



Advisory Circular

AC91-13

Revision 1

20 June 2011

Night Vision Imaging Systems— Helicopter

General

Civil Aviation Authority Advisory Circulars contain information about standards, practices, and procedures that the Director has found to be an **Acceptable Means of Compliance (AMC)** with the associated rule.

An AMC is not intended to be the only means of compliance with a rule, and consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices, or procedures are found to be acceptable they will be added to the appropriate Advisory Circular.

An Advisory Circular may also include **Guidance Material (GM)** to facilitate compliance with the rule requirements. Guidance material must not be regarded as an acceptable means of compliance.

Purpose

This Advisory Circular provides guidance material and the acceptable means of compliance for helicopter operators and helicopter crew members and instructors involved with the conduct of a helicopter night VFR operation using a Night Vision Imaging System (NVIS).

Related Rules

This Advisory Circular relates specifically to helicopter operations conducted under Civil Aviation Rule Part 91, and Parts 119 and 135.

Change Notice

Revision 1 includes the following changes:

- The purpose and applicability of the Advisory Circular have been clarified
- Definitions have been updated and clarified, where appropriate, including deleting the definition of NVGO and replacing it with NVG flight operations.

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- Guidance material relating to the helicopter modification regarding the NVIS design, testing, approval and maintenance process has been amplified and clarified.
- Guidance material in relation to overwater operations has been added.
- The section dealing with training competency and currency has been rearranged to improve the general flow and layout of this information.

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Preamble

Night flying carried out under VFR requires the flight to be conducted by maintaining visual reference to the ground, and is often conducted into an area that is not well lit. This exposes the aircraft and crew to a significant risk of controlled flight into terrain (CFIT) or collision with other obstacles.

An increasing interest on the part of NZ civil operators to conduct night operations has brought a corresponding increased level of interest in employing night vision goggles (NVGs) as an aid in night VFR flight.

A FAA study best summarised the potential benefit of NVGs when it stated:

When properly used, NVGs can increase safety, enhance situational awareness, and reduce pilot workload and stress that are typically associated with night operations.

The CAA accepts that approved NVGs may be used as an aid to night VFR flight in a helicopter that is equipped with an approved night vision imaging system (NVIS) where the safety of the flight path does not depend solely upon the external view through the NVGs. NVGs are solely enhancement devices which are used as part of a functioning NVIS as an aid to enhance vision during visual meteorological conditions (VMC). The use of NVGs does not alter the requirement for minimum VFR conditions to be present if a VFR flight is to proceed. There are limitations on the capability of the NVIS and use of NVGs for operating at night under VFR and it is therefore incumbent on the operator to employ proper training methods and operational procedures to minimise these limitations to ensure a safe night VFR operation.

This AC provides helicopter operators and crew members with information on the acceptable technical standards for a NVIS and the associated aircraft installations, and with guidance information on the operator procedures, training programmes, pilot competency and currency requirements, and maintenance requirements to safely utilise NVGs during night VFR flight in helicopters.

The following documents are referred to in this AC:

- Radio Technical Commission for Aeronautics (RTCA) documents:
 - 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 Operators' Training Guidelines for Integrated Night Vision Imaging System Equipment.

The RTCA documents are available for purchase through the RTCA Internet website at www.rtca.org.

- Federal Aviation Administration (FAA) documents:
 - FAA AC 27-1B , Certification of Normal Category Rotorcraft, Miscellaneous Guidance (MG) MG 16, Certification Procedure for Rotorcraft Night Vision Imaging Systems (NVIS) Lighting Equipment.
 - FAA TSO-C164, Night Vision Goggles.

- FAR Part 61, Certification: Pilots, Flight Instructors, and Ground Instructors

The three RTCA documents provide the foundation for the introduction of NVG flight operations into the civilian aviation environment in the USA and Europe. The Director has accepted that they provide the necessary guidelines and acceptable means of compliance with the New Zealand Civil Aviation Rules for the safe introduction of NVG flight operations into the NZ civil aviation environment.

Introduction

This AC provides information about the standards, practices and procedures for the safe use of NVGs by pilots of NVIS equipped helicopters conducting night VFR operations.

Applicability

This AC applies to operators of NVIS equipped helicopters, pilots, NVIS crew members, and instructors engaged in helicopter night VFR operations using NVGs.

Definitions

Aided Flight: Aided flight is a VFR flight at night where the pilot of an aircraft uses night vision goggles (NVGs) in an operational position (referred to as being 'Goggled up') to maintain visual reference to the surface.

Field of Regard: Field of regard is the total area of the field of view that can be scanned by a person using NVGs.

Note: *(NVGs have a limited field of view of 40°, but because NVGs are head mounted, that field of view can be scanned when viewing the outside scene. The field of regard will vary depending on several factors: physiological limit of head movement, NVG design and cockpit design e.g. seat location, proximity of windscreen or window; door frames, etc.)*

Generation: Generation refers to the technological design of an image intensifier.

Note: *Generation I (Gen I) systems are large, heavy and poorly performing devices that are unsuitable for aviation use. Gen II devices represent a significant technological advancement and provide a system that can be head-mounted for use in ground vehicles. Gen III devices represent another significant technological advancement in image intensification, and provide a system that is designed for aviation use. Because of the variations in interpretations as to generation, NVGs are not referred by the generation designation in the RTCA documents.*

Look Under: Look Under is the ability of a pilot to look under or around the NVGs to view inside and outside the aircraft.

Night Vision Goggles (NVGs): NVGs are a head-mounted, lightweight, and self-contained binocular appliance that amplifies ambient light. NVGs are worn by crew members and are used to enhance the crew member's ability to maintain visual reference to the surface at night.

Night Vision Imaging System (NVIS): A Night Vision Imaging System is the integration of all the elements necessary to successfully and safely operate an aircraft with NVGs. The system includes as a minimum:

- Operational procedures
- Training, competency and currency requirements
- NVGs and associated equipment
- A NVIS lighting system and other associated aircraft components

- Continuing airworthiness requirements.

NVIS is also referred to as Aviator Night Vision Imaging System (ANVIS).

Note: A NVIS does not include

- (1) *an Enhanced Flight Vision System (EFVS) – (EFVS technologies use imaging sensors to see in front and along the flight path of aircraft to display an image of the external scene topography to the flight deck).; or*
- (2) *a Synthetic Vision System (SVS) – (SVS uses computer generated images of the external scene topography from the perspective of the flight deck, derived from aircraft attitude, high-precision navigation solutions, and databases of terrain obstacles and relevant cultural features to display a synthetic vision image of the external scene topography to the flight deck.)*

NVIS Compatible Lighting: Aircraft lighting with spectral wavelength, colour, luminance level and uniformity that has been modified or designed for use with NVGs and does not degrade or interfere with the image intensification performance of the NVGs beyond acceptable standards.

NVIS Flight Crew Member: A trained crew member who is required to perform essential in-flight duties to ensure safe operation of the aircraft during NVG flight operations.

NVG Flight Operation: A flight or operation during any part of which NVGs are used by flight crew member(s) to maintain visual reference to the surface in an aircraft which is NVIS equipped and approved for NVIS operations.

NVG Flight Time: The flight time gained by a flight crew member during a NVG flight operation.

NVIS Lighting System: An aircraft lighting system that has been modified or designed to incorporate NVIS lighting components, including NVIS compatible lighting.

Note: A NVIS lighting system must provide adequate illumination, under day and night conditions, of instruments, displays and controls for unaided night readability without degrading NVG performance beyond acceptable standards. Unaided in this context means looking at the instruments, illuminated by the NVIS lighting, from underneath, not through, the NVG.

