection
2. Vigilant monitoring of systems in flight (using all senses)
3. Pilot knowledge of systems
4. Regular SADIE checks
5. Education on occurrences (GAP and Vector Magazine, accident investigations)
6. If detected late downwind, **Go around**, place aircraft into a hold/ level flight and consider options/risks

Diagnosis

1. Check electrical system – Masters ON, Voltage, CB's IN – both ALT and Flap motor. Caution.
2. Visual check of flaps to see if there is a mechanical failure obvious.

Flapless procedure



1. Stall seed is higher therefore approach speed is increased by normally 5kts
2. Less power required.
3. Higher nose attitude required – reduced forward visibility and aiming point lower in windscreen. **Trim accurately.**
4. Descent angle shallower.
5. Longer landing distance approx. 40%.

WAIKATO AVIATION ACADEMY

Circuit Emergencies – Flapless Approach

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Electrical current failure	Effective maintenance programme Pilot monitoring of system Pilot knowledge of system
Aerodynamic overload	Remain well within Vfe when selecting flap Limitation, Operation, Indication

Precautions – pre-flight inspection, monitoring, technical knowledge, safety education

Diagnosis – check electrical system, visual check of flaps

Procedure - + 5kts, less power, higher nose attitude trimmed, shallow descent, +40%

Aircraft Management

1. Smaller and incremental power adjustments due lower drag
2. Trim the aircraft well early from downwind turning base leg.

Airmanship and Human Factors

1. Go around giving you time to assess the situation and come up with a safe decision. Options v Risks.
2. Systems knowledge and safety education will enhance competence and confidence which contribute to safe outcomes.
3. Bias is to lower the nose like the normal approach "picture". Resist by trimming and becoming familiar with the flapless attitude.

Circuit Emergencies – Flapless Approach

Objective

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2. To demonstrate good airmanship and decision making.

Considerations

Mechanical linkage failure	Effective maintenance programme Operate flaps below Vfe, operate smoothly
Electrical flap motor failure	Effective maintenance programme Operate flaps below Vfe Electrical systems knowledge
Electrical current failure	Effective maintenance programme Pilot monitoring of system Pilot knowledge of system
Aerodynamic overload	Remain well within Vfe when selecting flap Limitation, Operation, Indication

Precautions – pre-flight inspection, monitoring, technical knowledge, safety education

Diagnosis – check electrical system, visual check of flaps

Procedure - + 5kts, less power, higher nose attitude trimmed, shallow descent, +40%

Aircraft Management

Smaller power adjustments

Trim the aircraft early

Airmanship and Human Factors

Go around and assess options v risks

System knowledge and safety education

Bias to maintain normal picture on finals

Air Exercise

Decision making

No flaps observed late downwind.

- Go around / hold and assess situation
- Options/Risks – runway length? divert?
- Review approach speed and technique.

Downwind

- Complete checks and downwind call
- Power less than normal circuit ~ 1-200 RPM
- Plan to turn onto base at about 60^o
- Trim aircraft

Base leg – 75 kts

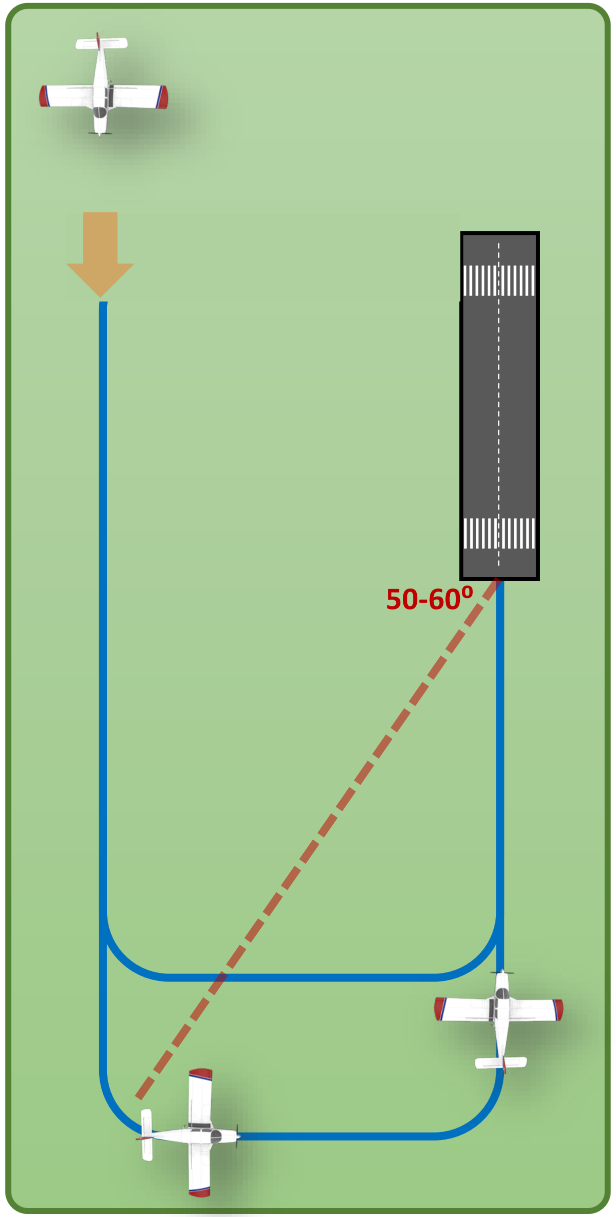
- Check PAT
- Power slightly lower
- Attitude higher
- Trimmed
- Aim for gate and anticipate turn

Final approach 75 > 70 kts

- Smaller incremental power adjustments
- Higher nose attitude – less fwd visibility

Landing 65 kts

- Small (1/2 round out) positive touchdown.
- Apply brakes early, maintain direction.



WAIKATO AVIATION ACADEMY

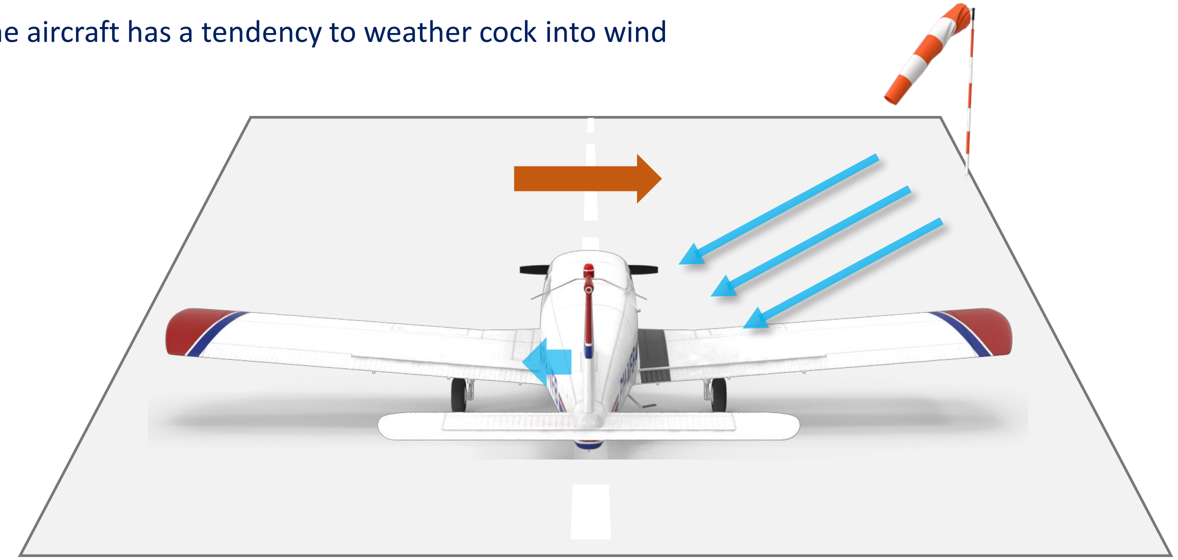
Objective

1. To correctly position the aeroplane controls while taxiing.
2. To compensate for drift throughout the circuit.
3. To take-off and land in crosswind conditions.

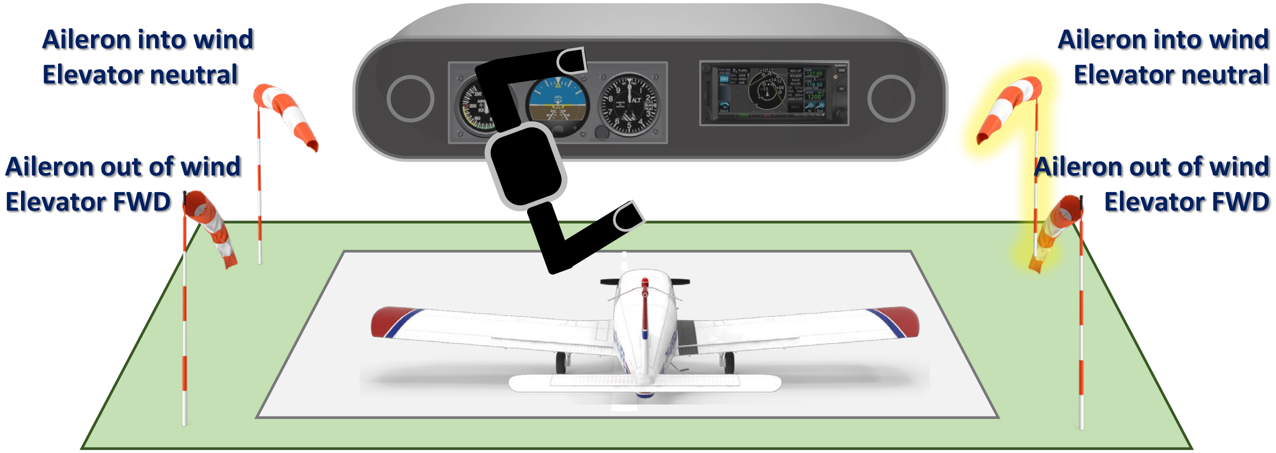
Considerations

Aircraft control on the ground

The aircraft has a tendency to weather cock into wind



Position the controls on the ground to compensate for the wind.



Objective

1. To correctly position the aeroplane controls while taxiing.
2. To compensate for drift throughout the circuit.
3. To take-off and land in crosswind conditions.

Considerations

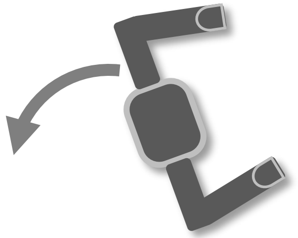
1. **Aircraft control on ground** – aircraft wants to weathercock into wind, position the controls to hold windward wing down

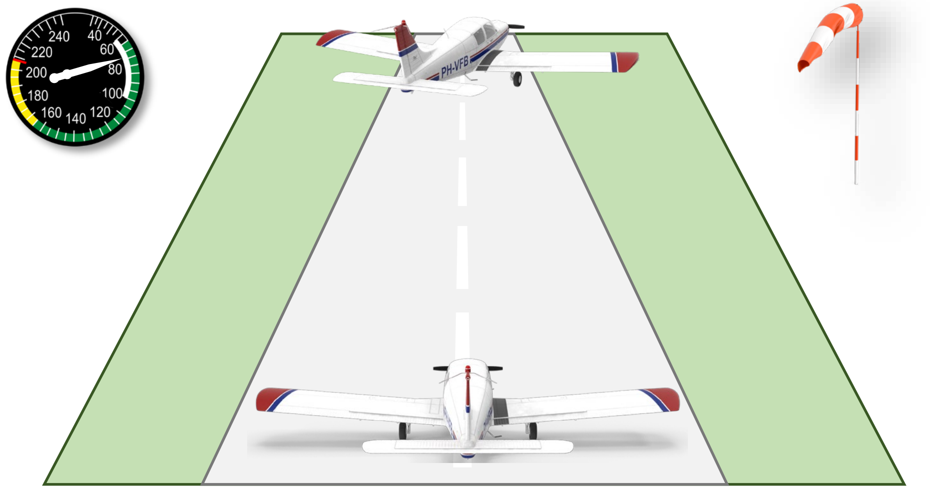
Considerations

Take-off

Position aileron into wind and as the aircraft accelerates to take-off speed, at the same time, slowly centralise the controls so that they are neutral at rotation airspeed.

In strong crosswinds, maintain slight pressure on nose wheel to assist with directional control and rotate at a higher airspeed ~ 5+ kts





Circuits - Crosswind

Objective

1. To correctly position the aeroplane controls while taxiing.
2. To compensate for drift throughout the circuit.
3. To take-off and land in crosswind conditions.

Considerations

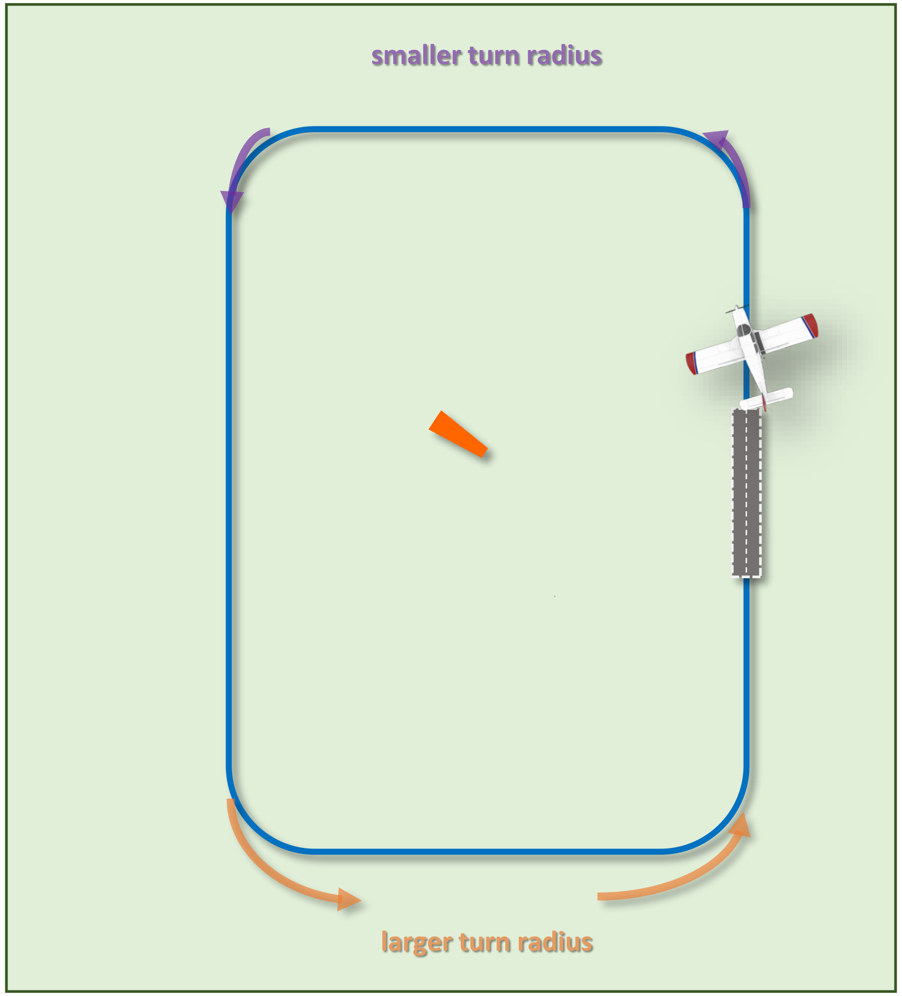
1. **Aircraft control on ground** – aircraft wants to weathercock into wind, position the controls to hold windward wing down
2. **Take-off** – ailerons into wind and centralise slowly to rotate speed, maintain slight pressure on nose wheel to assist with directional control

Considerations

In the circuit

Allow for drift and headwind/tailwind on all legs in the circuit.

Changes in **drift** and **groundspeed** will require consideration – **Base leg** is affected the most.



Objective

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3. To take-off and land in crosswind conditions.

Considerations

1. **Aircraft control on ground** – aircraft wants to weathercock into wind, position the controls to hold windward wing down
2. **Take-off** – ailerons into wind and centralise slowly to rotate speed, maintain slight pressure on nose wheel to assist with directional control
3. **Allow for crosswind effects** by crabbing into wind to maintain reference point and consider the effect of higher/lower groundspeed in the circuit

Considerations

On landing

As crosswind increases to 75%+ of maximum demonstrated, the amount of flap used for landing should be reduced to help improve directional control. Finals airspeed may need to be increased to increase control effectiveness. **Discuss with CFI.**

Increase your finals airspeed in gusty conditions by ½ the gust factor.

If you are approaching at a higher airspeed because of the conditions, you should consider if the runway length and width is suitable for the approach and consider diverting to a more suitable airstrip that is orientated more into wind.

Gusting 20 kts

Limits

The **maximum demonstrated crosswind** is the maximum crosswind that the aircraft was test flown in by a test pilot. It is not a legal limit but a sensible limit. It is found in the aircraft Flight Manual.

Limited by the ability of the aileron and rudder to maintain safe control of the aircraft. The limiting factor is normally the rudder effectiveness.

The maximum demonstrated cross wind for our aircraft is _______ kts. My limit is _______ .

Circuits - Crosswind

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3. **Allow for crosswind effects** by crabbing into wind to maintain reference point and consider the effect of higher/lower groundspeed in the circuit
4. **On landing** – reduce flaps setting and increase approach airspeed for the conditions. Consult AFM and CFI. Consider increase in landing distance and runway width.
5. **Max DEMO crosswind** - not a legal limit but a sensible limit. Might be other reasons for operating below this limit e.g. currency, skill etc

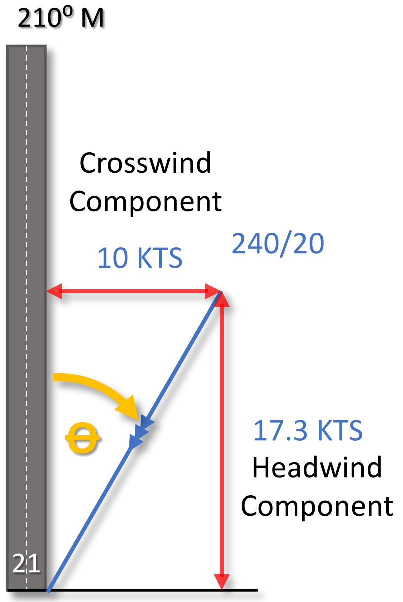
Considerations

Calculating crosswind component

1. Obtain wind velocity from a TAF or METAR.
2. Convert the direction of the wind to magnetic by applying variation
3. Vector the diagramme by using pencil, paper and protractor.

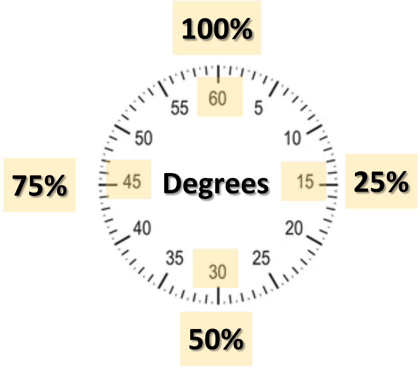
Good to calculate manually to better visualise the impact of the cross wind.

Also multiply by the sine ϴ of the angle.



Practical in-flight estimation

1. Use clock face



$30^o = 0.5$
$45^o = 0.7$
$60^o = 0.9$

WAIKATO AVIATION ACADEMY

Circuits - Crosswind

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4. **On landing** – reduce flaps setting and increase approach airspeed for the conditions. Consult AFM and CFI. Consider increase in landing distance and runway width.
5. **Max DEMO crosswind** - not a legal limit but a sensible limit. Might be other reasons for operating below this limit e.g. currency, skill etc
6. **Calculating crosswind component** – using diagramme, AFM, Sine θ or estimating by clock code.

Aircraft Management

Control positioning on ground with respects to wind velocity

May need to **use brakes** in very strong winds to maintain direction on the ground

Unnatural coordination of control input during the flare to land.

Airmanship and Human Factors

Think about the wind velocity always but especially with a strong crosswind.

Making the calculations enhances your situational awareness to the conditions and your actions

Max DEMO Crosswind is a **recommendation**, but there may be other limits

a. Pilot currency
b. Pilot familiarity with the aircraft
c. Pilot strength
d. Runway width and length
e. Gust factor

Assess the conditions to improve

1. **Situational Awareness**
2. **Threat Awareness**
3. **Decision Making capability**

Circuits - Crosswind

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4. **On landing** – reduce flaps setting and increase approach airspeed for the conditions. Consult AFM and CFI. Consider increase in landing distance and runway width.
5. **Max DEMO crosswind** - not a legal limit but a sensible limit. Might be other reasons for operating below this limit e.g. currency, skill etc
6. **Calculating crosswind component** – using diagramme, AFM, Sine ϴ or estimating by clock code.

Aircraft Management

Position of controls on the ground

Use of brakes for directional control

Unnatural coordination to land

Airmanship and Human Factors

Consider WV and make calculations

Max Demo and other limitations

Assess the conditions to improve SA, TEM and DM

Air Exercise

1 **Take-off**
Line up checks
Adjust ref point for drift
Aileron into wind then centralise for rotation
Nose wheel held on

2 **Rotate**
At slightly higher airspeed … +5 kts
Allow aircraft to crab into wind with gentle balanced turn

3 **Climb out**
Wings level, balance
Adjust heading to track runway centreline

4 **Crosswind**
Heading on reference to adjust for drift.
Expect headwind or tailwind component

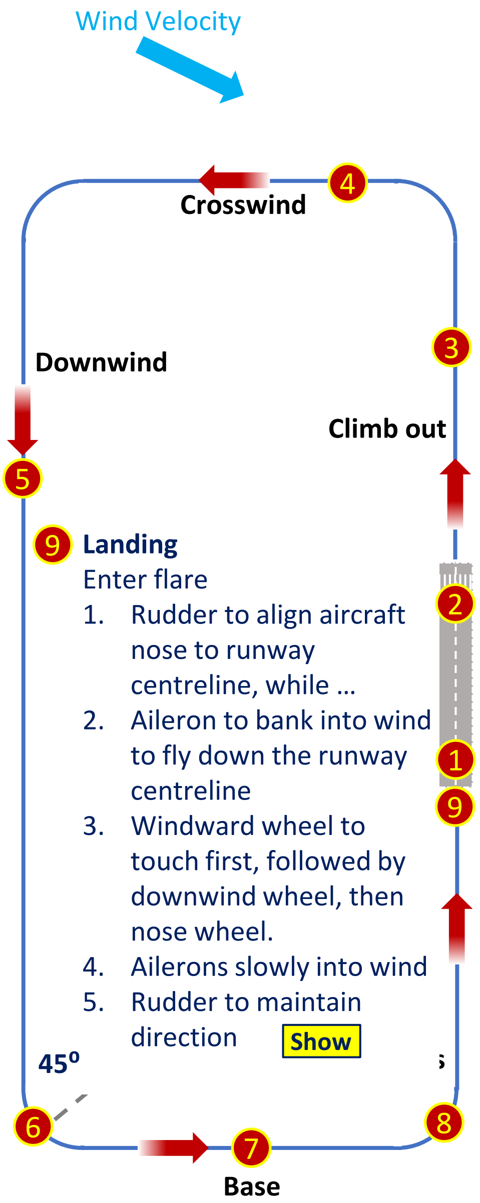
5 **Downwind**
Allow for wind on downwind turn
Heading on reference to track parallel
Assess conditions, decide on speeds and configuration
Check spacing downwind

6 **Base turn**
Allow for drift
Allow for headwind or tailwind

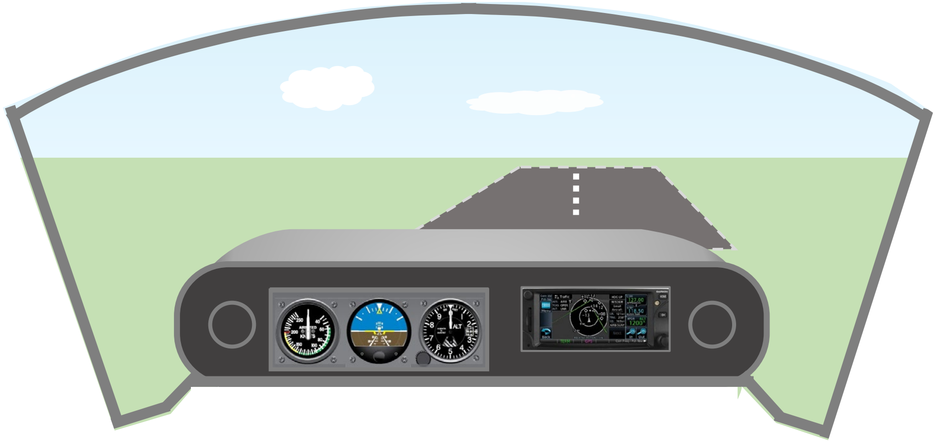
7 **Base leg**
Extend all landing flap if landing with reduced flaps
Anticipate turn radius onto finals

8 **Finals**
Heading to track centreline
Power controls rate of descent, attitude IAS

9 **Landing**
Enter flare
1. Rudder to align aircraft nose to runway centreline, while …
2. Aileron to bank into wind to fly down the runway centreline
3. Windward wheel to touch first, followed by downwind wheel, then nose wheel.
4. Ailerons slowly into wind
5. Rudder to maintain direction



WAIKATO AVIATION
ACADEMY



Return

Objective

1. To be able to select an appropriate landing site and carry out the pattern for a forced landing without power

Considerations

Aircraft configuration

The aircraft will be flown at an airspeed that equates to best LIFT/DRAG ratio with idle power, prop windmilling. This speed is 76kts for the PA28 and 68kts for C172.

Wind indication

1. **Smoke**

2. **Dust**

Objective

1. To be able to select an appropriate landing site and carry out the pattern for a forced landing without power

Considerations

Glide at best LIFT/DRAG ratio. Range reduces when gliding at a different airspeed

Wind Indications

1. Smoke
2. Dust

Considerations

Wind indication

3. **Crop Movement**

4. **Tree movement**

FLWOP – Pattern

Objective

1. To be able to select an appropriate landing site and carry out the pattern for a forced landing without power

Considerations

Glide at best LIFT/DRAG ratio. Range reduces when gliding at a different airspeed

Wind Indications

1. Smoke
2. Dust
3. Crop movement
4. Tree movement

Considerations

Wind indication

5. **Wind lanes on water**

6. **White caps on water**

Objective

1. To be able to select an appropriate landing site and carry out the pattern for a forced landing without power

Considerations

Glide at best LIFT/DRAG ratio. Range reduces when gliding at a different airspeed

Wind Indications

1. Smoke
2. Dust
3. Crop movement
4. Tree movement
5. Wind lanes
6. White caps

Considerations

Wind indication

7. **Wind shadow on water**

8. **Cloud shadow**

Objective

1. To be able to select an appropriate landing site and carry out the pattern for a forced landing without power

Considerations

Glide at best LIFT/DRAG ratio. Range reduces when gliding at a different airspeed

Wind Indications

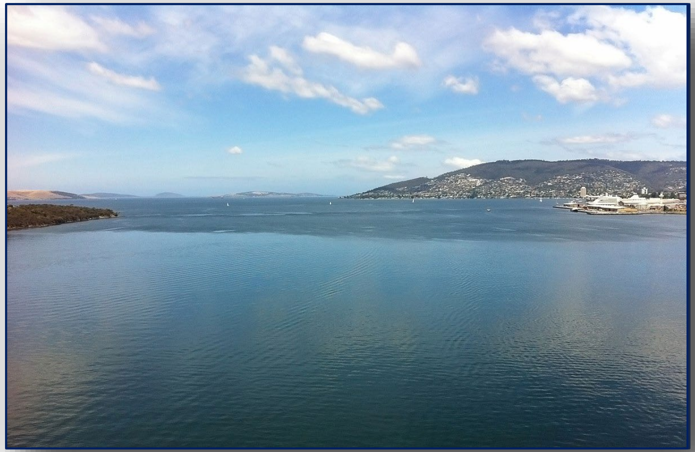
1. Smoke
2. Dust
3. Crop movement
4. Tree movement
5. Wind lanes
6. White caps
7. Wind shadow
8. Cloud shadow

Considerations

Wind indication

9. **Drift**

10. **Local Knowledge**



Objective

1. To be able to select an appropriate landing site and carry out the pattern for a forced landing without power

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Glide at best LIFT/DRAG ratio. Range reduces when gliding at a different airspeed

Wind Indications

1. Smoke
2. Dust
3. Crop movement
4. Tree movement
5. Wind lanes
6. White caps
7. Wind shadow
8. Cloud shadow
9. Drift
10. Local knowledge

Considerations

Landing site

1. **Size**

FLWOP – Pattern

Objective

1. To be able to select an appropriate landing site and carry out the pattern for a forced landing without power

Considerations

Glide at best LIFT/DRAG ratio. Range reduces when gliding at a different airspeed

Wind Indications

1. Smoke
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4. Tree movement
5. Wind lanes
6. White caps
7. Wind shadow
8. Cloud shadow
9. Drift
10. Local knowledge

Landing site

1. Size

Considerations

Landing site

1. **Size**
2. **Shape**

FLWOP – Pattern

Objective

1. To be able to select an appropriate landing site and carry out the pattern for a forced landing without power

Considerations

Glide at best LIFT/DRAG ratio. Range reduces when gliding at a different airspeed

Wind Indications

1. Smoke
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7. Wind shadow
8. Cloud shadow
9. Drift
10. Local knowledge

Landing site

1. Size
2. Shape

Considerations

Landing site

1. **Size**
2. **Shape**
3. **Slope**

Generally **don't** land downslope
When apparent from the air, can be steep

FLWOP – Pattern

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Wind Indications

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6. White caps
7. Wind shadow
8. Cloud shadow
9. Drift
10. Local knowledge

Landing site

1. Size
2. Shape
3. Slope

Considerations

Landing site

1. **Size**
2. **Shape**
3. **Slope**
4. **Surface**

FLWOP – Pattern

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8. Cloud shadow
9. Drift
10. Local knowledge

Landing site

1. Size
2. Shape
3. Slope
4. Surface

Considerations

Landing site

1. **Size**
2. **Shape**
3. **Slope**
4. **Surface**
5. **Surrounds**

Ideally no obstacles at each end
Obstacles require greater accuracy and reduce landing distance
Watch especially for power wires

FLWOP – Pattern

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Landing site

1. Size
2. Shape
3. Slope
4. Surface
5. Surrounds

Considerations

Landing site

1. **Size**
2. **Shape**
3. **Slope**
4. **Surface**
5. **Surrounds**
6. **Stock**

Objective

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Landing site

1. Size
2. Shape
3. Slope
4. Surface
5. Surrounds
6. Stock

Considerations

Landing site

1. **Size**
2. **Shape**
3. **Slope**
4. **Surface**
5. **Surrounds**
6. **Stock**
7. **Sun**

FLWOP – Pattern

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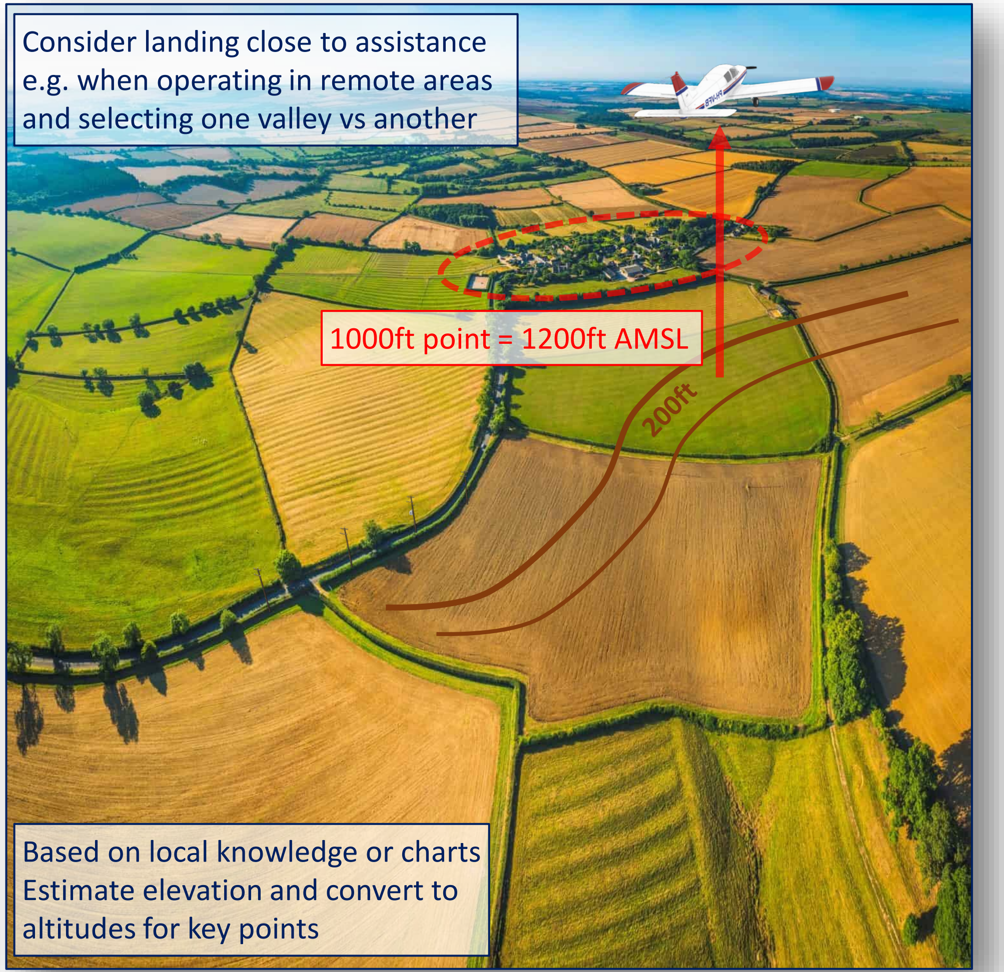
Landing site

1. Size
2. Shape
3. Slope
4. Surface
5. Surrounds
6. Stock
7. Sun

Considerations

Landing site

1. **Size**
2. **Shape**
3. **Slope**
4. **Surface**
5. **Surrounds**
6. **Stock**
7. **Sun**
8. **Communication**
9. **Elevation**



WAIKATO AVIATION ACADEMY

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Landing site

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2. Shape
3. Slope
4. Surface
5. Surrounds
6. Stock
7. Sun
8. Communication
9. Elevation

Considerations

Situation Awareness

Remain situationally aware of the wind

Remain situationally aware of suitable landing areas/options along your route

FLWOP – Pattern

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5. Surrounds
6. Stock
7. Sun
8. Communication
9. Elevation

Situational Awareness

Aware of surface wind direction

Aware of landing areas enroute

Aware of best local landing areas

Aircraft Management

Procedures with this first lesson are the same as per EFATO and glide approach

1. **Initial reaction checks** – Carb Heat and Fuel Pump.
2. **Off Checks (touch)** – Fuel OFF, Mixture Lean, Ignition OFF, Masters OFF.

