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Civil Aviation Advisory Publication

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Night Visual Flight Rules Rating

This publication is only advisory but it gives a CASA preferred method for complying with the Civil Aviation Regulations (CARs) 1988.

It is not the only method, but experience has shown that if you follow this method you will comply with the Civil Aviation Regulations.

Always read this advice in conjunction with the appropriate regulations.

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The relevant regulations and other references

- Civil Aviation Regulation (CAR) 1988 paragraph 5.01A, 5.01B
- Civil Aviation Regulation (CAR 1988 5.13(h)
- Civil Aviation Regulation (CAR 1988 5.14(1) and (2)
- Civil Aviation Regulation (CAR 1988 5.18, 5.19, 5.20A
- Civil Aviation Regulation (CAR 1988 5.74, 5.80(2), 5.90(2), 5.107(3), 5.123(4), 5.168(3), 5.177(4)
- Civil Aviation Regulation (CAR 1988 5.82(1)(b), 5.92(1)(b), 5.100(1)(b), 5.109(1)(b),
- Civil Aviation Regulation (CAR 1988 172
- Civil Aviation Regulation (CAR 1988 174A(2)
- Civil Aviation Regulation (CAR 1988 174B
- Civil Aviation Regulation (CAR 1988 174C
- Civil Aviation Regulation (CAR 1988 195
- Civil Aviation Order (CAO) 40.2.2
- Civil Aviation Order (CAO) 20.18 Appendix IV, V, VIII
- Civil Aviation Order (CAO) 29.2

References

- Night Operations, Airplane Flying Handbook, FAA-H-8083-3.
- NVFR Part II The Dark Side of Night Flying, Transport Canada Aviation Safety Letter 2/2001.
- Darkness Increases Risks of Flight, Flight Safety Foundation Human Factors and Aviation Medicine, November-December 1999.
- Spatial Disorientation, 'Confusion That Kills', AOPA Safety Advisory, Physiology No. 1.
- NTSB Annual review of Accident Data, US General Aviation, Calendar Year 2001, Lighting Conditions
- Spatial Disorientation, www.wikepedia.org.
- ICAO PANS Training, Chapter 3, Attachment C, Threat and Error Management.

Who this CAAP applies to

- Pilots and operators conducting Night Visual Flight Rules (NVFR) operations in aeroplanes and helicopters. Flight instructors and pilots providing and undergoing training for the issue of a NVFR Rating.

Why this CAAP was written

- Following a number of accidents involving flight at night under the VFR, this CAAP addresses typical threats and errors applicable to night flight and presents possible countermeasures or defences for pilots and operators conducting NVFR operations.

Users are encouraged to incorporate these into both training and operations.

Status of this CAAP

This is the first CAAP to be written on this subject.

For further information

Telephone the CASA Office closest to you on 131757.

1. Abbreviations

ADF	Automatic Direction Finder
AFRU	Aerodrome Frequency Response Unit (also known as a 'beepback' unit)
AGL	Above Ground Level
AIP ENR	Aeronautical Information Publication en-route section
AIP ERSA	AIP En-route Supplement Australia
ALA/HLS	Aircraft Landing Area/Helicopter Landing Site
ALT	Altitude
AOPA	Aircraft Owners and Pilots Association
ARN	Aviation Reference Number
ASEPTA	Approved Single-Engine Turbine Aeroplane
ASI	Air Speed Indicator
ATC	Air Traffic Control
ATS	Air Traffic Services
AWK	Aerial Work (Air work – general aviation)
BCN	Beacon (aeronautical ground light)
BKN	Broken
C/A	Course Acquisition
CAAP	Civil Aviation Advisory Publication
CAO	Civil Aviation Order
CAR	Civil Aviation Regulation (1988)
CASA	Civil Aviation Safety Authority
CB	Cumulonimbus (meteorological)
CDI	Course Direction Indicator
CFI	Chief Flying Instructor
CFIT	Controlled Flight into Terrain
CHTR	Charter
COM	Communications
CTA	Control Area
CTR	Control Zone
DME	Distance Measuring Equipment
DR	Dead Reckoning
EMS	Emergency Medical Service
ERC	En-route Chart
ERSA	En-route Supplement Australia
ETA	Estimated Time of Arrival
ETI	Estimated Time Interval
FAA	Federal Aviation Administration (of the USA)

FAAAC	Foreign Aircraft Air Operator's Certificate
FDS	Flight Director System
GAAP	General Aviation Aerodrome Procedures
GEN	General
GDOP	Geometric Dilution of Precision
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GPSN	Global Positioning System Navigation
G/S	Groundspeed
HDG	Heading
HF	High Frequency
HLS	Helicopter Landing Site
ICAO	International Civil Aviation Organization
ICAO PANS	ICAO Procedures for Air Navigation Services
IF	Instrument Flight
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
INTER	Intermittent/Intermittently (meteorological)
LL	Lower Limit
LSALT	Lowest Safe Altitude
M.02	Mach.02
MCC	Multi-crew Coordination
MTOW	Maximum Take-off Weight
NAIPS	National Aeronautical Information Processing
NAV	Navigation
NDB	Non-directional Beacon
NM	Nautical Miles
NOTAM	Notice to Airmen
NPA	Non-precision Approach
NTSB	National Transport Safety Board (of the US)
NVFR	Night Visual Flight Rules
OBS	Omni Bearing Selector
PAL	Pilot Activated Lighting
PAPI	Precision Approach Path Indicator
PC	Personal Computer
PCATD	PC-based Aviation Training Device
PDOP	Positional Dilution of Precision
PIC	Pilot-in-command
PICUS	Pilot-in-command Under Supervision
POH	Pilot Operating Handbook
PRD	Prohibited, Restricted, and Danger areas
PVT	Private
R/T	Radio Telephone

RAIM	Receiver Autonomous Integrity Monitoring
RPM	Revolutions per minute
RPT	Regular Public Transport
SA	Situation Awareness
SAR	Search and Rescue
SARTIME	Time search action required
SARWATCH	Search and Rescue Watch
SCT	Scattered (meteorological)
SOPS	Standard Operating Procedures
TEM	(Illustrated) Tool and Equipment Manual
TEM	Threat and error management
TEMPO	Temporary/temporarily (meteorological)
TMG	Track Made Good
TS	Thunderstorm (followed by RA = rain; SM = snow; PE = ice pellets; GR = hail; GS = small hail and/or snow pellets or combinations thereof, e.g. TSRASN = thunderstorm with rain and snow)
TSO	Technical Service Order
UFIT	Uncontrolled Flight into Terrain
USA	United States of America
VFR	Visual Flight Rules
VHF	Very High Frequency (30 – 300 MHz)
VHF COM	VHF Communications
VMC	Visual Meteorological Conditions
VOR	VHF Omni Range
VSI	Vertical Speed Indicator
W/V	Wind Velocity
WAC	World Aeronautical Charts
WGS84	World Geodetic Standard 1984
WPT	Waypoint

2. Definitions

Aeroplane/aircraft/helicopter is balanced: The skid ball in the balance indicator is less than a quarter of the ball diameter from the centre.

Aircraft is trimmed/Trims aircraft: The aircraft is trimmed within 10 seconds of achieving stabilised and balanced flight,

after an attitude, power or configuration change, so that no control input is required from the pilot to maintain this state.

Approved checklist: a checklist derived from information set out in the Flight Manual/POH, placards or other documents provided with the aircraft, necessary to ensure the safe operation of the aircraft.

Baro-aiding: When the GNSS receiver uses barometric data to calculate RAIM.

Closure rate: The apparent speed at which a helicopter or gyroplane moves towards a specified point or object.

Controlled corrective action: Timely and coordinated use of controls, without abrupt manoeuvring, is made to achieve specified performance.

Full panel: Flight instrument array of at least an artificial horizon (AH), stabilised heading indicator, vertical speed indicator, altimeter, turn and balance indicator/turn coordinator and engine power indication.

Limited panel: Flight instrument array of at least a magnetic compass, air speed indicator, vertical speed indicator, altimeter, turn and balance indicator/turn coordinator and an engine power indication.

Line up checks: Line up checks are performed before take-off when lined up in the runway or take-off direction. The checks should include:

- Compass checked and aligned with take-off direction;
- Engine instruments indicating engine within operating limits.

Operational requirements: The effects that weather forecasts, availability and serviceability of radio navigation aids and aerodrome lighting status have on the determination of fuel, holding and alternate aerodrome requirements.

Review and Brief: During instrument approaches, to study the instrument approach chart, interpret the instructions and self-brief or brief any crew members/assessors about the conduct of the approach procedure.

Safe/safely: Means that a manoeuvre or flight is completed without injury to personnel, damage to aircraft or breach of aviation safety regulations while meeting the flights standards specified.

Termination point: The 'termination point' associated with a landing, is the point at which the helicopter terminates the approach to the hover.

3. Introduction

3.1 Why you should read this CAAP

3.1.1 Night flying accidents are not as frequent as daytime accidents because less flying is done at night. However, statistics indicate that an accident at night is about two and a half times more likely to be fatal than an accident during the day. Further, accidents at night that result from controlled or uncontrolled flight into terrain (CFIT or UFIT) are very likely to be fatal accidents. Loss of control by pilots of night visual flight rules (NVFR) aircraft in dark night conditions has been a factor in a significant number of fatal accidents in this country and the purpose of this CAAP is to highlight the hazards of night flying and to provide advice to NVFR pilots and others on how to fly safe NVFR operations.

3.2 What is Night VFR (NVFR)?

3.2.1 Night Visual Flight Rules (NVFR) permit flight at night under the Visual Flight Rules (VFR) using visual navigation augmented by the use of radio navigation aids. Flight under the VFR (by day or night) must be conducted in Visual Meteorological Conditions (VMC), that specify minimum in-flight visibility and vertical and horizontal distance from cloud.

3.2.2 NVFR is not the same as flying at night under the Instrument Flight Rules (IFR), even though NVFR involves proficiency in instrument flying and the use of radio navigation aids. This is because NVFR flight is based on the use of visual procedures in VMC.

3.3 Pilot qualification for NVFR

3.3.1 The pilot qualification to conduct NVFR operations is either a NVFR Rating for the category of aircraft, or an instrument rating with NVFR aeronautical experience. NVFR has been available in Australia since the Class 4 instrument rating was introduced in 1967. That rating had the same privileges as the current NVFR Rating, but the name was subsequently changed to NVFR Rating, because it was not an instrument rating and did not authorise flight under the IFR.

3.3.2 Australia is one of the few countries to require a separate pilot qualification to fly at night under VFR, but the additional complexity and risk of night flying, as demonstrated by the accident record both in Australia and overseas, provides ample reason for pilots to undertake additional training for a night flying qualification.

3.3.3 Licence holders who do not hold a NVFR Rating or an instrument rating are permitted to fly as pilot-in-command (PIC) at night under VFR, subject to the following limitations:

- The pilot has met the night NVFR handling requirements specified in Civil Aviation Regulation (CAR) 5.01A;

- The flight is under the direct supervision of a flight instructor nominated by the Chief Flying Instructor (CFI) of a flying school;
- The flight takes place within the circuit area of the aerodrome.

3.4 What are the problems associated with NVFR?

3.4.1 Night is defined, for aviation purposes, as the period of darkness from the end of evening civil twilight to the beginning of morning civil twilight.

3.4. 2 Darkness considerably reduces the external visual references available to a pilot and therefore makes aircraft control and navigation more difficult. Loss of control of the aircraft is highly likely if a pilot attempts to fly by visual reference instead of by reference to instruments.

3.4.3 Limited outside visual reference at night means that the aircraft has to be flown by reference to instruments, otherwise the pilot runs a considerable risk of becoming disoriented. Even if visual reference is available, it can often be misleading and can further disorient a pilot who is attempting to fly visually rather than on instruments.

3.4.4 Under conditions where there is bright moonlight or extensive ground lighting available, flying at night can be a little more difficult than flying in daylight. However, in dark night conditions, without moonlight or significant ground lighting, it will be difficult, if not impossible, to discern the natural horizon and to maintain control of the aircraft by visual reference.

3.4.5 It is also important to understand that the flight visibility given in aviation weather forecasts relates only to the transparency of the atmosphere, and not to whether objects or terrain can actually be seen by a pilot at the distances specified. To be visible from an aircraft at night, an object must generally be lit by moonlight or artificial lighting, otherwise objects outside the aircraft cannot be seen, no matter how good the visibility.

3.4.6 Darkness also makes it more difficult for a pilot to see and avoid flying into cloud, terrain or obstructions. Taking-off, landing and navigation are also more difficult at night because of the limited visual cues available to assist the pilot.

4. What operations can a NVFR holder conduct?

4.1 NVFR Rating – Aeroplanes and helicopters

4.1.1 Grades of NVFR Ratings are issued under Civil Aviation Order (CAO) 40.2.2 for aeroplanes, helicopters and other categories of aircraft as well as for agricultural operations. However, because the bulk of NVFR Ratings are issued for aeroplanes and helicopters, the content of this CAAP refers mainly to those two grades of NVFR Rating. Night agricultural operations also have special requirements and will not be covered here.

4.2 NVFR Rating – Aeroplanes

4.2.1 The privileges of the aeroplane and helicopter grades of NVFR Rating are as follows:

- Permitted to act as pilot-in-command (PIC) of aeroplanes in NVFR private (PVT) and Aerial Work (AWK) operations only, in aeroplanes < 5700 kg MTOW;
- Permitted to use only the navigation aids endorsed on the rating;
- Limited to single-engine aeroplanes unless the flight test was conducted in a multi-engine aeroplane.

4.2.2 Does NOT authorise the holder to conduct charter (CHTR) operations (except marine pilot transfers in helicopters).

4.3 NVFR Rating – Helicopters

4.3.1 The privileges of the helicopter grade of NVFR Rating are:

- Permitted to act as PIC of helicopters in NVFR private (PVT) and aerial work (AWK) operations only;
- Permitted to act as PIC in NVFR charter in helicopters <5700 kg maximum pre-flight weight (MTOW) when conducting marine pilot transfers;
- Permitted to use only the navigation aids endorsed on the rating.

4.3.2 There is no single-engine limitation for a helicopter grade of NVFR Rating.

4.4 NVFR using an instrument rating

4.4.1 The holder of a command grade of instrument rating may conduct NVFR flights as PIC without holding a NVFR Rating, provided he or she meets all the night flying experience requirements for the issue of a NVFR Rating, including the NVFR cross country requirements. A NVFR rating flight test is not required.

4.4.2 The holder of a PIFR must not conduct a NVFR flight as PIC without holding a NVFR Rating.

4.5 NVFR Charter (CHTR) operations

4.5.1 A NVFR Rating does not authorise the holder to conduct CHTR operations, except for marine pilot transfers in helicopters. However, the holder of an instrument rating may conduct NVFR CHTR operations by meeting the NVFR experience requirements of CAO 40.2.1 and the recency requirements specified in paragraph 6.2.1:

- 10 hours night cross-country flight-time using NVFR procedures as either PIC or PICUS;
- Including a minimum of two navigation exercises of at least 300 nm or three hours duration each, including one landing at an aerodrome remote from ground lighting.

Note: Flight under the IFR at night is not the same as flight at night using NVFR procedures and cannot be used to meet the NVFR navigation experience requirements.

4.6 Carrying passengers on NVFR charter flights

4.6.1 Even though a pilot may be qualified to conduct NVFR CHTR operations, regulations limit the types of charter aircraft in which passengers may be carried to the following:

- Multi-engine aeroplanes or helicopters; or
- Approved Single-Engine Turbine Aeroplanes (ASETPA); or
- Marine pilot transfers in helicopters with a maximum take-off weight less than 5,700 kg where CASA has given an operator written permission.

4.6.2 Pilots should also note that:

- CAR 174B does not allow Regular Public Transport (RPT) operations to be conducted under NVFR;
- EMS (Emergency Services) operations are classified as AWK, not CHTR, and may be conducted under the NVFR by holders of a NVFR Rating in either single or multi-engine aircraft.

5. Obtaining a NVFR Rating

5.1 Requirements for issue

5.1.1 CAO 40.2.2 specifies the requirements that a pilot must meet to be issued with a NVFR Rating. They are:

- Hold a Private, Commercial or Airline Transport Pilot License for the category of aircraft for which the NVFR Rating is sought;
- Meet the minimum aeronautical experience for the issue of a NVFR Rating, as specified in Appendix 1 of CAO 40.2.2 (see paragraph 5.3 below);

- After meeting the aeronautical experience requirements and before undertaking the NVFR flight test, pass an oral test; or
- Written examination on NVFR aeronautical knowledge, normally conducted by an approved pilot;
- Successfully complete the NVFR Rating flight test specified in the Order.

