

FS ACADEMY

VFR

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FS ACADEMY



WELCOME

FS Academy – VFR will introduce you to the vast and varied world of flying under visual flight rules. Operating solo in a piston aircraft while navigating by sight is a remarkable experience and highly rewarding when done authentically using true to life techniques and knowledge.

VFR uses all-real techniques and procedures to learn how to fly visually with true realism.

The skills you will learn are transferable to practically any light aircraft and environment, as we will conduct our lessons in varied locations across the globe, using the local flying rules and procedures to give you the broadest international skillset possible.

Each mission has accompanying theory, found in this ground school manual. Progress through this manual to learn the theory behind VFR flight, as each pre-flight briefing covers the details of what you need to know before you take to the skies and practice it for yourself with the help of your instructor.

Once you are comfortable with your knowledge and abilities, take the Skills Test and put what you've learned into practice.

SUPPORT

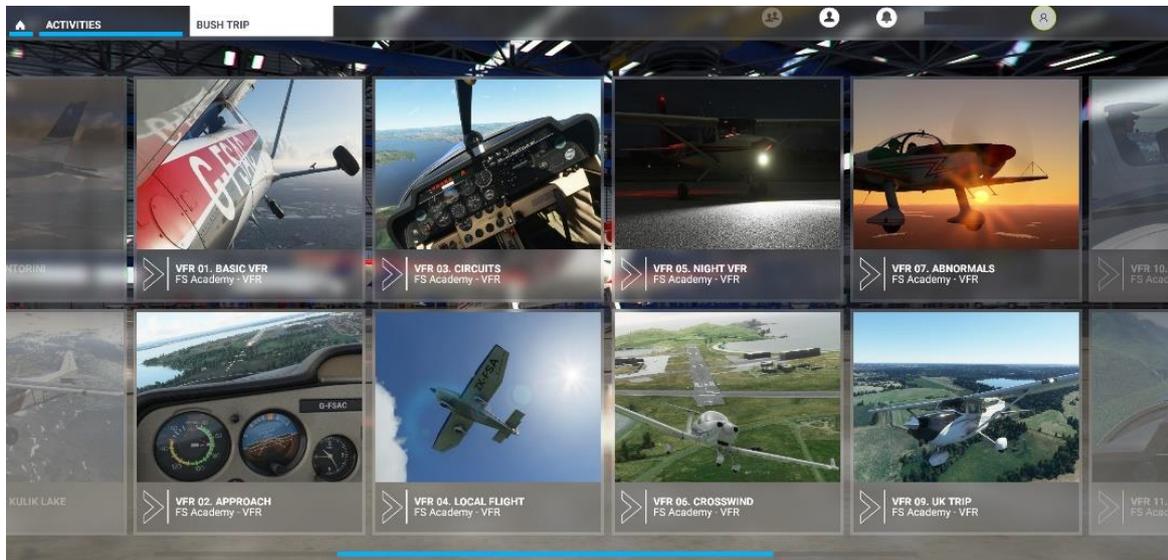
Please visit our support page if you encounter difficulties.

www.fsacademy.co.uk/support-vfr

FOR THE BEST EXPERIENCE

BUSH TRIPS MENU

You will find the VFR missions under **Activities** → **Bush Trips**.



AVOID PAUSING

MSFS currently has an issue regarding the passage of time whilst a flight is paused. This can be observed by noting the time on your aircraft clock, pausing for an amount of time, then unpausing and seeing that the aircraft clock has continued in the background. You can also see fuel being consumed and clouds travelling.

Some mission triggers are location activated, whilst others are time based. If the flight happens to be paused whilst awaiting a time activated trigger, dialog and instructions may be triggered silently in the background whilst the flight is paused, leading to missed instructions on your return.

Until this is addressed in a future MSFS update, **please avoid pausing** during a mission.

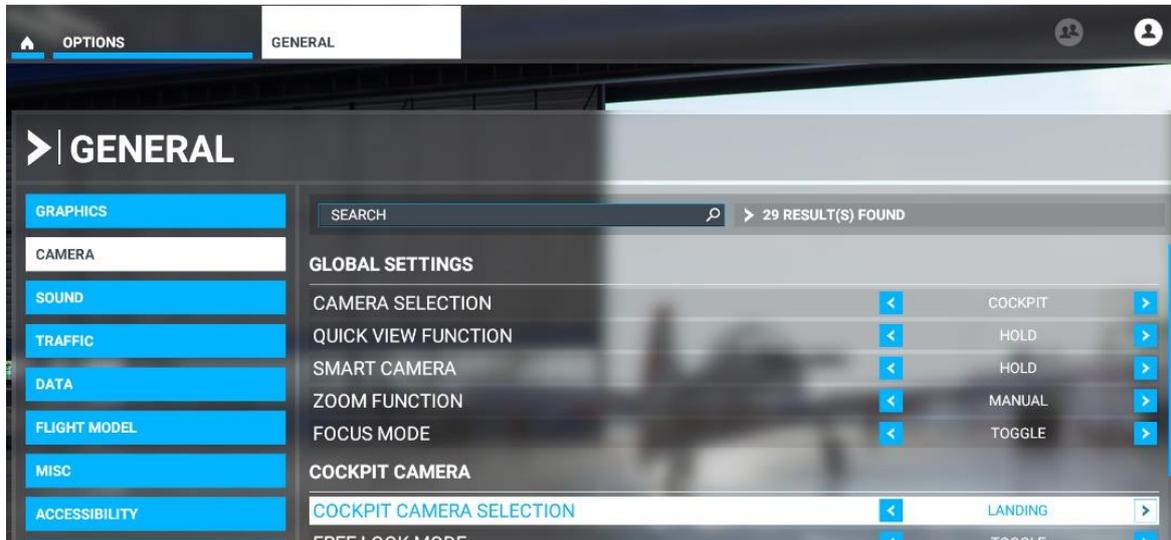
This does not apply to VFR missions 9, 10 & 11, as these are Bush Trips and do not have time triggers.

COCKPIT CAMERA

The viewpoint you use for VFR flight is something that mostly comes down to personal preference. Our recommendation is to set the 'Landing' cockpit view in your camera options, as we feel this gives the most true-to-life viewpoint, giving a clear view over the nose and allowing accurate setting of flight attitudes.

Set your view in **OPTIONS → GENERAL → CAMERA**

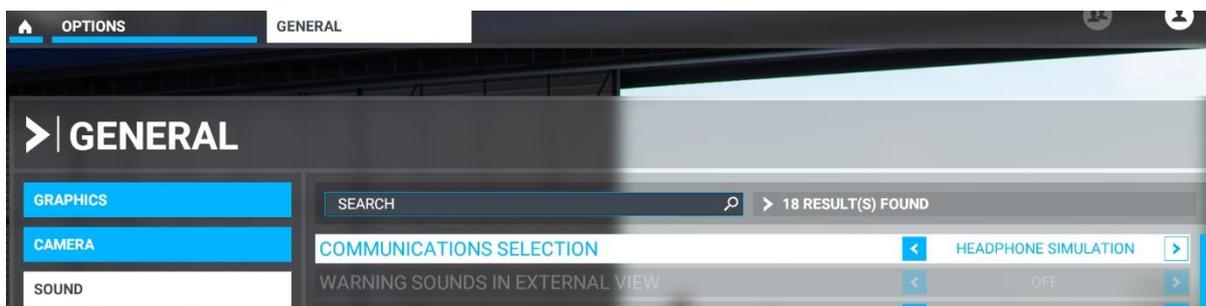
The examples of attitudes shown in this manual will assume this camera has been set.



SOUND SETTINGS

For the clearest audio, consider setting 'Headset Simulation' in your Sound Options, as this dampens the engine sound and boosts the voiceover to simulate the use of a cockpit headset.

Again, this is according to your own preferences.



Let's get started...

VFR 01. BASIC VFR



Principles of Flight
Flight Controls
Instrumentation
Attitudes
Trimming
Fuel Mixture

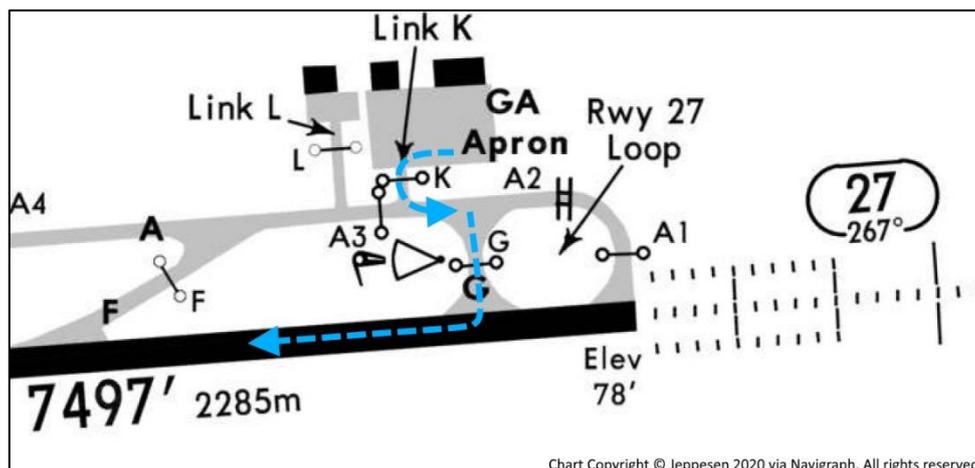
Welcome to the first lesson of FS Academy – VFR.

We'll focus on introducing you to basic aircraft handling skills. Get the weather information from the Automated Terminal Information Service (ATIS) and coordinate with ATC to depart Liverpool, following the Entry/Exit route known as "Mersey Lane" to Seaforth at the control zone (CTR) boundary, before practicing some basic handling once in uncontrolled airspace.

An Entry/Exit route is published for many of the busier airports that accommodate VFR traffic. They offer an organised way to allow a flow of light aircraft in and out of the airport without significantly interfering with commercial traffic.

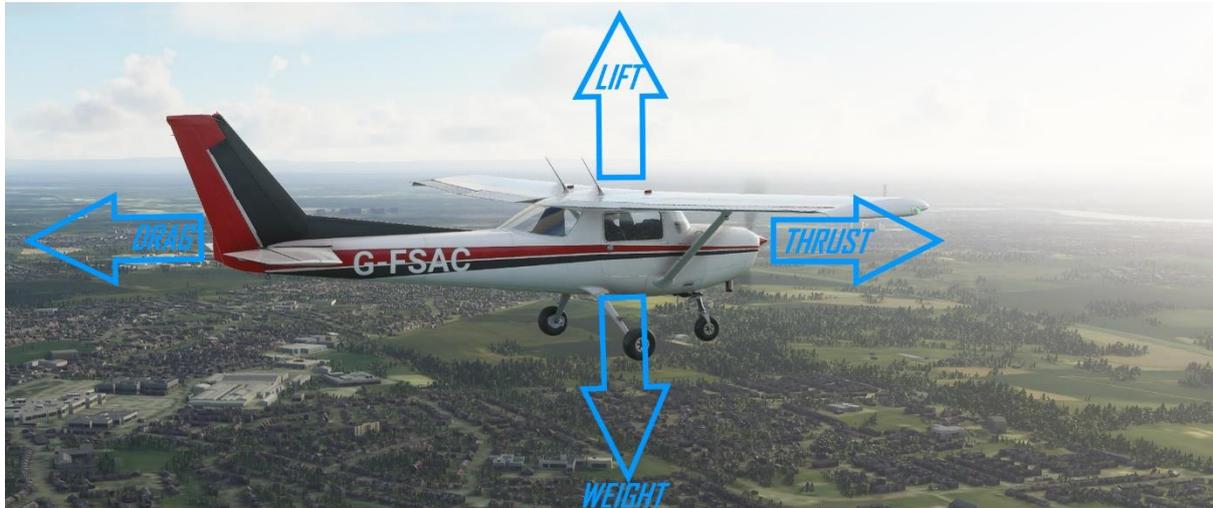
In this case, we follow the Mersey river, past the Liverpool city centre and further north to Seaforth, where we leave the Liverpool control zone (CTR). You will be cleared to depart by ATC with the instructions to remain "not above 1500ft". This instruction is given as 1500ft is the lower limit of airspace above, which you have not been cleared to enter.

Follow the taxi route shown below to reach the holding point for runway 27, where we will stop and request departure from ATC.



PRINCIPLES OF FLIGHT

There are four fundamental forces of flight, which are grouped into two pairs of opposing forces which must be balanced for steady flight. Lift vs Weight and Thrust vs Drag.



Lift vs Weight

An aircraft can fly if enough lift force is produced by the wing to counter the pull of gravity.

A heavier aircraft has a greater pull, so needs greater lift to counteract. To produce lift, the wing is inclined into the oncoming airflow, this angle is termed Angle of Attack (AoA).

This inclination into the airflow causes the air to be deflected downwards, which produces the equal and opposite reaction of lifting the wing upwards, much like skipping a stone across a pond.

The greater the speed of air that is flowing across the wing, the more lift will be generated for the same AoA, so a slow flying aircraft will need to fly with a nose-high attitude to produce enough lift to counteract the weight.



Thrust vs Drag

Thrust is the force generated by an engine. A conventional propellor is a group of blades which are each similar to small wings, which are spun at great speed by the engine to produce lift, directed forwards to pull the aeroplane along.

Drag is formed of two components; Profile Drag and Induced Drag.

Profile Drag is a result of the air's force against the aircraft structure, in the same way as putting your hand out of a car window at speed causes your hand to be pushed backwards. The more aerodynamic the aircraft is designed to be, the less profile drag it will generate. The faster the aircraft flies, the greater the profile drag will be.

Induced drag is a side effect of producing lift. As the stone loses energy as it skips, so does the aeroplane. As the wing is inclined to produce an AoA, the resultant lift force is upwards but also slightly backwards. The greater the AoA, the greater the induced drag.

Profile drag predominates at high speed, whilst induced drag is most prevalent at low speeds.



FLIGHT CONTROLS

The aircraft is manoeuvred in flight by deflecting the oncoming airflow. The moving parts that perform these duties are the Control Surfaces and a set of controls is provided for each axis of movement.

In the same way as a wing develops lift, the control surfaces adjust their own angles of attack to produce or diminish lift as desired.



Pitch

The nose up and nose down movement of the aircraft is primarily performed by the elevator, located at the trailing edge of the horizontal tailplane. By pulling back on the controls, the elevator is deflected upwards. This acts as an inverted wing, where the air is guided upwards, resulting in the tail being pushed downwards.

Like a see-saw, if the aircraft tail is pushed downwards, the nose is raised, increasing the wing AoA and subsequently increasing lift.

Respectively, if the controls are pushed forwards, the elevator deflects air downwards, lifting the tail and therefore lowering the nose.

Roll

Ailerons are located at the extremities of each wing and are move in opposing directions. If the controls are moved to the left, for a left turn, the left side aileron will raise, deflecting air upwards and therefore reducing lift on the left wing.



Simultaneously the right aileron is lowered, increasing lift on the right wing. These two lift adjustments combine to roll the aircraft to the left.

Rolling the aircraft redirects a component of the lift force towards the direction of turn. As some lift is now redirected to the side, some extra lift will be required to continue to balance the force of gravity. This loss of vertical lift is felt as the nose wanting to drop during a turn. Pulling back slightly during a turn produces the extra AoA required to maintain altitude.

Yaw

When turning, the sideways component of lift will pull the aircraft into the turn direction. This causes some of the airflow to strike the side of the aircraft.

The tail of an aircraft works in very much the same way as a weather vane or dart. With a large vertical surface at the rear of the aircraft, any airflow from the side will strike the tail and push the nose into-wind.

The force from the tail can be controlled by the pilot by moving the rudder. Rudder use is mostly minimal, primarily employed for comfort, efficiency and during crosswind operations.

Rudder pedals are typically also connected to the nosewheel steering, for ground manoeuvring. Some aircraft have a 'castoring' nosewheel, which may require extra persuasion for sharp turns, by use of differential braking, where brake pressure is applied to just the left or right brake to help turn the aircraft. Diamond aircraft often use castor style nosewheels.

INSTRUMENTATION



Airspeed Indicator - ASI



The airspeed indicator is essentially a pressure gauge. The harder the air is hitting the aircraft, and flowing into the Pitot Tube, the higher the reading, which is calibrated to display Nautical Miles Per Hour (Knots). As discussed in principles of flight, the speed of the air going past the wing is directly related to the lift produced.

If flying at a very low airspeed, the AoA would need to be increased. If increased too far however, the AoA can become excessive and disrupt the airflow around the wing, causing lift to be lost. This is a condition called a stall and is to be corrected without delay, particularly when in proximity to the ground, as the recovery consumes altitude.

Along with measuring your speed of travel, airspeed is of interest to the pilot due to this need to avoid a stall and to not exceed any speed limitations. There are coloured bands on the dial:

Green: The **normal** safe flying range. The lower end of the green band designates the stall speed with no flaps extended. The upper end is the maximum speed for use in Normal Operations, known as VNO.

White: The upper end of the white band designates the highest speed at which **flaps** may be extended. The bottom of the white band shows the stall speed with flaps extended. Some aircraft do allow initial stages of flaps at speeds beyond the white band, but these will have other limiting speeds as listed in the aircraft manual. VFR will use a variety of aircraft so for our purposes consider the white band to apply to any extension of flaps.

Yellow: VNO can safely be exceeded in **smooth air** conditions and with care, as rough handling or unstable air conditions can cause enough force to cause aircraft damage.

Red: At the upper end of the amber band is the red line which designates VNE. This is the speed that is to Never be Exceeded, as **damage** may occur above this speed even in smooth conditions. The profile drag on the aircraft structure becomes excessive above VNE.

Attitude Indicator – AI



Whilst your primary flying reference when VFR is the horizon, fine adjustments and precise attitudes can be obtained by use of the AI. Of most interest for visual flight is the angle of bank markings along the top. The first 3 white lines either side of centre designate 10 degrees of bank each, until the fourth line which indicates 60 degrees. Normal turns will be made at about 20 degrees.

Pitch angle will primarily be judged visually, as a large pitch change only produces a small movement on the AI, so greater precision can be found by setting the attitudes you will learn as part of this course, discussed later.

Altimeter



Indicating your altitude in thousands of feet, the altimeter is read in the same way as a clock, with a short (hour) hand and a long (minutes) hand. The short hand indicates thousands of feet, the little indicates hundreds.

The altimeter operates as a pressure gauge, measuring how air pressure reduces as height increases.

As the air pressure changes day to day with the weather, the airport weather report will include the current air pressure setting to correct for variations, known as the QNH. Setting the reported pressure will set the altimeter to display your altitude above mean sea level (AMSL).

Turn Coordinator



For VFR flight, the slip indicator on the turn coordinator is used throughout the flight to guide the pilot which inputs to make with the rudder. Keeping the black ball centred in the gauge ensures the aircraft is correctly aligned into the oncoming airflow, which gives the least drag and maintains passenger comfort.

The tilting white aircraft symbol is for turn rate reference when flying on instruments and is of little importance for VFR flight.

Directional Gyro - DG



The DG is your primary reference for flying particular headings. As the DG is gyroscope powered, gyroscopes can drift over time and lose accuracy. Before departure and periodically in flight you will check that the DG heading agrees with the magnetic compass and make any adjustments necessary.

A Horizontal Situation Indicator (HSI) is a more advanced form of DG, which usually has additional instrumentation combined within such as navigation aid guidance or glideslope indications, not typically used for VFR flight.

Vertical Speed Indicator - VSI



The VSI is useful for accurately ensuring level flight, but does often have some lag to it. Also, a pressure instrument, the VSI senses rate of altitude change and displays in Feet Per Minute (FPM).