Resolution: Resolution refers to the capability of the NVG to present a clear image of the separate and distinguishable components of a scene or object.

Unaided Flight: Unaided flight is a flight conducted without the use of NVGs, or a flight with NVGs in the non-operational position (referred to as ‘de-goggled’).

Unimproved landing area: Any site that is not an aerodrome, a heliport, or any other landing site authorised in the operations specifications of an air operator certificate holder.

Visual Acuity: Visual acuity is the relative ability of the human eye to resolve detail and interpret an image.

1.0—NVG Flight Operations

1.1 Operations under an air operator certificate

A holder of an air operator certificate who intends to conduct NVG flight operations using a helicopter must, in addition to complying with the equipment standards specified in section 2.0 of this AC:

- in accordance with rules 119.77 or 119.123, establish procedures for conducting NVG flight operations to ensure compliance with the requirements of Parts 91 and 135 for operating under VFR at night;
- in accordance with rule 119.165(a), amend their exposition –
 - to include those procedures for conducting NVG flight operations; and
 - as may be required by the Director in the interest of aviation safety for NVG flight operations.

Note: (to be acceptable to the Director, the procedures and the amendment to the exposition will need to address the items listed in Appendix I of this AC).

- be authorised in their Operations Specifications to conduct NVG flight operations in the helicopters that are equipped with an approved NVIS lighting system and authorised for use on NVG flight operations.

Note: (in accordance with section 2.4 of this AC, a helicopter will have a validation expiry date entered in the Operations Specifications for use on NVG flight operations.)

1.2 Operations not under an air operator certificate

An operator of a helicopter who intends to conduct NVG flight operations that are not conducted under the authority of an air operator certificate;

- must comply with equipment standards specified in section 2.0 of this AC; and
- in the interests of aviation safety, should implement operating procedures, crew member training and competency procedures, and maintenance procedures that are equivalent to those procedures and standards specified in this AC for the holder of an air operator certificate.

2.0—Equipment and Standards

2.1 Overall Standards

In accordance with the requirements of rules 91.501(2) and (3), rules 135(2) and (3), and rules 137.253(2) and (3), instruments and equipment installed in an aircraft must –

- (1) comply with applicable specifications and airworthiness design standards specified in the Rule Parts or with alternative specification and design standards approved by the Director; and
- (2) have been installed in accordance with the aircraft manufacturer's instructions or other equivalent instructions acceptable to the Director.

This AC provides the alternative specifications and design standards that are acceptable to the Director for the installation of NVIS in helicopters for use on NVG flight operations.

This AC adopts the FAA standards contained in FAA AC 27-1B and subsequent revisions except where a difference is required to allow for the practical implementation of NVG flight operations in the New Zealand civil aviation system. These differences are identified within this AC.

FAA AC 27-1B also incorporates by reference the operational performance standards contained in RTCA/DO-275.

Safety for a NVG flight operation is based on the following assumptions that are contained in FAA AC 27-1B, MG 16:

- Aircraft internal and external lighting is compatible in that it does not adversely affect the NVG image.
- Incompatible light, especially inside the aircraft, can significantly degrade the NVG image with corresponding loss of external cues.
- The NVIS has been properly maintained in accordance with the minimum operational performance standards or instructions for continued airworthiness (ICA).
- A pre-flight check has been performed on the NVIS confirming operation in accordance with the continued airworthiness standards and training guidelines.
- The pilot can maintain VFR flight unaided in event that NVG imagery is lost or degraded.
- Viewing imagery provided by NVGs will degrade one's depth perception and distance estimation.
- NVGs do not provide adequate imagery under all lighting, scene contrast, and atmospheric conditions.
- NVGs are not designed to be used for flight under IFR. However, it is possible to "see through" areas of light moisture when using NVGs, thus increasing the risk of inadvertently entering instrument meteorological conditions (IMC).

A NVG flight operation can be performed safely with proper equipment, operational procedures and training. These factors need to be taken into account during the design, installation, and testing of a NVIS in an aircraft.

Due to the inherent characteristics and the fundamental effect that NVGs have on visual perception and the inherent characteristics of NVIS technology, the installation of a NVIS in a helicopter to permit the use of NVGs is considered to be a 'major modification'.

2.2 Night Vision Goggles – Equipment Standards

NVG equipment intended for use on a helicopter NVG flight operation must meet, as a minimum, the performance standards detailed in FAA TSO-C164, or an equivalent standard that is acceptable to the Director.

Persons responsible for the supply and use of NVGs for use on NVG flight operations must ensure that each image intensifier tube used in a NVG is authorised for aviation use by means of an accompanying manufacturer's certification of the individual image intensifier tube. Image intensifier tubes which are marked "not for aviation use" or with other similar markings, and those

NVGs with a serial number that is listed as not suitable of aviation use by the manufacturer, must not be used for a NVG flight operation.

The standards and tests for the image intensifier tube element of NVG equipment are described in RTCA/DO-275, sections 1 and 2. These sections cover the design and testing to specification for the manufacturer (and the manufacturer's service centres) and such testing is normally beyond the scope of any operator of the appliance.

2.3 Modification/Certification Standards

A NVIS lighting system for a helicopter should be designed to comply with FAR 27, Airworthiness Standards for Normal Category Rotorcraft and FAA AC27-1B. The CAA modification approval process (Form CAA 337 – Design Change) is the means for showing that a modified helicopter lighting system complies with the airworthiness standard. The modification, testing, and qualification of a NVIS installation consists of three phases: the design and development (component modifications and tests, etc); ground tests; and flight tests.

The amount of testing necessary during each phase will vary depending on the amount of testing performed on previous phases. A thorough ground-testing programme should result in a successful flight test, thus reducing the need for extra flights. RTCA/DO-275, Appendix H provides guidelines for NVIS ground tests.

The modifications for the completed NVIS lighting system must contain all the necessary instructions for continued airworthiness. The instructions for continued airworthiness should be based on the manufacturer's recommendations and need to be prepared for inclusion in the maintenance programme for the aircraft.

The approved modification for a NVIS lighting system must include a Flight Manual supplement prepared in accordance with the template in Appendix VII of this AC rather than the template contained in FAA AC27-1B.

Note: If an operator is considering installing a modification for NVIS lighting that has a foreign supplemental type certificate (STC), it is important to first verify that installation of the STC is eligible for installation on the aircraft. There has been at least one instance in New Zealand where an operator purchased a foreign STC for NVIS lighting only to find that the data was not appropriate or directly applicable to the product, component or appliance. As a result the STC could not be used for a NVIS lighting modification.

2.4 Design/Tests and Inspections

Section 4 and Appendix E of RTCA DO 275 provide guidelines for installation performance, and testing integrated NVIS.

The operator must determine that the NVIS can perform the intended function after the installation of the equipment and that operation of the NVIS is not adversely affected by the operation of the aircraft or other installed equipment.

The modification approval process for the installation of the NVIS lighting system must include checks to determine that the NVIS does not interfere with other required equipment or the safe operation of the aircraft.

The installed performance of the NVIS to be used in conjunction with a particular NVIS lighting system must be able to be verified using the tests described in Section 4 of RTCA/DO-275.

A NVIS lighting system (internal and external) is considered compatible if the following conditions are met:

- the internal and external lighting does not adversely affect the operation of the NVGs during any phase of a NVG flight operation.
- the internal lighting provides adequate illumination of aircraft cockpit instruments, displays and controls for unaided flight and for 'look-under' viewing during aided flight.
- the external lighting assists other aircraft in the ability to see and avoid the NVIS equipped aircraft.
- modifications to the aircraft equipment do not adversely affect daylight readability.

