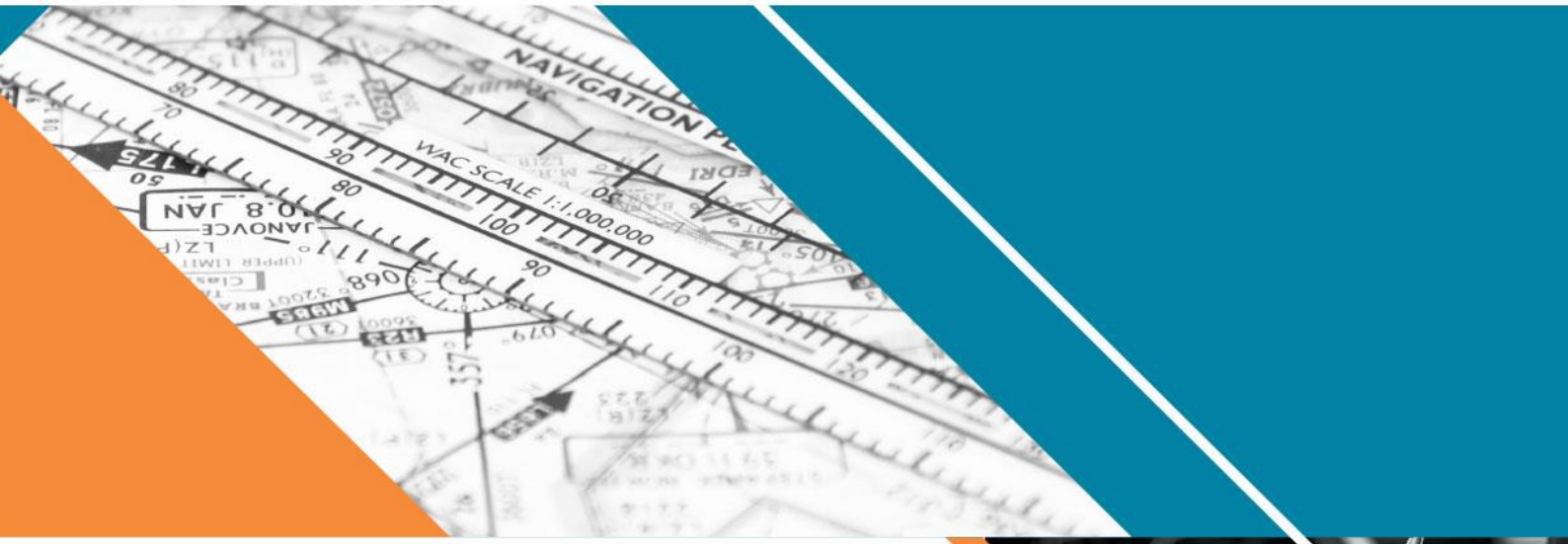
Australian Government
Civil Aviation Safety Authority

MULTI-PART ADVISORY CIRCULAR

AC 91-13, AC 133-09 and AC 138-06 - Version 1.2



Night vision imaging - helicopters

Date	June 2023
Project number	OS 13/19
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Advisory circulars are intended to provide advice and guidance to illustrate a means, but not necessarily the only means, of complying with the Regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material.

Advisory circulars should always be read in conjunction with the relevant regulations.

Audience

This advisory circular (AC) applies to:

- operators of helicopters using night vision imaging systems (NVIS)
- crew members (except as mentioned below) using NVIS
- individuals and organisations carrying out modifications and other engineering work on helicopters which are to be used for NVIS operations.

This AC is not directed at the use of NVIS by crew members where NVIS is used solely for the purposes of observation or surveillance and the crew members are not directly involved in air navigation or terrain avoidance functions.

Purpose

This AC provides guidance on the conduct of helicopter operations using NVIS. This publication supports and expands upon the content of Civil Aviation Safety Regulation (CASR) Part 91, Part 133 and Part 138 and relevant Manual of Standards (MOS).

For further information

For further information, contact CASA's Operations Standards (telephone 131 757).

Unless specified otherwise, all subregulations, regulations, Divisions, Subparts and Parts referenced in this AC are references to the *Civil Aviation Safety Regulations 1998 (CASR)*.

Status

This version of the AC is approved by the Branch Manager, Flight Standards.

Note: Changes made in the current version are annotated with change bars.

Version	Date	Details
v1.2	June 2023	New section 5.5 added on the topic of “use of white light during approach, hover, and departure”. New chapter 6 providing guidance on the RADALT requirements within the Part 91 and 133 MOS. Existing chapters 6, 7, 8 and 9 become chapters 7, 8, 9 and 10. Some definitions, legislation and form references updated.
v1.1	January 2022	A small number of minor grammatical and wording adjustments that have no substantive effect.
v1.0	January 2022	Initial version. This AC replaces CAAP 174-01 v2.2 – Night vision imaging – helicopters published September 2020.

Contents

1 Reference material

1.1 Acronyms

The acronyms and abbreviations used in this AC are listed in the table below.

Acronym	Description
AGL	Above Ground Level
ALARP	As Low as Reasonably Practical
ANVIS	Aviator Night Vision Imaging System
AOC	Air Operator's Certificate
AWB	Airworthiness Bulletin
CAR	*Civil Aviation Regulations 1988*
CASA	Civil Aviation Safety Authority
CASR	*Civil Aviation Safety Regulations 1998*
CAO	Civil Aviation Order
CP	Chief Pilot
FLIR	Forward Looking Infra Red
FOR	Field of Regard
FOV	Field of View
FRMS	Fatigue Risk Management Systems
ft	foot/feet
HLS	Helicopter Landing Site
HUD	Heads Up Display
IMC	Instrument Meteorological Conditions
LSALT	Lowest Safe Altitude
MOS	Manual of Standards
NVFR	Night Visual Flight Rules
NVG	Night Vision Goggles
NVIS	Night Vision Imaging System (s)
PIC	Pilot-in-command
RIFTO	Restricted Instrument Flight Take-off
SAR	Search and Rescue
TEM	Threat and Error Management
TSO	Technical Standard Order
VFR	Visual Flight Rules

Acronym	Description
VMC	Visual Meteorological Conditions

1.2 Definitions

Terms that have specific meaning within this AC are defined in the table below. Where definitions from the civil aviation legislation have been reproduced for ease of reference, these are identified by 'grey shading'. Should there be a discrepancy between a definition given in this AC and the civil aviation legislation, the definition in the legislation prevails.

Term	Definition
air crew member	means a crew member for a flight of an aircraft (other than a flight crew member) who carries out a function during the flight relating to the safety of the operation of the aircraft, or the safety of the use of the aircraft.
Class	is a term used, for the purposes of this AC, to divide NVG into different categories based on the filter present on the NVG objective lens. **Note:** The filter restricts the transmission of light below a determined frequency, thereby allowing the cockpit lighting to be designed and installed in a manner that does not adversely affect NVG performance.
Class A NVG	or 'minus blue' NVG incorporate a filter which generally imposes a 625-nanometre cut-off which allows the blue-green region of the light spectrum through the filter. **Note:** This class of NVG may limit the use of colours in the cockpit (e.g., colour displays, colour warning lights, etc.).
Class B NVG	NVGs that incorporate a filter that generally imposes a 665-nanometre cut-off. **Note:** This class of NVG enables cockpit lighting designs to incorporate more colours since the filter eliminates some yellows and oranges from entering the intensification process.
Crew member	See CASR Dictionary
de-goggle	for an NVIS, means the action of transferring from NVIS flight to non-NVIS (unaided) flight by removing the NVIS from a usable position. **Note:** The expression is also used as a command and is opposite to goggle-up.
Flight crew member	See CASR Dictionary
Generation	of an NVG, means the technological design of an image intensifier. **Notes:** 1. Systems incorporating these light-amplifying image intensifiers were first used during World War II and were operationally fielded by the US military during the Vietnam era. These systems were large, heavy and poorly performing devices that were unsuitable for aviation use and were termed Generation I (Gen I). Generation II devices represented a significant technological advancement and provided a system that could be head-mounted for use in ground vehicles. 2. Generation III devices represented another significant technological advancement in image intensification and provided a system that was designed for aviation use. Although not yet fielded, there are prototype NVG that include technological advances that may necessitate a Generation IV designation if placed into production.

Term	Definition
	3. Because of the variations in interpretations as to generation, NVG will not be referred to by the generation designation.
Goggle-up	for an NVIS, means the action of transferring to NVIS flight by placing the NVIS in a position where it may be used by the crew. **Note:** The expression is also used as a command and is opposite to de-goggle.
HLS operations	for a helicopter, means taking off or landing at a HLS, or other operations at a HLS (such as approach to the hover, winching, sling load operations, rappelling, hovering, deplaning, emplaning or similar types of operations).
IFR capable	for an aircraft, describes a circumstance in which: • the aircraft is equipped for IFR flight in accordance with the regulations; and • the crew who operate the aircraft meet the relevant requirements for IFR flight under Part 61 of CASR.
HLS-NVIS basic	means a HLS that does not conform to the requirement of a HLS-NVIS standard.
HLS-NVIS standard	See the definitions in the Part 91, 133 or 138 MOS that is relevant to the type of operation being conducted.
Human factors	The minimisation of human error and its consequences by optimising the relationships within systems between people, activities and equipment.
NVIS incendiary dropping	means an NVIS operation, in an operational area for a fire, to fight the fire using incendiaries for controlled burning that are dropped from an aircraft by means of an incendiary dropping device.
Look under	(under view) is the ability of operators to look under or around the NVG to view inside and outside the aircraft.
LSALT, or lowest safe altitude	for a route or route segment of a flight of an aircraft, means the lowest altitude that will provide safe terrain clearance for the aircraft for the route or route segment calculated in accordance with a method specified in the Part 173 Manual of Standards, the operator's exposition or the operator's operations manual. Note: The methods specified in the Part 173 Manual of Standards are also published in the AIP.
Minimum NVIS crew	means the minimum number of NVIS pilots and NVIS crew members required for a particular flight or operation. **Note:** Approval is not required for a person to use NVIS only for observation or surveillance that is not the primary means of terrain avoidance for safe air navigation using visual surface reference external to the aircraft. However, a person engaged in such unapproved use is not part of the minimum NVIS crew.
Modified Class B	means an NVG that incorporates a variation of a Class B filter and also incorporates a notch filter in the green spectrum that allows a small percentage of light into the image intensification process. **Note:** A Modified Class B NVG allows operators to view a fixed heads-up display (HUD) symbology through the NVG without the HUD energy adversely affecting NVG performance.
Night Vision Goggles	means a self -contained binocular night vision enhancement device that:

Term	Definition
	• is helmet-mounted or otherwise worn by a person; and • can detect and amplify light in both the visual and near infra-red bands of the electromagnetic spectrum.
NVFR capable	for an aircraft, describes a circumstance in which: • the aircraft is equipped for flight by night under the VFR in accordance with the regulations; and • the crew who operate the aircraft meet the relevant requirements for a VFR flight at night under Part 61 of CASR.
NVIS, or night vision imaging system	means a self-contained binocular night vision enhancement device, usually including goggles, that: • is helmet mounted or otherwise worn by a person; and • can detect and amplify light in both the visual and near infra-red bands of the electromagnetic spectrum.
NVIS air crew member	See the definitions in the Part 91, 133 or 138 MOS depending on the type of operation being conducted.
NVIS compatible lighting	means aircraft interior or exterior lighting with spectral wavelength, colour, luminance level and uniformity, that has been modified, or designed for use with NVIS, and does not degrade or interfere with the image intensification capability performance of the NVIS beyond acceptable standards.
NVIS flight	means a flight conducted using a night vision imaging system.
NVIS flight examiner	means: 1. a person who, in accordance with Part 61 of CASR, is the holder of: a. an NVIS rating with an NVIS endorsement; and b. a flight examiner rating with an NVIS flight test endorsement; or 2. a CASA NVIS FOI.
NVIS flight instructor	means a person who, in accordance with Part 61 of CASR, is the holder of: 1. an NVIS rating with an NVIS endorsement; and 2. a flight instructor rating with an NVIS rating training endorsement.
NVIS flight time	means the flight time gained by an NVIS air crew member or pilot, or a person receiving NVIS flight training, or during an NVIS operation. **Note:** NVIS flight time must be logged in the specialist column of the aircrew flying logbook.
NVIS FOI	means a CASA flying operations inspector appointed in writing to carry out some, or all, of the duties of an NVIS flight examiner.
NVIS operation	For the operations conducted under the Part 91 MOS: means an NVIS flight that is any of the following operations using NVIS: a. authorised Part 141 flight training that is for a person to qualify for an NVIS rating or endorsement; b. training and checking for a Part 141 operator in relation to its personnel who carry out the activities mentioned in paragraph (a); c. authorised Part 142 activity that is: i authorised Part 142 flight training that is for a person to qualify

Term	Definition
	for an NVIS rating or endorsement; ii contracted recurrent training of personnel holding an NVIS rating or endorsement; iii contracted checking of personnel holding an NVIS rating or endorsement; d. training and checking for a Part 142 operator in relation to its personnel who carry out the activities mentioned in paragraph ©; e. a flight test required under Part 61 of CASR; f. an NVIS proficiency check under Part 61 of CASR; g. a flight, conducted by a Part 141 operator or a Part 142 operator, for the purpose of ensuring the proficiency of an NVIS pilot; h. training or checking for a Part 133 operator in relation to its crew members who conduct NVIS flights during the operator's medical transport operations; i. a maintenance flight of an aircraft for the purpose of ensuring the serviceability of the aircraft, or the NVIS, for NVIS operations mentioned in any other paragraph of this definition; j. a test flight of an aircraft for the purpose of certifying the aircraft, or the NVIS, for NVIS operations mentioned in any other paragraph of this definition. Notes: 1. Unless otherwise expressly permitted (for example, under this Chapter [s–c - Chap 3 of the Part 91 MOS], or under the Part 133 or Part 138 MOSs) NVIS must not be used in any other operations for safe air navigation by means of visual surface reference external to the aircraft conducting the operation. 2. This Chapter [s–c - Chap 3 of the Part 91 MOS] does not apply to the use of NVIS by any crew member who is not directly involved in air navigation or terrain avoidance functions, and who uses NVIS solely for observation or surveillance. For the operations conducted under the Part 133 MOS: means an NVIS flight that is a medical transport operation. For the operations conducted under the Part 138 MOS: means an NVIS flight that is an aerial work operation conducted by an aerial work operator. Note: An aerial work operator is the holder of an aerial work certificate.
NVIS pilot	for an NVIS flight, means a pilot who: • holds each of the licences, ratings and endorsements required for the NVIS flight by Part 61 of CASR; or if the aircraft is a foreign registered aircraft — is authorised by the aircraft's State of registry to pilot the aircraft for the NVIS flight.
NVIS proficiency check	means a proficiency check of an NVIS pilot in accordance with the requirements under Part 61 of CASR for such a check.
operator	of an aircraft, means: a. if the operation of the aircraft is authorised by an AOC, a Part 141 certificate or an aerial work certificate—the holder of the AOC or certificate; or b. otherwise—the person, organisation or enterprise engaged in aircraft

Term	Definition
	operations involving the aircraft.
Part 141 certificate	see regulation 141.015 of CASR.
Part 141 operator	means the holder of: 1. a Part 141 certificate under which Part 141 flight training for an NVIS rating or NVIS endorsement is approved; or 2. a CASA approval under regulation 141.035 of CASR for Part 141 flight training for an NVIS rating or NVIS endorsement.
Part 142 authorisation	has the same meaning as in Part 142 of CASR.
Part 142 operator	means the holder of a Part 142 authorisation under which Part 142 flight training for an NVIS rating or NVIS endorsement in multi-crew operations is authorised.
resolution	means the capability of NVIS to present an image that makes clear and distinguishable the separate components of a scene or object.
RTCA/DO-275	means the document titled *Minimum Operational Performance Standards for Integrated Night Vision Imaging System Equipment*, referenced RTCA/DO-275, dated 12 October 2001, of RTCA Inc., Washington, USA.
search and rescue (SAR) operation	means an aerial work operation whose primary purpose is a combined search and rescue.
system	for NVIS, means the system in which all of the elements required to operate an aircraft effectively and safely using NVIS are integrated, including NVG and associated equipment, NVIS compatible lighting, other associated aircraft components and equipment, associated training and recency requirements and continuing airworthiness. **Note:** NVIS is synonymous with aviator night vision imaging system, sometimes called ANVIS.
the Regulations	means CAR and CASR.
unaided flight	means the NVIS is in a non-operational position when night vision is not being enhanced by any other means. **Note:** Unaided flight is associated with the de-goggle procedure where the crew member places the NVIS in the non-operational position.
used, using or uses	in relation to the use of NVIS, means used for safe air navigation by means of visual surface reference external to the aircraft conducting the operation.