A typical climb vertical speed (V/S) is just under 1000fpm.

An approach V/S is generally 300-400fpm when flying the normal 60-80kts light aircraft approach speeds.

Transponder

ATC use two radar returns to identify an aircraft. Primary radar is the reflection of a radio beam that determines range and direction (RADAR stands for Radio Detection And Ranging). Secondary radar uses transponder (XPDR) data sent from the aircraft to confirm identification and supply the radar screen with extra information such as current altitude.

To differentiate between aircraft in or near controlled airspace a transponder code known as a 'squawk' is assigned. For VFR operations a standard code of 7000 is set, although some countries (listed below) use 1200 (country dependant). A VFR code displays to ATC that you are an uncontrolled VFR flight.



Purpose	XPDR Code
VFR - USA, Canada, Australia, NZ	1200
VFR - ICAO Standard	7000
Emergency	7700
Radio Failure	7600
Unlawful Interference	7500

ATTITUDES

Climb Attitude

You will be introduced to a handful of attitudes or 'sight pictures' for various phases of flight. A very common attitude for takeoff and climb is to put the top of the engine cowling (the bodywork that shrouds the engine) on the horizon. In most light aircraft this gives an approximate takeoff pitch setting to safely climb away without risking striking the tail on the ground, then provides a good climb speed whilst maintaining some forward visibility.

Once established in the climb and flaps are retracted, set the pitch attitude as appropriate to maintain your target climbing airspeed, typically about 70kts.



Cruise Attitude

In the cruise, leave a small gap between the dashboard and the horizon. You'll discover and learn what works for each aircraft with experience. This will allow you to reliably return to straight and level flight after an altitude change or turn, only using the instruments for secondary guidance. This helps to support a good lookout as you fly, as the majority of your attention should be outside the window whilst flying VFR.



TRIMMING

As discussed, increased airspeed will increase lift. When lift is increased, a nose-up pitch effect is the result. After accelerating, to keep the attitude constant, a constant push forwards on the controls would be needed to counter this nose-up force. The opposite occurs with a reduction in airspeed, where a deceleration would require a pulling back on the controls, to prevent the nose from dropping.

Any period of time applying control forces consumes the capacity of the pilot, leaving less in reserve for performing other tasks. Also, the physical effort on the controls can be exhausting after a short period if the forces are significant, leading to tiredness and inaccurate handling.

Aircraft are fitted with trim systems to account for this. The system can work in various ways depending on the aircraft type, but effectively they all allow for the cancellation of these control forces.



The most common method of providing trim control on light aircraft is with the trim tab. This is a small control surface at the trailing edge of the elevator which is moved independently with trim wheel control in the cockpit.

Some older aircraft have the trim control as a handle on the cockpit ceiling.

After an increase in airspeed, the nose will want to rise. Initially counter this nose up force with forward pressure on the controls. Then, holding the desired attitude, begin to move the trim wheel upwards, which provides nose down trim and relieves your control force until fully neutralised.

This trimming effect is achieved by moving the trim tab, providing an aerodynamic force to the elevator in order to hold the elevator in the required position.

More complex aircraft also have aileron and rudder trim, for very precise trimmed out straight and level flight, but the majority of training aircraft will only provide elevator trim.



FUEL MIXTURE

An engine is designed to run at a particular Fuel to Air ratio for optimal efficiency. As you climb to higher altitudes, the air becomes thinner, supplying less air to enter the engine and altering the ratio.



If too much fuel is being supplied, the fuel/air mixture is termed as 'rich', which is experienced as a loss of performance. Prolonged rich running wastes fuel and can also cause carbon build-up in the engine, decreasing performance further and causing rough running.

The red mixture control is used to reduce the engine's fuel flow slightly to maintain the intended Fuel : Air ratio, a process known as 'leaning' the mixture.

Be sure not to pull the mixture control back too far, as this will close the fuel supply completely and shut down the engine!

Once flying level after a climb, lean the mixture by pulling the mixture control back a small amount, until you notice the engine RPMs rise. Leaning too much will cause the RPM to drop again and engine temperature will start to rise. Find the mixture setting that gives the highest RPM.

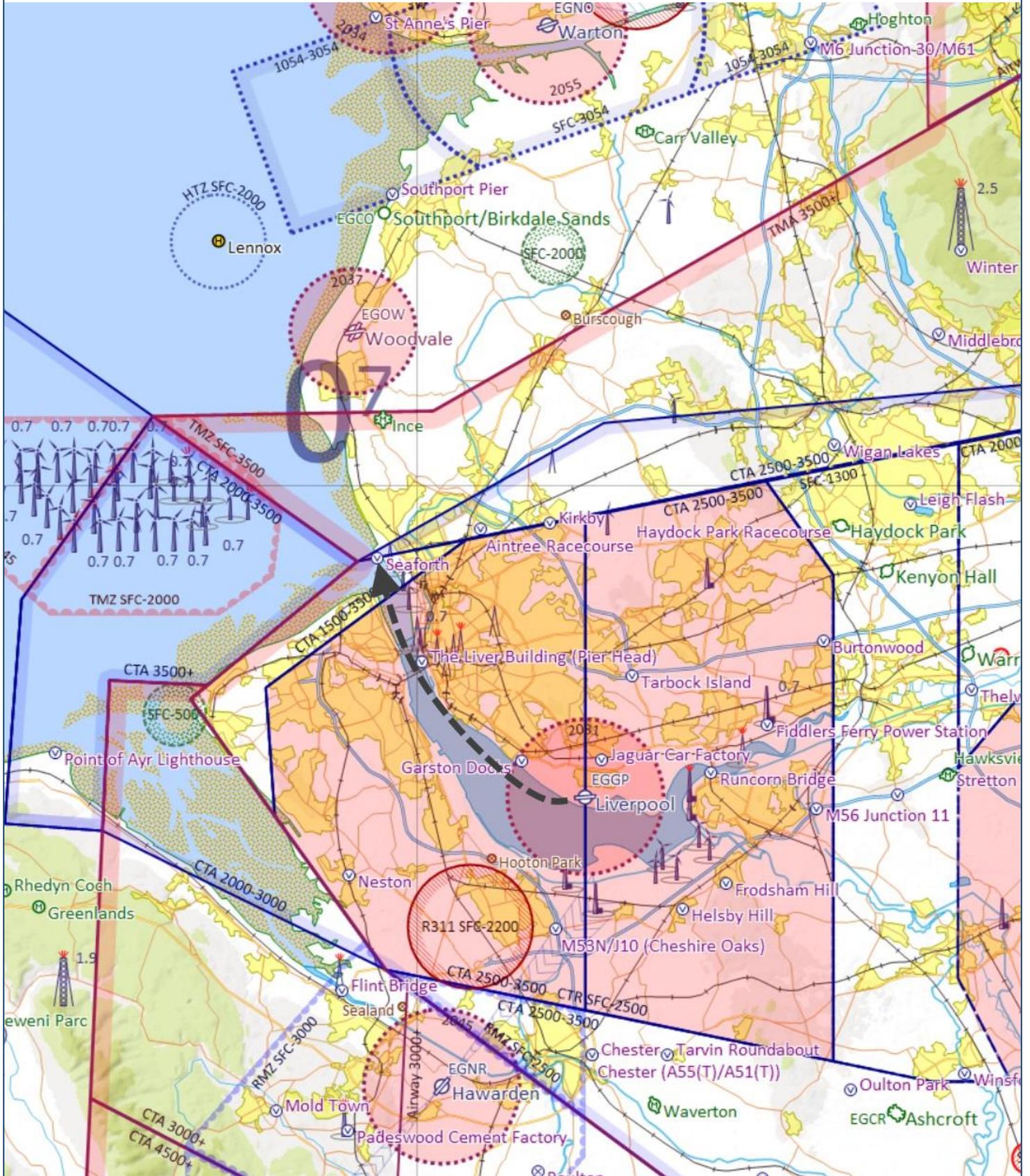
When coming in to land, the mixture is returned to full rich, so that maximum fuel is available in the event of full power being required for a go-around.

When operating at a high-altitude airport, such as those found in mountainous areas, you would pre-lean the mixture before departure, as you will likely be performance limited and need optimal power.

Returning to land at a high elevation airfield would not require you to go back to full-rich, as this would hamper your engine performance at such high altitudes.

You'll get to experience this for yourself in the lesson on Mountain Flying (VFR 08.)

MAP - VFR 01



Map courtesy of SkyDemon

VFR 02. APPROACH



Effect of Flaps
Visual Reference Points
Aiming Point
Touchdown

Get a feeling for how things will look and feel when on the approach, before re-entering the Liverpool control zone to return for landing.

We'll begin away from the airfield, slowing the aircraft and setting the power and attitude for an approach. This will introduce you to the picture you will expect to see on the approach to land.

Re-enter the Liverpool CTR at Kirkby before routing under air traffic control to the Jaguar Car Factory Visual Reference Points (VRPs), located just north of the airport. Before approach ATC will ask you to complete an 'orbit'. This is another term for a 360 turn, which is performed to allow sequencing of your arrival with other traffic.

Once on a parallel track to the runway, known as the downwind leg, continue until the landing runway threshold appears at 45 degrees over your right shoulder. Your instructor will assist you with this whilst you get used to the airfield environment.



At the appropriate moment you'll turn right onto a heading of South to fly the 'base leg'. Simultaneously reduce power and lower the nose slightly to begin a gradual descent. Once the speed has come back to within the white band on your ASI, you can extend the first 10 degrees of flaps.

Once you've made your turn onto the 'final approach', lined up on the runway centreline, extend flaps 20 and choose an aiming point, which you will fly straight towards all the way down to the last 50 feet before landing.

EFFECT OF FLAPS



An aircraft wing is typically engineered to be most efficient when in cruise flight. This gives the least drag whilst providing adequate lift, resulting in the optimal aircraft range.

When taking off or landing, flaps on the wing are extended to change the wing's shape, deflecting the oncoming airflow more aggressively, effectively increasing the AoA and providing extra lift, at the expense of additional drag. This extra lift allows for flight at a lower airspeed.



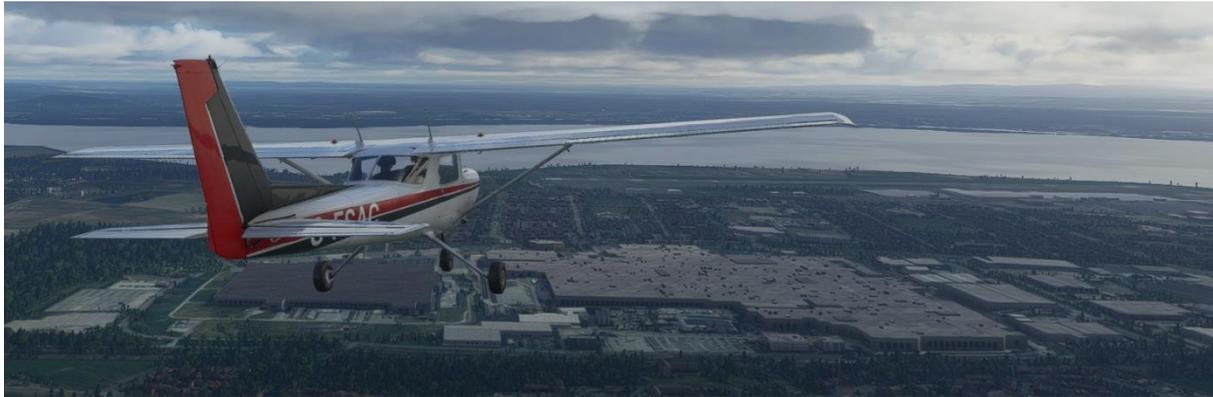
The ability to fly at lower airspeeds allows for shorter takeoff and landing distances, allowing operations into smaller airfields with short runways.

For takeoff, flaps are set to about 10 degrees, providing extra lift to reduce the takeoff distance, but not too much drag that would hamper your ability to climb. Once safely climbing away at about 300ft Above Ground Level (AGL), the flaps are retracted and the climb continued.

Landing flap of 20-30 degrees are used to add lift but also increase drag, allowing for both lower landing speeds and greater deceleration after touchdown.

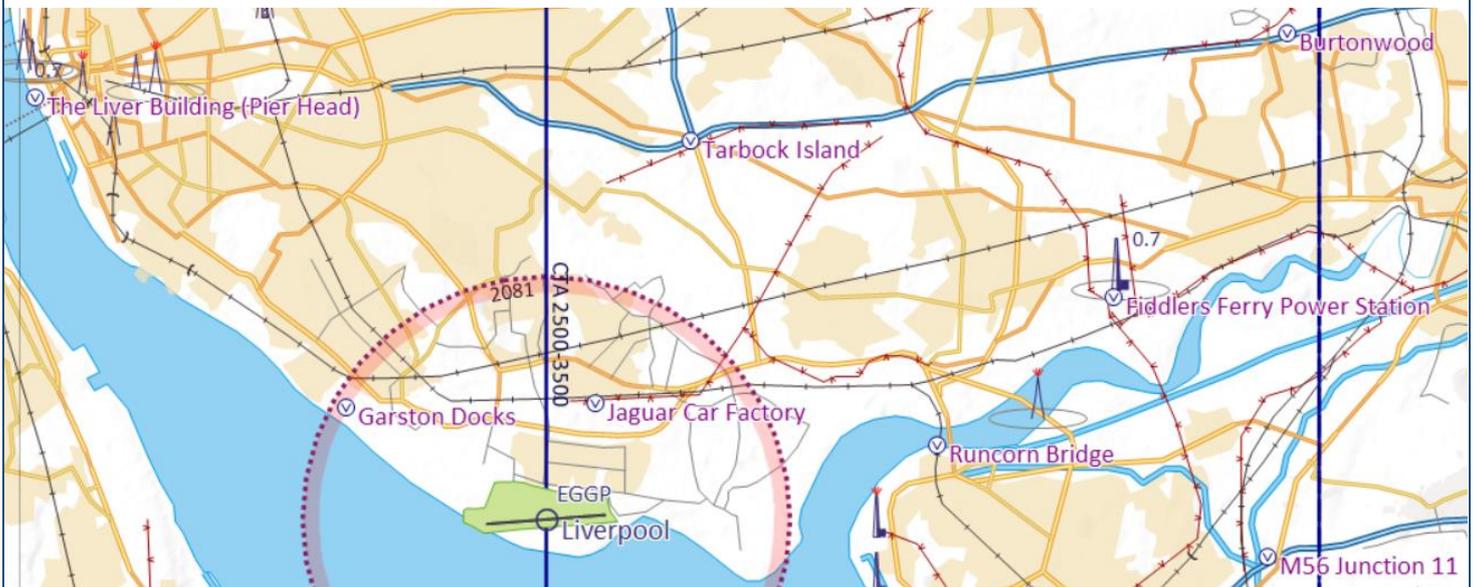
Flap settings are controlled with the flap lever in the cockpit.

VISUAL REFERENCE POINTS



Flying in the local area of an airfield is made simpler by defining a series of landmarks that can be used as a position reference. These Visual Reference Points (VRPs) are chosen for their visibility and permanence, usually large buildings, bridges, motorway junctions and similar distinctive features.

Pictured above is the Jaguar Car Factory, located just North of Liverpool airport and used as a VRP when returning to land.



Marked on VFR maps, VRPs will be of most use to those already familiar with the local landscape. Those flying in the area for the first time would benefit from pre-flight research to familiarise themselves with the VRPs appearance.

When in proximity to a VRP, take extra care in looking out for other aircraft, as these landmarks are routinely chosen as waypoints and subsequently tend to concentrate traffic.

AIMING POINT



Once on approach to land, choose a spot on the runway to aim for. This could be the runway numbers, touchdown markings or any other appropriate point within the first third of the runway surface.

Once selected, keep the aiming point stationary in your windscreen. If the aiming point starts to slip towards the bottom of the windscreen, you are overshooting your aiming point and should increase your rate of descent.

If the aiming point is rising up in the windscreen, you are descending too quickly and would fall short if left uncorrected.

Don't feel the need to chase the red and white Precision Approach Path Indicators (PAPIs) in a VFR light aircraft, just select an aiming point and hold it in place.

TOUCHDOWN

The aiming point is to be kept locked in place until the last moments before touchdown, roughly at 50ft AGL as you cross the runway threshold. At this point, smoothly cut the throttle to idle and move your gaze and look to the far end of the runway, allowing you to use peripheral vision to more reliably judge your touchdown.



Set the flare attitude and allow the aircraft to settle down onto the runway, main gear first. Once ground contact is made, smoothly allow the nose to lower onto the centreline. To avoid slamming the nosewheel down, commence braking only once all wheels are on the ground.

CHART - LIVERPOOL EGGP

EGGP/LPL

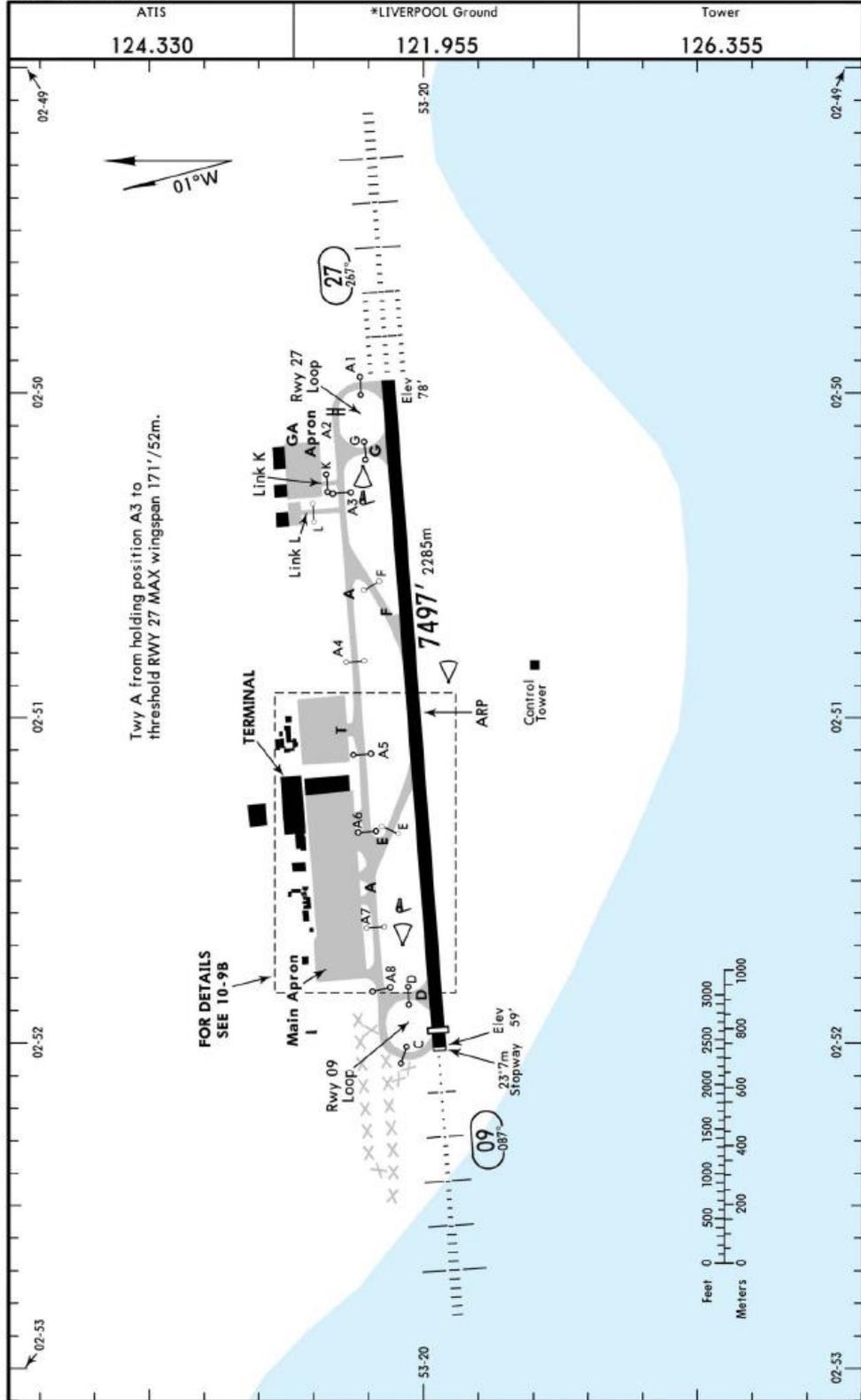
Apt Elev 81'
N53 20.0 W002 51.0

JEPPESEN

15 MAY 20 (10-9) Eff 21 May

LIVERPOOL, UK

LIVERPOOL



Twy A from holding position A3 to threshold RWY 27 MAX wingspan 171'/52m.