Engine cool

Good aviation practice to reduce power before simulated engine failure to limit engine shock cooling.

Monitor engine temperatures and pressures.

Engine Warm

Every 1000ft descent.

Primary Focus

To **fly the aircraft** in accordance with the pattern.

FLWOP – Pattern

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Landing site

1. Size
2. Shape
3. Slope
4. Surface
5. Surrounds
6. Stock
7. Sun

Situational Awareness

Aware of surface wind direction

Aware of landing areas enroute

Aware of best local landing areas

Aircraft Management

As per EFATO and glide approach

Engine cool and engine warm

Fly and navigate the aircraft

Airmanship and Human Factors

Time to plan – for each FLWOP, time will be provided to select the wind, the landing site and key points e.g. 1000ft and 1500ft points.

Legal limitations – we are not to carry out a FLWOP within close proximity to people and stock and should not descend below 500ft AGL outside of designated low flying areas.

Go-around – initially all FLWOP descents will go around from 500ft agl. When you become more competent, FLWOPs will be carried out onto airstrips.

Passengers are normally not to be carried on FLWOP exercises, refer SOR manual.

Decision making – to develop your risk/option decision making process, FLWOPs will be incorporated into scenarios e.g. engine deterioration over time.

Priority – is ensuring that you can navigate the aircraft as per the pattern to make the selected key points and landing area.

Don't' turn you back on the landing site or turn away from the landing site too far. Where possible turn in the vicinity of the overhead and in the direction of the pattern.

Re-evaluate your decisions to avoid fixed mindsets. Sometimes you will naturally see a better option once you descend and have a closer view of the landing areas.

FLWOP – Pattern

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6. Stock
7. Sun

Situational Awareness

Aware of surface wind direction

Aware of landing areas enroute

Aware of best local landing areas

Aircraft Management

As per EFATO and glide approach

Engine cool and engine warm

Fly and navigate the aircraft

Airmanship and Human Factors

Legal limitations – heights and passengers

Go-around initially, then onto airfields

Scenario based to assess decision making

Priority to achieve key points – re-evaluate

Air Exercise

Pattern Demo from 2000-2500ft

Glide from 1000ft point

Select suitable landing area into wind

Select aiming point & 1000ft point

Approaching 1000ft point – power idle and trim for Vglide

Confirm aiming point & sight line angle

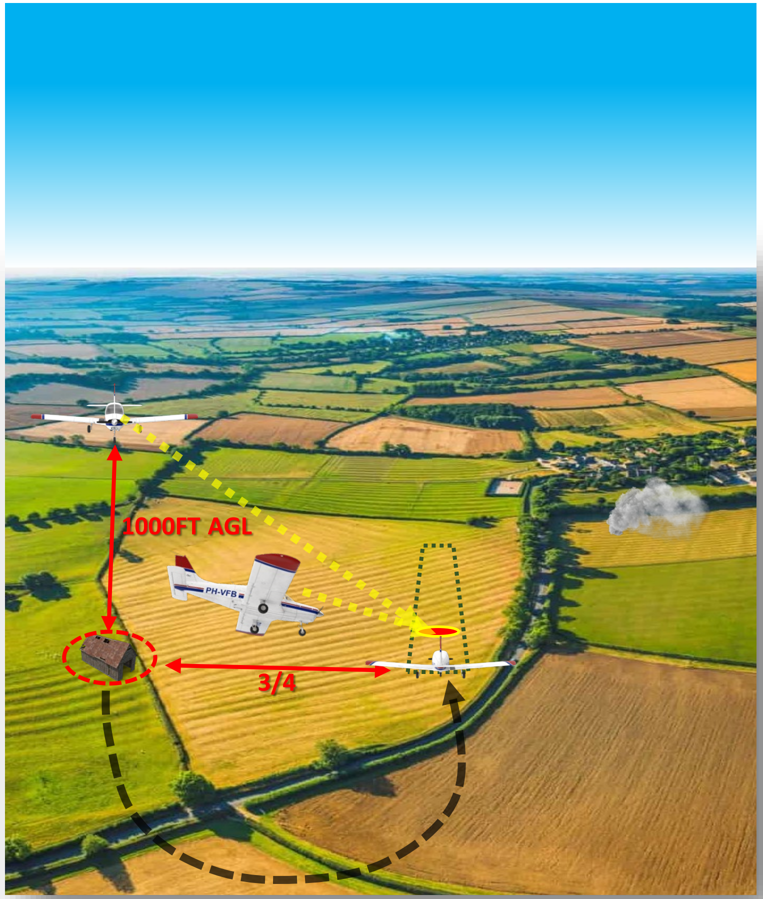
Initial reaction checks FP and CH

Adjust track to maintain sight line angle

Aiming point assured

Lower flaps in stages to move forward

Off – checks



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7. Sun

Situational Awareness

Aware of surface wind direction

Aware of landing areas enroute

Aware of best local landing areas

Aircraft Management

As per EFATO and glide approach

Engine cool and engine warm

Fly and navigate the aircraft

Airmanship and Human Factors

Legal limitations – heights and passengers

Go-around initially, then onto airfields

Scenario based to assess decision making

Priority to achieve key points – re-evaluate

Air Exercise

Glide from 1500ft area

Select 1500ft area

Approaching 1500ft area – power idle and trim for Vglide

Initial reaction checks FP and CH

Track for 1000ft point

Glide from 1000ft point

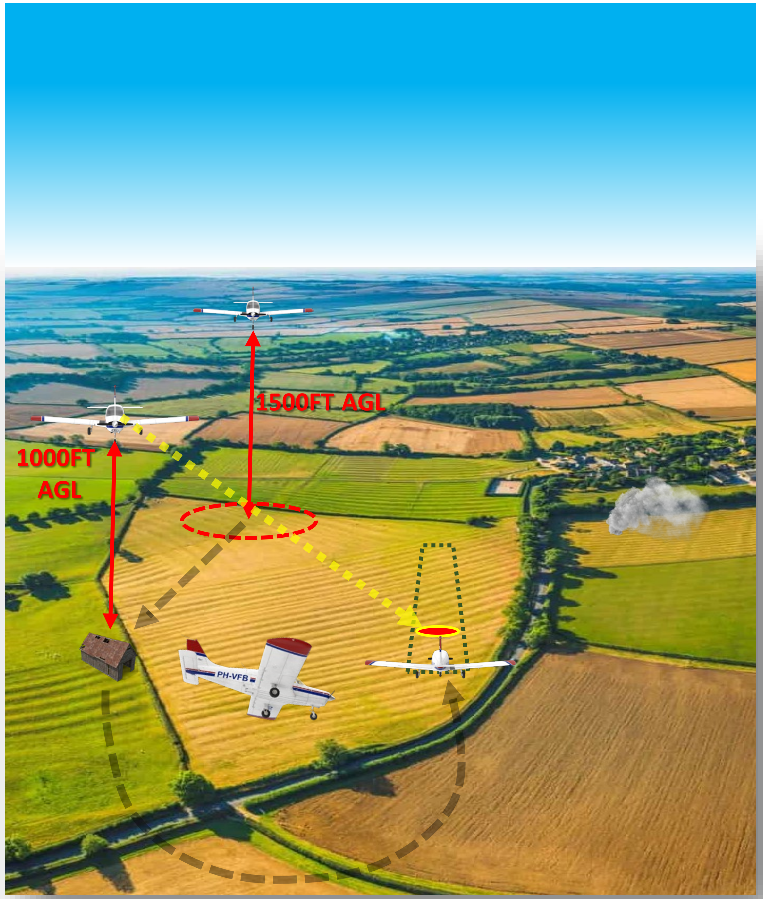
Confirm aiming point & sight line angle

Adjust track to maintain sight line angle

Aiming point assured

Lower flaps in stages to move forward

Off – checks



WAIKATO AVIATION ACADEMY

FLWOP – Pattern

Objective

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Considerations

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Landing site

1. Size
2. Shape
3. Slope
4. Surface
5. Surrounds
6. Stock
7. Sun

Situational Awareness

Aware of surface wind direction

Aware of landing areas enroute

Aware of best local landing areas

Aircraft Management

As per EFATO and glide approach

Engine cool and engine warm

Fly and navigate the aircraft

Airmanship and Human Factors

Legal limitations – heights and passengers

Go-around initially, then onto airfields

Scenario based to assess decision making

Priority to achieve key points – re-evaluate

Air Exercise

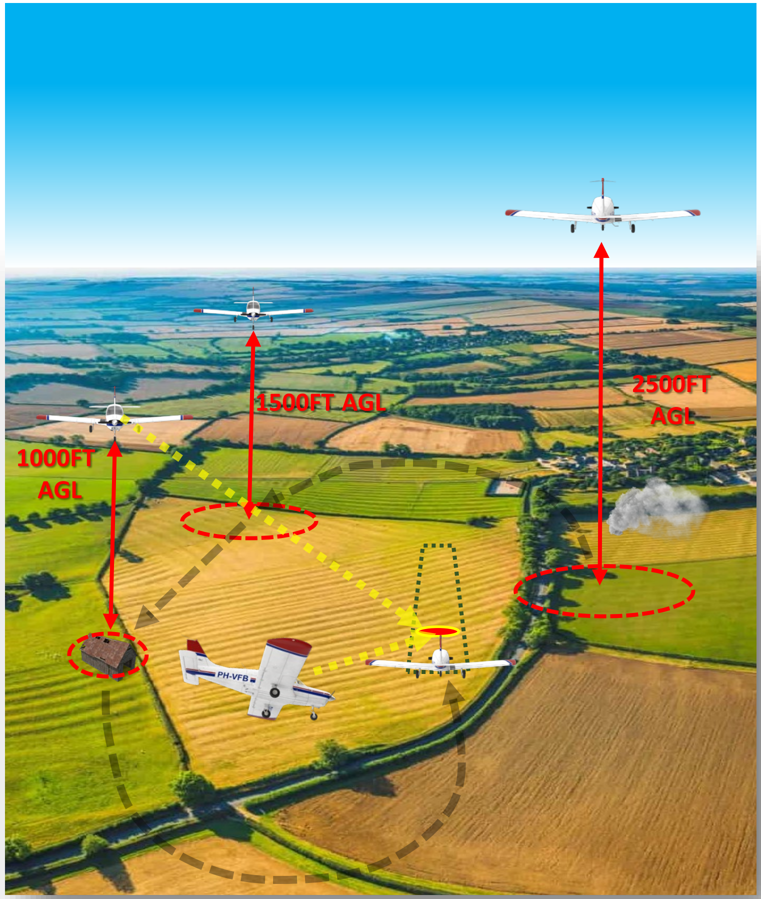
Glide from 2500ft area

Power to idle and trim for Vglidē

Calc altitude to lose

Plan track to 1500ft area

Initial reaction checks FP and CH



Glide from 1500ft area

Track for 1000ft point

Engine warm

Glide from 1000ft point

Confirm aiming point & sight line angle

Adjust track to maintain sight line angle

Aiming point assured

Lower flaps in stages to move forward

Off – checks

Exercise Progression

1. Instructor demonstrates FLWOP pattern
2. Student glides from 1000ft point, then 1500ft areas, then from 2500ft.
3. Student applies procedures into a different landing area.

WAIKATO AVIATION ACADEMY

Objective

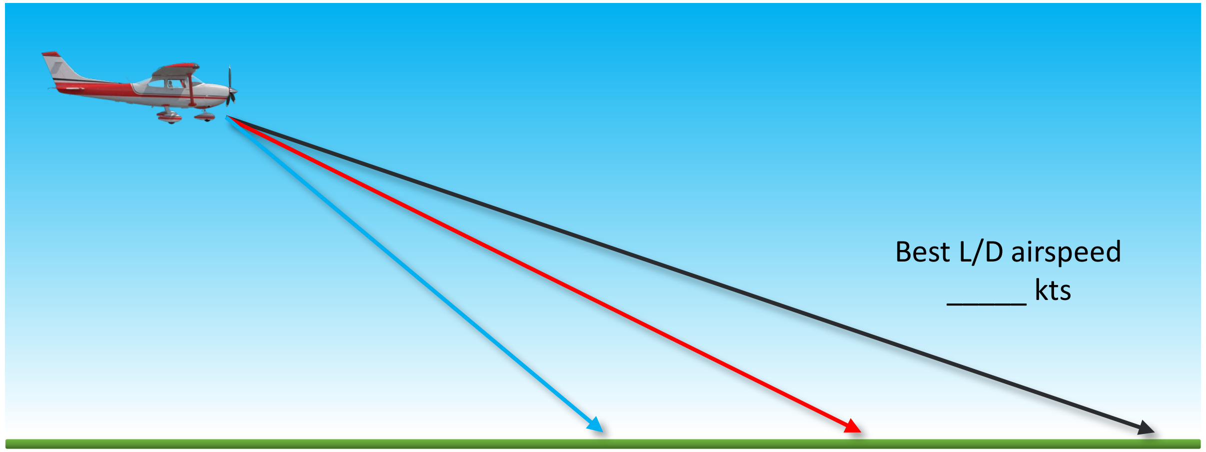
1. To carry out the recommended procedure in the event of a total or partial engine failure, incorporating the appropriate checks.
2. To practice aeronautical decision making to troubleshoot and rectify a partial power situation and select suitable landing areas.

Considerations

Best Lift/Drag ratio - airspeed

Best lift/drag ration airspeed for the aircraft flown is ______ kts. This equates to approximately 4^o angle of attack (AoA).

Raising or lowering the nose reduces the lift/drag ratio and the glide distance. Never raise the nose to stretch the glide



With the aircraft trimmed for best glide, the aiming point in the windscreen should be reached if during the glide, it slowly moves down the windscreen

Objective

1. To carry out the recommended procedure in the event of a total or partial engine failure, incorporating the appropriate checks.
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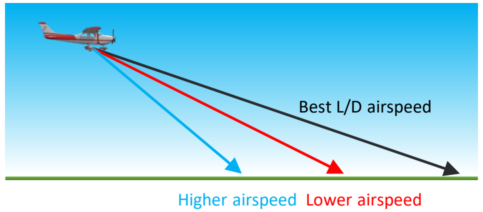
Considerations

Glide always at best L/D ratio



Considerations

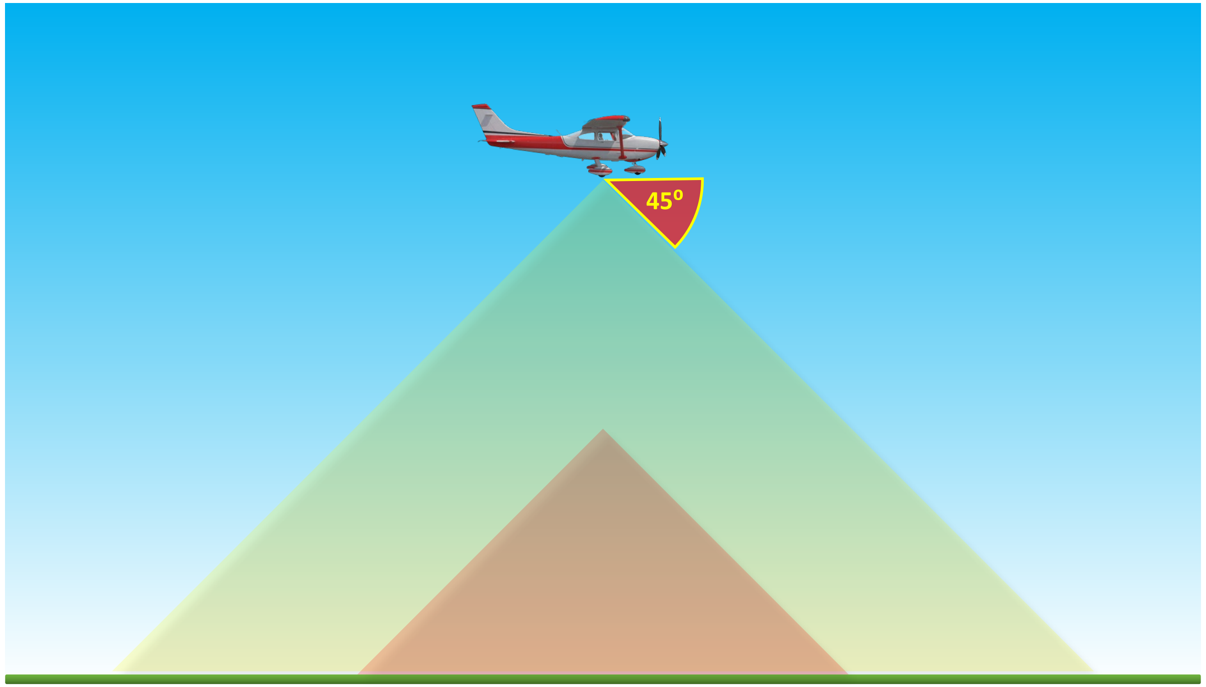
Height

Aircraft gliding at their best Lift/Drag ratio airspeed in descending through a vertical distance will travel forward a horizontal distance, e.g. C172 1000ft ↓ , 9000ft →

An easy and conservative rule of thumb is that all light training aircraft should glide to reach a point within 45^{o} angle.

The glide range is therefore dependent on the altitude of the aircraft. Altitude also provides the pilot with more time to react to the engine failure.

Do not fly lower than you must!



FLWOP – Considerations

Objective

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Considerations

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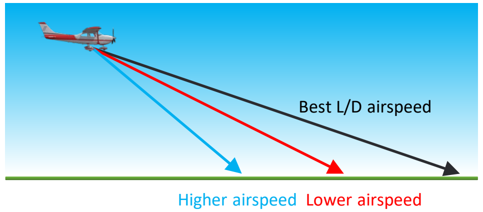


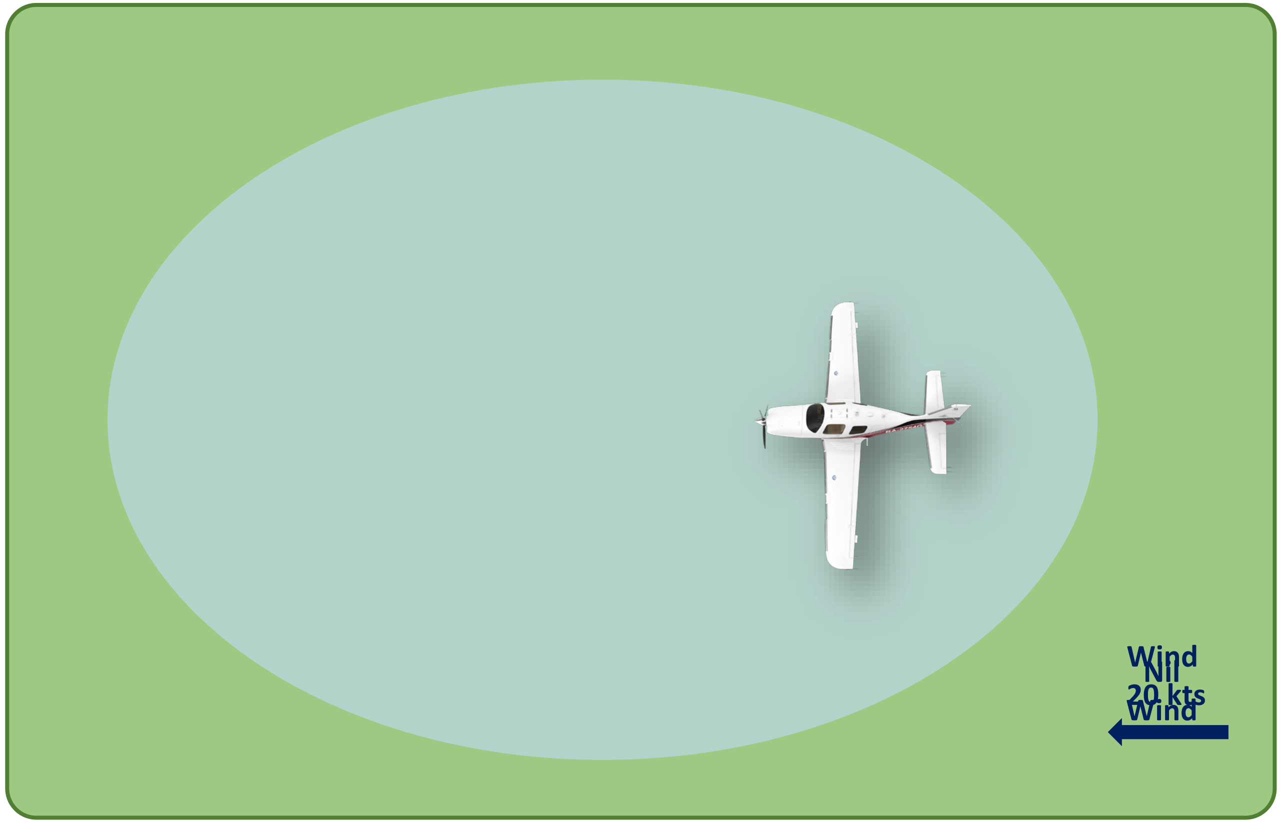
Glide range – fly high

Considerations

Wind

Glide range is increased by a tailwind and reduced by a head wind. The affect of wind on range is to elongate the glide range downwind.

Looking downwind for a landing area will provide you with more options



Objective

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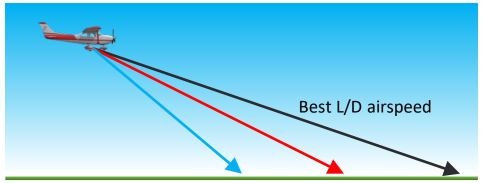
2. To practice aeronautical decision making to troubleshoot and rectify a partial power situation and select suitable landing areas.

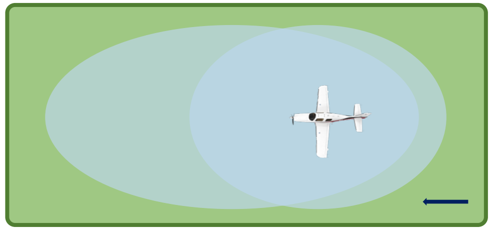
Considerations

Glide always at best L/D ratio



Glide range – fly high

Glide range extended by tailwind



Considerations

Partial Power

Partial power output from the engine is possible, e.g. failure of one of the cylinders e.g. valves, partially blocked air and fuel lines, or a magneto failure.

Partial power challenges a pilots decision making because more landing options may be available.

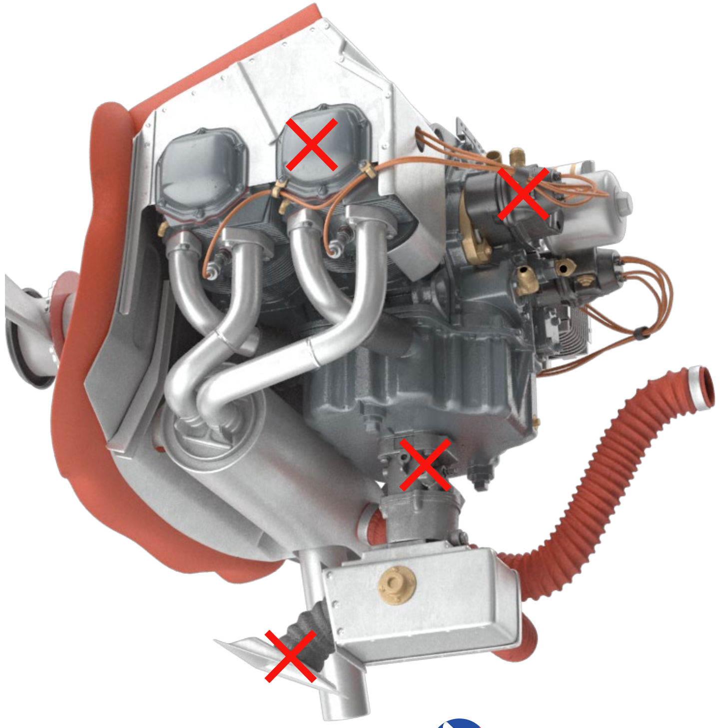
With partial power , a good decision-making approach is to

(a) Trim for Vglide to reduce RoD,

(b) Position the aircraft from which a glide approach could be carried out if the engine were to fail at any point going forward.

Options!

- Hold altitude under partial power and further consider options … but what if the aircraft failure deteriorates quickly e.g. mechanical failure leads to a fire?
- Continue the glide (under partial power) to another more suitable area …. but what if the engine fails enroute?
- Close the throttle and commit to a landing in the area below



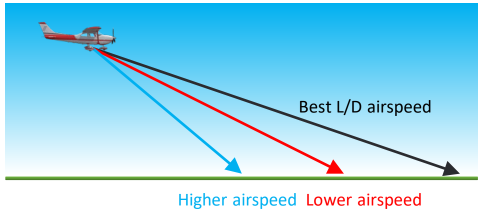
FLWOP – Considerations

Objective

1. To carry out the recommended procedure in the event of a total or partial engine failure, incorporating the appropriate checks.
2. To practice aeronautical decision making to troubleshoot and rectify a partial power situation and select suitable landing areas.

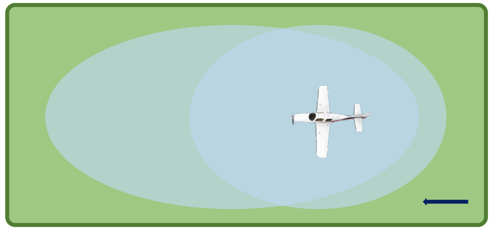
Considerations

Glide always at best L/D ratio

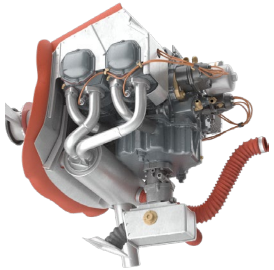


Glide range – fly high

Glide range extended by tailwind



Partial power – Trim Vglide



Considerations

Pilot decision making

The FLWOP requires that a pilot considers a number of **options** and then weighs up the **risk** of each option.

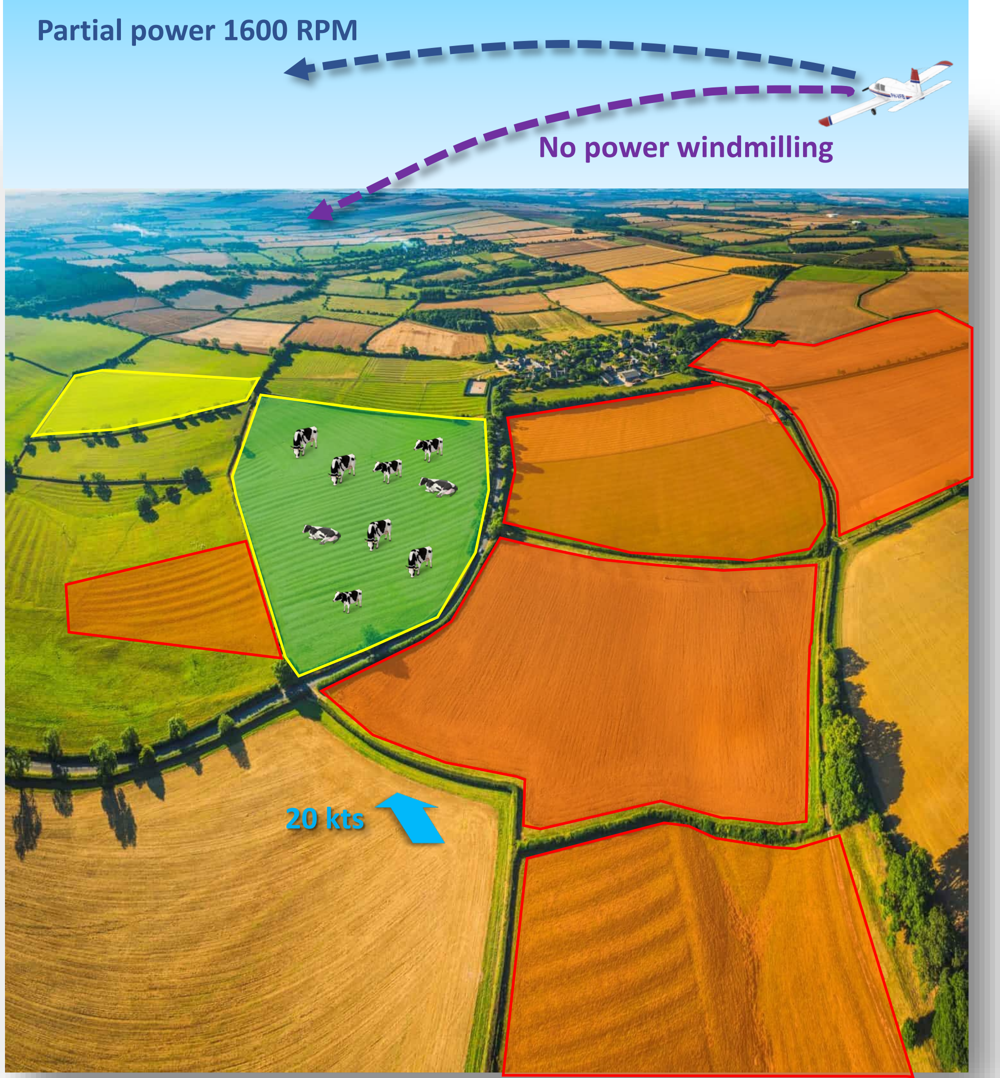
Partial power glide performance?

The increased **glide range** due to partial power.

The increased **glide time** due to partial power. How threatening is the system failure?

Wind strength, direction and **sun**?

Suitability of the landing area and approach?



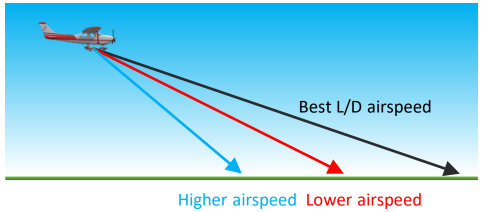
FLWOP – Pattern

Objective

1. To carry out the recommended procedure in the event of a total or partial engine failure, incorporating the appropriate checks.
2. To practice aeronautical decision making to troubleshoot and rectify a partial power situation and select suitable landing areas.

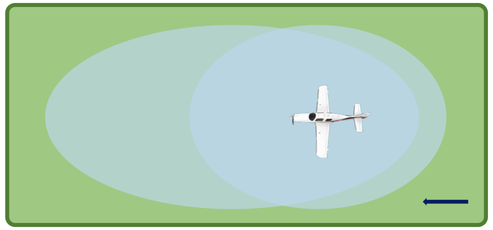
Considerations

Glide always at best L/D ratio

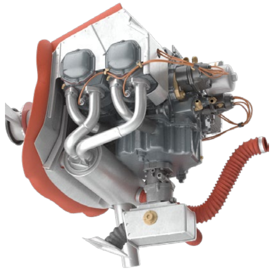


Glide range – fly high

Glide range extended by tailwind



Partial power – Trim Vglide



Pilot Decision Making – Options and risks

Aircraft Management

Engine cooling

Good practice to gradually reduce engine power before simulating engine failure to limit engine shock cooling.

Carb Heat

Use Carb Heat when RPM is below 1900 RPM especially with prolonged glides.

Monitor T's and P's

Monitor T's and P's especially in between glides to ensure they are stable.

Engine Warm

Every 1000ft descent.

Distress Call

MAYDAY x3

V2 Track (priority) – **PUSH RED BUTTON**

ELT – **ON**

Transponder code - **7700**

WAIKATO AVIATION ACADEMY

Objective

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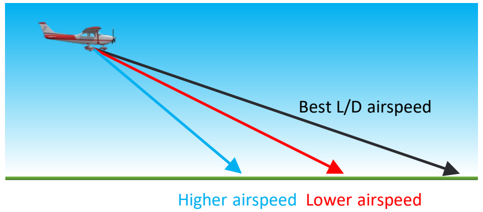
2. To practice aeronautical decision making to troubleshoot and rectify a partial power situation and select suitable landing areas.