NVIS/NVG compatibility and readability checklists are available from:

http://www.faa.gov/aircraft/air_cert/design_approvals/rotorcraft/nvis/

These checklists will be used by the CAA inspectors to verify the acceptable compatibility of a particular NVIS.

The operator should coordinate onsite testing of a NVIS to ensure that representatives from the contracted Design Organisation and the CAA are onsite at the same time when final compatibility and readability tests are carried out. This will help ensure that the testing process is completed efficiently and with minimal disruption to the operator.

For the holder of an air operator certificate, a NVIS compatibility verification expiry date will be shown on the Operations Specifications. This date will typically be set at 2 years from when the last compatibility testing or verification of the NVIS installation was done. To revalidate the aircraft for NVG flight operations for any further period, a CAA inspector will audit the modification prior to the verification expiry date. If changes to the original approved NVIS lighting system have been made, the CAA inspector may require further testing to verify continued acceptable compatibility of the aircraft's NVIS. When the CAA inspector is satisfied that the NVIS still meets the compatibility requirements, a new Operations Specifications will be issued.

Despite the 2 year verification expiry date, it is the responsibility of the operator to ensure that any change to the NVIS is approved and if a change is made, compatibility testing may be necessary to enable the appropriate person in a Part 146 aircraft design organisation to approve the change.

2.5 Maintenance

In accordance with rules 91.603 , 91.605, and 135.403 an operator of an aircraft must maintain the aircraft, including all installed equipment, in accordance with requirements of Parts 91 and 43 and in accordance with the manufacturer's recommendations, or a programme approved by the Director under rule 91.607, or rule 119.63 or 119.111.

The guidelines for maintenance and preparation of instructions for continued airworthiness for NVIS, as specified in RTCA DO-275 Section 5, are accepted by the Director as equivalents to the manufacturer's recommendations for the maintenance of NVIS, including NVGs. A NVIS maintenance programme under rules 91.607 or rule 119.63 or 119.111 must be consistent with these RTCA guidelines.

Note: NVGs are classified as an appliance and, as such, are subject to the general maintenance requirements of Part 91 and Parts 119, or 135.

Operators of NVIS equipped aircraft must take particular care to ensure that no unapproved change is made to the NVIS lighting system.

All NVGs used by NVIS pilots and crew members during NVG flight operations must be:

- maintained, stored and checked for serviceability prior to a NVG flight operation in accordance with RTCA DO-275 Appendix G, which provides guidelines for NVG pre-flight and adjustment procedures.
- maintained in accordance with the manufacturer's instructions for continued airworthiness and the approved maintenance programme. Apart from the NVG pre-flight and adjustment procedures, all NVGs used by NVIS pilots and crew members during flight operations need to be maintained by:
 - the manufacturer; or
 - an appropriately rated Part 145 maintenance organisation; or
 - an equivalent overseas maintenance organisation that has been endorsed by the manufacturer of the NVG as an appropriate organisation to carry out the maintenance.

The acceptable release documentation for this maintenance is a Form One or equivalent document.

2.6 Ancillary Equipment

An aircraft equipped with a NVIS needs to be also equipped with a radar altimeter, skid/slip indicator, gyroscopic attitude indicator, gyroscopic direction indicator or equivalent, and vertical speed indicator. This equipment needs to be positioned within the pilot's primary field of view to facilitate cockpit viewing with minimal head movement, thereby minimising the potential for spatial disorientation. It is recommended that the radar altimeter be equipped with an audio and/or visual warning device that can be triggered at a pilot selectable height.

All cockpit instruments and displays, must be capable of being viewed with unaided vision (look under) and not with NVGs.

3.0—Operational Procedures

In accordance with rule 119.77 and 119.123 an air operator certificate holder must establish procedures necessary to enable any requirement of the rules to be complied with. These include operational procedures for the types of operations being performed.

When establishing operational procedures for the use of NVIS, the procedures need to include the capabilities and limitations of the NVIS and personnel, as well as the constraints of the operating environment.

3.1 Personnel Considerations

3.1.1 Minimum Crew Members

Unless otherwise required by the aircraft flight manual, civil aviation rules, or procedures in the air operator's exposition, an aircraft performing a NVG flight operation needs to have at least one NVIS trained pilot who is competent to perform night operations using NVGs in the NVIS equipped aircraft. Differences between NVIS equipped aircraft types in the fleet need to be addressed by the operator.

Any other crew member required for the safe conduct of a NVG flight operation in accordance with the procedures in the air operator's exposition needs to be equipped with NVGs, intercom, and

have received the appropriate NVIS training for that same type of aircraft (a NVIS trained crew member may include a second NVIS trained pilot).

3.1.2 NVIS Crew Member

The safety of the operation should remain foremost for an operator performing a NVG flight operation. To ensure a safe outcome for a NVG flight operation, a second trained and NVG equipped crew member is needed for certain operations such as landing at an unimproved landing area.

Personnel who have essential in-flight duties to ensure the safe operation of the aircraft during a NVG flight operation are NVIS crew members for the purpose of the operation. In accordance with Subpart I of Part 135, the holder of an air operator certificate must ensure that each crew member is trained and competent to perform their assigned duties. The training programmes required under Subpart I must include any special equipment fitted in the aircraft for the intended operations. This must include NVIS if the operations include NVG flight operations. The records required to be maintained for each crew member must include any applicable details of NVIS training and NVIS competency assessment.

A NVIS crew member needs to—

- participate in crew briefings prior to each shift to:
 - become familiar with the general weather conditions;
 - confirm that NVIS equipment has been pre-flight checked;
 - know any restrictions to NVIS flight operations; and
- participate in crew briefings prior to a NVG flight operation to:
 - obtain a general knowledge of the weather conditions along the route of flight;
 - obtain a general knowledge about obstacles and significant terrain along the route of flight; and
- during a NVG flight operation—
 - use crew resource management principles to maintain crew situational awareness; and
 - maintain appropriate cockpit and aircraft lighting discipline.

Any additional person who is required for the safe operation of an aircraft during a NVG flight operation needs to wear approved NVGs and receive ground and flight training as detailed in the training guidelines in this AC.

3.1.3 Flight and Duty

An air operator's flight and duty scheme approved under Subpart K of Part 135 is considered adequate for NVG flight operations.

However, in accordance with the requirements of Subpart K, both the operator and the flight crew member must take into account the following potential fatigue effects associated with a NVG flight operation:

Physiological limitations that are prevalent during the hours of darkness and the limitations associated with NVGs may have a significant impact on a night vision goggle operation. Some of these limitations are the effects of fatigue (both acute and chronic), stress, eyestrain, working outside the individual's normal circadian rhythm envelope, increased helmet weight, aggressive scanning techniques associated with a NVIS, and cockpit ergonomics whilst wearing NVGs.

These limitations may be mitigated through proper training and recognition, experience, adaptation, rest, risk management, and proper crew rest/duty cycles.

3.2 Operating Limitations

3.2.1 Weather

The VFR meteorological limitations of rules 91.301 and 135.155 apply to all NVG flight operations. NVIS is a tool for assisting flights under current VFR rules to increase safety, enhance situational awareness and reduce pilot workload and stress. NVIS is not a tool to enable additional capabilities in marginal VMC.

3.2.2 Minimum Heights

Operating with a NVIS and using NVGs does NOT provide any exception to the minimum height requirements prescribed in rules 91.311, 135.85 and 135.93 for VFR flight.