1.3 References

Legislation

Legislation is available on the Federal Register of Legislation website https://www.legislation.gov.au/

Document	Title
Part 61 of CASR	Flight crew licensing
Part 61 MOS (Vols 1-4)	Part 61 Manual of Standards Instrument 2014
Part 91 of CASR	General operating and flight rules
Part 91 MOS	Part 91 (General Operating and Flight Rules) Manual of Standards 2020
Part 133 of CASR	Australian air transport operatio–s - rotorcraft
Part 133 MOS	Part 133 (Australian Air Transport Operations—Rotorcraft) Manual of Standards 2020
Part 138 of CASR	Aerial work operations
Part 138 MOS	Part 138 (Aerial Work Operations) Manual of Standards 2020
CASA EX82/21	Part 119 of CASR – Supplementary Exemptions and Directions Instrument 2021
CASA EX84/21	Part 133 and Part 91 of CASR – Supplementary Exemptions and Directions Instrument 2021
CASA EX86/21	Part 138 and Part 91 of CASR – Supplementary Exemptions and Directions Instrument 2021
CASA EX 87/21	Flight Operations Regulatio–s - Supplementary Exemption and Directions instrument
CASA EX 161/21	Miscellaneous flight operations exemptions and approvals instrument

Advisory material

C'SA's advisory materials are available at https://www.casa.gov.au/publications-and-resources/guidance-materials

Document	Title
AWB 25-031	Airworthiness Bulletin 25-0–1 - Defects with Night Vision Imaging Systems
AC 91-29	Guidelines for helicopte–s - suitable places to take off and land
AC 119-11 and 138-02	Training and checking systems
AC 119-12	Human factors principles and non-technical skills training and assessment for air transport operations
AC 139.E-01	Reporting of tall structures
AC 139.R-01	Guidelines for helipor–s - design and operation
AMC/GM Part 91	General operating and flight rules
AMC/GM Part 133	Australian air transport operatio–s - rotorcraft
AMC/GM Part 138	Aerial work operations

Other material

International Civil Aviation Organization (ICAO) documents are available for purchase from http://store1.icao.int/

Document	Title
ATSB AR-2008-044(1)	A pi'ot's guide to staying safe in the vicinity of non-controlled aerodromes
ATSB Aviation Research Report B2004/0152	Night Vision Goggles in Civil Helicopter Operations
RTCA/DO-268	Concept of Operations, Night Vision Imaging System for Civil Operators
RTCA/DO-275	Minimum Operational Performance Standards for Integrated Night Vision Imaging System Equipment
RTCA/DO-295	Civil Operat'rs' Training Guidelines for Integrated Night Vision Imaging System Equipment

1.4 Forms

CASA's forms are available at http://www.casa.gov.au/forms

Form number	Title
	Applicati–n - Aerial Work Operations (CASR Part 138)
	Applicati–n - Air Operator's Certificate/ Associated Approvals (CASR Part 119)
61-1516	Night Vision Systems Rating Proficiency Check
	Notificati–n - Non-significant changes (CASR Parts 119, 131 and 138)

2 Legislation

2.1 History

2.1.1 Austra'ia's civil aviation legislation framework has contained rules governing the use of night vision imaging systems (NVIS) since 2007. Until 2 December 2021, the majority of the operational and equipment requirements were found in Civil Aviation Order (CAO) 82.6, which applied to persons using NVIS for commercial aerial work activities and limited the kinds of activities in which the use of NVIS was permitted. Additionally, until 2 December 2021 CASA Instrument 288/07 prohibited the use of NVIS in private operations.

2.1.2 From a flight crew member licensing perspective, Part 61 requires pilots using NVIS to obtain a rating and certain endorsements. The construction of Part 61 effectively prohibits the use of NVIS by pilots in Australian aircraft other than helicopters.

2.1.3 From 2 December 2021, CAO 82.6 and Instrument 288/07 were either repealed or had no legislative effect. The main operational and equipment requirements for the use of NVIS are now found in rules empowered by Parts 91, 133 and 138 and are contained in each of the Part 91, 133 and 138 Manual of Standards (MOS).

2.1.4 An operator who held an approval to use NVIS issued under CAO 82.6 prior to 2 December 2021 is referred to, for the purposes of this AC, as an *existing NVIS operator*.

2.2 Underpinning terminology

2.2.1 A fundamental legal interpretation issue for the proposed NVIS content across the Part 91, 133 and 138 'OS's is the difference between the meaning of *NVIS flight* and *NVIS operation*.

2.2.2 NVIS flight

2.2.2.1 The definition of *NVIS flight* is in the CASR Dictionary and has the following meaning:

> *NVIS flight* means a flight conducted using a night vision imaging system.

2.2.2.2 It should be noted, that in this definition, unlike in the old CAO, the word 'using' does not have any special meaning. Therefore, the term NVIS flight is effectively an all-encompassing term that includes every flight of an aircraft that uses NVIS. Operators and pilots should note that there are subsections at the beginning of each main NVIS chapter of each MOS that exclude the NVIS rules from applying to a person on an NVIS flight who is wearing an NVIS, but who is not a flight crew member, provided the person is **NOT** involved in air navigation or terrain avoidance functions.

2.2.3 NVIS operation

2.2.3.1 In CAO 82.6, an NVIS operation was a specific kind of activity – such "s "Department of Defence supp"rt" "r "aerial firefight"ng".

2.2.3.2 Under the proposed NVIS rules, *NVIS operation* has a different meaning in each of the 3 MOS's and the legal definitions can be found in the Definitions section of each MOS chapter containing the main NVIS operational rules.

2.2.3.3 In general terms, for each MOS the definition of NVIS operation identifies those operations in that specific CASR Part which are permitted to fly below the Part 91 minimum height rules using NVIS, and who have certain other alleviations from the normal NVFR and IFR rules and, consequently, have certain additional requirements.

2.2.3.4 An example under the Part 91 MOS rules (Chapter 3 of the Part 91 MOS) is a Part 141 NVIS flight training operation. These operations would be permitted to conduct take-off and landings at an HLS-NVS basic and use the lower inflight cloud minima.

2.3 Where are the NVIS rules located?

2.3.1 The legal interrelationship between Parts 91, 133 and 138 results in a significant amount of proposed duplicated content across the three 'OS's. This duplication requires a solid understanding of when the rules contained in a particular MOS apply to a particular kind of flight that where NVIS is used.

2.3.2 The following list summarises the NVIS MOS content:

- Part 91 MOS:
  - Section 1.07 includes a definition of NVIS operation to enable the legal usage of this term in all Part 91 MOS chapters.
  - Chapter 2 includes some added visual meteorological conditions (VMC) specifically for NVIS operations.
  - Chapter 3 contains the main body of NVIS operational rules for all operations other than Part 133 operations or aerial work operations (when conducted by an aerial work certificate holder).
  - Chapter 26 contains the equipment related NVIS rules that apply to NVIS usage in all operations except when conducted as part of a Part 133 operation.
- Part 133 MOS:
  - Section 1.04 includes a definition of NVIS operation to enable the legal usage of this term in all Part 133 MOS chapters.
  - Chapter 8 contains the main body of NVIS operational rules for all operations other than NVIS operations conducted under Parts 91 or 138.
  - Division 14 of Chapter 11 contains the equipment related NVIS rules that apply to NVIS usage in Part 133 operations.
- Part 138 MOS:
  - Section 1.04 includes the NVIS related definitions with common meaning across all Part 138 MOS chapters.
  - Section 4.02 includes the requirement for an operator conducting an NVIS operation to have a training and checking system.
  - Chapter 12 contains the main body of NVIS operational rules for the use of NVIS by aerial work certificate holders.
  - Sections 16.04, 16.05, 16.06 and 16.07 include the requirements relating to NVIS helicopter firebombing and a requirement to hold an approval to conduct NVIS firebombing using an aeroplane.

- Sections 16.08, 16.09 and 16.10 include the requirements relating to NVIS incendiary dropping.
- Sections 17.10, 17.11 and 17.12 include the requirements relating to NVIS fire mapping.
- Section 22.10 includes the equipment requirements for NVIS fire mapping, NVIS incendiary dropping and NVIS helicopter firebombing.

2.3.3 Part 91 MOS - chapter 2 (VMC / minimum visibility rules)

2.3.3.1 The VMC rules in Chapter 2 of the Part 91 MOS apply to all flight operations across the CASR. Relevant NVIS aspects are:

- Table 2.07(3) contains the criteria for VMC for all aircraft operations
- Item 2A of Table 2.07 permits NVIS operations to be conducted clear of cloud in Class C airspace, the intent of which is to provide flexibility to operators to depart or arrive in Class C airspace when the standard 1000' clearance from cloud would preclude such operations
- Item 2B of Table 2.07(3) permits certain NVIS operators to apply to CASA to reduce inflight visibility requirement from 5000 m to a minimum of 3000 m, the ability to do this being initially included in the old CAO to allow certain SAR providers to support military operations in controlled airspace environments.

Notes:

1. Paragraph 2.07 (3C) (a) of the Part 91 MOS states that the reduction in visibility cannot be approved for NVIS firebombing, incendiary dropping or fire mapping.
2. It was not intended that these approvals would be granted for routine and expected NVIS operations such as Police and EMS functions.

2.3.3.2 Operators and pilots should, when considering applications for the approvals mentioned above, note the standard of safety being sought by CASA is outlined in paragraph 11.055 (1B) (b) which is "at least acceptable". In the context of this approval, an acceptable standard of safety is one that is equivalent to the standard of safety for the minimum visibility that applies without the approval. Therefore, it would be expected that operators applying for this approval should have put in place additional risk mitigation controls that fully compensate for the reduction in visibility. Examples of likely risk mitigators that CASA may consider for such operations would include:

- additional pilot training for low visibility operations
- operations conducted under the IFR with an IFR recovery plan during all phases
- operations conducted within a controlled operational area such as a military training zone or similar
- aircraft fitment of H-TAWS or similar
- aircraft operated at a speed that allows at least 30 seconds for detection and avoidance of obstacles
- flights that include operational tasking only, i.e., the lower visibility is not utilised for training sorties.

2.3.4 Part 91 MOS - chapter 3 (operational rules)

2.3.4.1 The NVIS operational rules in Chapter 3 of the Part 91 MOS apply to all NVIS flights across the CASR except those conducted during a flight that is an actual Part 133

operation, or a flight that is an aerial work operation conducted by an aerial work certificate holder. Operators and pilots are recommended to review section 3.01A of the Part 91 MOS to ensure a solid understanding of the persons to whom Chapter 3 applies.

2.3.4.2 Chapter 3 includes a definition of an HLS-NVIS Standard that is tailored for NVIS operations and which reflects the original intent of the old CAO and does not require a windsock or lighting. This definition is simplified compared to the pre-2 December 2021 definition of HLS Standard which was contained within CAAP 92-2 (now no longer effective). Some operators may choose to provide additional information in their operations manual to further specify the HLS-NVIS standard dimension and criteria.

2.3.4.3 Only an NVIS operation may conduct approaches to, and departures from, a HLS-NVIS basic. As a baseline, this kind of activity requires a minimum of 2 NVIS crew members.

2.3.4.4 However, an NVIS operator may apply to CASA to conduct operations to a HLS-NVIS basic using a single NVIS pilot as the only NVIS crew member. Operators and pilots should note that when considering applications for these approvals, the standard of safety being sought by CASA which is "at least acceptable" is outlined in paragraph 11.055(1B)(b). In the context of this approval, an acceptable standard of safety is one that is equivalent to the standard of safety for HLS-NVIS basic activities with 2 NVIS crew members. Therefore, it would be expected that operators applying for this approval should have put in place additional risk mitigation controls which fully compensate for the lack of the second NVIS crew member. Examples of likely risk mitigators might be:

- significant pilot NVIS experience
- detailed information on the landing area including day reconnaissance
- minimal dust or obscurants that would normally necessitate the use of a second NVIS crew member
- proposed landing area is of a suitable size as determined by the operator as suitable for single pilot operations.

2.3.5 Part 91 - section 3.09 (minimum height under the NVFR or IFR)

2.3.5.1 Section 3.09 provides an exemption from the Part 91 minimum height regulations for VFR flights at night and IFR flights. This exemption is necessary until the Part 91 regulations are amended to provide an exception directly for NVIS operations. The exemption is subject to the following requirements:

- the flight is a NVIS operation
- there is an operational necessity to descend below the minimum height
- there is a minimum of 2 NVIS crew members.

Note: The above does not mean that an NVIS flight or operation with only a single NVIS crew member cannot descent below the minimum height. It just means that descent below the minimum height when conducted with a single NVIS crew member needs to be fully compliant with the requirements for descent below minimum height specified under the relevant Part 91 minimum height regulation (91.277 or 91.305).

2.3.5.2 Subsection 3.09(5) requires that NVIS operations conducted by a single NVIS pilot as the only NVIS crew member must be conducted at or above 1000 ft AGL. An operator may apply to CASA to conduct a single NVIS pilot NVIS operation below 1000 ft AGL

but above 500 ft AGL subject to a detailed risk assessment. Operators and pilots should note that when considering applications for these approvals, the standard of safety being sought by CASA which is "at least acceptable" is outlined in paragraph 11.055(1B)(b). In the context of this approval, an acceptable standard of safety is one that is equivalent to the standard of safety for single NVIS crew member operations at 1000 ft AGL. Therefore, it would be expected that operators applying for this approval should have put in place additional risk mitigation controls that fully compensate for the reduction in height. Examples of likely risk mitigators include:

- operational necessity for the flight
- significant pilot NVIS experience
- familiar area of operation
- aircraft terrain awareness system.