Considerations

Glide always at best L/D ratio



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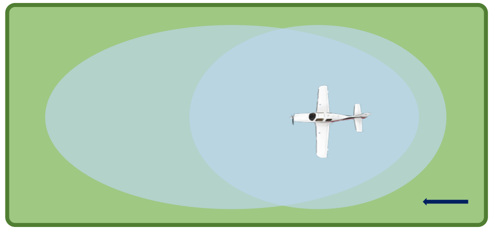

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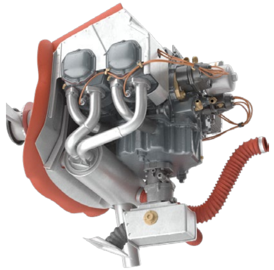


Pilot Decision Making – Options and risks

Aircraft Management

Engine cooling prior to the exercise

Carb Heat use

Monitor T's and P's

Warm engine every 1000ft descent

Airmanship and Human Factors

Engine power loss is simulated by **closing the throttle.** Instructor will call **"simulating"** so that the student is clear that it is a simulation.

Initial reaction checks can be combined with lowering the nose and setting/trimming the glide attitude. This is because there is more time to select a landing area.

Trouble Checks

Fuel - Change tanks , Fuel - **ON**, Pump - **ON**

Mixture – alter position, check **RICH**

Ignition – Check each magneto, (**isolate rough magneto**) or on **BOTH**

Instruments – Check T's and P's, Fuel Pressure

Partial Power – Check for power restored

Emergency Passenger Brief (should replicate pre departure passenger brief)

We have an engine failure and so will be landing in a field below

- Seat belts on and firm
- Loose items stowed under seats or at your feet
- Brace position

Aircraft landed

- Release seat belt by …
- Open the door by moving the handle(s) / latche(s) …
- Meet in front of the aircraft and only return to it for safety equipment when safe

Prioritising the key points and flying the pattern is more important than the checks

Practice and focusing on the pattern will help improve your competency.

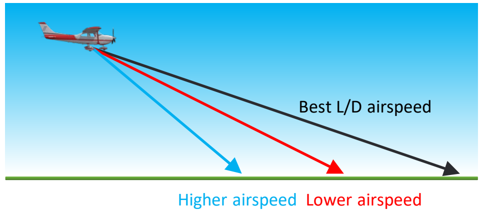
FLWOP – Pattern

Objective

1. To carry out the recommended procedure in the event of a total or partial engine failure, incorporating the appropriate checks.
2. To practice aeronautical decision making to troubleshoot and rectify a partial power situation and select suitable landing areas.

Considerations

Glide always at best L/D ratio



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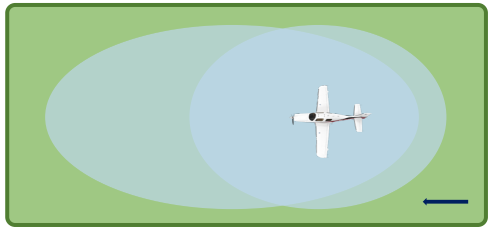

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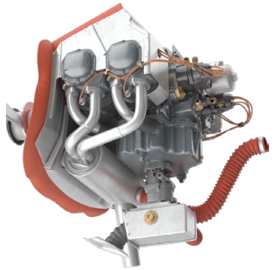


Pilot Decision Making – Options and risks

Aircraft Management

Engine cooling prior to the exercise

Carb Heat use

Monitor T's and P's

Warm engine every 1000ft descent

Airmanship and Human Factors

Initial Reaction and Trouble Checks

Emergency Passenger Brief

Prioritise key points and the pattern

Practice will improve competency

Air Exercise

A = Airspeed

Speed to height

Initial Reaction checks

Trim for Vglide attitude

B = Best Field

Select Wind

Select Landing area

Select aiming 1000ft 1500ft

PLAN your descent to 1500ft

C = Cause/Trouble Checks

F M I I P

Assess → TRK 1500ft

D = Distress Call

Mayday V2 ELT 7700

Assess → TRK 1000ft

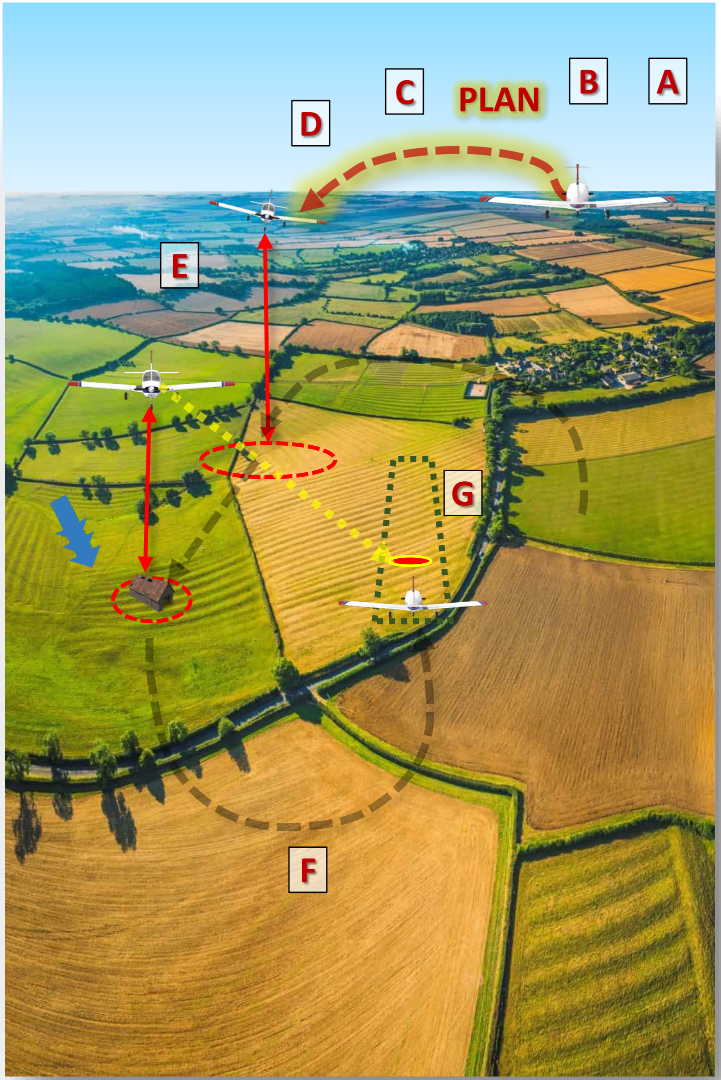
E = Emergency Brief

Secured Exit Return

F = Finals Checks

F M I M H

G= Get out … return if safe for emergency equipment



WAIKATO AVIATION ACADEMY

Objective

1. To change direction through 360^o at a constant rate – using 45^o angle of bank, while maintaining a constant altitude and keeping the aircraft in balance.
2. To become familiar with the sensations of high bank angles and high rates of turn.

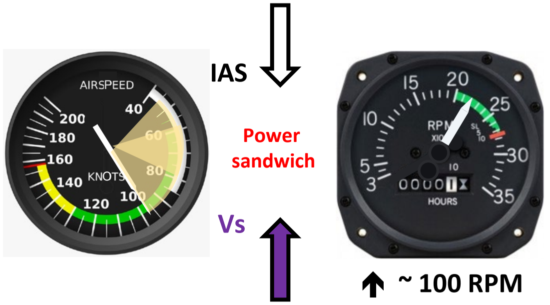
Principles of Flight

Medium turn at **30^o** angle of bank.

Steep turn **45^o** angle of bank.

Used to enhance coordination and to increase rate of turn to avoid coming into conflict with aircraft/terrain.

Bank Angle	Load Factor	% ↑ in Vs	Vs C172	Vs PA28
0^o	1.00	0	48	50
30^o	1.15	7	52	54
45^o	1.41	20	57	60
60^o	2.00	40	68	71
75^o	3.86	100	96	100



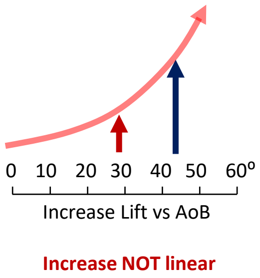
↑ Lift = ↑ Drag - 100% @ 45^o, 300% @ 60^o

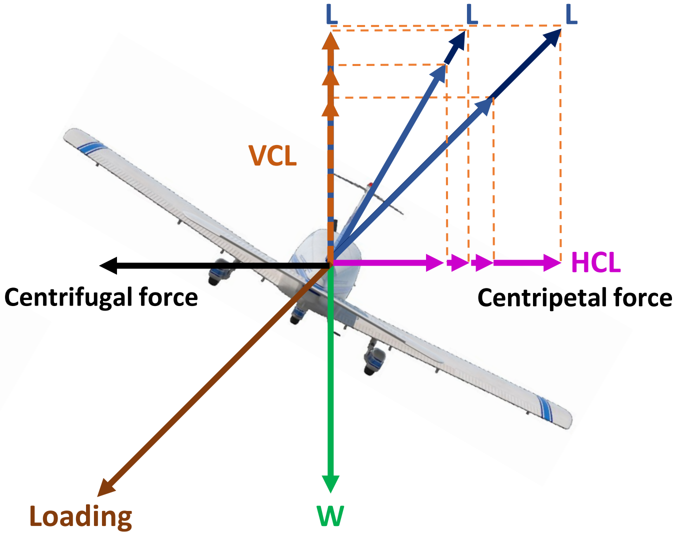
↑ Lift = ↑ Loading … ↑ Apparent Weight

↑ Apparent Weight = ↑ Stall Speed

Load Factor = Lift / Weight

↑ Stall Speed ~ $\sqrt{\text{Load Factor}}$





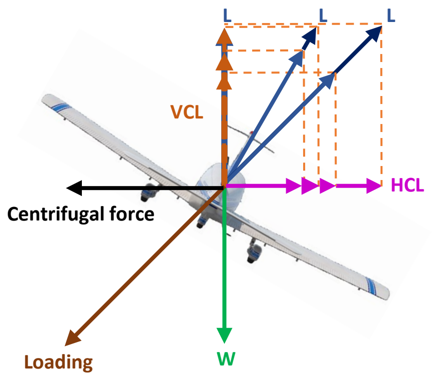
WAIKATO AVIATION ACADEMY

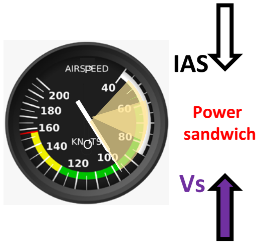
Steep Turns

Objective

1. To change direction through 360^o at a constant rate – using 45 ^{o} angle of bank, while maintaining a constant altitude and keeping the aircraft in balance.
2. To become familiar with the sensations of high bank angles and high rates of turn.

Principles of Flight





Bank Angle	Vs C172	Vs PA28
0^o	48	50
30^o	52	54
45^o	57	60
60^o	68	71
75^o	96	100

Considerations

Adverse yaw at higher roll rates

- Amount of rudder to overcome adverse yaw on entry depends of **rate of roll** in
- At higher roll rates or lower airspeeds more control deflection is required therefore **more adverse yaw** occurs
- When roll in/out ceases, rudder input is neutralised / centralised.

Balance and bank angle

When correcting for balance in the turn

1. Centre the ball **2**. Correct AOB to 45^o **3.** Reselect the correct nose attitude

Spiral descent

Caused by overbanking.

- Angle of bank increases
- Lift vector is tilted resulting in insufficient VCL, the aircraft will descend, and airspeed will increase normally rapidly.
- Increasing the backpressure to "pitch the nose up and climb out" without levelling the wings tightens the descent and increases the rate of descent.

Recovery

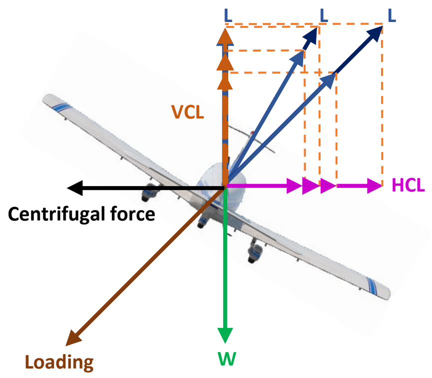
1. Reduce the power **(P)**
2. Smoothly roll out of the turn to wings straight and level **(A)**
3. Increase to climb power **(P)**
4. … and raise the nose to the climb attitude and climb back to altitude **(A)**

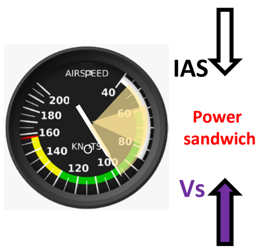
Steep Turns

Objective

1. To change direction through 360° at a constant rate – using 45° angle of bank, while maintaining a constant altitude and keeping the aircraft in balance.
2. To become familiar with the sensations of high bank angles and high rates of turn.

Principles of Flight





Bank Angle	Vs C172	Vs PA28
0°	48	50
30°	52	54
45°	57	60
60°	68	71
75°	96	100

Considerations

Adverse Yaw – greater rudder deflection with high roll rates or low airspeed

Regaining balance during the turn – (1) centre ball (2) reset AoB (3) reset nose attitude

Spiral descent recovery – (1) reduce power (2) wings level – nose S+L (3) increase power and raise nose to climb attitude.

Aircraft Management

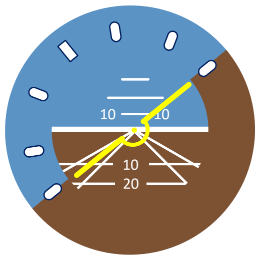
Smoothly increase RPM buy ~ 100 RPM

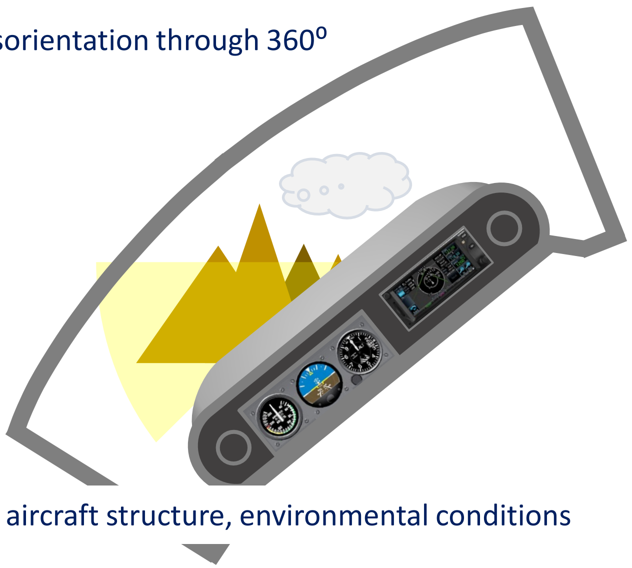
Aural recognition is beneficial

Airmanship and Human Factors

Select a reference point– To minimalise disorientation through 360°

Reference angle of Bank 45°





Lookout restrictions – empty field myopia, aircraft structure, environmental conditions

Head positioning in the turn – try and keep the head horizonal to the horizon line to increase lookout angle

Effect of G force on the body – 40% more weight on the body in a steep turn. Can take time to get use to.

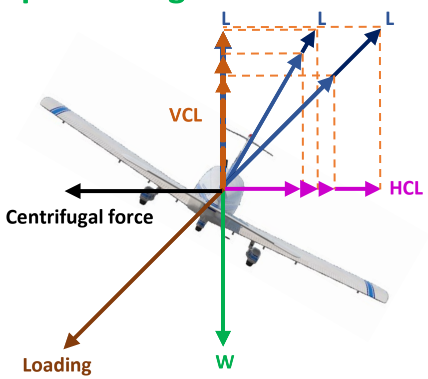
Sick Bags – the combination of turning and G forces associated may make you sick. Make sure you inform the instructor early on if this is the case and have sick bags onboard.

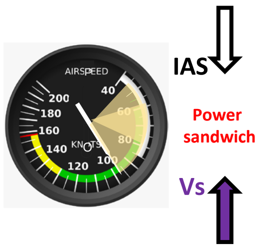
WAIKATO AVIATION ACADEMY

Objective

1. To change direction through 360° at a constant rate – using 30 ° angle of bank, while maintaining a constant altitude and keeping the aircraft in balance.
2. To become familiar with the sensations of high bank angles and high rates of turn.

Principles of Flight





Bank Angle	Vs C172	Vs PA28
0°	48	50
30°	52	54
45°	57	60
60°	68	71
75°	96	100

Considerations

Adverse Yaw – greater rudder deflection with high roll rates or low airspeed

Regaining balance during the turn – (1) centre ball (2) reset AoB (3) reset nose attitude

Spiral descent recovery – (1) reduce power (2) wings level – nose S+L (3) increase power and raise nose to climb attitude.

Aircraft Management

Throttle – Smoothly increase 100 RPM

Aural recognition

Airmanship and Human Factors

Reference point and AoB

Lookout

G force

Sick bags

Air Exercise

Practice Medium turns

Entry to Steep Turn

Reference point - select

Lookout Opposite, then in direction

Roll With aileron } Coordinated

Rudder Balance }

through 30° AOB

Increase Power ~ 100 RPM

Backpressure Elevator to set attitude

Hold Bank 45° to horizon

Rudder Reduce to maintain balance

Maintaining the Turn

Lookout In front and in direction

Attitude Set, Wings 45 °, Balance

Instrument Height, Bank, Balance

If altitude deviation or uncoordinated turn, check (1) aircraft balance (2) AoB and then (3) select the nose attitude to regain or maintain reference altitude

Exit to Straight and Level

Lookout Ref. point, ½ bank angle prior

Roll With aileron } Coordinated

Rudder Balance }

Backpressure Relax backpressure

Reset Straight and Level

Reset power Approaching 100kts

Check **PAT**

Recovery spiral descent

Power Reduce

Attitude Roll to wings level

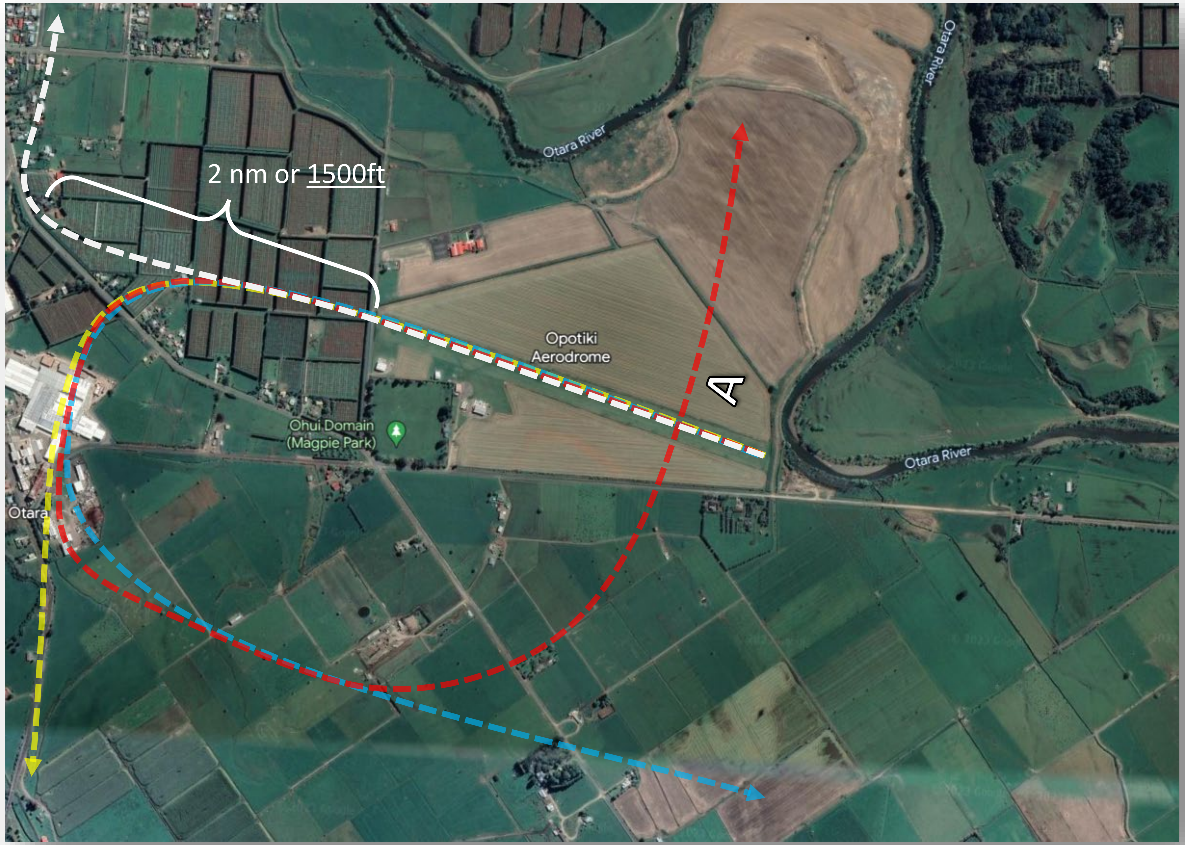
Attitude Straight and level

Power For the climb } Coordinated

Attitude For the climb }

Objective

1. To vacate and join the circuit in accordance with applicable procedures.
2. To join an uncontrolled circuit in accordance with the standard overhead join procedure.



Considerations

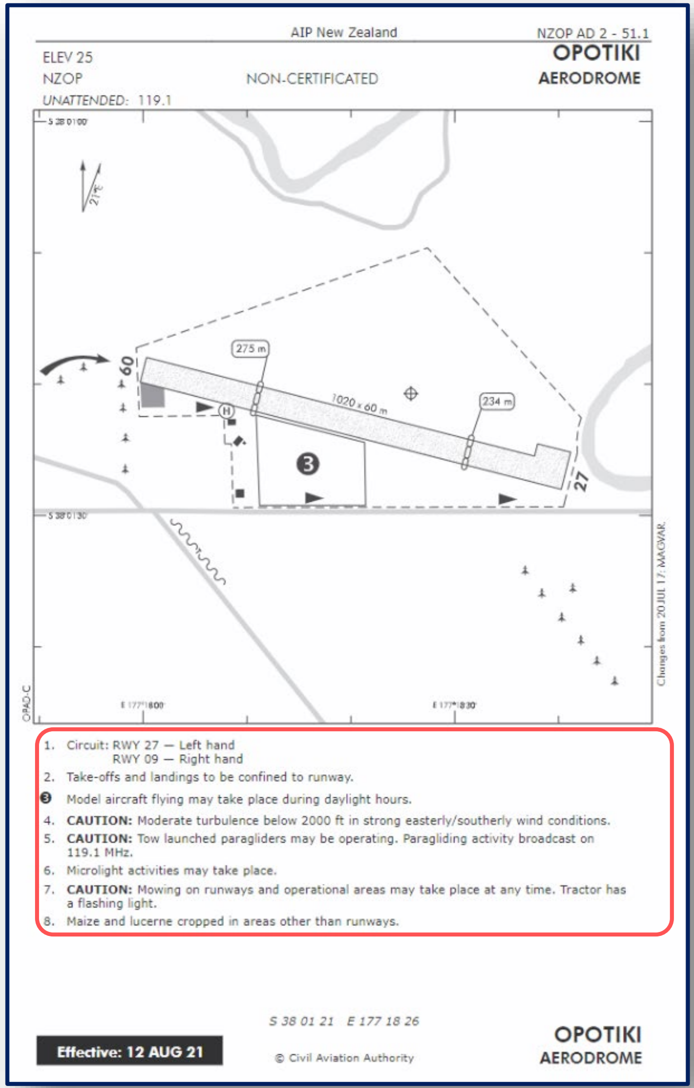
Vacating uncontrolled aerodromes

1. Review AIP plate and comments
2. Vacate via the crosswind
3. Vacate via the downwind
4. Vacate by climbing to the overhead
5. If turning other than in the direction of the circuit, climb to 2 nm or greater than 1500ft agl before turning.

Exceptions

a. Helicopters may conform or avoid the circuit joining in a manner to prevent conflict

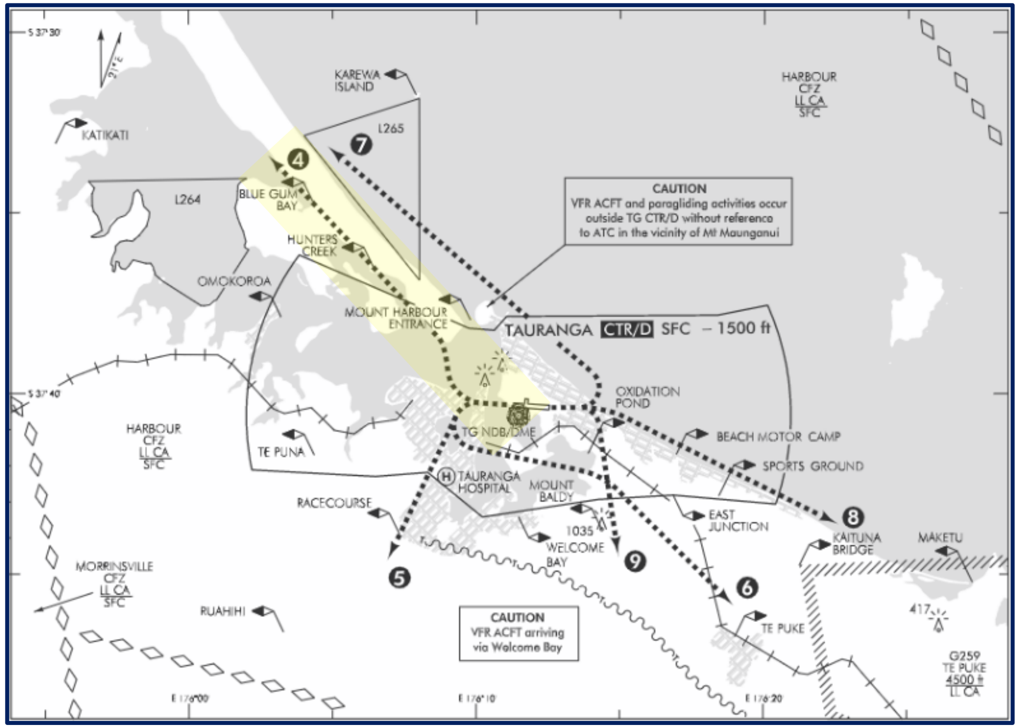
b. Agricultural aircraft when displaying a ground signal may not conform to the standard circuit pattern



Vacating and Joining at Aerodromes

Objective

1. To vacate and join the circuit in accordance with applicable procedures.
2. To join an uncontrolled circuit in accordance with the standard overhead join procedure.



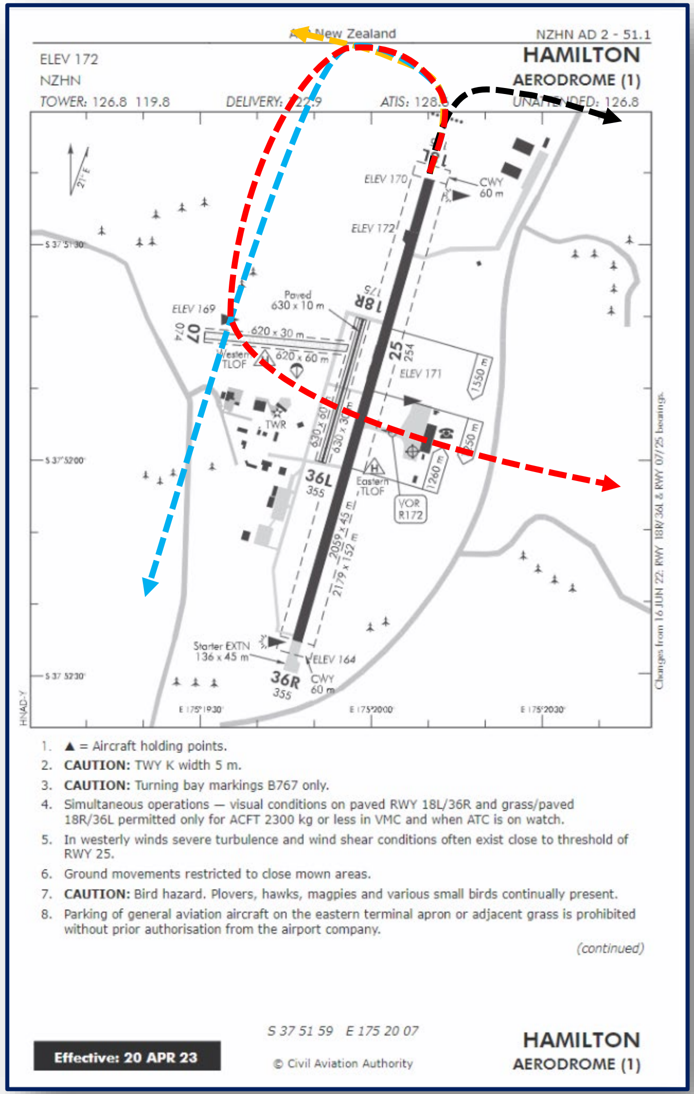
Considerations

Vacating controlled aerodromes

1. Review AIP plate and comments. Normally a greater number of requirements exist

Departure procedures are generally the same as uncontrolled aerodromes except a clearance is required from ATC.

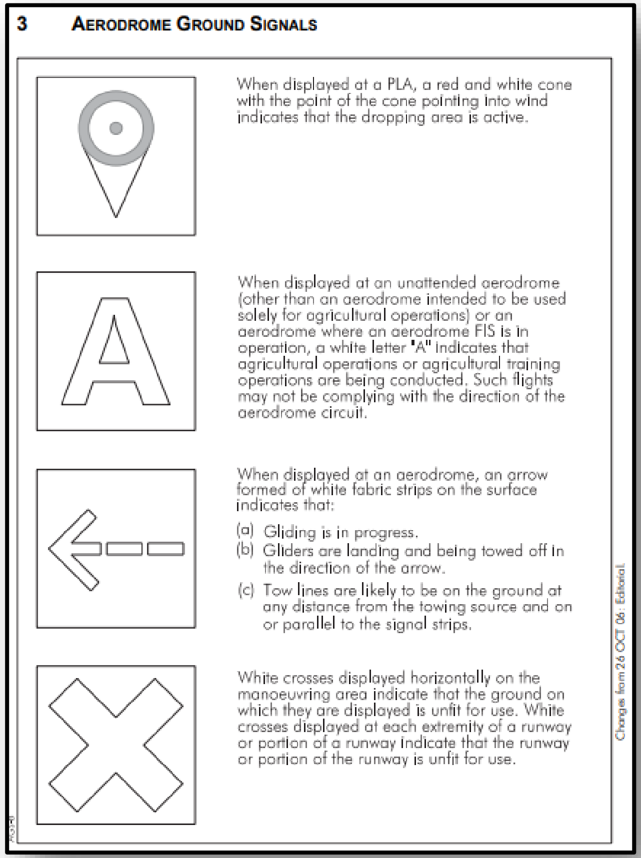
2. Vacate via the crosswind
3. Vacate via the downwind
4. Vacate by climbing to the overhead (not that common)
5. If turning other than in the direction of the circuit, ATC will provide "non standard turn" clearance.
6. For busy controlled aerodromes, **specific departure routes** are specified and given a "name" e.g. 18 West Departure at **Hamilton** or Hunters Creek Departure **Tauranga**



Vacating and Joining at Aerodromes

Objective

1. To vacate and join the circuit in accordance with applicable procedures.
2. To join an uncontrolled circuit in accordance with the standard overhead join procedure.



3 AERODROME GROUND SIGNALS

	When displayed at a PLA, a red and white cone with the point of the cone pointing into wind indicates that the dropping area is active.
	When displayed at an unattended aerodrome (other than an aerodrome intended to be used solely for agricultural operations) or an aerodrome where an aerodrome FIS is in operation, a white letter "A" indicates that agricultural operations or agricultural training operations are being conducted. Such flights may not be complying with the direction of the aerodrome circuit.
	When displayed at an aerodrome, an arrow formed of white fabric strips on the surface indicates that: (a) Gliding is in progress. (b) Gliders are landing and being towed off in the direction of the arrow. (c) Tow lines are likely to be on the ground at any distance from the towing source and on or parallel to the signal strips.
	White crosses displayed horizontally on the manoeuvring area indicate that the ground on which they are displayed is unfit for use. White crosses displayed at each extremity of a runway or portion of a runway indicate that the runway or portion of the runway is unfit for use.

Changes from 26 OCT 06: Editorial.

Considerations

Joining at uncontrolled aerodromes

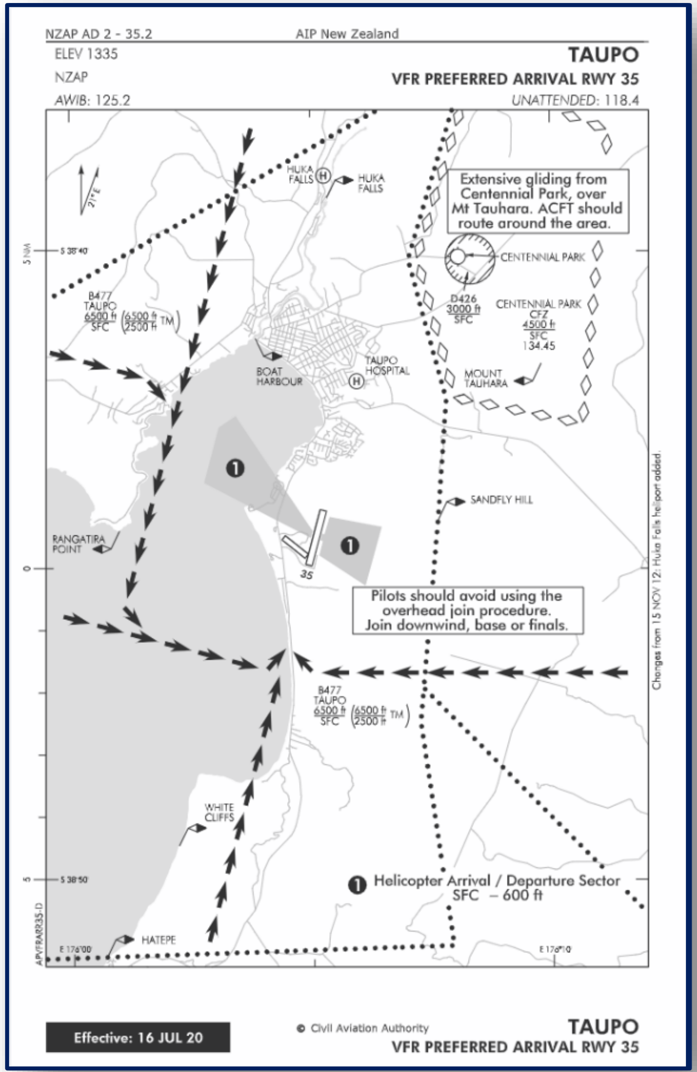
1. Review AIP plate and comments
2. Carry out **Standard Overhead Rejoin**
   a. To identify runway in use and assess wind and conditions, especially if no ATIS or AWIB
   b. To sequence with other traffic in the circuit, or remain clear until safe to integrate.
   c. To familiarise with aerodrome if unfamiliar.
   d. To observe other traffic that might be operating, especially NORDO. Thus predictability and standard procedures are important.