FOR DETAILS SEE 10-9B

CHANGES: Link L added.

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NAVIGRAPH CHARTS INTENDED FOR FLIGHT SIMULATION ONLY - NOT FOR NAVIGATIONAL USE

VFR 03. CIRCUITS



The Circuit
Go-Around
Touch & Go
Low Circuit

You've had your first exposure to the circuit pattern in the previous lesson. Now it's time to nail down the basics of both the normal and low-level circuit at Tauranga on New Zealand's North Island.

THE CIRCUIT

The Circuit, or Traffic Pattern, is a rectangular course around a runway made up of four legs. Circuits are left-hand as standard, unless airspace or obstacles require a right-hand circuit, which will be noted on the airport charts. We will assume a left-handed circuit here. All turns once in the circuit are made in the same direction. All to the left in a left-hand circuit, all to the right in a right-hand circuit.

A circuit is performed at a 'Circuit Altitude' of 1000ft Above Airfield Level (AAL), unless a different altitude is specified on the charts. The airfield elevation is listed on the chart.



Crosswind Leg

After reaching 500ft Above Airfield Level (AGL) after takeoff, a climbing 90-degree turn is made to the left. This puts you onto the Crosswind Leg. Continue until reaching circuit altitude, at which point another 90-degree turn is made onto the Downwind Leg.

Downwind Leg

The downwind runs parallel to the landing runway and is flown at circuit altitude.

Once established onto 'Downwind', a call is made on the radio to announce your position. This could be to ATC at a controlled airport, or as a broadcast on the local traffic frequency at an uncontrolled airfield.

This is a good time to perform a before landing checklist. They might be prescribed in the aircraft manual or Standard Operating Procedures (SOPs).

An example downwind checklist to follow is BUMFIS:

B	Brakes	Brake pressure, parking brake released
U	Undercarriage	Landing gear fixed or down and locked
M	Mixture	Full rich in case of a go-around
F	Fuel	Sufficient for a go-around and correct tank selected
I	Indications	Engine oil temperatures and pressures (Ts & Ps) normal
S	Security	Seatbelts fastened, doors secure and windows closed

This covers the important items to be checked before landing and will be performed for each circuit or when arriving at an airfield. Brake pressure is checked by squeezing the brake pedals, located on the top of the rudder pedals, to feel there is pressure in the system. Undercarriage is either confirmed down and locked in a retractable gear aircraft, or simply stated as "fixed" in a fixed gear aeroplane.

Many light aircraft have at least two fuel tanks. The desired tank can be selected to supply the fuel by use of a cockpit control, which varies by aircraft. As part of the fuel check, ensure a tank is selected with adequate fuel quantity.

Base Leg

Continue on the downwind leg until the landing runway aiming point appears at roughly a 45-degree angle over your left shoulder, at which point you'll commence your base turn.



Turning base involves another 90-degree turn whilst simultaneously beginning a gradual descent and engine power reduction.

The amount of throttle reduction depends on aircraft type, some will require a reduction all the way to idle power, whilst others will need only a small movement of the throttle. You are aiming to both descend and decelerate whilst turning, so this could be considered the most intensive point of early circuit flying, but becomes easy with practice and experience.

Aim for a moderate 300-400fpm descent rate and a speed reduction into the white airspeed band, allowing the first stage of flaps to be extended. The Robin DR400 we are flying has two flap extension positions, Takeoff and Landing. Set flaps to Takeoff on the base leg and set power to hold 80kts.

Final

Judged visually, make your final turn to line-up with the runway centreline. If well executed, you will complete your turn at roughly 500ft AAL and airspeed 80kts. Once established on final approach, stabilise your aiming point, extend landing flaps and set a speed of 60kts.



GO-AROUND

An approach may be discontinued at any time for a multitude of reasons, including:

- Runway occupied
- Aircraft technical fault
- ATC instructions
- Training
- Poorly executed approach
- Excessive runway distance consumed during flare

The procedure is similar across aircraft types, generally as follows:

FULL POWER

Set full throttle without delay, but with smoothness. Slamming the throttle to full can cause some piston engines to 'choke' momentarily, causing power interruptions just when you need thrust the most.

PITCH UP

Raise the nose smoothly and set the climb attitude. Do not yank back on the controls as this rapid pitch change may cause excessive increases in AoA and G-Force, causing a stall.

POSITIVE CLIMB

The transition from descending down the approach to a climb is not instantaneous, so before changing aircraft flap settings or retracting the landing gear (if available) ensure that you observe a confirmed rate of climb.

REDUCE FLAPS

Full landing flap settings add more drag than lift, so leaving them extended would hamper your climb performance. Once climbing safely, set approach or takeoff flaps, as appropriate to the aircraft type. In the DR400 we will set them to their takeoff settings. Do not retract them completely at this stage as airspeed will still be low.

If intending to perform a go-around for training purposes, it would be prudent to inform ATC in advance to assist with traffic sequencing. ATC would never 'deny' a go-around in principle as it may be necessary for any of the above reasons, but they may have other conflicting traffic and could adjust spacing to improve safety margins for all.

TOUCH & GO

When flight training, you will often make multiple approaches and landings in one flight. To save time, it is not usually necessary to touchdown, slow down, vacate the runway, taxi to the holding point and takeoff again. Instead, you can perform a 'touch and go' where you complete your touchdown, set takeoff flaps and apply full power to takeoff again immediately.

- 1. TOUCHDOWN**
- 2. ENSURE ADEQUATE REMAINING RUNWAY LENGTH**
- 3. SET TAKEOFF FLAPS**
- 4. SET FULL POWER**
- 5. TAKEOFF**

This is only of use when flying to a runway with adequate length. In the event of an abnormality, a short, wet, grass runway would be unlikely to provide enough safety margin to allow you to land, attempt to accelerate to takeoff speed, recognise a problem and then come to a stop in the runway length remaining.

At a controlled airfield, request permission to perform a touch and go as part of your downwind radio call. ATC may clear you for a "touch and go" (sometimes termed "the option" in the USA) or they may deny and require a full-stop landing due to a congested traffic circuit.

Note that 'full-stop' does not imply stopping on the runway, rather that you are to perform a normal landing followed by vacating the runway and taxiing to stand. Some of our missions in the simulator will however have you come to a stop on the runway, as required by your instructor.

LOW CIRCUIT

We will introduce you to the low-level circuit, where you fly the pattern at half normal height, 500ft AAL. This allows a lower, tighter circuit to be flown, which may be required at airfields where terrain or obstacles prohibit the normal circuit footprint. It is flown with reduced speed and keeps takeoff flaps extended throughout, both of which further tighten your turning radius.

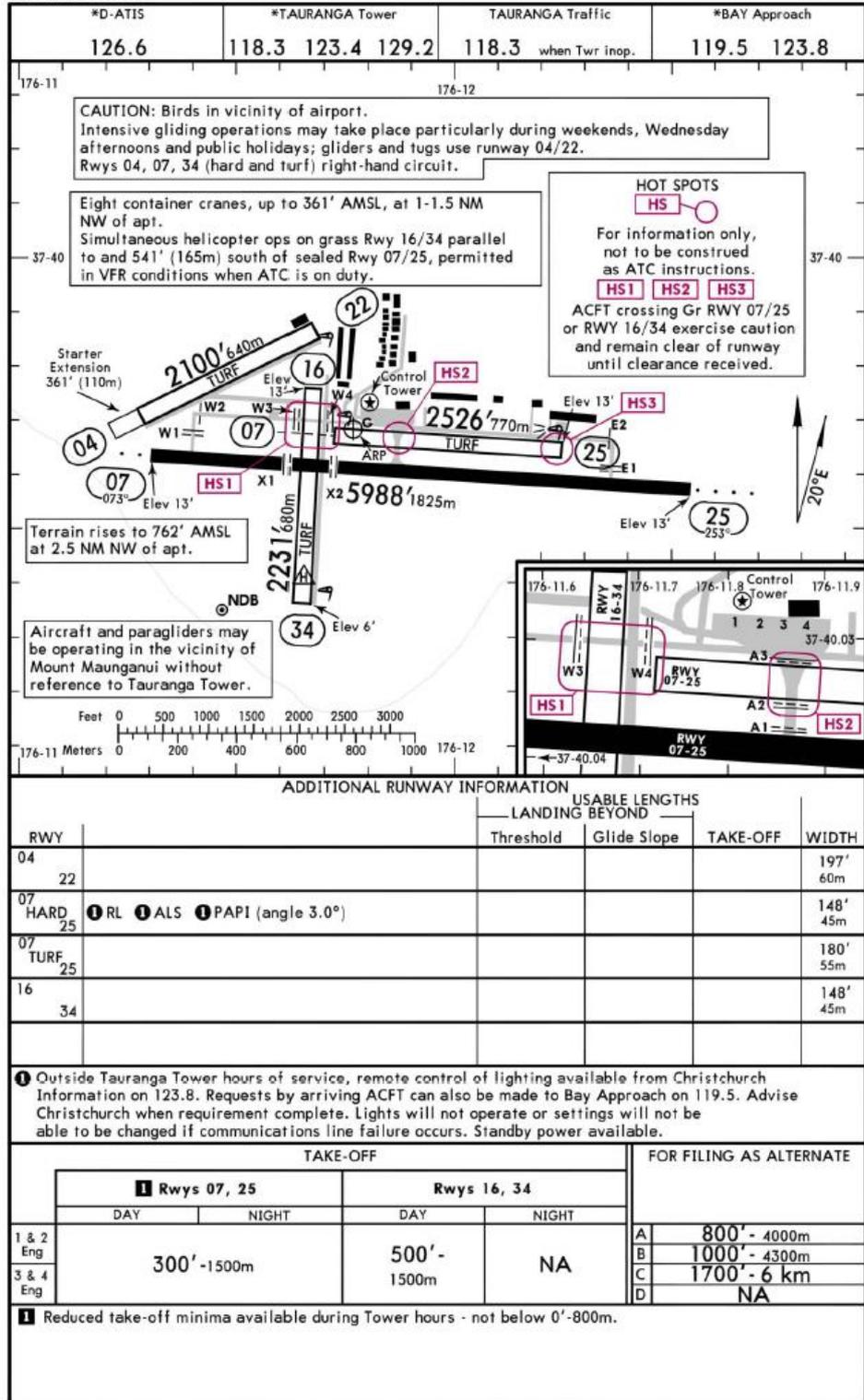
As less climbing is required, the crosswind leg will be shorter and therefore subsequently shortens the base leg. Although the turn onto base will happen at the same 45-degree angle as usual, there will not be the need to start descending simultaneously.

Commence the base turn still maintaining 500ft AAL. You may not require a 'base leg' as such, but instead perform a continuous turn all the way from downwind until lined up with the runway centreline.

CHART - TAURANGA NZTG

NZTG/TRG
Apt Elev 13'
S37 40.3 E176 11.8

JEPPESEN TAURANGA, NEW ZEALAND
24 JAN 20 (10-9) Eff 30 Jan
TAURANGA

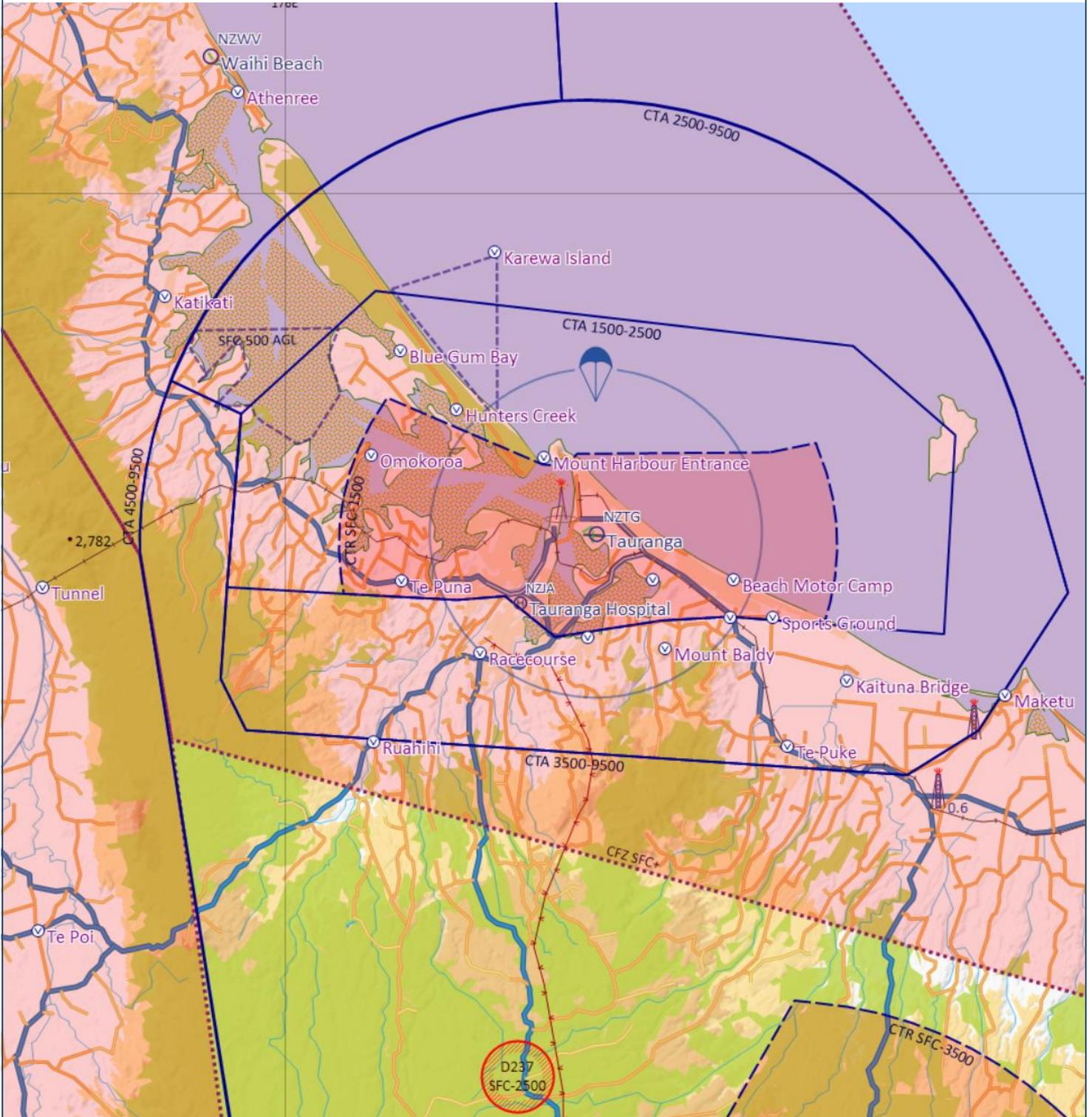


CHANGES: Cranes note.

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NAVIGRAPH CHARTS INTENDED FOR FLIGHT SIMULATION ONLY - NOT FOR NAVIGATIONAL USE

MAP - VFR 03



Map courtesy of SkyDemon

VFR 04. LOCAL FLIGHT



- Airspace Simplified
- VFR Weather Minimums
- Minimum Heights
- Overhead Join
- VFR Cruising Levels
- National Differences

We are going to leave the familiar airfield environment and explore further afield by departing the circuit and venturing out into the New Zealand countryside.

AIRSPACE SIMPLIFIED

The organisation and regulation of airspace varies internationally and has multiple aspects to consider, leading to a potentially complex and difficult to understand topic.

If we make the assumptions that we are flying **VFR below 10,000ft**, we can quickly narrow down and focus on the regulations that apply to us, therefore simplifying the airspace system. Airspace is divided into classes A-G. Class A is IFR (Instrument Flight Rules) only.

Each class has different requirements:

- Class B** Mainly **Canada + USA**, surrounds busy airports with ATC traffic separation.
- Class C** ATC provides separation **INSTRUCTIONS** between VFR and IFR traffic.
- Class D** ATC provides separation **INFORMATION** between VFR and IFR traffic.
- Class E** Radio not mandatory if VFR. Traffic may be separated if radio is used.
- Class G** Uncontrolled airspace.

The main areas of difference between each class for VFR flights are:

- Must a radio be fitted and used for contacting ATC?
- Will ATC provide traffic separation instructions or just information?
- Is there an airspeed limitation of 250kts below 10,000ft?

	B	C	D	E	G
RADIO + ATC SEPARATION	YES	YES	YES	NO	NO
SEPARATION	ALL	FROM IFR	INFO ONLY	INFO ONLY	NO
SPEED LIMIT	NO	YES	YES	YES	YES

VFR WEATHER MINIMUMS

When flying VFR within any airspace class, we must comply with visibility and cloud avoidance regulations. These rules apply when flying above BOTH **3000ft** Above Mean Sea Level (AMSL) and **1000ft** Above Ground Level (AGL).

A minimum of 5km visibility is required, maintaining at least 1500m horizontal and 1000ft vertical cloud separation. Above 10,000ft, the visibility requirement increases to 8km.



Flying **below EITHER 3000ft AMSL OR 1000ft AGL**, the 5km visibility requirement remains, but cloud avoidance simplifies to remaining 'Clear of Cloud'. This means you can get as close as necessary to cloud vertically and horizontally, but must not come into contact with the cloud, whilst ensuring you are in sight of the surface.



MINIMUM HEIGHTS



500 within 500

A minimum height of 500ft above the surface or any obstacle within 500ft (150m) of the aircraft must be maintained, except for the purposes of taking off or landing.

Flying at such a low height restricts your options considerably and increases the chance of bird strikes, proximity to hazards such as power lines and obstacles not included on maps. Military low flying is concentrated below 1000ft AGL, particularly in the UK.



Congested Areas

When flying across a congested area, the minimum height is raised to 1000ft clearance above the tallest obstacle within 600m (2000ft) of the aircraft.

Glide Clear Rule

The above minimum heights may need to be increased to ensure that whilst flying over a town, city or large open-air gathering such as a music festival, you must always have enough altitude to facilitate a glide to a safe area for an emergency landing.