5.2 Aeronautical knowledge

5.2.1 Note that a pilot must meet the aeronautical experience requirements for the NVFR Rating before undertaking the examination in NVFR aeronautical knowledge. The examination may be written or oral, and may be conducted either by the Civil Aviation Safety Authority (CASA) or an approved pilot.

5.2.2 The underpinning knowledge standards included in the NVFR Rating competency standards in Appendix A of this CAAP provide guidance for the content of the knowledge test. They include:

- Privileges and limitations of the rating;
- NVFR aircraft equipment requirements;
- NVFR operating procedures;
- Principles of operation, limitations and errors for the radio navigation method used;
- Aircraft landing area/helicopter landing site (ALA/HLS) dimension and lighting;
- Flight planning/notification; requirements including lowest safe altitude (LSALT), weather, fuel and lighting;
- Alternate aerodrome planning requirements;
- Airfield lighting requirements including Pilot Activated Lighting (PAL);
- Air traffic control (ATC) procedures;
- Operation of flight instruments and any limitations;
- Aircraft systems and emergency procedures; and
- Human factors/physiology.

5.3 Aeronautical experience

5.3.1 The aeronautical experience requirements for the issue of a NVFR Rating are specified in CAO 40.2.2, Appendix 1. In summary, the requirements for the aeroplane or helicopter grade of NVFR Rating are:

- Sufficient instrument flight time to achieve the specified standard;
- At least 10 hours flight time at night;
    - Including at least five hours in aeroplanes or helicopters as appropriate to the rating;

- Including at least two hours night circuits;
- Including at least one hour night circuits in aeroplanes or helicopters as appropriate to the rating;
- Five hours of dual navigation training at night;
- Including one cross country flight of at least three hours duration covering at least 100 miles;
- Including one landing at an aerodrome other than the departure aerodrome and which is not in an area that has sufficient ground light to provide a discernible horizon.

5.3.2 **NVFR flight training** – The training syllabus for a NVFR Rating should ensure that the pilot gains all of the knowledge and skills necessary to safely operate and navigate an aircraft in night under the VFR, and the competency standards at Appendix A of this Civil Aviation Advisory Publication (CAAP) are provided as a basis for training and assessment of the required competencies. The achievement record at Appendix B is also provided as a tool for instructors to use to ensure all standards have been assessed.

5.3.3 Instructors should note that the aeronautical experience specified in CAO 40.2.2 is the minimum night flying experience for the issue of the rating; it is NOT a training syllabus. A training syllabus should be structured to ensure that all the NVFR competencies are achieved as well as the minimum experience requirements met.

5.3.4 **Instrument flying** – For example CAO 40.2.2 does not specify a minimum requirement for instrument flight time, yet the standards for the flight test (and the safety of night operations) require proficiency in instrument flight. A properly structured training syllabus should therefore provide sufficient training to ensure competency in instrument flying is achieved. (Competency standards are included in Appendix A of this CAAP.) Because instrument flying skills are basic to night flying, it is also desirable that a training syllabus would provide for instrument flying proficiency to be demonstrated before commencing actual night flying.

5.3.5 While NVFR flight must be conducted in VMC, a visual horizon is often not available and sudden loss of visual reference is also possible, such as when turning away from a well-lighted area or if there is inadvertent entry into cloud. Night flying training should therefore emphasise the importance of flying the aircraft at all times by reference to the flight instruments, even in conditions where external lighting provides adequate visual reference.

5.3.6 The training required to meet NVFR instrument flight competency standards may vary considerably, particularly for

pilots who have not received previous instrument flight training – such as helicopter pilots.

5.3.7 NVFR is often conducted in single-engine aircraft in which failure of the vacuum system powering the gyroscopic attitude indicator is a possibility. Accordingly, instrument flight training should include normal flight manoeuvres and recovery from unusual attitudes using only limited panel (no gyroscopic attitude indicator or directional indicator).

5.3.8 **Engine failure simulation in multi-engine aeroplanes** – Accident records show that simulation of engine failure in multi-engine aeroplanes at night is a high risk activity and CASA strongly recommends that this exercise is NOT conducted at night. Engine failure training for night operations in multi-engine aeroplanes is best practised by day under simulated instrument conditions at a safe height, and the Order permits the procedure to be tested in this way for the issue of the rating. Conducting engine failure procedures by day under simulated instrument conditions also affords the opportunity to practice engine failure after take-off which, although not a requirement of the flight test for the issue of the NVFR Rating, cannot be ruled out as a possible occurrence in NVFR operations.

5.4 Instructor qualifications

5.4.1 **Aeroplanes** – CAO 40.1.7 includes provisions that automatically approve (under CAR 7.20) holders of a flight instructor (aeroplane) rating to give training for the NVFR Rating, provided they hold either:

- A NVFR Rating; or
- A command instrument rating and meet NVFR experience requirements.

5.4.2 Instructors who wish to provide NVFR training in a multi-engine aeroplane also need to hold a multi-engine training approval and have no limitation on their NVFR Rating.

5.4.3 **Helicopters** – Similarly, helicopter instructors are automatically approved in CAO 40.3.7, to give training for the NVFR Rating except that there is an additional requirement to have undertaken a course of training of at least 10 hours dual instruction with a grade 1 instructor covering basic instrument flying and night flying.

5.5 NVFR Rating flight test

5.5.1 The flight test for a NVFR Rating must assess three basic areas of night flying proficiency:

- Flying solely by reference to instruments;

- Night circuit and landing;
- Navigation at night by visual reference both with and without the use of radio navigation aids.

5.5.2 The NVFR Rating Flight Test Report Form published by CASA outlines the content of the flight test to meet the requirements of the Order. The form is available on the CASA website (http://www.casa.gov.au).

5.5.3 CAO 40.2.2 allows the option of testing instrument flying by day under simulated instrument conditions, but whether demonstrated by day or by night, proficiency should be demonstrated without external visual reference (as specified in the Order) by the use of appropriate field-of-vision limiting devices.

5.5.4 If the flight test for a NVFR Rating is conducted in a single-engine aeroplane, then the rating is valid for use in single-engine aeroplanes only and should be endorsed accordingly. (For the purpose of the NVFR Rating, single-engine aeroplanes include multi-engine centre-line thrust aeroplanes.)

Note: This limitation does NOT apply to helicopters, and a NVFR Rating for helicopters is valid for both single and multi-engine helicopters, regardless of the type of helicopter used for the test.

5.6 Helicopter NVFR rating

5.6.1 A Helicopter NVFR rating authorises the pilot to fly any helicopter that they hold an endorsement for.

5.6.2 Pilots must ensure they are competent performing the engine failure items specified in the flight test applicable to the helicopter they operate.

5.7 Removing a single-engine aeroplane limitation

5.7.1 To remove a single-engine aeroplane limitation from a NVFR Rating, a flight test must be conducted in a multi-engine aeroplane. However, where a person also holds a current aeroplane command or co-pilot instrument rating that was issued or renewed on the basis of a flight test conducted in a multi-engine aeroplane or simulator, a flight test is not required for the removal of the limitation.

5.7.2 When a NVFR rating flight test is required, the testing officer must be satisfied that the applicant can safely control an aircraft of the appropriate category (aeroplane or helicopter) in all the procedures specified for the flight test. However, in a

flight test for the removal of an aeroplane limitation, the manoeuvres or procedures previously demonstrated in the flight test in an aeroplane may be accepted, at the testing officer's discretion, as meeting that requirement and need not be demonstrated again in a multi-engine aeroplane. In exercising this discretion, the testing officer should take account of the applicant's night-flying and multi-engine experience as well as his or her currency in night-flying. The testing officer is entitled to require any or all elements of the flight test to be demonstrated again.

5.7.3 CASA suggests that the minimum requirement for a NVFR flight test in a multi-engine aeroplane to remove an aeroplane limitation should include the following:

- Demonstration of engine failure in cruise (mandatory) preferably by day under simulated instrument conditions;
- Demonstration of instrument flying proficiency; and
- Any other night-flying item or items of the flight test at the discretion of the testing officer.

5.7.4 Following successful completion of the flight test, the single-engine aeroplane limitation can be removed from the NVFR rating by the delegate.

5.8 Navigation aid endorsements

5.8.1 Navigation aids that may be endorsed on a NVFR rating include a non-directional beacon (NDB), VHF omni range (VOR), distance measuring equipment (DME) and Global Position System Navigation (GPSN).

5.8.2 When issued, a NVFR Rating will normally include an endorsement for one or more radio navigation aids. If the holder of a NVFR Rating subsequently wishes to add additional radio navigation aid endorsements to the rating then another flight test is required unless the person holds a current pilot-in-command or co-pilot instrument rating.

5.8.3 In the case of a flight test for adding a new navigation aid endorsement to a NVFR Rating, the same principles apply as for the removal of a single-engine limitation in that the testing officer may use discretion in accepting which items of the flight test that do not need to be demonstrated again.

5.8.4 CAO 40.2.2 includes a note which states that the ability to navigate by reference to radio navigation aids must be demonstrated at night. However, if navigation at night using radio navigation aids has been previously demonstrated as part of the flight test for initial issue, it can be argued that subsequent radio navigation aid endorsements may be tested by

day under simulated instrument conditions without detriment to the safety intent of the Order.

5.8.5 Similarly, demonstrating proficiency in a synthetic flight trainer approved for the purpose of testing the use of the particular radio navigation aid for instrument rating renewal is also acceptable. Testing officers may also allow the holder of a NVFR Rating to demonstrate navigational proficiency with Global Navigation Satellite System (GNSS) to qualify for a GPSN endorsement by using the aircraft equipment on the ground in simulation mode, in the same way as provided under CAO 40.2.1 for the issue of a GNSS en-route navigation certification to an instrument rating holder.

5.8.6 The holder of a NVFR rating who also holds a current command or co-pilot instrument rating endorsed with the VOR or NDB navigation aids may apply to add those aids, together with the DME navigation aid, to a NVFR rating without a flight test provided navigational competency using at least one other navigation aid has been demonstrated at night.

5.8.7 In addition, the holder of a current command or co-pilot instrument rating who has a log-book certification authorising the use of GNSS for en-route navigation under the IFR would also be entitled to the GPSN endorsement on a NVFR rating without a flight test if they had previously demonstrated navigational competency using another aid at night.

5.8.8 When required, it is suggested that the minimum requirement for a NVFR flight test to add a radio navigation aid endorsement to a NVFR Rating would include the following:

- Demonstration of orientation, intercepting and tracking using the navigation aid, which may be conducted by day under simulated instrument conditions or in an approved synthetic flight trainer;
- Demonstration of instrument flying proficiency;
- Any other night flying item or items of the flight test at the discretion of the testing officer.

5.8.6 Following successful completion of the flight test, all radio navigation aids which the holder is authorised to use should be endorsed on the NVFR rating.

6. Keeping Current

6.1 NVFR recent experience requirements

6.1.1 The recent experience requirements that must be met before a pilot can exercise the privileges of the NVFR Rating are specified in CAO 40.4.2 and include the following requirements:

- Conducted a flight of at least one hour at night within the previous 12 months; and
- Conducted at least one take-off and landing at night within the previous 6 months.

6.1.2 A flight review, proficiency check or flight test conducted at night will meet the latter requirement.

6.2 Carriage of passengers

6.2.1 If passengers are to be carried at night, then there is an additional requirement under the CARs to have completed at least three take-offs and three landings at night within the previous 90 days.

6.3 Instrument flying recency

6.3.1 While instrument flying proficiency is essential for safe flight at night, there are no instrument flight recency requirements specified for NVFR flight. As all night flying requires transition to instrument flight immediately after take-off, it is imperative that NVFR pilots are confident that their instrument flight skills are current before undertaking any flight at night, as there is no opportunity to gradually regain proficiency.

6.3.2 CAO 40.1.0 does not permit aeroplane pilots who do not hold an instrument rating to practice instrument flying in VMC under simulated instrument conditions with a safety pilot. This limits the opportunities for NVFR pilots to practice instrument flying and the following methods are suggested for NVFR pilots to maintain instrument flying skills.

- Keep in current night flying practice and fly the aircraft by reference to instruments at all times when flying at night; or
- Practice instrument flying under simulated conditions with a flight instructor; or
- Practice instrument flying in a suitable synthetic flight trainer.

6.3.3 In the event that none of the above alternatives is available, using a home personal computer running a flight simulator programme has been shown to be beneficial in maintaining a minimum level of instrument flying proficiency.

7. NVFR Hazards

7.1 Introduction

7.1.1 The limited visual reference available at night introduces additional hazards (or threats) for NVFR pilots and these need to be known and understood, so that counter-measures can be adopted to manage the threats.

7.2 Night vision

7.2.1 The human eye can take up to 30 minutes to adjust fully to conditions of darkness, therefore lighting levels need to be kept low both before and during flight to maintain night adaptation. Cockpit lighting should be set at the minimum necessary to read flight instruments and documentation – the use of red cockpit lighting may assist in maintaining dark adaptation, however, red lines or printing on maps may not be visible.

7.2.2 Exposure to bright light will cause the eyes to immediately loose dark adaptation and may possibly cause temporary blindness. If a bright light cannot be avoided, one tactic is to close one eye to maintain dark adaptation in that eye. Night vision is also adversely affected by lower oxygen levels at altitudes above 4000' and can be further exacerbated by the effects of cigarette smoking.

7.2.3 It should be emphasised that good night vision is not the basis for controlling the aircraft, but is necessary for visual navigation, traffic and weather avoidance and similar functions.

7.2.4 Pilots should also realise that the eye sees differently at night. Daylight visual receptors in the eye are at the centre of the field of vision while night receptors are at the periphery. Therefore, a continuous visual scanning technique needs to be used at night, because looking directly at an object does not utilise the night vision receptors.

7.2.5 However, even with proper scanning and dark adaptation, the human eye is not capable of seeing unlit objects on a dark night.

7.3 Visual illusions

7.3.1 Visual illusions can occur when flying at night or in limited visibility and have been the cause of a number of loss of control accidents. The effective method of avoiding or overcoming disorienting visual illusions is to use the flight attitude indicator as the primary flight reference at night. External visual cues should only be used at night for navigation, to position the aircraft in the circuit, and to avoid

other aircraft or lighted obstructions, but should not be used as the primary flight reference.

7.3.2 When flying at night, it is good practice to always fly by reference to instruments, even when external lighting provides good visual cues, because:

- Visual illusions can provide misleading information;
- Visual reference can be suddenly and unexpectedly lost;
- Flying on instruments helps to maintain instrument flying skills.

7.3.3 It is helpful to understand some of the common visual illusions which may be encountered at night and the associated hazards.

- False horizon — a sloping cloudbank or sloping terrain can create a false impression of the horizon and lead to disorientation. Confusing scattered ground lights with stars can have a similar effect;
- Reflections — helicopters with extensive areas of Perspex are particularly prone to disorienting reflections on the inside of the cockpit canopy;
- Flicker vertigo — Flashing lights or flicker effects from propellers and helicopter rotor blades are known to cause disorientation in some circumstances;
- Autokinesis — is a result of concentrating on a single light source against a dark background. The eyes need to continually adjust focus to utilise the night vision receptors which can cause the light to appear to move erratically. Trying to align the aircraft with the apparent movement can cause disorientation. A continual scanning technique inside and outside the aircraft helps to reduce this effect;
- Empty field myopia — conditions where there are no discernible objects in view (such as on a dark night or in cloud) cause the eyes to lose focus and possibly not see distant objects. Constant scanning inside and outside the aircraft eliminates this problem;
- Landing illusions — include:
    - Black-hole illusion — occurs at aerodromes where there is little or no ground lighting in the vicinity of the aerodrome to provide visual cues to assist the pilot with depth perception or to estimate height and distance. Studies have shown that when approaching to land under these conditions there is a strong tendency to descend below the correct approach path and undershoot the runway;
    - Runway width illusion — narrow runways can give the pilot an impression of being too high on the approach while wider runways can have the opposite effect;

- Sloping runway — a runway sloping upwards can also give the impression that the approach is too high and a downsloping runway can have the opposite effect;
- Rain on windscreen — can cause a refraction effect which makes it appear that the aircraft is too high on the approach.