Cautions

1. Parachute operations
2. Glider operations, especially winching operations
3. Agricultural operations

4. Other joining procedures may exist to deconflict traffic and different aviation activities

Remember - *to* terminate flight plan or SAR watch once on the ground.



WAIKATO AVIATION ACADEMY

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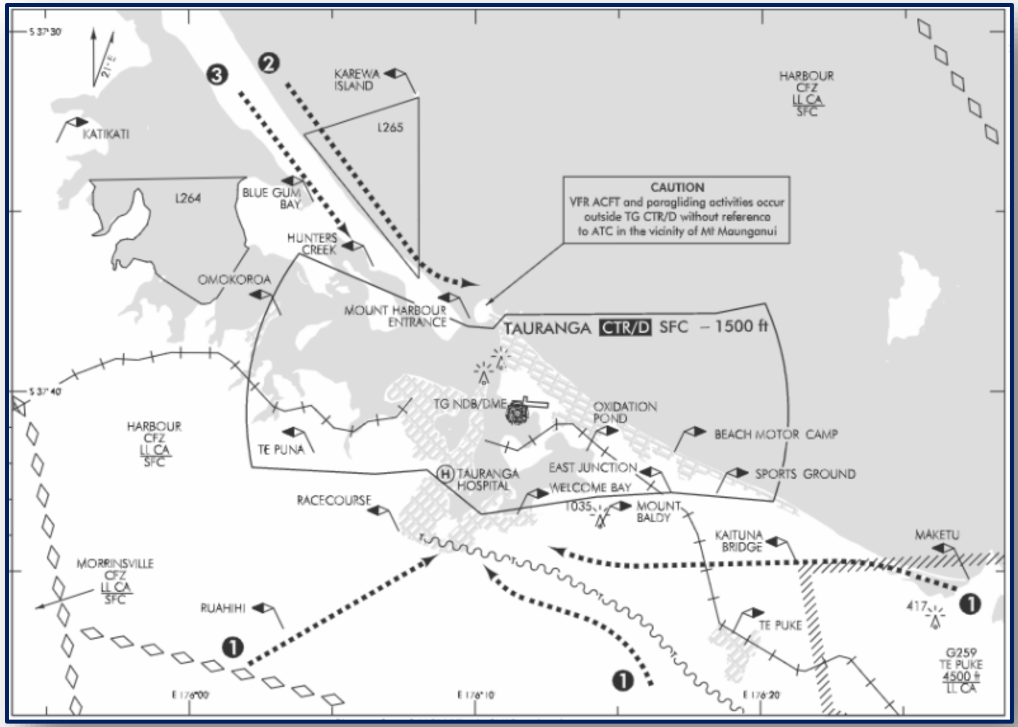
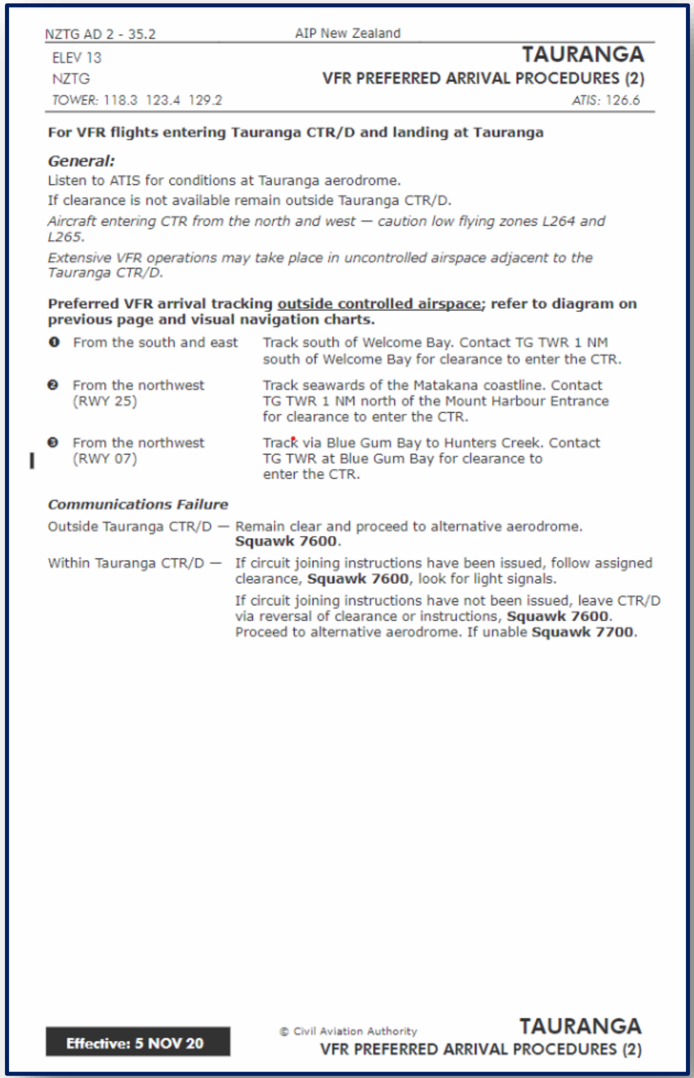


Considerations

Joining at controlled aerodromes

1. Review AIP plate and comments. Normally a greater number of requirements exist
2. Can request an overhead rejoin to help familiarise yourself with the environment.
3. First obtain ATIS "weather conditions" and you will normally be instructed to join downwind, base or directly onto final.
4. May get a clearance to "Cross overhead and join downwind"
5. You can request to join via a specific procedure or if the airspace is busy, will normally be given joining instructions that are standard and known.
6. Must still give way to traffic that is established in the circuit.


NZTG AD 2 - 35.2 AIP New Zealand

ELEV 13
NZTG
TOWER: 118.3 123.4 129.2

TAURANGA
VFR PREFERRED ARRIVAL PROCEDURES (2)
ATIS: 126.6

For VFR flights entering Tauranga CTR/D and landing at Tauranga

General:
Listen to ATIS for conditions at Tauranga aerodrome.
If clearance is not available remain outside Tauranga CTR/D.
Aircraft entering CTR from the north and west — caution low flying zones L264 and L265.
Extensive VFR operations may take place in uncontrolled airspace adjacent to the Tauranga CTR/D.

Preferred VFR arrival tracking outside controlled airspace; refer to diagram on previous page and visual navigation charts.

1	From the south and east	Track south of Welcome Bay. Contact TG TWR 1 NM south of Welcome Bay for clearance to enter the CTR.
2	From the northwest (RWY 25)	Track seawards of the Matakana coastline. Contact TG TWR 1 NM north of the Mount Harbour Entrance for clearance to enter the CTR.
3	From the northwest (RWY 07)	Track via Blue Gum Bay to Hunters Creek. Contact TG TWR at Blue Gum Bay for clearance to enter the CTR.

Communications Failure

Outside Tauranga CTR/D — Remain clear and proceed to alternative aerodrome. **Squawk 7600**.

Within Tauranga CTR/D — If circuit joining instructions have been issued, follow assigned clearance, **Squawk 7600**, look for light signals.
If circuit joining instructions have not been issued, leave CTR/D via reversal of clearance or instructions, **Squawk 7600**. Proceed to alternative aerodrome. If unable **Squawk 7700**.

Effective: 5 NOV 20

TAURANGA
VFR PREFERRED ARRIVAL PROCEDURES (2)

Vacating and Joining at Aerodromes

Objective

1. To vacate and join the circuit in accordance with applicable procedures.
2. To join an uncontrolled circuit in accordance with the standard overhead join procedure.

Aircraft Management

Slow down to 120kts or slower

Make yourself visible as your join – landing light.

Complete landing checks early so you can focus on the procedure and lookout

Airmanship and Human Factors

Be familiar with AIP Vol 4, VNC VRPs, applicable procedures both in the air and when on the ground

Right of Way Rules

Lookout and Listen out

Manage your workload, brief the landing plate before top of descent and look for signs of wind direction as you approach the aerodrome.

Have your landing charts orientated in the direction of travel to reduce confusion. Be clear on position of windsocks.

Apply a systematic approach and if confused, start from establishing the circuit direction and work from there.

Vacating and Joining at Aerodromes

Objective

1. To vacate and join the circuit in accordance with applicable procedures.
2. To join an uncontrolled circuit in accordance with the standard overhead join procedure.

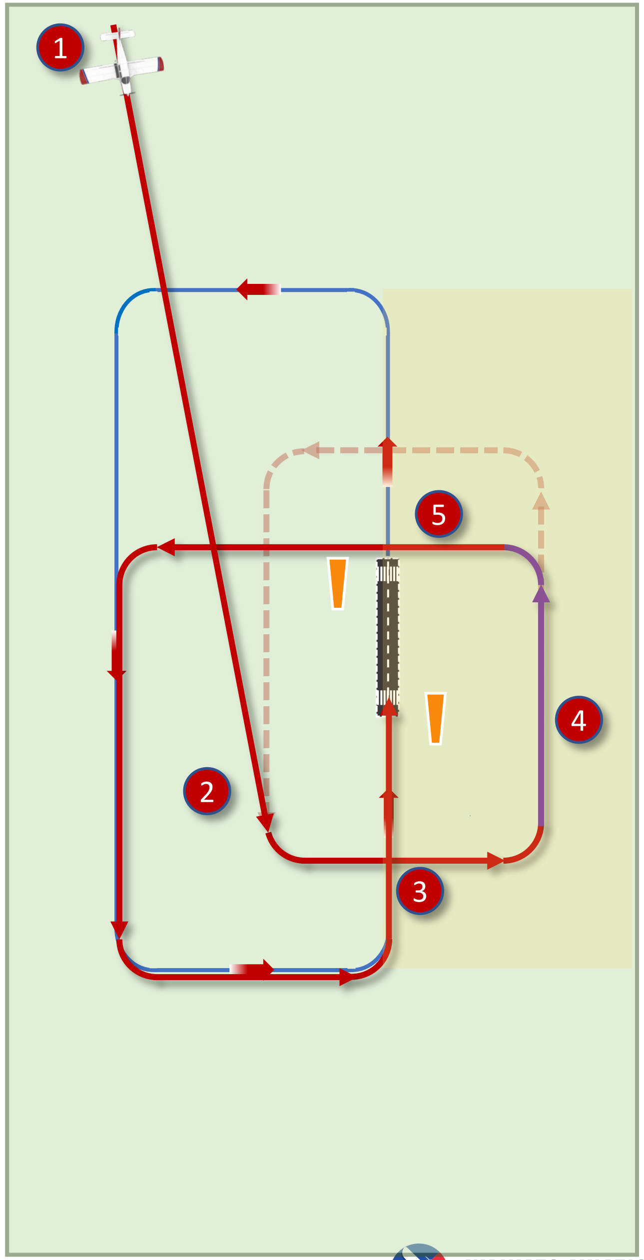
Air Exercise

Vacating

- From your homebase (Hamilton – controlled aerodrome)
- From uncontrolled aerodrome.

Standard Overhead Rejoin

1. Radio call traffic 5-10nm prior if there are no other requirements (a) position (b) altitude (c) intentions
2. Approach the aerodrome so that it is on your left at 1500ft AGL. Look for traffic and confirm wind direction.
3. Remain at 1500ft AGL until you have confirmed circuit direction and then turn in the direction of the circuit. Be mindful of NORDO, helicopter and glider traffic.
4. Call overhead joining for runway XX and then proceed to the non traffic side and **descend** at a low rate of descent to traffic height and position to cross the upwind threshold at circuit altitude. Circle again if need be.
5. Track crosswind and give way to aircraft already established in the circuit. Join downwind, downwind call and prelanding checks.



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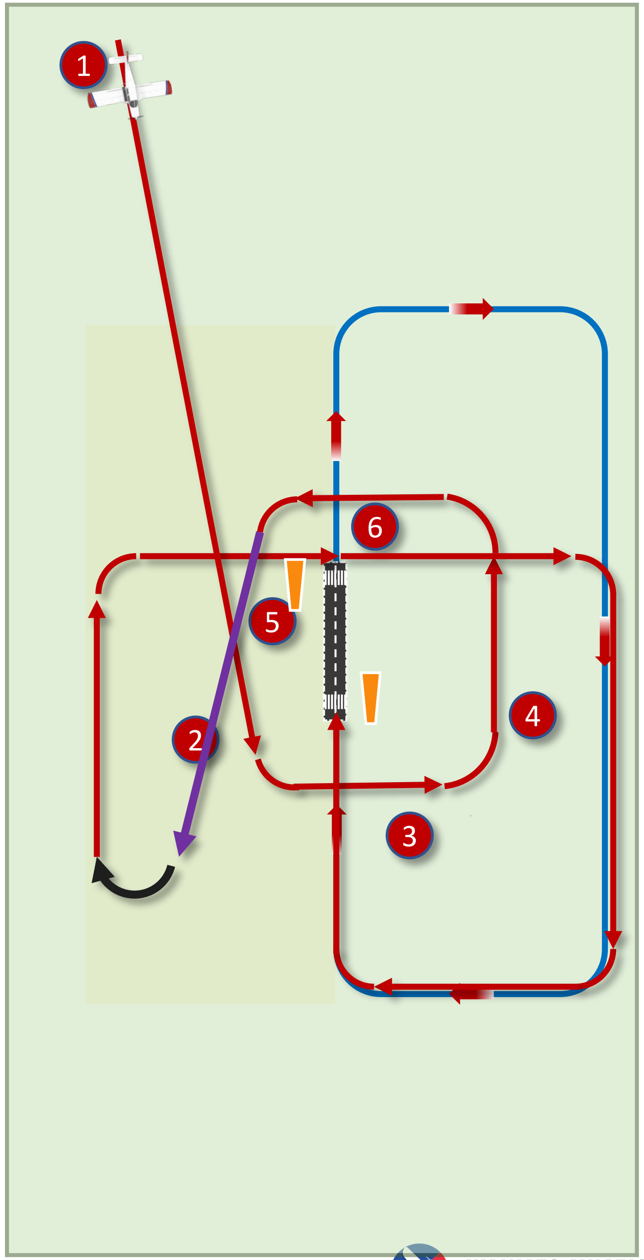
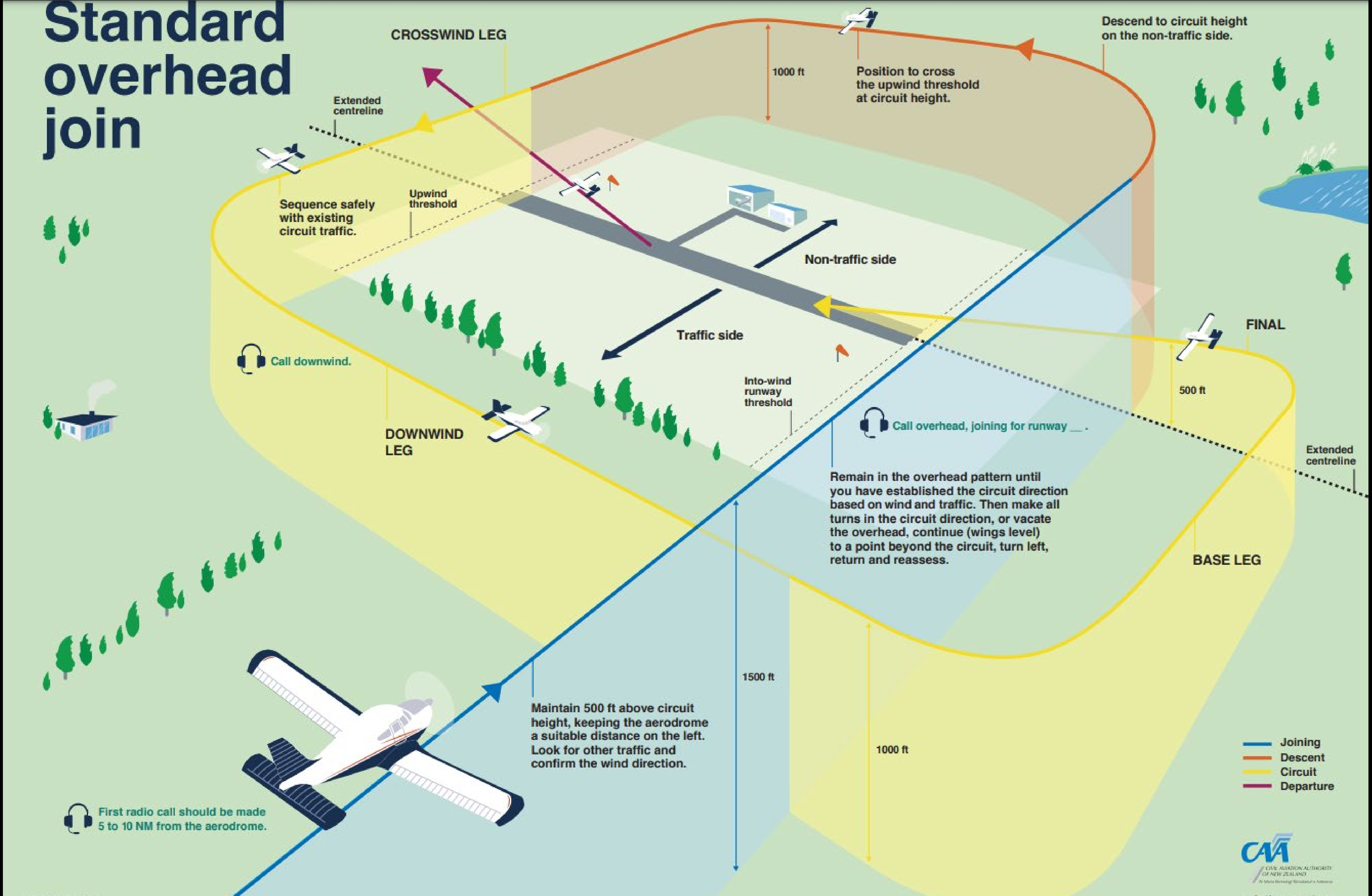
- From uncontrolled aerodrome.

Standard Overhead Rejoin

1. Radio call traffic 5-10nm prior if there are no other requirements (a) position (b) altitude (c) intentions
2. Approach the aerodrome so that it is on your left at 1500ft AGL. Look for traffic and confirm wind direction.
3. Remain at 1500ft AGL until you have confirmed circuit direction (right-hand), continue left turns until positioned on non-traffic side
4. Call overhead joining for runway XX
5. When positioned on non-traffic side commence a **descent** to traffic height and **turn** in the direction of the circuit. Position to cross the upwind threshold at circuit altitude.
6. Track crosswind and give way to aircraft already established in the circuit. Join downwind, downwind call and prelanding checks.



Standard overhead join



Standard overhead join

Right-hand pattern

aviation.govt.nz

May 2022

Safety Message

Non-conformance with uncontrolled or unattended aerodrome circuit procedures can be fatal

Issued 12 August 2019

A recent spate of incidents and accidents, including the loss of life at an uncontrolled aerodrome, has prompted the Civil Aviation Authority to issue this safety message.

Pilots operating at an uncontrolled or unattended aerodrome must comply with the published circuit directions and procedures in the NZAIP Volume 4 for that aerodrome.

These procedures are established to ensure the greatest possible safety for pilots when they are joining or vacating an uncontrolled or unattended aerodrome.

Advising local traffic via a radio call that you are joining or vacating 'non-standard' is not acceptable and does not absolve the pilot from complying with the published circuit direction. This applies to operations of all types, however, some agricultural and helicopter operations may be exempt under certain conditions.

Adherence to the rules, coupled with the use of standard radiotelephony procedures and a good lookout scan, is essential to ensure flight safety. Never assume that you are the only aircraft in the vicinity of the aerodrome, even if no other radio communications from aircraft have been heard.

Wing Drop Stalling

Objective

1. To revise stalling with power and flap
2. To carry out a stall from straight and level recovering from a wing drop with minimum height loss.

Principles of Flight

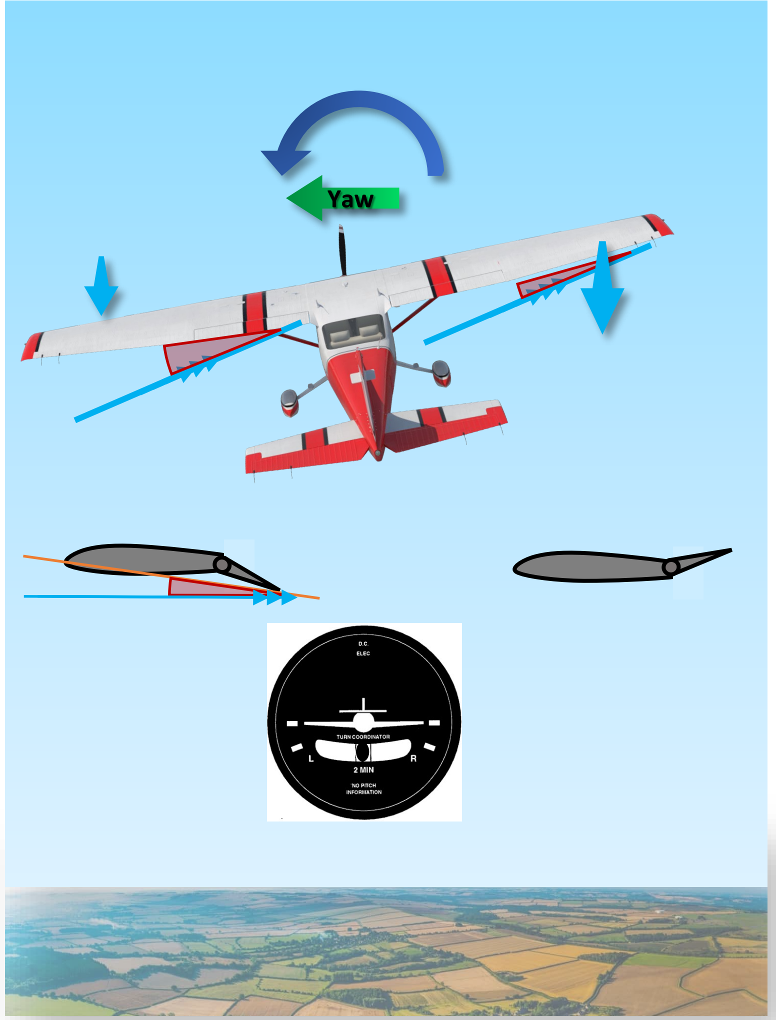
Aircraft will stall when the wing of the aircraft exceeds the critical angle of attack.

One wing may stall before the other which can lead to a wing drop.

Reasons for one wing to stall before the other

Out of balance

1. Aircraft yaws (skid)
2. Outside wing has higher airspeed creating more lift
3. Aircraft rolls
4. Increasing AoA on down-going wing.
5. Additionally, raising the wing with aileron increases the mean AoA on that wing



Objective

1. To revise stalling with power and flap
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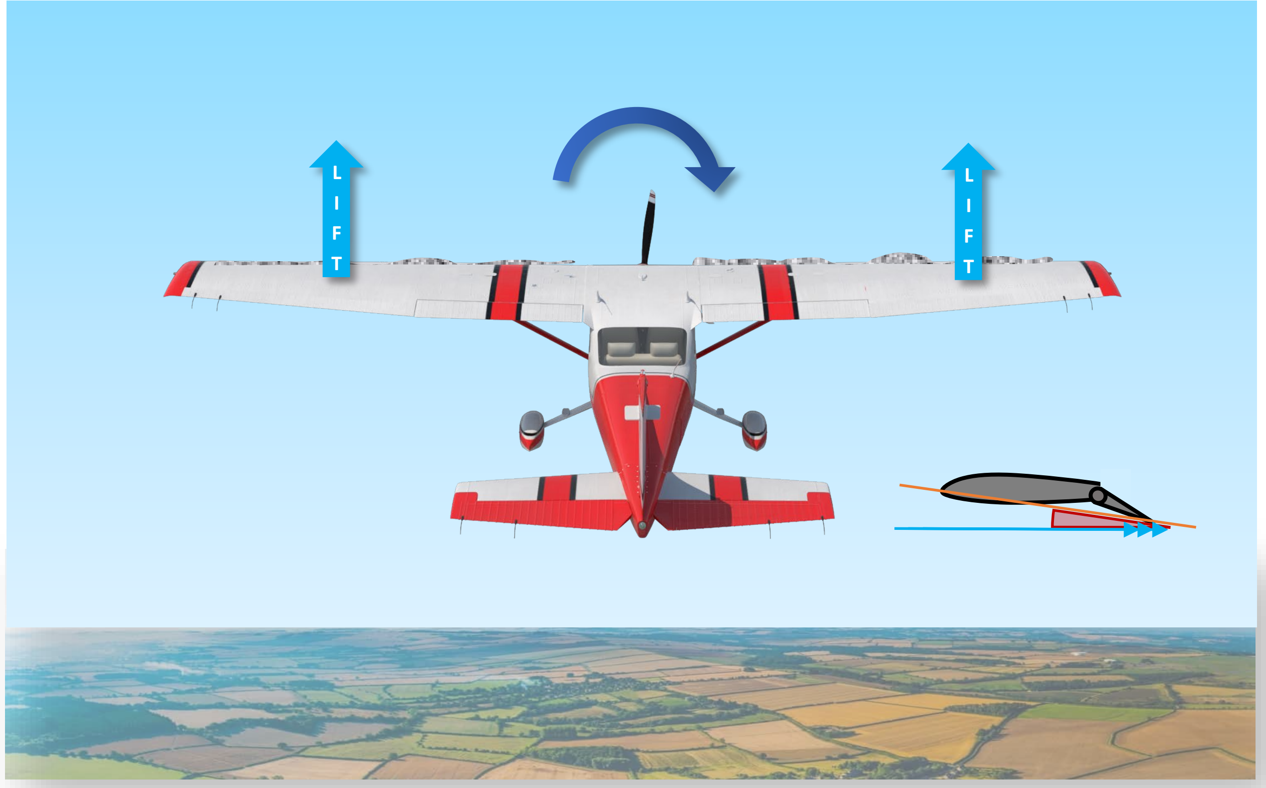
Principles of Flight

Out of balance	Aircraft yaws near stall, ➔ aircraft rolls, ↑ AoA on down-going wing Raising the wing with aileron may exceed stall angle

Principles of Flight

Ice or damage

1. Ice forming on the wings unevenly or if one wing's aerodynamic shape is damaged and distorted may cause the airflow over that wing to become turbulent and break away earlier than the other wing causing a premature loss of lift.
2. Additionally, the pilot may attempt to counter the loss of lift by lowering the aileron (attempt to increase the lift) on the affected wing which increases the mean AoA on that wing.



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Principles of Flight

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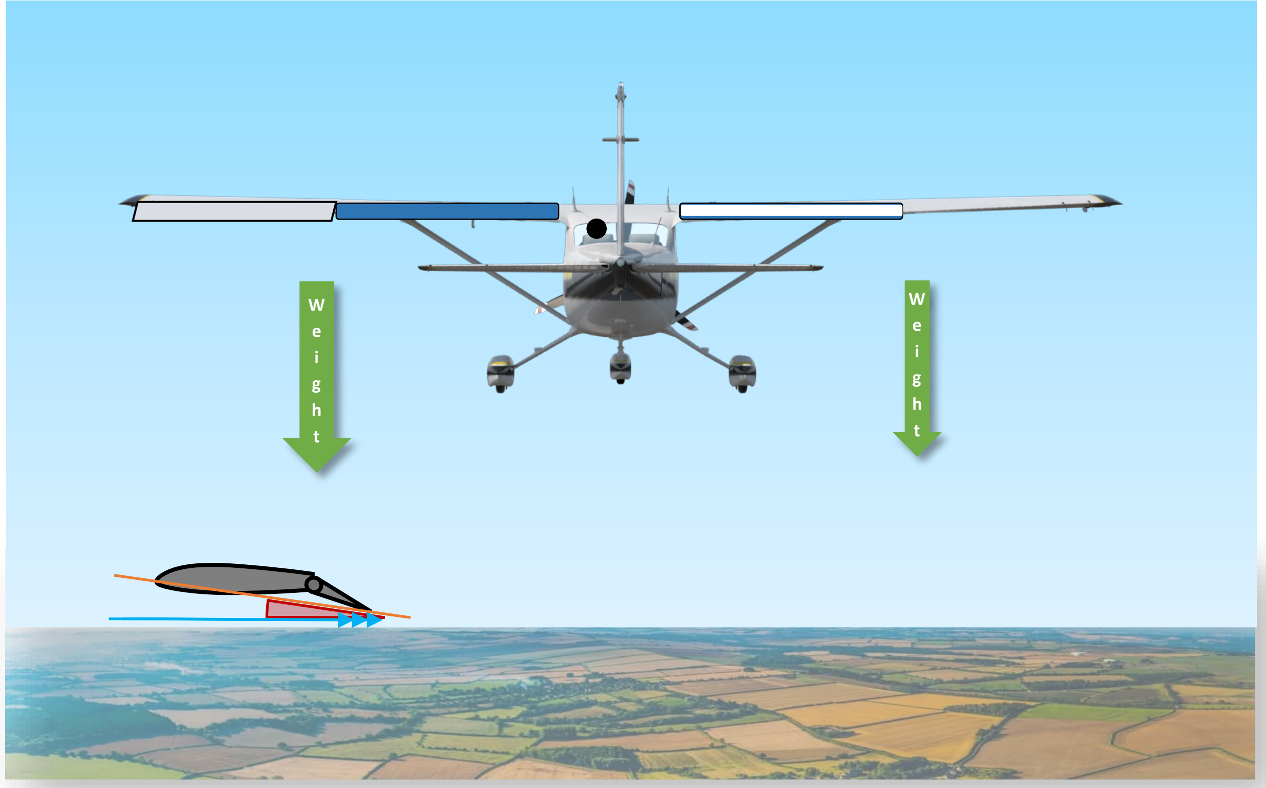
Ice or damage	Ice/damage may cause airflow to become turbulent, breaking away earlier. Holding the wings level with aileron may exceed stall angle.

Principles of Flight

Weight imbalance

If all the passengers are loaded onto one side of the aircraft, or, the aircrafts fuel is not kept balanced such that one wing is significantly heavier than the other.

The pilot will have to apply aileron to maintain wings level.



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Wgt imbalance	Due to uneven loading or fuel imbalance. Further aileron deflection to maintain wings level

Principles of Flight

Turbulence

When operating near the critical angle, e.g. practicing stalling, or, when entering the flare to land and holding off prior to touchdown, a gust or turbulence may cause the pilot to apply aileron to counter an uncontrolled roll, or, the adjusted direction of the airflow from a gust may cause one wing to exceed the critical angle before the other.

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Turbulence	Close to stall, aileron applied to counter turbulence, or, adjusted direction of airflow may cause one wing to stall before the other

Principles of Flight

Rigging

One wing may stall before the other due to incorrect rigging where the angle of incidence on one wing is greater than the other. The wing with the greater angle on incidence will reach the critical angle of attack before the other wing.