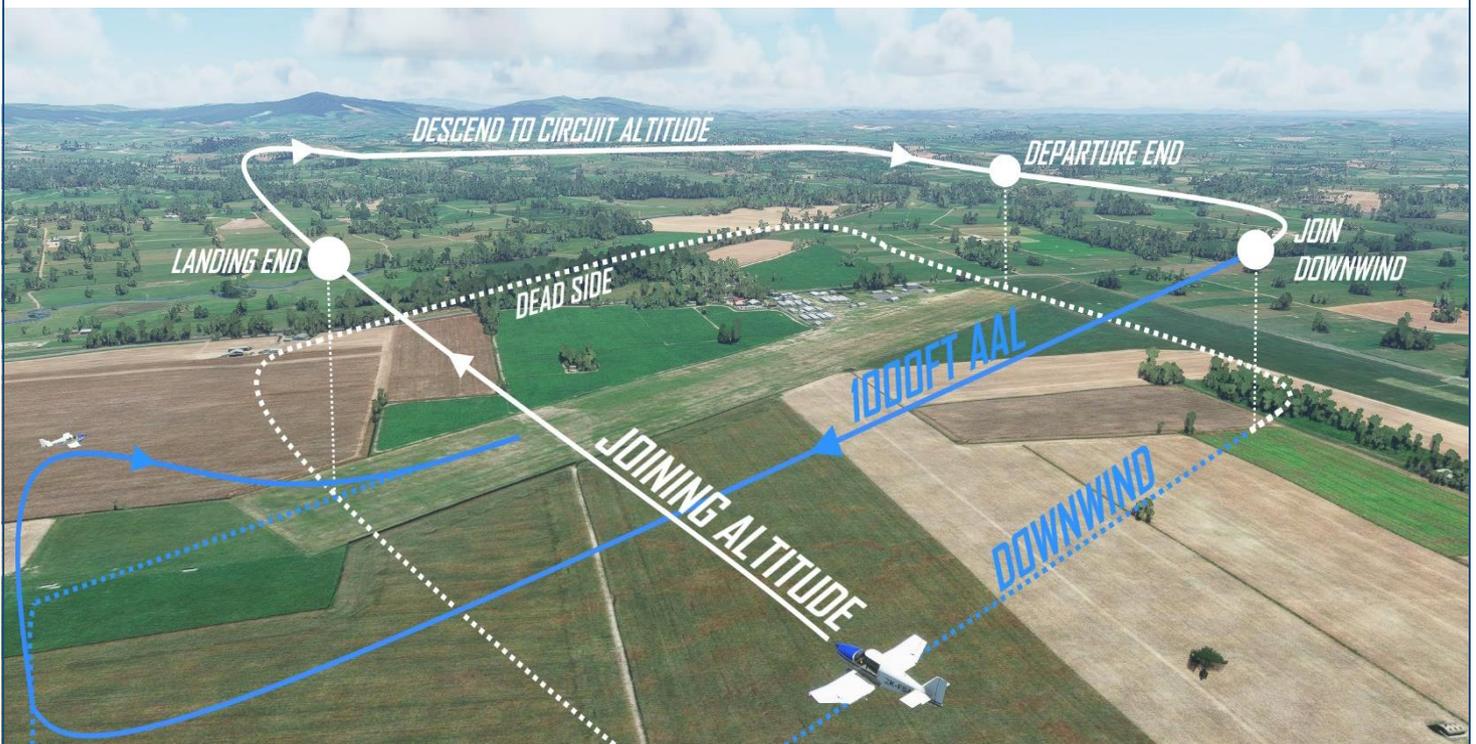
OVERHEAD JOIN

We're going to be arriving at an airfield that does not have a control tower. We'll explore how to join a circuit at an uncontrolled airfield using a procedure known as the Overhead Join.

All circuits have two sides, the live side and the dead side. The live side is the side where the circuit is flown. The dead side is opposite the live side and used for descending to circuit altitude during an Overhead Join. Circuit direction is to the left unless stated otherwise on the airfield chart, where published.

Before arrival, gather the information that is available, such as weather, circuit direction and airfield elevation. Weather can be obtained pre-flight or enroute if an ATIS or other weather transmission is available.

For this lesson we're going to introduce you to a right-hand circuit at Matamata, New Zealand. The true circuit direction is left-hand, but in our introductory lesson we will disregard this for the purpose of simplicity. As Matamata is not a fully published airfield a Jeppesen chart is not available, but may be obtained from other sources.



Once beginning the Overhead Join, make all turns in circuit direction. The sequence of five easy steps for an Overhead Join are as follows:

STEP 1 – ARRIVE FROM THE LIVE SIDE

Position yourself at joining altitude, flying towards the airfield on the live side of the circuit. Joining altitude is typically the circuit altitude +500ft, though some regions and individual airfields require higher than this.

If arriving from the dead side, overfly the airfield first then turn back to position yourself onto the live side, as required.

STEP 2 – OVERFLY LANDING END

Fly over the landing end of the runway in use.

For example, if landing on runway 28, overfly the runway 28 threshold, maintaining joining altitude.

STEP 3 – DESCEND TO CIRCUIT ALTITUDE

Once across the landing threshold and on the dead side, you can begin descending to circuit altitude, typically 1000ft AAL.

STEP 4 – OVERFLY DEPARTURE END

Arrange your next turn to overfly the departure end of the runway. This is the end where an aircraft taking off from the active runway would lift off and climb away.

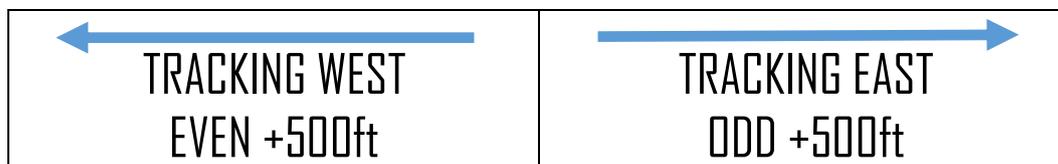
Pay extra attention to your lookout here, as you may have such departing traffic climbing beneath you.

STEP 5 – JOIN DOWNWIND LEG

Once crossed back over to the live side, you are now at circuit altitude and in a position to join the normal circuit by turning downwind.

VFR CRUISING LEVELS

When flying a route, you need to choose a compatible altitude to fly. The altitude you choose depends on the direction you are flying for that leg. If **VFR** above **3000ft** then pick an **EVEN** altitude when flying **WEST** or an **ODD** altitude when flying **EAST**. Then finally add 500ft.



For example, if flying VFR and your HDG to the next waypoint is 070. An ODD altitude +500ft would be chosen, such as 5500ft. This system continues all the way up to the Transition Altitude, which is the highest available altitude for your region before the Flight Level system begins to be used instead.

NATIONAL DIFFERENCES

Airspace and weather regulations are mostly standardised worldwide and supported by the International Civil Aviation Organisation (ICAO). However, individual countries may impose differences, some of which are summarised here:



UK

Speed limit not applicable to military
Overhead joining altitude: circuit altitude +1000ft



USA

Cloud Separation: Horizontal: 2000ft. Vertical: +1000/-500ft
Class B or G >1200ft AGL: Clear of Cloud. Visibility 1SM

Circuit Join from live side: Enter downwind on a 45-degree intercept.
Circuit Join from dead side: Descend to circuit altitude then cross runway at the centre to enter downwind.



Canada

Controlled: Cloud Horizontal 1SM. Vertical +/- 500ft. Visibility 3SM
Uncontrolled >1000ft AGL: Cloud Horizontal 2000ft. Vertical +/- 500ft. Visibility 1SM
Uncontrolled <1000ft AGL: Visibility 2SM



New Zealand

Cloud Horizontal separation: 2km
Cloud Vertical separation inside Control Zone: +/-500ft.

SM = Statute Miles. Unit conversations are approximate and regulations simplified.

VFR 05. NIGHT VFR



Night Considerations
Traffic Avoidance
Night Airspace Differences

Learn how to keep the show on the road after the daylight fades, taking advantage of still, clear night time conditions whilst remaining aware of the implications on VFR flights.

NIGHT CONSIDERATIONS

Flying after dark has some distinct advantages. As the weather is generally more stable, you can expect lighter winds, smoother air and improved visibility. Towns, cities and airports are easier to pick out due to their night lighting, as is other traffic.

Traffic conditions tend to be lighter at night too, so you will be in with a chance of quieter circuits, fewer delays and more direct routings. There are a few areas of consideration however.

A pilot may fly after dark only if they possess a night rating, otherwise they must be back on the ground by nightfall. The time that daytime is considered to have ended is a published figure. This time differs by location and date, so is published in advance. Remain mindful of the time that daylight ends, as it may not be immediately obvious or pitch-black at this time, especially at altitude.

Steps should be taken to safeguard your night vision. It can take around 30mins to gain full night vision, but only a short flash of white light can reset this and take another 30mins to fully restore. To aid with this, onboard lighting and flashlights should ideally be red, which does not affect night vision in the same way and greatly reduces glare. However, be mindful that monochrome light distorts colouring and usability of maps.

Greater importance is given to the aircraft instrumentation, but they still remain a secondary source of attitude information. The loss of a visible horizon makes the Attitude Indicator (AI) valuable for bank angle information. A good look-out for other aircraft is still vital to ensure safe separation.

TRAFFIC AVOIDANCE

The sighting and avoidance of other aeroplanes at night can be considerably easier than during daytime, especially at a distance.



The orientation of oncoming traffic can easily be deciphered by the coloured position lighting system fitted to all aircraft that are permitted to be flown after dark.

The right wing will feature a green light, which can only be viewed from ahead or to the right. A red coloured wing light is positioned on the left wing, only visible from ahead and to the left. A third light, white in colour, is located on the tail, viewable only from behind. In the above image, we can see both green and red position lights, so this aircraft is approaching us head-on. Be aware that a white position light at the rear may be confused with a taxi or landing light at the front.



NIGHT AIRSPACE DIFFERENCES

As we saw in the previous lesson, the airspace system can be complex. Some other minor complexities are introduced as night time begins.

The intention is to increase requirements to preserve the same level of safety as a daytime flight. Some of these differences are listed below:



UK

500ft minimum height within 500ft increases to 1000ft within 5NM



USA

Class B or G, <1200ft AGL: 1SM visibility increases to 3SM



CHART - TORONTO CITY CYTZ

CYZT/YTZ

Apt Elev **252'**
N43 37.7 W079 23.8

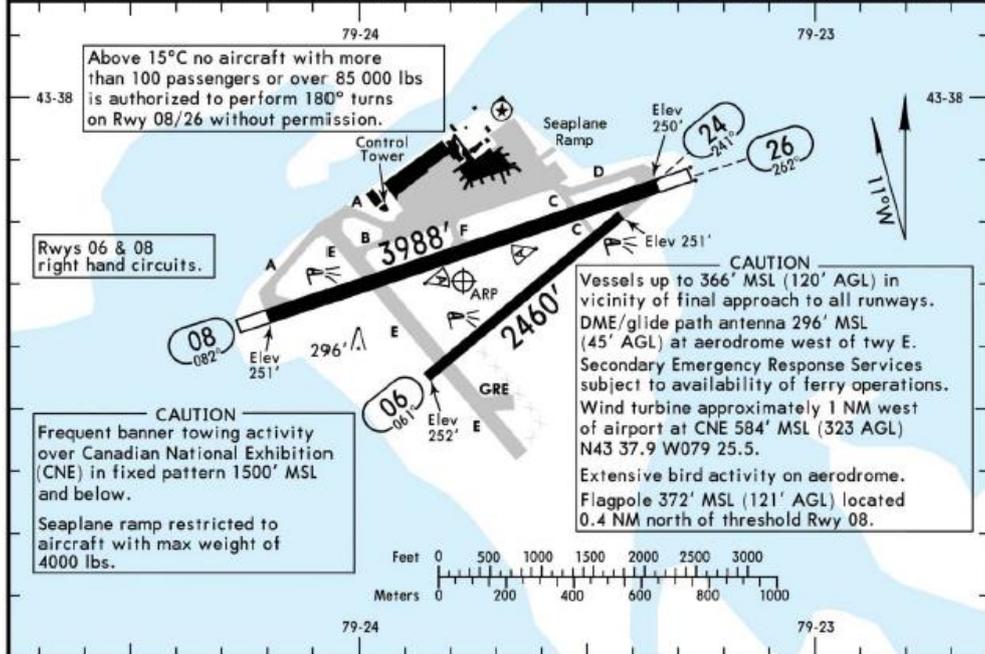
JEPPESEN

10 JUL 20
Eff 16 Jul **(30-9)**

TORONTO, ONT

TORONTO/BISHOP TORONTO CITY

ATIS (AWOS when Twr inop) 133.6	Data Comm: ATIS PDC DCL	*CITY Ground 121.7	*Tower 119.2 118.2	CITY Traffic ATF (Control Zone) 118.2 when Twr inop.	TORONTO Departure 133.4
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ADDITIONAL RUNWAY INFORMATION

RWY	USABLE LENGTHS	LANDING BEYOND		TAKE-OFF	WIDTH
		Threshold	Glide Slope		
06 24	MIRL				100'
08 26	HIRL CL REIL 2 PAPI-R (angle 3.9°) RVR		3045'		150'
	HIRL CL ALS REIL 2 APAPI-R (angle 4.8°) RVR		3290'		

- 1** Three white inset pre-threshold centerline lights. Two pairs of inset white lights 1099' upwind of each threshold mark. Yellow rwy edge lights for final 1305' Rwy 26 and Rwy 08. **2** For aircraft with eye-to-wheel height up to 10'. **3** CAUTION: PAPI approach slope Rwy 08 will ensure clearance over tall vessels.
- 4** CAUTION: APAPI Rwy 26 approach slope 4.8°. APAPI approach slope Rwy 26 will ensure clearance over vessels and chimney 952' MSL (700' AGL) 2.6 NM from threshold.

1 TAKE-OFF & DEPARTURE PROCEDURE

	2 Rwy 08		3 Rwy 26	
	Authorized Air Carriers	All Other Aircraft	Authorized Air Carriers	All Other Aircraft
A				
B	RVR 12	RVR 26	RVR 12	RVR 26
C	or 1/4	or 1/2	or 1/4	or 1/2
D				
	3 Rwy 24		Rwys 06	
	Climbing LEFT turn heading 150° to 2000'. Proceed on course after 3 DME ITZ.		Pilots are responsible for determining minimum climb gradient and/or routing for obstacle and terrain avoidance. Pilots may depart IFR by using a take-off visibility that will allow avoidance of obstacles on departure, in no case less than 1/2 mile.	
A				
B	1/2			
C				
D				

- 1** Flight between hdg 019° clockwise to hdg 057° prohibited below 3100'.
- 2** Ships to 316' MSL approximately 0.1 NM past departure end of rwy.
- 3** Ships to 363' MSL approximately 0.4 NM past departure end of rwy.

4 DEPARTURE CLIMB RATE V/V (FPM)

GROUND SPEED	90	120	140	160	180	200	250	300
380 FT/NM	570	760	890	1020	1140	1270	1590	1900

CHANGES: Tower frequency added.

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NAVIGRAPH CHARTS INTENDED FOR FLIGHT SIMULATION ONLY - NOT FOR NAVIGATIONAL USE

CHART - TORONTO OSHAWA CY00

CY00/Y00

Apt Elev **460'**
N43 55.4 W078 53.8

JEPPESEN

4 SEP 20 (50-9) Eff 10 Sep

TORONTO, ONT

OSHAWA EXECUTIVE

ATIS (METAR AUTO when Twr inop)	*OSHAWA Ground	*Tower	OSHAWA Traffic	TORONTO Terminal
125.675	118.4	120.1	MF 120.1 when Twr inop.	133.4

CAUTION: Winch launched hang gliders, cable up to 2000' AGL from N43 55 W079 08 approximately 11 NM west of airport
CAUTION: Wildlife frequently on runways. Rws 23 & 30 right hand circuit.

78-54

Pilots are requested to maintain 2000' MSL or above over Metropolitan Toronto Zoo (N43 49 05 W079 11 15).

Flights are prohibited between 2230-0630 local time unless approved by Airport Manager.

Take-off Run Available for Intersection Departures:		
RUNWAY	INTERSECTION	RUNWAY REMAINING
30	B	4000'

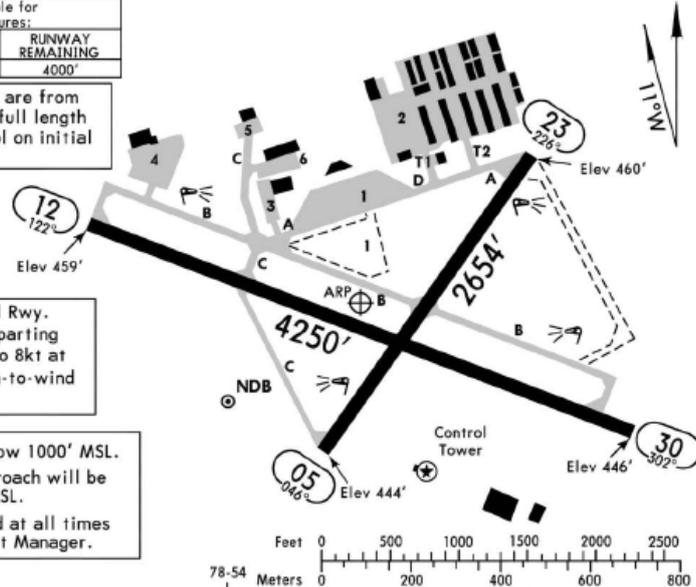
Normal Rwy 30 departures are from Twy B. Aircraft requiring full length must notify Ground Control on initial contact.

43-55.5

Rwy 30 is the preferential Rwy. Anticipate landing and departing Rwy 30 in crosswinds up to 8kt at 90°. Pilots may request in-to-wind rwy if necessary.

On departure no turns below 1000' MSL. Arrival turns to final approach will be made at or above 1000' MSL.

Training flights prohibited at all times unless approved by Airport Manager.



ADDITIONAL RUNWAY INFORMATION

RWY		USABLE LENGTHS			WIDTH
		LANDING Threshold	BEYOND Glide Slope	TAKE-OFF	
05	① MIRL ① REIL ①② PAPI-L (angle 3.0°)				100'
23	① MIRL ①② PAPI-L (angle 3.0°)				100'
12	① HIRL ① REIL ①③ PAPI-L (angle 3.0°)				100'
30	① HIRL ① REIL ①③ PAPI-L (angle 3.0°)				100'

① Activate on 120.1.

② For aircraft with eye-to-wheel height up to 10'.

③ For aircraft with eye-to-wheel height up to 25'.

TAKE-OFF & DEPARTURE PROCEDURE

	① Rwy 12	② Rwy 30
		③ Requires a minimum climb gradient of 270'/NM to 700'.
		Climb visual over airport to 1300' before proceeding on course.
A	1/2	1
B	1/2	1/2
C/D	1/2	2
	④ Rwy 23	⑤ Rwy 05
		⑥ Requires a minimum climb gradient of 230'/NM to 1300'.
		Climb visual over airport to 1300' before proceeding on course.
A	1/2	1
B	1/2	1/2
C/D	1/2	2

① Berm to 475' MSL within 0.1 NM of departure end of runway. Trees to 541' MSL within 0.5 NM of departure end of runway.

② Trees to 570' MSL within 0.5 NM of departure end of runway.

④ Trees to 528' MSL within 0.5 NM of departure end of runway. Church to 593' MSL aprx 0.7 NM past departure end of runway, 1600' left of runway centerline.

⑤ Trees to 561' MSL within 0.6 NM of departure end of runway.

