CIVIL AVIATION AUTHORITY OF NEW ZEALAND

# Advisory Circular AC91-13

**Revision 2**

**5 April 2026**

## Night Vision Imaging Systems—Helicopters

### General

Civil Aviation Authority Advisory Circulars (ACs) contain information about standards, practices, and procedures that the Director has found to be **an acceptable means of compliance** with the associated rule.

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 AC.

### Purpose

This AC 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 Visual Flight Rules (VFR) operation using a Night Vision Imaging System (NVIS).

This AC should be read in conjunction with *Night Vision Imaging System (NVIS) - Helicopter Civil Aviation Notice (*NTC 91.273) and rules 91.271, 91.273(a), and 91.273(b).

### Applicability

This AC applies to operators of NVIS-equipped helicopters, pilots, licenced aircraft maintenance engineers, Parts 145 and 146 organisations, Design Delegation Holders, NVIS crew members, and instructors engaged in helicopter night VFR operations using Night Vision Goggles (NVGs).

### Related Rules

This AC relates specifically to helicopter operations conducted under Civil Aviation Rule Parts 19, 21, 43, 61, 91, 119, 135, 145, and 146.

### Change Notice

Revision 2 is a substantive update to reflect the intent of changes to Parts 61 and 91 following the Assorted Issues Rules Project (2023) and the associated Notice.

We have also:

- Added sections on Airworthiness and Continued Airworthiness
- Updated Appendix VII and added a new Appendix VIII
- Added a version history and made stylistic and formatting changes.

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**Version history**

| Revision No. | Date | Summary of Changes |
|---|---|---|
| AC91-13, Rev 0 | 11 Jun 2007 | Initial issue |
| AC91-13, Rev 1 | 20 Jun 2011 | Clarified purpose and applicability of AC.<br><br>Updated and clarified definitions, where appropriate, including deleting the definition of NVGO and replacing it with NVG flight operations.<br><br>Amplified and clarified guidance material relating to helicopter modification regarding NVIS design, testing, approval and maintenance process.<br><br>Added guidance material in relation to overwater operations.<br><br>Rearranged section dealing with training competency and currency to improve general flow and layout. |
| AC91-13, Rev 2 | 5 April 2026 | Substantive update to reflect the intent of changes to Parts 61 and 91 following the Assorted Issues Rules Project (2023) and the associated Notice.<br><br>We have also:<br>• Added sections on Airworthiness and Continued Airworthiness<br>• Updated Appendix VII and added a new Appendix VIII<br>• Added a version history and made stylistic and formatting changes. |

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# Table of Contents

# 1. Introduction

This AC provides guidance on the safe use of Night Vision Goggles (NVGs) in NVIS-equipped helicopters conducting night VFR operations. It applies to helicopter operators, pilots, NVIS crew members, and instructors.

The AC also provides guidance for Licenced Aircraft Maintenance Engineers, Design Delegation Holders (DDH) and Part 146 Design Organisations.

Night VFR flight requires pilots to maintain visual reference to the ground and is often conducted in low-light environments, increasing the risk of controlled flight into terrain and collision with other obstacles.

When used correctly, NVGs can enhance situational awareness and reduce pilot workload during night operations. CAA accepts the use of NVGs as an aid to night VFR flight in helicopters equipped with an approved NVIS, as long as flight safety does not rely solely on the external view through the NVGs.

NVGs are enhancement devices only and must be used in visual meteorological conditions (VMC). Their use does not alter minimum VFR requirements. Due to the limitations of NVIS and NVGs, operators must establish appropriate training, procedures, and competency requirements to ensure safe night VFR operations.

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 website at www.rtca.org.