2.3.5.3 Subsection 3.09(6) outlines that when established in the hover below 500 ft AGL, if it is necessary to enhance operational safety, the pilot in command (PIC) may elect to de-goggle as an individual or as a crew. This subsection enables hover operations, particularly winching operations, where a stable hover reference is established through extensive white light such as ‘Nitesun’, ‘Trakka’ or rear cabin hand-held spotlight. For further information see section 7 of this AC.

2.3.5.4 Subsection 3.09(7) considers NVIS operations (not an NVIS flight) with at least 2 NVIS crew members over areas of extensive illumination and provides the option to de-goggle when the performance of the NVIS becomes degraded and is likely to affect operational safety. For further information see section 7 of this AC.

2.3.5.5 Some examples of NVIS operations that might be affected by areas of extensive illumination below minimum height when operating under the Part 91 MOS NVIS rules, such that the NVIS crew experience NVIS performance degradation that affects operational safety, include Part 142 training flights and NVIS proficiency checks.

2.3.6 Part 91 MOS - Division 26.17 (equipment for NVIS flights)

2.3.6.1 The NVIS equipment rules contained in Chapter 26 of the Part 91 MOS apply to all NVIS flights across the CASR except those conducted during a flight that is an actual Part 133 operation.

2.3.6.2 This Division begins at section 26.74 of the Part 91 MOS. Due to the interaction of regulation 91.035, and Subparts 91.K, 133.K and 138.K, this Division of the Part 91 MOS applies to NVIS flights conducted by all persons and operators, except a flight that is a Part 133 operation.

2.3.7 Part 133 MOS - general

2.3.7.1 The Part 133 MOS NVIS rules apply to the holder of an Australian air transport AOC when the holder is conducting a flight that is a Part 133 operation. These operations are the actual flights of the AOC holder that are air transport operations, which consist of passenger transport operations, cargo transport operations or medical transport operations.

2.3.7.2 Importantly, training flights or training sequences for air transport operations, where they are not conducted during an actual air transport operation, are not Part 133

operations themselves. These flights are Part 91 operations and are required to be conducted under the Part 91 rules, not the combination of the Part 91 and Part 133 rules. Under CASA EX84/21, Part 133 operators may comply with some Part 133 rules instead of their equivalent Part 91 rule (as a simple example, section 16 of the exemption instrument permits compliance with the Part 133 equipment rules instead of the Part 91 equipment rules).

2.3.8 Part 133 MOS - chapter 8 (operational rules)

2.3.8.1 For Part 133, the only NVIS operation is an NVIS flight that is a medical transport operation.

2.3.8.2 Operators and pilots are recommended to review section 8.01A of the Part 133 MOS to ensure a solid understanding of the persons to whom Chapter 8 applies.

2.3.8.3 Due to the way that regulation 133.265 takes precedence over regulation 91.085 when a Part 133 NVIS flight is being conducted, Chapter 8 of the Part 133 MOS, generally repeats the NVIS rules contained within Chapter 3 of the Part 91 MOS.

2.3.8.4 However, since regulation 133.167 already provides an alleviation from the Part 91 minimum height rules for medical transport operations, the exemption that is included in subsection 3.09(2) of the Part 91 MOS does not need to be included in Chapter 8 of the Part 133 MOS.

2.3.8.5 For the minimum height rules for a Part 133 medical transport operation, see Division 2 of Chapter 5 of the Part 133 MOS (which begins at section 5.08).

2.3.8.6 Subsection 8.09(5) provides a similar alleviation regarding de-goggling below minimum height as per the Part 91 MOS. This subsection considers NVIS operations (not an NVIS flight that is not an NVIS operation) with at least 2 NVIS crew members over areas of extensive illumination and provides the option to de-goggle when the performance of the NVIS becomes degraded and is likely to affect operational safety. See section 7 of this AC for additional information.

2.3.9 Part 133 MOS - Division 14 of Chapter 11 (equipment for NVIS flights)

2.3.9.1 This Division begins at section 11.59 of the Part 133 MOS. Due to the interaction of regulation 91.035, and Subparts 91.K, 133.K and 138.K, this Division of the Part 133 MOS applies to NVIS flights conducted during a Part 133 operation. For a training flight for a Part 133 operator that is not conducted as part of a Part 133 operation, then the equipment requirements of the Part 91 MOS will apply, subject to the operator's use of the exemption included in section 16 of CASA EX84/21.

2.3.10 Part 138 MOS - general

2.3.10.1 Part 138 combines the aerial work rules for persons that prior to 2 December 2021 rules were aerial work AOC holders or conducting what was colloquially known as ‘private aerial work’. As a result, the Part 138 regulations specifically identify which regulations apply to an aerial work operation that is not required to be the subject of an aerial work certificate.

2.3.10.2 The specific NVIS Part 138 regulation – 138.350 – only applies to aerial work certificate holders. Therefore, Chapter 12 of the Part 138 MOS, which contains the aerial work NVIS operational rules, only applies to aerial work certificate holders.

2.3.10.3 For persons conducting aerial work without an aerial work certificate, the Part 91 MOS NVIS rules apply.

2.3.10.4 The NVIS elements contained in Chapters 4, 9, 11, 15, 16, 17 and 22 of the Part 138 MOS apply according to their terms. In almost all cases, they only apply to aerial work certificate holders because persons conducting aerial work without an aerial work certificate are not permitted to conduct the operations that require a more specialised use of NVIS.

2.3.10.5 It should be noted that training flights for an aerial work operation are defined to be part of aerial work operations (see regulation 138.010). Therefore, where a training flight is conducted by an aerial work certificate holder is specifically training for an aerial work operation, but is not, for example, solely for the purposes of Part 61 NVIS rating training, then the Part 138 MOS NVIS rules also apply to that training flight.

2.3.11 Part 138 MOS - chapter 12 (operational rules)

2.3.11.1 For Part 138, the only NVIS operation is an NVIS flight that is an aerial work operation conducted by an aerial work certificate holder.

2.3.11.2 Due to the wording of subregulations 138.005(3) and (4), and regulation 138.350, none of Chapter 8 applies to the conduct of an aerial work operation by a person that is not required to hold an aerial work certificate. For operations conducted by these persons, the requirements of regulation 91.085, and therefore Chapter 3 of the Part 91 MOS, apply.

2.3.11.3 Operators and pilots are recommended to review section 12.02 of the Part 138 MOS to ensure a solid understanding of the persons to whom Chapter 12 is applicable.

2.3.11.4 Chapter 12 of the Part 138 MOS, due to the way that regulation 138.350 takes precedence over regulation 91.085 when it applies to a flight that is an aerial work operation, generally repeats the NVIS rules contained within Chapter 3 of the Part 91 MOS.

2.3.11.5 However, since regulation 138.275 already provides an alleviation from the Part 91 minimum height rules for aerial work operations, the exemption that is included in subsection 3.09(2) of the Part 91 MOS does not need to be included in Chapter 12 of the Part 138 MOS.

2.3.11.6 For the minimum height rules for an aerial work operation, see Chapter 9 of the Part 138 MOS.

2.3.11.7 Subsection 12.10(7) provides a similar alleviation regarding de-goggling below minimum height as per the Part 91 MOS. This subsection considers NVIS operations (not an NVIS flight that is not an NVIS operation) with at least 2 NVIS crew members over areas of extensive illumination and provides the option to de-goggle when the performance of the NVIS becomes degraded and is likely to affect operational safety. See section 7 of this AC for additional information.

2.3.12 Part 138 MOS - chapters 16 and 17 (other operational rules)

2.3.12.1 Operators conducting NVIS firebombing, incendiary dropping or fire mapping should refer to additional requirements in the following Part 138 MOS areas:

- Division 2 of Chapter 16
- Divisions 3 and 4 of Chapter 17.

2.3.13 Part 138 MOS - chapter 26 (fire operations equipment for NVIS flights)

2.3.13.1 Airworthiness, ongoing serviceability, and additional equipment requirements for a NVIS operation are in Part 91 MOS Chapter 26.

2.3.13.2 Additional equipment requirements for NVIS fire operations are located in Chapter 22 of the Part 138 MOS.

2.3.14 CAO 100.5

2.3.14.1 Subsection 2A of CAO 100.5 also contains rules relevant to the use of NVIS.

2.4 When, and how, does an operator need to apply for approval to use NVIS?

2.4.1 During the public consultation in October 2021 of the NVIS rules that would apply from 2 December 2021 onwards, CASA requested industry input on the circumstances where industry would be required to apply to CASA for an approval to use NVIS. Noting that the specific definition of *significant change* in regulation 119.020 and 138.012 could not be changed until the next regulation amendment opportunity in mid-late 2022, and after reviewing the consultation feedback on this proposal, CASA issued directions, contained in section 6A of CASA EX82/21 and section 23 of CASA EX86/21, that an operator conducting an NVIS operation for the first time would require CASA's approval before commencing the activity.

2.4.2 Operators and pilots should note the difference between the definitions of *NVIS flight* and *NVIS operation* when considering how to comply with these directions. It should also be noted that if an operator was to commence conducting subsequent NVIS operations after that first NVIS operation, then those operations would not automatically require CASA's pre-approval, but would remain subject to the change management rules of Parts 119 and 138, as applicable.

2.5 HOFO / HOO - adequate NVIS experience

2.5.1 Operators conducting NVIS flights with key personnel who have limited NVIS experience (i.e., no experience as they are a first time NVIS operator, or who have a Head of Flying Operations (HOFO) or Head of Operations (HOO) with a newly gained NVIS rating), may not appropriately satisfy the requirements of subparagraph 28 (1)(b)(iv) of the *Civil Aviation Act 1988* (the Act) (for an AOC holder), or of regulations 119.135, 138.090, 141.125 or 142.185 (as applicable to the operator).

2.5.2 The Part 61 NVIS rating and endorsement is not designed to ensure competency of a pilot in specific NVIS flights or NVIS operations conducted by a certificate holder. In

circumstances where a HOFO/HOO has limited NVIS experience, safety gaps can be created as the HOFO/HOO may not be able to conduct effective oversight and risk monitoring of the operator's NVIS flights.

2.5.3 In these circumstances, the most frequently utilised options for operator's to satisfactorily mitigate the risks relating to general HOFO/HOO NVIS inexperience are:

- The operator employs (whether full time or part time - depending on the operator's operations) an experienced NVIS senior pilot with considerable NVIS experience, who can assist the HOFO/HOO to carry out NVIS supervision and training duties and who provides regular assessments to the HOFO/HOO on operational safety matters relating to the operator's NVIS operations.

  Note: If this person is a part-time employee the operator can expect that CASA will request that information be provided demonstrating that the person will be available to the operator's operation when necessary. This might be via a service level agreement that outlines this availability.

- The HOFO/HOO receives additional training (by an approved and suitably experienced NVIS training organisation) in line with that required in the operator's exposition/operations manual. This is to ensure the HOFO/HOO is at a minimum standard for NVIS line flying and checking in a requisite number of the NVIS activities performed by the operator.

2.5.4 An operator could also utilise a different course of action that provides an equivalent level of safety and risk mitigation to the previously mentioned options, and which meets the criteria in the Act and/or the regulations as appliable.

2.6 What happened to NVIS operator approvals from before 2 December 2021?

2.6.1 On and after 2 December 2021, existing NVIS operators do not need to take any actions specifically relating to their existing NVIS approvals. In particular, noting the effect of section 6A of CASA EX82/21, and section 23 of CASA EX86/21, an existing NVIS operator will be taken by CASA to already have already conducted an NVIS operation and therefore will not need to gain the "first conduct of an NVIS operation" approval mentioned in those sections of the 2 mentioned exemption instruments.

2.7 Existing NVIS operators and new approvals within the Part 91, 133 and 138 MOS's

2.7.1 Where an element of their existing approval is equivalent to an approval proposed to be required under the new MOS rules, the existing approval will be deemed by CASA to be the future approval without any action needing to be taken by the operator. Two examples of this principle are:

- Where CASA accepted amendments to the operator's operations manual in relation to a single NVIS pilot being the only NVIS crew member when operating into an HLS-NVIS basic under CAO 82.6 Appendix 3 paragraph 8.3 (b), that acceptance will be deemed to be the approval required under paragraph 12.06(c) of the proposed Part 138 MOS.

- Where CASA approved, under CAO 82.6 Appendix 3 clause 10.2, minimum in-flight cloud requirements lower than those prescribed under item 1 or item 2 of Table 10.1, that approval will be deemed to be the approval required under paragraph 12.11(3)(c) of the proposed Part 138 MOS.

2.7.2 The deeming of the 2 approvals mentioned above will be added to CASA EX161/21 in January 2022.

2.8 General information regarding training and checking requirements

2.8.1 Under the pre-2 December 2021 rules, CAO 82.6 required NVIS operators to have an approved training and checking organisation under Part 217 of CAR. However, Part 217 of CAR was repealed on 2 December 2021 and has been replaced by dedicated training and checking requirements in the Part 119 and 138 regulations; and for Part 138 additional operations are specified in section 4.02 of the Part 138 MOS. Parts 141 and 142 already contain requirements relating to the competency of personnel used in those operations.

2.8.2 For existing NVIS operators that transitioned into conducting Part 133 medical transport operations using NVIS, the training and checking system deferral contained in CASA EX87/21 does not apply to your NVIS medical transport operation since these operators were required to have a Part 217 of CAR TCO.

2.8.3 For existing NVIS operators who transitioned into conducting aerial work operations using NVIS, the effect of the training and checking system deferral contained in CASA EX 86/21 is that the deferral will not apply to these aerial work operations as these operators were required to have a Part 217 of CAR TCO. Section 4.02 of the Part 138 MOS contains the requirement for aerial work certificate holders using NVIS to meet the Part 138 training and checking system requirements.

2.8.4 For Part 141 certificate holders, there are general provisions in Part 141 that require the operator to ensure that its personnel are suitably experienced and qualified (as just one example – see subparagraph 141.120(1)(a)(i)). There are also specific requirements relating to internal training and checking under Subpart 142.J.

2.8.5 For Part 142 AOC holders, there are general provisions in Part 142 that require the operator to ensure that its personnel are suitably experienced and qualified (as one example – see subparagraph 142.180(1)(a)(i)). There are also specific requirements relating to internal training and checking under Subpart 142.J.

2.8.6 See section 7, and Appendix D, of this AC for additional guidance on training and checking matters.

3 Overview of AC

3.1 Philosophy

3.1.1 The CASA philosophy on the civil use of NVIS is that the correct use of NVIS has the potential to enhance the safety of visual flight at night by assisting the crew's ability to discern the horizon and terrain, observe much of the in-flight meteorological conditions, and to identify objects that may cause a hazard to flight.

3.2 Broad policy and concept

3.2.1 This document expands, where necessary, on the content of Part 91, Part 133 and Part 138 MOS and provides advice on the CASA concept of operations of NVIS use in civil aviation operations.