7.4 Black-hole operations

7.4.1 Approaching to land at an aerodrome in 'black-hole' conditions is possibly the most challenging aspect of night flying. 'Black-hole' conditions are said to exist where there is no ground lighting on the approach path or in the vicinity of the aerodrome. There have been a number of 'black-hole' accidents in Australia where an aircraft has been flown into terrain well below the normal approach path, for no obvious reason other than misjudgment of the aircraft's height or distance from the runway. To avoid, or overcome the visual illusions associated with the lack of visual cues under 'black-hole' conditions, careful planning and execution of the approach and landing is essential.

- Identify the aerodrome elevation and circuit height;
- Identify significant obstructions and/or terrain on the approach and in the circuit area and establish minimum heights for critical points in the circuit and approach to remain well above these;
- Plan the approach and circuit, including heading (HDG) to fly for each leg;
- Avoid long straight-in approaches if there is no glideslope guidance available;
- Fly the aircraft by reference to instruments, particularly during turns;
- Fly HDG and height for each leg of the circuit;
- Don't rely on visual estimates to judge height and distance in the circuit. Use timing or align the flarepath with selected reference points on the airframe to achieve positioning;
- Establish a stabilised approach and avoid large changes in power and rate of descent;
- Don't descend below planned minimum heights until established on a stabilised approach and you are satisfied, from all the information available, that you are on the correct approach path;
- On final approach, select an aiming point well beyond the runway threshold to avoid landing short;
- Remember that landing distance requirements are normally based on crossing the runway threshold at a height of 50 feet.

7.5 Sensory illusions and spatial disorientation

7.5.1 Flying at night with limited visual reference, can result in sensory illusions which can be very powerful and can result in even experienced pilots rapidly becoming disoriented. Any pilot intending to fly at night should be familiar with the sensations involved, and the methods used to retain orientation.

7.5.2 Sensory illusions are caused by the balance mechanisms of the body being unable to distinguish between normal gravitational forces and those produced by the accelerative forces acting on the aircraft in flight. The sensory systems used by the body to establish orientation are generally classified as:

- Visual — the eyes;
- Vestibular — the inner ear balance organs;
- Somatic — nerves in the skin, muscles and joints that sense gravity and other pressures on the body.

7.5.3 Because the vestibular and somatic senses cannot distinguish between gravitational force and the accelerative forces felt during flight manoeuvres, pilots relying on these senses alone can quickly become disoriented. In one study of pilots untrained in instrument flight, the average time for the pilots to lose control of an aircraft after losing visual reference was 178 seconds.

7.5.4 During visual flight, the visual sense is normally able to correct conflicting signals from the other senses, but when visual reference is unavailable or misleading, other sensory inputs can quickly become erroneous.

7.5.5 The types of sensory illusions commonly encountered in NVFR flight include:

- The leans — This term generally refers to a situation where a balanced turn has been sustained for long enough that the body feels a sensation of level flight. On rolling out of the turn the illusion is a feeling of banking in the opposite direction even though the wings may be level;
- Coriollis — Moving the head excessively during instrument flight confuses the balance mechanism in the ears, producing a tumbling sensation. The effect is minimised by scanning with eye movements rather than head movements;
- Somatogravic — Caused by changes in forward speed which are misinterpreted as feelings of climbing or descending. For instance, the acceleration after take-off can give a sensation of climbing too steeply.

7.5.6 The primary defence against sensory illusions during instrument flight is to ignore the physical sensations and to maintain orientation by reference to the flight instruments.

Attempting to use outside visual reference at night can cause further confusion. Correct instrument scanning technique uses the flight attitude indicator (artificial horizon) in place of the natural horizon as the primary source of attitude information.

Performance instruments, air-speed indicator (ASI), altitude (ALT) and vertical speed indicator (VSI) are used to confirm that the attitude being maintained is providing the desired aircraft performance.

7.5.7 Note that when the attitude indicator is functioning correctly, the horizon bar will be level with the real horizon, and the aircraft symbol will correspond to the attitude of the aircraft in roll and pitch. While this may seem obvious, incorrect interpretation could have disastrous results. Using the attitude indicator correctly is a very effective means of overcoming sensory illusions because it provides visual input to correct the other senses.

7.5.8 Many light aircraft being flown under the NVFR in the private category have only one attitude indicator and one power source (normally a vacuum pump) to power that gyroscopic instrument. Failure of either of these will leave the pilot with no direct source of attitude indication. Accordingly, NVFR Rating holders should ensure that they also acquire and maintain the skills required to fly on limited panel instruments — that is, without an attitude indicator or directional indicator.

7.6 Hazards

7.6.1 Risks associated with take-off at night are well recognised, and pilots who don't transition to instrument flight immediately after take-off leave themselves open to the effects of visual and/or spatial disorientation.

7.6.2 Somatographic illusion is more commonly encountered in high performance aircraft and is caused by the acceleration to climbing speed during and after take-off. The acceleration is incorrectly sensed by the pilot as a feeling of climbing too steeply, leading to a strong urge to lower the nose. A number of accidents where aircraft have been flown into the ground after take-off have been attributed to the Somatographic illusion. Maintaining aircraft attitude and confirming positive rate of climb by reference to instruments is the best method of avoiding this illusion.

7.6.3 Another significant threat on take-off is an aerodrome where the external ground lighting appears to be sufficient to allow the pilot to conduct the take-off and initial climb by visual reference. However, a high nose attitude after take-off or a climbing turn away from the well lighted area can result in sudden loss of visual reference and rapid disorientation. At low altitude, the margin for recovery is small and a number of accidents have been attributed to this cause.

7.6.4 Transitioning to instrument flight immediately on lift-off should be the standard procedure for all take-offs, and is effective in overcoming take-off illusions.

7.7 Weather

7.7.1 Hazardous weather conditions are more difficult to see and avoid at night and the risk of inadvertent entry into instrument meteorological condition (IMC) is greater. In dark night conditions, entry into cloud can be sudden and unexpected. Extensive high cloud cover may also block moonlight and result in dark night conditions. Weather forecasts should be carefully studied during pre-flight planning to ensure that the flight can be conducted in visual meteorological conditions (VMC).

7.7.2 Cloud forecast and planning

- What is the cloud amount, base and tops, and the extent of the cloud over the route?
- Forecast cloud should allow the cruise level to be planned above lowest safe altitude (LSALT) and with 1000' clearance below or above the cloud layer(s):
  - Don't plan to cruise at the same level as the cloud layer;
  - Is there cloud forecast below LSALT or below the planned cruising level? Cruise above cloud in VMC is possible but:
    - Does the forecast (and other information) clearly indicate that you can climb and descend in VMC? You need to be very confident that VMC for descent will not be a problem;
    - How will you navigate? Visual navigation is generally not possible over more than scattered (SCT) cloud;
    - NVFR flight over more than SCT cloud for more than short periods is not advisable even if VMC can be maintained on top.

7.7.3 Hazardous Weather

- Check for fronts, thunderstorms (TS), cumulonimbus (CB) and turbulence;
- Thunderstorms are easier to see at night due to lightning, but may give misleading automatic direction finding (ADF) indications;

- Fly well clear of thunderstorms and avoid planning NVFR flight through areas where TS are forecast to be frequent or aligned along a front or squall line;
- The lower temperatures at night may increase the risk of carburettor or airframe ice:
  - Flight above the freezing level may result in airframe icing if cloud is inadvertently entered;
  - Light winds, low temperatures and moisture are conducive to fog;
  - Dry and wet bulb temperatures close together on the aerodrome forecast may indicate the probability of fog;
  - Remember that aerodrome lighting that can be easily seen through fog from overhead an aerodrome, may be completely obscured on the approach to land.

7.7.4 **Destination weather**

- Does the forecast indicate that you can make a visual approach and landing at the destination in VMC?
- What is the forecast cloud ceiling and visibility at the aerodrome and is the crosswind within aircraft limitations?
- If destination weather is marginal, are there suitable alternate aerodromes available?

7.8 VFR into IMC

7.8.1 Due to the difficulty with detecting cloud on a dark night, inadvertent entry into IMC has to be accepted as a definite possibility if there is significant cloud. Unintended entry into IMC is well recognised as a major contributing factor in many NVFR accidents. To minimise the risk, plan not to fly at levels where cloud is forecast and consider not flying at all if the cloudbase is not higher than LSALT + 1000'. Pre-flight planning must be based on conducting and completing the flight in VMC.

7.8.2 If inadvertent entry into cloud occurs:

- Don't panic;
- Continue to fly on instruments;
- Turn on pitot heat if fitted;
- Turn off flashing or rotating beacon and strobe lights if disorienting;
- Maintain an altitude above LSALT;
- Execute a 180° turn to exit cloud (or continue straight ahead if in CB);
- Determine heading (HDG), LSALT, navigation and fuel requirements for diversion in VMC to nearest suitable aerodrome or return to departure aerodrome;

- If unable to exit cloud, declare an emergency and request assistance as necessary;
- Maintain control of the aircraft by reference to instruments as the first priority;
- Navigate to establish VMC and land at the nearest suitable aerodrome;
- Maintain terrain clearance until established visually in the aerodrome circuit area.

7.8.3 No matter what the emergency or abnormal situation, it is important to broadcast your circumstances using either a 'Mayday' or 'Pan' call. Do not hesitate to do this and ask for assistance. Air Traffic Services and other aircraft can assist you with navigational, weather and technical advice that will reduce your workload and allow you to concentrate on flying the aircraft and resolving the situation safely.

7.9 Controlled flight into terrain (CFIT)

7.9.1 Controlled flight into terrain is the result of a loss of situational awareness and is a significant problem worldwide both in NVFR and IFR operations. The common factor in this type of accident is that due to the pilot's lack of awareness of either the horizontal or the vertical position of the aircraft, it is flown under full control into the ground or water.

7.9.2 NVFR procedures depend on maintaining a safe height above terrain and should not rely on the pilot's ability to visually avoid terrain. Relying on sight alone to maintain terrain clearance at night is unreliable and hazardous.

- Maintain height above LSALT or 1000' above the highest terrain within a 10 nm radius;
- Plan departures and arrivals to clear terrain laterally and vertically until above LSALT or within the circuit area;
- Don't go below LSALT on descent until positively established that high terrain/obstacles have been passed then establish the new LSALT for continuation of descent until in the circuit area;
- If visual reference is lost then maintain above LSALT and declare an emergency if visual reference cannot be regained;
- Maintain situational awareness;
- HDG — be aware of the direction you are flying in relation to terrain;
- Be aware of your LSALT for the route sector;
- Be aware of the critical terrain and obstacles for your flight;
- Preparation of a 'mud map' is particularly useful to aid situational awareness.

7.10 Uncontrolled flight into terrain (UFIT)

7.10.1 Uncontrolled flight into terrain is also a significant cause of night accidents, which are usually fatal. Triggering factors leading to spatial disorientation and loss of control can be some or all of:

- Sudden or unexpected loss of visual reference;
- Sensory or visual illusions;
- Unexpected distractions or emergencies;
- Turbulence.

7.10.2 Maintaining control at night depends on having:

- Current instrument flight skills, including limited panel;
- Serviceable instruments;
- Serviceable lighting.

7.10.3 Manage all procedures, distractions, abnormal situations or emergencies by always making aircraft control the first priority and flying the aircraft by reference to instruments.

7.11 Engine failure

7.11.1 For single-engine aircraft operations, by far the most serious night time emergency is total engine failure, but careful pre-flight planning to avoid inhospitable terrain gives the best chance of survival in such an emergency. Planning to fly at a higher altitude may also increase the options available.

7.11.2 Interestingly, accident data from the United States of America (USA) has shown a fatality rate for engine failure accidents at night in single-engine aeroplanes that was less than for similar accidents by day. This apparent anomaly may be explained by the limited options available at night. Many fatalities following engine failure result from loss of control while attempting to manoeuvre to a suitable landing area.

7.11.3 Configuring the aircraft for optimum glide into wind towards the least inhospitable terrain should be planned, with the aim to achieve ground contact in controlled descent at the minimum forward speed. Use of landing lights in the final stages may assist in making ground contact and avoiding obstacles, but maintaining control throughout the procedure is critical to a successful outcome.

7.11.4 Continuing to fly by reference to instruments is essential to maintaining control.

7.11.5 The same basic principles are applicable to both aeroplanes and helicopters.

7.11.6 **Multi-engine aircraft –** Pre-flight planning to ensure that the aircraft's single-engine service ceiling is higher than the

route LSALT preserves an advantage in having more than one engine. If the aircraft's single-engine performance makes it incapable of reaching a suitable aerodrome following engine failure, then the procedures for single-engine aircraft apply.

7.11.7 Maintaining control of the aircraft is essential, so keeping in current practice in asymmetric flight by reference to instruments is the best possible insurance.

7.12 Electrical failure

7.12.1 Electrical failure is a serious but controllable abnormal situation. Normal operation of the electrical generating system should be checked before flight and at frequent intervals during flight. Failure to check the system in flight could lead to the first indication of electrical failure being the lights going out.

7.12.2 As a backup, it is essential to have an appropriate torch (or better still, two torches) fitted with fresh batteries. It would be foolish to undertake a night flight with a torch that has partially discharged batteries — your life is worth more than the cost of fresh batteries. As well, it would be more than frustrating to discover that a torch kept in the nav bag stowed in the luggage compartment is going to be of not much use in an emergency. Make sure that the torch is immediately accessible.

7.12.3 Instrument lighting, radio communication and navigation equipment depend on the electrical system as, more than likely, does the turn indicator. When a generator or alternator fails, the useful life of the aircraft battery can be extended by turning off unnecessary electrical equipment. It is also advisable to make appropriate radio calls early, while sufficient battery power is still available. If electrical power is needed to lower flaps or landing gear, then battery conservation is particularly important, as is familiarity with the emergency landing gear extension system.

7.13 Gyroscopic instrument (vacuum) failure

7.13.1 Another serious abnormal situation is the loss of attitude flight instruments as this can lead to loss of control of the aircraft. Vacuum pump failure is probably the most common cause of instrument failure and the vacuum gauge should be checked pre-flight and frequently monitored for proper operation. The attitude indicator will probably not fail instantaneously, but may give inaccurate indications for a time, which could be disorienting. Any indication of loss of vacuum should be cause to use the attitude indicator with caution.

7.13.2 If the attitude indicator is sluggish or topples, the performance of the indicator should be confirmed by reference

to the turn coordinator or turn and balance indicator. If a fault is detected, it is advisable to cover the attitude indicator to avoid any distraction.

7.13.3 Continued flight should still be possible using the turn indicator or a standby attitude indicator powered by an alternate power source, but current practice in instrument flying by reference to limited panel is essential, as a number of fatal UFIT accidents attributable to vacuum pump failure have demonstrated.

8. Threat and Error Management

8.1 TEM concepts

8.1.1 Threat and error management (TEM) is an operational concept that encompasses the traditional role of airmanship, but provides for a structured and proactive approach for pilots to use in identifying and managing threats and errors that may affect the safety of flight operations. TEM uses many tools, including training, Standard Operating Procedures (SOPS), checklists, briefings and crew resource management principles to assist pilots to manage flight more safely. It has been widely accepted in the airline industry as an effective method of improving flight safety and is now required by the International Civil Aviation Organization (ICAO) as an integral part of pilot training at all licence levels from student to airline transport pilot.

8.1.2 **Threats –** In the TEM model, threats are events whose occurrence is outside the control of the pilot(s) and which may threaten the safety of the flight. They may be anticipated or they may be unexpected, or they may be latent in the operational system. Pilots need good situational awareness to anticipate and to recognise threats as they occur. Threats must be managed to maintain normal flight safety margins.

8.1.3 **Errors –** The TEM model accepts as unavoidable that pilots, as human beings, will make errors. Errors may be intended or unintended actions or inactions on the part of the pilot(s), and can be classified as either handling errors, procedural errors or communications errors. External threats can also lead to errors on the part of the pilot(s).

8.1.4 While errors may be inevitable, safety of flight demands that errors that do occur are identified and managed before flight safety margins are compromised.

8.1.5 **Undesired aircraft state –** Threats and errors that are not detected and managed correctly can lead to an undesired aircraft state, which is a deviation from flight path or aircraft configuration that reduces normal safety margins. An undesired

aircraft state can still be recovered to normal flight but, if not managed appropriately, may lead to an accident or incident.