DEPARTURE CLIMB RATE V/V (FPM)

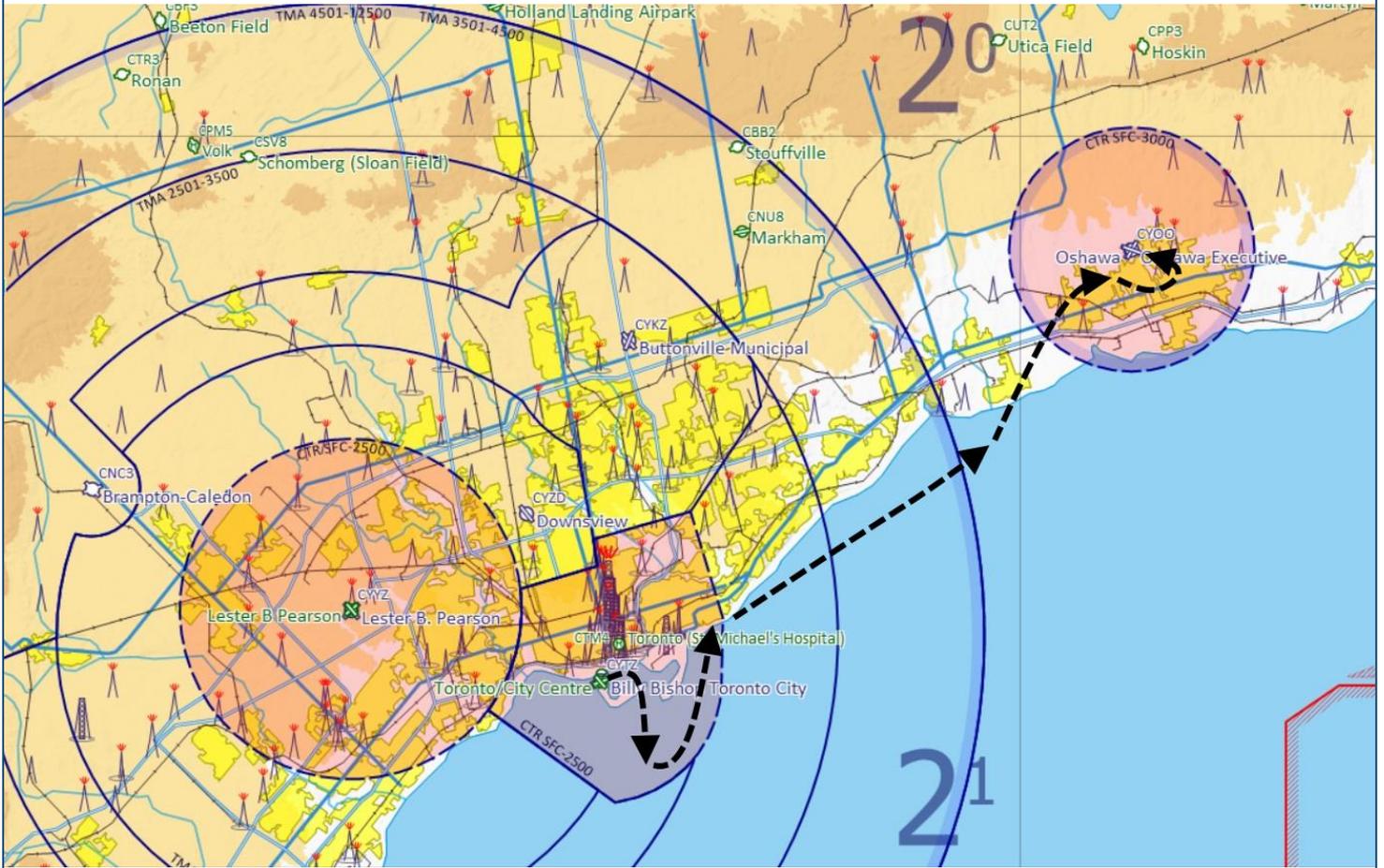
GROUND SPEED	90	120	140	160	180	200	250	300
⑥ 230 FT/NM	350	460	540	620	690	770	960	1150
③ 270 FT/NM	410	540	630	720	810	900	1130	1350

CHANGES: Chart reindexed, runway 12/30 length, location and airport name.

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NAVIGRAPH CHARTS INTENDED FOR FLIGHT SIMULATION ONLY - NOT FOR NAVIGATIONAL USE

MAP - VFR 05



Map courtesy of SkyDemon

VFR 06. CROSSWIND



Crosswind Inputs
Drift Angle
Short Field Landing

Battle the wind in the circuit at Sumburgh in the Shetland Islands as we introduce you to the considerations needed to deal with crosswind conditions before returning for a short-field landing.

The wings of an aeroplane are, of course, designed to give lift when air is passing over them. This airflow can be produced by accelerating the aircraft with thrust, but the same result can be achieved if a strong wind is present, giving rise to problematic ground handling.

Whilst taxiing in windy conditions, you can consciously position the controls in a way to resist any asymmetrical lift, which may otherwise conspire to make manoeuvring difficult or even cause momentary, uninvited flight!

Follow this taxi route, crossing runway 24 and holding short at the holding point.

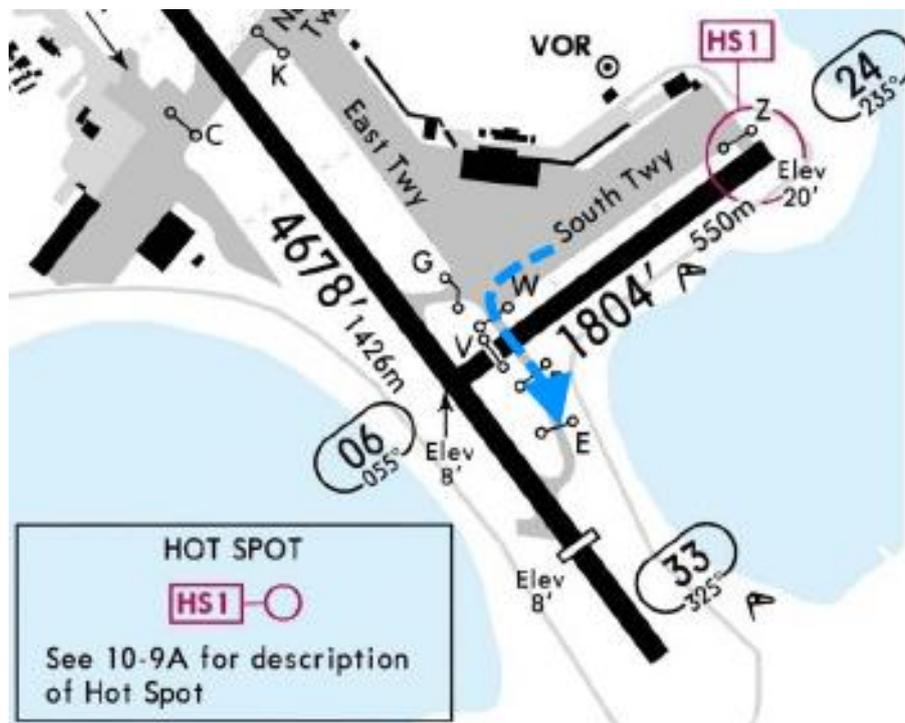
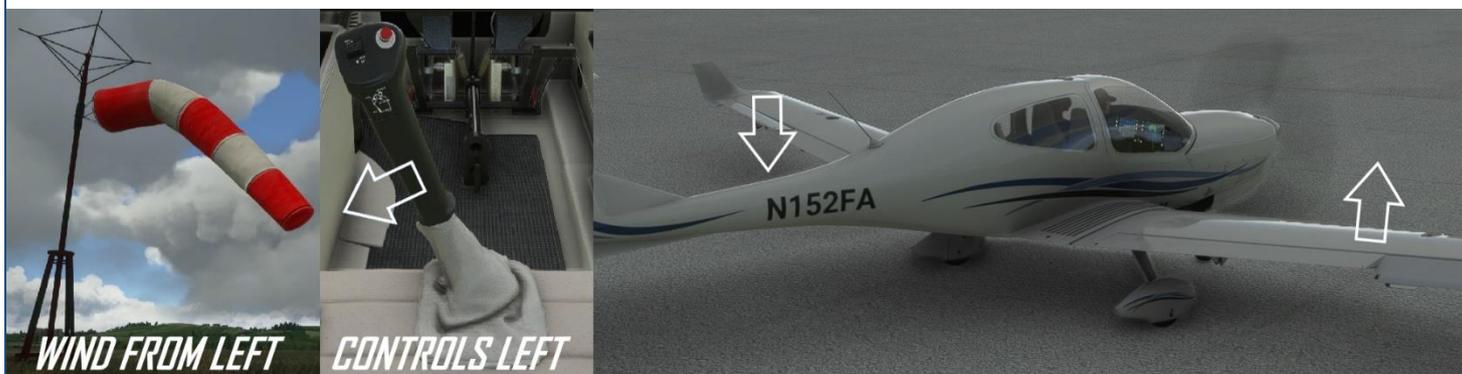


Chart Copyright © Jeppesen 2020 via Navigraph. All rights reserved.

CROSSWIND INPUTS

A strong wind from the front left of the nose will increase lift on the left wing, which may cause the aircraft to roll right and strike the right wingtip on the ground.

To counter this right-rolling force, move the controls fully to the left as though you are turning left. This deflects the ailerons to reduce the lift on the left wing and increase the lift on the right. The image below illustrates a wind from ahead and left of the nose.



If the wind is striking the aircraft from rear left, the reverse situation occurs, where the wind pushes down on the left wing. This would be countered by a full deflection right-turning input on the controls.

With a strong crosswind from ahead (nose into wind), turn the controls into wind. If the crosswind is from behind (nose out of wind), turn out of wind.

NOSE IN - TURN IN

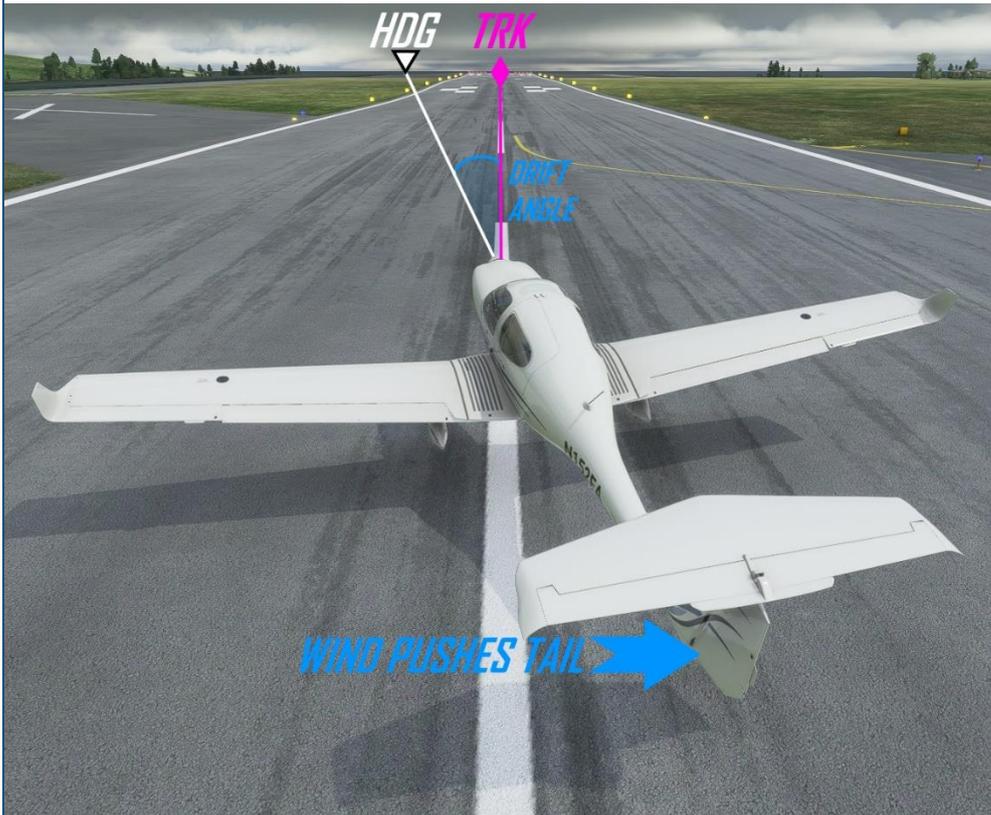
NOSE OUT - TURN OUT

Continue to apply these control inputs all the while you are on the ground, remembering to reconsider the wind direction each time you turn whilst taxiing. The takeoff roll is no different, maintain full control deflection at the commencement of the takeoff run.

As you accelerate and your speed increases, so does the force being generated by the ailerons. Gradually reduce your input as you gain speed, still holding some aileron deflection for lift-off.

Once both main wheels are off the ground you can resume normal flying techniques and neutralise the controls.

DRIFT ANGLE



As soon as the nosewheel is lifted for takeoff, the tyre loses traction and the effects of weathercocking take place. The wind pushes on the tail, turning the aircraft nose more into wind. Although this causes the aircraft to yaw, your track over the ground remains mostly unaltered.

The difference between where your nose is pointing (Heading/HDG) and your path over the ground (Track/TRK) is your drift angle.

Modern avionics allow the pilot to see their drift angle on the instrument displays, as part of the Horizontal Situation Indicator (HSI). The magenta coloured diamond represents the aircraft track. The G1000 instrumentation system fitted to our DA40 allows the detected wind to be displayed on screen. To do this, click **PFD → WIND** and select the format you prefer.

Calculating and Using Drift Angle

Drift angle is related to your Ground Speed (GS) and the speed of the Crosswind (X/W) component. If travelling at 60kts GS, your drift angle equals the X/W.

So, at 60kts GS with a 20kts X/W, your drift angle will be 20 degrees. Double your GS to 120kts, the drift angle will halve to 10 degrees.

By applying a Heading (HDG) correction into wind that is equal to your drift angle, you will fly the required Track (TRK).

To fly a TRK of 360, with a 20kts X/W from the left at 120kts GS, your drift angle is 10 degrees, requiring a HDG of 350.



SHORT FIELD LANDING

We're going to practice landing on the short runway 24 at Sumburgh, totalling just 550m. A short field landing is very much like a normal landing but requires extra precision in speed control and touchdown, followed by maximum deceleration.

Normally runway 24 at Sumburgh is reserved for helicopter use, but we're going to use its short, paved surface for our demonstration.

Choose an aiming point nearer to the runway start than usual, perhaps the runway numbers, an early centreline or other marking. You will aim for this point, but due to distance taken up in the flare, the touchdown will occur beyond the aiming point. The challenge is to minimise this flare distance.

After touchdown, lower the nose and commence firm braking as soon as possible, with enough pressure to hold a strong deceleration but avoiding locking up and skidding a tyre, which would damage the tyre, affect controllability and ultimately increase stopping distance.



For this landing onto runway 24, use the middle of the first centreline stripe as an aiming point. Strive to touchdown in the zone shown in green, between the aiming point and the first taxiway on the right.

After touchdown, brake hard and try to come to a stop in the yellow Stop Zone before the second exit on the right.

CHART - SUMBURGH EGPB

EGPB/LSI

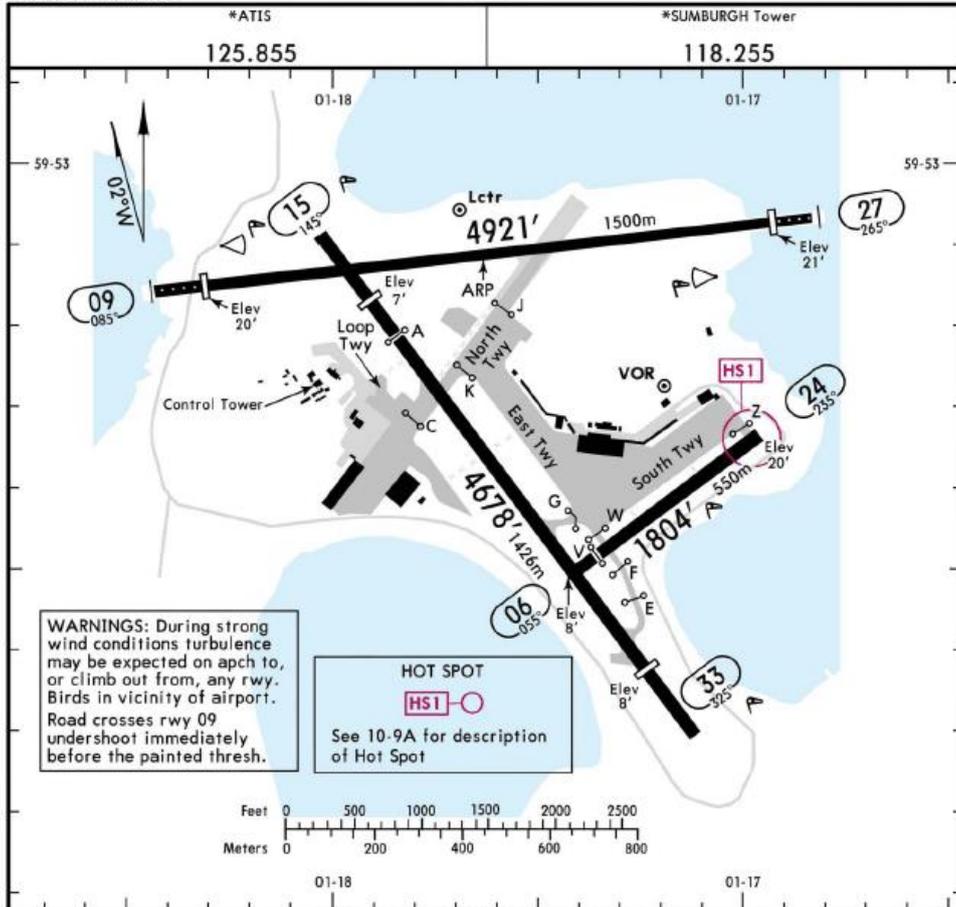
Apt Elev 21'
N59 52.9 W001 17.6

JEPPESEN

7 SEP 18 (10-9) Eff 13 Sep

SUMBURGH, UK

SUMBURGH



WARNINGS: During strong wind conditions turbulence may be expected on approach, or climb out from, any runway. Birds in vicinity of airport. Road crosses runway 09 undershoot immediately before the painted threshold.

HOT SPOT
HSI - O
See 10-9A for description of Hot Spot

ADDITIONAL RUNWAY INFORMATION

RWY		USABLE LENGTHS			WIDTH
		Threshold	Landing Beyond	Glide Slope	
06 ① 24					148' 45m
09 ② 27	HIRL HIALS PAPI-L (3.0°, MEHT 20')	RVR 4579' 1396m ④			4327' 1319m 148' 45m
	HIRL HIALS PAPI-L (angle 3.0°)	RVR 4626' 1410m ⑤	2858' 871m		
15 ③ 33	HIRL APAPI-L (angle 4.0°)				151' 46m
	HIRL				

- ① Rwy 06/24 for helicopter use only.
- ② Rwy grooved.
- ③ Closed to fixed wing aircraft for NIGHT landings, except in an emergency. NIGHT take-offs are restricted to operators with procedures accepted by the CAA. Rwy grooved.
- ④ LDA 4084' 1245m
- ⑤ LDA 4134' 1260m

	TAKE-OFF		
	Low Visibility Take-off	Adequate vis ref (Day only)	
A	Day: RL & RCLM Night: RL	Day: RL or RCLM Night: RL	Adequate vis ref (Day only)
B	RVR 300m ①	400m	500m
C	NOT APPLICABLE		
D	NOT APPLICABLE		

① T/O RVR rwy 09/27 and VIS rwy 15/33 below 400m available only for authorized Air Operator Certificate holders.

CHANGES: Hot spot. © JEPPESEN, 2000, 2018. ALL RIGHTS RESERVED.

NAVIGRAPH CHARTS INTENDED FOR FLIGHT SIMULATION ONLY - NOT FOR NAVIGATIONAL USE

VFR 07. ABNORMALS



Initial Actions

Aviate – Navigate – Communicate

DODAR

Diagnose – Options – Decide – Assign – Review

Learn the decision-making process real pilots use to fly safely in the face of adversity and come up with a plan of action to land your stricken aircraft.