Longitudinal axis

Cord Line of aerofoil

Wing Drop Stalling

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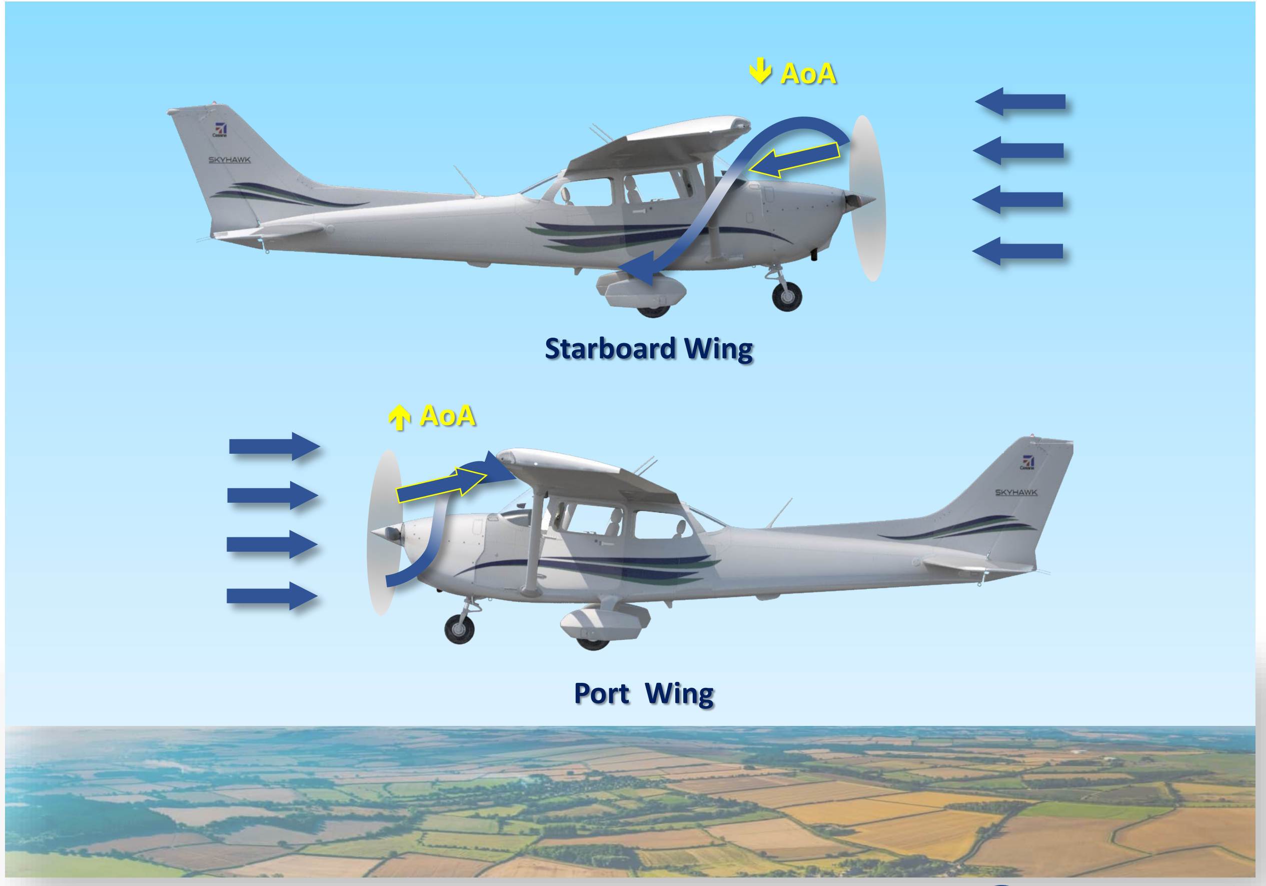
Turbulence	Close to stall, aileron applied to counter turbulence, or, adjusted direction of airflow may cause one wing to stall before the other
Rigging	Wings may be fitted at a different angle of incidence, or, flaps rigged differently. One wing reaches critical angle before the other.

Principles of Flight

Power

Slipstream modifies the angle of attack on each wing because the rotational flow (clockwise when viewed from behind) when combined with the freestream airflow decreases the angle of attack on the starboard wing and increases it on the port wing.

Due to aileron input or the difference in angle of attack, the aeroplane may suffer from a wing drop when partial power is used approaching the critical angle of attack.



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Rigging	Wings may be fitted at a different angle of incidence, or, flaps rigged differently. One wing reaches critical angle before the other.
Power	Slipstream modifies the angle of attack of the airflow approaching the wing. One wing more readily may wing drop with partial power.

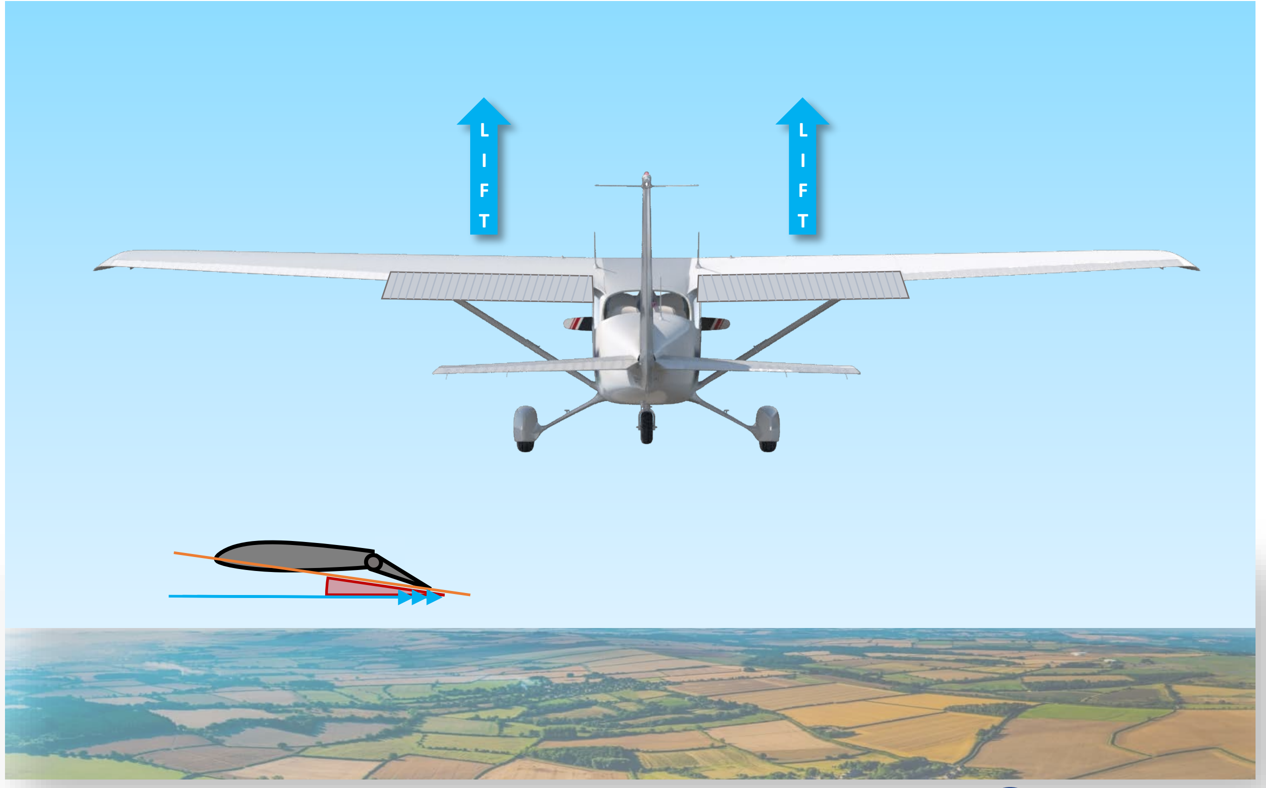
Principles of Flight

Flaps

Flaps when extended may be set at slightly different angles altering the mean angle of attack on that wing.

When flaps are extended, the aircraft is less laterally stable because the average centre of pressure of each wing moves towards the wing root. The aircraft is more easily disturbed in roll with turbulence which may cause the wing to exceed the critical angle of attack.

Additionally, to correct for the roll disturbance more down aileron will be applied which may exceed the angle of attack.



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Power	Slipstream modifies the angle of attack of the airflow approaching the wing. One wing more readily may wing drop with partial power.
Flaps	May extend to different angles. Lift CoP moves inboard making the aircraft more laterally unstable, increased tendency for aircraft to be disturbed in roll. Greater amount of aileron applied to maintain wings level

Principles of Flight

Lift and drag

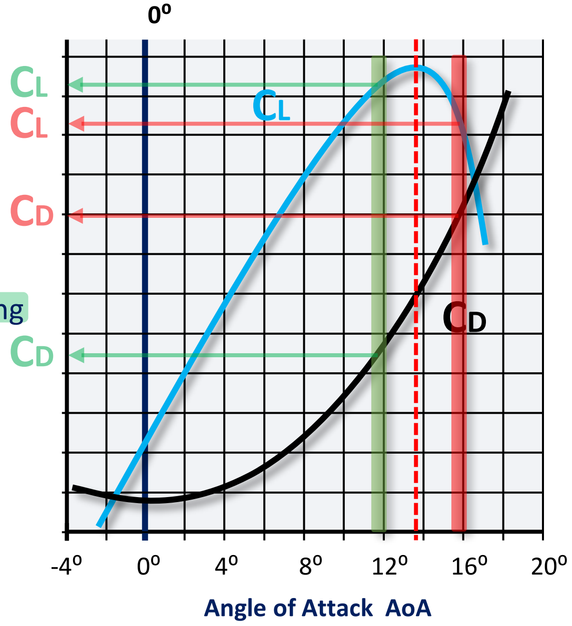
Wing stalled first compared to the unstalled wing, there is a 🡇 Lift and aircraft rolls towards the stalled wing because of difference in Lift

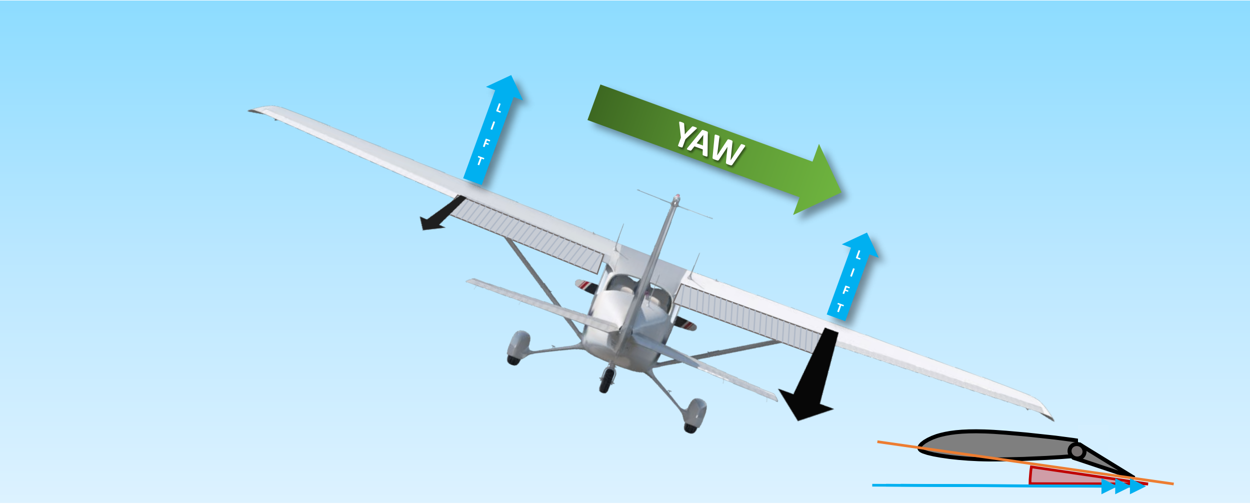
🡅 AoA on down-going exceeds critical angle of attack causing significant 🡅 DRAG compared to unstalled wing

🡅 DRAG yaws aircraft towards down-going wing, further delays stall of upgoing wing due 🡅 airspeed, yaw causes roll ➔ autorotation.

Using aileron to pick up down-going wing only 🡅 AoA further, causes 🡇 LIFT and 🡅 DRAG

ONLY rudder is effective in stopping the yaw





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Flaps	Extend to different angles. Lift CoP moves inboard, the aircraft more laterally unstable, increased tendency for aircraft to be disturbed in roll. Greater amount of aileron applied to maintain level
Lift / Drag	Stalled wing ↓ Lift ↑ Drag. ↑ Drag yaws aircraft towards lower wing.

Aircraft Management

Carb Heat – On prior to power reduction and off at 65-70 kts

Smooth and coordinated power application

Limits - Airspeed and RPM

Cabin – Check for loose items/objects. If the plane has an axe or fire extinguisher, are they well secured? Flight bag?

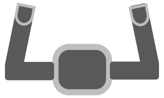
Airmanship and Human Factors

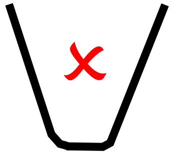
HASELL and HELL checks

Cruise checks – between and after stalling exercises

Situational awareness – configuration, symptoms, attitude and airspeed

Controls – smooth and coordinated response. Smooth not jerky.





Confidence through practice– the more you practice and expose yourself to stalling the more comfortable, confident and therefore competent you will become. In the early days, you may want to check that sick bags are on board the aircraft just in case.

WAIKATO AVIATION ACADEMY

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Lift / Drag	Stalled wing ↓ Lift ↑ Drag. ↑ Drag yaws aircraft towards lower wing.

Aircraft Management

Carb Heat

Smooth and coordinated

Limits – Airspeed and RPM

Cabin secure

Airmanship and Human Factors

HASELL and HELL Checks / Cruise Checks

Situational awareness – config, recovery

Controls – smooth application

Confidence through practice

Air Exercise

Practice advanced stalls

ENTRY

HASELL Select Ref point and Altitude

Power 1700 RPM – rudder direction

Altitude Maintain - elevator

Flaps < Vfe approx. 90kts

Carb Heat OFF ~ 70 kts

Symptoms Identify esp. warning, buffet, **stall**

Stall **Aircraft sinks, nose pitches down**

One wing may drop

RECOVERY **Keep ailerons neutral**

Check CF to ↓ S+L Attitude

Apply opposite rudder – stop yaw

Follow with full power

Aircraft Unstalled

Roll wings level **Attitude ➔ S+L**

Centralise the rudder

ASI ↑ - VSI ↑

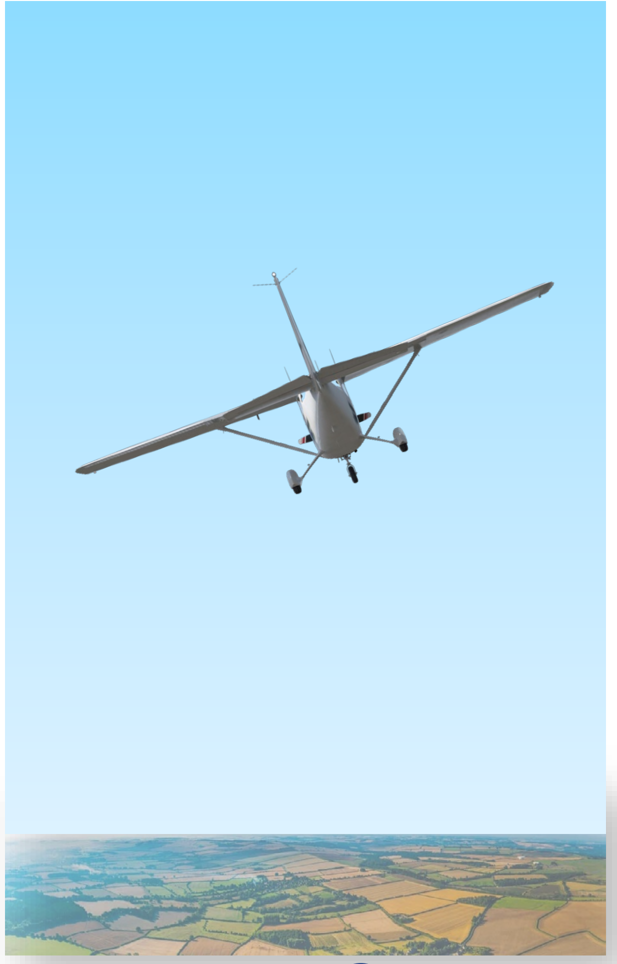
Retract Drag Flap

ASI ↑, ROC + ↑ and safe speed

Slowly raise nose to Horizon line

Retract Lift Flap in stages

Select **Climb attitude**



WAIKATO AVIATION ACADEMY

Objective

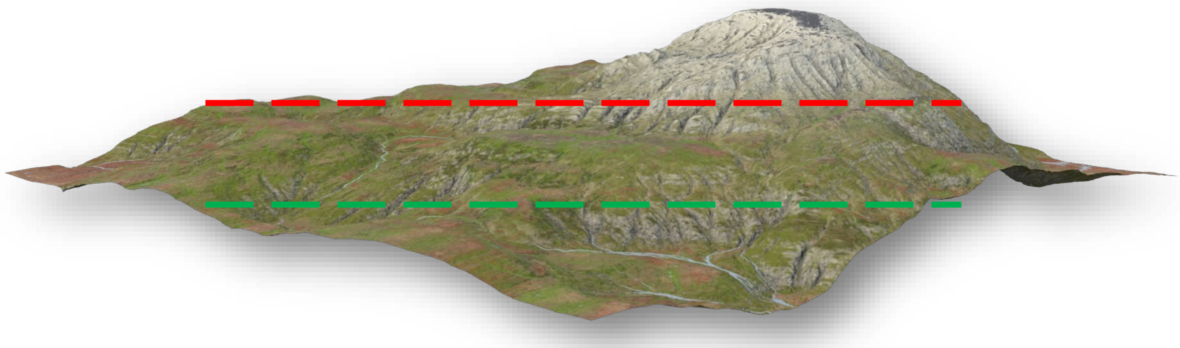
1. To recognise the various illusions and sensations when carrying out low flying.
2. To operate the aircraft with safe margins in the poor visibility configuration.

Considerations

Visual perspective changes

Changes from a plan (top down) view to profile (side) view

Important to reference to a **superimposed horizon line**. Tendency is to raise aircraft nose in turns to a **false higher horizon line**.



Objective

1. To recognise the various illusions and sensations when carrying out low flying.
2. To operate the aircraft with safe margins in the poor visibility configuration.

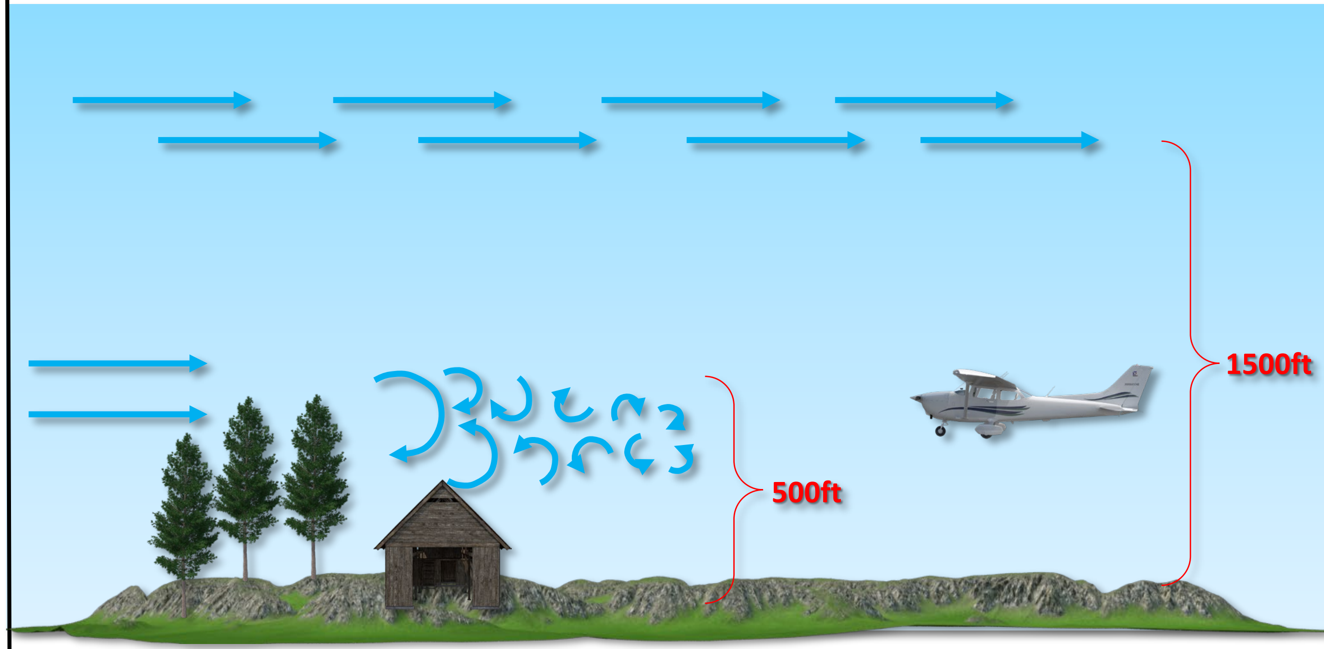
Considerations

1. Change in perspective

Considerations

Flight environment

Increase in mechanical turbulence



WAIKATO AVIATION ACADEMY

Objective

1. To recognise the various illusions and sensations when carrying out low flying.
2. To operate the aircraft with safe margins in the poor visibility configuration.

Considerations

1. Change in perspective
2. Increased mechanical turbulence

Considerations

Inertia and speed

Aircraft's **inertia** is more apparent at low level.

Sensation of **speed** is more noticeable at low level. When turning, greater anticipation is needed and the requirement for larger areas to safely manoeuvre more apparent.

Objective

1. To recognise the various illusions and sensations when carrying out low flying.
2. To operate the aircraft with safe margins in the poor visibility configuration.

Considerations

1. Change in perspective
2. Increased mechanical turbulence
3. Effect of aircraft inertia and speed

Considerations

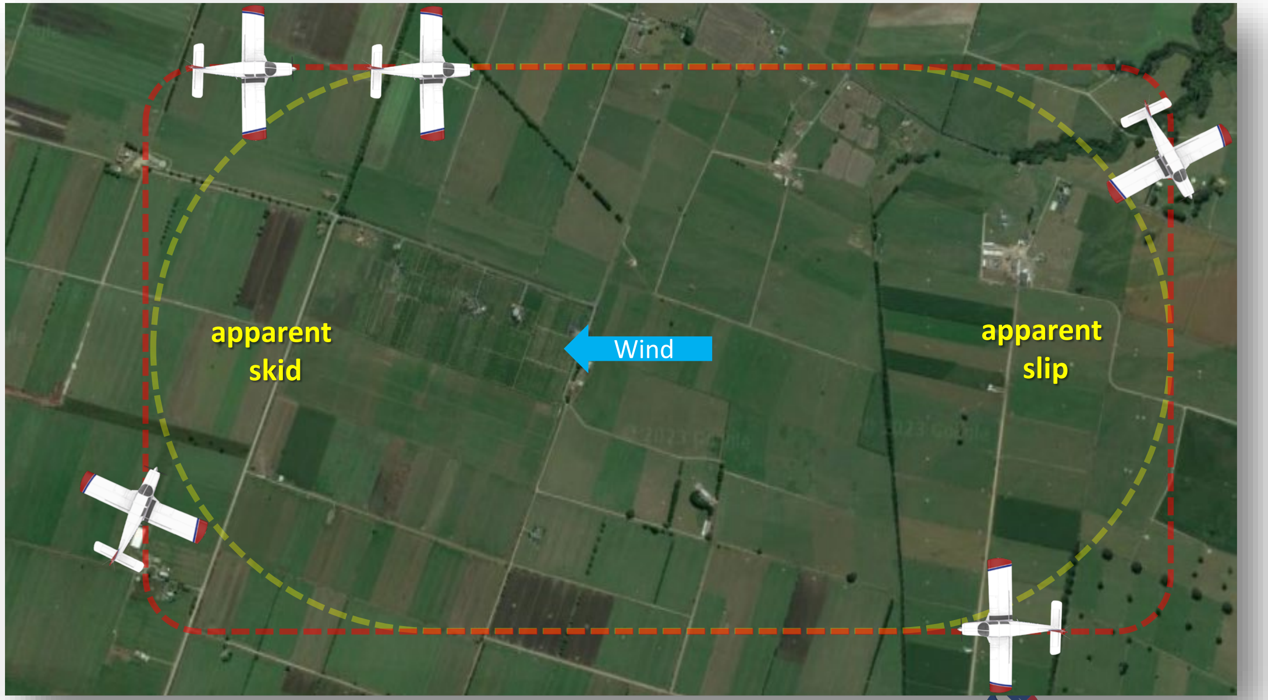
Visual effects due to wind when low flying

Into wind the low groundspeed is more apparent therefore pilot tendency to lower nose and increase power.

Crosswind, drift is more apparent, track on reference point and avoid crossed controls

Downwind, the high groundspeed is more apparent, therefore pilot tendency is to raise the nose and decrease the power

When turning 180^{o} from **into wind to downwind**, sensation of slipping into the turn, but this is apparent only. When turning 180^{o} from **downwind into wind**, sensation of skidding out of the turn, but again this is only apparent. Make sure you cross reference with the balance indicator.



Low Flying Introduction

Objective

1. To recognise the various illusions and sensations when carrying out low flying.
2. To operate the aircraft with safe margins in the poor visibility configuration.

Considerations

1. Change in perspective
2. Increased mechanical turbulence
3. Effect of aircraft inertia and speed
4. Visual effects due to wind when flying low

Considerations

Poor visibility configuration - benefits

Airspeed **70kts** – **2 stages** of flaps

Reduced Airspeed

1. Lower ground speed, smaller turning radius, reduced momentum
2. More time to anticipate and react to obstacles especially in reduced visibility

Increases Lift and Drag

1. Affects L/D ratio
2. Increased Lift = reduced stall speed, lower nose attitude.
3. Increased Drag = means higher power setting to maintain straight and level. Can make the aircraft more speed stable. Datum power setting (as per slow flight) = ~1900 RPM

Power application

1. Lead with power to maintain 70kts in turns
2. Reduces stall speed and slipstream increases rudder and elevator effectiveness
3. Cycle carb heat (do not leave on) and monitor T's and P's as T may increase

Control coordination

1. Controls are less effective at lower airspeed, therefore increased displacement required.
2. Adverse yaw increases due to increased aileron displacement.

Low Flying Introduction

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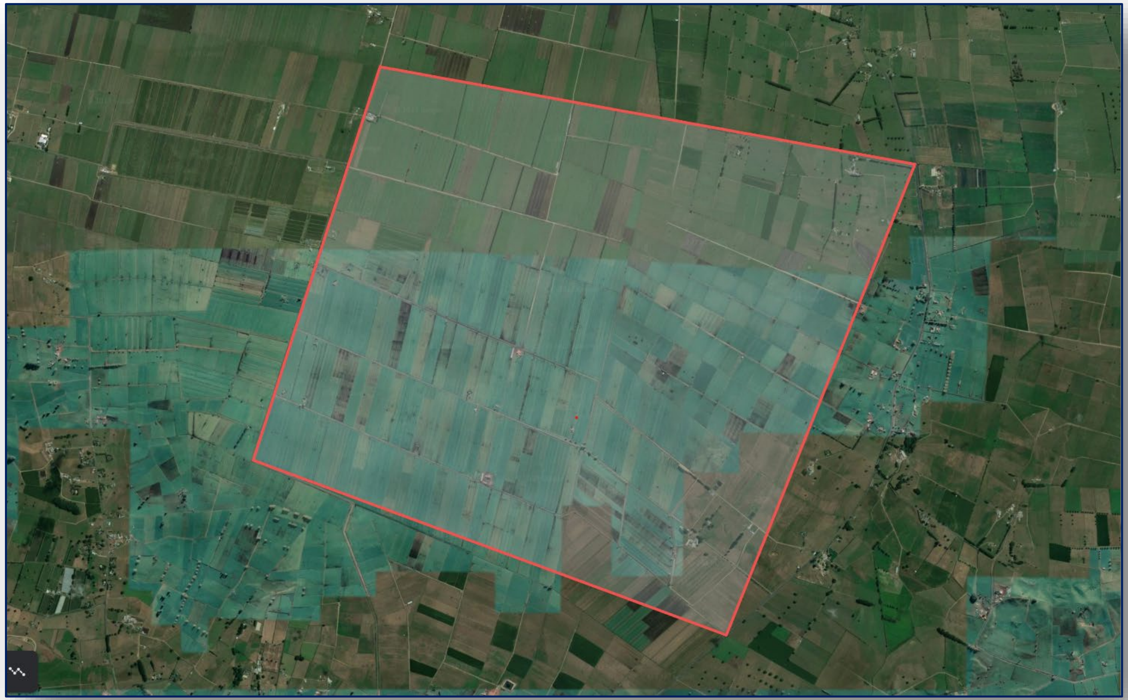
Considerations

1. Change in perspective
2. Increased mechanical turbulence
3. Effect of aircraft inertia and speed
4. Visual effects due to wind when flying low
5. Poor visibility configuration
   a. Reduced airspeed
   b. Increased lift and drag
   c. Power application
   d. Control coordination

Considerations

Low flying area

1. Fly the boundaries at 1000ft agl to inspect low flying area and become familiar with area/obstacles and if another aircraft is operating in the LFA.
2. Carry out HASELL checks before descending to 500ft agl.
3. Stay within the boundaries and do not descend below 200ft agl.
4. If operating low level over water (e.g. LFA Thames), wear a life jacket.
5. Radio calls on entering and leaving the LFA.



WAIKATO AVIATION ACADEMY

Low Flying Introduction

Objective

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Considerations

1. Change in perspective
2. Increased mechanical turbulence
3. Effect of aircraft inertia and speed
4. Visual effects due to wind when flying low
5. Poor visibility configuration
   a. Reduced airspeed
   b. Increased lift and drag
   c. Power application
   d. Control coordination
6. Low flying area

Aircraft Management

1. **Carb Heat** Use - cycle
2. **Fuel management** – lower fuel burn
3. **T's and P's** – monitor temperatures due to lower airspeed
4. Caution – **Vfe**
5. **Poor visibility** configuration and DATUM power setting

Airmanship and Human Factors

HASELL checks

Height	> 200ft agl
Airframe	State configuration
Security	Items and harnesses secure
Engine	Fullest tank, fuel pump ON, mixture RICH, Carb heat CYCLE
Locality	Boundaries of LFA identified
Lookout	Traffic, wind, obstacles, landing areas
Lights	All lights ON

Risks

Obstacles	Hard to detect, look for unnatural shapes/lines
Stress	Reduced margins, heightened risk, lead to fixation
Visibility	Don't push lowering visibility, maintain VFR and only SVFR if familiar

Low Flying Introduction

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4. Visual effects due to wind when flying low
5. Poor visibility configuration
   a. Reduced airspeed
   b. Increased lift and drag
   c. Power application
   d. Control coordination
6. Low flying area

Aircraft Management

Carb Heat / T's and P's

Fuel management

Caution Vfe

Poor visibility configuration and DATUM

Airmanship and Human Factors

HASELL checks

Obstacles

Stress

Pushing lowering visibility

Air Exercise

Low Flying area boundaries

1. Fly the **boundaries**
2. HASELL checks
3. Radio call entering

Visual illusions and sensations at 500ft

1. Crz descent, superimpose horizon line
2. Plan to elevation
3. Increased mechanical turbulence
4. Effect of inertia on turns, reaction time

Risks of flying at 200ft

1. Speed, anticipation and reaction times
2. Closer to obstacles
3. Stress and safety considerations

Effect of wind at 500ft – visual illusions

1. **Box pattern** – effect of headwind, crosswind and tailwind on ground speed and sensations
2. **Racetrack pattern** – effect of wind on ground speed, and sensation of slip/skid in turn

Poor visibility configuration

1. Effect of poor visibility configuration on speed, anticipation, time, nose attitude, effect of controls and coordination with power.
2. Importance of trimming
3. Turn radius as compared to cruise configuration

Flying line features

1. **Flying with line features** located to left of aircraft with various wind directions

Objective

1. To compensate for the effects of inertia, visual illusions and stress when low flying.
2. To manoeuvre the aircraft accurately in the poor visibility configuration.

Considerations

Visual perspective changes and sloping terrain

1. Changes from a plan (top down) view to profile (side) view
2. Important to reference to a **superimposed horizon line**. Tendency is to raise aircraft nose in turns to a **false higher horizon line**.
3. Estimate your height above ground visually – altimeter should only be a second reference
4. Cross reference airspeed, VSI and altimeter to cross check aircraft performance

Low Flying Consolidation

Objective

1. To compensate for the effects of inertia, visual illusions and stress when low flying.
2. To manoeuvre the aircraft accurately in the poor visibility configuration.

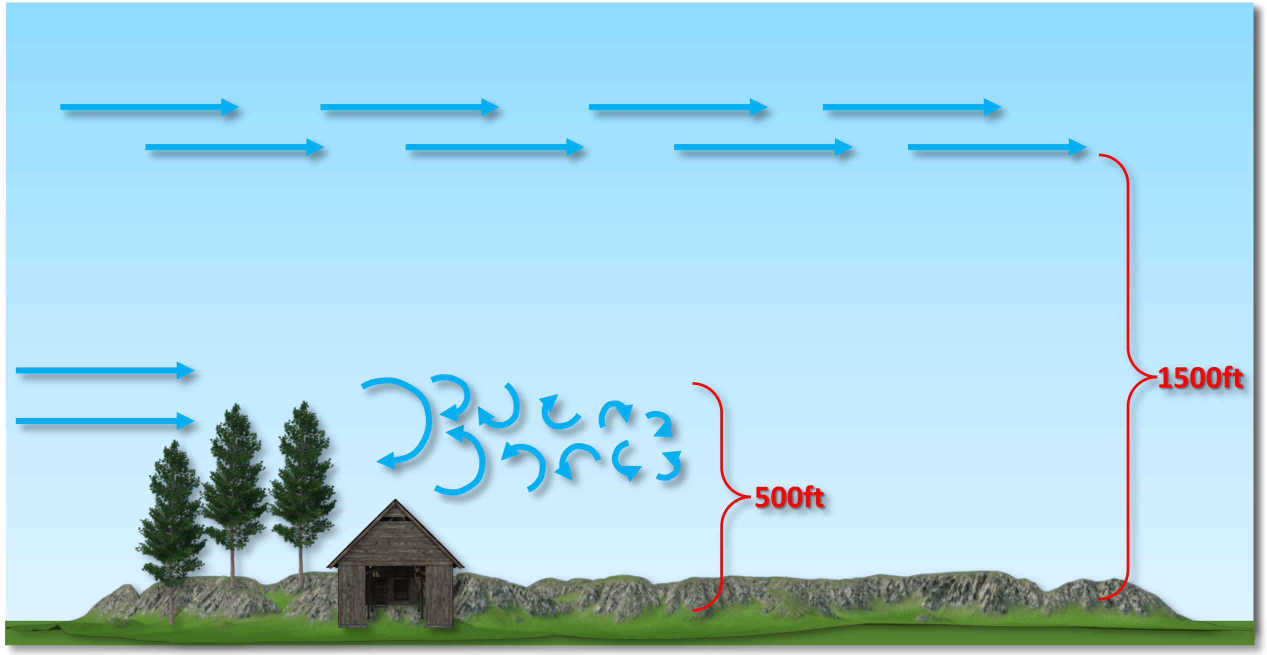
Considerations

1. Visual perspective changes and sloping terrain

Considerations

Turbulence - obstacles

1. Increase in mechanical turbulence at low level



WAIKATO AVIATION ACADEMY

Low Flying Consolidation

Objective

1. To compensate for the effects of inertia, visual illusions and stress when low flying.
2. To manoeuvre the aircraft accurately in the poor visibility configuration.