8.1.6 Good TEM requires the pilot to plan and use appropriate countermeasures to prevent threats and errors from leading to an undesired aircraft state. Countermeasures used in TEM include many standard aviation practices and may be categorised as follows:

- Planning countermeasures — including flight planning, briefing, and contingency planning;
- Execution countermeasures —- including monitoring, cross checking, workload and automation management;
- Review countermeasures — including evaluating and modifying plans as the flight proceeds, and inquiry and assertiveness to identify and address issues in a timely way.

8.1.7 **TEM Application –** Threats and errors occur during every flight as demonstrated by the considerable database that has been built up in observing threats and errors in flight operations worldwide. One interesting fact revealed by this programme is that around 50% of crew errors go undetected.

8.1.8 TEM should be integral to every flight, including anticipation of potential threats and errors and planning of countermeasures. Include potential threats, errors and countermeasures in the self-briefing process at each stage of flight, and avoid becoming complacent about threats that are commonly encountered.

8.1.9 Error management requires an acceptance that errors are unavoidable and the use of standard operating procedures, checklists, monitoring and cross checking procedures to both minimise the risk of errors and to detect and manage those that occur. Good situational awareness at all times is essential to TEM.

- Try to anticipate possible threats and errors associated with each NVFR flight and plan countermeasures;
- Brief (self brief) planned procedures before and before every change of flight path or aircraft configuration;
- Include anticipated threats and countermeasures in briefings;
- Continuously monitor and cross check instrument indications and flight progress (situational awareness);
- Prioritise tasks and manage workload so as not to be overloaded but to maintain situational awareness;
- Identify and manage threats and errors;
    - Identify the threat/error;
    - Maintain control of the aircraft and flight path by reference to instruments;

- Manage the threat error; and
- Monitor the flight progress to confirm that all is going to plan;
- Identify and manage undesired aircraft states;
- Aircraft control and flightpath are the first priority;
- Don't fixate on error management;
- Confirm recovery to planned flight and normal safety margins.

8.2 Risk management and TEM

8.2.1 TEM is an operational concept applied to the conduct of a flight. However, risk management is a process that can be applied before deciding to undertake a proposed flight, to determine whether or not it should be conducted or modified, based on the assessment of the risk involved. The basic question that risk management addresses is whether the level of risk for a proposed flight is acceptable or if it can be managed to make it acceptable?

8.2.2 Risk management provides a structured method of assessing and mitigating risks associated with an activity. The process of risk management involves:

- Identify the risks;
- Consider the likelihood and consequences of events arising from the risk;
- Develop plans to mitigate risks;
- Implement plans;
- Review performance of plans.

8.2.3 There is obviously overlap between risk management and TEM at the stage of developing and implementing plans to mitigate risks and in reviewing the progress of the flight.

8.3 Threats/errors

8.3.1 A review of reports from Australia and overseas has identified a number of threats/errors that are common to accidents and incidents which have occurred during flight at night in VMC.

8.3.2 Identified causes of accidents and incidents during night operations have been:

- Uncontrolled flight into terrain (UFIT);
- Dark night or black-hole conditions;
- Inadvertent entry into cloud or other hazardous weather;
- Engine power loss;
- Electrical failure;
- Loss of light sources;
- Failure of instrument power sources;
- Failure to recognise instrument failure;

- Mid-air collisions;
- Controlled flight into terrain (CFIT);
- Misjudged approach, landing or baulked approach;
- Heavy landings;
- Gear up landings;
- Collisions on the ground.

Note: Loss of control is often the result of lack of visual reference and other factors, such as aircraft systems malfunctions, which place higher demands on the pilot in terms of both managing the emergency and controlling the aircraft. Mid-air collisions are a small but significant factor. Controlled flight into terrain includes accidents in the approach and landing phase but also descent into the water at night during low level emergency medical service (EMS) operations. Other landing accidents that occur at night, such as heavy or gear up landings, may have had darkness as a contributing factor. The list points to the need for skills in managing typical threats and errors at night.

8.4 Situational awareness

8.4.1 Situational awareness involves three elements: the past, the present, the future. Situational awareness is knowing what *has* happened to your aircraft, what *is* happening and what *could* happen to the aircraft in the immediate future. It requires good anticipation and asking "what if …?"

8.4.2 Situational awareness is the awareness of all the elements in the environment, and how they affect your flight or could affect your flight in the future. Situational awareness at night includes the pilot's mental picture of the aircraft relative to its three dimensional operational environment, including both horizontal and vertical navigation particularly in relation to terrain clearance, the configuration of the aircraft, and the health and mode of operation of its systems. Because there is less visual information available at night, situational awareness at night must include greater emphasis on maintaining control of the aircraft and predicting the flightpath.

8.4.3 Situational awareness at night:

- Aircraft attitude — reference to flight instruments;
- External lighting — effect of ambient lighting conditions including possible illusions;
- Position — visual and radio navigation;
- Intended flight path — Heading, distance, time and terrain clearance;
- Weather — pre-flight and inflight forecasts, reports and observations;

- Aircraft systems serviceability — engine, electrical, vacuum, pitot-static;
- Destination — lighting facilities, navaids, weather, alternate, arrival procedures;
- Alternate options;
- Fuel state.

8.4.4 To maintain situational awareness, pilots should use all sources of information available, such as obtaining thorough pre-flight briefings, and seeking information from Air Traffic Services or other aircraft as necessary during flight. Wherever possible, instrument indications, particularly navigational and altitude information, should be cross-checked to confirm accuracy. Fixation on one particular facet of the operation to the exclusion of others should be avoided. Situational awareness is a continual process during a flight and a vital source of information necessary for reasoned decision-making.

8.5 Decision-making

8.5.1 The ability to assess a situation, identify the need to make a decision, and then to implement the decision in the time available is an essential element of aircraft operation. This ability is also a key to successful TEM. Emotions often play a significant role in decision-making with the decision being an emotional reaction to a situation rather than the result of a logical and structured process. The use of a logical and structured decision-making process will reduce the likelihood of emotions clouding or confusing the result. Decisions can be proactive (anticipating a problem) or reactive (dealing with an unexpected problem) but the decision-making process always involves:

- Identifying a problem;
- Collecting relevant information;
- Generating and analysing options;
- Deciding on the most appropriate option;
- Implementing the decision;
- Monitoring progress against intended outcomes and modifying actions as required.

8.5.2 Good decision-making relies on good situational awareness and the ability to identify available options and decide on the best plan without being influenced by extraneous pressures.

8.5.3 **Extraneous pressure and decision-making** – Commencing a NVFR flight with no other plan but to reach the destination potentially locks the pilot into a single course of action and reduces his/her ability to consider other options which may become necessary due to changing circumstances.

Similarly, extraneous pressures due to unrealistic passenger or pilot expectations may also limit the pilot's ability to consider safer options during the flight.

8.5.4 A NVFR flight will generally have very limited options in comparison to a similar flight by day, so careful contingency planning and an acceptance that diversion may be necessary is essential to managing the risk.

8.5.5 Additional thought needs to be given before the flight to avoid extraneous pressures which eliminate options, such as self- or passenger-imposed expectations or deadlines for arrival at the destination, and to ensure that appropriate facilities will be available at possible alternate aerodromes. These include not only such essentials as aerodrome lighting but also transport and accommodation should an unplanned overnight stop prove necessary.

8.5.6 Ensure that all passengers and other interested parties are aware of the constraints and the options applicable to the flight before departure, so that the pilot is free to make decisions based on safety outcomes.

8.6 Task management

8.6.1 Task management is an important tool for all pilots. During periods of high workload, the ability to prioritise tasks is essential so that important flight safety issues are not overlooked. There are numerous instances of accidents which were caused by pilots fixating on a single task to the exclusion of basic, but important, items such as monitoring aircraft altitude or fuel remaining.

8.6.2 Flying single pilot NVFR in a light aircraft is a demanding task requiring the ability to plan ahead (task manage) to avoid periods of activity which could exceed the pilot's capability. Pre-flight planning, cockpit organisation and self-briefing — tasks which, if properly managed, contribute significantly to the reduction of in-flight workload — are all examples of TEM in action.

8.7 Fatigue management

8.7.1 Fatigue is well recognised as a threat to safe operation. Good fatigue management should minimise the risk of the pilot's skill and judgment being affected by fatigue to the extent that flight safety margins are compromised.

8.7.2 A common fatigue risk in NVFR operations is the expectation that a NVFR flight can be undertaken following a full day's activities, whether flight-related or not. NVFR flight,

even under the best conditions, is demanding and adequate time needs to be allowed for rest and preparation before a flight, particularly if it will extend into the pilot's normal sleep cycle.

8.7.3 The time of the highest workload on most if not all flights is approach and landing, which is when fatigue is likely to be greatest after a long day. However, there is some evidence that pilots can compensate for fatigue by a high level of arousal at times of high activity and that the effects of fatigue are more likely to be a threat at times of low activity. There is more than one anecdote of a pilot on a long night flight waking to find that there is no one else aboard awake!

8.7.4 Apart from the effect on performance, fatigue introduces an extraneous pressure on the pilot which may adversely influence the decision-making process. For instance, a pilot may be influenced by fatigue not to divert to an alternate when conditions at the destination are below minimums.

8.7.5 All studies indicate that quality restorative sleep is by far the most significant single factor that permits the body to recover from fatigue. Napping has short-term benefits, especially when scheduled during the night, and, while rest and recreation are central for individual wellbeing, these activities do not reduce fatigue. If night flying has interfered with normal sleeping patterns, then only sleep will reduce or eliminate fatigue.

9. Planning NVFR Operations

9.1 Flight planning

9.1.1 Throughout this CAAP, emphasis has been placed on the need for sound pre-flight planning and the application of TEM. Night flying, whether in the circuit or cross-country, presents particular threats and errors and has a unique set of requirements. As noted previously, careful and comprehensive pre-flight preparation will result in an in-flight workload which is both safe and manageable.

Note: As well as the AIP references given in this CAAP, CASA's VFR Flight Guide has a section on planning and conduct of NVFR operations which includes all the applicable references.

9.1.2 **Route selection –** Factors that may influence selection of the route at night include:

- Navigation requirements;
- Terrain;
- Weather;
- Alternate aerodromes;
- Airspace.

9.1.3 A direct route is not necessarily the best option at night. Take into account the factors listed when choosing the route, particularly in regard to maintaining the safest options in event of an emergency.

9.1.4 You may plan a suitable route using World Aeronautical Charts (WAC) or you may use the routes shown on lower limit (LL) en-route charts (ERC LOW), but topographical charts showing terrain along the proposed route and to possible alternates are essential for NVFR navigation.

9.1.5 **Navigation requirements –** Navigation under NVFR may be by visual reference or by reference to radio navigation aids. (See AIP ENR 19.2.)

9.1.6 If visual navigation is to be used, then you must be able to obtain visual fixes along the route at not greater than 30 minute intervals. This may require deviation from the direct route to enable your position to be fixed over landmarks visible at night, such as towns.

9.1.7 Alternatively, radio navigation aids may be used for navigation, but you must plan to fix your position at regular intervals and you should only use radio navigation aids within their rated coverage as specified in GEN 4.2 and Aeronautical Information Publication En-route Supplement Australia (AIP ERSA).

9.1.8 **Position fixing requirements –** The route distance between radio position fixes must not exceed that which enables you to arrive within the rated coverage of an on-track radio navigation aid after making allowance for possible tracking errors from the last positive fix. (See AIP ENR 1.1, 19.1.9. and AIP ENR 1.1, 19.5 for the actual requirements.) As well as the distance limitation, the maximum allowable time between radio position fixes is 2 hours. Some routes shown on planning charts will require a minimum ground speed to be maintained to meet the position fixing requirement.

9.1.9 A position fix using radio navigation aids may be obtained by station passage over an aid or by the intersection of bearing lines from at least two navigation aids while the aircraft is within rated coverage of both aids. Pre-planning the appropriate bearings will assist in position fixing by this method. Requirements for position fixing are specified at AIP ENR 1.1, 19.7.1.

9.1.10 Of course, an approved Global Navigation Satellite System (GNSS) is capable of providing position fixes anywhere over mainland Australia most of the time. However, if planning to navigate using GNSS, the unit must be approved for IFR navigation and you should check the Receiver

Autonomous Integrity Monitoring (RAIM) availability for the time of the flight.

9.1.11 Non-IFR approved GNSS receivers should only be used to assist with visual navigation, or with navigation using ground based radio navigation aids. They should not be relied on as the main means of navigation because non-approved receivers cannot be relied on to provide a warning if the navigation information is unreliable.

9.1.12 **Lowest Safe Altitude (LSALT) –** Regulations require that, unless it is necessary for taking off or landing, a NVFR aircraft must not be flown at a height less than 1000' above the highest obstacle within a 10 nm radius of the aircraft in flight.

9.1.13 Part of the flight planning process must therefore be to plan a LSALT to ensure that this requirement can be met.

9.1.14 NVFR flights can use either of two methods for planning LSALT:

- For visual navigation, plan a LSALT 1000' above all obstacles within 10 nm radius of the planned track (including the departure and destination aerodrome); or
- For radio navigation, use the IFR LSALT specified on ERC charts or the procedure specified at AIP GEN 5.3.3 for determining IFR LSALT on other routes.

9.1.15 In flight, if the pilot of a NVFR flight can determine by means of a visual fix that a critical obstacle has been passed, then the aircraft can be descended to a lower altitude immediately provided that the 1000' obstacle clearance is maintained for obstacles ahead of that position. In other words, a new lower LSALT applies. This procedure can be used as a stepped descent for arrival at the destination aerodrome but is best planned pre-flight.

9.1.16 Climb to or descent below the planned LSALT should only be made in the vicinity of the departure or destination aerodrome and, with the aerodrome in sight, using a procedure which maintains clearance from obstacles and terrain.

9.1.17 Maintaining track accurately and not descending below LSALT is the best defence against CFIT.

9.2 Chart preparation

9.2.1 Ensure you have all the current and relevant charts and that tracks and LSALT are clearly marked on maps (use colours that will be visible in reduced light – not red light).

9.2.2 The preparation of a ‘mud map’ or ‘sketch map’ which highlights essential features and information is also useful for

developing and maintaining full situational awareness and in managing the flight. The sketch map would generally show such items as:

- Departure, destination and alternate aerodromes;
- Tracks and distances;
- LSALT and high terrain or obstacles;
- Step down LSALT for arrival;
- Controlled airspace boundaries;
- Radio communication and navigation aids and frequencies;
- Prominent visual features;
- Radio bearings to aid visual fixing.

9.2.3 **Weather interpretation –** Obtain at least an area forecast or forecasts covering the intended route and aerodrome forecasts for destination and alternate aerodromes if available.

9.2.4 Because cloud is difficult to see at night, extra care should be taken in the interpretation of meteorological reports to accurately assess the likelihood of any phenomena which could reduce in-flight visibility. If a check of the forecast reveals cloud at less than 1000' above the LSALT, consider not proceeding with the flight.

9.2.5 Remember if the cloud is forecast as BKN (broken) or greater, you will be unable to maintain VMC at the level of the layer. Flight may be planned above a cloud layer with the appropriate vertical clearance for VMC. However, it is unwise to plan above more than scattered cloud unless it is limited in extent and the forecast indicates extensive clear areas which allow for VMC on climb to and descent from cruising level. Navigation requirements must still be able to be met.

9.2.6 If extensive cloud is forecast, you should also check the freezing level as airframe icing could be encountered on inadvertent entry into cloud above the freezing level. Carburettor icing can also be a possibility well below the freezing level.

9.2.7 Check for the possibility of adverse weather at the destination:

- Low cloud;
- Thunderstorms;
- Excessive crosswind component;
- Reduced visibility in rain, dust, smoke or fog.

Note: A temperature forecast close to dew point may indicate the likelihood of fog later in the night.

9.2.8 Because encountering adverse weather conditions at night is potentially much more hazardous than in daylight, don't hesitate to cancel a flight if you have any doubts about the suitability of the weather.

9.3 Aerodrome requirements

9.3.1 For night operations at any aerodrome, it is essential to check that the facilities are available, suitable and serviceable. Aerodrome lighting information is found in AIP ERSA and Notice to Airmen (NOTAMs) should be checked for unserviceabilities. Elements to check include:

- Aerodrome elevation;
- Type and availability of runway lighting;
- Airfield layout, including lighted runways, taxiways, movement areas and holding points;
- Location of windsock;
- Method of activating lighting;
- Standby power available or not;
- Local procedures or restrictions such as curfews;
- Potential hazards such as high terrain or obstructions, lit or unlit, in the vicinity of the aerodrome.