INITIAL ACTIONS

If an incident occurs, it is likely to be unexpected and will catch you by surprise. Historically there have been cases where the shock has been so strong that it consumes all of the pilot's attention, leaving nothing for safely flying the aircraft.

It is of great benefit to be able to overpower this instinctive and impulsive reaction. One reliable way of doing so is to employ a structured approach.

A simple three-step response, performed in the correct order, will keep you safe in the short term and help buy you crucial seconds to allow the shock to pass whilst still remaining firmly in control of the situation.

AVIATE	Ensure you have straight and level control of the aeroplane or perform any manoeuvres that are immediately required, such as aborting your takeoff or commencing a go-around.
NAVIGATE	Guide the aircraft onto a safe flight path, which might necessitate a turn away from terrain or controlled airspace.
COMMUNICATE	If outside assistance is required, inform ATC that you have a problem and you are having to alter your flight path to deal with it. You can provide further information once a plan has been made.

DODAR

Once the initial actions have been completed, you will have more situational awareness and will be better prepared to construct a sensible plan, which can also be arrived at by following another structured approach.

<i>DIAGNOSE</i>	Making decisions based on bad information will only result in a bad plan. Take time to ensure you have correctly identified what has happened and what the implications are.
<i>OPTIONS</i>	For a minor occurrence, one option is to do nothing, but be sure there are not deeper implications before continuing a journey after a failure. If a diversion appears necessary, gather your airport options, taking account of distance, facilities, runway length, weather etc.
<i>DECIDE</i>	Once you have considered your options, decide which results in the safest course of action.
<i>ASSIGN</i>	Once a decision has been reached, begin to put your plan into motion and communicate your intentions to ATC. Set up your aircraft systems if needed.
<i>REVIEW</i>	Review your decision to ensure that it is still the safest course of action if conditions have changed. Run through any special procedures you might have to perform.

Following these steps give you the best chance at correctly identifying what has occurred, formulating a plan and arriving at a safe outcome. The steps can be used for all types of flying, from a solo VFR trip to an airline flight.

Rushing through the process may lead you to hurry your decision and not consider a more suitable option, so controlling your pace is an important aspect.

Committing these steps to memory will put you in a good position to be able to deal with whatever comes your way.

CHART - LULEÅ ESPA

ESPA/LLA

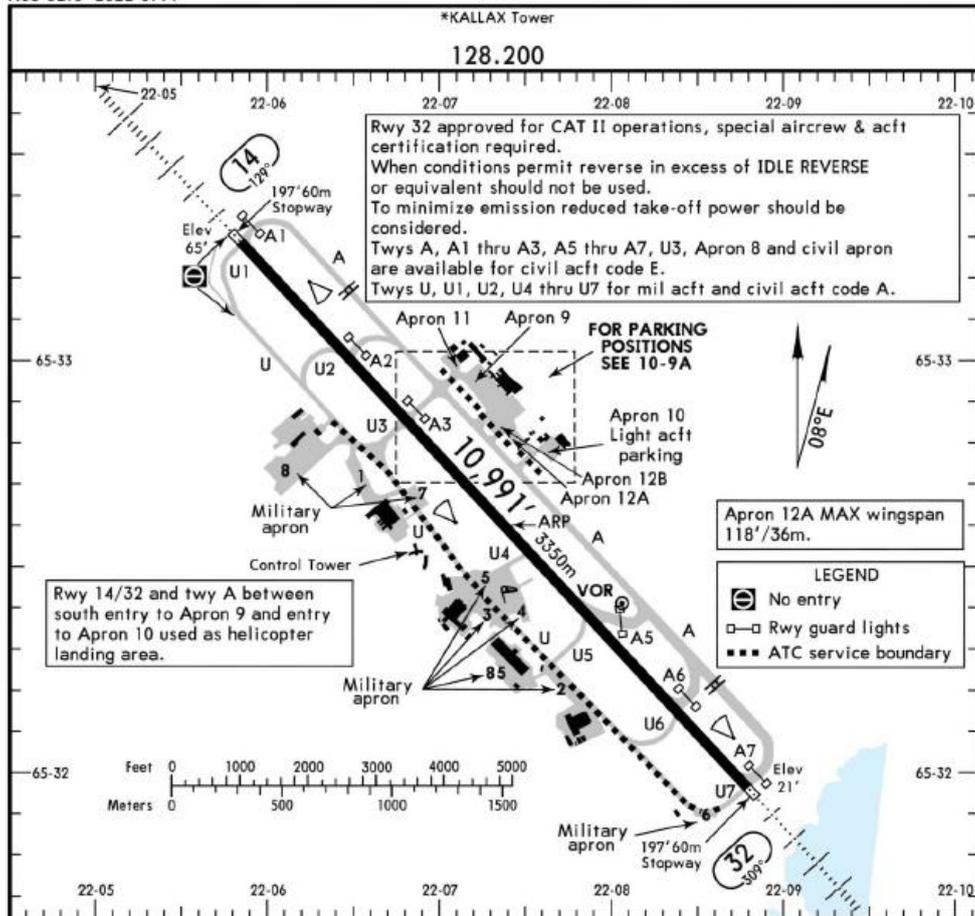
Apt Elev 65'
N65 32.6 E022 07.4

JEPPESEN

6 NOV 20 (10-9)

LULEA, SWEDEN

KALLAX



ADDITIONAL RUNWAY INFORMATION

RWY		USABLE LENGTHS		TAKE-OFF	WIDTH
		Threshold	Glide Slope		
14	HIRL (60m) HIALS SFL PAPI-L (angle 2.86°) RVR		9837' 2998m	1	148' 45m
32		10,112' 3082m			

1 TAKE OFF RUN AVAILABLE

RWY 14:

From rwy head 10,991' (3350m)
 twy A2 int 8694' (2650m)
 twy A3 int 7415' (2260m)

RWY 32:

From rwy head 10,991' (3350m)
 twy A6 int 9465' (2885m)
 twy A5 int 7661' (2335m)

Standard

TAKE-OFF & DEPARTURE PROCEDURE

	Low Visibility Take-off	
	Day: RL & RCLM Night: RL	Day: RL or RCLM Night: RL
A		Adequate vis ref (Day only)
B		
C	RVR 300m	400m
D		500m

OMNIDIRECTIONAL DEPARTURE PROCEDURE

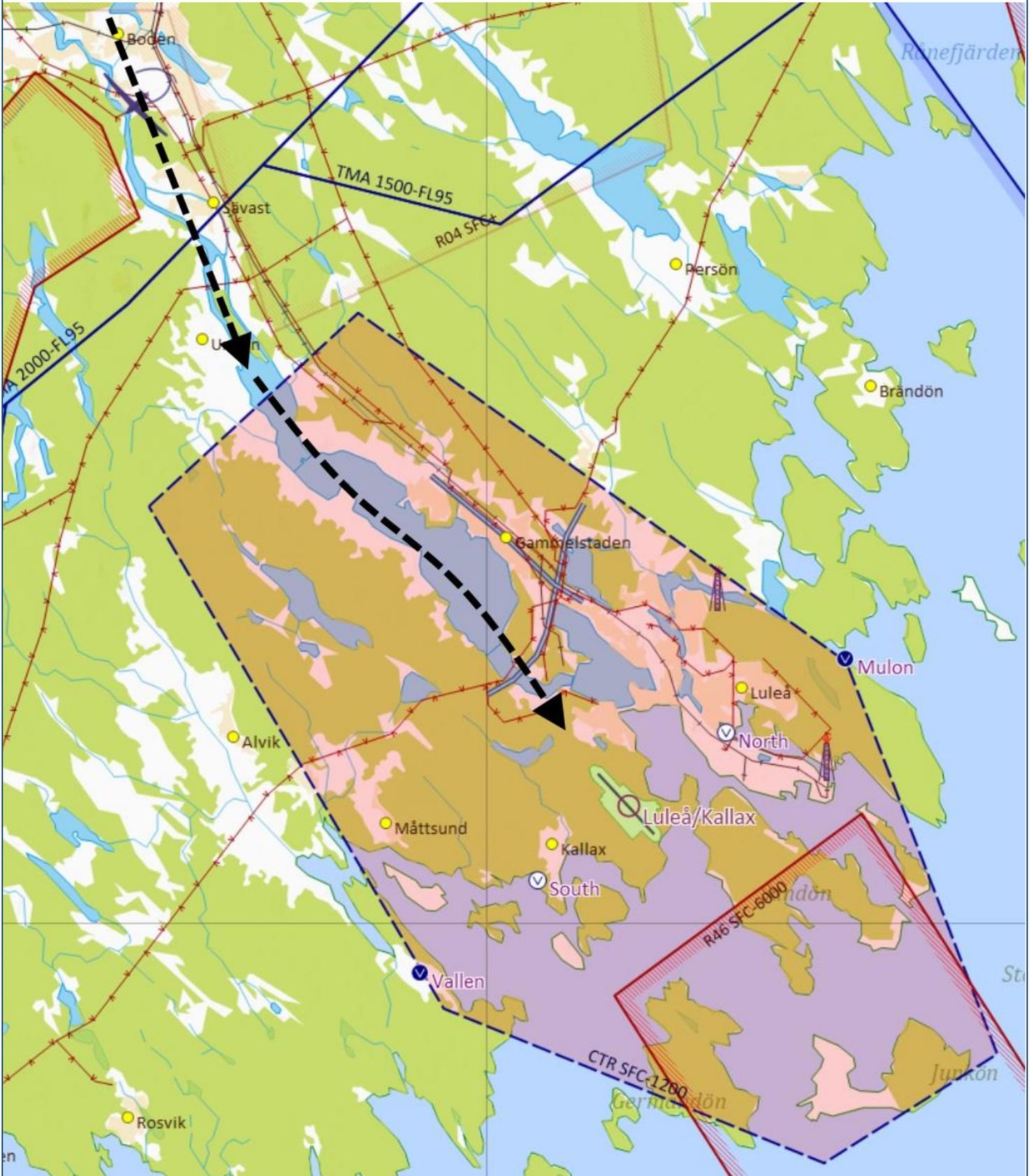
ALL RWYS: Climb STRAIGHT AHEAD to minimum turning alt 500'. Continue climb to appropriate MSA.

CHANGES: None.

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NAVIGRAPH CHARTS INTENDED FOR FLIGHT SIMULATION ONLY - NOT FOR NAVIGATIONAL USE

MAP - VFR 07



Map courtesy of SkyDemon

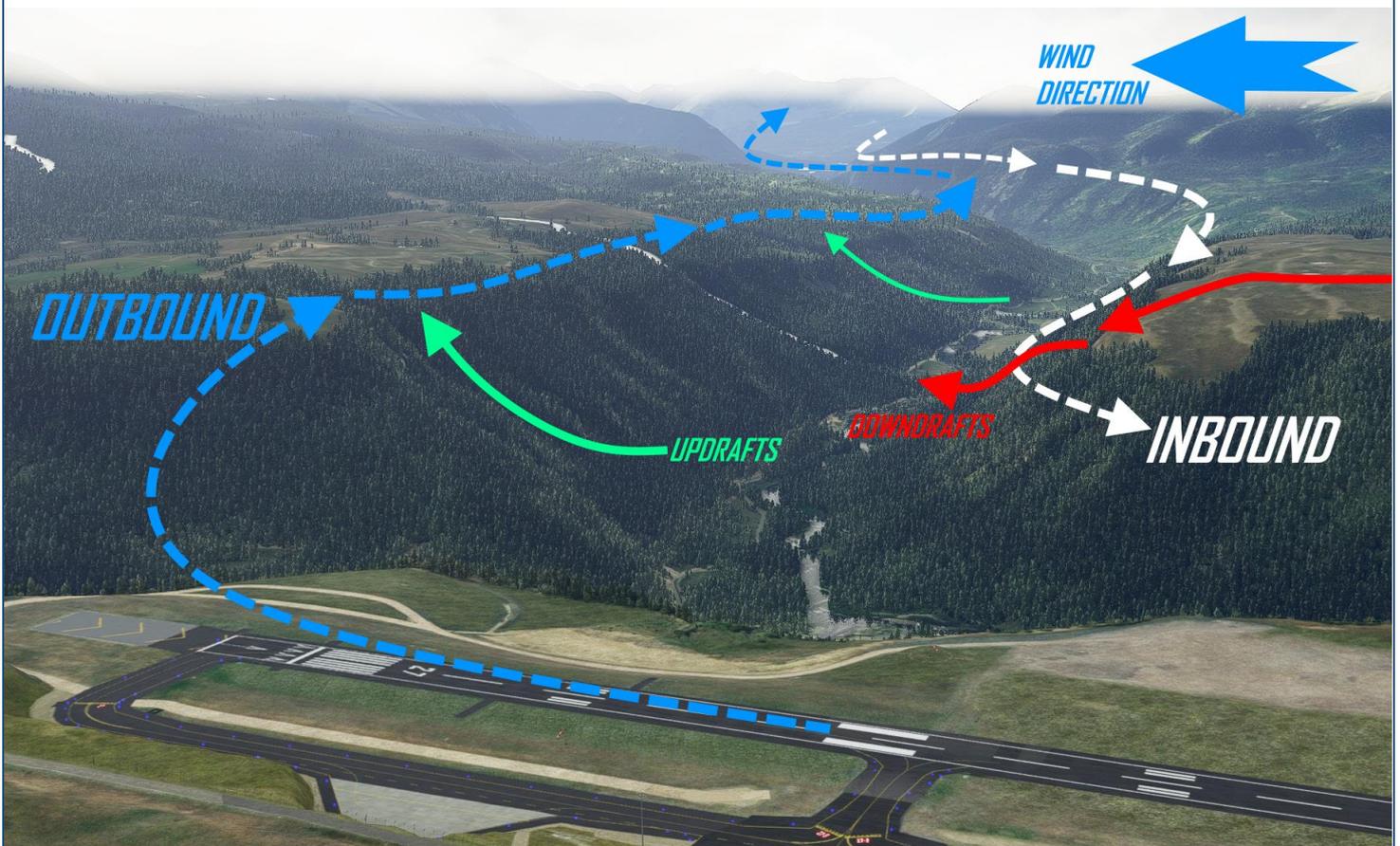
VFR 08. MOUNTAIN FLYING



Valley Winds
Density Altitude
Ridge Crossing
Valley Turns

Tour the glorious high lands and towering mountain ranges surrounding Telluride, Colorado as we introduce the basic theory surrounding mountain flying.

Flying at high altitudes and around mountains is a deep topic with risk and rewards. We will touch on the basics of this fascinating undertaking here.



VALLEY WINDS



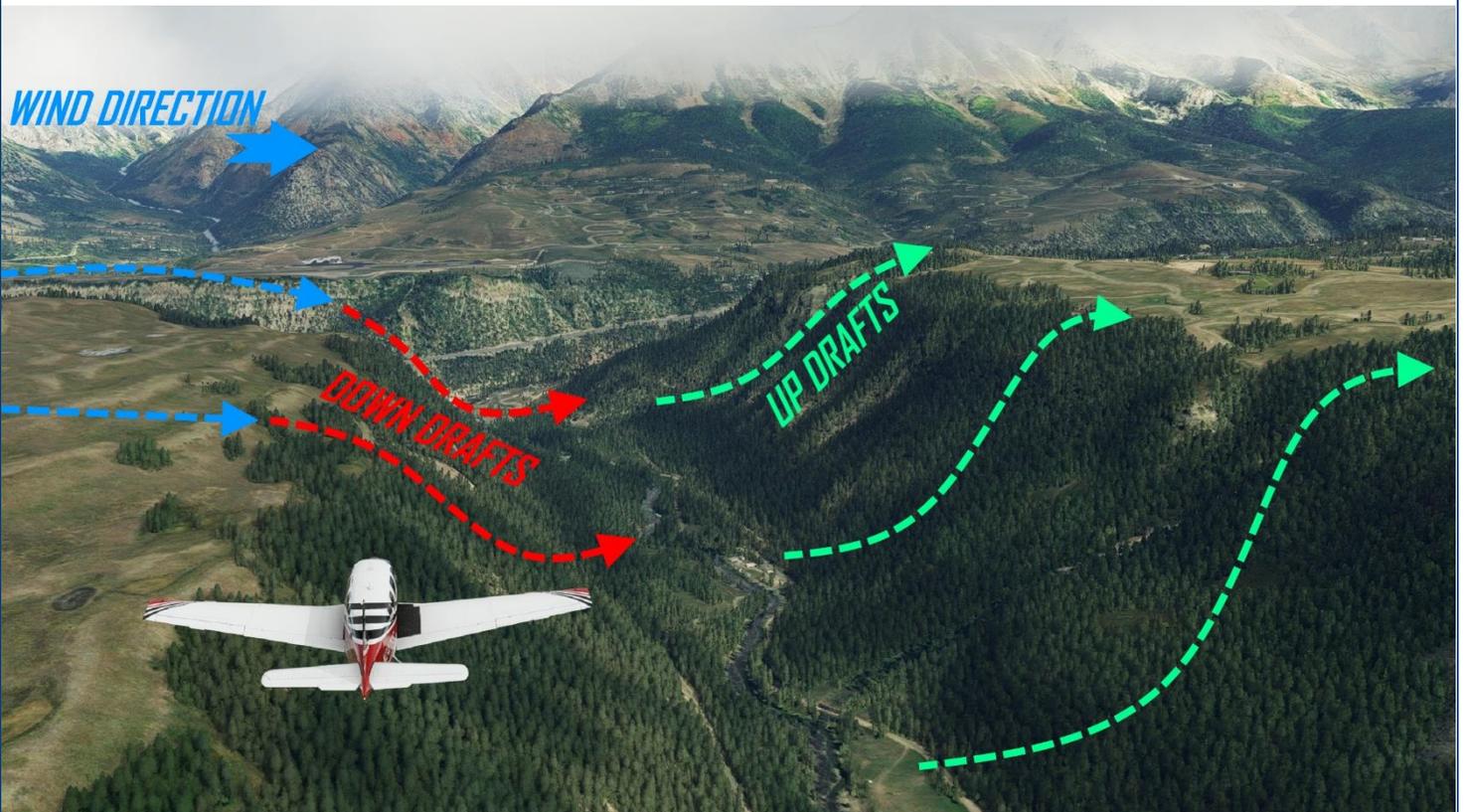
Much of your mountain flying will involve flight along valleys. In windy conditions, your positioning within the valley has great importance for safe flight.

When the wind blows down a valley side, it flows very much like a waterfall. When flying along this leeward side of a valley wall, you would have to fight this downward flow just to maintain altitude.

Conversely, flight along the windward side would allow you to ride a rising cushion of air, which glider pilots regularly seek for hours aloft without thrust.

Downdrafts can be severe and possibly too strong for your aircraft to cope with. At high altitude, this effect is compounded by performance losses, discussed next.

In this lesson, we will take you along a valley and compare the marked differences between each side. try to stay as close to the valley walls as possible, maintaining 10,000ft to get the strongest effect.



DENSITY ALTITUDE

The air gets thinner as you increase altitude, which has several effects on an aeroplane. This causes a noticeable reduction in the performance of the engine and the wings, resulting in increased takeoff distances and reduces your climb rate.

Altitude is only one factor in aircraft performance, as other aspects such as high temperature or humidity also reduce the air density; this effective altitude is known as Density Altitude.

Weight becomes more important than ever, as you may be lifting off the runway already near to your aircraft's maximum operating altitude. You may not be able to depart fully loaded.