**Federal Aviation Administration (FAA) documents:**

- FAR 27, Airworthiness Standards: Normal Category Rotorcraft
- FAR 29, Airworthiness Standards: Transport Category Rotorcraft
- FAA AC 27-1B, Certification of Airworthiness Standards Normal Category Rotorcraft, Miscellaneous Guidance (MG) MG 16, Certification Guidelines for Rotorcraft Night Vision Imaging Systems (NVIS) Aircraft Lighting Equipment
- FAA AC 29-2C, Certification of Airworthiness Standards Transport Category Rotorcraft, Miscellaneous Guidance (MG) MG 16, Certification Guidelines for Rotorcraft Night Vision Imaging Systems (NVIS) Aircraft Lighting Equipment
- FAA TSO-C164, Night Vision Goggles

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

These FAA documents are available at www.faa.gov

*Note: Subsequent revisions or changes to these documents will be regarded by the Director as an acceptable means of compliance.*

**European Union Aviation Safety Agency (EASA) documents:**

- CS-29 - Certification Specifications, Acceptable Means of Compliance and Guidance Material for Large Rotorcraft
- CS-27 - Certification Specifications, Acceptable Means of Compliance and Guidance Material for Small Rotorcraft
- ETSO - C164, Night Vision Goggles (NVG).

These EASA documents are available at www.easa.europa.eu.

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

# 2. Abbreviations and Definitions

## 2.1 Abbreviations

| Abbreviation | Meaning |
|---|---|
| AC | Advisory Circular |
| AOC | Air Operator Certificate |
| CS | Certification Specification |
| EASA | European Union Aviation Safety Agency |
| FAA | Federal Aviation Administration |
| IFR | Instrument Flight Rules |
| IMC | Instrument Meteorological Conditions |
| MEL | Minimum Equipment List |
| MG | Miscellaneous Guidance |
| MOPS | Minimum Operational Performance Standards |
| NVG | Night Vision Goggles |
| NVIS | Night Vision Imaging System |
| RFMS | Rotorcraft Flight Manual Supplement |
| RTCA | Radio Technical Commission for Aeronautics |
| STC | Supplemental Type Certificate |
| VFR | Visual Flight Rules |
| VMC | Visual Meteorological Conditions |

## 2.2 Definitions

***Note:*** *Some of the definitions from Part 1- Definitions and Abbreviations are included for easy reference and may also be included in NTC.91.273.*

| Term | Definition |
|---|---|
| **Aided Flight** | A VFR flight at night where the pilot of an aircraft uses NVGs in an operational position (referred to as being "goggled up") to maintain visual reference to the surface. |
| **Class A** | An NVG in which a 625nm minus blue objective lens filter has been incorporated. This term also can refer to the NVIS lighting designed for use with NVGs that contain a class A filter. |
| **Class B** | An NVG in which a 665nm minus blue objective lens filter has been incorporated. This term also can refer to the NVIS lighting designed for use with NVGs that contain a class B filter. |
| **Class C** | An NVG in which a 645nm minus blue objective lens filter has been incorporated. These filters are typically incorporated in NVGs produced in Europe. |
| **Direct View Image NVG (Type I)** | Any NVG in which the intensified image is displayed in the operator's direct line of sight. |
| **Enhanced Flight Vision System (EFVS)** | These are technologies that 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 |
| **Field of Regard** | Field of regard is the total area of the field of view that can be scanned by a person using NVGs.<br><br>***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.* |

| Term | Definition |
|---|---|
| **Generation** | Generation refers to the technological design of an image intensifier.<br><br>***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.* |
| **Image Intensifier tube** | An image intensification tube greatly amplifies available energy to provide an imaging capability at night. It consists of a photocathode, microchannel plate, phosphor screen, and fibre optic twist. Embedded circuitry is designed to protect the tube from bright light sources, and to automatically adjust the gain in response to varying light input levels by controlling the electron flow through the microchannel plate. |
| **Light leaks** | Light that is emitted from a location in the cockpit that was not intended to emit light. One form consists of incompatible light sources found after the installation of an NVIS lighting system. The sources could originate from within a modified component but more typically result from inadequate installation. In addition to light leaks resulting from incompatible sources, there can be light leaks from compatible sources that may interfere with unaided readability (e.g., scratched panels). Light leaks may also develop after prolonged operational use. |
| **Look Under** | The ability of a pilot to look under or around the NVGs to view inside and outside the aircraft. |
| **Major design change** | A change that is not a “minor design change”. |
| **Minor design change** | A change that has no appreciable effect on the weight, balance, structural strength, reliability, operational characteristics, or other characteristics affecting the airworthiness of the product. |
| **Night Vision Goggles (NVGs)** | A head-mounted, lightweight, and self-contained binocular appliance that amplifies ambient light used to enhance the ability to maintain visual reference to the surface at night. |