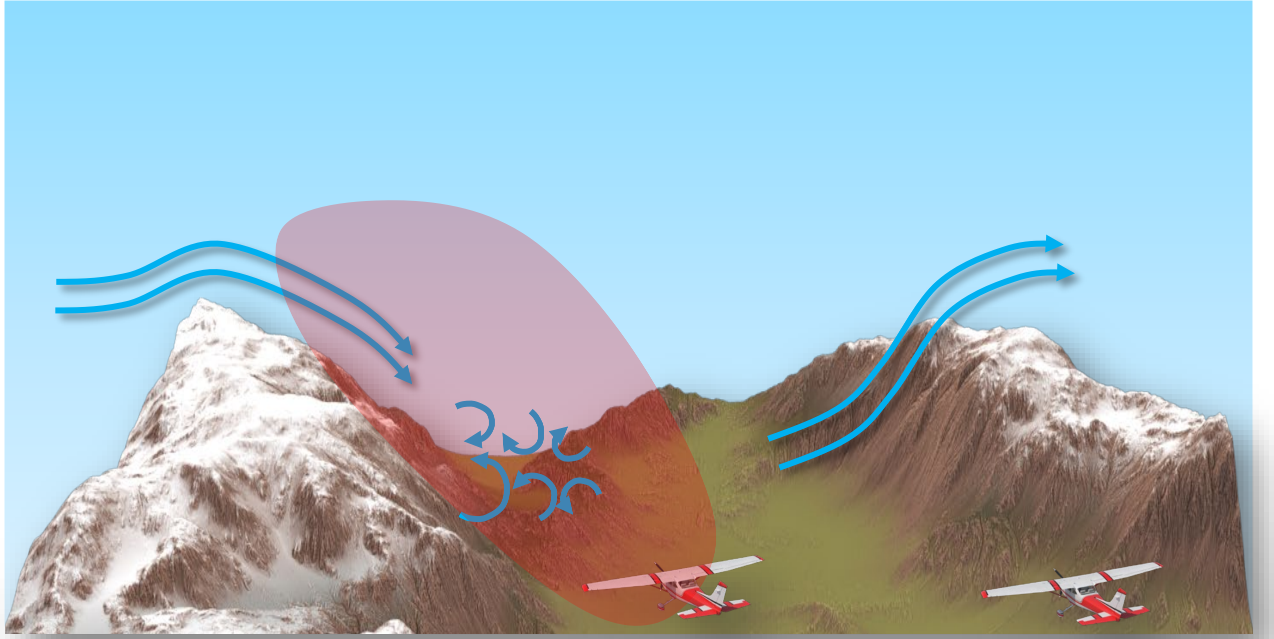
Considerations

1. Visual perspective changes and sloping terrain
2. Increased mechanical turbulence due obstacles

Considerations

Turbulence - terrain

1. Increase in mechanical turbulence at low level
2. Turbulence more pronounced in terrain with stronger up and downdrafts in terrain
3. Avoid flying in the lee of hills or valleys
4. Fly to the upwind side of hilly terrain or updraft side of valleys



Objective

1. To compensate for the effects of inertia, visual illusions and stress when low flying.
2. To manoeuvre the aircraft accurately in the poor visibility configuration.

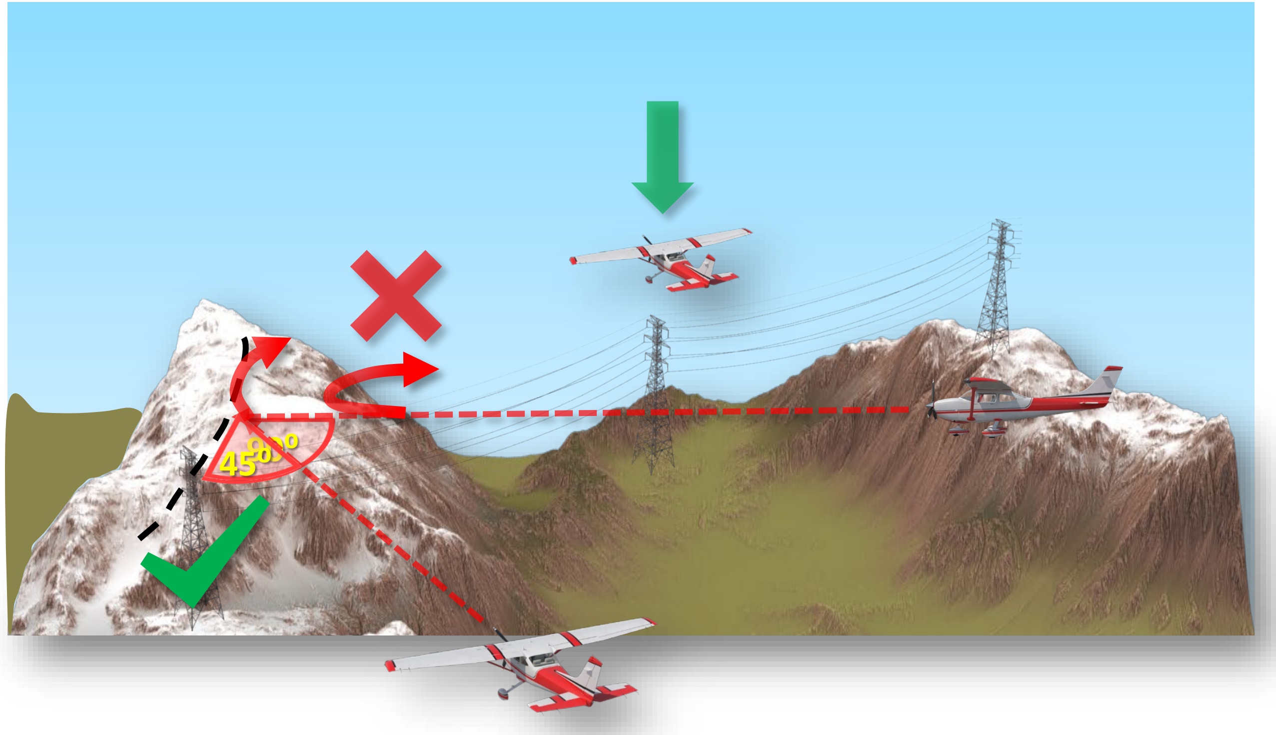
Considerations

1. Visual perspective changes and sloping terrain
2. Increased mechanical turbulence due obstacles, more pronounced in terrain
    a. Do not fly on lee side as turbulence is worse, fly on upwind side of valley

Considerations

Obstacle clearance

1. Cross over power lines and pylons overhead the pylon structure
2. Cross ridges at an oblique angle to provide room to turn back
3. Approach ridges at an angle of 45^o or less



Low Flying Consolidation

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2. To manoeuvre the aircraft accurately in the poor visibility configuration.

Considerations

1. Visual perspective changes and sloping terrain
2. Increased mechanical turbulence due obstacles, more pronounced in terrain
   a. Do not fly on lee side as turbulence is worse, fly on upwind side of valley
3. Cross over the top of power line poles and high voltage pylons
4. Approach ridges at an oblique angle of 45⁰ or less

Aircraft Management

1. **Carb Heat** Use - cycle
2. **Fuel management** – lower fuel burn, endurance increase but range decrease. Plan on using endurance.
3. **T's and P's** – monitor temperatures due to lower airspeed
4. Caution – **Vfe**
5. **Poor visibility** configuration and DATUM power setting

Airmanship and Human Factors

1. **HASELL** checks prior to low flying
2. Be clear on boundaries and make a **TWOP** assessment
3. Solo flights to be authorised.
4. Maximum of 1 aircraft in LFA at a time unless approved procedures in place
5. Broadcast radio calls as required , entry and exit
6. **Superimpose horizon**, don't lift nose to false horizon line and cross check performance on instruments
7. Watch out for **visual illusions of terrain and wind** – check balance.

WAIKATO AVIATION ACADEMY

Low Flying Consolidation

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Aircraft Management

Carb Heat / T's and P's

Fuel management

Caution Vfe

Poor visibility configuration and DATUM

Airmanship and Human Factors

HASELL and TWOP checks

Legal requirements

Radio calls

Illusions – check performance instruments

Air Exercise

Medium turns

1. Poor visibility configuration – small increase in power

Steep turns

1. Poor visibility configuration – limited to 45^o AoB
2. Increase power with roll in to maintain IAS, Drag and Vs ↑ significantly > 45^o AoB
3. Watch for lower G-load limitation with flap selected
4. Monitor perf instruments to confirm safe performance especially AoB, IAS, balance
5. If descending in turn, reduce AoB and increase power if necessary

WAIKATO AVIATION ACADEMY

Low Flying Consolidation

Objective

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Considerations

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    a. Do not fly on lee side as turbulence is worse, fly on upwind side of valley
3. Cross over the top of power line poles and high voltage pylons
4. Approach ridges at an oblique angle of 45° or less

Air Exercise

Medium turns

1. Poor visibility configuration – small increase in power

Steep turns

1. Poor visibility configuration – limited to 45° AoB
2. Increase power with roll in to maintain IAS, Drag and Vs increase significantly > 45° AoB
3. Watch for lower G-load limitation with flap selected
4. Monitor perf instruments to confirm safe performance especially AoB, IAS, balance
5. If descending in turn, reduce AoB and increase power if necessary

Aircraft Management

Carb Heat / T's and P's

Fuel management

Caution Vfe

Poor visibility configuration and DATUM

Airmanship and Human Factors

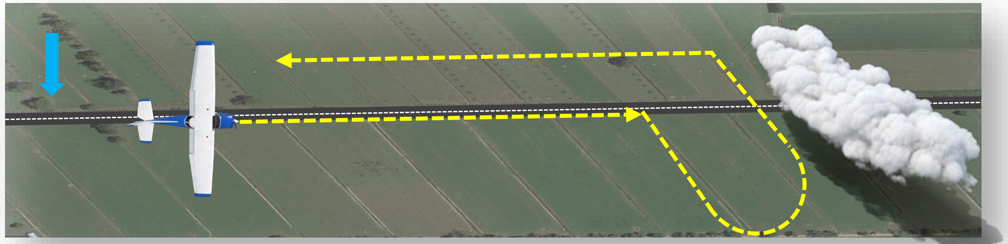
HASELL and TWOP checks

Legal requirements

Radio calls

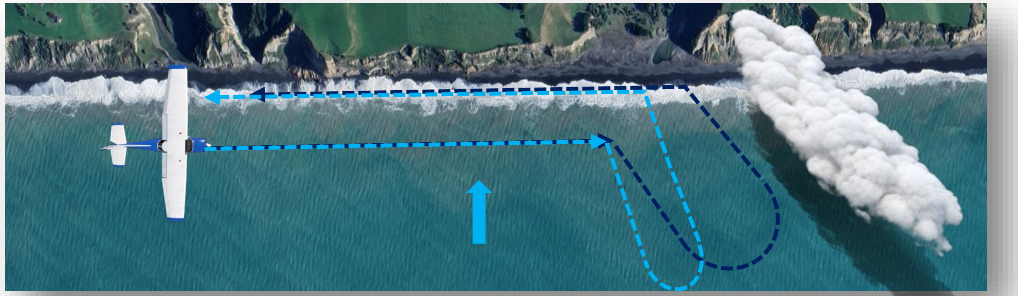
Illusions – check performance instruments

Line feature reversal turns – AoB 30-45°



1. Poor vis configuration, following line feature and obstacle or visibility requires reversal
2. Turn downwind at 45° to line feature, turn back into wind, position feature to left of aircraft.

Coastal reversal turn



1. Coastal reversal turn required, no horizon out to sea, high ground overland
2. Keep coastline in sight when turning to reference distance and AoB
3. Turn at 45° to coastline and compensate for wind strength (onshore breeze being worse). ↑ AoB to 45° initially then reducing as required turning back onto coastline track.
4. Strong onshore wind, turn at an angle of 60°+ to compensate for wind with coastline visible.

Constant radius turn

1. Select 4 points equidistant from centre reference point
2. Adjust AoB to compensate for drift to maintain constant radial distance from point.
3. Turning downwind ↑ G/S, ↑ AoB, turning into wind ↓ G/S ↓ AoB

Objective

1. To carry out a precautionary landing applying an effective procedure.
2. To make safe decisions as to the suitability of the landing area.

Considerations

Weather

Hold to personal meteorological minima that is above the legal minima. What does 5km visibility look like?

Carefully consider the weather before any flight and always have an open back door. Get a second opinion on the weather and always consider the trends.

Watch out for “get home it is” If you are feeling uncomfortable then turn back.

Objective

1. To carry out a precautionary landing applying a safe procedure.
2. To make safe decisions as to the suitability of the landing area.

Considerations

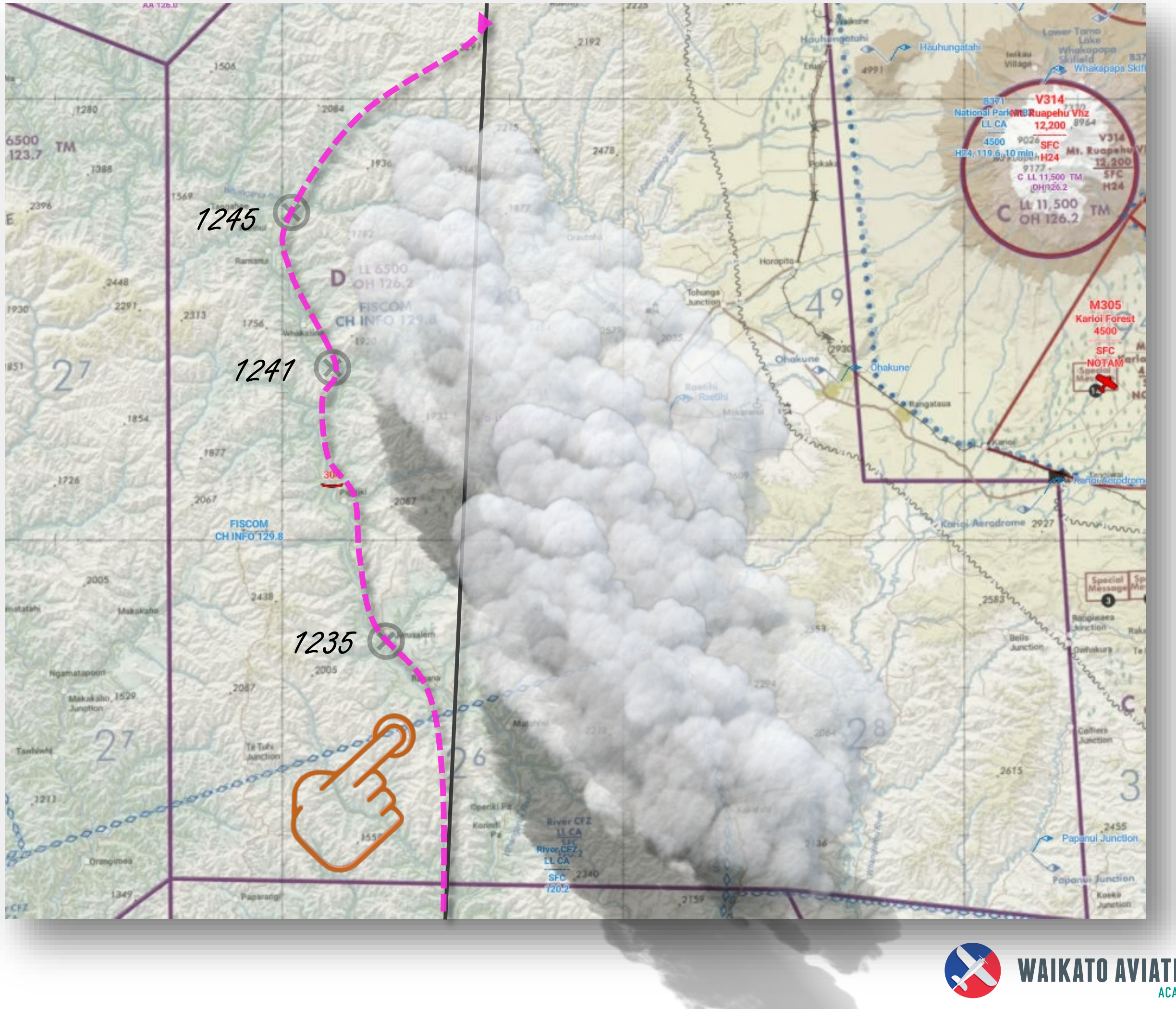
1. Weather
   a. Minima, planning, backdoor open, “watch for get home it is”

Considerations

Lost

Maintain your situational awareness by keeping up to date with your position on the map.

Maintain your situational awareness by remaining aware of your position and time locations.



WAIKATO AVIATION
ACADEMY

Objective

1. To carry out a precautionary landing applying a safe procedure.
2. To make safe decisions as to the suitability of the landing area.

Considerations

1. Weather
    a. Minima, planning, backdoor open, “watch for get home it is”
2. Lost
    a. Maintain situational awareness = positional awareness against time

Considerations

Fuel

A low fuel situation can occur as a result of a diversion around weather and flying at a lower ground speed.

Fuel consumption rate may vary in poor visibility configuration. Therefore, calculating an accurate fuel remaining quantity may be difficult. This can increase stress levels.

Always fly and plan diversions with a known **fuel endurance** (not range) and use a **conservative** fuel consumption rate.

Planning Details

FRM	TO	ALT	W/V	TAS	TRUE TRK	MAG TRK	MAG HDG
WU	HN	3500	120/10	110	008	347	350

Endurance	Flight 1	Flight 2	Flight 3	Flight 4
T/O	03 : 15	:	:	:
1420	02 : 45	:	:	:
1450	02 : 15	:	:	:
1520	01 : 45	:	:	:
1550	01 : 15	:	:	:
	:	:	:	:
	:	:	:	:
Ltrs Remain				

Fuel PLAN	Flight 1		Flight 2		Flight 3		Flight 4	
Fuel On-board	03 : 15	130	:		:		:	
	Time	Litres	Time	Litres	Time	Litres	Time	Litres
Taxi Take-Off	:		:		:		:	
Route	:		:		:		:	
Approach Landing	:		:		:		:	
Alternate	:		:		:		:	
Sub Total	:		:		:		:	
Cont Reserve	:		:		:		:	
Fixed Reserve	:		:		:		:	
Total Fuel Required	:		:		:		:	
Excess	:		:		:		:	

Objective

1. To carry out a precautionary landing applying a safe procedure.
2. To make safe decisions as to the suitability of the landing area.

Considerations

1. Weather
    a. Minima, planning, backdoor open, "watch for get home it is"
2. Lost
    a. Maintain situational awareness = positional awareness against time
3. Fuel
    a. Fly to an endurance, use a conservative consumption rate

Considerations

Daylight

Refer to Waikato Aviation Safe Operation Requirements Manual (SOR) manual for last landing time requirements section 12

- **Training pilots** must be on the ground **30 minutes** before Evening Civil Twilight (ECT) when operating in the circuit and must have joined the circuit 45 minutes before ECT when arriving at the destination aerodrome from a local or cross-country flight.
- **Licenced pilots** must be on the ground **15 minutes** before Evening Civil Twilight (ECT) when operating in the circuit and must have joined the circuit 30 minutes before ECT when arriving at the destination aerodrome from a local or cross-country flight.

Always plan a **last take-off time** to ensure you are situationally aware of your ECT and flight leg time.

Low Flying Consolidation

Objective

1. To carry out a precautionary landing applying a safe procedure.
2. To make safe decisions as to the suitability of the landing area.

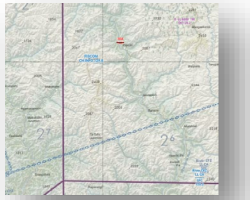
Considerations

1. Weather
   a. Minima, planning, backdoor open, "watch for get home it is"
2. Lost
   a. Maintain situational awareness = positional awareness against time
3. Fuel
   a. Fly to an endurance, use a conservative consumption rate
4. Daylight
   a. Know your last landing time, plan a last take-off time which his conservative

Considerations

Critical elements

- **Accurate knowledge of your position**



- **Fuel**

- **Daylight**

- **Pilot wellbeing (stress/fatigue or health)**

If one of the above critical elements is significantly compromised, you should consider a precautionary landing

1. Slow to poor visibility configuration
2. Carry out the procedure methodically as learnt
3. Make sure you don't rush it – it can take up to 15 – 20 minutes

WAIKATO AVIATION ACADEMY

Low Flying Consolidation

Objective

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2. To make safe decisions as to the suitability of the landing area.

Considerations

1. Weather
   a. Minima, planning, backdoor open, “watch for get home it is”
2. Lost
   a. Maintain situational awareness = positional awareness against time
3. Fuel
   a. Fly to an endurance, use a conservative consumption rate
4. Daylight
   a. Know your last landing time, plan a last take-off time which his conservative
5. Critical elements
   a. Knowledge of location
   b. Fuel
   c. Daylight
   d. Pilot stress, fatigue and health

Aircraft Management

1. **Fuel management** – lower fuel burn, endurance increase but range decrease. Plan your fuel state using endurance but at a conservative consumption rate.
2. **Poor visibility** configuration.
3. **Be seen** – lights, consider marking your position on V2 track or even pushing V2 emergency button if you feel you are low on options and/or the safety of the flight is of concern.

Airmanship and Human Factors

1. **Good assessment and planning** is important, and make early decisions
2. Be aware of the **wind**
3. Make sure you **assess for obstacles** on approach and go around areas
4. Don’t forget **passenger brief and normal checks**
5. Take your time, **be methodical** making sure you assess the situation and make clear decisions. Therefore, you should **overlearn** the procedure
6. Watch out for **stress** and the impact this has on your decision making.

Low Flying Consolidation

Objective

1. To carry out a precautionary landing applying a safe procedure.
2. To make safe decisions as to the suitability of the landing area.

Considerations

1. Weather
   a. Minima, planning, backdoor open, “watch for get home it is”
2. Lost
   a. Maintain situational awareness = positional awareness against time
3. Fuel
   a. Fly to an endurance, use a conservative consumption rate
4. Daylight
   a. Know your last landing time, plan a last take-off time which his conservative
5. Critical elements
   a. Knowledge of location, Fuel, Daylight, Pilot stress, fatigue and health

Air Exercise

1. Carry out in LFA
2. Complete checks and radio calls
3. Commence scenario at 4-500ft agl in poor visibility configuration
4. Low pass at 200ft agl

Aircraft Management

Fuel management

Poor visibility configuration

Be seen

Airmanship and Human Factors

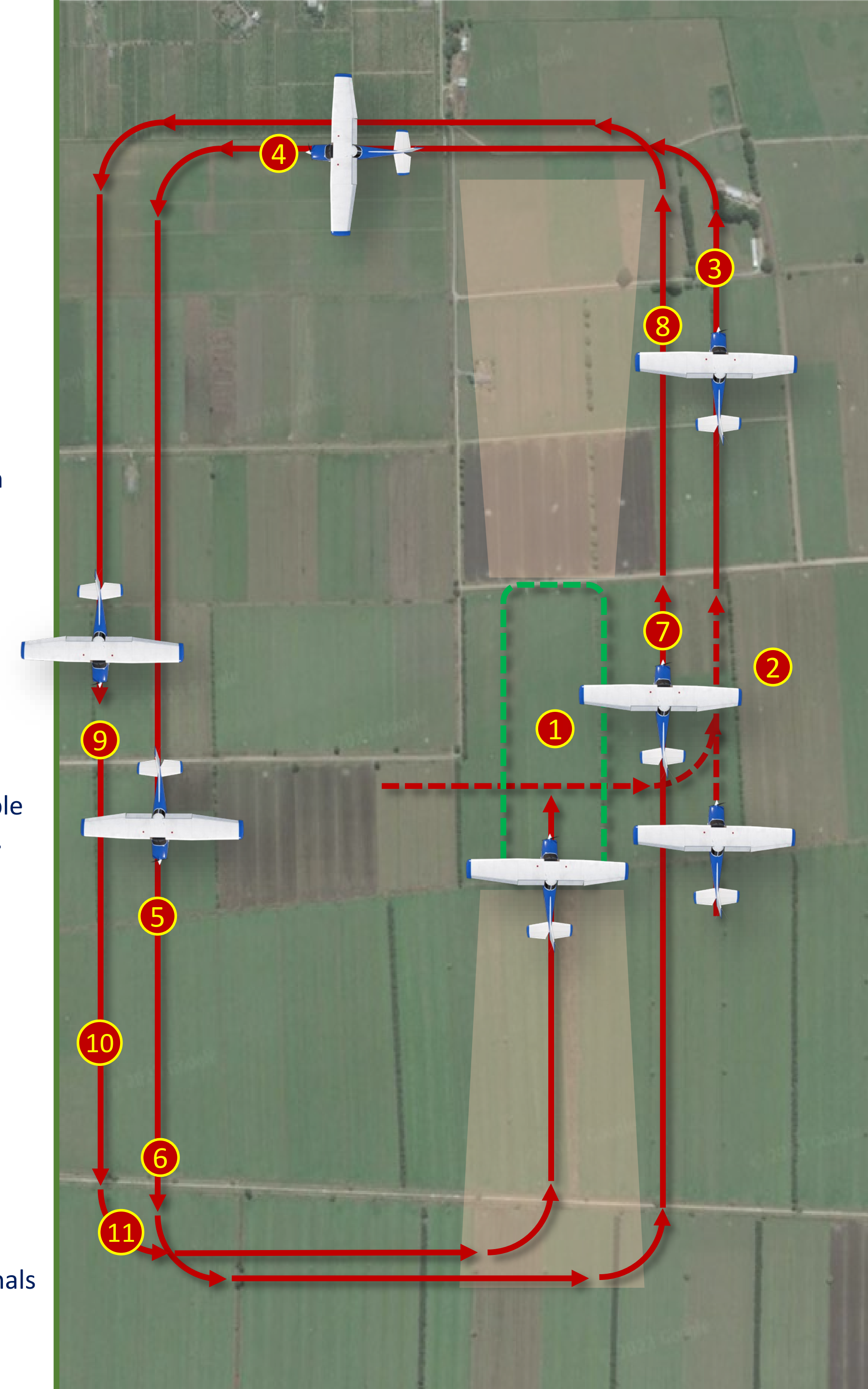
Planning, assessment and wind

Cautious with obstacles

Carry out normal checks

Be methodical, watch stress with PDM

1. **Select Wind & landing area**
   7 x S’s, C and E
2. **Orientate into wind**
   Landing area to left
   Check **size** and **surface**
   Confirm DI heading
3. **Upwind**
   Check climb out for obstacles
4. **Crosswind**
   Track out to a downwind
   Use DI to assist with direction
5. **Downwind**
   Check **slope** and **surrounds**
   Approach area for obstacles
6. **Decision #1**
   Safe to carry out a low pass
7. **Low Pass – 200ft agl**
   Start descent on finals
   Must be level and speed stable before reaching start of pass.
   Re-set Datum power.
8. **Climb back to 500ft agl**
9. **Decision #2**
   Safe to carry out a landing
10. **Communicate**
    PAN PAN - ATC contact
    V2 Emergency button, ELT
    Passenger Brief
11. **Checks**
    Pre-landing
    Consider OFF checks short finals



Short Field Take-off and Precision Landing

Objective

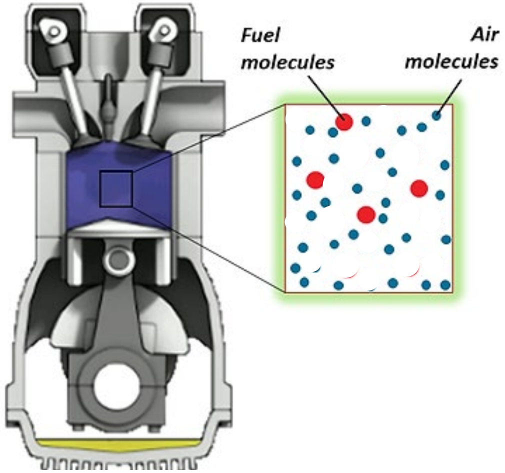
1. To ensure by calculation that there is adequate runway length for take-off and landing in accordance with the aeroplane's performance data.
2. To apply sound decision-making principles before adopting the recommended procedure for take-off or approach for a runway of minimal length
3. To operate the aeroplane in accordance with the manufacturer's recommended short-field techniques in order to obtain the best possible performance.

Take-off considerations

Temperature

The most important effect of temperature is to change density. An increase in temperature results in a decrease in density.

Engine performance is affected by air density calibrated from the standard temperature of 15^{o}C. Therefore, a correction is required using the OAT or METAR weather report.



↑ Temperature

Reduced air density

Reduced power

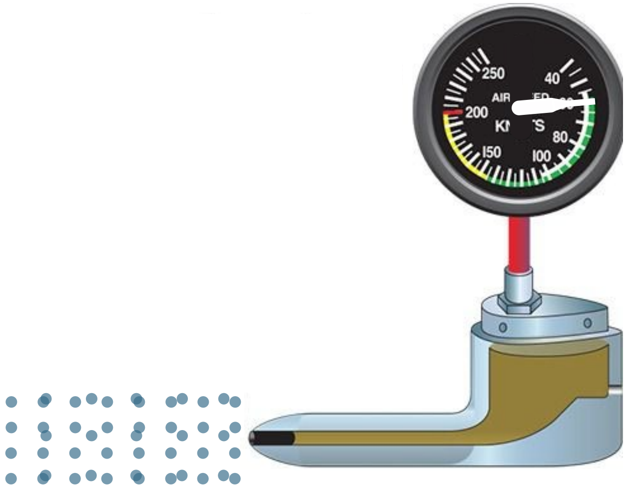
Reduced take-off performance

Density

As the air density decreases, indicated airspeed (IAS) also decreases.

The TAS will need to be increased to achieve the same IAS e.g. IAS for Vr.

This increases the length of the take-off roll required (TORR)



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Take-off

Temperature	↑ Temperature = ↓ density. Correct with OAT/METAR
Density	↓ Density ↓ IAS = ↑ TAS = ↑ TORR. Power critical

Take-off considerations

Pressure altitude

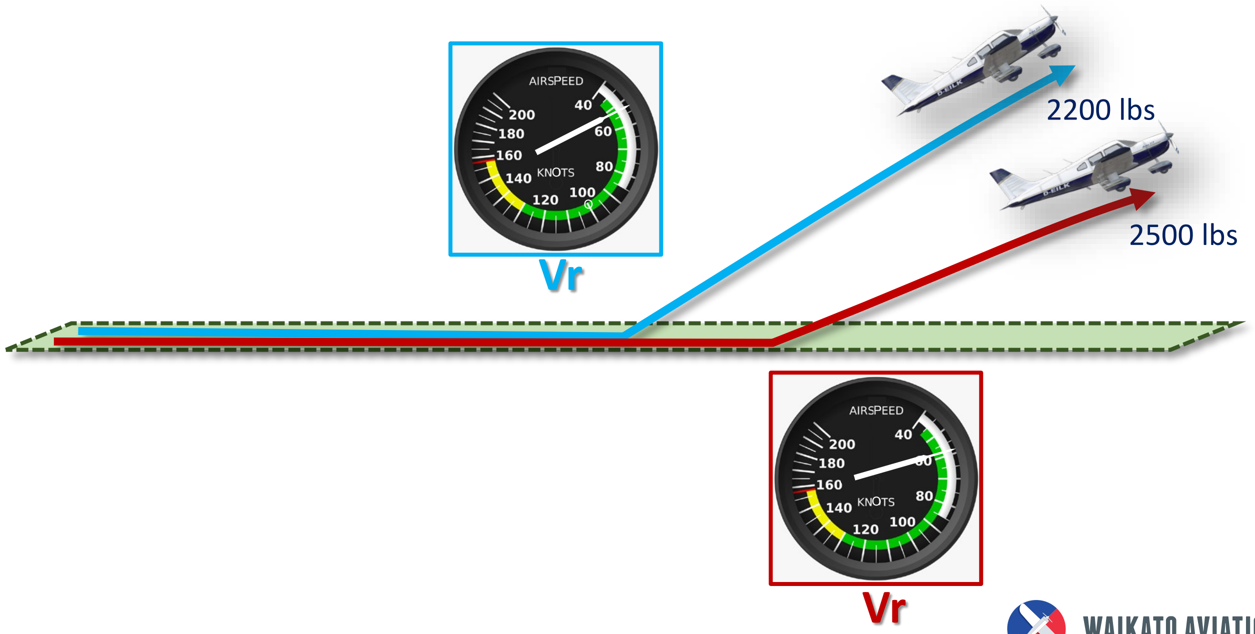
Corrects airfield elevation under the existing conditions to an elevation within the standard atmosphere

Setting 1013 hpa on the subscale of an altimeter, the altimeter will read pressure altitude, or you can apply the ambient pressure to the elevation to calculate pressure altitude.

Aircraft weight

The heavier the aircraft, the more lift is required to overcome the weight. This additional lift requires more airspeed and therefore more distance to achieve the additional airspeed.