3.2.3 Overwater Operations

Overwater operations and operations to small offshore islands, ships decks and offshore platforms, using NVIS below a height of 500 feet above the surface, are not to be carried out unless procedures covering these operations have been established in the operator's exposition and accepted by the Director. The procedures should address, at least, the following issues:

- Sea state and wind velocity:
- The ability of the crew to maintain continuous visual contact with the shoreline using NVG, including any illumination levels and potential hover references:
- Any specific training and checking requirements above that required for overland NVG flight operations:
- Availability of sufficient water/surface disturbance and/or surface objects which may provide adequate surface contrast to maintain depth perception which may assist the crew in maintaining a safe height:
- Whether the crew are trained to use any height hold function or automatic hover function coupled to the automatic pilot/stabilisation equipment.

3.2.4 Carriage of passengers during NVIS training

Only persons who are essential to the training operation may be carried during a NVIS crew training, qualification, or proficiency flight. Trainees may be carried on any other suitable NVIS flight operation.

3.2.5 Use of dissimilar NVG

Where dissimilar type/models of NVGs are used, the PIC must wear the highest performance and capability level (in terms of resolution, gain and acuity) of NVG. The operator must establish procedures for the use of dissimilar NVGs.

3.3 Operational Risk Management Procedures

As part of any safety management system for the operation of an aircraft, a risk assessment needs to be done before any NVG flight operation. The risk assessment needs to take into account at least the following:

- Illumination level of the flight environment.
- Forecast and reported weather conditions along the intended route and at the intended destination.
- Recency of experience for pilot and crew.
- Crew composition .
- Operator/crew experience with NVG flight operations.
- PIC field of regard.
- PIC/crew rest condition and health.
- Aircraft serviceability (MEL & Tech Log).
- Windshield/window condition.
- NVG tube performance, battery condition.
- Types of operation allowed and applicable standard operating procedures.
- External lighting environment.

4.0—NVIS Training, Competency and Currency

4.1 NVIS Training

NVIS instructor, pilot, and crew member training for operations under Part 135 must be part of the training programme required under Subpart I of Part 135 if the holder of the air operator certificate intends to conduct NVG flight operations.

NVIS instructor, pilot, and crew member training for NVG flight operations that are not conducted under the authority of a Part 119 air operator certificate need to be conducted by a training provider authorised in accordance with Part 141 or 119 to conduct the NVIS training.

NVIS Initial qualification training consists of an approved NVIS ground theory course, an approved NVIS flight training course, and an initial qualification check.

High levels of NVIS proficiency, along with a well-balanced NVIS experience base, will help to offset many of the visual performance degradations associated with night operations. NVIS experience stems from proper training coupled with numerous NVG flight operations. An experienced NVIS crew member should be acutely aware of the NVIS operational envelope and its correlation to various operational effects, visual illusions and performance limitations. This experience base is gained (and maintained) over time through a continual, all encompassing NVIS training programme which exposes the crew member to NVIS operations conducted under various moon angles, percentages of available illumination, contrast levels, and varying degrees of cloud coverage.

Continued exposure during the NVIS recurrent training will help strengthen and solidify this experience base. NVIS recurrent training needs to include a ground training and a flight training curriculum. Recurrent training needs to be conducted at least annually for NVIS pilots and crew members who should continue to serve in the same duty position in a specific make and model of aircraft during NVG flight operations.

4.2 NVIS Flight Instructor

In accordance with Part 61, a flight instructor with a valid night instruction certification must not instruct in the use of NVIS unless a Flight Examiner authorised for NVIS has certified in the instructor's logbook that the instructor has the necessary experience and has demonstrated competency to perform NVIS flight instruction.

4.2.1 NVIS Flight Instructor Prerequisites

To be acceptable as a NVIS flight instructor, a flight instructor needs to have the following qualifications and experience:

- hold a current Category A, B or D flight instructor rating for the appropriate category of aircraft:
- hold valid night instruction privileges endorsed in the pilot's logbook:
- have at least 50 hours flight instruction experience in the appropriate category of aircraft including at least 5 hours of night instruction:
- have successfully completed a NVIS flight instructor training course conducted in accordance with the NVIS flight instructor training syllabus detailed in Appendix IV by the holder of a Part 141 aviation training organisation certificate or a holder of a Part 119 air operator certificate if the certificate holder is authorised to conduct NVIS training; and
- have completed at least 40 hours NVG flight time experience and 100 NVG flight operations as the sole manipulator of the aircraft controls as pilot-in-command in the appropriate category of aircraft performing NVG flight operations.

4.2.2 NVIS Flight Instructor Certification

In accordance with Part 61, a flight instructor who meets the prerequisite requirements of paragraph 4.2.1 may have a Flight Examiner who is authorised for NVIS and who conducted the qualification check required by Appendix IV certify in the flight instructor's logbook that the flight instructor is authorised to give flight instruction at night using NVIS.

4.2.3 NVIS Flight Instructor Currency

A flight instructor needs to meet the recent flight experience requirements described in paragraph 4.3.4-*NVIS pilot currency* before giving flight instruction at night using NVIS.

4.3 NVIS Pilot

In accordance with Part 61, a holder of a pilot licence must not operate an aircraft under VFR at night, and in this case using NVIS, unless an appropriately authorised, including NVIS authorisation, flight instructor has certified in the pilot's logbook that the pilot has the necessary experience and demonstrated competency to perform VFR flight at night using NVIS.

4.3.1 NVIS Pilot Prerequisites

Prior to undergoing NVIS flight training, a pilot needs to meet the following prerequisites:

- hold at least a current Private Pilot Licence; and

- hold a current type rating for the aircraft to be used for NVIS flight operations; and
- hold a current night cross-country certification for night operations beyond 25nm of a lighted heliport or aerodrome; and
- have a minimum of 20 hours VFR night flight time experience including 10 hours as PIC of which 5 hours need to be VFR night cross-country; and
- demonstrate to an appropriately qualified flight instructor acceptable instrument flight proficiency by:
 - maintaining a nominated altitude within ± 100 feet, a nominated heading within $\pm 5^\circ$, in balance during straight and level flight and level turns; and
 - maintaining a rate one turn or a nominated angle of bank $\pm 10^\circ$ during all turning manoeuvres to within $\pm 10^\circ$ of pre-selected roll-out heading; and
 - maintaining a nominated climbing or descending speed within ± 5 knots. Level flight to be re-established at the pre-selected altitude \pm no more than 100 feet; and
 - performing an instrument recovery appropriate for the area of operations whilst maintaining the above manoeuvring limits; and
 - correctly identifying an aircraft unusual attitude and returns to straight and level references after a small delay, without entering a second unusual attitude while attempting to regain the references; and
- have at least 250 hours of flight time experience as PIC in the appropriate category of aircraft, of which no more than 50 hours can be in an approved flight simulator representative of the aircraft category that will be used for NVIS training.

Note: the emphasis is for a pilot flying night VFR utilising NVIS to obtain, and maintain, proficiency in instrument flying skills. It is recommended, but not essential for the pilot to hold an instrument rating. The holder of an instrument rating will be better placed to cope with the night VFR/NVIS environment.

The above prerequisite flight performance parameters are based on those required in AC61-5 for the issue of a CPL with night certification. The above prerequisites are therefore mandatory for CPL holders and the Director considers it necessary in the interests of aviation safety for PPL holders to meet the same minimum prerequisites as commercial pilots.