| Term | Definition |
|---|---|
| **Night Vision Imaging System (from Part 1)** | (1) refers to the integration of all the following elements for the successful and safe operation of an aircraft using NVGs –<br>(i) operational procedures;<br>(ii) suitable training, competency and currency requirements;<br>(iii) NVGs and associated equipment;<br>(iv) lighting system and associated aircraft components;<br>(v) continuing airworthiness requirements; but<br>(2) excludes –<br>(i) enhanced vision imaging system:<br>(ii) a synthetic vision system: |
| **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 an NVG flight operation. |
| **NVG operation (from Part 1)** | An operation during any part of which NVGs are used to maintain visual reference to the surface in an aircraft which is NVIS equipped and approved for NVIS operations. |
| **NVG-compatible** | Aircraft internal and external lighting is NVG-compatible when it does not adversely affect the NVG image.<br>***Note**: In this context, "compatible" means that the light source has been tested with the combination of NVG and NVIS lighting system and found not to degrade the performance of the NVG.* |
| **NVIS-friendly (as applicable to external lights)** | Exterior lights that can be viewed by the unaided eye, meet the position light requirements of FAR/CS 27/29, and do not significantly interfere with NVG performance. An NVIS-friendly exterior light will emit more NVG-detectable, usually infrared wavelengths of energy compared to lights that are completely NVIS-compatible. NVIS-friendly exterior lights will be detected when viewed through the NVGs and not overwhelm the aircraft outline or cause shadowing or objectionable reflections off the aircraft. When viewed through NVGs, the light does not cause excessive "blooming". |
| **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. |

| Term | Definition |
|---|---|
| **NVIS lighting component** | Any component intended for use with NVGs that emits or transmits light within the flight deck or other crew compartments, or attached to the aircraft exterior, and does not degrade NVG performance. |
| **NVIS lighting system** | An aircraft lighting system modified or designed to incorporate NVIS lighting components. It provides adequate illumination, under day and night conditions, of instruments, displays, and controls for the unaided eye without degrading NVG performance. NVIS lighting systems must meet part FAR/CS Part 27/29 lighting requirements. |
| **Projected Image NVG (Type II)** | Any NVG which projects the intensified image on a see-through. |
| **Resolution** | The capability of the NVG to present a clear image of the separate and distinguishable components of a scene or object. |
| **Synthetic Vision System (SVS)** | A system which 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 features to display a synthetic vision image of the external scene topography to the flight deck. |
| **Unaided Flight** | 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 (AOC) holder. |
| **Visual Acuity** | The relative ability of the human eye to resolve detail and interpret an image. |

# 3. Night Vision Goggles Flight Operations

## 3.1 Operations under an air operator certificate

**NVIS Operational Approval**

With respect to NTC 91.273, section 2.3(5), CAA will approve an NVIS-certified helicopter for the operator to conduct NVG operations for a period of two years. The NVIS compatibility verification expiry date will be shown on the Operations Specifications. This date will typically be set at two years from when the last compatibility testing or verification of the NVIS was done.

In line with NTC 91.273, section 3.9(b), any subsequent internal or external modifications to the helicopter invalidates the original airworthiness approval. This includes the installation or modification of operational equipment such as Forward Looking Infrared or Emergency Medical Services equipment, that incorporates light emitting or reflecting devices.