Therefore, weight directly affects take-off and climb performance



Short Field Take-off and Precision Landing

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Take-off

Temperature	↑ Temperature = ↓ density. Correct with OAT/METAR
Density	↓ Density ↓ IAS = ↑ TAS = ↑ TORR. Power critical
Pressure Alt	Corrects elevation within the standard atmosphere
Weight	↑ Weight, ↑ TORR and ↓ ROC

Take-off considerations

Runway surface

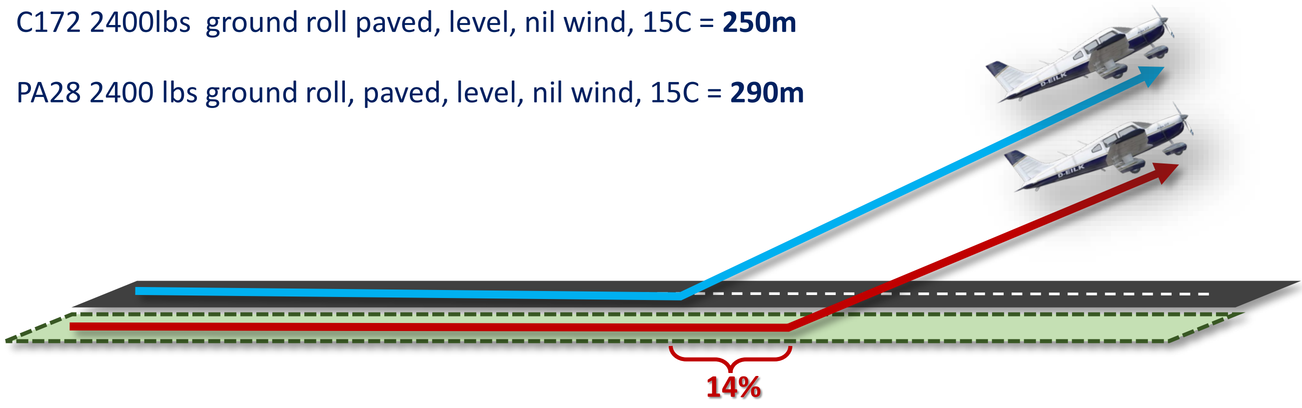
Take-off roll is less on a firm and sealed surface compared to a soft or grass surface.

The take-off surface factor for a hard firm surface is 1.00, whereas short grass is 1.14.

Grass surface is defined as short dry grass

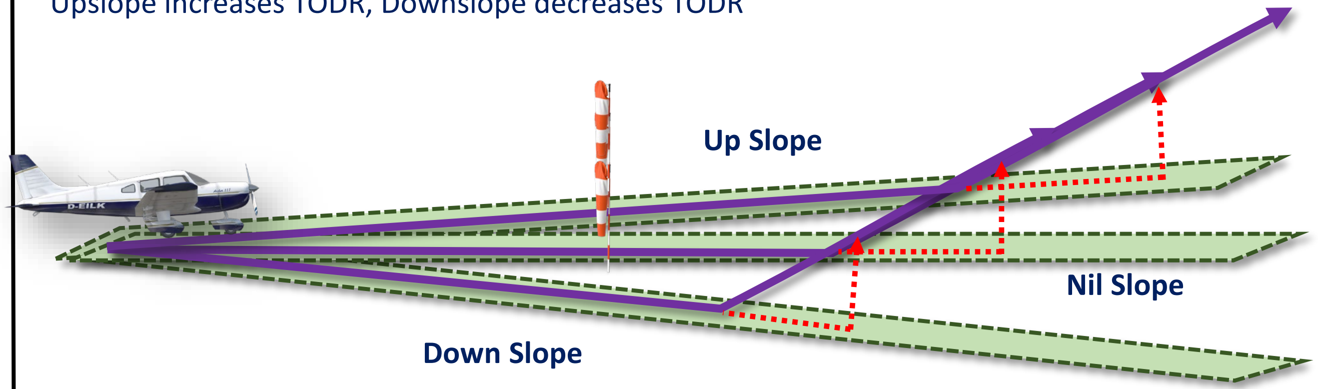
C172 2400lbs ground roll paved, level, nil wind, 15C = **250m**

PA28 2400 lbs ground roll, paved, level, nil wind, 15C = **290m**



Slope

Upslope increases TODR, Downslope decreases TODR



WAIKATO AVIATION ACADEMY

Short Field Take-off and Precision Landing

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3. To operate the aeroplane in accordance with the manufacturer's recommended short-field techniques in order to obtain the best possible performance.

Take-off

Temperature	↑ Temperature = ↓ density. Correct with OAT/METAR
Density	↓ Density ↓ IAS = ↑ TAS = ↑ TORR. Power critical
Pressure Alt	Corrects elevation within the standard atmosphere
Weight	↑ Weight, ↑ TORR and ↓ ROC
Surface	↑ TORR compared to sealed runway, short grass 1.14
Slope	Up-slope ↑ TODR, Down-slope ↓ TODR

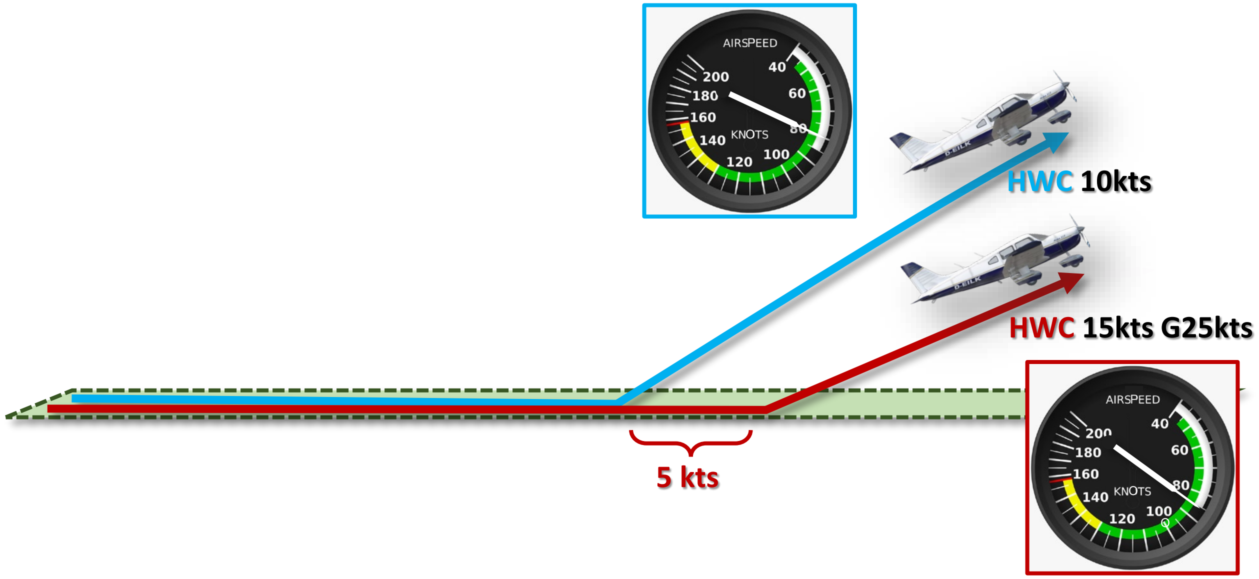
Take-off considerations

Wind

Head wind component (HWC) needs to be calculated when the wind is at an angle to the runway direction.

When the conditions are gusty, windshear might be present, and the IAS will ↑ and ↓. To counter a sudden loss of IAS in gusty conditions, higher rotate and climb speeds should be used.

Generally, for wind speeds up to 10 kts, use the AFM figures. For wind speeds above 10 kts, increase the AFM figures by ½ the gust factor or as per the AFM's recommendations.



Short Field Take-off and Precision Landing

Objective

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Slope	Up-slope ↑ TODR, Down-slope ↓ TODR
Wind	Calculate HWC. Increase speeds ½ gust factor

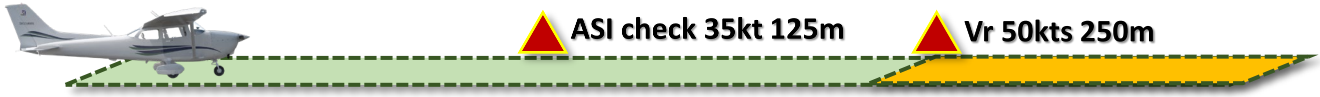
Take-off considerations

Calculation

1. Performance calculations for operations under Part 91 in NZ shall be calculated using the information in the AFM and AC91-3.
2. Performance includes take-off ground roll and the distance to climb to 50ft agl.
3. Calculated distance to 50ft assumes full power is applied before brake release and
    a. Stated flap setting is used and static RPM is achieved prior to brake release
    b. The engine and propeller are in optimal condition (i.e. like new)
4. The calculated distance to 50ft takes into account,
    a. Density altitude of the aerodrome to be used
    b. Any headwind or tailwind component
    c. The surface type and slope

Airspeed Check

At 70% of Vr, the aircraft will have achieved 50% of the TORR. C172 125m/35kts, PA28 150m/35kts. Nominate an airspeed check point and check performance during T/O roll.



Caution

1. Is the grass dry (1.14) or wet and long (??)
2. Don't round up your airspeed, fly the accurate numbers especially when only speeds for MTOW are provided.

WAIKATO AVIATION ACADEMY

Short Field Take-off and Precision Landing

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Slope	Up-slope ↑ TODR, Down-slope ↓ TODR
Wind	Calculate HWC. Increase speeds ½ gust factor

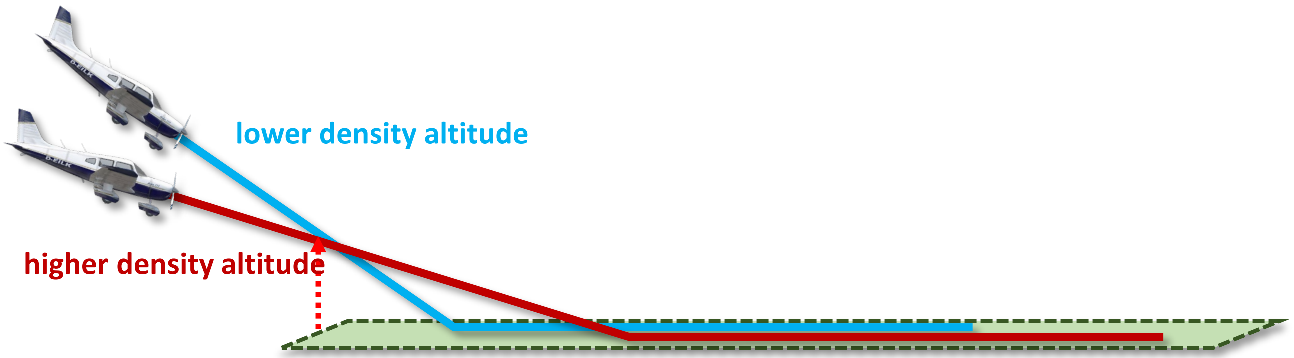
Landing considerations

Elevation or Pressure Altitude

Aerodrome elevation is normally used when calculating landing distance because engine performance is not as critical.

An increase in density altitude will mean that a higher TAS will be required which translates to a longer landing distance.

Some AFMs use PA in their calculations in which case the AFM system should be followed.



Weight

The heavier the aircraft, the greater the inertia and therefore a longer distance is required to stop the aircraft.

Runway surface

The landing roll is reduced on a firm dry surface compared with a grass or wet surface because of the improved braking action. Remember that grass is defined as short dry grass.

Slope

An up slope decreases the landing distance, and a down slope increases it.

Short Field Take-off and Precision Landing

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Slope	Up-slope ↑ TODR, Down-slope ↓ TODR
Wind	Calculate HWC. Increase speeds ½ gust factor

Landing

Elevation/PA	↑ Elevation = ↑ LDR. PA maybe used. Check AFM
Weight	↑ Inertia ↑ LDRR
Surface	↑ LDRR due to reduced braking action
Slope	Up-slope ↓ LDR, Down-slope ↑ LDR

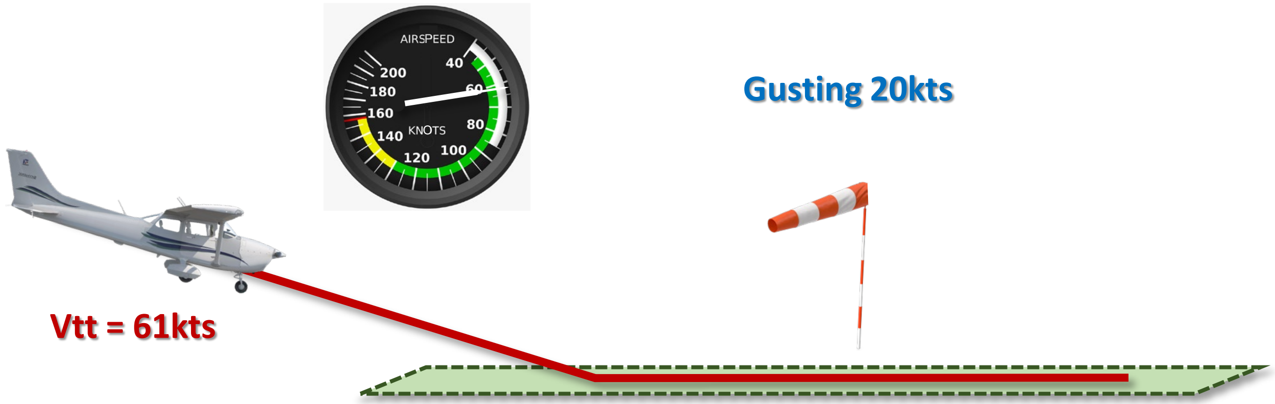
Landing considerations

Wind

Head wind component (HWC) needs to be calculated when the wind is at an angle to the runway direction.

When the conditions are gusty, windshear might be present, and the IAS will ↑ and ↓. To counter a sudden loss of IAS in gusty conditions, higher approach and threshold speeds should be used.

Generally, for wind speeds up to 10 kts, use the AFM figures. For wind speeds above 10 kts, increase the AFM figures by ½ the gust factor or as per the AFM's recommendations.



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Landing

Elevation/PA	↑ Elevation = ↑ LDR. PA maybe used. Check AFM
Weight	↑ Inertia ↑ LDRR
Surface	↑ LDRR due to reduced braking action
Slope	Up-slope ↓ LDR, Down-slope ↑ LDR
Wind	Calculate HWC. Increase VTT by ½ gust factor

Landing considerations

Calculation

1. Performance calculations for landing operations under Part 91 in NZ shall be calculated using the information in the AFM and AC91-3.
2. Landing performance includes distance to descend from 50ft to touchdown and the ground roll.
3. Calculated distance from 50ft assumes
   a. Correct airspeed as per AFM at 50ft, this is called Velocity target threshold (Vtt)
   b. Stated flap setting is selected
4. The calculated distance from 50ft takes into account,
   a. Airfield elevation (or PA)
   b. Any headwind or tailwind component
   c. The surface type – (Grass 1.18 = 18% factor)
   d. The surface slope – (each percentage of slope = 5% factor)

Caution

1. Crossing the threshold higher than 50 ft, using less than full flap, or crossing the threshold at a higher airspeed, will increase the landing distance.

Short Field Take-off and Precision Landing

Objective

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Considerations

Take-off

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Landing

Elevation/PA	↑ Elevation = ↑ LDR. PA maybe used. Check AFM
Weight	↑ Inertia ↑ LDRR
Surface	↑ LDRR due to reduced braking action
Slope	Up-slope ↓ LDR, Down-slope ↑ LDR
Wind	Calculate HWC. Increase VTT by ½ gust factor

Aircraft Management

Full power – before brake release – check for Static RPM (see AFM).

Flaps - visually check that flaps are selected to the take-off position.

Airmanship and Human Factors

Careful consideration of **airspeed selection** required in relation to strong and windy conditions.

Caution with Vx climbs in the situation of an EFATO. Immediate reaction required to lower the aircraft nose to avoid stalling the aircraft. Forward vision maybe hampered by Vx climb attitudes after take-off.

Stabilise the approach early and select an altitude gate turning finals that will establish the aircraft on the correct 3^{o} profile.

Illusions can be present in terrain which may require cross referencing of instruments, especially VSI.

Never attempt a take-off or landing if the performance calculations are not favourable with some **margin.**

Circuits Introduction

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Considerations

Take-off

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Density	↓ Density ↓ IAS = ↑ TAS = ↑ TORR. Power critical
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Landing

Elevation/PA	↑ Elevation = ↑ LDR. PA maybe used. Check AFM
Weight	↑ Inertia ↑ LDRR
Surface	↑ LDRR due to reduced braking action
Slope	Up-slope ↓ LDR, Down-slope ↑ LDR
Wind	Calculate HWC. Increase VTT by ½ gust factor

Aircraft Management

Full power check

Flaps check

Airmanship and Human Factors

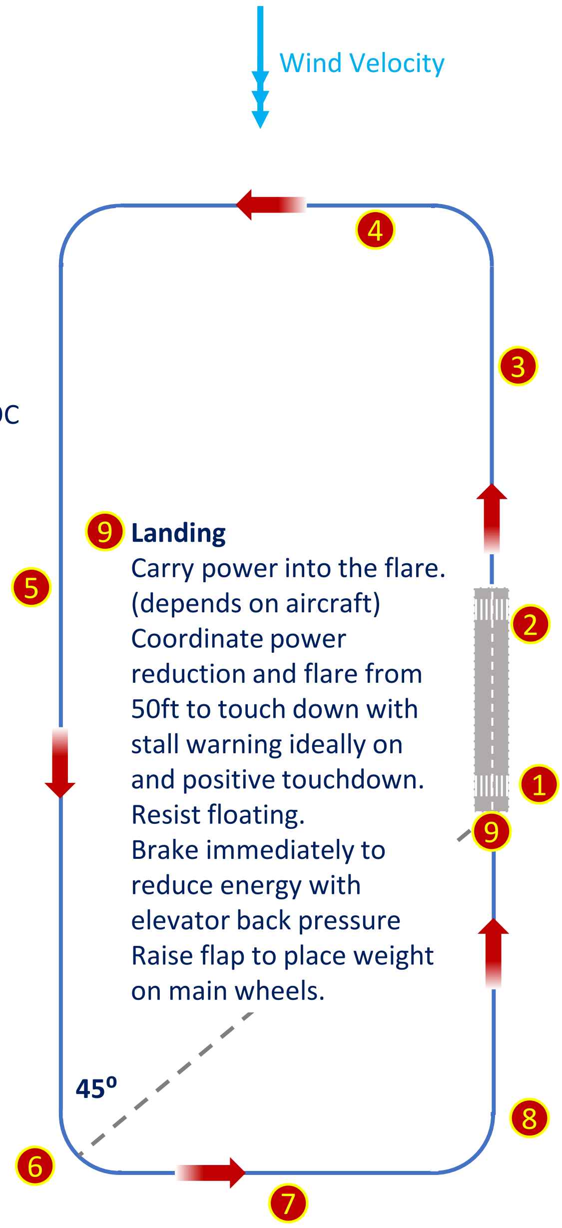
Consider airspeeds in gusty conditions

Careful with Vx climbs, lookout and EFATO

Stabilise approach from base leg

Watch for illusions cross reference instr.

Air Exercise



4 Crosswind
Heading on reference
Turn downwind – correct width

3 Climb out
Clear of obstacles
Accelerate and then retract flap in stages
Safe height, speed, +ROC

2 Take-off roll
Weight off nose wheel
Rotate at Vr
Accelerate to Vx
Check balance

1 Take-off checks
Reference points
Airspeed check points
Static RPM check
Engine checks

5 Downwind
Consider illusions
Select approach speeds
Select aiming/touchdown point and 50ft point.
"Down and braking by" – decision point

6 Base turn
Delay turn onto base to enable a more powered approach.

7 Base leg
Target gate altitude to place aircraft on correct profile

8 Finals
Stabilise Vtt early
Check stable at 200ft agl or go around.
Locate 50ft point and touchdown point.

9 Landing
Carry power into the flare. (depends on aircraft)
Coordinate power reduction and flare from 50ft to touch down with stall warning ideally on and positive touchdown.
Resist floating.
Brake immediately to reduce energy with elevator back pressure
Raise flap to place weight on main wheels.

IF Introduction

Objective

1. To experience the sensory illusions that occur when deprived on visual references.
2. To maintain straight and level flight, climb, descend and carry out turns by sole reference to the aeroplane's instruments.

Considerations

Power + Attitude = Performance

Control instruments

Attitude indicator

Tachometer

Performance instruments

Airspeed indicator (ASI)

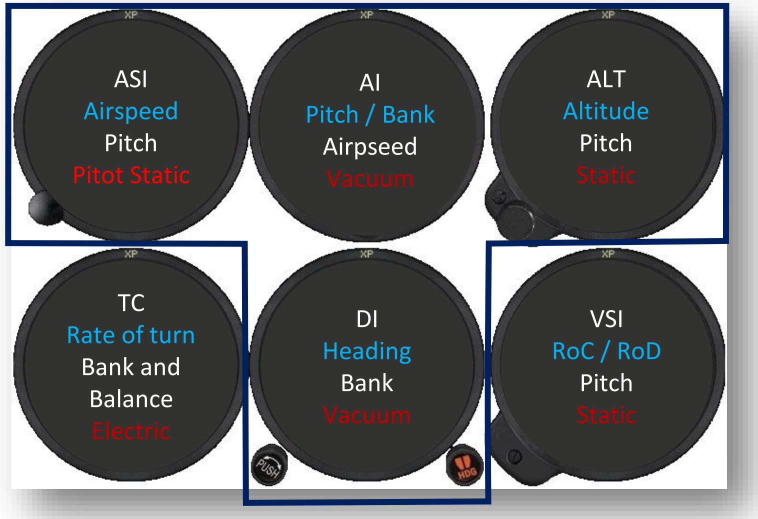
Altimeter

Directional indicator (DI)

Turn coordinator (TC)

Balance indicator

Vertical speed indicator (VSI)



Instrument layout

Basic T plus TC, VSI and RPM

Objective

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Considerations

Power + Attitude = Performance

Control Instruments = Attitude indicator and RPM

Performance Instruments = Altimeter, Vertical speed indicator, Direction Indicator, Turn and Bank Indicator and Airspeed Indicator

Instrument Layout – Basic Six Instruments, Basic T

Considerations

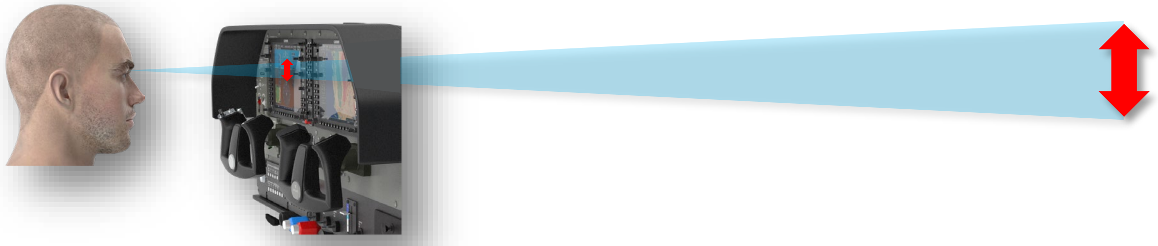
Instrument lag

All instruments have lag (delay in indicating correct information)

The vertical speed indicator has significant lag and must be checked against other indications/information.

Accuracy and sensitivity

Selecting pitch and roll attitudes on the AH will require finer selection and adjustment as compared to the normal visual attitude you have used so far.



IF Introduction

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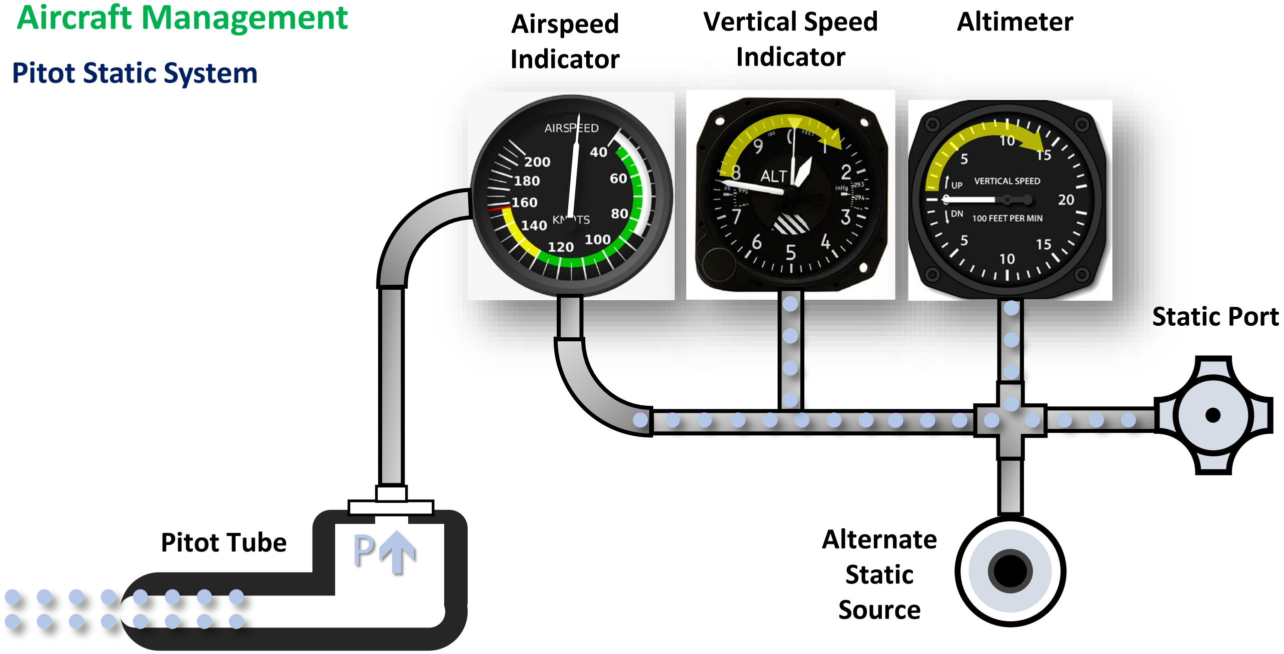
Instrument Layout – Basic Six Instruments, Basic T

Instrument Lag – especially VSI

Accuracy and sensitivity

Aircraft Management

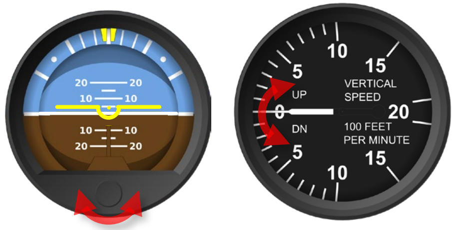
Pitot Static System



Instrument calibration check

When the aircraft is sitting level on the ground and you are seated, set the attitude indictor to 0^{o} pitch attitude.

Observe where the VSI needle is resting on the ground.



Instrument taxi check

Carry out an instrument check to confirm serviceability of instruments prior to flight.

IF Introduction

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Instrument Layout – Basic Six Instruments, Basic T

Instrument Lag – especially VSI

Accuracy and sensitivity

Aircraft Management

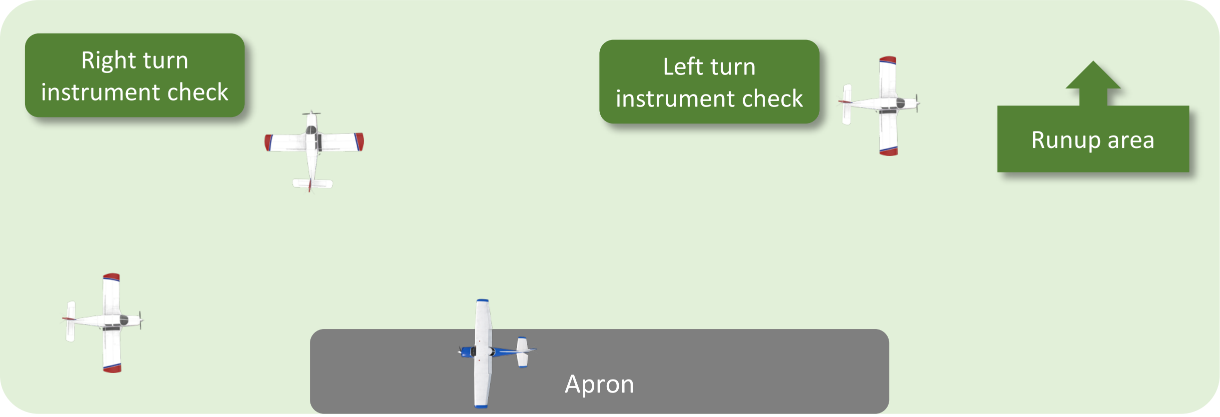
Pitot static system

Instrument calibration check

Instrument taxi check

Airmanship

Instrument check – Carry out during 60-90^{0} turns, one left and one right hand as you taxi out to the runup area. Turning through 60-90 gives you more time to check on the instruments. Do not carry out this check until you are clear of the ramp area/risks. **Keep eyes outside**



Peripheral vision – is not available when simulating IFR or when in IMC conditions. Visual field is narrow focused on the aircraft's instruments

Inertia – greater awareness of inertia as you select attitudes and turn the aircraft. Important to

Select Attitude → **Hold Attitude** → **Adjust Attitude** → **Trim Attitude**

Hold Attitude: Stabilise IAS

Adjust Attitude: Incremental

Lookout – when you instructor asks you to turn left / right to climb / descent. You are to confirm with your instructor "Cleared Left" or "Cleared to climb" and the instructor must confirm.

WAIKATO AVIATION ACADEMY

IF Introduction

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Aircraft Management

Pitot static system

Instrument calibration check

Instrument taxi check

Airmanship

Instrument check

Visual field is narrow, no peripheral vision

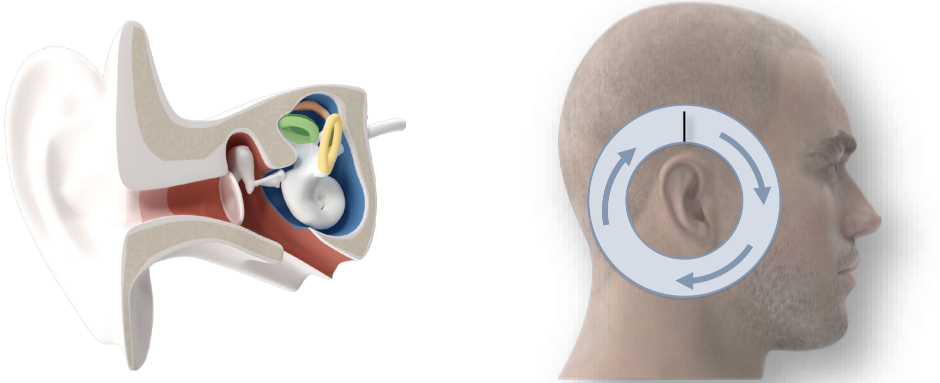
Aircraft inertia

Lookout when under simulation

Human Factors

Three sensing systems

Vestibular system – senses angular acceleration or change of direction in three planes by the movement of fluid in the semicircular canals triggering hair sensors in all three planes.



This system is limited by the inability to detect change when the direction or the angular acceleration is constant or very slow

Muscular system – pressure sensors in the nervous system detect pressure, e.g. determining whether we are standing or sitting.

The muscular system cannot differentiate directionally between increases in G force e.g. the result of pulling out of a dive or entering a steep turn.

Visual system – is the most power sensor for orientating the human and resolves ambiguous or conflicting information received by the brain.

In instrument flight conditions, the visual references used to resolve ambiguous or conflicting orientation information are not available which can cause false sensations e.g. "the leans".