9.3.2 Taxiing on an aerodrome at night can be confusing with the added risk of runway incursion and collision with unlit aircraft or objects, so familiarity with the aerodrome layout is essential.

9.3.3 **Alternate Aerodromes** – Planning for an alternate aerodrome allows you another option if, for some reason, you may not be able to land at your destination. AIP ENR 1.1 72, Alternate Aerodromes, includes detailed NVFR alternate planning requirements and this section is intended to provide an overview of those requirements.

9.3.4 Under NVFR planning requirements, you must carry sufficient fuel to fly to an alternate aerodrome if any of these three elements at your destination is below the standard specified:

- Radio navigation aids;
- Weather;
- Aerodrome lighting.

9.3.5 Keep in mind that, if you do need to plan to an alternate aerodrome, you cannot use an aerodrome as an alternate if it also requires an alternate.

9.4 Radio navigation aid requirements

9.4.1 If you are not qualified and able to navigate to your destination aerodrome using either a non-directional beacon (NDB) or a VOR located at the aerodrome or, alternatively, using an IFR-approved GNSS receiver, then you must plan to be able to fly to an alternate aerodrome within one hour's flight time of your destination that satisfies this requirement.

9.5 Weather Conditions

9.5.1 Alternate weather minima provide a small buffer above the minimum conditions required for NVFR flight at the aerodrome. You should check the aerodrome forecast (or area forecast if no aerodrome forecast is available) to ensure that weather conditions are forecast to be above the alternate minima at the time of your planned arrival.

9.5.2 If conditions are forecast to be below any element of the alternate minima at your destination at the time of your planned arrival (and up to 30 minutes beforehand), you must plan to carry sufficient fuel to fly to an alternate aerodrome.

9.5.3 The following weather conditions forecast at your destination would require you to plan for an alternate aerodrome:

- More than SCT cloud below a ceiling of 1500';
- Forecast or percentage probability of visibility less than 8 km;
- Crosswind component greater than the maximum for the aircraft;
- Thunderstorms or associated severe turbulence, or their probability, are forecast.

Note: The specified NVFR alternate minima allow for very marginal conditions for night flying and, if the weather is forecast close to or below these minima, it may be advisable to reconsider whether to conduct the flight at all.

9.5.4 If weather conditions are below the alternate minima but are forecast to improve at a specific time, then an alternate aerodrome need not be planned if sufficient fuel is carried to allow the aircraft to hold until that time plus another 30 minutes.

9.5.5 Sometimes weather conditions are above the alternate minima but forecast to deteriorate below minima for short periods. You do not need to plan for an alternate aerodrome if sufficient fuel is carried to hold for the expected periods of deterioration. The additional holding fuel requirements are:

- For deteriorations forecast as intermittent (INTER) — 30 minutes;
- For deteriorations forecast as temporary (TEMPO) — 60 minutes.

Note: Thunderstorms are forecast as either INTER or TEMPO and the same holding requirements apply.

9.6 Runway lighting

9.6.1 Check that aerodrome lighting will be available at your destination at the planned time of arrival. For aerodromes with other than pilot activated lighting (PAL), this means for a period 30 minutes prior to the estimated time of arrival (ETA) until landing and taxiing is completed. (Details of the type of lighting available at specific aerodromes are found in AIP ERSA.)

9.6.2 However, to guard against unexpected lighting unserviceability, an alternate aerodrome should be planned if any of the following criteria apply to the runway lighting system.

- Portable runway lighting — alternate required unless a responsible person will be in attendance;
- No standby power — alternate required unless a responsible person is in attendance to display portable lighting;
- PAL activation — alternate required unless a responsible person is in attendance to manually activate the lighting AND the aerodrome has standby power.

9.6.3 An aerodrome with PAL lighting can only be nominated as an alternate if one of the following requirements are met:

- The aircraft is equipped with dual VHF radio; or
- The aircraft is equipped with one very high frequency (VHF) and one high frequency (HF) radio and carries 30 minutes holding fuel; or
- A responsible person is in attendance to manually activate the lighting.

Note: A responsible person must be capable of activating the lighting system and must be in attendance at the aerodrome from at least 30 minutes before the planned ETA until landing and taxiing is completed.

9.7 Pilot Activated Lighting (PAL)

9.7.1 AIP ERSA specifies those aerodromes equipped with a PAL system which allows the runway lighting to be activated by a radio transmission consisting of three 3 second pulses within 25 seconds on a specific VHF channel. Some aerodromes have PAL associated with an Aerodrome Frequency Response Unit (AFRU) which has a different transmission requirement for activation, also specified in ERSA. PAL should normally be activated before taxiing for departure, or within 15 nm and at LSALT for arrival.

9.7.2 Once activated, the runway lights will remain on for 30 minutes after which they are automatically switched off. The windsock light will start flashing as a warning 10 minutes before the lights automatically switch off, and the system may be reactivated in the normal way at any time for another 30 minutes.

9.7.3 **Flight notification and search action required (SAR) –** Flight notification and SAR requirements for NVFR are the same as for day VFR flights, except that flights at night proceeding beyond 120 nautical miles (nm) from the aerodrome of departure are required to submit a search and rescue time (SARTIME) flight notification to air traffic services (ATS) or leave a Flight Note with a responsible person (refer AIP ENR 1.10.2).

9.8 Aircraft requirements

9.8.1 **NVFR approval –** The aircraft maintenance release should be checked to ascertain if the aircraft is approved for NVFR flight, i.e. IFR or VFR Night.

9.8.2 **NVFR aircraft equipment –** Additional aircraft equipment for NVFR falls into three categories:

- external and internal aircraft lighting;
- flight instruments;
- radio communication (COM) and navigation (NAV) equipment.

9.8.3 A pre-flight inspection should check that the aircraft is properly equipped and that the required equipment is serviceable.

9.8.4 In summary, the aircraft equipment requirements for NVFR are as follows:

9.8.5 **Aircraft lighting –** (refer to CAO 20.18 appendix V).

- External lighting:
  - One landing light (or for Charter flights with passengers two landing lights or a lamp with two separately energised filaments);
  - Position lights (red, green and white navigation lights);
  - Anti-collision light (a flashing light or rotating beacon).
- Internal lighting:
  - Instrument lights for all essential instruments and equipment;
  - Two sources of power for instrument lights (normally the generating system and a battery);

  - Pilot and passenger compartment lights adequate to read maps and documents.
- Emergency lighting:
  - A shock-proof electrical torch is required for each crew member. (A second torch and/or spare batteries is recommended).

9.8.6 **Flight and navigation instruments (refer CAO 20.18 Appendix IV) –** The minimum serviceable instruments required for NVFR flight in aeroplanes are;

- An airspeed indicator;
- An altimeter;
- A direct reading magnetic compass;
- An accurate clock (or watch);
- A vertical speed indicator;
- An outside air temperature indicator;
- An attitude indicator (artificial horizon);
- A heading indicator (directional gyroscope);
- A turn and slip indicator;

Means of indicating whether the power supply to the gyroscopic instruments is working satisfactorily.

9.8.7 Specific requirements for NVFR flight instruments, that allow for some variation in instrumentation is found at CAO 20.18 Appendix IV.

9.8.8 Radio communication and navigation equipment is detailed at AIP GEN 1.5.

9.8.9 **Radios –** VHF COM is required for all NVFR flights in all classes of airspace. Other radio communication equipment requirements are the same as for day VFR.

9.8.10 **Navigation aids (Navaids) –** NVFR aircraft must be equipped with at least one of the following radio navigation aids which is serviceable:

- Automatic Direction Finder (ADF);
- VHF Omni Range (VOR);
- Global Navigation Satellite System (GNSS).

9.8.11 ADF or VOR equipment must be approved for IFR or NVFR operations, but the GNSS for NVFR operations must be an IFR approved receiver. IFR GNSS receivers incorporate a RAIM function which provides a warning to the pilot when navigation information is unreliable and other receivers do not have this function. Pilots must hold the appropriate navigation aid endorsement to use the equipment for NVFR navigation.

10. Conducting NVFR Operations

10.1 Pre-flight

10.1.1 A pre-flight inspection for NVFR flight should be conducted in a well lit area if possible and with the aid of a torch. In addition to a normal pre-flight inspection, the following items should be checked for serviceability:

- Before boarding the aircraft:
  - All aircraft lighting, internal and external is operating;
  - Radio navigation aid antennae;
  - Pitot heat (if fitted) is operating;
  - Windscreen is clean;
  - Emergency lighting (torch) serviceable and accessible;
  - Take particular care to ensure that your own passengers are closely supervised while on the movement area and are not in danger from other aircraft;
  - Survey the aircraft parking area, noting the position of any other aircraft and rough ground;
  - Note any other personnel on the movement area;
  - Note any obstructions; and
  - Plan where to taxi to avoid collision.
- After entering the aircraft:
  - Adjust the aircraft lighting to suit your needs;
  - Ensure that that instrument and controls are illuminated and discernable;
  - Organise the cockpit so that maps, navigational equipment and flight plans are accessible;
  - Switch on the navigation lights and rotating beacon; and
  - Set the park brake and clear the area before starting the engine.

Note: A rotating propeller is even more difficult to see at night so be aware of the activities of personnel in the parking area. Also, for night operations it is critical that generators/alternators and instrument power sources (vacuum gauges) are checked and functioning normally.

10.2 Taxiing

10.2.1 Before taxiing, switch on the taxi light and while taxiing monitor and control taxi speeds. There is a tendency to taxi faster at night because it is more difficult to gauge taxi speed. Use the taxi way lighting and reflected navigation lights to judge speed — looking at the wingtips can help this process. Avoid pointing taxi and landing lights at other aircraft. As your

own aircraft's movement is difficult to detect at night, always set the park brake when holding or performing a run-up.

10.2.2 Check the operation of gyroscopic instruments while taxiing and also the indications of radio navigation aids for serviceability when this is possible.

10.3 Night circuits

10.3.1 Although take-off preparations and the take-off should be conducted in the same way day or night, there are some additional aspects which require consideration before and during a night take-off. These are:

- Re-check the windsock, and consider the effects of the wind on the departure path;
- A comprehensive TEM briefing, including any emergency considerations and the planned departure procedure with provision for terrain clearance will greatly assist with the execution of the departure;
- Anti-collision lights should be displayed when crossing an active runway;
- Landing lights should be switched on before entering the take-off runway;
- After lining up in the centre of the runway, confirm that the attitude and heading indications are correct;
- Maintain direction by reference to the runway lights (and centre line markings when available);
- Transition to the flight instruments immediately on becoming airborne;
- Check that the aircraft establishes a positive rate of climb;
- Be wary of sensory illusions and maintain flight by reference to instruments;
- Initiate the crosswind leg turn by reference to the flight instruments; and
- Check aircraft position by reference to the runway lights.

10.3.2 When flying in the circuit, the aircraft should be controlled by reference to flight instruments, and positioned in the circuit by reference to heading, altitude and the runway lights. A lookout is maintained for other aircraft and lighted obstructions.

10.3.3 The practice of keeping the landing lights switched on while flying in the circuit is recommended as an aid in making your aircraft conspicuous to other traffic.

10.3.4 **Downwind –** Position the aircraft on downwind leg in the normal way. It is good practice to limit turns to rate 1 at night. There is likely to be a tendency to think you are closer to the runway at night and correct positioning of the aircraft

should be maintained by the use of known visual cues such as the position of the runway lights in relation to a reference point on the airframe. The turn onto base leg can be judged by either timing the aircraft past the runway threshold (30-40 seconds) or by angular displacement from it (45°).

Note: It is important to maintain an effective lookout and complete all checks without rushing.

10.3.5 **Base Leg/Approach –** The descent on base leg should normally be planned to position the aircraft to start the turn onto final at about 600-700' above ground level (AGL). Don't descend below pre-planned critical heights until established at the appropriate position on the approach path and on a stabilised approach.

10.3.6 The turn onto final approach should be flown by reference to instruments, particularly in 'black-hole' conditions. Fixating on the approach lights under black-hole conditions may cause the autokinesis illusion. Keeping a visual scan going on approach which includes flight instruments will avoid this.

10.3.7 Select an aiming point well into the runway, keeping in mind the tendency to undershoot in the absence of ground lighting and approach slope guidance.

10.3.8 Use the apparent shape of the flarepath on final as an aid to establishing the correct approach path, keeping in mind that narrow or sloping runways may give a different picture.

10.3.9 If aircraft attitude is kept constant and the approach path is being maintained, the aiming point should appear to remain stationary in the windscreen. As the runway gets closer, the lights ahead and behind the aiming point will appear to expand away from the aiming point in the pilot's field of vision.

10.3.10 Judgment of the landing flare will be aided by retaining a picture of the flarepath as seen from the position on the runway. Landing lights can be used to assist but landings should be able to be accomplished without them.

10.3.11 Accident statistics show that gear up landings are also prevalent at night, so ensure that normal pre-landing checks are accomplished using standard procedures.

10.3.12 **Landing –** The flare, hold off and landing is probably best judged by the perspective of runway side lighting rising in your peripheral vision. There are a number of techniques for judging this part of the landing with practice and repetition being an important factor. At the point where the runway edge lighting starts rising in your peripheral vision it is important to transfer your sight to the centre of the far end of the runway. Avoid fixating on the area of the runway illuminated by the

landing lights. Reduce power to idle and adjust the attitude to arrest the descent rate while maintaining directional control. After touchdown, stay on the centre line until the aircraft has slowed to a safe speed and vacate the runway.

10.3.13 Heavy landings also feature prominently in night accident statistics. Good judgment of the landing will take time and practice to achieve and to maintain.

10.3.14 **Go-Around –** A go-around at night is little different to one conducted in daylight. Make the decision to go-around as early as possible and apply power and appropriate flap setting. As the nose is raised to the climb attitude, the runway lights may disappear, so it is critical to resume flight by reference to instruments. Be aware of the possibility of sensory illusions and complete the after take-off procedures at a safe height.

10.4 Night navigation

10.4.1 **Departure –** A comprehensive TEM briefing prior to every major change of flight path or aircraft configuration is recommended practice for all flight operations, but is particularly useful in night operations where many factors need to be considered and visual feedback is limited.

10.4.2 Plan your departure before getting airborne — consider how you will intercept your departure track by 5 nm from the aerodrome and how you will maintain terrain clearance while climbing to LSALT. It may be necessary to gain height in the circuit area prior to departure to ensure obstacle clearance. When flying a multi-engine aircraft, plan your departure to accommodate a possible engine failure and return to the aerodrome.

10.4.3 As the departure can be very busy, it is important not to be distracted from the task of controlling the aircraft at low altitude — maintain reference to the flight instruments. Essential practice is to maintain aircraft control by reference to flight instruments at all times. Maintain visual scanning procedures to include the flight instruments, lookout for other aircraft and positioning the aircraft by reference to ground features. Finally, record your departure time from a known position, either on track or from overhead the aerodrome.

10.4.4 **En-route Navigation –** It is important to 'stay ahead of the aircraft' during flight, and to have a clear plan of navigation and management tasks in a linear sequence and to anticipate future events. In other words, to maintain situational awareness with emphasis on anticipating future actions. Use all facilities and aids to make the job of flying the aircraft easier,

and use the autopilot if fitted. Remember the old adage 'aviate, navigate and communicate', and meet your LSALT requirements.

10.4.5 The basis of good navigation, whether day or night, is knowing where you are and where you wish to go. Three simple steps that can help to ensure this are:

- Fly a constant heading;
- Maintain a known airspeed; and
- Appreciate the passage of time.

10.4.6 In this way the pilot maintains a mental picture of flight progress and can predict the arrival time at preplanned positions along the route which may be used to fix position with radio navigation aids or by visual means. If navigating by visual reference, it is important to select a route that has features that are easily recognisable at night. Features such as:

- Rivers;
- Lakes;
- Highways;
- Coastlines;
- Beacons; and
- Prominent light sources (such as towns etc) are useful geographical and man made features that assist navigation at night; however, in dark night conditions, unlighted features may be difficult to make out and should not be relied on.