In such cases, an airworthiness re-evaluation of the helicopter is required. The NVG operational approval is invalid until the re-evaluation has been completed.

To re-approve the helicopter for NVG operations for any further period, a CAA inspector will audit the helicopter records before issuing the new Operations Specifications.

It is recommended that operators apply for the amendment to the Operations Specifications 45 days before the expiry date.

**Operational Procedures**

In accordance with NTC 91.273, section 2.7, 2.15 and its Appendix, it is recommended that the AOC captures the risks associated with NVIS operations in their Safety Management System and subsequent Operational Procedures.

A risk assessment (risk analysis, mitigation and management) is recommended before any NVIS operation. The risk assessment should include:

1. illumination level
2. weather
3. pilot recency of experience
4. pilot experience with NVG operations
5. pilot vision
6. pilot rest condition and health
7. . windshield/window condition
8. NVG tube performance
9. NVG battery condition
10. types of operations allowed, and
11. external lighting environment.

When preparing the Operations Manual, the following should also be considered:

1. equipment to be carried and its limitations
2. the Minimum Equipment List (MEL) entry covering the equipment specified
3. pre- and post-flight procedures and documentation
4. selection and composition of crew
5. crew coordination procedures, including:
   a) flight briefing
   b) procedures when one crew member is wearing NVG and/or procedures when two or more crew members are wearing NVGs
   c) procedures for the transition to and from NVIS flight
   d) use of the radio altimeter on an NVIS flight, and
   e) inadvertent Instrument Meteorological Conditions (IMC) and helicopter recovery procedures, including unusual attitude recovery procedures.
6. the NVIS training syllabus including:
   a) in-flight procedures for assessing visibility, to ensure that operations are not conducted below the minima stipulated for non-assisted night VFR operations
   b) weather minima, taking the underlying activity into account, and
   c) the minimum transition heights to/from an NVIS flight.

## 3.2 Operations not under an air operator certificate

Refer NTC 91.273, section 2.7 (b).

# 4. Airworthiness, Equipment and Standards

An NVG flight operation can be performed safely with appropriate operational procedures, airworthiness certification, maintenance, and training. Operators need to fully consider these factors during the design, installation, and testing of an NVIS in a helicopter. This section provides an acceptable means of compliance for the installation of NVIS in helicopters for use on NVG operations.

In line with NTC 91.273, section 3.7, this AC adopts the Miscellaneous Guidance (MG) 16 of both FAA ACs 27-1B for Part 27 helicopters, and 29-2C for Part 29 helicopters, and any subsequent revisions as an acceptable means of compliance to support the airworthiness approval of NVIS. FAA AC 27-1B and 29-2C also incorporate by reference the Minimum Operational Performance Standards (MOPS) contained in RTCA/DO-275, which means that RTCA/DO-275 is also an acceptable means of compliance.

Safety for an NVG operation is based on the following assumptions in FAA AC 27-1B) and 29-2C, MG 16:

- Aircraft internal and external lighting do 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 MOPS or Instructions for Continued Airworthiness (ICAs)
- 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 the pilot'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 IMC.

## 4.1 Airworthiness requirements for Night Vision Goggles

In accordance with NTC 91.273, section 3.5, NVGs intended for use on a helicopter for NVG operation must meet, as a minimum, the performance standards acceptable to the director. In the context of this AC, FAA TSO-C164 (or later approved versions) and EASA ETSO-C164 (or later approved versions) are standards acceptable to the Director.

An equivalent standard acceptable to the director is RTCA DO-275. This standard constitutes the minimum operating performance specification of the FAA TSO/ETSO. If the NVGs are not granted a TSO/ETSO authorisation, operators should provide

evidence that the NVGs are at least compliant with requirements of DO-275 Section 2, 5.2, and 5.5.

The effective and safe integration of the NVG with the NVIS must be verified by the demonstration (ground and flight test) of the NVG performance, human factors characteristics, inter-system interface and mechanical installation.