3.2.2 The focus is on the safe and effective use of NVIS during various phases of flight, with the emphasis on improving the situational awareness of crews during night visual flight rules (NVFR) operations or instrument flight rules (IFR) flight in VMC conditions where NVIS flight is permitted. The overall premise is that use of NVIS is an adjunct to visual flight at night.

3.2.3 Whilst CASR Part 91 permits the use of NVIS in private operations, alleviations from certain flight rules are only available to NVIS operators (defined term). Other operators must comply with the IFR or NVFR flight rules.

4 De-goggling when below minimum height

4.1.1 When operating over areas of extensive illumination below LSALT during certain NVIS operations (for examples of NVIS operations for each of Parts 91, 133 and 138 - see sections 4, 5 and 6 of this AC), the NVIS crew may experience degradation in the performance of the NVIS that affects operational safety.

Note: CASA would consider an area of extensive illumination to be a large metropolitan area or similar. This alleviation is not to be used over areas of high illumination due large fires in firefighting operations.

4.1.2 The main hazards arising from this NVIS degradation included increased eye fatigue, NVIS blooming and halo, gain down and the inability to identify cranes and other obstacles due to the use of NVIS compatible LED obstacle lights (i.e., the wavelength used for the obstacle lighting cannot be seen using NVG's).

4.1.3 To facilitate the conduct of an NVIS operation over areas of extensive illumination below the relevant minimum height unaided, the Part 91, 133 and 138 MOS's include the ability for a NVIS crew to de-goggle over areas of extensive illumination where the performance of the NVIS is degraded. Should the PIC elect to de-goggle they must be able to visually identify and avoid terrain and obstacles.

Note: This alleviation is not available for an NVIS flight that is not an NVIS operation.

4.1.4 The conditions for the use of this alleviation include:

- the flight must be a NVIS operation
- there must be a minimum of 2 NVIS crew members
- the flight must be conducted over areas of extensive illumination
- the performance of the NVIS is degraded because of the extensive illumination
- the continued use of the NVIS is likely to affect operational safety
- the terrain and obstacles in the area can be visually identified and avoided.

4.1.5 If the conditions mentioned in paragraph 4.1.4 are met, then the PIC may do the following, but only if, and for as long as, the de-goggling enhances operational safety:

- de-goggle as an individual

  or
- permit all, or any, particular NVIS pilot or NVIS air crew member to de-goggle.

4.1.6 In considering the inclusion of this procedure in a NVIS operation the operator should:

- carry out detailed risk assessment and implement risk management strategies to mitigate the risk operating below LSALT at night whilst de-goggled
- determine and define what the operator considers as an "area of extensive illumination"
- determine and define how a pilot quantifies "performance of the NVIS is degraded"
- determine how a pilot will identify and avoid terrain and other obstacles whilst de-goggled whilst below LSALT at night
- include the relevant procedures in the operator's exposition or operations manual (as applicable).

5 NVIS - general information

5.1 System description-night vision imaging systems (NVIS)

5.1.1 Night vision goggles (NVG)

5.1.1.1 NVG are head-worn (helmet or other approved mounting device), and consist of a binocular imaging assembly, a mounting interface, user controls, a power module and a low-power indicator. The binocular imaging assembly is attached to a head-borne platform (usually a flight helmet) via the mounting interface. Generally, the mounting interface allows the binocular to detach during adverse gravity (G) loading conditions. Controls enable the user to position the binocular for optimum line of sight, field of view and focus.

5.1.1.2 A battery power module provides sufficient electrical power for operation of the binocular and includes both primary and secondary sources. Each source is capable of independently operating the binocular for equal duration and may also include provisions to interface with an external power source. In this case, the power module supplies uninterrupted power to the binocular in the event of failure of the external power source. A low-power indicator signals the user to select the spare power module source when primary power is insufficient to operate the binocular. The low-power indicator is visible to the user.

5.1.1.3 The binocular consists of two independent channels, with each channel presenting collimated scene information directly to one eye. Filters designed to facilitate the compatibility of cockpit lighting are provided in each channel. Channels contain one (or more) objective lens(es), image intensifier tube(s) and eyepiece lens(es). Binoculars may include other optical components, including: combiners, prisms, beam-splitters, cameras, and displays.

5.1.1.4 In addition to scene information, binoculars may present injected head up display (HUD) information. Each channel contains one (or more) image intensifier tube(s). The image intensifier consists of a photo-cathode, micro-channel plate, phosphor screen and power supply. The power supply automatically adjusts gain for optimized performance. In some cases, the image intensifier power supply is remotely located with the image intensifier not susceptible to electromagnetic interference.

5.1.2 NVG Head Up Display (NVG HUD)

5.1.2.1 The NVG HUD provides critical, real-time, flight, navigation, and aircraft data in the field of view of the NVG. The NVG HUD enables the crew to obtain flight information while using NVG, minimising the requirement to look under the NVG. This further improves situational awareness and spatial orientation while reducing workload during NVIS operations.

5.1.3 NVIS capabilities - general

5.1.3.1 NVIS generally provides an image of the outside scene that is enhanced compared to that provided by the unaided, dark-adapted eye. However, NVIS may not provide an

image equal to that observed during daylight. Since the user has an enhanced visual capability, situational awareness is generally improved.

5.1.3.2 Forward looking infra-red (FLIR) devices, synthetic vision devices and aircraft head up displays (HUD) can also provide imagery and information useful during night operations. However, the scope of the CASRs and this NVIS AC concentrates on NVIS.

5.1.3.3 **Critical Elements** - The following critical elements are the underlying assumptions in the system description for NVIS:

- Aircraft internal and external lighting has been modified or initially designed to be compatible, and the NVIS have been properly maintained in accordance with the manufacturer approved data.
- Environmental conditions are adequate for the use of NVIS (e.g., sufficient illumination is present and favourable weather conditions).
- The NVIS has been properly maintained in accordance with the minimum operational performance standards.
- A proper check has been performed on the NVIS confirming operation in accordance with the continued airworthiness standards and training guidelines.
- The crews involved have been properly trained and meet recency and experience requirements.
- Organisations utilising NVIS have in place strategies to limit, as far as practical, any impairment to crews due to fatigue and other human factors.

5.1.3.4 Even when ensuring that these conditions are met, there remain variables that can adversely affect the safe and effective use of NVIS (e.g., flying towards a low angle moon, flying in a shadowed area, flying near extensive cultural lighting and flying over low contrast terrain). It is important to understand these limitations when considering the capabilities of NVIS.

5.1.3.5 The typical unaided eye with a daytime visual acuity of 20/20 may yield a night-time unaided visual acuity to 20/200 or worse. The improved resolution capability of later generation NVG may allow for a comparative visual acuity of 20/30 or better under optimal conditions.

5.1.4 Detection and identification of obstacles

5.1.4.1 An advantage of using NVIS is the enhanced ability to detect, identify, and avoid terrain and most obstacles that present a hazard to night operations. Correspondingly, NVIS assists in night navigation by allowing the aircrew to view waypoints and features.

5.1.4.2 Being able to visually locate and in some cases, identify objects or areas critical to operational success will also enhance operational effectiveness. NVIS also may allow crew members to readily detect other aircraft.

5.2 NVIS limitations

5.2.1 NVIS design characteristics

5.2.1.1 While there are certain limitations inherent in current NVIS design, the enhanced visual capabilities generally outweigh the disadvantages.

5.2.2 Visual acuity

5.2.2.1 Visual acuity with NVIS is less than normal daytime visual acuity, however visual acuity is greater using NVIS than otherwise under unaided night flight. However, it is reasonable to expect, given the scope of operation of these devices, that concentration of crews will be greater, giving rise to an earlier onset of fatigue.

5.2.3 Field of view

5.2.3.1 Field of View (FOV) in current NVG systems is approximately 40 degrees. This reduction can increase the likelihood of susceptibility to misperceptions and illusions. As such, proper scanning techniques must be employed to mitigate against this outcome.

Note: As the FOV is diminished compared to normal vision when using NVGs, it is likely that pilot workload will increase, thereby giving rise to work induced fatigue.

5.2.4 Field of regard

5.2.4.1 The NVG has a limited FOV but, because it is head-mounted, that FOV can be scanned when viewing the outside scene. The total area that the FOV can be scanned is called the field of regard (FOR). The FOR will vary depending on several factors: physiological limit of head movement, NVG design (e.g., protrusion of the binocular assembly, etc.) and cockpit design issues (e.g. proximity of canopy or window, seat location, canopy bow, etc.).

5.2.5 NVG weight and centre of gravity (CG)

5.2.5.1 The increased weight and forward CG projection of head supported devices may have detrimental effects on user performance due to neck muscle strain. Any physical stressors place on a flight crew member will give rise to the earlier onset of fatigue. There may be an increased risk of neck injury in the event of an accident.

5.2.6 Monochromatic image

5.2.6.1 The NVG image appears in shades of green or white, termed 'monochromatic'. Colour differences between components in a scene helps one discriminate between objects and aids in object recognition, depth perception and distance estimation. The lack of colour variation in the NVG image will degrade these capabilities to varying degrees.

5.2.7 Ambient or artificial light

5.2.7.1 The NVG requires some degree of light (energy) in order to function. Low light levels, non-compatible aircraft lighting and poor windshield/window light transmissivity, diminish the performance capability of the NVIS. The pilot-in-command is ultimate responsibility to determine when to transition from aided to unaided flight, due to unacceptable NVIS performance in accordance with the company operations manual.

5.2.8 Daytime use for NVIS

5.2.8.1 NVIS are intended to be used at night; are not designed for daytime use and are unlikely to aid a user in decreased daytime visibility conditions. Further, exposure to bright daylight sources for extended periods may damage or significantly reduce the life of the intensifier tube.

5.3 Scanning procedures

5.3.1 Scanning

5.3.1.1 When using NVIS there are three different scan patterns to consider and each is used for different reasons:

- instrument scan;
- aided scan outside; and
- unaided scan outside.

5.3.1.2 Normally, all three are integrated and there is a continuous transition from one to the other depending on the mission, environmental conditions, immediate tasking, flight altitude and many other variables. For example, scanning with the NVG will allow early detection of external lights. However, the bloom caused by the lights will mask the aircraft until fairly close or until the lighting scheme is changed. Once close to the aircraft, visual acquisition can possibly be made unaided or with the NVG. Whether to use the NVIS or unaided vision depends on many variables. A proper scan depends on the situation and variables present, and that scanning outside is critical when close to another aircraft. For a multi-crew environment, coordination of scan responsibilities is vital.

5.3.2 Instrument crosscheck scan

5.3.2.1 It is important to predict conditions under which an instrument crosscheck scan will be required. This should commence during planning when critical phases of flight can be identified and prepared for. For example, it may be possible when flying over water or featureless terrain to employ a good instrument crosscheck. However, the most important task is to make the appropriate decision during flight as conditions and events change. In any event, experience, training and constant attention to the situation are vital contributors to the operator assessment of the situation.

5.3.3 NVG scan

5.3.3.1 To counteract the limited field of view, crews should continually scan throughout the FOR to build a mental image of the surrounding environment. The rate at which the outside scene is scanned to update the mental image is determined by many variables. For example, when flying over flat terrain where the highest obstacle is below the flight path, the scan may be fairly slow. However, at low altitude in mountainous terrain, the scan should be more rapid due to the presence of more information and the increased risk.

5.3.3.2 How much of the FOR to scan is also determined by many variables. For example, if a crew is anticipating a turn, then more attention may be placed in the area around the turn point, or in the direction of the intended heading or track. In this situation, the scan will be limited briefly to only a portion of the FOR.

5.3.3.3 As with an instrument scan, it is important to anticipate and plan ahead. It may be possible to determine when the scan may be interrupted due to other tasks, or when it is possible to become fixated on a specific task, or when it is important to maximize the

outside scan. An important lesson regarding the NVG scan is when not to rely totally on visual information.

5.3.3.4 It is easy to overestimate how good a person can see with NVIS, especially on high illumination nights, and it is vital to maintain a constant awareness of personal limits. This should be continually emphasised during training and should be reinforced as an item when briefing NVIS flights. Distance estimation may be difficult when relying solely on NVIS, especially when remote cultural lighting is being viewed.

5.3.4 Unaided scan

5.3.4.1 Under certain conditions, unaided scan may be as important as aided scan. For example, it may be possible to detect distance and/or closure to another aircraft more easily using unaided vision, especially if the halo caused by external lights is masking aircraft detail on the NVIS image. Additionally, there are other times when unaided information can be used in lieu of or may augment NVIS and instrument information.

5.3.5 Scan patterns

5.3.5.1 Environmental factors may influence scan by limiting what may be seen in specific directions or by degrading the overall image. If the NVIS image is degraded, aircrew may scan more frequently in a subconscious attempt to obtain more information, or to avoid the chance of missing information that suddenly appears and/or disappears.

5.3.5.2 The operation itself may influence the scan pattern. Scanning for another aircraft, HLS, or aerodrome may require focusing the scan in a particular direction. In some cases, the operation may require aircrew in a multi-place aircraft to assign particular crew members responsibility for scanning of specific sectors.

5.3.5.3 The restrictions to scan and the variables affecting the scan pattern are not specific to night operations or the use of NVIS, but due to the NVIS limited field of view, the degree of impact is magnified.

5.4 Environmental considerations

5.4.1 Weather and atmospheric obscurants

5.4.1.1 Any atmospheric condition, which absorbs, scatters, or refracts illumination, either before or after it strikes terrain, may reduce the usable energy available to the NVIS.

5.4.2 Weather

5.4.2.1 During NVIS operations, users can see areas of moisture that are dense (cloud, thick fog), but may not see areas that are less dense (thin fog, light rain showers). The inability to see some areas of moisture may lead to hazardous flight conditions during NVIS operations and will be discussed separately in the next section.

5.4.2.2 The different types of moisture will have varying effects and it is important to understand these effects and how they apply to NVIS operations. For example:

- It is important to know when and where fog may form in the flying area. Typically, coastal, low-lying river, and mountainous areas are most susceptible.

- Light rain or mist may not be observed when conducting flights using NVIS, but will affect contrast, distance estimation, and depth perception. Heavy rain is more easily perceived due to large droplet size and energy attenuation.
- Snow occurs in a wide range of particle sizes, shapes, and densities. As with clouds, rain, and fog, the denser the airborne snow, the greater the effect on NVIS performance. On the ground, snow has mixed effect depending on terrain type and the illumination level. In mountainous terrain, snow may add contrast, especially if trees and rocks protrude through the snow. In flatter terrain, snow may cover high contrast areas, reducing them to areas of low contrast.
- On low illumination nights, snow may reflect the available energy more effectively than the terrain it covers and thus increase the level of illumination.

5.4.2.3 All atmospheric conditions reduce the illumination level to some degree and recognition can be difficult. Thus, a thorough weather briefing, familiarity with local weather patterns and an understanding of the effects on NVIS performance are important for successful flight.