10.4.7 In addition to visual techniques, mentioned radio aids are a boon to navigation at night. Used correctly, they can provide tracking, position and groundspeed information and significantly simplify the navigation task. The most beneficial of these is (GNSS). However, pilots should not be lulled into a false sense of security by the availability of radio aids, particularly GNSS, and should cross-check such navigation information wherever possible.

10.4.8 An additional aspect of navigation at night is terrain awareness.

- Maintain awareness of your intended flight path laterally and vertically in relation to terrain;
- Maintain an altitude at least 1000' above all obstacles within a 10 nm radius of the aircraft (LSALT).

10.4.9 **Descent and Arrival –** Careful planning of the descent, approach and landing is essential to ensure that descent below LSALT is not commenced until the aircraft is within 3 nm of the aerodrome and the aerodrome is in sight.

10.4.10 However, NVFR procedures allow for a step down descent based on a new LSALT when the aircraft's position has

been positively determined by a visual fix as having passed a critical en-route obstacle. The new LSALT is based on 1000' clearance above all obstacles within a 10 nm radius ahead of the aircraft. This procedure provides more flexibility for NVFR flights to descend earlier than aircraft maintaining the IFR LSALT, but it requires a visual fix to determine each successive new LSALT. Step down arrival procedures are best carefully planned pre-flight and terrain clearance is obviously the sole responsibility of the pilot.

10.4.11 In controlled airspace, Air Traffic Services (ATS) may authorise a visual approach at night when within 30 nm of the aerodrome, but the pilot remains responsible for terrain and obstacle clearance and compliance with the LSALT requirements of CAR 174B.

Descent may be conducted in accordance with a step down procedure as outlined in the previous paragraph and not below the current LSALT until within 3 nm of the aerodrome.

10.4.12 Other conditions applicable to a visual approach in controlled airspace are:

- Be clear of cloud;
- The pilot must be able to see the ground or water;
- The aerodrome is in sight; and
- Flight visibility is not less that 5 km.

10.4.13 Once established in the circuit area, normal approach and landing procedures for night operations apply.

11. Specialised NVFR Operations

11.1 General

11.1.1 Specialised NVFR operations include EMS, law enforcement and similar types of activities that are conducted under NVFR because the demands of the task require more flexibility in conducting visual flight at low level than provided for under IFR procedures. Many such operations involve helicopters as the category of aircraft best suited to the role.

11.1.2 Preparation and planning are central to safe operations in specialised NVFR operations. Planning should include a full risk analysis addressing at least the following:

- Crew qualifications;
- Fatigue risk management;
- Equipment availability;
- Equipment serviceability;
- Aircraft suitability;
- Hazards awareness/recognition;
- Threats and errors;
- Likely flight hazards; and
- Task modification.

11.1.3 Except for the purpose of pre-flight and landing, a NVFR aircraft must normally not be operated below LSALT or 1000' above the highest obstacle within 10 nm of the intended track. Operations below the minimum height permitted for VFR flight at night may only be conducted if the operator holds a permission under CAR 174B.

11.1.4 The safety standard for NVFR operations conducted below LSALT should be based on having a discernable horizon and adequate illumination to identify hazardous terrain and proposed landing areas. In the absence of these conditions, the use of special lighting equipment, electronic guidance, or night vision enhancement that provides for an equivalent level of safety needs to be considered.

11.1.5 Although conducted under NVFR, low level operations at night involve skills beyond the training requirements for the issue of a NVFR Rating and include better instrument flying skills, special training for the specific role and training in the use of specialised equipment.

11.1.6 Specialised NVFR operations often place significant pressure on a pilot to undertake tasks that may be beyond the pilot's or the aircraft's capabilities, particularly if human life is in the balance. Operators need to consider a system of operational oversight involving the chief pilot making the appropriate risk assessment before tasking such operations.

11.2 Risk management of specialised NVFR operations

11.2.1 The tasks are demanding of a high level of pilot skills that go beyond those normally required for the issue of a NVFR Rating. There may also be a higher level of risk which is justified by the nature of the emergency or law enforcement task. Operations involving a higher level of risk may combine one or more of the following:

- Operations below LSALT;
- Operations at poorly lit, or unlit, helicopter landing sites;
- Operations at night in rugged terrain;
- Operations in adverse weather;
- Operations in dark night conditions.

11.2.2 Any detailed discussion of such specialised NVFR operations is beyond the scope of this CAAP; however, the accident record both in Australia and overseas points up the need for appropriate pilot training and the application of risk management and TEM principles for the conduct of such operations.

11.2.3 Operators should consider the following controls in relation to specialised high risk NVFR operations:

- A formal risk assessment and management process to assess the risk of typical operations and to identify control measures;
- The risk assessment and control measures for typical operations to be included in the company operations manual;
- A formal task approval process involving the chief pilot, where operational scenarios differ from those identified in the operations manual or involve greater risk;
- A safety management system involving all personnel and supported by management to identify and deal with ongoing safety issues;
- Developing a fatigue risk management system suitable to operational requirements;
- Inclusion of TEM in the operations manual and SOPs and provision of training in TEM;
- MCC training involving all crew members;
- Instrument rating requirement for pilots conducting specialised NVFR operations;
- Provision of additional instruments and safety equipment in aircraft used for specialised NVFR operations;
- Provision of recurrent training in instrument flight and dark night operations;
- Provision of initial and recurrent training in specialised equipment and roles.

APPENDIX A TO CAAP 5.13.2(0)

NIGHT VISUAL FLIGHT RULES (NVFR) RATING - FLIGHT STANDARDS

INTRODUCTION

This appendix includes competency standards for night flying under the visual flight rules (VFR) for aeroplanes and helicopters, as guidance for trainees, instructors testing officers and NVFR Rating holders.

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NVFR RATING FLIGHT STANDARDS – AEROPLANE AND HELICOPTER

Range of variables applicable to all standards

The generic range of variables detailed in Table 1 applies to all standards included in this Civil Aviation Advisory Publication (CAAP), unless otherwise specified in a particular unit of competency. The range of variables limits the context and operating conditions under which the standard is assessed and includes the evidence used in making the assessment.

Table 1 Generic Range of Variables

Range of Variables
Performance standards are to be demonstrated in flight in an aircraft of the appropriate category equipped with dual flight controls and electronic intercommunication between the trainee and the instructor or examiner.
Consistency of performance is achieved when competency is demonstrated on more than one flight.
Flight accuracy tolerances specified in the standards apply under flight conditions from smooth air up to, and including, light turbulence.
Where flight conditions exceed light turbulence appropriate allowances as determined by the assessor may be applied to the tolerances specified.
Infrequent temporary divergence from specified tolerances is acceptable if the pilot applies controlled corrective action.
Units and elements may be assessed separately or in combination with other units and elements that form part of the job function.
Assessment of an aircraft operating standard also includes assessment of the threat and error management and human factors standards applicable to the unit or element.
Standards are to be demonstrated while complying with approved checklists, placards, aircraft flight manuals, operations manuals, standard operating procedures and applicable aviation regulations.
Performance of emergency procedures is demonstrated in flight following simulation of the emergency by the instructor or examiner, except where simulation of the emergency cannot be conducted safely or is impractical.
Assessment should not involve simulation of more than one emergency at a time.
Private pilots should demonstrate that control of the aircraft or procedure is maintained at all times, but if the successful outcome is in doubt, corrective action is taken promptly to recover to safe flight.
Commercial and airline transport pilots should demonstrate that control of the aircraft or procedure is maintained at all times such that the successful outcome is assured.

Range of Variables
• The following evidence is used to make the assessment: • The trainee's licence and medical certificate as evidence of identity and authorisation to pilot the aircraft. • For all standards, the essential evidence for assessment of a standard is direct observation by an instructor or examiner of the trainee's performance in the specified units and elements, including aircraft operation and threat and error management. • Oral and written questioning of underpinning knowledge standards. • Completed flight plan, aircraft airworthiness documentation, appropriate maps and charts and aeronautical information. • Aircraft operator's completed flight records to support records of direct observation. • Completed achievement records for evidence of consistent achievement of all specified units and elements of competency. • The trainee's flight training records, including details of training flights and instructors comments, to support assessment of consistent achievement. • The trainee's log-book for evidence of flight training completed. • For licence and rating issue: o Completed application form, including, licence or rating sought, aeronautical experience, Chief Flying Instructor (CFI) recommendation and the result of the flight test; o Completed flight test report indicating units and elements completed; o Examination results and completed knowledge deficiency reports.

Unit IF1: Full Instrument Panel Manoeuvres – Flight Standard

Unit Description: Skills and knowledge to perform all normal flight manoeuvres and recover from unusual attitudes using the full instrument panel during flight under instrument flight rules (IFR).

Element	Performance Criteria
IF1. Determine and monitor serviceability of flight instruments and instrument power sources	• Determines serviceability of flight instrument, pilot/static system and instrument power sources in accordance with Flight Manual/Pilot Operator's Handbook (POH), before flight. • Performs functional checks of turn, heading and attitude indicators while taxiing. • Monitors flight instrument and instrument power source and reacts appropriately to any warnings, unserviceabilities or erroneous indications.
IF1.2 Perform manoeuvres using full instrument panel	• Interprets and reacts appropriately in the time available to flight instrument indications to achieve and maintain specified flight profiles using full instrument panel. • Sets and maintains power and attitude by reference to full instrument panel to achieve straight and level performance during: o normal cruise (±100 ft, ±5°, ±10 kts or ±Mach (M).02); o in an aeroplane, approach configuration with flap (when fitted) and undercarriage down (±100 ft, ±5°, ±10 kts nominated speed but not below minimum approach speed); o in a helicopter, at minimum power for level flight speed (±10 kts). • Sets and maintains power and attitude by reference to <u>full instrument panel</u> to achieve nominated climb performance (±5° ±5 kts M.01). • Sets and maintains power and attitude by reference to <u>full instrument panel</u> to achieve nominated descent performance (±5°, ±10 kts, ±M.02, ±150 ft/minute. • Sets and maintains power, attitude and bank during climb, descent and straight and level flight by reference to full instrument panel to achieve rate one turns onto a nominated heading (±10° on exit, then ±5°). • <u>Balances aircraft.</u> • <u>Trims aircraft.</u> • Levels aircraft at a nominated altitude (±100 ft), from a climb or descent during straight or turning flight.

Element	Performance Criteria
IF1.3 Perform steep turns	• Sets and maintains power, attitude and bank during level (±150 ft) and descending (±10 kts or ±M.02) flight by reference to full instrument panel to achieve a steep turn using a nominated angle of bank between 45° and 60° (±10°) onto a nominated heading (±10° on exit, then ±5°). • Balances aircraft.
IF1.4 Recover from unusual attitudes using full instrument panel	• Identifies uncontrolled flight involving high and low nose attitudes, varying angles of bank and power settings and unbalanced flight, and resumes controlled flight by reference to flight instruments using full instrument panel. • Achieves straight and level attitude without excessive oscillations at the horizon (±250 ft of height at which aircraft nose first passed through horizon, then ±100 ft of nominated altitude).

Range of Variables

- Single-engine or multi-engine aircraft or approved flight simulators.
- Manually flown in single-pilot or multi-crew operations.
- Instrument Meteorological Condition (IMC) or Visual Meteorological Conditions (VMC) with simulated IMC.
- Fitted flight instruments suitable for full panel instrument flight.

Underpinning Knowledge

- Explain a scan technique appropriate to fitted flight instruments and phase of flight.
- State the attitude and power requirements to achieve specified flight profiles.
- State instrument failure and warning systems fitted to the aircraft.

Unit IF2: Limited Instrument Panel Manoeuvres – Flight Standard

Unit Description: Skills and knowledge to perform all normal flight manoeuvres and recover from unusual attitudes using the limited instrument panel during flight under IFR.

Element	Performance Criteria
IF2.1 Recognise failure of attitude indicator and/or stabilised heading indicator	• Monitors flight instruments and instrument power sources, recognises warning indicators or erroneous instrument indications, and transitions to instrument flight by reference to limited panel flight instruments.
IF2.2 Perform manoeuvres using limited instrument panel	• Interprets and reacts appropriately in the time available to flight instrument indications to achieve and maintain specified flight profiles using limited instrument panel. • Sets and maintains power and attitude by reference to limited instrument panel to achieve straight and level performance during: o normal cruise (±200 ft, ±15°, ±10 kts or ±M.02). o in an aeroplane, approach configuration with flap (when fitted) and undercarriage down (±200 ft, ±15°, ±10 kts nominated speed but not below minimum approach speed). o in a helicopter, at minimum power for level flight speed (±10 kts). • Sets and maintains power and attitude by reference to limited instrument panel to achieve nominated climb performance (±5°, ±5 kts, ±M.01). • Sets and maintains power and attitude by reference to limited instrument panel to achieve nominated descent performance (±15°, ±10 kts, ±M.02, ±200 ft/minute). • Sets and maintains power, attitude and bank during climb, descent and straight and level flight by reference to limited instrument panel to achieve rate one turns onto a nominated heading (±20° on exit, then ±15°). • Balances aircraft. • Trims aircraft. • Levels aircraft at a nominated altitude (±200 ft), from a climb or descent during straight or turning flight.

Element	Performance Criteria
IF2.3 Recover from unusual attitudes using limited instrument panel	• Identifies uncontrolled flight involving high and low nose attitudes, varying angles of bank and power settings and unbalanced flight, and resumes controlled flight by reference to flight instruments using limited instrument panel. • Achieves straight and level attitude without excessive oscillations at the horizon (±300 ft of height at which aircraft nose first passed through horizon, then ±200 ft of nominated altitude).

Range of Variables

- Single-engine or multi-engine aircraft or approved flight simulators.
- Manually flown in single-pilot or multi-crew operations.
- IMC or VMC with simulated IMC.
- Fitted flight instruments suitable for limited panel instrument flight.
- During unusual attitude recovery, straight and level flight is achieved when there are no excessive oscillations at the horizon.

Underpinning Knowledge

- Explain a scan technique appropriate to fitted flight instruments and phase of flight (without attitude or stabilised heading indicators).
- Recall the performance instrument indications and power requirements to achieve specified flight profiles.
- State the anti-icing and de-icing controls/switches fitted to the aircraft type, and when these systems should be operated.
- Recall the instrument failure and warning systems fitted to the aircraft.

Unit NVFR1: Flight Management and Operational Fuel Planning – Flight Standard

Unit Description: Knowledge and skills to plan and make flight notification for a night visual flight using all applicable current operational documents, after obtaining and applying pre-flight briefing information and allowing for operational requirements.

Element	Performance Criteria
NVFR1.1 Possess and use current operational documents	• Ensures all current operational documents applicable to the flight are in the pilot's possession and used for flight planning and management. • Possesses a complete set of approved operational documents that are applicable to the flight. • Ascertains currency of operational documents. • Stows all documents required for the flight and ensures accessibility of documents during the flight. • Interprets and applies applicable information contained in documents for flight planning and management.
NVFR1.2 Obtain meteorological and NOTAM pre-flight briefing	• Obtains, interprets and applies meteorological, airways facilities, aerodrome and Notice to Airmen (NOTAM) information applicable to the planning and conduct of the intended flight.
NVFR1.3 Plan flight	• Selects and prepares charts suitable for the intended flight. • Obtains analyses and applies relevant information to prepare a flight plan which details tracks, distances, times, altitudes to be flown and fuel requirements to reach destination in accordance with the VFR requirements. • Plans route to optimise options in the event of an engine failure.
NVFR1.4 Determine operational fuel requirements	• Determines duration of flight. • Determines alternate, holding and fuel reserve requirements by applying operational requirements due to weather, navigation aid availability and aerodrome lighting in accordance with regulations. • Calculates total fuel required in accordance with regulations.

Element	Performance Criteria
NVFR1.5 Determine whether an aerodrome is suitable for night operations	• Determines whether aerodrome lighting is suitable and available for night operations. • Determines whether aerodrome requires an alternate or holding fuel reserve due to weather, navigation aids or lighting in accordance with Aeronautical Information Publications (AIPs). • Complies with any curfew requirements.
NVFR1.6 Make flight notification	• Submits completed flight plan to and ensures acceptance by National Aeronautical Information Processing System (NAIPS) at a time adequate to ensure processing of flight plan or at least 30 minutes before flight.

Range of Variables

- NVFR.
- Approved aircraft fitted with flight instruments, including attitude and stabilised heading indicators.
- Simulated IMC.
- Simulated abnormal or emergency situations.
- Simulated hazardous weather.