Operators should gather evidence of the compatibility with cockpit and external lighting under any foreseeable operating condition. This is to establish that pilot visibility and workload are not impaired and that NVG susceptibility to halo, reflections and glares remains acceptable. Both ground and inflight NVIS/NVG aided evaluation should be conducted in support of this assessment.

NVG assemblies or 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 for aviation use by the manufacturer must not be used for an NVG operation.

### 4.1.1 White Phosphor NVGs

White phosphor NVGs are a recent advancement in goggle technology. Unlike traditional NVGs that use a P-43 (green) phosphor screen to display images in green and black, white phosphor NVGs use a P-45 screen to display images in black and white. Black-and-white imagery is generally more natural to the human eye. It can also improve scene recognition while providing equal or improved performance in contrast, reduced night blindness, and lower eye strain.

Some manufacturers produce the same NVG models with either green or white phosphor screens without distinguishing between them in the model name or number. As a result, it is important that the NVG identification in the Rotorcraft Flight Manual Supplement (RFM) clearly states the image-intensifier phosphor type.

The introduction of a white phosphor NVG (or any new NVG) in an already NVIS- certified helicopter should be classified as a major design change. However, where it can be demonstrated that the new NVG is the same make and model as a previously approved device, differs only in phosphor colour and provides equal or better performance, extensive ground and flight testing may not be required.

### 4.1.2 NVIS Required equipment

In addition to the instruments and equipment required for flight at night, and in accordance with NTC 91.273, section 3.5, the following equipment is required:

- NVIS lighting
- Helmet with suitable NVG mount for each pilot and crewmember required to use NVGs
- Radio altimeter, as required in NTC 91.273
- Pilot steerable external light, as required in NTC 91.273
- Slip/skid indicator
- Gyroscopic attitude indicator

- Gyroscopic direction indicator or equivalent
- Vertical speed indicator or equivalent
- NVIS-compatible utility lights
- Portable NVIS-compatible flashlight
- Communications and navigation equipment necessary for the successful completion of an inadvertent IMC procedure in the intended area of operations; and
- Any other aircraft or personal equipment required for the operation (e.g. curtains, NVG stowage, extra batteries for NVGs).

### 4.1.3 Instrument arrangement and visibility

The mounting position of all instruments, switches, position labels, and controls should be visible to the pilot during unaided and aided flight and in all cockpit lighting conditions (day and night).

Instruments required for NVG operations should be in or as close as possible to the pilot's primary scan.

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

Further details regarding instrument arrangement and visibility can be found in the MG 16 of both FAA ACs 27-1B, for Part 27 helicopters, and 29-2C for Part 29 helicopters.

## 4.2 NVIS airworthiness approval

Under NTC 91.273, section 3.1, NVIS airworthiness approval must be completed using a process that is acceptable to the Director. FAA-certified helicopters can use FAA MG 16 guidance directly, while EASA-certified helicopters should use the equivalent CS-27 or CS-29 guidance ensuring any EASA-specific requirements are also addressed.

As noted above, this AC adopts the acceptable means of compliance from MG 16 contained in FAA AC 27-1B (for Part 27 helicopters) and FAA AC 29-2C (for Part 29 helicopters). This guidance is automatically accepted for helicopters that have an FAA certification basis.

For helicopters certified under EASA with a Certification Specification (CS) basis, applicants should refer to MG 16 contained in CS-27 (small rotorcraft) and CS-29 (large rotorcraft). While EASA guidance is largely based on FAA MG 16, applicants should ensure they also consider any EASA-specific guidance material that applies.

### 4.2.1 Classification of NVIS Design Changes

#### 4.2.1.1 Non-NVIS approved helicopters

Because NVGs and NVIS significantly affect pilot vision and aircraft operation, converting a helicopter from non-NVIS compliant to NVIS-compliant is considered a major design change.