4.3.2 NVIS Pilot Training

For a pilot to be certified for night flying, as required under Part 61, using NVIS, the pilot needs to—

- complete an approved NVIS ground training course. Appendix II of this AC details the syllabus for the ground training course (for both pilots and crew members), which should be conducted by an aviation training organisation certificated in accordance with Part 141 or as part of a Part 119 air operator training programme if the aviation training organisation certificate or the air operator certificate authorises the holder to conduct NVIS ground training; and
- complete an approved NVIS Flight Training course for the same type of aircraft as the one intended for NVG flight operations, consisting of a minimum of 5 hours flight time, conducted by an aviation training organisation certificated in accordance with

Part 141 or by an air operator certificated in accordance with Part 119 provided the certificate authorises NVIS flight training and checking approvals. Appendix III of this AC details the minimum NVIS flight training to be completed on a NVIS flight training course; and

- successfully complete a NVIS initial flight check conducted by an appropriately qualified flight instructor or flight examiner. A NVIS initial flight check should, as a minimum, require the candidate to demonstrate competency in the following:
 - mission planning/flight planning for the flight:
 - determining the serviceability of NVIS equipment, including the aircraft components:
 - performing cockpit drills and ‘Goggle up/de-goggle’ procedure:
 - performing NVIS hover (if appropriate), taxi departure, transit, navigation and arrival procedures:
 - performing NVIS practice malfunctions and emergency procedures:
 - performing circuit operations to unlit confined areas located in areas devoid of surrounding cultural lighting:
 - performing loss of visual reference procedures on landing and take-off:
 - performing inadvertent IMC penetration procedures and safe recovery to VMC flight, including a single pilot unusual attitude recovery, maintaining controlled flight within the limits stated in paragraph 4.3.1- *NVIS Pilot Prerequisites* for the demonstration of instrument flight proficiency; and
 - performing a selection of practice aircraft emergency procedures, under NVIS conditions, applicable to the aircraft type.

Note: the initial flight check can be completed as part of an approved NVIS course.

4.3.3 NVIS Pilot Certification

In accordance with rule 61.29, the successful completion of the flight training and the NVIS initial flight check needs to be certified in the pilot’s logbook as a *night flight endorsement using NVIS* by the NVIS Flight Instructor or NVIS Flight Examiner who conducted the check along, with the aircraft make and model for which the endorsement is valid.

4.3.4 NVIS Pilot Currency

For a pilot who has a logbook certification for night flight using NVIS:

- the take-offs and landings required under rules 61.37(c), and 61.37(d) for a helicopter pilot, needs to:
 - be carried out in a NVIS equipped helicopter of the same type that is normally used by the pilot for NVG flight operations; and
 - be performed using NVGs; and
 - include hovering tasks and an enroute segment or an area reconnaissance.

- Instrument flight proficiency needs to be demonstrated to an appropriately authorised flight instructor or flight examiner, or person approved by the Director, within the limits stated in paragraph 4.3.1-*NVIS Pilot Prerequisites* for the demonstration of instrument flight proficiency. This instrument flight time is to include a simulated inadvertent IMC penetration and recovery to VMC flight. The method of instrument flight proficiency may be prescribed in an air operator's exposition and must be recorded in accordance with those exposition procedures.

A person who does not meet the 120 day NVIS recent flight experience requirements as provided for in FAR 61.57, must not act as PIC of an aircraft conducting a NVG flight operation until that person completes a NVIS proficiency check.

4.3.5 NVIS Pilot Proficiency Check

A NVIS qualified pilot needs to be checked annually for proficiency. For ease of planning, a NVIS annual proficiency check that is conducted up to 60 days before it is due can be regarded as being completed on the due date. A NVIS annual proficiency check needs to include a NVG flight operation that is representative of a typical NVG flight operation conducted by the pilot to satisfy the requirements of paragraph 4.3.4, and include as a minimum:

- approach and departure from an unimproved landing area:
- procedures for utilising backup power to the NVGs:
- NVG unit failure for each of the flight crew members:
- standard emergency exercises from the NVIS Flight Training Syllabus:
- procedures for loss of visual reference (brownout/whiteout, etc) when visibility is inadvertently lost on departure or arrival to or over a landing area:
- procedures for coping with deteriorating in-flight visibility and/or picture quality:
- inadvertent IMC penetration, unusual attitude recovery and instrument recovery to VMC flight, maintaining controlled flight within the limits stated in paragraph 4.3.1-*NVIS Pilot Prerequisites* for the demonstration of instrument flight proficiency:
- completing one unaided approach to a lit area in the circuit. This is to ensure the unaided night flying skills that underpin effective single pilot aided flight are being maintained to a satisfactory standard.

The proficiency check needs to be conducted by:

- a flight instructor or flight examiner who is current to perform NVIS flight operations in that same aircraft category and type; or
- a person approved by the Director to conduct NVIS proficiency checks.

4.3.6 NVIS Pilot Requalification Training

NVIS requalification training is required for a pilot who has been unqualified for more than 12 months. It consists of both ground training and flight training. A pilot who has been unqualified for 12 months or less, should complete the NVIS Recurrent Training program (Appendix VI of this AC).

Flight and ground training sufficient to successfully complete the NVIS pilot proficiency check should be completed.

4.4 NVIS Crew Member Instructor

A NVIS Crew Member Instructor needs to have the following minimum experience:

- hold a recognised NVIS qualified crew member or NVIS qualified pilot endorsement or certificate; and
- meet the instructional experience, standards and qualification requirements in the operator's exposition for day and night (unaided) operations for the relevant crew member position i.e. winch, sling load, SAR, observation, etc; and
- have logged at least 20 hours of NVG flight operation time inclusive of a recognised NVIS course.

4.5 NVIS Crew Member

4.5.1 NVIS Crew Member Training Prerequisites

A person must meet the following minimum qualifications/experience to qualify as a NVIS crew member:

- meet the experience, competency, recency and qualification requirements as specified in the air operator's exposition for day and night (unaided) operations for the relevant crew position and aircraft type; and
- meet any physical and medical standards specified in the operator's exposition.

4.5.2 NVIS Crew Member Training

- a NVIS crew member needs to have completed an approved NVIS ground theory course that follows the syllabus detailed in Appendix II of this AC. Appendix II represents the minimum ground theory training (for both pilots and crew members), and should be conducted by an aviation training organisation certificated in accordance with Part 141 or as part of the air operator's training programme under Part 119 if the aviation training organisation certificate or the air operator certificate authorises NVIS ground training; and
- subsequent to completing an approved NVIS ground theory course, a NVIS crew member needs to complete an approved NVIS flight training course, minimum of 2 hours flight time, conducted by an aviation training organisation certificated in accordance with Part 141 or by an air operator certificated in accordance with Part 119, if the certificate authorises NVIS flight training and checking. Appendix V of this AC provides a training syllabus for NVIS flight training to be completed by a crew member on an approved NVIS flight training course.

4.5.3 NVIS Crew Member Certification

A person who complete the prerequisites and training detailed in paragraphs 4.5.1 and 4.5.2 may be endorsed as a qualified NVIS crew member by means of a certificate signed by a NVIS crew member Instructor certifying the NVIS qualification. This certificate is to be retained in the air operator's crew member files.

4.5.4 NVIS Crew Member Currency

A person should not act as a NVIS crew member on a NVG flight operation unless, in the preceding 120 days, the person has accomplished either of the following:

- completed initial or recurrent training in accordance with an approved NVIS training programme; or
- completed 3 NVG flight operations.

4.5.5 NVIS Crew Member Requalification Training

For a NVIS crew member who has been unqualified for more than 12 months, NVIS requalification training comprising ground and flight training will need to be carried out. A crew member, who has been unqualified for 12 months or less, will need to:

- complete the NVIS recurrent training program (Appendix VI of this AC); and
- complete flight and ground training sufficient to demonstrate proficiency.