Underpinning Knowledge

- State the NVFR operations a single-engine aircraft is limited to.
- State the requirements for submission of flight notification and Search and Rescue Watch (SARWATCH).
- State the speed restrictions a night visual flight must operate to.
- State the requirements for in-flight progress reports.
- State the procedures for flight plan amendments and revised estimates.
- Specify the documents required to be carried on a night visual flight.
- Extract and apply relevant information from operational documents.
- Determine the meteorological forecasts required for a night visual flight.
- State the sources of aviation meteorological forecasts.
- Explain the methods of obtaining these meteorological forecasts.
- Determine the validity of a given meteorological forecast for a night visual flight.
- Determine whether a flight should proceed based on available meteorological forecasts.
- State what meteorological broadcast services are available in Australia for a flight.
- Determine alternate aerodrome requirements for a night visual flight to a specified destination given relevant information including NOTAMs.
- Determine suitability of a specified alternate aerodrome for a night visual flight given relevant information including NOTAMs.
- Determine holding requirements due to weather, traffic or traffic advisory.
- Determine fuel quantity required for a night visual flight.

Unit NVFR2: Manage Pre- and Post-Flight Actions – Flight Standard

Unit Description: Knowledge and skills to determine aircraft equipment suitability for night visual flight, perform and certify daily inspection, conduct serviceability test of flight instruments and radio navigation aids before flight, and complete post-flight actions.

Element	Performance Criteria
NVFR2.1 Determine whether aircraft meets equipment and serviceability requirements for night visual flight	• Determines whether aircraft is equipped for flight in accordance with NVFR requirements and ensures that the flight instruments, minimum electrical lighting equipment and navigation aids fitted are suitable and serviceable. • Ensures ready access to a shock-proof torch in accordance with regulations.
NVFR2.2 Conduct daily inspection	• Performs an inspection in accordance with aircraft system of maintenance approved by the Civil Aviation Safety Authority (CASA), and ensures certification in accordance with regulations for flight at night under the VFR.
NVFR2.3 Conduct pre-flight serviceability test of flight instruments and radio navigation aids	• Confirms serviceability of flight instruments and radio navigation aids for night visual flight.
NVFR2.4 Complete post-flight actions	• Ensures SARWATCH is terminated. • Certifies maintenance release (flight technical log), if required.

Range of Variables

- NVFR.
- Approved aircraft fitted with flight instruments, including attitude and stabilised heading indicators.
- Simulated abnormal or emergency situations.

Underpinning Knowledge

- State the pilot medical fitness necessary for night visual flight.
- State the pilot qualifications necessary for night visual flight.
- State the privileges of the NVFR rating.
- Specify the aircraft flight instruments required for night visual flight.
- Specify the aircraft electrical lighting equipment required for night visual flight.
- Specify the aircraft radio communication equipment required for night visual flight.
- Specify the aircraft radio navigation equipment required for night visual flight.

Unit NVFR 3: Operate Aircraft in the Traffic Pattern at Night – Flight Standard

Unit Description: Skills and knowledge to take-off and land and to operate an aircraft safely in the traffic pattern at night.

Element	Performance Criteria
NVFR3.1 Taxiing at night	• Adjusts instrument lighting to provide optimum illumination. • Complies with Air Traffic Control (ATC) instructions and safely manoeuvres the aircraft on the ground at night within the approved movement area as defined by aerodrome ground lighting. • Operates aircraft lighting as required. • Confirms functioning of flight instruments while taxiing.
NVFR3.2 Take-off at night	*Aeroplane* • Lines up aircraft in centre of runway in take-off direction and performs line-up checks appropriate to night take-off in accordance with approved checklist. • Executes take-off by reference to flare path/runway lighting and aircraft instruments. • Rotates aircraft at manufacturer's recommended speed. • Establishes climb attitude and controls aircraft in climb after take-off solely by reference to instruments. • Establishes alignment with runway by visual reference when established on crosswind leg and maintains lookout. • Performs after-take-off checks at a safe height. *Helicopter* • Accelerates helicopter in take-off direction on a prescribed track. • Recognises and controls translational lift. • Executes take-off by reference to flare path/runway lighting/Helicopter Landing Site (HLS) lighting and aircraft instruments. • Applies climb power and adjusts attitude to maintain climb speed (±5 kts) appropriate to obstacle clearance requirements. • Aligns helicopter landing gear with the planned take-off direction until the point at which balanced flight is required. • Maintains helicopter outside the height-velocity chart avoid area. • Retracts undercarriage at a safe height and airspeed, if applicable. • Trims helicopter, if applicable. • Balances helicopter. • Performs after-take-off checks in accordance with approved checklist.

NVFR3.3 Perform circuit and approach at night	• Conducts a circuit and approach, controlling the aircraft and maintaining a safe altitude by reference to instruments and positioning aircraft by reference to runway lighting.
NVFR3.4 Land at night with and without the use of aircraft landing lights	• Lands aircraft at night with and without landing lights. • Performs after-landing checks in accordance with approved checklist.
NVFR3.5 Take-off and land at night at an aerodrome remote from ground lighting	• Conducts take-off and circuit procedures and lands aircraft at night at an aerodrome remote from any ground lighting that could assist the pilot in maintaining control of the aircraft, and uses runway lights for positioning aircraft in circuit. • Confirms aircraft performance and attitude by reference to flight instruments. • Refers to runway lighting to position the aircraft in the circuit and for landing.
NVFR3.6 Make baulked approach	• Conducts a baulked approach at night from any point on the final approach leg.

Range of Variables

- NVFR.
- Aircraft fitted with flight instruments, including attitude and stabilised heading indicators.
- Simulated IMC.
- Suitable aircraft lighting.
- Simulated abnormal or emergency situations.
- Simulated hazardous weather.

Underpinning Knowledge
• Detail normal circuit procedures. • Explain light signals used in the circuit area at night. • State the colour and pattern of permanent threshold light. • State the colour and pattern of runway threshold identification lights. • State the colour and pattern of displaced threshold lighting. • State the colour and pattern of runway edge lighting. • State the colour and pattern of runway end lighting. • State the colour and pattern of runway centreline lighting. • State the colour and pattern of obstacle lighting. • Describe the method of activating Pilot Activated Lighting (PAL). • Describe the method of activating an aerodrome frequency response unit with PAL options. • State the time that PAL remains illuminated. • Describe how the PAL system warns users that the lights are about to be extinguished. • Describe the operations and use of a Vertical Air Speed Indicator (VASI) system. • Describe the operations and use of a Precision Approach Path Indicator (PAPI) system. • Identify aerodromes with standby power.

Unit NVFR4: Navigate Under VFR at Night – Flight Standard

Unit Description: Knowledge and skills to use night VFR procedures, perform a visual departure to lowest safe altitude (LSALT), navigate above LSALT using visual navigation procedures and radio navigation aids, perform diversions and complete a visual approach to the destination.

Element	Performance Criteria
NVFR4.1 Make visual departure at night	• Conducts a visual departure from an aerodrome using night VFR procedures, and climbs on track clear of obstructions to LSALT. • Remains clear of traffic and obstructions.
NVFR4.2 Conduct visual flight at a safe height over a nominated route at night	• Maintains planned route above LSALT in accordance with regulations, maintains navigation documents, calculates estimated time of arrival (ETA), revises fuel planning and completes all checks while flying in accordance with NVFR procedures.
NVFR4.3 Make visual approach at night	• Conducts a visual approach from LSALT, maintaining track, to the circuit area of an aerodrome other than the aerodrome of departure, using NVFR procedures.
NVFR4.4 Use approved altimetry procedure	• Uses altimeter checking and setting procedures specified in AIPs.
NVFR4.5 Activate PAL system	• Selects appropriate radio/telephone (R/T) frequency and activates PAL system when within radio range. • Monitors wind indicator lighting to determine end of activation period.
NVFR4.6 Conduct a diversion at night	• Determines route to alternate unplanned destination, maintains track, calculates ETA ±2 minutes, amends fuel requirements and complies with airspace requirements using NVFR procedures.

Range of Variables

- NVFR.
- Aircraft fitted with flight instruments, including attitude and stabilised heading indicators.
- Simulated IMC.
- Suitable aircraft lighting.
- Simulated abnormal or emergency situations.
- Simulated hazardous weather.

Underpinning Knowledge
• Explain the navigation requirements for a night visual flight using radio navigation systems. • Determine the navigation requirements for a night visual flight using self-contained or long-range navigation systems. • Determine the navigation requirements for a night visual flight using visual reference to ground and water. • Determine the navigation tolerance for a night visual flight avoiding control area (CTA). • Detail the requirements for positive radio fixing. • Determine the requirements for the most precise track guidance. • Apply the navigation requirements for night visual flight with respect to time interval between fixes, accuracy of time reference, and accuracy and procedures in track-keeping. • Apply the procedures of night visual flight in all classes of airspace when diverting from track due to navigation or weather. • Determine route for night visual flight with respect to forecast weather, controlled airspace, Prohibited, Restricted and Danger Areas, engine out performance for multi-engine aircraft, specified route limitations, airways operational requirements, and availability of published routes, en-route alternate aerodromes, navigation aids, rated coverage and radio communication. • Determine compulsory reporting points for route selected. • Determine whether a flight may proceed based on route, aircraft equipment and NVFR navigation requirements. • Determine LSALT for a night visual flight for a route published on a chart. • State dimensions of the significant safety sector when calculating LSALT for a route not published on a chart. • Explain methods of calculating LSALT for a route not published on a chart. • Select cruising altitude/level after assessing LSALT, forecast freezing level, engine out performance for multi-engine aircraft, CTA and Prohibited, Restricted and Danger areas (PRDs), table of NVFR cruising levels, availability of published routes, availability of navigation aids, rated coverage, specified route limitations and airways operational requirements. • Calculate LSALT when uncertain of position. • Explain conditions for descent below LSALT. • State the pre-flight altimeter accuracy check for a night visual flight. • Apply altimetry procedures to all stages of a night visual flight.

Unit NVFR5: Comply with Air Traffic Rules and Procedures – Flight Standard

Unit Description: Knowledge and skills to communicate and comply with ATS instructions, maintain separation from other air traffic and manage airspace procedures.

Element	Performance Criteria
NVFR5.1 Obtain and comply with airspace clearances	• Obtains air traffic clearances when applicable, prior to entry into airspace, and complies with clearances while operating in that airspace.
NVFR5.2 Maintain separation from other air traffic	• Maintains separation from other air traffic during visual approach and departure in accordance with NVFR procedures. • Maintains visual separation in accordance with AIP class of airspace requirements.
NVFR5.3 Communicate using radio	• Maintains two-way communication with ATS and other aircraft in accordance with NVFR procedures.
NVFR5.4 Use transponder	• Operates and monitors transponder in accordance with AIPs during normal and emergency operations.

Range of Variables
• NVFR. • Aircraft fitted with flight instruments, including attitude and stabilised heading indicators. • Simulated IMC. • Suitable aircraft lighting. • Simulated abnormal or emergency situations. • Simulated hazardous weather.

Underpinning Knowledge
• State airways clearance requirements for operating in all classes of airspace, including lead time required for flight plan submission, contents, 'clearance void time' and 'read back' requirement. • State airways clearance requirements for entering, operating in and departing CTA and control zone (CTR), including what details to provide to ATC, and what details to expect from ATC. • Explain the term 'controlled area protection'. • Explain ATC requirements for a normal or emergency change of level in CTA. • Explain departure, climb, transition to cruise (levelling out), cruise, change of level, descent and visual approach procedures, day and night, in CTA and CTR. • Explain the provision of separation for night visual flights in the various classes of CTA. • Explain the provision of separation for night visual flights in General Aviation Aerodrome Procedures (GAAP) CTR. • Explain procedures for handling loss of radio communication in CTA and CTR. • Explain night visual approach procedures, in Class G airspace and at non-controlled aerodromes, including landing manoeuvres, cancellation of SARWATCH, and operation of PAL. • Explain transponder procedures for conducting abnormal and emergency operations in CTA and CTR. • State what radar services are provided by ATC. • Explain radar vector procedures, including radio procedures and phraseology. • State the maximum permissible intervals between ATC transmissions during radar vectoring. • Explain radar emergency procedures, including loss of radio communication, radar failure and transponder emergency code.

Unit NVFR6: Manage Abnormal Situations at Night – Flight Standard

Unit Description: Knowledge and skills to identify abnormal situations at night, perform appropriate actions to manage abnormal situations, and select and proceed to the nearest suitable landing area.

Element	Performance Criteria
NVFR6.1 Manage engine failure	• Controls aircraft after engine failure in a single-engine aircraft, performs immediate actions, manoeuvres aircraft in a safe direction to achieve visual flight and performs a controlled landing at a suitable landing area. • Controls multi-engine aeroplane after failure of an engine; performs all checks in accordance with the Flight Manual/POH; and if an engine restart is not achieved, manages asymmetric flight in accordance with VFR procedures to the nearest suitable aerodrome. • Controls multi-engine helicopter after failure of an engine; performs all checks in accordance with the Flight Manual/POH; and if an engine restart is not achieved, conducts single-engine flight in accordance with VFR procedures to the nearest suitable helicopter landing site (HLS). *Note: Practice of engine failure at night in single- and multi-engine aircraft is to be performed in accordance with AIP ENR 1.1, paragraph 77.3.*
NVFR6.2 Manage R/T communication and/or navigation aid or navigation system failure	• Identifies R/T and/or navigation aid or navigation system failure and conducts abnormal procedures in accordance with Flight Manual/POH, AIPs and En-route Supplement Australia (ERSA).
NVFR6.3 Manage electrical system failure at night	• Controls aircraft. • Identifies and confirms electrical system failure and performs emergency procedures in accordance with Flight Manual/POH.
NVFR6.4 Manage electrical or vacuum system failure	• Identifies and confirms flight instrument electrical or vacuum system failure. • Controls aircraft by reference to functioning flight instruments. • Performs abnormal procedures in accordance with Flight Manual/POH.

NVFR6.5 Manage instrument failure	• Identifies and confirms instrument failure. • Controls aircraft by reference to functioning instruments. • Manages failure in accordance with Flight Manual/POH.
NVFR6.6 Manage hazardous weather conditions	• Identifies and avoids hazardous weather conditions. • Identifies procedures for penetration of hazardous weather.
NVFR6.7 Demonstrate turbulence penetration technique	• Demonstrates or explains aircraft configuration and flight procedures for turbulence penetration in accordance with Flight Manual/POH or Company Operations Manual.
NVFR6.8 Fly helicopter with one hydraulic system failed	• Identifies and confirms hydraulic failure. • Controls helicopter in accordance with Flight Manual/POH.
NVFR6.9 Fly helicopter without stability augmentation	• Identifies and confirms stability augmentation failure. • Controls helicopter in accordance with Flight Manual/POH.
Range of Variables	
• NVFR. • Aircraft fitted with flight instruments, including attitude and stabilised heading indicators. • Simulated IMC. • Suitable aircraft lighting. • Simulated abnormal or emergency situations. • Simulated hazardous weather.	
Underpinning Knowledge	
NOT APPLICABLE	

Unit NVFR7: Manage Tasks – Flight Standard

Unit Description: Knowledge and skills to organise documentation and equipment in the cockpit for night visual flight; prioritise and manage flight tasks, navigation and passengers; and, when fitted, use autopilot in night visual conditions.

Element	Performance Criteria
NVFR7.1 Set priorities and manage tasks	• Organises flight, navigation, communication and passenger management tasks and sets priorities to ensure that the workload at any phase of flight allows the pilot, in the time available, to safely manage the flight.
NVFR7.2 Use autopilot	• Engages autopilot and flight director system (FDS) to assist flight and navigation tasks when available. • Disengages autopilot before reverting to manual control of aircraft.
Range of Variables	
• NVFR. • Aircraft fitted with flight instruments, including attitude and stabilised heading indicators. • Simulated IMC. • Suitable aircraft lighting. • Simulated abnormal or emergency situations. • Simulated hazardous weather. • Aircraft fitted with autopilot.	
Underpinning Knowledge	
NOT APPLICABLE	

Unit NVFR8: Navigate Using Non-directional Beacon (NDB) – Flight Standard

Unit Description: Knowledge and skills to navigate an aircraft by reference to an ADF tuned to an NDB in night visual conditions.