In accordance with Rule 21.73 - *Approval of design changes*, the approval of a major design change should be conducted via the approval of a modification or the approval of a change to the Type Certificate or a Supplemental Type Certificate (STC). For the purposes of this AC, and in accordance with NTC 91.273 section 3.1, the airworthiness approval of NVIS from non-NVIS compliant to NVIS-compliant should follow the STC process.

#### 4.2.1.2 Design Changes to previously approved NVIS

With respect to NTC 91.273, section 3.1, any subsequent design change to an NVIS that was approved before 5 April 2026 may follow the process of the original NVIS airworthiness approval.

### 4.2.2 Part 146 organisations requirements

NVIS design changes could involve many disciplines and specialised expertise. Part 146 organisations need to have, or need to subcontract, significant resources (e.g. a dark hangar, tri-bar charts and illuminators, qualified test pilot) and have appropriate procedures to manage them. Initial assessment and continuous oversight and personnel competencies are required to give assurance that these resources and procedures are maintained at an acceptable level to comply with Part 146.

#### 4.2.2.1 Part 146 scope

Part 146 organisations that intend to perform NVIS design changes should apply for the inclusion of the NVIS capability in their scope. Lack of this capability will lead to limitations in the ability to perform NVIS-related design changes.

#### 4.2.2.2 DDH and Engineering personnel competency and training

NVIS compliance affects various certification requirements under the responsibility of different disciplines. Part 146 organisations that intend to approve design changes related to NVIS shall ensure that at least one of their DDH has NVIS in their scope.

Although the choice is left to the Part 146 organisation, it should be recognised that NVIS design and compliance demonstration may require specific skills to be developed and maintained over time. Therefore, CAA recommends that personnel appointed as DDH, even though they may not be flying crew or responsible for NVIS projects, are specifically trained and have extensive experience in NVIS design and certification.

Engineering personnel who support the NVIS design and certification activities should receive appropriate training.

### 4.2.3 NVIS Testing

#### 4.2.3.1 NVIS Ground Test

**Equipment**

The design organisation should ensure that all required equipment is properly identified in the ground test plan.

The test facility used for the night tests should be sealed from all light sources and have a minimum of 7.62 metres (25 feet) of space in front of the helicopter. The test facility should also have sufficient room to either side of the helicopter to accommodate test equipment setup.

As the test site is very dark during the night aided, and unaided, ground testing it may be useful to equip flight and ground crew with NVIS-compatible handheld lights for ease of movement.

**Helicopter conformity**

For all compliance test or compliance inspection articles forming part of a design change, a Statement of Conformity form should be signed by the following authorised person:

- For a design change that is not major, a person authorised to certify the Return to Service of the changed product
- For a major design change, a person authorised to certify the conformity of a major modification or repair.

**Test set-up conformity**

For compliance tests, DDH within the aircraft design organisation should verify that the test set-up conforms to the applicable test plan and include a corresponding statement in the test report or the applicable CAA Conformity Inspection Record form, as well as a CAA Statement of Conformity form.

#### 4.2.3.2 NVIS Flight Test

A flight test should be scheduled for a low illumination (i.e. moonless) night, preferably in an area where there is little community lighting. Evaluation of NVG and NVIS lighting integration should be conducted in low ambient light conditions, as high ambient lighting conditions may mask the effects of inadequate cockpit lighting and reflections or glare.

A daylight familiarisation flight of the flight test area should take place before the flight test evaluation. Any specific flight regimes, manoeuvres, terrain, or landing areas that will be used for the NVIS evaluation should be flown in advance to familiarise the test pilots with possible hazards in the test area.

The flight test profile should consist of manoeuvres representative of those performed during normal or special operations over terrain and community areas in various illumination and weather conditions. This test should include evaluation under low illumination conditions (e.g. moonless and overcast sky with little community lighting). RTCA Document DO-275, section 4.4.2, provides one acceptable test procedure and test

sequence. Alternatively, as a minimum, the NVIS-NVG Compatibility Flight Evaluation can be found at: https://www.faa.gov/aircraft/air_cert/design_approvals/rotorcraft/nvis.