5.4.3 Deteriorating weather

5.4.3.1 Crews should remain cognisant to changes in the weather when using NVIS. It is possible to 'see through' some areas of light moisture when using NVIS, thus increasing the risk of inadvertently entering instrument meteorological conditions (IMC). Some ways to assist reducing this possibility include:

- be attentive to changes in the NVIS image
  - halos may become larger and more diffuse due to diffraction of light in moisture
  - scintillation in the image may increase due to a lowering of the illumination level caused by the increased atmospheric moisture
  - loss of scene detail may be secondary to the lowering illumination caused by the changing moisture conditions;
- obtain a thorough weather brief with emphasis on NVIS effects
- be familiar with weather patterns in the area of operations
- occasionally scan the outside scene as the unaided eye may detect weather conditions that are not detectable to the NVIS.

5.4.3.2 In the event of inadvertent IMC penetration, crews should quickly resort to exposition / operations manual procedures to recover the aircraft.

5.4.4 Thunderstorms

5.4.4.1 Thunderstorms should be avoided by a safe distance to avoid the hazardous effects such as lighting, turbulence etc.

5.4.4.2 Distances from thunderstorms may be difficult to estimate visually when using NVIS. Consequently, operators should consider the fitment of airborne weather radar or other electronic detection devices to their aircraft. In addition, it should be noted that the NVIS image may be adversely affected by lightning flashes.

5.4.5 Airborne obscurants

5.4.5.1 Apart from weather, there may be other obscurants in the atmosphere that may block energy from reaching the NVIS, such as haze, dust, sand, or smoke. As with moisture, the size and concentration of the particles will determine the degree of impact. Examples of these effects include:

- high winds during the day can uplift considerable dust in the air that may still be present at night
- bush or forest fires produce heavy volumes of smoke that may cover areas well displaced from the fire source
- the effects of rotor wash may be more pronounced when using NVIS depending on the type of material, such as sand, snow or dust
- air pollution in and around major cultural areas and cities may have an adverse effect on NVIS performance.

5.4.6 Snow

5.4.6.1 Due to its reflective nature, snow presents crews with significant visual challenges during the en-route phase and in the area of operations / intended landing area. During the en-route phase of a flight, snow may cause distractions to the crew if any aircraft external lights (anti-collision beacons/strobes, position lights, landing lights) are not NVIS compatible. In the area of operations or landing area, the hazards associated with 'whiteout' landings using NVIS is not diminished and may be more disorienting due to lights reflecting from the billowing snow around the aircraft during the landing phase. Any emergency vehicle lighting or airport lighting in the landing area may exaggerate the effects.

5.4.7 Ice fog

5.4.7.1 Ice fog presents the pilot with hazards normally associated with IMC in addition to problems associated with snow operations. The highly reflective nature of ice fog will further aggravate any lighting problems. Ice fog conditions can be generated by aircraft operations under extremely cold temperatures and the right environmental conditions.

5.4.8 Icing

5.4.8.1 Airframe icing is difficult to detect while looking through a NVIS. Crews should develop a proper crosscheck to ensure airframe icing does not exceed operating limits. Crews should already be aware of icing indicator points on their aircraft.

5.4.9 Low ambient temperatures

5.4.9.1 Depending on the cockpit heating system, fogging of the NVIS may arise which could significantly reduce goggle effectiveness. There is potential for reduced battery duration associated with low temperatures which may require additional battery resources.

5.4.10 Illumination

5.4.10.1 NVIS require illumination, either natural or artificial, to produce an image. Although current NVIS technology has significantly improved low light-level performance, some illumination is required.

5.4.11 Natural illumination

5.4.11.1 The main sources of natural illumination include the moon and stars. Other sources can include sky glow, the Aurora Australis, and ionisation processes that take place in the upper atmosphere.

5.4.12 Moon phase

5.4.12.1 The moon provides the greatest source of natural illumination during the night. Moon phase and elevation determines the amount of moonlight which will be available, while moon rise and set times determine when it will be available. Lunar illumination is reported in terms of percent illumination; 100% illumination being full moon. It should be noted that this is different from the moon phase (25% illumination does not mean the same as a quarter moon). Percent lunar illumination may only be obtained from limited sources.

5.4.13 Lunar azimuth and elevation

5.4.13.1 The moon can have a detrimental effect on night operations depending on its relationship to the flight path. When the moon is on the same azimuth as the flight path and low enough to be within or near the NVIS FOV, the effect on NVIS performance will be similar to that caused by the sun on the unaided eye during the day. The brightness of the moon drives the NVIS gain down, thus reducing image detail. This can also occur with the moon at relatively high elevations. For example, it is possible to bring the moon near the NVIS FOV when climbing to cross a ridgeline or other obstacle, even when the moon is at a relatively high elevation. It is important to consider lunar azimuth and elevation during planning. Shadowing, another effect of lunar azimuth and elevation, is discussed separately.

5.4.14 Shadowing

5.4.14.1 Moonlight creates shadows during night-time just as sunlight creates shadows during daytime. However, night-time shadows contain very little energy for the NVIS to use in forming an image. Consequently, image quality within a shadow will be degraded relative to that obtained outside the shadowed area. Shadows can be beneficial or can be a disadvantage to operations depending on the situation.

5.4.15 Benefits of shadows

5.4.15.1 Shadows alert crews to subtle terrain features that may not otherwise be noted due to the reduced resolution in the NVIS image. This may be particularly important in areas where there is little contrast differentiation, such as flat featureless deserts, where large dry expanses and high sand dunes may go unnoticed in the absence of contrast. The contrast provided by shadows helps make the NVIS scene appear more natural.

5.4.16 Disadvantages due to shadows

5.4.16.1 Within a shadow area, terrain detail can be significantly degraded, with objects in or around shadowed areas subject to loss of terrain detail to NVIS users. During flight under adequate illumination, users expect to see a certain level of detail.

5.4.16.2 Flight into a shadow area while the operator is preoccupied with other matters (communication, radar), may result in possible loss in terrain detail which is immediately detected. A user may perceive the reduced detail is due to an increase in-flight altitude and begin a descent - even though at a low altitude. Consideration during mission planning to factors such as lunar azimuth and elevation, terrain type (mountainous, flat), and the location of items significant to operation success (ridgelines, pylons, targets, waypoints), will assist in predicting the location of shadows and potential adverse effects.

5.4.17 Sky glow

5.4.17.1 Sky glow is an effect caused by solar light and continues until the sun is approximately 18 degrees below the horizon. When viewing in the direction of sky glow there may be enough energy present to adversely affect the NVIS image.

5.4.17.2 For the middle latitudes the effect on NVIS performance may last up to an hour after official sunset. For more northern and southern latitudes the effect could be for extended periods of times during seasons when the sun does not travel far below the horizon. Unlike sky glow after sunset, sky glow associated with sunrise does not have an obvious effect on NVIS performance until close to official sunrise. The difference is due to the length of time the atmosphere is exposed to the sun’s irradiation, which causes ionisation that releases near infrared (IR) energy (low frequency radiation adjacent to the red hues in the visible spectrum). These effects should be taken into account during planning as they have most significance when looking west around sunset and may extend for a period of time.

5.4.18 Artificial illumination

5.4.18.1 The NVIS is sensitive to any source of energy in the visible and near infrared spectrums, and there are also many types of artificial illumination sources (flares, IR, searchlights, cultural lighting). As with any illumination source, these can have both positive and detrimental effects. For example, viewing a scene indirectly illuminated by a searchlight may enable the user to more clearly view the scene; conversely, viewing the same scene with the searchlight near or within the NVIS FOV will reduce the available visual cues. It is important to be familiar with the effects of cultural lighting in the area of operations to avoid adverse effects, but to be able to make use of the advantages. Also, it is important to know how to properly use artificial light sources (i.e., 'Nitesun', searchlights etc.). As artificial light sources may not always be available or dependable, this should be taken into consideration.

5.4.19 Terrain contrast

5.4.19.1 Contrast is one of the more important influences on the ability to correctly interpret the NVIS image, particularly in areas where there are few cultural features. Any terrain that contains varying albedos (forests, cultivated fields) will likely increase the level of

contrast in a NVIS image, thus enhancing detail. The more detail in the image, the more visual information aircrews have for manoeuvring and navigating. Low contrast terrain (flat featureless desert, snow-covered fields, water) contains few albedo variations, thus the NVIS image will contain fewer levels of contrast and less detail.

5.5 Use of white light during approach, hover, and departure

5.5.1 Appendix A, A.1.12 and Appendix B, B.1.1.10 of this multi-part AC provide guidance on operations manual content and flight procedures relating to the use of white light. This section concentrates on operator guidance for the fitment and use of white light and the impact of white light on HLS approach, hovering and departure.

5.5.2 Unlike military NVIS operations where the use of white light is limited due to the tactical nature of operations, civilian NVIS operations may extensively use white light for obstacle detection, landing area reconnaissance, the provision of a suitable hover reference during winching and external load operations and HLS departures.

5.5.3 CASR Part 133 and Part 138 require operators to conduct a risk assessment for all NVIS operations including the use of white light. The risk assessment should consider aircraft hazards during approach, HLS operations such as winching and during departure and climb out. The risk assessment should consider and include:

- type of searchlight fitted to the aircraft and suitability for the operating environment (high wattage searchlight/'Trakka' Beam/'Nitesun' etc.
- pilot ability to dim the searchlight in flight
- ability of the searchlight to detect high tension and standard powerlines
- location of the lights (pilot or co-pilot side) and ability of the pilot to manoeuvre the lights to illuminate either side of the aircraft
- switchology and ease of use of the light controls
- shadowing effects of additional equipment such as FLIR and/or downlink antenna and the impact of the shadowing on the pilot's ability to detect obstacles
- searchlight pitch limits during approach and departure
- engineering matters such as does the aircraft have a relevant STI or EO (wattage, focal beam adjustment, ability to be used near the ground and upper or lateral limit of effectiveness).

5.5.4 Operators are also required to carefully consider the use of white light during winch or external load operations. Pilots and aircrew members require significant white light illumination to establish a suitable/stable hover reference, maintain obstacle clearance and spatial awareness during the operation. Operators may also consider permitting the pilot to de-goggle if appropriate to maintain an unaided hover reference and to gain extra peripheral vision not available when conducted an (NVIS) aided hover. The light mix must be effective and enhance operational safety based on pilot judgement.

5.5.5 As a guide, operators may use or modify the following quantitative searchlight performance requirements:

- Searchlight clearly illuminates high voltage power lines from 500' AGL and low voltage power lines from 200' AGL (operator to consider moon illumination/angle/cloud cover).

5.5.6 Regardless of the methodology used, operators and pilots must ensure the fitted NVIS searchlight is fit for purpose and:

- is supported by an STC or EO
- provides adequate illumination to detect, identify and avoid obstacles during an NVIS flight or operation
- provides adequate illumination to conduct HLS-NVIS basic and standard operations in area devoid of cultural lights including, approach, hover and departure operations.
- provides an illuminated area that is not unreasonably impacted by shadowing caused by portions of the airframe or other fitted equipment based on pilot judgment
- the Human/machine interface (HMI) is effective and does not unreasonably increase the pilot workload or reduce operational safety based on pilot judgment
- supports the conduct of winch hover operations unaided by NVIS.

5.5.7 Operators must also consider the possibility of a NVIS failure during winch operations and establish a suitable unaided hover reference.

6 Equipment requirements

6.1 RADALT

6.1.1 The CASR Part 91 MOS section 26.79 and CASR Part 133 MOS section 11.64 outlines the minimum equipment requirements for an NVIS flight, including RADALT. The RADALT equipment requirement was developed considering EASA SPA.NVIS.110 (b).

6.1.2 The following guidance is provided for each of the MOS requirements:

"It must have a presentation that requires minimal interpretation for both an instantaneous impression of absolute height and rate of change of height"

Guidance material from EASA relating to this requirement states "A type display presentation may be, for example, a representation of a dial, ribbon or bar, but not a display that provides numbers only".

Whilst CASA accepts that modern after-market glass cockpits or digital RADALT only provide a digital number readout, operators must use their risk management processes to ensure that the pilot(s) can clearly interpret the digital readout (considering font size and other relevant matters) and identify the RADALT rate of change.

"It must be positioned to be instantly visible and discernible to each NVIS crew member from the person's station in the cockpit"

The above requirement codifies the need for the RADALT to be visible to all pilots and front seat air crew members. The requirement may include a separate RADALT for each NVIS front seat crew member or the positioning of the RADALT so that it is instantly visible and discernible to each crew member.

"It must have an integral audio and visual low height warning that operates at a height selectable by the pilot"

The requirement for an audio and visual height warning that operates at a height selectable by the pilot considers that the height selector is readably accessible to the pilot. Some glass cockpit systems have a complex method of selecting heights which may include scrolling through menu pages to change a RADALT height. Should such a system be fitted to the aircraft, the operator is required to risk manage the operation of the RADALT to ensure the pilot is able to change the selectable height effectively and easily.

"Has an audio warning system that: is unambiguous and readily cancellable"

Some RADALT audio warnings will continue once the selected height has been reached until cancelled, whilst other systems provide an audio on passing through the selected height and then automatically cancel. Both types meet this requirement however operators are required to ensure that they have procedures specifying the pilot actions on the activation of the audio warning.

Note: Actions may include simply acknowledging the height, i.e., pilot announces - "300 ft".

7 Human factors and physiological limitations

7.1 General

This section provides information and guidance on the minimum physiological and associated human factors that should be considered before the commencement of NVIS operations.

7.2 Situational awareness

7.2.1 Situational awareness is 'the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future.' (Endsley, 1998). Basically, good situational awareness is obtained by understanding what is happening around you, and how the situation will develop in the future.

7.2.2 Situational awareness may be diminished due to a number of human factors associated with NVIS operations, especially fatigue impairment of flight crews.

7.2.3 If situational awareness is diminished by these factors, strategies can be put in place to assist in mitigating the effects.

7.3 Crew resource management (CRM)

7.3.1 Due to the inherent limitations of NVIS operations, emphasis should be placed on good communication. This applies to both single-pilot and multiple-crew cockpit environments. NVIS flight particularly requires effective CRM between all crew members, not just aircrew.

7.3.2 Therefore, CRM procedures and training should include all crew on board. CRM procedures should be addressed in detail in the operations manual and covered as part of the briefing package.

7.3.3 Operators should produce specific NVIS CRM procedures (including standard crew duties and phrases) involving all aircrew in all phases of flight.

7.4 Threat and error management

7.4.1 Within Threat and Error Management (TEM), a threat is defined as 'an event or error that [is] outside the influence of the flight crew, increases operational complexity and requires crew attention and management if safety margins are to be maintained' (Merritt & Klinect, 2006).

7.4.2 Error is defined as 'a crew action or inaction that leads to a deviation from crew or organisational intentions or expectations' (Merritt & Klinect, 2006).

7.4.3 As such, TEM is aimed at helping flight crew manage threats and errors that may lead to an undesired aircraft state (the result of threats or errors that go unnoticed by flight crew), and also helping to manage the undesired aircraft state if and when it occurs.

7.4.4 Flight crews should be familiar with the TEM concept because it can help combat complacency and improve situational awareness. For this reason, training in TEM is recommended for all crews involved in NVIS operations.