4.6 Recognition of New Zealand Defence Force (NZDF) NVIS Qualifications

A pilot who has a NZDF NVIS qualification may be certified for night flying using NVIS if the pilot has completed the night flight training required under Part 61 and has completed the NVIS recurrent training specified in Appendix VI of this AC, conducted by a flight instructor who is certified for NVIS instruction and authorised under the authority of a Part 141 aviation training organisation certificate or a Part 119 air operator certificate to conduct the NVIS training.

A crew member, other than a flight crew member, who has a NZDF NVIS qualification may be qualified as a NVIS crew member if the crew member completes as a minimum the NVIS recurrent training specified in Appendix VI of this AC, conducted by a NVIS crew member instructor authorised under the authority of a Part 141 aviation training organisation certificate or a Part 119 air operator certificate to conduct the NVIS training.

4.7 Recognition of Foreign Civil and Military NVIS Qualifications

A pilot or crew member who holds a foreign military NVIS qualification or a civil NVIS qualification from an ICAO Contracting State should submit details of their NVIS qualification and experience to the Director for a determination on what further training in accordance with this AC may be required.

As a minimum a pilot will need to complete the night flight training required under Part 61 and the NVIS recurrent training specified in Appendix VI of this AC, conducted by a flight instructor who is certified for NVIS instruction and authorised under the authority of a Part 141 aviation training organisation certificate, or a Part 119 air operator certificate to conduct the NVIS training.

As a minimum a crew member will need to complete the NVIS recurrent training specified in Appendix VI of this AC, conducted by a NVIS crew member instructor authorised under the authority of a Part 141 aviation training organisation certificate, or a Part 119 air operator certificate to conduct the NVIS training.

Appendix I—Procedures for using NVGs on helicopter night VFR operations

The following items, as a minimum, must be included in the operating procedures for NVG flight operations:

Airworthiness and Maintenance of NVIS Equipment

1. Aircraft pre-flight
2. NVIS pre-flight
3. MEL
4. Reporting of NVIS equipment defects

Crew Member Responsibilities

1. Pilot:
 - a. Duties, responsibilities and authority
 - b. Logging NVG flight operations
 - c. Training and qualification
 - d. Recency of experience.
2. NVIS Crew Member:
 - a. Duties, responsibilities and authority
 - b. Training and qualification
 - c. Recency of experience.
3. NVIS Flight Instructors:
 - a. Experience and qualifications
 - b. Duties, responsibilities and authority
 - c. Recency of experience.

Flight Operations

1. Pre-flight and departure:
 - a. Before takeoff NVIS check
 - b. NVG Goggle and de-goggle limitations. Transition:
 - unaided to aided
 - aided to unaided
 - c. Area of operations
 - d. Route planning
 - e. Risk assessment procedures to be completed
 - f. NVIS flight operations ceiling and visibility requirements
 - g. Fuel requirements
 - h. Briefing of passengers
 - i. Equipment requirements.
2. Enroute:
 - a. Minimum safe altitudes
 - b. Hostile terrain
 - c. Helicopter surface reference
 - d. Operating near other aircraft.
3. Standard Flight Manoeuvres
4. Arrival:
 - a. Landing area requirements
 - b. Reconnaissance
 - c. Unimproved landing sites.

5. Post Flight Procedures.

Crew Procedures

1. Minimum Crew.
2. Pre-flight Brief:
 - a. Required actions of each person, duties and responsibilities during each phase of flight
 - b. Light discipline
 - c. Sterile cockpit procedures
 - d. Crew resource management
 - e. Standardise terminology.

Emergency Procedures

1. Inadvertent IMC
2. NVIS equipment failure
3. Aircraft emergencies.

Reports and Forms

1. Training Forms
2. Recency of Experience Forms
3. NVG Maintenance Logbook.

Definitions

Appendix II–NVIS Ground Training Syllabus

RTCA/DO 268 and RTCA/DO 295 Appendix A, Section 2 are used as the basis for this training curriculum.

The NVIS Ground training syllabus must cover the following subject areas:

Aero medical Subjects

1. Anatomy and physiology of the eye
 - a. Retina
 - Cones
 - Rods
2. Common visual limitations/deficiencies
 - a. Myopia
 - b. Hyperopia
 - c. Astigmatism
 - d. Presbyopia
 - e. Night Myopia
 - f. Retinal blind spots
 - Day blind spot
 - Night blind spot
 - Dark adaption
 - Factors affecting dark adaption
 - Effects of lighting on night vision
 - Strobe lights
 - Bright white lights
 - Position lights
 - Advantages/disadvantages of red lights
3. Types of Vision
 - a. Photopic
 - b. Mesopic
 - c. Scotopic
4. Night viewing techniques
 - a. Unaided
 - Scanning
 - Stop-turn-stop-turn technique
 - 10° overlap
 - Off centre (peripheral) vision
 - b. Aided
 - Instrument scanning
 - Peripheral scanning
5. Methods used to protect night vision
6. Self imposed stress factors and night vision
7. Cues utilised to estimate distance and depth perception
 - a. Binocular cues
 - b. Monocular cues
 - Geometric perspective
 - Linear perspective

- Apparent foreshortening
 - Vertical positioning in the field
 - Retinal image size
 - Known size of an image
 - Increasing/decreasing size of an object
 - Terrestrial associations
 - Overlapping contours
 - Aerial perspective
 - Fading of colours or shades with distance
 - Loss of discrimination or texture
 - Light and shadows
 - Motion parallax
8. Visual illusions
- a. Relative motion illusion
 - b. Confusion with ground/star lights
 - c. False horizons
 - d. Height perception illusion
 - e. Structural illusion
 - f. Autokinetic illusion
 - g. Size-distance illusion
 - h. Flicker vertigo
 - i. Fixation
 - j. Empty field myopia
 - k. Reversible perspective
 - l. Altered planes of reference
9. Red Light Emitting Diodes (LEDs) falling outside the combined visual and near infra-red spectrum of an NVG (approximately 665 to 930 nm will not be visible to goggles. Therefore, beware of obstacles that are lit by LED lighting and of aircraft lighting that is red (US Safety Alert for Operators No 09007 dated 6/3/09).

Introduction and Theory of NVGs

1. NVG Description, Model Detail, Capabilities and Limitations
 - Light amplification, intensity, sensitivity
 - Visual acuity
 - Astigmatism
 - Magnification
 - Field of view
 - Field of regard
 - Focal range
 - Depth perception and Distance estimation
 - Peripheral vision
 - Operational temperature range
 - Weight and centre of gravity
 - Detachability
 - Monochromatic image and adaption
 - Environment detection and identification
2. NVG Associated Equipment
 - Binocular assembly
 - Operator's manual
 - Helmet mounted assembly

- Battery cartridges
 - Carry case
 - Lens paper
 - Battery pack
 - Authorised batteries
 - Battery life
 - Lens caps
 - Neck cord
 - Inspection/maintenance records
3. Additional Equipment
- Helmet
 - Quick release mount
 - Counterweight bag
 - Supplemental lighting
4. Monocular Components and Operational Sequence
- Objective lens
 - Image intensifier tubes
 - Photocathode
 - Microchannel Plate (MCP)
 - Phosphor screen
 - Image inverter
 - Eyepiece lens
5. NVG Functions and Pre-Flight Inspections
- Binocular Assembly
 - Vertical adjustment knob
 - Eye span (interpupillary distance) adjustments
 - Fore/aft adjustments
 - Tilt adjustment lever
 - Objective Focus ring
 - Eyepiece Focus ring
 - Lock release button
 - Low battery indicator light
 - Pre-Flight checks
 - Mounting/Dismounting NVG to/from helmet
 - Low battery indicator check
 - Adjusting the NVG for operation
 - Focussing procedure
6. NVG Visual Deficiencies
- Unacceptable Defects
 - Shading
 - Edge glow
 - Flashing, flickering or intermittent operation
 - Acceptable Faults
 - Bright spots
 - Emission points
 - Distortion
 - Veiling glare
 - Black spots
 - Chicken wire