You may find only a narrow window in the day where you can satisfy both performance and mountain flying requirements. Early in the morning the winds are generally lighter and cooler temperatures reduce your density altitude. Later in the day, you can get quick developing storms and changeable conditions. Later into the evening the temperatures are starting to cool again, but daylight is fading.

This also combines with many mountainous airfields being remote and lacking services, such as 24hr operation, further limiting your options.

RIDGE CROSSING

The air can have very strong and rapidly changing effects on your aeroplane when approaching complex terrain. One method to improve safety margins when crossing a ridge line is to approach at a 45-degree angle, so that you can more easily make an escaping turn towards lower ground should your plan not go well.

If you need to cross a ridge but clearly do not have enough distance to climb sufficiently, you can perform a 'shuttle climb' where you make a continuous climbing turn, flying in a circle, until reaching your desired altitude. It may take several laps to gain enough height, especially as your climb rate diminishes whilst turning, so factor this into your fuel planning.

At the end of this lesson, we'll try a simple ridge crossing to demonstrate this procedure, after which you are free to roam as long as you wish, keeping an eye on your fuel level.

VALLEY TURNS

It wouldn't take much to take a wrong turn as you carve your way through a mountain range.

You may find yourself accidentally heading up a valley towards a dead-end, with walls too steep to climb above. The only way out is to turn around to go back the way you came.

Making even a tight turn in a valley takes up considerable lateral distance. This turning radius can be tightened by reducing your speed, employing the help of flaps if needed. We will practice a valley turn halfway through the mission in a relatively wide area to demonstrate the room you might need.

If you deem a turn to be necessary, first move over to one side of the valley to allow for extra room to complete the manoeuvre. Be sure that you have enough room to turn before beginning the manoeuvre, as once you have begun you will have to recognise an error rapidly in order to abort and escape unscathed.

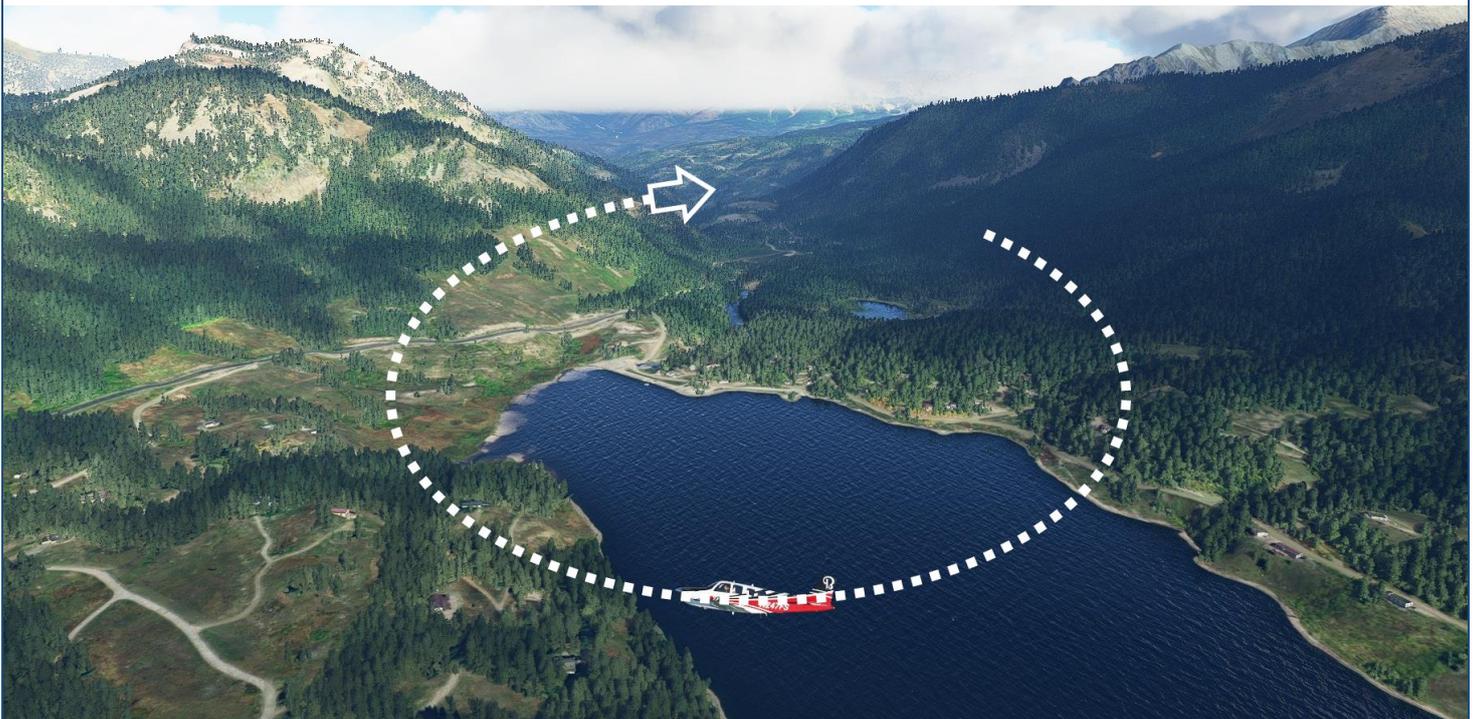
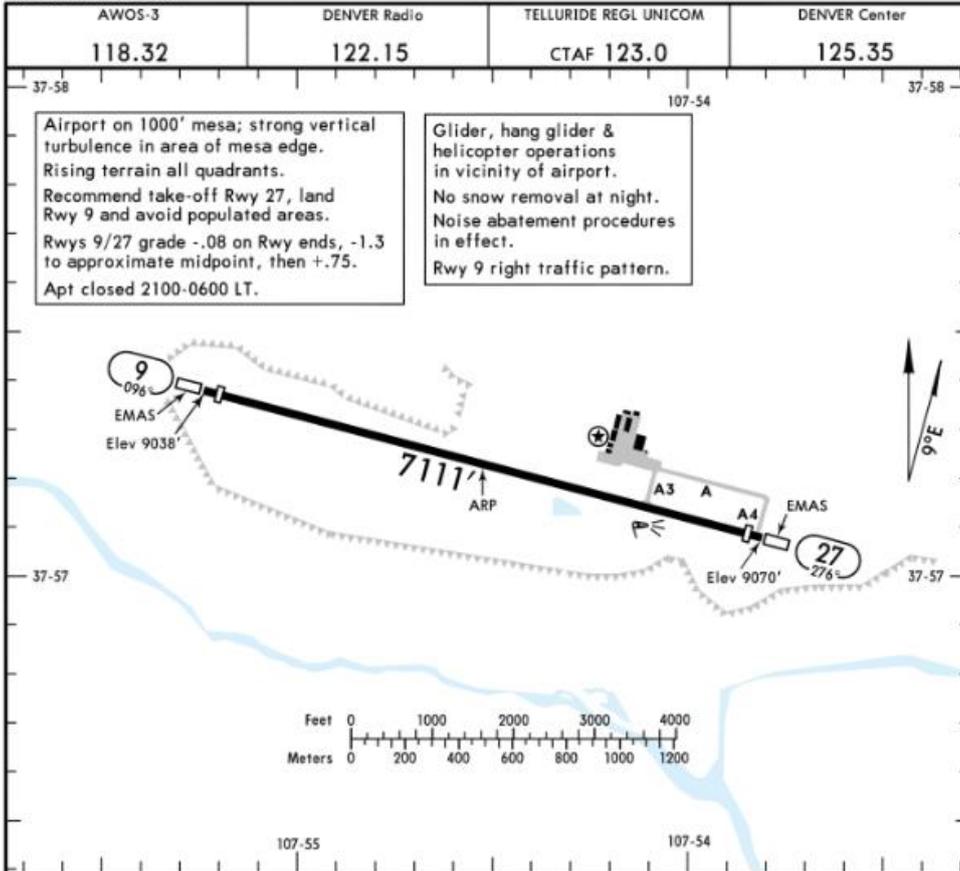


CHART - TELLURIDE KTEX

KTEX/TEX
Apt Elev **9070'**
N37 57.2 W107 54.5

JEPPESEN
5 MAY 17 (10-9)

TELLURIDE, COLO
TELLURIDE REGL



ADDITIONAL RUNWAY INFORMATION

RWY		USABLE LENGTHS			TAKE-OFF	WIDTH
		Threshold	Glide Slope	LANDING BEYOND		
9	① HIRL ① REIL ① PAPI-L (angle 3.55°) grooved	6911'				
27	① HIRL ① REIL ② PAPI-L (angle 4.0°) grooved	6911'			100'	

- ① Activate on 123.0. Approach lighting system is for emergency use only, 2100-0600 LT.
- ② Unusable beyond 2.5 NM due to terrain.

TAKE-OFF & OBSTACLE DEPARTURE PROCEDURE				FOR FILING AS ALTERNATE				
Rwy 27			Rwy 9	LOC Rwy 9	RNAV (GPS) Z Rwy 9	RNAV (GPS) Y Rwy 9	VOR DME-A	
Adequate Vis Ref	STD	Visual Climb Over Airport						
1 & 2 Eng	1/4	1	NA	A	2300-2	2600-2	3100-2	3400-6
3 & 4 Eng		1/2		C	NA	2600-3	NA	NA
				D	NA	NA	NA	NA

OBSTACLE DP: Rwy 27, climb to 12000' on heading 276° and the ETL R-096 to ETL VOR. For aircraft departing V-382 southeast bound, continue climb-in-hold to 14200'.

VISUAL CLIMB OVER AIRPORT (VCOA): Rwy 27: Obtain ATC approval for VCOA when requesting IFR clearance. Climb in visual conditions to cross Telluride Rgnl Airport westbound at or above 14300' then proceed on ETL R-096 to ETL VOR.

TAKE-OFF-OBSTACLE NOTES: Note: Rwy 27: Terrain 174' from DER, 355' left of centerline, 9090' MSL. Terrain 286' from DER, 288' left of centerline, 9076' MSL. Fence 32' from DER, 430' left of centerline, 10' AGL/9106' MSL. Fence 154' from DER, 423' right of centerline, 15' AGL/9068' MSL. Fence 292' from DER, 422' right of centerline, 18' AGL/9065' MSL. Tree 32' from DER, 420' left of centerline, 72' AGL/9111' MSL. Tree 67' from DER, 495' left of centerline, 88' AGL/9126' MSL. Tree 70' from DER, 498' left of centerline, 86' AGL/9124' MSL. Tree 77' from DER, 415' left of centerline, 73' AGL/9111' MSL. Tree 173' from DER, 530' right of centerline, 41' AGL/9079' MSL. Tree 234' from DER, 385' left of centerline, 55' AGL/9093' MSL. Tree 385' from DER, 380' right of centerline, 56' AGL/9094' MSL. Tree 431' from DER, 266' right of centerline, 50' AGL/9088' MSL.

CHANGES: Take-off minimums, obstacle notes.

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NAVIGRAPH CHARTS INTENDED FOR FLIGHT SIMULATION ONLY - NOT FOR NAVIGATIONAL USE

VFR TRIPS

It's time to lose your training wheels and be let loose on three short cross-country trips with a stop along the way. This time you're on your own.

Each trip is broken into two parts and allow you to exercise your new skills solo and with purpose. Advice is given in the NavLog to help identify each waypoint and which altitudes to fly, but all checks, aircraft operations and joining procedures are down to you. Airfield charts are provided (where published and available) below the map.

You depart with plenty of fuel, but be sure to put into practice your fuel mixture leaning for optimum efficiency. Unlike the other lessons, feel free to pause during these trips without adverse effects.

Make sure to come to a **stop on the runway** to end each leg. Feel free to use the 'back on track' function as currently there are no 'achievements' to be earned for these trips.

The screenshot displays the game's navigation interface. On the left is the NavLog table, which lists waypoints and provides instructions for each leg. The table is as follows:

FROM	TO	DISTANCE	ETE	
EGTR	EGKB	53.43 NM	25'48"	
#	NAME	HEADING	DISTANCE	ETE
06	POI6	191°	6.45 NM	3'7"
DARTFORD BRIDGE Head south to follow thr M25 Motorway, keeping it on your left, to cross the Thames at Dartford's Queen Elizabeth II Bridge. Fly to the right of the bridge and watch for opposite direction traffic.				
07	POI7	188°	6.36 NM	3'4"
BRANDS HATCH Make a slight left hand turn to reach Brands Hatch racetrack, a popular VRP.				
08	POI8	216°	5.53 NM	2'40"
SEVENOAKS Find this town with a triangular shape and cluster of small lakes.				
09	EGKB	299°	6.16 NM	2'58"
BIGGIN HILL ELEV: 599. Runway 21 right-hand circuit.				

Below the table is a VFR Map showing the flight route between waypoints. The map includes a 'BACK ON TRACK' button. At the bottom of the interface, there is a cockpit view showing the time as 10:36 Local / 10:36 UTC, a 'STOP WATCH' with a 'RESET' button, and a 'START' button. The cockpit also displays various instrument readouts and warnings.

Navigate enroute with the NavLog, which includes your Heading, Distance and Estimated Time Enroute (ETE) for each waypoint.

The SkyDemon route map is shown at the bottom of the NavLog and which has your route drawn. Press 'N' to open/close.

Also, you can see your route on the in-game VFR Map. Press 'V' to open/close.

CHOOSE THE CONDITIONS

In the briefing page for each trip, you can set the weather, time, date and season you wish for your trip, giving you plenty of flexibility and allowing multiple runs to really get to grips with VFR in a multitude of scenarios.

Set the flight conditions by opening the menu on the top right of the briefing screen, or using the weather toolbar options in-game.



Conditions set on your first leg are locked in if you quit and return later to resume your flight, so choose wisely. Try routes in the snow, at night or with strong winds to expand your skills and broaden your VFR experience. To re-fly a trip with different conditions, you will have to reset your progress for that trip, as detailed below.

RESETTING YOUR PROGRESS

To delete your progress and start a trip again, navigate to this standard path and delete the save files for that trip. Be careful to only delete the saves for the trips you intend to restart. This folder may need un hiding in Windows to access.

C:/Users/YOURNAME/AppData/Local/Packages/Microsoft.FlightSimulator_LETTERS+NUMBERS/LocalState/MISSIONS/ACTIVITIES

Consider Pinning this location to your start menu for future easy access.

VFR 09. UK TRIP



ELSTREE to BIGGIN HILL

54 NM - 25 MINS

BIGGIN HILL to SHOREHAM

51 NM - 24 MINS

Leave the popular Elstree airfield North of London and make your way around the capital, crossing the Thames at Dartford and making a stopover at Biggin Hill. Then continue South towards the coast, avoiding Gatwick airspace towards Shoreham.

Avoid climbing too high as most of the route is underneath the London Control Zone, which starts from 2500ft upwards. Keep an eye out for other traffic especially near Biggin Hill and Stapleford.

When following a line feature such as a motorway, keep it on your left to maintain a clear view and expect oncoming traffic to do the same.



VFR 10. USA TRIP



RENTON MUN to TACOMA NARROWS

43 NM - 20 MINS

TACOMA NARROWS to APEX AIRPARK

72 NM - 34 MINS

Depart Seattle's Renton Municipal airport and cruise through valleys, over bridges and across lakes as you tour the Washington landscape. Remain safely below the Class B airspace near the major Seattle Tacoma and Boeing Field airports.

The Seattle city centre and Sky Needle are within controlled airspace, but you'll still get a great view as you fly overhead the Stadium.

Be sure to climb as you leave The Great Bend on the second leg, as you'll encounter very high ground and mountain tops between the valleys.



VFR 11. NEW ZEALAND TRIP



MILFORD SOUND to MARTINS BAY

25 NM - 13 MINS

MARTINS BAY to QUEENSTOWN

72 NM - 37 MINS

Behold the stunning New Zealand South Island as you make a quick hop out of Milford Sound to Martins Bay before settling in on a long stretch to Queenstown, marvelling at the snow-capped mountains and meandering rivers.

New Zealand VFR flight gives a fantastic view of one of the world's most scenic locations. Be sure to choose the correct valley before you enter it, as you may end up out of options. If you discover you have taken a wrong turn, continue to navigate using your VFR map.



VFR 12. SKILLS TEST



Departure
Normal Circuit
Go-Around
Overhead Join
Touch & Go
Low-Level Circuit

Now that you've reached this stage, you have been shown everything you'll need to pass your skills test. Depart runway 22R in Venice, Italy and follow the lesson profile, as discussed with your examiner.

There will be certain aspects that the examiner will give special attention to, such as using 100% power when initiating a go-around or touch & go and using the correct flap setting. They will look for altitude holding accuracy and infringement of the restricted airspace over Venice City.

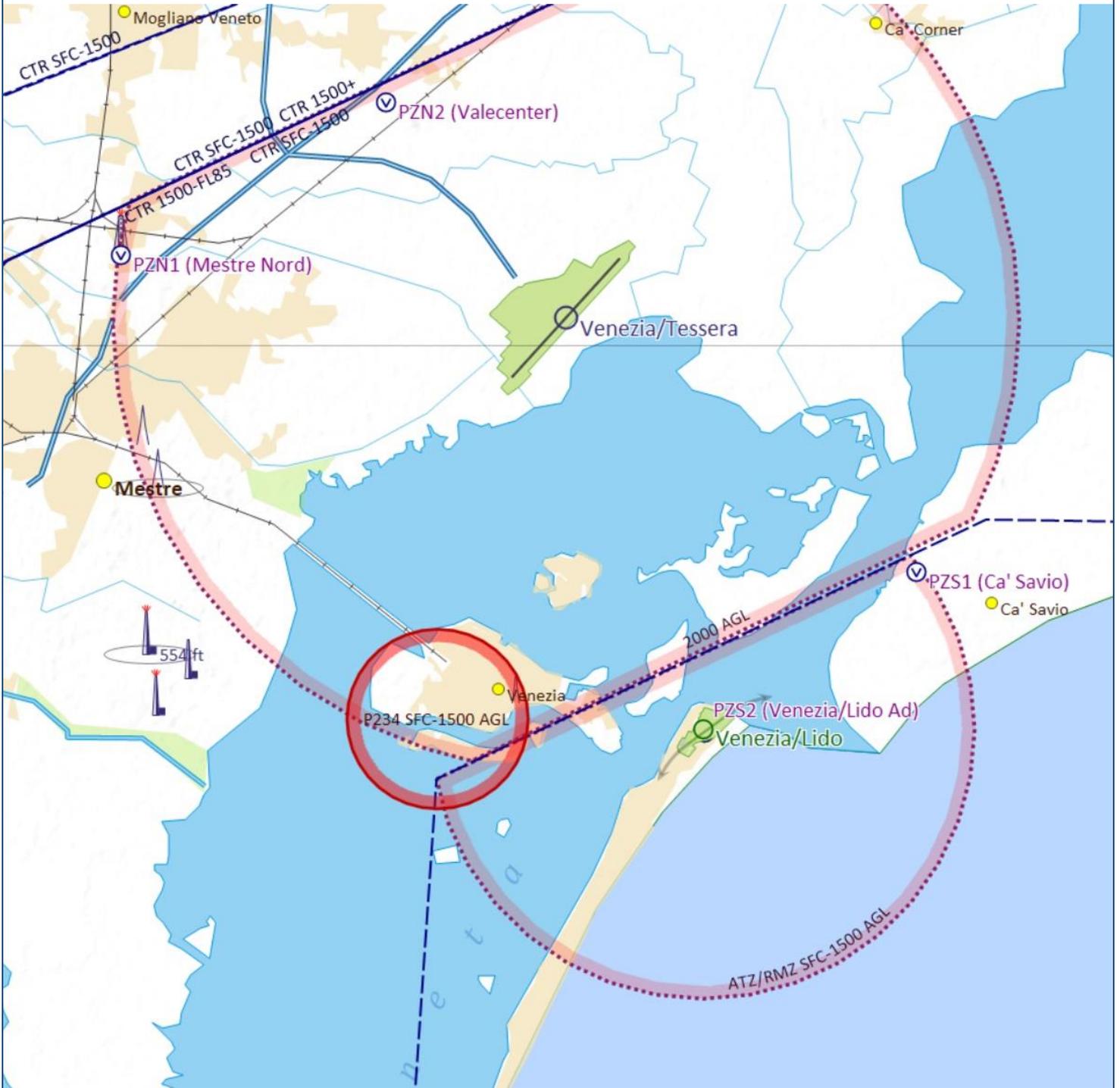
If the examiner notices a parameter starting to drift or sees something that needs correcting, they will give a brief caution. If the error goes uncorrected, it will result in a failure, requiring you to restart the flight to try again. Some errors will trigger an instant failure.