#### 4.2.3.3 Experimental Flight Testing and Test Pilot Approval

The purpose of certification flight test is to ensure that the airworthiness and operational requirements, for both aided and unaided operation, are met.

In accordance with Parts 21.193, 91.105 and following guidance in AC21-3 and AC21-10 for NVIS certification, a helicopter must be operated under a Special Category – Experimental Airworthiness Certificate. Also, the pilot of this helicopter will require test pilot approval in accordance with Rule 19.405 and AC19-1.

In accordance with AC19-1, flight tests for the development and certification of helicopters with initial NVIS approval, including full NVIS approval of helicopters with NVIS-friendly lighting, should be classified as Category 2, as the NVIS will require a re-assessment of the basic crew procedures and workload. Similarly, NVIS flight tests for changes to previously NVIS approved helicopters should be classified as Category 2. So, for these cases, flight test pilots, and lead flight test engineers if required, should have the applicable qualifications and experience requirements as detailed in the same AC.

In addition to the requirements above, the applicable Part 146 procedures and/or the Specific Flight Test Plan should establish the minimum NVIS operational and/or flight test experience in certification projects.

## 4.3 Configuration Control

### 4.3.1 Non-NVIS approved helicopters

Applicants seeking NVIS approval of a helicopter that has already been approved for Night VFR but not for NVIS should establish a procedure that allows clear identification and assessment of each cockpit-cabin lighting configuration.

A configuration file should be prepared and made available to the operator, and the maintenance organisation. The configuration file will be used to check the conformity of each helicopter configuration to the NVIS- approved configuration. The configuration file can be provided as an Appendix of the ICA or of the Master Drawing List, detailing the applicable serial number(s) having the same configuration. Refer to Appendix IX of this AC for an example.

### 4.3.2 Design changes to previously approved NVIS

Applicants seeking to introduce changes to previously approved NVIS for which they do not hold the original airworthiness approval should carefully examine the existing NVIS configuration file, Rotorcraft Flight Manual Supplement (RFMS), and ICA.

### 4.3.3 Configuration control of Night Vision Goggles

NVGs are part of the NVIS configuration and therefore this item will be under responsibility of the NVIS airworthiness approval holder for the configuration control. The list of approved NVG models shall be included in the RFMS Limitation Section and should also be included in the configuration file and ICA. Any change or addition of new NVG models are to be considered as a change to the existing approval.

## 4.4 Continuing Airworthiness

The design organisation responsible for the NVIS approval is expected to issue ICAs. In accordance with NTC 91.273 section 3.9, continued airworthiness tasks such as scheduled maintenance or non-routine tasks such as repairs that affect NVIS cockpit compatibility could compromise the initial approval. ICAs should include dedicated NVIS instructions to cover, at least, the following occurrences:

- Scheduled and unscheduled maintenance instructions including cockpit disassembly
- Repairs on NVIS components
- An inspection to check if the cockpit and external lights conform to the approved NVIS configuration, to be conducted following the change/repair of any NVIS equipment, or regularly. Any discrepancies must be communicated to the NVIS design change holder
- The maintenance instructions should also include a NVIS light leak check to be conducted as part of the NVIS inspection. This check should verify that the NVIS lighting has not degraded since its approval
- The ICA should indicate that the check is to be conducted by appropriate personnel capable of assessing the existing cockpit compared to the one initial NVIS certified configuration. The assessment should be conducted from all crew stations that are intended to be used (including cabin, if applicable) during NVG operations
- Light leak checks should be conducted on a regular basis and also after a hard landing or after any lightning strike
- All NVIS bezel lights / map lights/ post lights/ should be checked for condition and security
- The following are maintenance items typical to NVIS that should be considered in the scheduled maintenance:
    - Change the windshield/transparencies if crazed or cracked in a manner that impairs vision when using NVGs
    - If the NVIS configuration includes removable filters, they should be checked for condition, cleanliness, security, crazing and moisture between the filter and instrument glass
    - No cracks, crazing or moisture should be allowed
    - A daylight inspection of the filtered avionics should be conducted to ensure that the filter has not degraded in a way that impairs readability or colour identification in daylight conditions.