Because the limitations of the human orientation system are considerable, and instrument failure is rare, **trust the instruments**

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Instrument Lag – especially VSI

Accuracy and sensitivity

Aircraft Management

Pitot static system

Instrument calibration check

Instrument taxi check

Airmanship

Instrument check

Visual field is narrow

Aircraft inertia

Lookout under simulation

Human Factors

Vestibular system

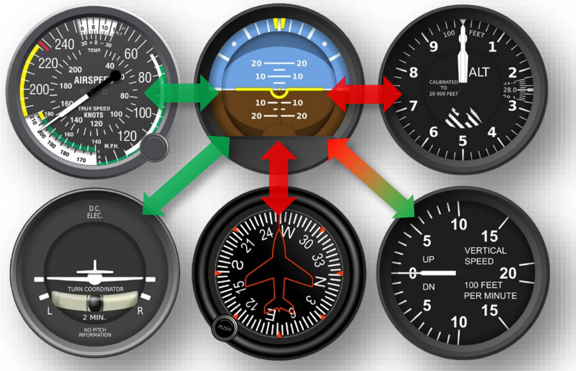
Muscular system

Visual system

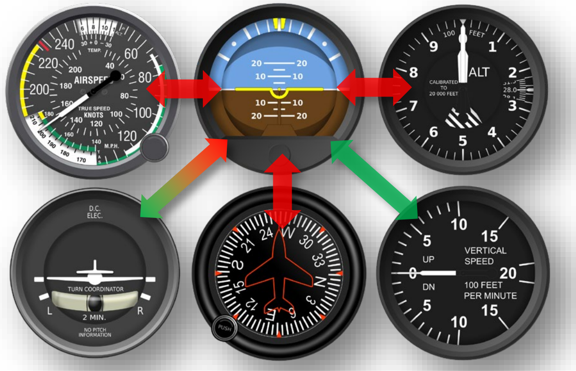
Air Exercise

Demonstrate limitations of the vestibular and muscular system

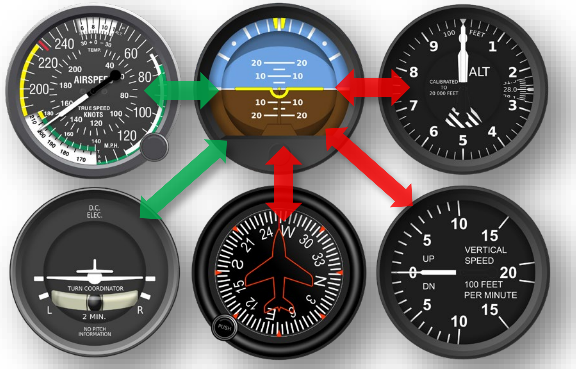
Selective Radial Scan



1. Straight and level



2. Climbing and descending



3. Rate 1 and Medium turns

Primary more frequent scan

Secondary less frequent scan

Primary on entry/exit

Select Attitude → Hold Attitude → Adjust Attitude → Trim Attitude

WAIKATO AVIATION ACADEMY

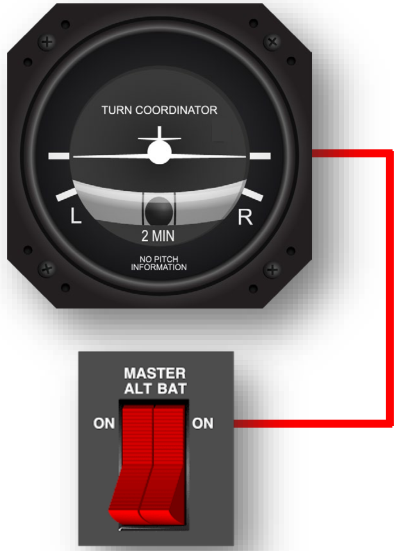
Objective

1. To maintain straight and level and climb and descend by sole reference to a limited flight instrument panel.

Considerations

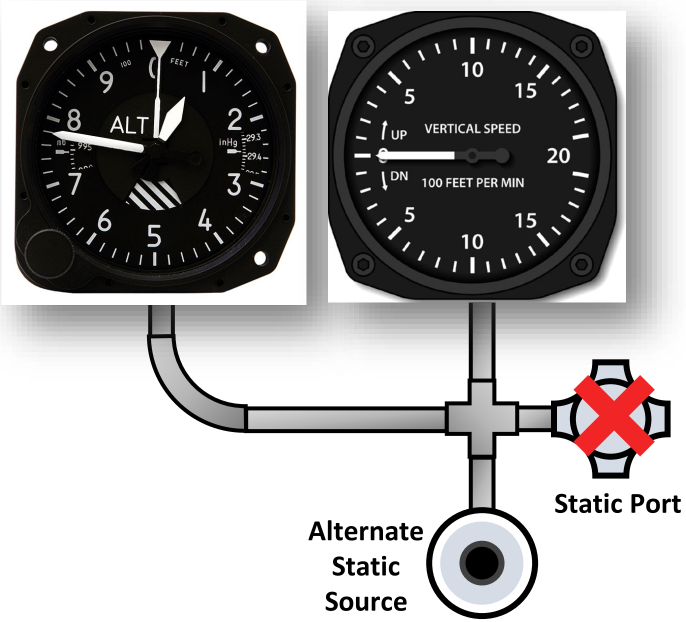
Turn coordinator

1. Electrically driven
2. Failure is shown by a warning flag
    a. Rate 1 turn can be estimated from AI TAS/10+7
3. Balance indicator will normally not fail as it does not require electrical power or suction
4. Check serviceability during taxi and SADIE checks



VSI and Altimeter

1. Rely on static pressure
2. Static pressure fails (blockage), need to open alternate static source and use AI and RPM to set climb/descent performance.
3. Inspect the static vent during preflight.



IF Limited Panel

Objective

1. To maintain straight and level flight by sole reference to a basic/limited flight instrument panel.
2. To carry out rate 1 turns onto compass headings

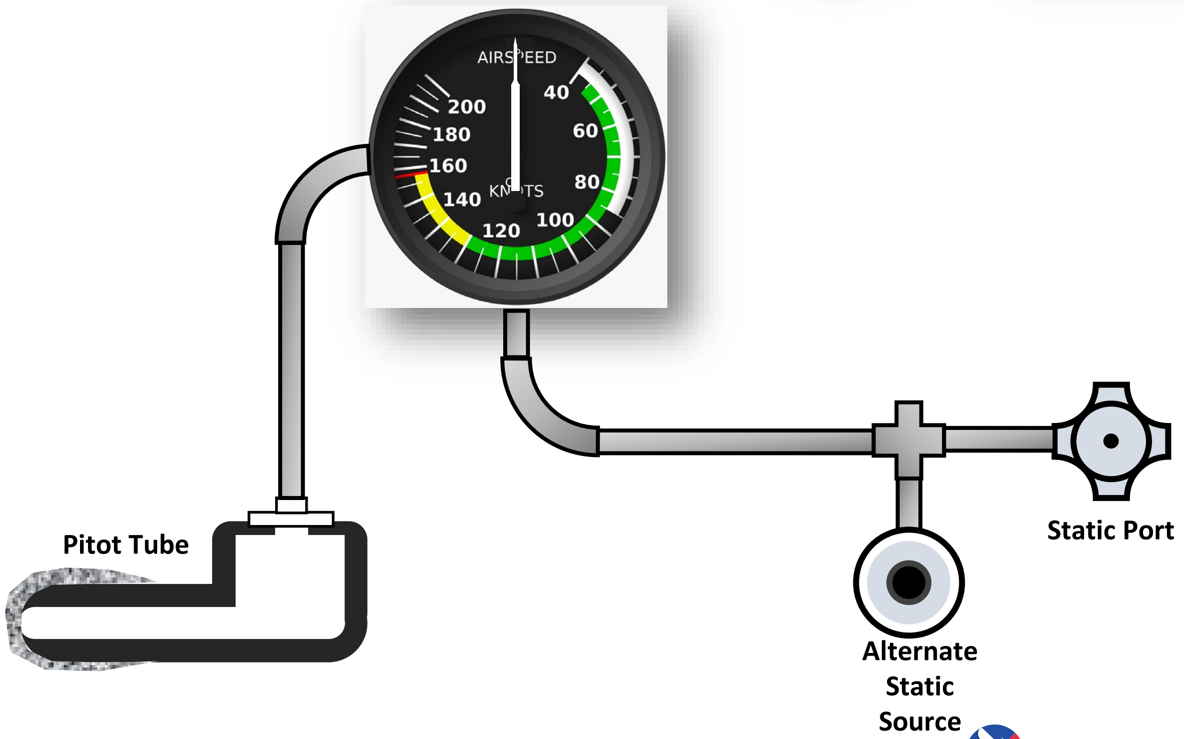
Considerations

1. Turn coordinator – electric, red failure flag, Rate 1 = 15^{o} AoB, balance reliable
2. VSI and ALT – rely on static pressure, if fails use AI and RPM, inspect static vent

Considerations

Airspeed indicator

1. Requires pitot and static pressure
2. Most common blockage is ice over pitot head
   a. Will indicate wrong airspeed or zero
3. If fails, there is **no failure flag**. Need to use AI and RPM to set climb and descent performance.
4. Inspect pitot and static head during preflight.



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2. VSI and ALT – rely on static pressure, if fails use AI and RPM, inspect static vent
3. Airspeed - pitot and static pressure, ice blockage, use AI / RPM, inspect preflight

Considerations

Heading indicator

1. Called DI, DG or HSI
2. Gyro stabilised and normally powered by engine drive vacuum pump
3. Should be checked for alignment to DI every 15 minutes
4. If fails, will slowly run down, card may spin
5. If fails, will need to use the magnetic compass
6. Checked during taxi and SADIE checks.

Attitude indicator

1. AH
2. Normally driven by engine driven vacuum pump
3. May have a failure flag
4. If fails, will need to use indirect information for performance instruments
5. Checked during taxi and SADIE checks.

Objective

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Considerations

1. Turn coordinator – electric, red failure flag, Rate 1 = 15^{0} AoB, balance reliable
2. VSI and ALT – rely on static pressure, if fails use AI and RPM, inspect static vent
3. Airspeed - pitot and static pressure, ice blockage, use AI / RPM, inspect preflight
4. DI – gyro stabilised, vacuum pump, fails use compass, taxi and SADIE checks
5. AI – driven by vacuum pump, may have flag, fails use performance instruments, taxi and SADIE checks.

Aircraft Management

1. Electrical system failure may affect other instruments.
    a. Instruments affected depends on when the instrument system is conventional or EFIS

2. Static system has a backup selection which is normally located inside the cabin. Slight correction may need to applied to instrument readout if selected on. Refer AFM.
3. Vacuum pump can fail, therefore vacuum suction should be checked regularly as part of SADIE checks.

4. Pitot head is heated and should be turned on when OAT is below 5^{0}C and visible moisture is observed e.g. in rain or if approved to fly in cloud.
5. Regularly check that the DI is aligned to the magnetic compass.

IF Limited Panel

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3. Airspeed - pitot and static pressure, ice blockage, use AI / RPM, inspect preflight
4. DI – gyro stabilised, vacuum pump, fails use compass, taxi and SADIE checks
5. AI – driven by vacuum pump, may have flag, fails use performance instruments, taxi and SADIE checks.

Aircraft Management

Electrical and Pitot Static systems

Vacuum system

Pitot Heat

Align DI

Airmanship and Human Factors

Instrument check - It is important to check on the serviceability of the instruments prior to flight

Develop a **systematic instrument scan**

Trust the instruments

If an instrument fails, **cover it up** in flight so that it does not confuse your interpretation of the instruments.

When selecting an attitude without the AI, slowly and smoothly select the required attitude using the ASI (**make incremental changes**).

WAIKATO AVIATION ACADEMY

IF Limited Panel

Objective

1. To experience the sensory illusions that occur when deprived on visual references.
2. To maintain straight and level flight, climb, descend and carry out turns by sole reference to the aeroplane's instruments.

Considerations

Power + Attitude = Performance

Control Instruments = Attitude indicator and RPM

Performance Instruments = Altimeter, Vertical speed indicator, Direction Indicator, Turn and Bank Indicator and Airspeed Indicator

Instrument Layout – Basic Six Instruments, Basic T

Instrument Lag – especially VSI

Accuracy and sensitivity

Aircraft Management

Electrical and Pitot Static systems

Vacuum system

Pitot Heat

Align DI

Airmanship and Human Factors

Instrument check prior to flight

Systematic instrument scan / Trust

Cover up a failed instrument

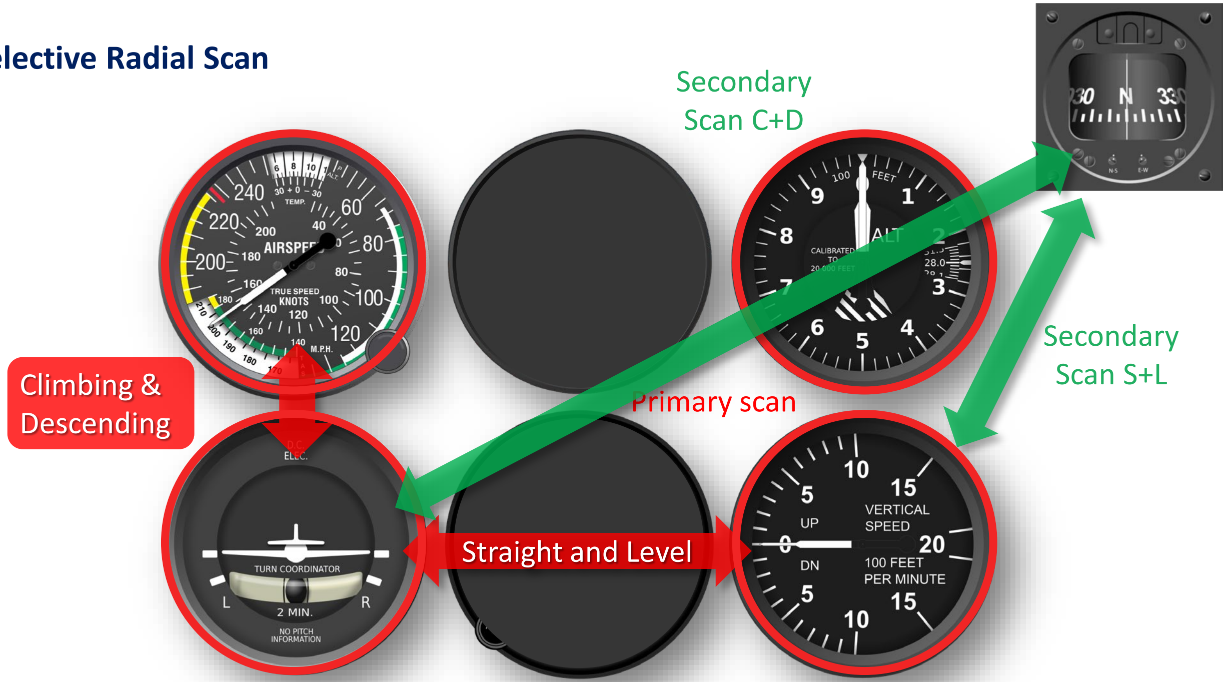
Limited panel, incremental changes

Air Exercise

Simulate vacuum system failure (or failure of the AI and DI)

Pitch	ASI, ALT, VSI, RPM
Bank	TC, Compass
Yaw	Balance

Selective Radial Scan



Select Attitude → Hold Attitude → Adjust Attitude → Trim Attitude

IF Compass Turns

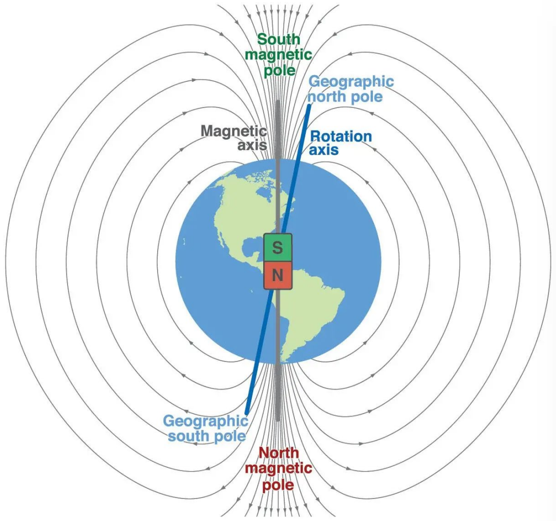
Objective

1. To turn onto compass headings compensating for known errors in the magnetic compass when under limited panel.

Considerations

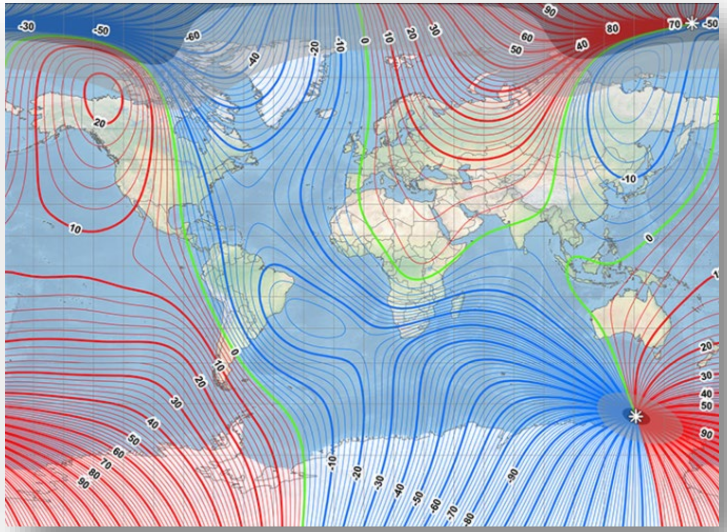
Earth's Magnetic Field

1. Variation is the difference between true North and Magnetic North
2. Bar magnet will align itself with the lines of magnetic flux.



Easterly variation

Westerly variation



Deviation

1. Aircraft compass acted on by other than the lines of flux, i.e. metal objects, aircraft electrical systems.
2. Compensated for by a compass swing which is carried out by an aircraft engineer with all electrical systems working. Compass deviation card provides correction for residual magnetism in the aircraft..

Objective

1. To turn onto compass headings compensating for known errors in the magnetic compass when under limited panel.

Considerations

1. Earths magnetic field. Lines of flux and variation
2. Compass deviation due to residual magnetism in the aircraft

Considerations

Dip

1. At magnetic equator magnetic flux lines are parallel with the surface of the earth
2. As they approach the magnetic poles they dip down towards the earth's surface
3. A bar magnet will try and align itself with the lines of flux dip towards the earth's surface. It will be inclined at an angle of dip
4. To compensate for dip, the bar magnet is set on a pivot and is weighted to reduce the influence of dip, but some dip remains
5. This pivot arrangement is designed to be low friction and is therefore unstable, so the compass card and magnets are immersed in fluid that dampens out oscillations – also providing lubrication

IF Compass Turns

Objective

1. To turn onto compass headings compensating for known errors in the magnetic compass when under limited panel.

Considerations

1. Earths magnetic field. Lines of flux and variation
2. Compass deviation due to residual magnetism in the aircraft
3. Dip – compass design to compensate for dip

Considerations

Compass Errors

Due to the angle of dip, the centre of gravity of the compass card and the pivot point do not act through the same point.

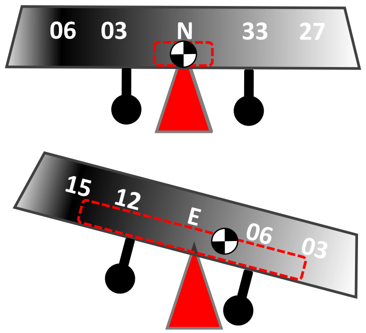
Turning Error - ONUS

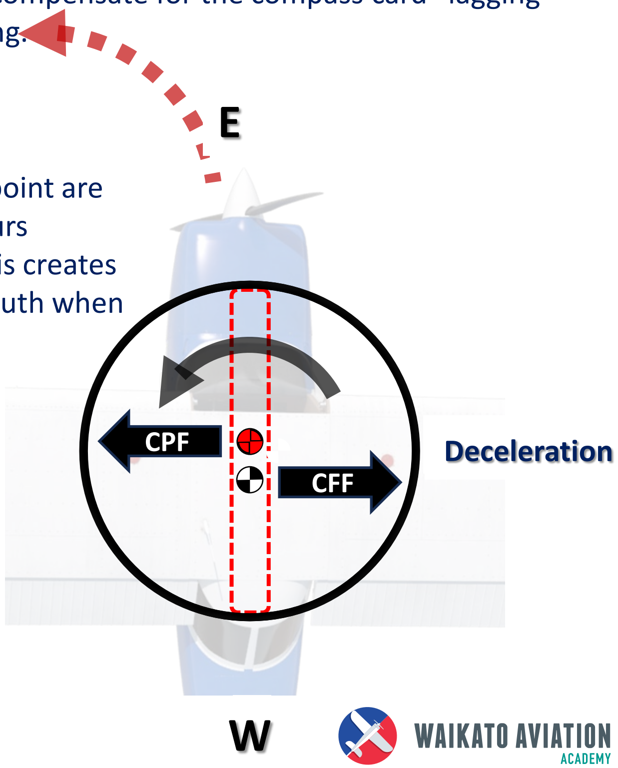
The centripetal forces acts through the pivot point and the centrifugal force acts through the centre of gravity. The creates a turning moment which is greatest when the CoG and pivot point are both tangential to the centre of the turn. This occurs when heading North or South where the turning error at a Rate 1 turn is 30^{o} reducing to 0^{o} heading East or West.

To compensate – overturn to compensate for the compass card “leading” when turning onto a northern hemisphere heading, and under turn to compensate for the compass card “lagging” when heading onto a southern hemisphere heading.

Acceleration and Deceleration Error - SAND

When heading East and West, the CoG and pivot point are at 90^{o} to the direction of travel. Acceleration occurs through the pivot and inertia through the CoG. This creates a turning moment which indicates a turn to the south when accelerating and north when decelerating.





WAIKATO AVIATION ACADEMY

IF Compass Turns

Objective

1. To maintain straight and level flight by sole reference to a basic/limited flight instrument panel.
2. To carry out rate 1 turns onto compass headings

Considerations

1. Earths magnetic field. Lines of flux and variation
2. Compass deviation due to residual magnetism in the aircraft
3. Dip – compass design to compensate for dip
4. Compass errors
    1. Turning errors – ONUS
    2. Acceleration and deceleration errors - SAND

Aircraft Management

1. Compass system checked for **serviceability** before flight.
    a. no leaks
    b. no air bubbles
    c. Fluid not discoloured
    d. No cracks in the glass

2. **Deviation** card valid

3. Keep metal items as far as possible away from compass e.g. headphones

4. **Suction gauge** should be checked during engine checks and indicating normal

WAIKATO AVIATION ACADEMY

IF Compass Turns

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Considerations

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3. Dip – compass design to compensate for dip
4. Compass errors
    1. Turning errors – ONUS
    2. Acceleration and deceleration errors - SAND

Aircraft Management

Compass serviceability check

Deviation card validity

Keep magnetic items distant from compass

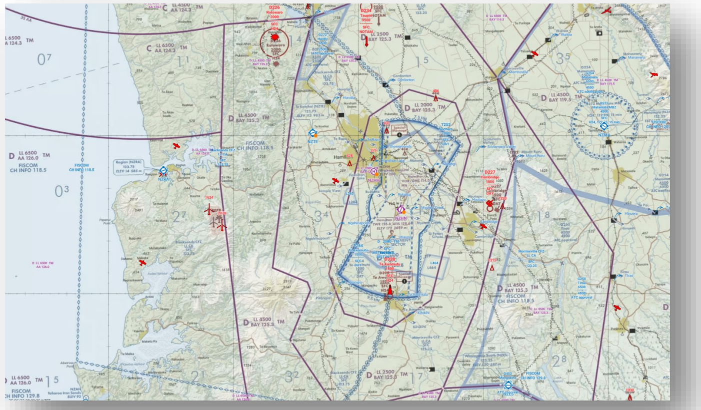
Check suction system for serviceability

Airmanship and Human Factors

Instrument check - check compass during taxi and confirm accuracy with runway alignment check, e.g. 176/356 Hamilton

Lookout during turns and confirm clear if flying with a safety pilot.

Calculate compass headings from **big picture awareness** and orientation. Resist deferring to aids to help calculate shortest distance and corrections. Practice so that you are proficient without referring to other instruments.



If an instrument fails, **cover it up** in flight so that it does not confuse your interpretation of the instruments.

WAIKATO AVIATION ACADEMY

IF Compass Turns

Objective

1. To experience the sensory illusions that occur when deprived on visual references.
2. To maintain straight and level flight, climb, descend and carry out turns by sole reference to the aeroplane's instruments.

Considerations

1. Earths magnetic field. Lines of flux and variation
2. Compass deviation due to residual magnetism in the aircraft
3. Dip – compass design to compensate for dip
4. Compass errors
    1. Turning errors – ONUS
    2. Acceleration and deceleration errors - SAND

Aircraft Management

Compass serviceability check

Deviation card validity

Keep magnetic items distant from compass

Check suction system for serviceability

Airmanship and Human Factors

Instrument check prior to flight

Confirm lookout

Big picture SA to calculate headings

Cover up failed instruments

Air Exercise

Demonstration of acceleration and deceleration errors

Demonstration of turning errors

Making a turn

1. Check present heading against desired heading and turn in shortest arc
2. Calculate amount of overturn or underturn – ONUS
3. Confirm lookout (simulated) and turn using a rate one turns
4. Anticipate roll out and select a reference point
5. Confirm wings level and in balance and hold reference point to allow compass to settle
6. Check compass and make correction at 3^{o} per second.

150

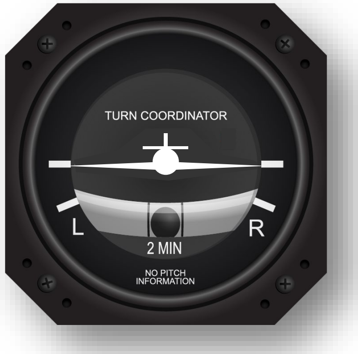
300

210

090

315

360



WAIKATO AVIATION ACADEMY

IF Unusual Attitudes

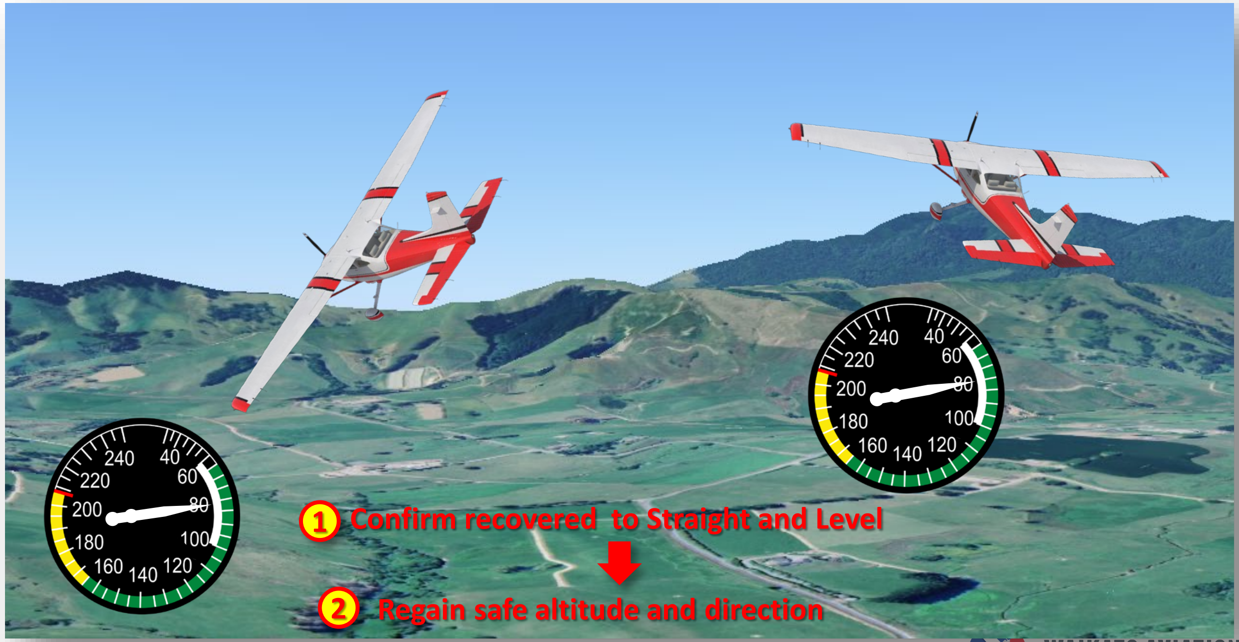
Objective

1. To recognise and recover to straight and level from a nose high or nose low unusual attitude.

Considerations

1. Entry into an unusual attitude occurs due to disorientation. This may be due to …
   a. **Distraction** (breakdown of instrument selective radial scan) due to workload and then fixation.
   b. **Stress** (accidental in cloud or poor visibility navigation)
   c. **Not trusting** the instruments (visual) rather the vestibular or muscular senses, responding to the leans.

2. Two **undesired aircraft states**
   - **High nose attitude** (approaching stall) situation
   - **Low nose attitude** (entering spiral descent) situation



IF Unusual Attitudes

Objective

1. To recognise and recover to straight and level from a nose high or nose low unusual attitude.

Considerations

1. Reasons for unusual attitude recovery
   a. Distraction
   b. Stress
   c. Not trusting instruments
2. High or Low Nose attitude recovery – recovery to Straight and Level and then regain altitude and heading

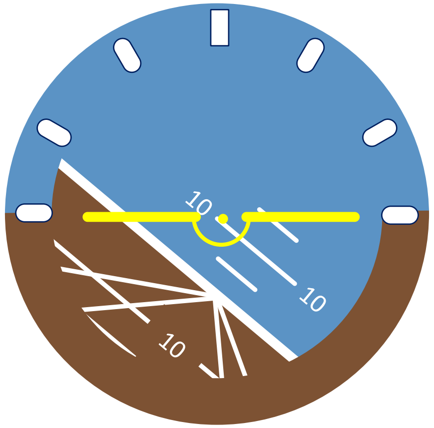
Considerations

High Airspeed – (spiral decent) apply controls in one axis of movement at a time and reduce IAS immediately with a reduction in power

a. ↓ Power **then** Roll **then** Pitch

Low Airspeed – (approaching stall) apply controls in both axis at the same time and increase IAS immediately with an addition in power after lowering the nose.

a. Pitch **and** Roll **and** ↑ Power



Roll Pitch → Hold Attitude → Adjust Attitude → Trim Attitude

IF Unusual Attitudes

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Considerations

1. Reasons for unusual attitude recovery
   a. Distraction
   b. Stress
   c. Not trusting instruments
2. High or Low Nose attitude recovery – recovery to Straight and Level and then regain altitude and heading.
3. High airspeed – power … then roll … then pitch
4. Low airspeed – roll and pitch and power

Considerations – limited panel

Nose high

1. Pitch forward, roll wings level and increase to full power
2. Continue to pitch forward progressively until altimeter stops
3. Adjust attitude on ASI incrementally to establish Straight and Level
4. Cruise power as ASI approaches cruise airspeed

Roll Pitch → Hold Attitude → Adjust Attitude → Trim Attitude

Objective

1. To recognise and recover to straight and level from a nose high or nose low unusual attitude.

Considerations

1. Reasons for unusual attitude recovery
   a. Distraction
   b. Stress
   c. Not trusting instruments
2. High or Low Nose attitude recovery – recovery to Straight and Level and then regain altitude and heading.
3. High airspeed – power … then roll … then pitch
4. Low airspeed – roll and pitch and power

Considerations – limited panel

Nose low

1. Reduce power (with increasing airspeed)
2. Roll wings level on turn coordinator (anticipate wings level position)
3. Raise nose attitude progressively until altimeter stops
4. Adjust attitude on ASI incrementally to transition to required performance
5. Climb power as ASI approaches cruise airspeed

Roll Pitch → Hold Attitude → Adjust Attitude → Trim Attitude

IF Unusual Attitudes

Objective

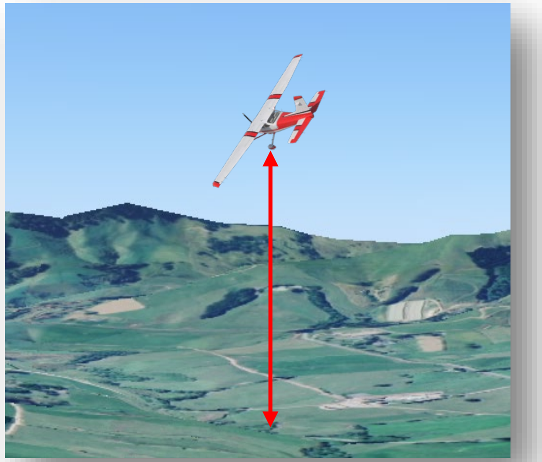
1. To recognise and recover to straight and level from a nose high or nose low unusual attitude.

Considerations

1. Reasons for unusual attitude recovery
   a. Distraction
   b. Stress
   c. Not trusting instruments
2. High or Low Nose attitude recovery – recovery to Straight and Level and then regain altitude and heading
3. High airspeed – power … then roll … then pitch
4. Low airspeed – roll and pitch and power
5. Limited Panel
   a. Power (Full - low ASI or closed - high ASI)
   b. Wings Level
   c. Pitch until altimeter stops
   d. Adjust pitch incrementally on ASI and transition/adjust to required performance
   e. Power – as ASI approaches cruise setting

Aircraft Management

Smooth and positive control movements



Airmanship and Human Factors

Confirm adequate **Height** for recovery

Maintain **selective radial scan**

Airspeed is critical to avoid high loading. With high airspeed, one control axis of movement at a time.

Limiting speeds – **Va**, **Vno**, **Vne**, and RPM limits

Our human orientation system has **limitations**

Instrument failure is rear so important to **trust the instruments**

IF Unusual Attitudes

Objective

1. To recognise and recover to straight and level from a nose high or nose low unusual attitude.

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   b. Wings Level
   c. Pitch until altimeter stops
   d. Adjust pitch incrementally on ASI and transition/adjust to required performance
   e. Power – as ASI approaches cruise setting

Aircraft Management

Smooth and coordinated controls

Airmanship and Human Factors

Confirm minimum height

Airspeed critical careful Va, Vno, Vne

Limited panel use altimeter for pitch

Trust your isnstruments

Air Exercise

Smooth control movements whenever airspeed is above Va.

Attitude	Recognition	Recovery
Nose High 	Low and decreasing IAS Increase in altitude Increase rate of climb Decrease in RPM	1. Pitch forward, level wings, full power 2. *Pitch forward until Alt/ASI stops* 3. Hold ➔ Check ➔ Adjust 4. Approaching cruise airspeed, reduce power 5. Trim
Nose Low 	High and increasing IAS Decrease in altitude Increase rate of descent Increase in RPM	1. Reduce power then level wings then pitch to S+L then climb attitude 2. *Pitch up until Alt/ASI stops* 3. Hold ➔ Check ➔ Adjust 4. Set cruise (S+L) or climb power (climb) when IAS approaches cruise 5. Trim
Spiral descent 	High and increasing IAS Decrease in altitude High angle of bank High rate of descent High G loads Increase in RPM	1. Close power then level wings then pitch to S+L then climb attitude 2. *Pitch up until Alt/ASI stops* 3. Hold ➔ Check ➔ Adjust 4. Set cruise (S+L) or climb power (climb) when IAS approaches cruise 5. Trim

WAIKATO AVIATION ACADEMY