Night Flying

Flying VFR at night is inherently more risky than flying VFR during the day. These risks and threats can, and must, be managed carefully with good preparation and instrument flight currency.

A student's night flying ability will not be assessed by an examiner, so it is important that the instructor uses the night flying instructional time to ensure the student is aware of the issues and is competent at night flying.

Objective

To operate the aircraft safely both on the ground and in the air at night.

Considerations

Night is defined as the time between the end of evening civil twilight and the beginning of morning civil twilight. These times are published in *AIP New Zealand* GEN 2.7 Daylight Tables, and are dependent on location and the time of year.

Legal: Aerodrome and aircraft lighting requirements, VFR night minimas for controlled (1500'/5km) and uncontrolled (1500'/8km).

Prerequisites

Students must have completed at least two hours instrument flight time, which includes the following instrument flight manoeuvres, before they can undertake night flight training:

- *Straight and level flight*: maintain heading to a required accuracy of ± 5 degrees, ± 100 feet altitude and in balance.
- *Medium & Rate One turns*: at least 180 degrees turns left and right, in balance, to within ± 10 degrees of pre-selected roll-out heading with a maximum altitude variation of ± 100 feet.

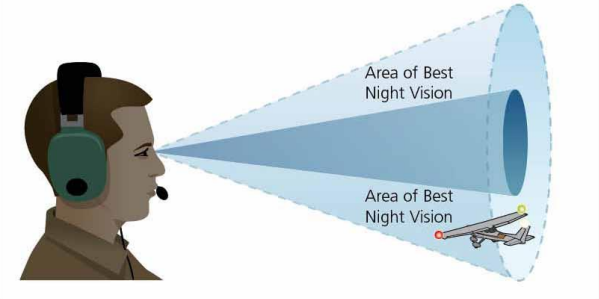
- *Climbing and descending*: to preselected altitudes. Level flight to be re-established at the preselected altitude ± no more than 100 feet.
- *Unusual attitude*: prompt and correct recovery from unusual attitudes.

PPL requirements: two hours dual, two hours solo, five hours total

Night Vision

Light-sensitive nerves, called cones and rods, are located at the back of the eye. The cones are located in the centre of the retina, and the rods are concentrated in a ring around the cones.

Figure 1



Cones detect colour, details and faraway objects.

Rods are used when something is seen out of the corner of the eye, ie, for peripheral vision. They detect objects, particularly those that are moving, but do not give detail or colour. Rods make night vision possible. Because the rods are distributed in a band around the cones and do not lie directly behind the pupil, off-centre viewing (looking to one side of an object) is important during night flight.

In low light, central vision does not work as well, so peripheral vision is relied upon. As peripheral vision is good at noticing changes, objects are more likely to be noticed at night with peripheral vision.

Central vision is still required to read instruments or charts, but it is important to preserve as much function in peripheral vision. In order to achieve this, allow time for eyes to adapt to the dark, avoid bright light by keeping cockpit lights and torches as dim as possible, and use a practised scanning motion when looking outside the aeroplane.

Dark Adaptation

Allow time to adjust to low light after completing any tasks that need to take place in bright light, such as the preflight inspection. The rods become fully effective after approximately 30 minutes, so avoid any bright light once dark adaption has started.

Be aware that mobile phones can have very bright displays.

Illusions

A careful lookout on the ground and in air is critical. It is very easy to lose sight of other aircraft lights as they merge with background lights.

Speed perception is very difficult at night, and it is common to find the taxy speed building up without noticing it, consciously taxy slower than normal.

Transfer to instruments quickly after takeoff. The horizon will probably not be visible, so attitude speed and direction must be maintained with reference to the aeroplane's instruments.

The student should already be familiar with the illusions they may experience when instrument flying, these will still be present at night.