7.5 Complacency and overconfidence

7.5.1 Compared to other types of flight operations, there may be an increased tendency by a crew member to overestimate the capabilities of the NVIS equipment and operational capabilities. This can potentially result in complacency and overconfidence in the equipment. Similar to other specialised flight operations, complacency and overconfidence may lead to an acceptance of situations that would not normally be permitted. For example, attention span and vigilance maybe reduced, important elements in a task series overlooked, and scanning patterns, which are essential for situational awareness, break down. Critical but routine tasks can often be skipped or overlooked.

7.5.2 Consequently, both operators and individual crew members should remain vigilant to the onset of any overconfidence and/or complacency during operations. This may be achieved by regular flight checks and refresher training and during flight operations by crew monitoring and CRM procedures that allow all crew members to query the actions of the pilot flying. Examples of such procedures include Threat and Error Management techniques such as the three-strike rule.

7.6 Depth perception and distance estimation

7.6.1 It is important for crews to be able to accurately employ both depth perception and distance estimation techniques. To accomplish this, NVIS users utilise both binocular and monocular vision.

7.7 Instrument lighting brightness considerations

7.7.1 When viewing the NVIS image, the brightness of the image will affect the amount of time taken to adapt to the brightness level of the instrument lighting, thereby affecting the time taken to interpret information provided by the instruments. For example, if the instrument lighting is at a bright level, the time taken to interpret information provided by the instruments may be instantaneous.

7.7.2 However, if the brightness of the lighting is set to a low level, several seconds may be required to interpret information, thus increasing the head down time and increasing the risk of spatial disorientation. It is important to ensure that instrument lighting is kept at a brightness level that makes it easy to rapidly interpret information. This will likely be a brighter level than that used during normal unaided night operations.

7.8 Dark adaptation time from NVIS to unaided operations

7.8.1 When viewing an NVIS image, both the eyes' rods and cones are being stimulated (mesopic vision), but the brightness of the image is reducing the effectiveness of rod cells. If the outside scene is bright (urban area, bright landing pad), both rods and cones will continue to be stimulated. In this case there will be no improvement in acuity over

time and the best acuity is essentially instantaneous. In some cases (rural area with scattered cultural lights), the outside scene will not be bright enough to stimulate the cones and some time will be required for the rods to fully adapt, possibly taking up to two minutes for the rods to fully adapt for the best acuity. If the outside scene is very dark (no cultural lights or moon), it may take up to five minutes to fully adapt to the outside scene after removing the NVIS.

7.8.2 The preceding are general guidelines and the time to fully adapt to the outside scene on removing NVIS depends on many variables; the length of time NVIS have been used, whether or not the crew member was dark adapted prior to flight, the brightness of the outside scene, the brightness of cockpit lighting, and variability in visual function among the population. It is important to understand the concept and note the time requirements for any given operation.

7.9 Monochromatic adaptation

7.9.1 Upon re-entering a high ambient light environment, after wearing the NVIS for an extended period of time, the operator may experience a brownish tint or discolouration of objects viewed with the unaided eye. This is a normal physiological phenomenon; it causes no discomfort and it will disappear after a few minutes.

7.10 Fatigue management

7.10.1 Human biological limitations that are prevalent during the hours of darkness, along with the limitations associated with NVIS, may have an impact on the level of risk associated with an NVIS operation. Some of these limitations are the effects of fatigue, stress, eyestrain, and working when crews are biologically predisposed to sleep (circadian rhythm). Early onset of fatigue may be caused by increased helmet weight or NVIS mounting device, scanning techniques associated with NVIS operational use, or various ergonomic factors that may have a direct influence on how the particular crew member works in the aircraft while wearing the NVIS.

7.10.2 These risks must be mitigated through proper training, recent experience, personal adaptation to night flying, prior sleep, risk treatment strategies, and crew rosters that recognise the propensity for sleep of individuals during the day.

7.10.3 CAO 48.1 flight and duty limitations remain unchanged when using NVIS, although rules outside of CAO 48.1 have the ability (if issued) to articulate additional restrictions.

7.10.4 Operators may find that as part of their risk management process, there is a need to be more restrictive than current flight and duty limitations require.

7.10.5 Various workload factors common to the use of NVIS by low experience crew members (less than 100 hours for NVIS pilots and less than 50 hours for NVIS aircrew members), may introduce the early onset of fatigue. Accordingly, operators should consider reducing flight limits for low experience NVIS crew or those lacking in recency.

7.10.6 Operators should give guidance via the exposition / operations manual, in limiting NVIS flight time per duty period for low NVIS experienced crew or single pilot operations for operations below 500 ft above terrain or obstacles. For example, it may be appropriate for activities where NVIS use only occurs in the arrival phase of flight to have a

limitation on sectors flown, or to limit the overall flight time for NVIS operations that occur wholly below LSALT. Notwithstanding any prescriptive limitations that an operator may impose, further flight time reductions must be considered should crews feel fatigue impaired or exhibit behavioural indications consistent with fatigue impairment.

7.11 Human factors / fatigue recommended training

7.11.1 The information below is suggested content for human factors training:

- a Human Factors Plan designed to address any human factors issues associated with NVIS flight that limits the performance of a flight crew member that might include:
  - ergonomic issues
  - interface/coordination issues
  - crew communication
  - fatigue
- HOFO / Safety Manager training consisting of how to:
  - investigate adverse events and determine contributing factors
  - determine and monitor the effectiveness of corrective action as necessary
- crew training consisting of how to:
  - effectively forward rotate a roster and minimise fatigue
  - assure alertness via the prior sleep wake rule
  - recognise behavioural patterns in-flight crew members due to increasing fatigue
  - manage sleep debt
  - manage sleep hygiene
  - assess physical and mental wellbeing with fatigue as a context
  - provide information regarding internal company reporting system.

8 Training and checking

8.1.1 High levels of NVIS proficiency, along with a well-balanced NVIS experience base, will assist in off-setting many of the visual performance degradations associated with night operations. NVIS experience is a result of proper training coupled with numerous NVIS operations. An experienced NVIS crew member is acutely aware of the NVIS operational envelope and its correlation to various operational effects, visual illusions and performance limitations.

8.1.2 This experience base is gained and maintained over time through a continual, holistic NVIS training programme which exposes the crews to NVIS operations conducted under various moon angles, percentage of available illumination, contrast levels, visibility levels, and varying degrees of cloud coverage. A crew member should be exposed to as many of these variations as practical during the initial NVIS qualification programme. Continued exposure during the NVIS recurrent training enhances the experience base.

8.1.3 Consequently, a robust training and checking programme should cater for the broad cross-section of operating exigencies. To ensure that the currency and competency of NVIS pilots and air crew members is maintained, an Operator is required to provide for one of the following:

- Part 119/133 Operator:
  - a training and checking system as outlined in regulation 119.170, including the initial / conversion training and recurrent proficiency required by the relevant Chapters of the Part 133 MOS
- Part 138 Operator:
  - a training and checking system as outlined by regulations 138.125 (section 4.02 of the Part 138 MOS), 138.130 and 138.135, including the initial / conversion training and recurrent proficiency required by the relevant Chapters of the Part 138 MOS
- Part 141 Operator:
  - maintenance of NVIS Instructor competence
- Part 142 Operator:
  - a training and checking system as outlined by Subpart 142.J.

8.1.4 The determination of recency for NVIS operational sequences such as winching, hover exit, etc, will also need to be considered and incorporated as part of the ongoing training and checking requirements.

8.1.5 Nothing prohibits the operator placing additional requirements and increasing the minimum checking cycles in line with their particular operation or safety and risk management systems. Indeed, CASA actively encourages operators to consider this in their operations – particularly during the start-up phases of NVIS operations, or where the organisation has little or no experience with the technology.

8.1.6 See Appendix D for detailed information on air crew member training and checking.

9 Exposition / operations manual content

9.1.1 Appendix A contains an outline of recommended exposition / operations manual content for a certificate holder conducting NVIS flights.

9.1.2 Appendix B contains a greater level of detail regarding the flight procedures elements of an exposition / operations manual.

9.1.3 Appendix C contains the recommended content for an NVIS pre-flight briefing.

10 Acknowledgements

10.1 RTCA

10.1.1 This AC contains extracts from certain copyright documents of RTCA. Use of these extracts is made with the written permission of RTCA.

10.1.2 The complete RTCA documents may be purchased from RTCA, using the following contact information:

RTCA
1150 18th NW
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Fax 202-833-9434
www.rtca.org

10.1.3 The paragraph references and the extract descriptions are as follows:

- Design Considerations - RTCA DO268 - 'Concept of Operations - Night Vision Imaging System for Civil Operators' - 2.1- Design Considerations, Page 34.
- Compatible - RTCA DO295 - 'Civil Operators Training Guidelines for Integrated Night Vision Imaging System Equipment' - 2.2 - Compatible, Page 34.
- Instrument Lighting Brightness Considerations - RTCA DO268 'Concept of Operations - Night Vision Imaging System for Civil Operators' 2.3 Page 35.

Appendix A

Exposition / operations manual content

A.1 Recommended exposition / operations manual content

A.1.1 Overview

Prior to 2 December 2021, CAO 82.6 Appendix 2 contained a framework of content relating to NVIS operations that an NVIS operator was required to contain within their operations manual.

With the transition of the NVIS to the relevant MOS's, the operations manual content has transitioned to this appendix as guidance material. Whilst this content is not specifically legally mandatory, it provides a solid basis for the construct of NVIS procedures for an exposition or operations manual.

A.1.2 Organisation chart

An organisation chart which clearly indicates the following:

- the key NVIS-related positions and position-holders responsible for the operator's NVIS operations

  Note: This would include, for example, the safety manager (however described), the NVIS senior pilot, and the NVIS training and checking pilot.

- the lines of accountability and responsibility of these position holders:
  - to the more senior people to whom they are accountable; and
  - to the more junior people for whom they are responsible.

A.1.3 Competency and procedures

Ongoing training programs for all NVIS flight crew members ensuring that the requirements of CASR Parts 61, 119, 133, 138, 141 and 142 (as applicable) are met.

Qualifications for the pre-flight and post-flight inspection procedures and standards that are to be used by the flight crew to establish whether the relevant NVIS, including all NVIS components, are serviceable for use before and after a flight.

Procedures to be followed for introducing new aircraft or personal equipment to ensure compatibility with the NVIS standards and environment.

Procedures to be followed when introducing new crew, passengers or patients and their equipment and baggage to the NVIS operational environment to ensure NVIS operational environment compatibility.

A.1.4 Airworthiness and maintenance of night vision equipment and aircraft

Aircraft and NVIS pre-flight and post-flight procedures including:

- equipment checks; and
- procedures, including aircraft and NVIS equipment, inspection criteria; and
- storage; and
- quarantine; and
- logging of defects.

Manufacturer's inspection criteria to be kept in the company technical library with copies accessible for ready reference to all NVIS crew.

MEL related to lighting systems.

Mounting system requirements for handling by pilots and other crew members.

Stowage and use procedures for crew members not using head mounted attachments.

Procedures that ensure NVIS operations are only conducted in a helicopter that is equipped and maintained for NVFR or IFR.

Manufacturer's requirements for the maintenance and modification of aircrew flying helmets for NVIS use.

A.1.5 NVIS flight operations

Operational procedures and risk management plans (including fatigue awareness and management) for all intended NVIS flight profiles including over water and shipboard operations.

See Appendix B for detailed recommendations for flight procedures.

A.1.6 Post-NVIS endorsement requirements

Post-NVIS endorsement experience required before a person may be a pilot in command.

Operators must be conscious of the training requirement for a pilot with a basic CASR Part 61 NVIS rating and the training needs analysis to qualify for specialist NVIS operations. An example being a qualified SAR pilot that conducts an initial NVIS rating, would not be qualified post course to commence NVIS SAR operations.

The operator in this example would need to develop a course of training that would cover NVIS low level flight, winch operations, raft dropping, over water flight, HUET considerations with the wearing of the NVIS etc. It is highly recommended that a period of ICUS also be conducted as risk managed by the operator. Finally, a check to line to ensure the pilot is competent to conduct SAR operations on NVIS.

Other specialist operations requiring a course of training would include but not limited to:

- Medical transport operations
- Police operations
- Fire mapping
- Firebombing
- Incendiary dropping
- Marine pilot transfer
- Department of Defence support.

A.1.7 NVIS Firebombing

For NVIS firebombing, the specialist course of training was originally contained within Temporary Management Instruction (TMI) 2017-01. This TMI was removed on 2 December 2021 and the standards for NVIS firebombing transitioned to CASR Part 138 MOS.

The specialist course of training was a suggested training syllabus that may be adopted or modified by the Operator and should be designed to develop competency in the following matters:

a. Assessing the risks of NVIS helicopter firebombing operations, including the risks arising from:
    i. The effects of excessive light created by a fire, on the performance of the NVIS.
    ii. Inadvertent entry into IMC caused by, for example, smoke or cloud.
    iii. Turbulence.
    iv. The environment of a fire, for example the area of operations, the weather, the terrain and the smoke.
    v. Fatigue.
    vi. The aircrafts performance.
    vii. Potential aircraft emergencies.
b. The planning and procedures required to deal with the risk of the operation.
c. NVIS helicopter water collection and firebombing techniques taking into account the nature of the operation and the environment.
d. Communicating and interacting effectively with observers and fire authorities who are in the air or on the ground.
e. Communicating and interacting effectively with other aircraft that may be operating in the area of the fire.
f. Emergency procedures for NVIS helicopter firebombing, including emergencies arising from any failure or malfunction to the belly tank.

Upon completion of the training the pilot should be required to complete 20 hours of ICUS / dual or co-pilot flight time on NVIS conducting NVIS helicopter firebombing before flying as PIC.

A.1.8 Equipment

Equipment to be carried and used on NVIS flights or operations and associated limitations and serviceability.

A.1.9 NVIS flight crew composition, roles and responsibilities

Minimum NVIS crew composition, qualifications, and experience requirements for each intended NVIS flight profile.

Crew stations, duties and responsibilities for all crew in all phases of NVIS flight.

Procedures, crew duties and crew co-ordination for transition between flight under the I.F.R. and flight under the NVFR.

Logging of NVIS flight time.

A.1.10 Weather and environment

Minimum weather conditions and alternate aerodrome requirements at departure, enroute and at the destination or area of operations.

Thunderstorm avoidance instructions.

Guidance material on other operational environment conditions that may affect NVIS flight, including smoke, snow and dust haze, atmospheric moisture, predicted moon data, for example, moon rise and set times, elevation, ambient illumination, and similar matters.

A.1.11 Dissimilar NVIS

Where dissimilar NVIS are to be used:

- a hierarchical list of the various NVIS in terms of level; and
- a statement advising the pilot in command to wear the highest level of NVIS.

A specific risk management plan for resolving any human factor or risk issues resulting from the differences between the dissimilar NVIS.

A.1.12 NVIS flight

Pre-flight preparation, briefing, procedures and documentation. See Appendix C for recommended pre-flight briefing content.

Minimum NVIS flight altitudes and requirements and limitations on flight below LSALT if such flight is permitted.

Crew goggle up and de-goggle procedures and the procedures to ensure the delineation of aided and unaided flight.