- Fixed pattern noise – Honeycomb pattern
 - Image disparity
 - Output brightness variation
7. General care and cleaning
- Adverse environments
 - Saltwater
 - Heat, humidity, rain
 - Dust, sand
 - Extreme cold

Night Terrain Interpretation and Environmental Factors

1. Light sources
 - a. Natural
 - b. Artificial
2. Meteorological Conditions
 - a. Cloud, fog and mist
 - b. Indications to restrictions to Visibility
 - Loss of celestial lights
 - Loss of ground lights
 - Reduced ambient light levels
 - Reduced visual acuity
 - Increase in scintillations (video noise)
 - Increase in halo effect
3. Cues for Visual Recognition
 - a. Object size
 - b. Object shape
 - c. Contrast
 - d. Shadow
4. Factors affecting NVIS Interpretation
 - a. Ambient light
 - b. Terrain
 - c. Seasons
 - d. Viewing distances
 - e. Flight altitude
 - f. Moon illumination (%) and azimuth
 - g. Visibility restrictions
 - Field of regard
 - Windshield
5. Night navigation cues
 - a. Terrain relief
 - b. Vegetation
 - c. Water features
 - d. Cultural features
6. Special Considerations
 - a. Flight over low contrast environment
 - b. Whiteout
 - c. Brownout

NVIS Flight Planning

1. Ambient light
 - a. Moon
 - Phase, illumination (%)
 - Rise/set times
2. Meteorology
3. Protection of night vision
4. Before departure checks
5. Route planning
6. Operational risk assessment
7. Scene operations
8. Contingency planning

Operator Specific Training

1. Civil Aviation Rule requirements
 - a. Parts 61, 91, 133 and 135
 - b. Advisory Circulars
2. Exposition requirements
 - a. General
 - b. NVIS Supplement
 - c. Authorised operations
 - d. Operational limitations
 - e. NVIS Crew
 - Minimum qualifications and experience
 - Currency
 - Flight and duty
 - Crew resource management
 - f. Company specific SOPs
 - g. Company documentation requirements
3. Aircraft
 - a. RFM
 - b. Lighting modifications
 - c. MEL
4. NVIS serviceability requirements

Aircraft ground training

1. Lighting systems
 - a. Internal
 - Cockpit lighting
 - Cabin lighting
 - Instrument lighting
 - Radio lighting
 - Utility lighting
 - b. External
 - Anti-collision lights
 - Position lights
 - Landing, search and other external lights

2. Caution warning system
 - a. Aircraft flight manual
 - b. Emergency procedures/familiarity
3. Cockpit familiarisation
 - a. Conduct (ground) practice in an aircraft at night or in a dark environment
 - b. Assemble NVIS equipment
 - c. Use aircraft internal and external lighting systems
 - d. Wearing NVGs, ensure wearer can clearly sight all instruments and controls
 - e. Pilot to ensure adequate situational awareness of all aircraft controls and displays with NVGs on
 - f. Other system familiarisation
 - Radar altimeter
 - GPS
 - Other equipment as installed

Appendix III–NVIS Flight Training Syllabus (Pilots)

RTCA/DO 268 and RTCA/DO 295 Appendix A, Section 2 are used as the basis for this training curriculum.

NVIS Flight Training Course

The NVIS Flight Training syllabus must cover the following subject areas:

Preparation

1. NVG equipment assembly/initial focus
2. Pre-flight planning
 - Weather
3. Operational Risk Assessment
4. Aircraft pre-flight inspection
5. Before take-off NVG check

Departure

1. Take-off, hover, hover-taxi
2. Climb out
 - a. Best rate
 - b. Best angle

Enroute

1. Medium bank turns
2. Low/high speed characteristics
3. Navigation along a pre-determined route
4. Minimum heights/obstacle avoidance
5. Weather conditions (as appropriate)
 - a. Rain
 - b. Snow
 - c. Fog and mist
 - d. Haze and dust

Descent and Landing

1. Initial Reconnaissance
2. Normal approach
 - a. Clear area
 - b. Confined area
 - c. Point in space approach
3. Steep approach
4. Landings
 - Slope landings

Systems procedures training during any airborne phase (normal)

1. Communication equipment
2. Navigation systems
3. Aircraft lighting systems

Emergency procedures training during any airborne phase

1. NVG failure
2. NVIS failure
3. Unusual attitude recovery

4. Inadvertent IMC recovery
NOTE: This exercise must be demonstrated to the acceptable flight proficiency limits as listed in NVIS Pilot Prerequisites (paragraph 4.3.1).
5. Aircraft systems emergencies (the pilot needs to be able to find and activate the correct switches, systems etc with goggles on as this can be difficult where overhead panels are involved).
6. Engine failure/autorotation (power recovery at a safe height)
7. Tail rotor malfunctions (flying of the profile only, not to touchdown).
8. OEI operations (not necessary to include OEI landing but should include running landings AEO)

Special procedures

Any procedures specific to the operator's operation, e.g.

- a. Winching
- b. Over water operations
- c. Low level searching
- d. Snow landings, etc

Crew resource management

Post flight Procedures

1. Recording NVG flight time
2. NVIS and NVG defects

NVIS Initial Flight Check

The NVIS Initial Flight Check must include the following:

Written/Oral test

Preparation

1. Pre-flight planning
2. Pre-flight inspections
 - a. NVIS
 - b. Aircraft
3. Before take-off NVG check

Departure

1. Take-off, hover, hover-taxi
2. Climb out

Enroute

1. Navigation along a pre-determined route
2. Adjustment in-flight

Descent and landing

1. Initial Reconnaissance
2. Normal approach
 - a. Clear area
 - b. Confined area
 - c. Point in space approach
3. Steep approach
4. Landings
 - Slope landings
5. Unaided approach in the circuit

Systems procedures during any airborne phase

1. Communication equipment
2. Navigation systems
3. Aircraft lighting systems

Emergency procedures during any airborne phase

1. NVG failure
2. NVIS failure
3. Unusual attitude recovery
4. Inadvertent IMC recovery

NOTE: This exercise must be demonstrated to the acceptable flight proficiency limits as listed in NVIS Pilot Prerequisites (paragraph 4.3.1).

Special procedures

Any procedures specific to the operator's operation

Cockpit resource management

Post flight procedures

Appendix IV–NVIS Flight Instructor Training Syllabus

RTCA/DO 268 and RTCA/DO 295 Appendix A, Section 6 are used as the basis for this training curriculum.

NVIS Flight Instructor training comprises a ground and flight training segment, and will be conducted by an appropriately trained NVIS Flight Instructor. All NVIS flight instructor training should be conducted with the emphasis on factors such as the correct configuration of the aircraft, the proper scenario setting for the manoeuvre, common errors made by the students and the safe and timely input of corrective action so as to avert any hazardous conditions.

To be eligible for the issue of a NVIS Training and Checking approval, an A, B or D flight instructor must be certified by an examiner for night instruction and endorsed for NVIS training and checking approval.