In addition the following illusions can be experienced at night:

- Flicker Vertigo – flashing lights and flickering from propellers can cause disorientation.
- Auto-Kinesis – a fixed light source against a dark background can appear to move. Avoid looking directly at the light.
- Ground Light or Star Light? – or even fishing boats. In areas with little ground lighting, isolated lights can appear to be stars, making it seem the aeroplane is in an irregular attitude.
- Black Hole – can happen when approaching a lit area over unlit terrain. Can cause the runway to seem out of position. Use the visual approach slope indicators, if available, or carefully monitor the flight instruments.

Equipment

For the preflight check a torch will be required, in particular a torch powerful enough to be able to see the detail required.

While carrying out the preflight, note the position of the aeroplane on the aerodrome and the position of other aircraft.

It is also advisable to wear a high visibility jacket, and to be conscious of personal safety.

All lights should be checked to ensure they are working, including but not limited to; navigation lights, anti-collision lights, strobe lights, taxi lights and landing lights. The pilot should also be familiar with their operation, how much can be seen with them and when they are used.

Internal aeroplane lighting, including the compass, must be operational and the pilot should know how to adjust the lighting levels.

The pilot's personal night equipment should include:

- Torch, with spare batteries
- Pen attached to the flight log, and a spare nearby
- Mobile phone
- Watch
- Warm clothing and a survival kit
- May like to carry a spare handheld VHF radio or GPS

Familiarity with the Aeroplane

It is important to know the location of the controls and switches, so the pilot can operate them without needing to look at them. At this stage of their training the student should be familiar with the aeroplane.

Familiarity with the Aerodrome

AIP Vol 4 Aerodrome Charts Operational Data details the lighting available on the aerodrome – a thorough knowledge of lighting facilities is important.

Discuss the location, colour and if applicable, the direction of all aerodrome lighting, including apron, taxi, holding point, runway and approach lighting. If pilot activated lighting (PAL) is available discuss the operation of this.

Review ATC light signals.

Discuss the particular approach lighting available at the aerodrome, and how it is to be used, eg PAPI. Check that the student can decode the lighting codes, and they know where to find the decodes for those they cannot.

Weather

Inadvertent IMC is more likely at night. Exercise extreme caution. It can be very difficult to recognise weather deterioration and extremely hard to determine if cloud is blocking the view of terrain.

At night there is less mixing in the air up to 2000 feet and the surface wind will lessen and back. This can also mean the surface wind is significantly different from the wind at circuit altitude.

When the night is overcast it will be much harder to identify cloud than it would be on a clear night.

Pay particular attention to the temperature/dew point relationship as an indicator of potential fog/ low cloud.

Emergencies

Detail the procedures to carry out in the event of the following emergencies:

- Radio failure – follow the local procedure, use the aeroplane's lights and squawk 7600
- Runway lighting failure – the flight will need to divert to another aerodrome where the lighting is operational. This will need to be checked during the planning stages.
- Landing light or navigation light failure – the flight can continue, but should end at the next landing.
- Internal light failure – the flight can continue, but should end at the next landing.
- Electrical failure – should be noticed before total failure because of the increased frequency of **SADIE** checks. Total failure is a serious event and the flight should land as soon as practicable. Use the standard

overhead rejoin procedure.

- Engine failure – is particularly difficult to deal with at night. If the surface can be seen in the moonlight, plan for a normal forced landing. If the ground cannot be seen, fly at the minimum descent speed (1.1 V_S) and turn into wind. Do not use flap unless the ground can be seen. Landing lights should only be used from below 400 feet agl as the glare will reduce the ability to see beyond the light's beam.

See the *Night VFR* GAP booklet for further information.

Airmanship

Preflight in the light if possible, otherwise use a good torch.

Correct use of taxi/landing lights and strobe light.

Consider the number of other aircraft in the circuit, as it can be hard to see other aircraft in the circuit at night.

Caution – illusions discussed above.

Fly at the Minimum Safe Altitude. This can be determined from the MFA figures on the VNCs.

Identify local landmarks/lighting patterns – if any disappear such as a neighbouring community –there is a strong likelihood of cloud or fog development.