Procedures for the use of aircraft landing lights and searchlights when below LSALT for descent, approach, landing or take off, including procedures for wire and obstacle detection and avoidance using white light (for example from a steerable searchlight or ‘Nitesun’/’Trakka’ beam.

Restrictions on close proximity and formation NVIS flights.

Advice and guidance on the fatigue issues of NVIS operations and the physiological stressors of NVIS operations.

Flight and duty times.

Guidance for NVIS operations over low contrast terrain.

Limitations and requirements for the carriage of passengers if applicable.

A.1.13 HLS operations

Register for HLS-NVIS standard operations and HLS-NVIS basic operations.

HLS procedures for HLS-NVIS basic and HLS-NVIS standard operations.

A.1.14 Phraseology

Phraseology for all phases of NVIS flight and contain phraseology for:

- informing or advising of terrain or other obstructions when operating below LSALT; and
- NVIS aircrew members providing “the con” for the flying pilot, i.e., verbal corrections to rates of closure, movement, climbs and descents and verbal means of creating accurate mental pictures of the obstacle environment; and
- transition between flight under the I.F.R. and flight under the NVFR; and
- ensuring scan sector observation responsibility; and
- informing crew of emergency situations; and
- NVIS single tube failure and double tube failure and for selection of backup power; and
- informing or advising of obstacles or terrain, or of hazards such as whiteout, brown out, wires or other obstructions;

- flight into deteriorating in-flight visibility situations or loss of visual reference (including brownout or whiteout) and
- for multiple-crew NVIS operations - for “eyes in” and “eyes out” of the cockpit or the aircraft, including to ensure that at all times when the aircraft is below LSALT at least 1 crew member is conducting an NVIS scan outside the front of the aircraft.

A.1.15 Single crew operations

For single crew NVIS operations, procedures to remind a single crew member to maintain a vigilant scan outside the helicopter.

A.1.16 Emergency procedures

Procedures, crew duties and crew co-ordination in the event of the following:

- in-flight serviceability issues of NVIS equipment including:
  - single tube failure; and
  - double tube failure (unit failure); and
  - equipment malfunctions (for example, causing “chicken wire”)
- NVIS flight into deteriorating weather and visibility or complete loss of visibility conditions (including brownout or whiteout) including:
  - when visibility is inadvertently lost on departure from, or arrival at, or over, a HLS; and
  - when in-flight “turn back” procedures, precautionary landings or reversion to unaided flight and flight rules are needed
- recovery to V.M.C. flight after inadvertent I.M.C. penetration
- aircraft malfunctions and emergencies
- white light failure requiring a no-light approach to landing.

A.1.17 Procedures for incendiary dropping and fire mapping

Procedures for the following:

- an incendiary dropping device
- the minimum NVIS pilot and NVIS aircrew member qualifications and experience required for NVIS operations involving incendiary dropping or fire mapping
- procedures, crew duties and crew coordination for the following matters:
  - the in-flight functioning and serviceability of the incendiary dropping device, including in relation to:
    - failure or malfunction of the device, or of equipment on which the device is dependent for effective operation
    - fire in the device or that equipment
    - fire in the helicopter
  - the duties of the following:
    - each NVIS aircrew member
    - each incendiary dropping device operator
    - each person carried to map, locate or observe fires.

Appendix B

NVIS flight procedures

B.1 General

B.1.1 This Appendix contains general information relating to NVIS operations

B.1.1.1 Flight below minimum height for VFR flights at night

The Part 91, 133 and 138 MOS's make provision for flight below the NVFR minimum height under circumstances other than those permitted by regulation 91.277, but only if operationally necessary.

The exposition / operations manual should establish the conditions, situations and associated procedures for when NVIS operations below the minimum height may be carried out. Such low altitude flights should be limited to manoeuvring that is operationally necessary in the vicinity of the intended landing or area for the operation.

B.1.1.2 Flight below minimum height for IFR flights at night

The Part 91, 133 and 138 MOS's make provision for flight below the IFR minimum height under circumstances other than those permitted by regulation 91.305, but only if operationally necessary.

The exposition / operations manual should establish the conditions, situations and associated procedures for carrying out NVIS operations below the minimum height. Such low altitude flights should be limited to manoeuvring that is operationally necessary in the vicinity of the intended landing or the area for the operation.

B.1.1.3 VMC for NVIS

Item 2A of Table 2.07(3) of the Part 91 MOS makes provision for NVIS flight in Class C airspace at a different distance from cloud than what is required by the non-NVIS VMC.

Subsection 2.07(3C) of the Part 91 MOS provides that CASA may grant an approval for a reduction in inflight visibility (see section 4.2.4 of this AC for further information).

B.1.1.4 Logging of NVIS flight time

Regulation 61.080 of CASR provides a definition of *flight time* which is applicable to pilots.

It is recommended that NVIS crew member flight time be recorded in the individual crew members logbook under a discrete NVIS column.

Only flight time conducted when 'goggled-up' is to be recorded as NVIS flight time.

B.1.1.5 NVIS Air crew member - endorsements

It is recommended that logbook entries for air crew members specify whether the flight time was conducted as an NVIS air crew member or NVIS air crew member instructor.

B.1.1.6 Night Vision Imaging System (NVIS) Goggle and De-goggle Procedures

Airborne

It is recommended that the aircraft be at a safe height (generally above 500 ft AGL) prior to conducting the procedure. In accordance with the restrictions associated with de-goggling below the NVFR or IFR minimum heights in the Part 91, 133 and 138 MOS's, the procedure can only be initiated by the PIC.

It is recommended that the PIC commence the procedure by announcing the aircraft parameters (altitude, heading and airspeed), followed by 'crew goggle-up' or 'crew de-goggle' as required.

It is recommended that at any time only one member of the crew be conducting the procedure. Upon completing the procedure each crew member should announce their crew position and the term 'goggled-up' or 'de-goggled' as required. This statement would then form the executive command for the next crew member to commence the procedure.

It is recommended that the aircraft parameters should remain unchanged until all crew members have completed the procedure.

On the Ground

It is recommended that a ground (i.e., not in the hover) 'goggle-up' and 'de-goggle' point be briefed prior to the flight and that the aircraft be stationary for the conduct of the procedure. For simplicity of procedure design, and consistency of competent performance by crew members, it is recommended that the procedure be the as the airborne procedure, after the PIC has announced 'crew goggle-up' or 'crew de-goggle'.

It is recommended that operators avoid landing or taking off on rotorcraft trolleys whilst ‘goggled-up’.

B.1.1.7 Emergency Situations

The exact characteristics of an emergency will determine whether the use of NVIS improves situational awareness and helps moderate crew workload. For example, during an emergency that requires an immediate landing, NVIS may provide the crew with a means of locating a suitable landing area to carry out a safe landing.

The operator and the pilot-in-command should determine if the use of NVIS during certain emergency situations is appropriate. In some situations, it may be advantageous for the crew members to remove the NVIS during the performance of an emergency procedure.

In any event, such detail is highly recommended to be included in the operator's exposition / operations manual.

Loss of Visual Reference During NVIS Take-off and Landing

Emergency procedures for loss of visual reference (brownout/whiteout) are to be published in the operator's exposition / operations manual. It is highly recommended that the procedures include a restricted visibility vertical instrument take-off and transition to forward flight, known as a Restricted Instrument Flight Take-off (RIFTO).

The procedures need to compensate for the possibility of visibility being inadvertently lost on departure or arrival to an unsealed helicopter landing area, thereby increasing the chance of the helicopter striking obstacles.

If any crew member situated in the cockpit loses visual reference, then they should advise the flying pilot immediately. The flying pilot should then determine the most appropriate course of action, i.e., land immediately, or proceed with normal approach/departure (flying pilot may have visual reference), or conduct the RIFTO procedure with the non-flying crew member providing regular/cyclical advice regarding:

- aircraft attitude

- aircraft rate of climb
- aircraft power
- when external visual reference is regained
- aircraft position ref the ground and/or obstacles.

When the non-flying crew member calls 'visual', the flying pilot should look up and regain visual reference before transitioning to forward flight. Prior to operations being conducted to/from an unsealed helicopter landing site, the PIC should ensure aircraft performance that allows a positive vertical rate of climb sufficient to expeditiously climb away from any obstacles to be maintained in the event of the RIFTO procedure being utilised. The RIFTO procedure should be reviewed by crew members prior to each NVIS flight when the aircraft will be operated to or from un-sealed landing areas.

Inadvertent IMC

Despite careful preparation, the potential for inadvertent IMC penetration exists. It is important that crews are able to recognise subtle changes to the NVIS image that occur prior to entry into instrument meteorological conditions (IMC). These include:

- onset of scintillation
- loss of scene detail
- changes in the appearance of halo.

The decision to delay taking avoiding action in deteriorating conditions may reduce safety margins, particularly if at lower altitudes.

B.1.1.8 Risk Assessment

It is unlikely that operators considering NVIS operations and/or associated training will be able to design adequate procedures without carrying out a risk assessment prior to the commencement of operations or training. The risk assessment would identify the risks with that require treatment and this information is recommended to be collated in a risk register accessible to all crew members.

For each flight, flight crew members are recommended to specifically review the characteristics of each flight to enable the identification of the hazards that are most likely to occur during the specific circumstances of the flight, and to establish whether the documented treatments / mitigators will adequately control the risks and hazards. If an operation falls outside of the operators documented risk profile, the operator should provide guidance for the crew to further manage the risk.

As an example of an exposition / operations manual procedure, the operator may require the operating crew to discuss the situation, consider further control measures, and seek further advice from the HOFO and/or other management. In some situations, where the risks cannot be adequately controlled or mitigated, the crew may consider cancelling a flight.

Operators should ensure that all hazards identified during a risk assessment are reduced As Low As Reasonably Practicable (ALARP). There are numerous sources providing risk assessment process and models to assist in carrying out an assessment. The following resources may be of assistance:

- Australian / New Zealand Standard, Risk management -Principles and Guidelines AS/NZS ISO 31000:2009
- CASA Safety management system resource kit.

B.1.1.9 Overwater Operations

Overwater operations to small offshore islands, ships, decks or offshore platforms are most likely to be conducted in a low contrast environment, which is generally not conducive to NVIS adequately controlling the risks associated with flight outside of the Part 91 minimum height rules.

The suitability of NVIS use for these overwater operations, particularly those below 500 ft above the surface, should not be carried out unless all aspects have been carefully considered and detailed procedures included in the exposition / operations manual.

If contemplating such operations, the following additional issues should be included for consideration, but not limited to:

- sea state and wind velocity/direction
- the ability of the crew to maintain continuous visual contact using NVIS with land or a shoreline, including any illumination levels and potential hover references
- any specific training and checking requirements above that required for overland NVIS operations
- if there is sufficient water surface disturbance and/or surface objects, which may provide adequate visual surface contrast to ensure continuous and sufficient visual cues to maintain depth perception, which may assist the crew in maintaining an accurate and safe height
- whether the crew are trained for, and use, a height hold function coupled to a serviceable autopilot/stabilisation equipment
- whether the crew are trained for and use an automatic auto hover function coupled to serviceable autopilot/stabilisation equipment.

B.1.1.10 Flight Planning and Flight Conduct

This section provides additional information and guidance on planning issues that should be considered for NVIS flights.

Departure/en-route/destination weather - The latest terminal and area forecasts should be obtained and analysed with particular emphasis on temperature/dew point spread, cloud cover and visibility, sunset, civil and nautical twilight, moon phase, moonrise and moonset, and anticipated illumination levels for all phases of flight.

Night VFR/IFR - NVIS are intended for use in visual meteorological conditions (VMC), as an adjunct to visual flight at night either under the NVFR or IFR. The exposition / operations manual procedures should be sufficiently robust to ensure that there is a clear delineation between flight under the IFR using NVIS below minimum height and flight under the NVFR using NVIS.

NVIS - should be confirmed serviceable and adjusted in accordance with the manufacturer's requirements. Documentation required by the NVIS manufacturer is to be maintained by the operator.

Aircraft - A pre-flight inspection should be conducted prior to an NVIS flight with emphasis on proper operation of the aircraft and associated equipment lighting. The aircraft windshield should also be clean and free of major defects which might degrade NVIS performance.

Instrument functional checks - Aircraft instrument functional checks are to be carried out prior to NVIS flight being conducted. Details of these checks should be specified in the exposition / operations manual.

Route planning - The operator and crew should assess factors that will affect the NVIS operation. A thorough route study of terrain, obstacle clearance, surface contrast, illumination levels, and reflectivity should be considered, as well as a review of applicable Notice to Airmen (NOTAM).

Low level planning considerations - Operators should be aware of the safety advantages of providing guidelines in relation to the reduction of airspeed commensurate with decreasing altitude (i.e., 'the lower you go the slower you go'),

Obstacles/power lines - Although night operations under VFR conditions may be flown unaided, use of NVIS should enhance the crew's ability to see and avoid obstacles, and other aircraft. While natural obstacles such as hills and mountains can be seen through the NVIS, some man-made obstacles such as towers can be difficult to acquire.

Power lines and wires can be extremely difficult to acquire visually until very close, and usually with insufficient time to take avoiding action. However, similar to day operations, visually acquiring the poles or pylons provides a cue that lines and wires are likely to be strung between the poles/pylons which may present a hazard to flight.

Pre–flight risk assessment - In addition to risk assessment requirements placed on an operator relating to the consideration of the NVIS operations, a risk assessment should be undertaken by the crew prior to each NVIS operation. The risk assessment should include as a minimum:

- illumination level
- weather
- crew recency and experience
- operator experience with NVIS operations
- crew vision
- crew general wellbeing (fitness to fly)
- windshield/window condition
- NVIS performance
- NVIS battery condition
- types of operations allowed and to be undertaken
- external lighting environment
- assessment of task duration and consideration given to reasonable alertness assured by the prior sleep wake rule.

Departure

Airspace - NVIS operations do not change the requirement to comply with applicable airspace requirements. Operators should include in the exposition / operations manual, procedures for

advising air traffic services (ATS) that NVIS operations are to be undertaken irrespective of any other requirements.

Other agencies - Operators should include in their exposition / operations manual, procedures for the use of NVIS when operating with other agencies that may have little understanding of NVIS and their limitations. This may include the extent of the use of bright and flashing lights which may degrade the NVIS image when aircraft using NVIS are in close vicinity. Such procedures may differ to a degree from unaided operations and could require additional training of and communication with other agencies.

Operations to a HLS-NVIS standard (see the definitions section of this AC) may be conducted during a NVIS flight or a NVIS operation.

Operations to HLS-NVIS basic may only be conducted only during a NVIS operation with 2 NVIS operating crew or by a single NVIS pilot providing the operator has the relevant CASA approval. Consideration should be given to employing additional personnel to scan the sides and rear areas of the helicopter due to limited field of view (FOV) and field of regard (FOR).

En-route

Elevated terrain - Safety should be enhanced by NVIS during operations near elevated terrain at night. The obscuration of elevated terrain is more easily detected with NVIS thereby allowing the crew to make alternate flight path decisions.