Configuration and checklists are your responsibility, so choose your speeds, turning points and flap settings as you deem appropriate, except at the request of the examiner. Make sure to correctly identify the boundaries of Lido runway 23, as it has few markings.

TEST PROFILE

- Depart Venice 22R and enter a normal left-hand circuit, followed by a go-around
- Leave Venice Tessera (LIPZ) for Venice Lido (LIPV), a small grass strip to the south east
- Fly overhead Lido and continue southbound for a short distance
- Make a U-turn to fly back towards Lido and execute an overhead join
- Fly a circuit and perform a touch & go
- Enter a low-level circuit to a full stop landing

MAP - VFR 12



Map courtesy of SkyDemon

CHART - VENICE TESSERA LIPZ

LIPZ/VCE

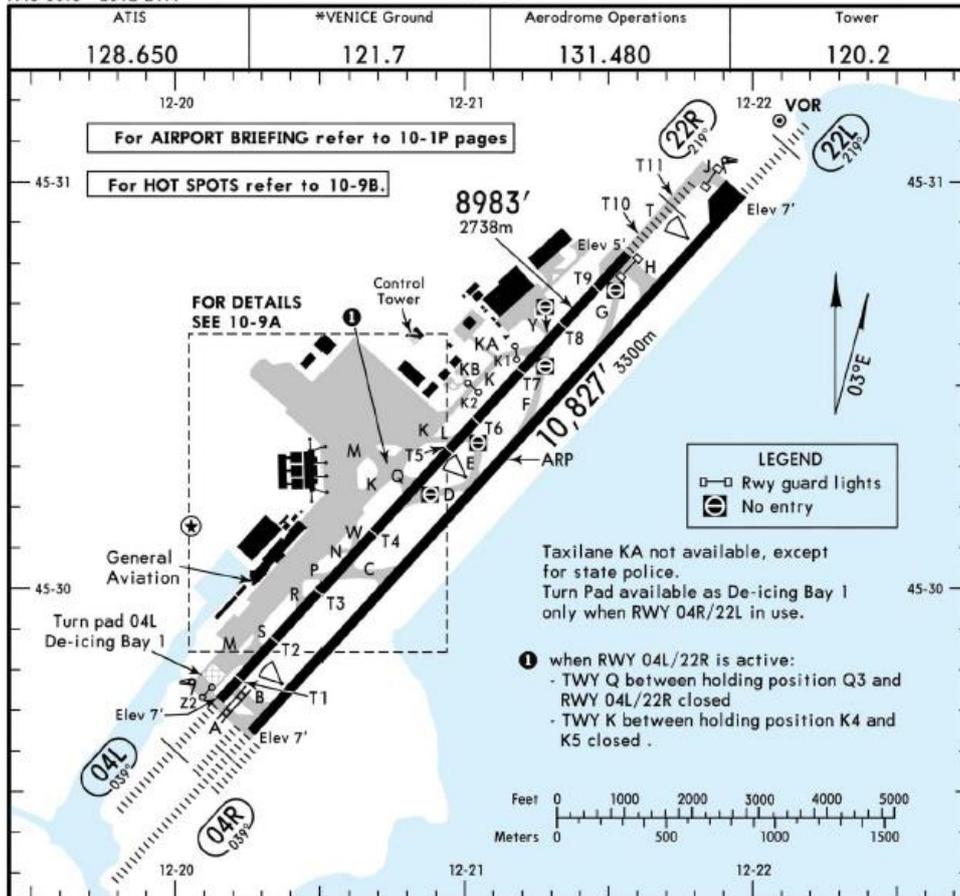
Apt Elev 7'
N45 30.3 E012 21.1

JEPPESEN

7 AUG 20 10-9 Eff 13 Aug

VENICE, ITALY

TESSERA



ADDITIONAL RUNWAY INFORMATION

RWY	HIRL (60m) HIALS REIL PAPI-L (3.2°)	USABLE LENGTHS			WIDTH
		Threshold	Glide Slope	TAKE-OFF	
04L 22R	HIRL (60m) CL (15m) HIALS-II TDZ REIL ③ RVR			④	148' 45m
04R 22L	HIRL (60m) CL (15m) HIALS REIL PAPI (3.2°) RVR		9856' 3004m	④	148' 45m

② RWY 04L/22R will only be used when RWY 04R/22L is not active. RWY 04L/22R and RWY 04R/22L cannot be used simultaneously. RWY 04L/22R used as taxi route when RWY 04R/22L is active.

③ PAPI (3.0°)

④ TAKE-OFF RUN AVAILABLE
Intersection take-offs are usable only on pilot's request or on TWR's request, previous pilot's agreement.

RWY 04L:
From rwy head 8983' (2738m)
twy S int 7940' (2420m)

RWY 22L:
From rwy head 10,827' (3300m)
twy H int 8694' (2650m)

RWY 04R:
From rwy head 10,827' (3300m)
twy B int 10,400' (3170m)
twy C int 7513' (2290m)

RWY 22R:
From rwy head 8983' (2738m)
turn pad 8530' (2600m)
twy K int 6693' (2040m)

	TAKE-OFF					
	Rwy 04R/22L					
	Low Visibility Take-off			Adequate vis ref (Day only)		
	① HIRL, CL & relevant RVR	RL, CL & relevant RVR	RL & CL	Day: RL & RCLM Night: RL or CL	Day: RL or RCLM Night: RL or CL	
A						
B	TDZ, MID, RO	TDZ, MID, RO				
C	RVR 125m	RVR 150m	RVR 200m	RVR 300m	400m	500m
D						1100m

① RWY 04R: RVR 75m with approved guidance system or HUD/HUDLS.

CHANGES: TWYs F and G. © JEPPESEN, 1999, 2020. ALL RIGHTS RESERVED.

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CHART - VENICE LIDO LIPV

LIPV

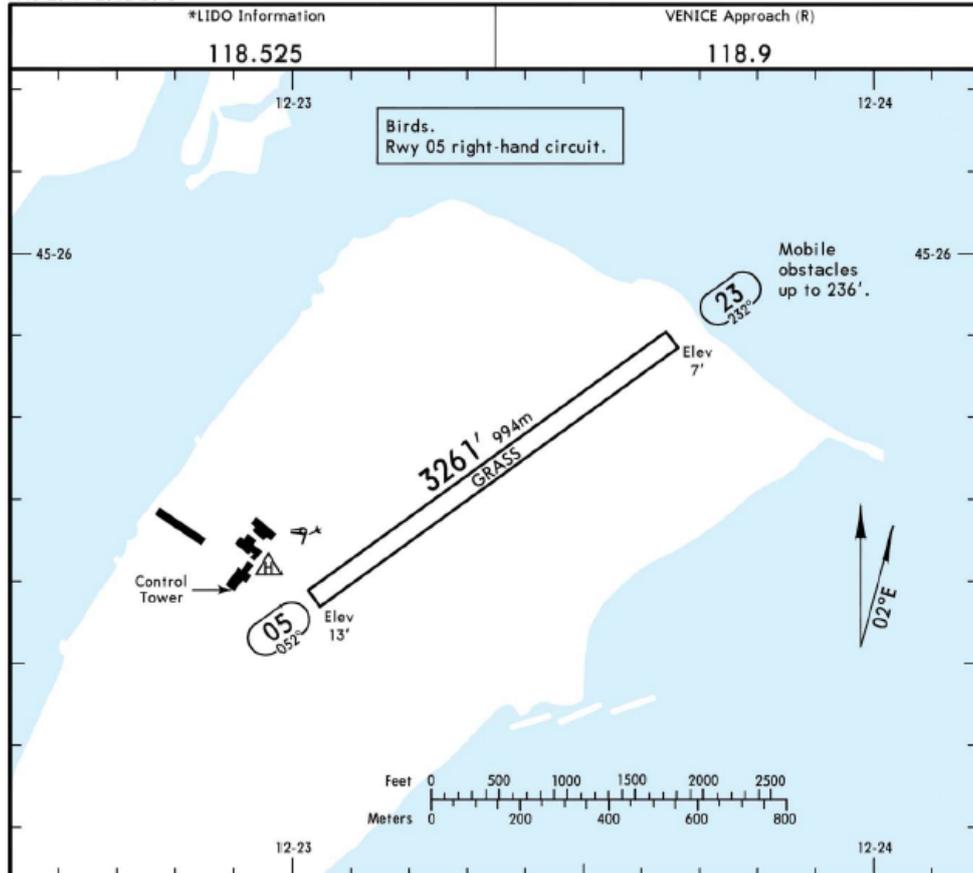
Apt Elev 13'
N45 25.7 E012 23.3

JEPPESEN

11 AUG 17 (20-9) Eff 17 Aug

VENICE, ITALY

LIDO



ADDITIONAL RUNWAY INFORMATION

RWY	USABLE LENGTHS		TAKE-OFF	WIDTH
	LANDING BEYOND Threshold	Glide Slope		
05				148' 45m
23				

CHANGES: Communications.

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MISSION ACCOMPLISHED



...or is it?

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WHERE NEXT?

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ABBREVIATIONS

Aviation is awash with abbreviated terms. This list will help you navigate a selection of the most common and useful to know abbreviations that will come up from time to time.

Bold indicates commonly used abbreviations for VFR flight.

AAL	Above Airfield Level
ACARS	Aircraft Communications and Reporting System
ADF	Automatic Direction Finding
AI	Attitude Indicator
AER	Approach End Runway
ADS	Automatic Dependent Surveillance
AFB	Air Force Base
AFM	Aircraft Flight Manual
AGL	Above Ground Level
AGNIS	Azimuth Guidance Nose in Stand
AIAA	Area of Intense Aerial Activity
ALS	Approach Lighting System
AMM	Aircraft Maintenance Manual
AMSL	Above Mean Sea Level
APU	Auxiliary Power Unit
ASDA	Accelerate Stop Distance Available
ASI	Airspeed indicator
ASU	Air Start Unit
ATA	Actual Time of Arrival
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATPL	Airline Transport Pilots Licence (UK)
ATR	Airline Transport Rating (USA & Canada)
BALS	Basic Approach Light System
BC	Patches
BR	Mist
C/S	Callsign
CAA	Civil Aviation Authority
CAS	Calibrated Airspeed
CAT	Clear Air Turbulence/Approach Category
CAVOK	Cloud and Visibility OK
CB	Cumulonimbus
CDA	Continuous Descent Arrival
CDI	Course Deviation Indicator
CDL	Configuration Deviation List

CG	Centre of Gravity
CGL	Circling Guidance Lights
CLL	Centreline Lights
CPDLC	Controller-Pilot Datalink Communications
CPL	Commercial Pilots Licence
CRM	Crew Resource Management
CTR	Control Zone
CVR	Cockpit Voice Recorder
CWY	Clearway
DA	Decision Altitude
DCL	Departure Clearance
DER	Departure End of Runway
DFDR	Digital Flight Data Recorder
DH	Decision Height
DME	Distance Measuring Equipment
DST	Daylight Savings Time (Summer)
DU	Dust
DZ	Drizzle
EAS	Equivalent Airspeed
EASA	European Aviation Safety Agency
EAT	Expected Approach Time
ECAM	Electronic Centralised Aircraft Monitoring
EFB	Electronic Flight Bag
EFIS	Electronic Flight Instrument System
EGPWS	Enhanced GPWS
EGT	Exhaust Gas Temperature
EICAS	Engine Indicating and Crew Alerting System
ELT	Emergency Locator Transmitter
EMDB	Embedded
EPR	Engine Pressure Ratio
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
ETOPS	Extended Range Twin Operations
ETP	Equal Time Point
EVS	Enhanced Vision System
EWB	Eye to Wheel Height
FAA	Federal Aviation Administration
FAF	Final Approach Fix
FALS	Full Approach Lighting System
FANS	Future Air Navigation System
FAP	Final Approach Point
FAR	Federal Aviation Regulation
FBL	Feeble/Light
FC	Funnel Cloud/TAF with validity <12hrs

FD	Flight Director
FG	Fog
FL	Flight Level
FMC	Flight Management Computer
FMS	Flight Management System
FT	TAF with validity >12hrs
FU	Smoke
FZ	Freezing
GA	Go-Around/General Aviation
GMT	Greenwich Mean Time
GNSS	Global Navigation Satellite System
GP	Glidepath
GPU	Ground Power Unit
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
GR	Hail
G/S	Glideslope/Ground Speed
GS	Small Hail
H24	Applies 24hours
HDG	Heading
HG	Mercury
HIALS	High Intensity Approach Light System
HJ	Applies only in Daytime
HN	Applies only at Night
HP/hP	Holding Pattern/Hectopascals
HOT	Holdover Time
HSI	Horizontal Situation Indicator
HUD	Head Up Display
HURCN	Hurricane
HZ/Hz	Haze/Hertz
IAF	Initial Approach Fix
IAS	Indicated Airspeed
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
IF	Intermediate Fix
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IM	Inner Marker
IMC	Instrument Meteorological Conditions
INOP	Inoperative
INS	Inertial Navigation System
IR	Instrument Rating
IRS	Inertial Reference System
ISA	International Standard Atmosphere

ITCZ	Inter Tropical Convergence Zone
KM	Kilometres
KT	Knots
LCTR	Locator. Shorter range NDB.
LDA	Landing Distance Available
LIAL	Low Intensity Approach Lighting
LMT	Local Mean Time
LNAV	Lateral Navigation
LOC	Localiser
LT	Local Time
LTNG	Lightning
LTS	Lower Than Standard
LVO	Low Visibility Operations
LVP	Low Visibility Procedures
MA	Missed Approach
MAPt	Missed Approach Point
MATZ	Military Air Traffic Zone
MBST	Microburst
MCDU	Multifunction Control and Display Unit
MDA	Minimum Descent Altitude
MDH	Minimum Descent Height
MEA	Minimum Enroute Altitude
MEHT	Minimum Eye Height
MEL	Minimum Equipment List
MMEL	Master MEL
METAR	Meteorological Aerodrome Report
MFA	Minimum Flight Altitude
MGA	Minimum Grid Altitude
MHA	Minimum Holding Altitude
MI	Shallow
MIALS	Medium Intensity Approach Light System
MISAP	Missed Approach Procedure
MLW	Maximum Landing Weight
MLS	Microwave Landing System
MNPS	Minimum Navigation Performance Specifications
MOC	Minimum Obstacle Clearance
MORA	Minimum Off Route Altitude
MPS	Meters Per Second
MRA	Minimum Reception Altitude
MROT	Minimum Runway Occupancy Time
MSA	Minimum Safe Altitude
MSL	Mean Sea Level
MTCA	Minimum Terrain Clearance Altitude
MTOW	Maximum Takeoff Weight

MVFR	Marginal VFR
MZFW	Maximum Zero Fuel Weight
NADP	Noise Abatement Departure Procedure
NALS	No Approach Light System
NAVAID	Navigational Aid
NCD	No Cloud Detected
NDB	Non-Directional Beacon
NM	Nautical Mile
NOSIG	No Significant Change
NOTAM	Notice to Airmen
NPA	Non-Precision Approach
NSC	Nil Significant Cloud
NSW	Nil Significant Weather
NTZ	No Transgression Zone
OAT	Outside Air Temperature
OCA	Obstacle Clearance Altitude
OCH	Obstacle Clearance Height
OCNL	Occasional
OEI	One Engine Inoperative
OFP	Operational Flight Plan
OM	Outer Marker
OTS	Other Than Standard
OVC	Overcast
PALS	Precision Approach Lighting System
PANS	Procedures for Air Navigation Services
PAPI	Precision Approach Path Indicator
PAX	Passengers
PBN	Performance Based Navigation
PCL	Pilot Controlled Lighting
PCN	Pavement Classification Number
PDC	Pre-Departure Clearance
PDG	Procedure Design Gradient
PFD	Primary Flight Display
PIC	Pilot in Command
PL	Ice Pellets
PN	Prior Notice Required
PO	Dust/Sand Whirls
POB	Persons on Board
PRFG	Partial Fog
PRNAV	Precision Area Navigation
PROB	Probability
QDM	Magnetic Heading to Station
QDR	Magnetic Bearing from Station

QFE	Air Pressure at Airfield Level
QFU	Magnetic Orientation of Runway
QNH	Air Pressure at Sea Level
QRH	Quick Reference Handbook
RA	Rain
RAIL	Runway Alignment Indicator Lights
RAIM	Receiver Autonomous Integrity Monitoring
RASN	Rain and Snow
RCLL	Runway Centreline Lights
RCLM	Runway Centerline Markings
REDL	Runway Edge Lights
REIL	Runway End Indicator Rights
RENL	Runway End Lights
RET	Rapid Exit Taxiway
RFFS	Rescue and Fire Fighting Services
RTIL	Runway Threshold Identification Lights
RMI	Remote Magnetic Indicator
RMK	Remark
RNAV	Area Navigation
ROC	Rate of Climb
ROD	Rate of Descent
RSC	Runway Surface Condition
RTIL	Runway Threshold Identification Lights
RVR	Runway Visual Range
RVSM	Reduced Vertical Separation Minima
SA	Sand
SAR	Search and Rescue
SCT	Scattered
SEV	Severe
SELCAL	Selective Calling
SFC	Surface
SG	Snow Grains
SH	Showers
SI	International System of Units
SID	Standard Instrument Departure
SIGMET	Significant Meteorological Information
SIGWX	Significant Weather
SKC	Sky Clear
SLP	Speed Limiting Point
SM	Statute Miles
SMC	Surface Movement Control
SNOCLO	Airport Closed due to Snow
SQ	Squall
SRA	Surveillance Radar Approach
SS	Sandstorm

STAR	Standard Terminal Arrival Route
SWY	Stop way
TA	Transition Altitude
TAF	Terminal Area Forecast
TAS	True Airspeed
TCAS	Traffic Alert and Collision Avoidance System
TCH	Threshold Crossing Height
TCU	Towering Cumulus
TDO	Tornado
TDZ	Touchdown Zone
TECR	Technical Reason
TEMPO	Temporary
TL	Transition Level
TS	Thunderstorm
U/S	Unserviceable
UAV	Unmanned Aerial Vehicle
UNREL	Unreliable
UTC	Coordinated Universal Time
VA	Volcanic Ash
VASI	Visual Approach Slope Indicator
VC	Vicinity
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
VMCA	Minimum Control Speed (Airborne)
VOLMET	Weather reports for aircraft inflight
VOR	VHF Omnidirectional Range
VPT	Visual Manoeuvre with Prescribed Track
VRB	Variable
VV	Vertical Visibility
WEE	Whichever is Earlier
WEL	Whichever is Later
WGS-84	World Geodetic System 1984
WIP	Work in Progress
WKN	Weakening
WS	Windshear
WTH	Wheel to Threshold Height
WX	Weather
WXR	Weather Radar
XPDR	Transponder