Aeroplane Management

More frequent **SADIE** checks

Particular attention should be paid to dew on windscreens and frost on wings.

Cockpit layout familiarity

Trust the instruments

Human Factors

Instrument flying illusions will be present.

Night vision factors – 10/30 minute adaptation, health (**I'MSAFE**), importance of oxygen to brain/eye function, colour perception, depth perception, focus (cones/rods), focal length (myopia), black hole, lights/stars.

Air Exercise

On the Ground

Taxi slowly.

Recognise runway lighting position in peripheral vision as this is the landing perspective.

When lining up make sure to have a careful lookout for aircraft on the approach.

During takeoff use the runway lighting to keep on the centreline as a reference point in the distance may not be available.

Once airborne immediately transfer to instruments to establish the aeroplane attitude and speed, and a positive rate of climb.

When established in the climb, then a combination of instruments and visual reference can be used.

In the Circuit

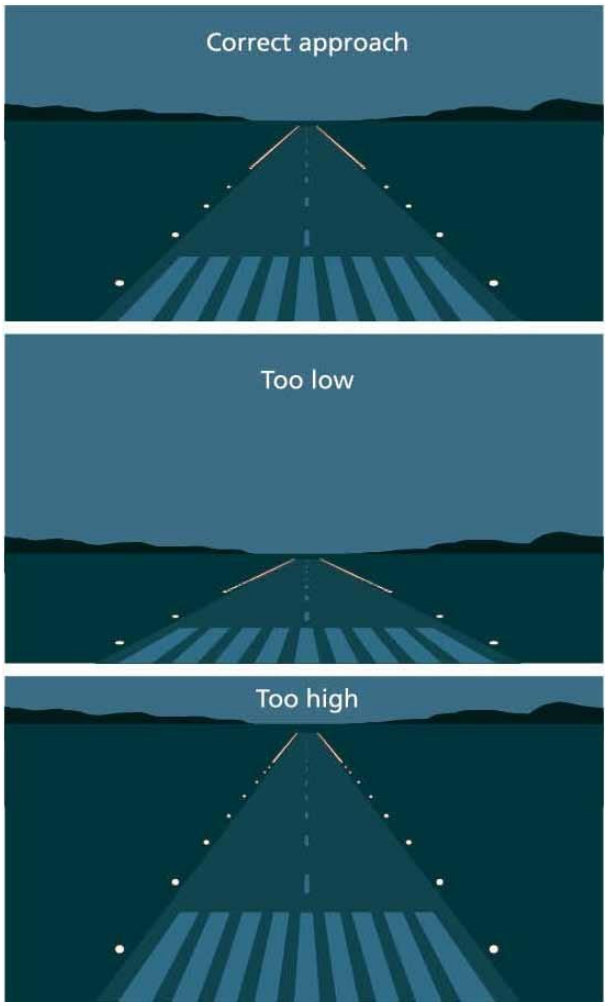
The first circuit should be a familiarisation circuit. It is a chance to see the local area, and compare how it looks at night to how it looks in the day. It is also a chance to orientate and locate local landmarks and townships.

At night it can be difficult to see the runway lighting from the downwind position, care must be taken positioning the aeroplane downwind at the correct spacing.

Approach and Landing

At night the runway edge lights must be used to judge the approach perspective.

Figure 2



During the landing it is important to use the runway perspective to judge the roundout and flare, not look for the ground in the landing light. The first few landings should be completed without the landing light.

Be careful of carrying too much speed when turning off the runway.

Airborne Sequence

Teach night taxi principles and the various apron/runway/light recognition/application factors.

Take off and vacate the circuit to familiarise the student with the different night perspective i.e. illusions including black hole effect, lookout – other aircraft speed/direction, lack of depth perception, etc.

Return to the circuit and carry out approach and low overshoots to view the runway lighting perspectives of too low, on profile and too high.

Conduct night circuits, progressively introducing various emergencies.