Arrival

Aerodrome and heliport landings - Usually there is sufficient light at an aerodrome so NVIS operations are not required. However, NVIS may be used depending on several variables: brightness level of the runway lights; width of the runway; presence of threshold lights; and proximity of brightly illuminated hangers. Whether or not to use NVIS for aerodrome or lit HLS operations depends on the effect of these variables and the effect on the quality of the image viewed through the NVIS.

Reconnaissance and landing at HLS - The reconnaissance phase should involve crew-coordinated use of NVIS and white lights, or an infra-red searchlight if fitted. The aircraft external white lights such as landing lights, searchlights, floodlights and infra-red searchlights, should be used during this phase of flight in accordance with the operator's procedures. The crew should select and evaluate approach and departure paths to the site considering wind velocity and direction, and obstacles or indications of obstacles. An approach without use of white light landing/searchlight or infrared searchlights may be undertaken in accordance with the operator's procedures and following crew assessment of the environmental and other operational conditions.

Sources of high illumination - Sources of direct high illumination have the potential to reduce the effectiveness of the NVIS. In addition, certain colour lights, such as red, will appear brighter, closer and may display large halos.

Appendix C

Night vision imaging systems/night vision goggles (NVIS/NVG) - Suggested pre-flight briefing checklist

Table 1: NVIS/NVG Suggested pre-flight briefing checklist for NVIS elements

Item	Subject	Considerations
1	Weather	• Cloud and visibility meet MOS minima for the particular NVIS operation
2	Operational issues	• NVG adjusted in accordance with manufacturer's instructions • NVG serviceability checks • personal equipment, including flashlights, lip/finger lights/spare batteries • known or expected hazards at the destination/area of operations and en-route, including terrain • recovery plan in the event of instrument meteorological conditions (IMC) penetration • destination alternate lighting requirements • other potentially conflicting traffic
3	Ambient Light	• moon rise/set/phase/position/elevation • % illumination for the duration of flight
4	Mission/Flight planning	• mission/flight plan profile • obstacles/ hazards/lowest safe altitude (LSALT)/minimum altitude to be flown • NVG procedures/phases of flight
5	Crew considerations	• NVG spare set if required
6	Aircraft	• aircraft serviceability for NVIS flight • aircraft configuration for the mission, including specialised equipment
7	Emergencies	• NVIS failure/malfunctions during flight above and below LSALT • inadvertent IMC penetration and recovery to VMC • RTB recovery or to alternate

Appendix D

Air crew member training

D.1 Introduction

The information contained within this Chapter was sourced from the previously mandatory requirements contained within the old CAO.

From 2 December 2021, Chapter 14 of the Part 133 MOS and Chapter 24 of the Part 138 MOS contain the requirements for air crew member training and ongoing proficiency.

The information in this Appendix constitutes an acceptable means of compliance (AMC) for a training system. As always, an AMC is not mandatory and operators are able to develop a different course of training, which would then be subject to CASA oversight through normal entry control processes (if renewing, or applying for a new, AOC, Part 141 certificate or aerial work certificate) or surveillance events.

D.2 NVIS air crew member training course

To meet the requirements of CASR Part 138 MOS Chapter 14 or CASR Part 138 MOS Chapter 24, Operators are to develop a NVIS air crew member training course which is designed to achieve at least the competency outcome described in subclause D.6.

At the end of the course, the trainee is to be able to perform the duties of an NVIS air crew member to safely and effectively assist an NVIS pilot to take off, fly and navigate enroute across country and descend, reconnoitre and land or hover to a HLS-NVIS basic devoid of HLS lighting or surrounding cultural lighting using NVIS.

Note: It is recognised that many operators will have a requirement for the air crew member to fulfil other duties outside the provision of basic scan sector observation, for example, aided winching, or advanced cockpit duties while aided. As these competencies are not covered by the stated training competency outcome above, those operators should add instructional sequences and flight time to these basic minimums to achieve those competencies.

D.3 NVIS air crew — ground training

NVIS air crew member training should include a NVIS ground theory training course of at least 6.5 hours followed by a written examination to certify competency.

NVIS ground theory subjects must, as a minimum, cover the following:

- applicable CASR, MOS, AC and operations manual contents that relate to NVIS regulations, limitations and flight operations
- NVIS system technical description, functions, limitations and maintenance, including normal, abnormal and emergency operations
- aeromedical and human factors considerations with NVIS, including limitations, spatial and vision illusions, eye adaptation, perception limitations, overconfidence, stressors and fatigue
- environmental considerations, including moon data, illumination, atmospherics, weather, shadow and moisture
- NVIS navigation and flight planning including terrain interpretation and obstacle avoidance
- crew co-ordination principles, procedures and phraseology for NVIS operations
- risk management awareness based on the latest ISO risk management standard.

Operators should include an advanced course of training for NVIS air crew member conducting complex NVIS operations such as Police operations, SAR, firebombing, incendiary dropping, fire mapping etc.

D.4 NVIS air crew member — NVIS flight training

NVIS flight training syllabus for NVIS air crew member qualifications is to be included in the Operators operations manual.

D.5 NVIS air crew member flight training — prerequisites

Before commencing NVIS training leading to the award of an operator specific NVIS qualification, the trainee air crew member should meet the following minimum qualifications and experience (or an equivalent level of experience):

- the experience, recency, and qualifications stipulated in the relevant operator's operations manual for day and night (unaided) operations for the relevant crew position and aircraft type
- the physical and medical standards stipulated by the operator's operations manual
- at least 50 hours flight time as an air crew member in a form that is acceptable to the operator as set out in the operator's operations manual
- the qualifications and certification required, in accordance with the operator's operations manual, for any advanced operational sequences, for example, winching, before undergoing NVIS training for that sequence.

D.6 NVIS air crew member flight training — requirements

NVIS flight training for the initial NVIS air crew member qualification should include at least 3 hours of NVIS flight time.

Flight training should:

- be conducted in at least 2 separate flights by an NVIS pilot qualified to conduct an NVIS CCF for an NVIS air crew member

  Note: See clause D.6 of this Appendix.

- expose the trainee to at least 1 flight in low illumination conditions, for example, with little or no moon in an area devoid of surrounding cultural lighting.

  Note: The requirement for separate flights is to emphasise the importance of the pre-flight planning and goggle adjustment phases.

Flight training may be conducted in an approved NVIS flight simulator.

Note: The competency assessment flight test is not training and may not be conducted in a flight simulator.

Flight training should include development of competency in at least the following subjects:

- preparation and use of internal and external aircraft lighting systems for NVIS flights and operations

- pre-flight preparation of NVIS and an understanding of planning considerations and appropriate route selection for NVIS flights and operations
- the rules, regulations and operations manual instructions relating to NVIS
- using NVIS to accurately recognise, identify, announce and provide verbal correction ("the con") to the pilot for drift, rates of climb and descent, obstacle avoidance and ground hazards, including dust or debris, during NVIS take-off and landing phases
- loss of visual reference procedures on take-off and landing
- if an NVIS aircrew member's operational role requires him, or her, to sit in the front seat of the aircraft and provide assistance to the pilot — assisting the pilot:
  - during procedures for flight into deteriorating in-flight visibility situations; and
  - during in-flight safe recovery to V.F.R. flight following simulated inadvertent entry to I.M.C.
- sound crew co-ordination
- procedures for wire and obstacle detection and avoidance using white light (for example, from a steerable searchlight or night sun).

D.7 NVIS air crew member training syllabus

The NVIS air crew member training should, as a minimum, cover the syllabus contained in the tables below. For operations where air crew members are required to occupy a control seat of a helicopter, directions within CASA EX84/21 and EX86/21 also apply to Part 133 operators and aerial work certificate holders respectively.

Table 1: NVIS fly air crew 1 and 2: NVIS operations

Time (hours)	Content
2.0 Note: Can be done in two one hour training sorties.	1. Assist mission planning and flight planning for the flight. 2. Determine the serviceability of NVIS equipment, including aircraft components. 3. Perform drills including NVG battery switch selection and goggle and de-goggle procedures. 4. Perform crew resource management appropriate to NVIS operations. 5. Perform air crew member duties for hover, taxi and transit procedures. 6. Perform air crew member duties for descent, reconnaissance, and circuit operations to and from unlit confined areas located in areas devoid of surrounding cultural lighting. 7. Perform wire and obstacle detection and avoidance procedures using white light (for example from a steerable searchlight or 'Nitesun'). 8. Perform NVIS practice malfunctions and emergency procedures. 9. Accurately recognise, identify, announce, and provide verbal correction (the con) to the pilot for drift, rates of climb or descent, obstacle avoidance, and ground hazards for example dust and debris. 10. Accurately con the aircraft during confined area manoeuvring, slope landings. 11. If an NVIS air crew member's operational role requires them to sit in the front seat of the aircraft and provide assistance to the pilot — assisting the pilot: a. during procedures for flight into deteriorating in-flight visibility situations; and b. during in-flight safe recovery to VMC flight after inadvertent entry to IMC; 12. Perform aircrew member duties during a selection of practice aircraft emergency

Time (hours)	Content
	procedures, under NVIS conditions, applicable to the aircraft type. 13. Perform post-flight shutdown and NVIS procedures.

Table 2: NVIS fly air crew 3: Flight test

Time (hours)	Content: **Note: The intent is that the unlit HLS operations should be conducted in areas devoid of significant cultural lighting.**
1.0	As a minimum, the trainee to demonstrate competency in: 1. Assisting the pilot in mission planning and flight planning; 2. Determining the serviceability of NVIS equipment, including aircraft components; 3. Performing cockpit drills including switch selection and goggle/de-goggle procedure; 4. Performing crew resource management appropriate to NVIS operations; 5. Performing NVIS practice malfunctions and emergency procedures; 6. Performing air crew member duties for descent, reconnaissance, and circuit operations to and from unlit confined areas located in areas devoid of surrounding cultural lighting; 7. Perform wire and obstacle detection and avoidance procedures using white light (for example from a steerable searchlight or 'Nitesun'). 8. Provide a timely and accurate con to the pilot for drift, rates of climb and descent, obstacle avoidance, and ground hazards including dust and debris. 9. If an NVIS air crew member's operational role requires them to sit in the front seat of the aircraft and provide assistance to the pilot — assisting the pilot: a. during procedures for flight into deteriorating in-flight visibility situations; and b. during in-flight safe recovery to VMC flight after inadvertent entry to IMC.

D.8 NVIS air crew member — flight testing

A flight test for the initial NVIS air crew member qualification should be conducted by an NVIS pilot or an air crew member Instructor qualified to conduct an NVIS flight test for an NVIS air crew member; and, as a minimum, the candidate must demonstrate competency in the following:

- assisting the pilot in mission planning and flight planning
- determining the serviceability of NVIS equipment, including aircraft components
- performing cockpit drills including switch selection and goggle/de-goggle procedure
- performing crew resource management appropriate to NVIS operations
- performing NVIS practice malfunctions and emergency procedures
- performing air crew member duties for descent, reconnaissance and circuit operations to HLS-NVIS basic located in areas devoid of HLS lighting or surrounding cultural lighting using NVIS
- providing a timely and accurate "con" to the pilot for drift, rates of climb and descent, obstacle avoidance and ground hazards, including dust and debris
- if an NVIS air crew member's operational role requires them to sit in the front seat of the aircraft and aid the pilot — assisting the pilot:

- during procedures for flight into deteriorating in-flight visibility situations
- during in-flight safe recovery to VFR flight following simulated inadvertent entry to IMC
- performing wire and obstacle detection and avoidance procedures using white light (for example, from a steerable searchlight or night sun).

D.8.1 Minimum recency requirements — NVIS air crew member

An NVIS aircrew member should meet the following minimum recency requirements or an NVIS proficiency check should be undertaken:

Table 4: Minimum NVIS air crew member recency requirements

	Front seat aircrew member	Rear cabin aircrew member
NVIS flight time	1 hour incorporating 3 take-offs, circuits and landings in the last 3 months or a NVIS Proficiency Check in the last 3 months.	Performing the duties of an NVIS air crew member, 2 hours in the last 6 months or a NVIS Proficiency Check in the last 6 months.
NVIS Proficiency Check	For an air crew member with LESS than 50 hours NVIS experience — 6 monthly, and after the first NVIS Proficiency Check each subsequent NVIS Proficiency Check may be conducted within 90 days before the recency would otherwise expire. For an air crew member with MORE than 50 hours NVIS experience —12 monthly, and after the first NVIS Proficiency Check, each subsequent NVIS Proficiency Check may be conducted within 90 days before the recency would otherwise expire.	Annually, after the first NVIS Proficiency Check, each subsequent NVIS Proficiency Check may be conducted within the 90 days before recency would otherwise expire.
For additional tasks or roles specific to a permitted NVIS operation	NVIS recency requirements in accordance with the operator's operations manual and acceptable to CASA.	NVIS recency requirements in accordance with the operator's operations manual and acceptable to CASA.

Notes:

1. For these recency requirements, the aircrew member must be using NVIS (i.e., goggled-up).
2. If an aircrew member alternates their operational role between front seat aircrew member and rear cabin aircrew member, they must meet front seat aircrew member recency requirements.

D.9 NVIS air crew member proficiency check

The requirements for an NVIS proficiency check may be met for an NVIS aircrew member by an initial endorsement of the NVIS aircrew member qualification or following qualification, a successful NVIS proficiency check.

An NVIS proficiency check for an NVIS air crew member should be conducted by an appropriately qualified and experienced person appointed within the training and checking system to conduct the NVIS proficiency check. The proficiency check should as a minimum:

Note: An NVIS pilot appointed by the operator to conduct an NVIS front seat air crew member proficiency check should be qualified and experienced in relation to those duties. Unless the NVIS pilot is qualified and experienced to conduct mission specific NVIS air crew member functions in the cabin of a helicopter (for example, winch, rappelling or conning of aircraft), the NVIS pilot is permitted to assess only those NVIS air crew member duties that were relevant to assisting the NVIS pilot.

a. involve an NVIS flight that is:
    i. representative of the operator's typical NVIS mission profile; and
    ii. in the nature of a check flight that establishes the NVIS aircrew member's competency; and
b. as a minimum, require the candidate to demonstrate competency in all of the following:
    i. NVIS unit failure for each of the crew members;
    ii. NVIS single tube failure for each of the crew members;
    iii. procedures for utilising backup power to the NVIS;
    iv. circuit operations to NVIS basic HLS located in areas devoid of HLS lighting or surrounding cultural lighting;
    v. procedures for loss of visual reference (for example, brownout or whiteout) when visibility is inadvertently lost on departure or arrival to, or over, a HLS;
    vi. if an NVIS air crew member's operational role requires him, or her, to sit in the front seat of the aircraft and provide assistance to the pilot — assisting the pilot:
        A. during procedures for flight into deteriorating in-flight visibility situations; and
        B. during in-flight safe recovery to V.M.C. flight after inadvertent entry to I.M.C.;
    vii. procedures for wire and obstacle detection and avoidance using white light (for example, from a steerable searchlight or night sun); and
c. otherwise be in accordance with the NVIS operator's operations manual.

D.10 Due date for NVIS Proficiency check

For an NVIS air crew member, recency is deemed to expire at the end of the last day of the month in which recency would otherwise expire but for this clause.