Ground Training Segment

NVIS Flight Instructor/Training and Checking duties and responsibilities

1. Functions
2. Duties
3. Responsibilities

Policies and procedures

1. Training documentation
 - Review of applicable parts of CAA NZ Flight Test Standard Guides and Advisory Circulars for Training and Checking techniques, standards and evaluation methods
2. Schedule of training
3. Evaluation documentation
4. Appropriate corrective action for unsatisfactory student progress/checks

Correct evaluation of pilot performance

1. Detection of improper and insufficient training
2. Personal characteristics that could adversely affect safety
3. Ensuring the acceptable instrument flight proficiency standards are achieved
4. Approved methods, procedures and limitations for performing the required normal, abnormal and emergency procedures appropriate to aircraft type.
 - a. Simulated emergencies
 - b. Approved procedures for simulating systems malfunctions

NVIS Theory

Appendix II theory subjects reviewed in entirety

Flight Training Segment

The training must include, but is not limited to, all the NVIS Flight Training Course and NVIS Initial Qualification Check elements of Appendix III.

Appendix V–NVIS Flight Training Syllabus (NVIS Crew Members)

After completing the approved NVIS ground theory course (Appendix II of this AC), a NVIS Crew Member must complete a minimum of two hours of NVIS flight training/checking that covers the following:

Preparation

1. NVIS equipment checks
 - NVG equipment pre-flight inspection and focussing procedures
2. Pre-flight planning
3. Aircraft pre-flight inspection
4. Before take-off NVG check

Emergency procedures during any airborne phase

1. NVIS failure
2. NVG failure
3. Aircraft emergencies
 - a. Lighting systems
 - b. Communications systems
4. Inadvertent IMC procedures

Special procedures

Any procedures specific to the operator's operation e.g. winching operations, etc

Crew/Cockpit resource management

Post flight procedures

1. NVG recording time
2. NVIS/NVG defects
3. Aircraft defects

NVIS Initial qualification check

To include all elements of this Appendix

Appendix VI–NVIS Recurrent Training Syllabus

The NVIS recurrent training course is to include the following:

Ground Training Segment

All NVIS Pilots and Crew Members are to review the following elements of Appendix II – NVIS Ground Training Syllabus at the discretion of the NVIS instructor:

1. Aeromedical Subjects, 4 through 8.
2. Introduction and Theory of NVGs, 5, 6 and 7
3. Night terrain interpretation and environmental factors, 2, 4 and 5
4. NVIS flight planning in its entirety
5. Operator specific training in its entirety
6. Aircraft ground training in its entirety

Flight Training Segment

All NVIS qualified Pilots are to complete the NVIS Initial Flight Check, as detailed in Appendix III of this AC.

All NVIS qualified Crew Members are to complete the NVIS Initial Flight Check, as detailed in Appendix V of this AC.

Appendix VII—Flight Manual Supplement Template for NVIS Lighting System

NOTE: Flight Manual Supplements can only be produced as part of a modification approval by the CAA or a delegation holder operating within Part 146 Aircraft Design Organisation. This template gives technical content only. There are other format requirements which a Part 146 Design Organisation will be familiar with.

1. GENERAL

(Add text of a general nature, as applicable.)

2. LIMITATIONS

2.1 Operational Limitations:

NOTE: The following limitation is required in the Flight Manual Supplement verbatim:

“Installation of this NVIS system does not approve or imply approval for flight operation with Night Vision Goggles (NVGs). The Operator must be authorised by the Director to conduct NVG flight operations.”

2.2 Training:

NOTE: The following limitation is required in the Flight Manual Supplement verbatim:

“Crew members required to use NVGs during a NVG flight operation in this aircraft must meet the minimum accepted training, recency and competency levels detailed in the operator’s procedures.”

2.3 Minimum Equipment Required for NVG Flight Operations:

- Helmet with compatible NVG attachment device for each flight crew member using NVGs.
- Identify the NVGs that have been tested and approved for use.

NOTE: This limitation must specify the NVG manufacturer, type and model that was shown to be compatible with the NVIS lighting system during compatibility testing or by other means acceptable to the Director.

- Radar altimeter.
- Slip/Skid indicator.
- Gyroscopic attitude indicator.
- Gyroscopic direction indicator or equivalent.
- Vertical speed indicator.

- Communications and navigation equipment necessary for the successful completion of an inadvertent IMC procedure in the intended area of operations.
- Any other aircraft or personal equipment required for the operation e.g. curtains, extra batteries for NVGs, NVIS compatible torch, etc.

NOTE: Some aircraft external lights cause distracting glare and reflections through the chin-bubble. If this is the case and chin-bubble mats are shown to be effective, consider adding the following note and caution:

“Chin bubble mats, if appropriate.

CAUTION:

If chin bubble mats are used to block glare from external aircraft lights, ensure that they are positioned and secured properly, provide sufficient view out of the chin bubble and do not block operation of tail rotor pedals.”

2.4 Minimum Crew Requirements:

NOTE: The following limitation is required in the Flight Manual Supplement verbatim:

“An additional NVG qualified and equipped crew member is required to ensure the safe operation of the aircraft during flight below the minimum heights for VFR flights prescribed in rule 91.311(a) and (c), and during an approach and departure from an unimproved landing area.”

2.5 Configuration Requirements:

Identify cockpit equipment and lighting particular to the installation that is, by design, not NVIS compatible and that must remain off during a NVG flight operation (e.g. passenger cabin lighting, non-mission essential radios, etc.) or must be configured in a particular way to be compatible (e.g. multi-function display units etc.).

2.6 Placards:

Include all NVIS specific placards.

3. EMERGENCY AND MALFUNCTION PROCEDURES

3.1 NVG Malfunction or Failure:

- Transition from aided to unaided flight as required.
- Discontinue the use of the failed NVGs until any defect(s) have been rectified.

3.2 NVIS Lighting Malfunction or Failure in Flight:

- Reconfigure the NVIS lighting as applicable to maintain NVG compatibility.
- Discontinue NVG use if the malfunction or failure degrades NVIS compatibility.

3.3 Aircraft Emergencies:

Maintain aircraft control and then initiate the procedures outlined in the basic aircraft Flight Manual. The pilot's decision to continue use of NVGs should be based on the emergency situation.

4. NORMAL PROCEDURES

4.1 Preflight:

- Check windshield, windows, and chin bubble windows for suitability (e.g. scratches, crazing, cleanliness, etc.).
- Check NVIS modified equipment for light leakage and compatibility.
- Perform NVG checks, adjustment and alignment.
- Check function of minimum equipment required for NVG flight operations.
- Interior Configuration – check for NVIS equipment (e.g. deselect incompatible light sources).
- Exterior Configuration – check for NVIS equipment (e.g. ensure exterior lights comply with the approved NVIS modification).
- Adjust lighting as desired.

NOTE: Add any other items relevant to the NVIS installation.

4.2 In-flight:

- Adjust lighting as desired during flight.
- Transition to aided flight from unaided flight (and vice versa) as necessary.

NOTE: Add any other items relevant to the NVIS installation.

4.3 Post Flight:

Note any defects (NVGs, NVIS lighting and equipment, windshield, etc.) and record in the aircraft Technical Log for maintenance action and follow-up.

4.4 Special Procedures:

Describe any unique procedures for each phase of flight if required.

5. PERFORMANCE

As per the basic aircraft Flight Manual.

6. WEIGHT AND BALANCE

The basic weight and balance should include the installation of NVIS equipment.

7. SYSTEM DESCRIPTION

Include a sufficiently detailed NVIS description.

NOTE: Use of photos or illustrations in addition to text is preferred.