Element	Performance Criteria
NVFR8.1 Tune, identify and monitor navigation aids	• Tunes navigation equipment, identifies and monitors navigation aids and tests navigation system.
NVFR8.2 Determine position in relation to navigation aids	• Fixes position of aircraft in relation to navigation aids using overhead passage or two or more bearings.
NVFR8.3 Intercept and maintain desired tracks to and from stations	• Intercepts specified tracks to and from navigation aids using intercept angles appropriate to navigation requirements and maintains the track within tracking tolerances in accordance with AIPs.
NVFR8.4 Make station passage	• Maintains planned inbound track within the tolerances specified in AIPs, passes overhead the navigation aid and ensures a positive back bearing is achieved.
Range of Variables	
• NVFR. • Aircraft fitted with flight instruments, including attitude and stabilised heading indicators. • Simulated IMC. • Suitable aircraft lighting. • Simulated abnormal or emergency situations. • Simulated hazardous weather.	
Underpinning Knowledge	
• Explain limitations of navigation aids and aircraft equipment. • State how NDB indications or range may be affected by coastal refraction, night error, thunderstorms, mountainous areas, other types of terrain and altitude of aircraft. • State the methods of performing tracking and position fixing with an NDB.	

Unit NVFR9: Navigate Using VHF Omni Range (VOR) – Flight Standard

Unit Description: Knowledge and skills to navigate an aircraft by reference to VOR in night visual conditions.

Element	Performance Criteria
NVFR9.1 Tune, identify and monitor navigation aids	• Tunes navigation equipment, identifies and monitors navigation aids, ensures no warning flags are visible and tests navigation system.
NVFR9.2 Determine position in relation to navigation aids	• Fixes position of aircraft in relation to navigation aids using overhead passage or two or more bearings.
NVFR9.3 Intercept and maintain desired tracks to and from stations	• Intercepts tracks to and from navigation aids, with Course Deviator Indicator (CDI) indicating in the command sense using intercept angles appropriate to navigation requirements and maintains the track within tracking tolerances specified in AIPs.
NVFR9.4 Make station passage	• Maintains planned inbound track within the tolerances specified in AIPs, passes overhead the navigation aid and maintains track outbound on the radial desired.

Range of Variables

- NVFR.
- Aircraft fitted with flight instruments, including attitude and stabilised heading indicators.
- Simulated IMC.
- Suitable aircraft lighting.
- Simulated abnormal or emergency situations.
- Simulated hazardous weather.

Underpinning Knowledge

- Fix position by two or more bearings or overhead passage or navigation aid.
- Intercept and maintain inbound and outbound track to a VOR.
- Manoeuvre aircraft to track overhead a specified aid.
- Explain VOR indications of scalloping, VOR station passage, and abeam VOR station on VOR radial, track error and drift.
- Determine off-track distance using VOR and DME indications.
- State VOR omni-bearing selector settings required to ensure command indications when flying on given tracks both to and from a VOR.
- Calculate the heading to steer to intercept a track to or from a VOR.
- Fix position using two VOR stations.

Unit NVFR10: Navigate Using Global Navigation Satellite System (GNSS) – Flight Standard

Unit Description: Knowledge and skills to navigate an aircraft by reference to GNSS in night visual conditions.

Element	Performance Criteria
NVFR10.1 Check GNSS receiver operation	• Checks and confirms operation, settings and indications of receiver, including navigation database currency and signal integrity, by accessing appropriate GNSS receiver operational modes.
NVFR10.2 Enter, retrieve, edit, delete and activate flight plan and waypoints	• Operates GNSS computer functions required to enter, retrieve, edit, delete and activate flight plan and waypoint information in a GNSS.
NVFR10.3 Determine position and other relevant navigational information from GNSS	• Interprets GNSS to determine aircraft position and to extract navigational information, including the estimated time of arrival (ETA), and the estimated time interval (ETI), ground speed and wind velocity relevant to the flight.
NVFR10.4 Intercept and maintain desired track to selected waypoint	• Intercepts and maintains desired track to selected waypoint, in accordance with tolerances specified in AIPs, using GNSS.
NVFR10.5 Conduct a diversion to selected waypoint	• Diverts from flight planned route and track to selected waypoint.
NVFR10.6 Conduct confidence checks of GNSS navigational information	• Conducts GNSS confidence checks in accordance with GNSS operator's manual. • Confirms GNSS flight plan track and distances against information shown on current charts and checks GNSS position information using any data available from other sources.
NVFR10.7 Monitor integrity of GNSS navigation	• Monitors integrity of GNSS navigation by reference to receiver autonomous integrity monitoring (RAIM), recognising the RAIM warnings and messages, and takes appropriate action.
NVFR10.8 Respond to GNSS messages	• Interprets displayed messages on GNSS and reacts appropriately.

Range of Variables

- NVFR.
- Aircraft fitted with flight instruments, including attitude and stabilised heading indicators.
- Simulated IMC.
- Suitable aircraft lighting.
- Simulated abnormal or emergency situations.
- Simulated hazardous weather.

Underpinning Knowledge

GNSS components and principles of operation

- Explain the following aspects of a GNSS and its principles of operation:
  - GNSS components, space, control and user;
  - aircraft equipment requirements;
  - GNSS satellite signal and pseudo-random code;
  - principle of position fixing;
  - method of minimizing receiver clock error;
  - minimum satellites required for navigation functions;
  - masking function;
  - performance limitations of various equipment types;
  - GNSS use of the World Geodetic Standard 1984 (WGS84) coordinate system.

Navigation system performance requirements

- Define the following terms in relation to a navigational system and recall to what extent a GNSS meets the associated requirements:
  - accuracy;
  - means of providing GNSS integrity;
  - RAIM;
  - availability;
  - continuity of service.

GNSS errors and limitations

- Recall the cause and magnitude of typical GNSS errors:
  - ephemeris;
  - clock;
  - receiver;
  - atmospheric/ionospheric;
  - multi-path;
  - situation awareness (SA);
  - typical total error associated with C/A code;
  - effect of positional dilution of precision/geometric dilution of precision (PDOP/GDOP) on position accuracy;
  - susceptibility to interference;
  - comparison of vertical and horizontal errors;
  - tracking accuracy and collision avoidance.

Human factors and GNSS

- State the human factor limitations associated with the use of GNSS equipment.
- Apply GNSS operating procedures which provide safeguards against navigational errors and loss of situational awareness because of the following:
  - mode errors;
  - data entry errors;
  - data validation and checking, including independent cross-checking procedures;
  - automation-induced complacency;
  - non-standardisation of the GNSS–pilot interface;
  - human information processing and situational awareness.

GNSS equipment-specific navigation procedures

- Recall and apply knowledge of appropriate GNSS operating procedures to typical navigational tasks using a specific type of aircraft equipment, including:
  - select appropriate operational modes;
  - recall categories of information contained in the navigational database;
  - predict RAIM availability;
  - enter and check user-defined waypoints;
  - enter/retrieve and check flight plan data;
  - interpret typical GNSS navigational displays, such as latitude and longitude, distance and bearing to waypoint, CDI;
  - intercept and maintain GNSS-defined tracks;
  - determine track made good (TMG), ground speed, ETA, time and distance to waypoint, wind velocity in flight;
  - explain indications of waypoint passage;
  - use of 'direct to' function;
  - use of nearest airport function;
  - use of GNSS in GPS and DME/GPS arrival procedures.

GNSS equipment checks

- For a specified type of aircraft equipment, carry out the following GNSS operational and serviceability checks at appropriate times:
  - Technical service order (TSO) status;
  - satellites acquired;
  - RAIM status;
  - PDOP/GDOP status;
  - Instrument Flight Rules (IFR) database currency;
  - receiver serviceability;
  - CDI sensitivity;
  - position indication.

GNSS warnings and messages

- For a specified type of aircraft equipment, recognise and take appropriate action for GNSS warnings and messages, including the following:
  - loss of RAIM;
  - two-dimensional navigation;
  - in deduced reckoning (DR) mode;
  - database out of date;
  - database missing;
  - GNSS fail;
  - barometric input fail;
  - power/battery fail;
  - parallel offset on;
  - satellite fail.

Methods of RAIM prediction

- Recall the parameters applicable to RAIM warnings in the en-route modes.
- Explain the effect of availability or otherwise of baro-aiding on RAIM availability and prediction.

- predict RAIM availability at destination and ETA using:
  - aircraft GNSS receiver;
  - if available, an external RAIM prediction service.
- Explain the effect of satellite unserviceability on the reliability of each type of prediction.
- Explain the effect of each type of RAIM prediction on operational requirements.
- Predict, within a period of one hour before departure, the availability of approach RAIM at the destination or alternate aerodrome within ±15 minutes of ETA.
- State any limitations which apply to the prediction.

Operational requirements

- Specify the operational requirements that apply to planning a flight on the basis of conducting a GNSS/non-position approach (NPA) at destination.
- State the alternate and/or holding requirements that apply at a destination served by a GNSS/NPA procedure.

Human factors and GNSS operation

- Describe how the following factors may adversely affect the conduct of a GNSS/NPA and describe suitable pilot procedures to minimise such effects:
  - data input;
  - functions selection logic;
  - automation effects;
  - fixation;
  - mode awareness;
  - alert modes;
  - control loop;
  - situational awareness.
- Recall operating procedures for GNSS equipment which reduce or eliminate errors due to any of the factors specified.

Unit NVFR11: Navigate Using Distance Measuring Equipment (DME) – Flight Standard

Unit Description: Skills and knowledge to use DME to fix position in conjunction with bearings from other navigation aids, home to a station and fly DME arcs in night visual conditions.

Element	Performance Criteria
NVFR11.1 Tune and identify DME station	• Tunes navigation equipment, identifies and monitors navigation aids and checks distance indicator.
NVFR11.2 Use DME to provide distance information and fix position	• Fixes position using the distance from a DME navigation aid and bearings from a suitable navigation aid with an azimuth capability.
NVFR11.3 Conduct DME homing procedure	• Tracks to overhead the DME navigation aid using the ground speed function of the DME navigation system.
NVFR11.4 Fly DME arc	• Tracks aircraft along a DME arc at a nominated distance by reference to a DME navigation aid, within the tolerances specified in AIPs, in IMC or simulated IMC (±1 nm).

Range of Variables

- NVFR.
- Aircraft fitted with flight instruments, including attitude and stabilised heading indicators.
- Simulated IMC.
- Suitable aircraft lighting.
- Simulated abnormal or emergency situations.
- Simulated hazardous weather.

Underpinning Knowledge

- Interpret and explain DME or GPS arrival information.
- State the DME or GPS arrival procedures and limitations in all classes of airspace.
- State pilot's responsibilities when DME or GPS arrival is conducted outside controlled airspace.
- Specify the conditions permitting descent below LSALT.
- Specify the procedure for joining the circuit using a DME or GPS arrival.
- Explain the principles of the DME or the GNSS radio equipment.
- Specify procedures for handling loss of radio communication during a DME or GNSS arrival.

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APPENDIX B TO CAAP 5.13.2(0)

NIGHT VISUAL FLIGHT RULES - ACHIEVEMENT RECORDS

NAME:..... ARN:.....

NIGHT CIRCUIT AREA ENDORSEMENT ACHIEVEMENT RECORD – AEROPLANE AND HELICOPTER

The standard for certification of each element is that all performance criteria for that element are met.

Unit	Element	Instructor/ ARN/Date	Student/Date
IF1 Full instrument panel manoeuvres	• Determine and monitor serviceability of flight instruments and instrument power sources • Perform manoeuvres using full instrument panel • Perform steep turns • Recover from unusual attitudes using full instrument panel		
IF2 Limited instrument panel manoeuvres	• Recognise failure of attitude indicator and/or stabilised heading indicator • Perform manoeuvres using limited instrument panel • Recover from unusual attitudes using limited instrument panel		
NVFR1 Flight management and operational fuel planning	• Determine whether an aerodrome is suitable for night operations		
NVFR2 Manage pre- and post-flight actions	• Determine whether aircraft meets equipment and serviceability requirements for night visual flight • Conduct daily inspection • Conduct pre-flight serviceability test of flight instruments and radio navigation aids • Complete post-flight actions		

Unit	Element	Instructor/ ARN/Date	Student/Date
NVFR3 Operate aircraft in the traffic pattern at night	• Taxi at night • Take-off at night • Perform circuit and approach at night • Land at night with and without the use of aircraft landing lights • Make baulked approach		
NVFR6 Manage abnormal situations at night	• Manage engine failure • Manage R/T communication and/or navigation aid or navigation system failure • Manage electrical system failure at night • Manage electrical or vacuum system failure • Manage instrument failure		

I have completed the training specified in the elements which have been certified on this achievement record.

.....(Signature) Date.....

APPENDIX C TO CAAP 5.13.2(0)

NAME:..... ARN:.....

NIGHT VISUAL FLIGHT RULES (NVFR) RATING-ACHIEVEMENT RECORD – AEROPLANE AND HELICOPTER

The standard for certification of each element is that all performance criteria for that element are met.

Unit	Element	Instructor/ ARN/Date	Student/Date
IF1 Full instrument panel manoeuvres	• Determine and monitor serviceability of flight instruments and instrument power sources • Perform manoeuvres using full instrument panel • Perform steep turns • Recover from unusual attitudes using full instrument panel		
IF2 Limited instrument panel manoeuvres	• Recognise failure of attitude indicator and/or stabilised heading indicator • Perform manoeuvres using limited instrument panel • Recover from unusual attitudes using limited instrument panel		
NVFR1 Flight management and operational fuel planning	• Possess and use current operational documents • Obtain meteorological and Notice to Airmen (NOTAM) pre-flight briefing • Plan flight • Determine operational and fuel requirements • Determine whether an aerodrome is suitable for night operations • Make flight notification		

Unit	Element	Instructor/ ARN/Date	Student/Date
NVFR2 Manage pre- and post-flight actions	• Determine whether aircraft meets equipment and serviceability requirements for night visual flight • Conduct daily inspection • Conduct pre-flight serviceability test of flight instruments and radio navigation aids • Complete post-flight actions		
NVFR3 Operate aircraft in the traffic pattern at night	• Taxi at night • Take-off at night • Perform circuit and approach at night • Land at night with and without the use of aircraft landing lights • Take-off and land at night at an aerodrome remote from ground lighting • Make baulked approach		
NVFR4 Navigate under VFR at night	• Make visual departure at night • Conduct visual flight at a safe height over a nominated route • Make visual approach at night • Use approved altimetry procedure • Activate pilot activated lighting (PAL) system • Conduct a diversion at night		
NVFR5 Comply with air traffic rules and procedures	• Obtain and comply with airspace clearances • Maintain separation from other air traffic • Communicate using radio • Use transponder		

Unit	Element	Instructor/ ARN/Date	Student/Date
NVFR6 Manage abnormal situations at night	• Manage engine failure • Manage R/T communication and/or navigation aid or navigation system failure • Manage electrical system failure at night • Manage electrical or vacuum system failure • Manage instrument failure • Manage hazardous weather conditions • Demonstrate turbulence penetration technique • Fly helicopter with one hydraulic system failed • Fly helicopter without stability augmentation		
NVFR7 Manage tasks	• Set priorities and manage tasks • Use autopilot		
NVFR8 Navigate using non-directional beacon (NDB) (Requirement is for NVFR8 **or** NVFR9)	• Tune, identify and monitor navigation aids • Determine position in relation to navigation aids • Intercept and maintain desired tracks to and from stations • Make station passage		
NVFR9 Navigate using VHF omni-range (VOR) (Requirement is for NVFR8 **or** NVFR9)	• Tune, identify and monitor navigation aids • Determine position in relation to navigation aids • Intercept and maintain desired tracks to and from stations • Make station passage		

Unit	Element	Instructor/ ARN/Date	Student/Date
NVFR10 Navigate using GNSS (optional)	• Check GNSS receiver operation • Enter, retrieve, edit, delete and activate flight plan and waypoints • Determine position and other relevant navigational information from GNSS • Conduct a diversion to selected waypoint • Conduct confidence checks of GNSS navigational information • Monitor integrity of GNSS navigation • Respond to GNSS messages		
NVFR11 Navigate using distance measuring equipment (DME) (optional)	• Tune and identify DME station • Use DME to provide distance information and fix position • Conduct DME homing procedure • Fly DME arc		

I have completed the training specified in the elements which have been certified on this achievement record.

.....(Signature) Date.....