Appendix VIII of this AC contains examples of daylight and nightlight leak checks that could be incorporated into the ICA.

Appendix IX of this AC contains an example of a configuration file and cover page as an ICA appendix, including applicability to specific configurations or helicopter serial numbers.

Where the Part 145 Maintenance organisation has no previous or recent experience with NVIS-modified rotorcraft, and is undertaking its first NVIS installation and/or first NVIS maintenance activity on an approved NVIS design change, the following tasks should be performed in collaboration with the NVIS design change holder:

- light leak check
- compatibility inspections
- functional system checks, and
- conformity inspections of the configuration.

It is important to note that the design organisation is also responsible for providing ICAs that include scheduled and unscheduled maintenance as well as regular checks of the NVGs approved for the NVIS configuration. The NVGs are to be considered as part of the approved NVIS configuration and as such cannot be excluded from the ICA.

Please also note that NVIS installations are considered major modifications. For a licensed engineer to be able to certify the release to service, in accordance with Rule 43.103, the licensed engineer needs to ensure that the helicopter has acceptable technical data that shows the current helicopter NVIS configuration has been approved.

### 4.4.1 Design Changes to previously approved NVIS

If an NVIS system is to be modified by a party other than the organisation that certified the original NVIS system, that party takes responsibility for the modified system's continued airworthiness. While a "complete recertification" may not be necessary, the modifying party would typically need to carry out additional certification activity involving the wider system or directly obtain the original certification data to meet this responsibility.

It is acknowledged that each helicopter will exhibit different lighting characteristics due to the cockpit layout and the location and type of instruments fitted and this will have a bearing on crew NVG-aided vision. Accordingly, any future modification, including role or mission-specific equipment, involving a light-emitting or reflecting device is a major design change. This requires a re-evaluation of the NVIS against the original airworthiness requirements to ensure its compatibility with the NVGs.

# 5. NVIS Training, Competency and Currency

## 5.1 NVIS training

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 that 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 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 and be conducted at least annually for NVIS pilots and crew members who continue to serve in the same duty position in a specific make and model of aircraft during NVG flight operations.

Each person performing maintenance, inspections, preventive maintenance or changes to NVIS should be suitably trained to do so. The training should include, but not limited to the following:

1. The operation of the test equipment, special tools or other equipment required to maintain or test the NVIS or NVGs
2. Inspection and maintenance of windscreens and transparencies
3. Inspection and maintenance of a NVIS compatible lighting system to include any precautions in the care and cleaning of filters or lenses
4. NVIS Installation description and operation
5. NVG mount installation, test and repair
6. Binocular assembly adjustments, tests, functional checks, and component replacement.

For further information regarding training requirements for maintenance personnel, see RTCA/DO-275 section 5.

# Appendix I – Procedures for using NVGs on helicopter night VFR operations

As a minimum, the following items 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 take-off 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. En route:
    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.

# 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
            - 10º 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.

**Note:** *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. Accordingly, 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:
    a. Light amplification, intensity, sensitivity
    b. Visual acuity
    c. Astigmatism
    d. Magnification
    e. Field of view
    f. Field of regard

g. Focal range
h. Depth perception and distance estimation
i. Peripheral vision
j. Operational temperature range
k. Weight and centre of gravity
l. Detachability
m. Monochromatic image and adaption
n. Environment detection and identification.

2. NVG Associated Equipment:
    a. Binocular assembly
    b. Operator's manual
    c. Helmet mounted assembly
    d. Battery cartridges
    e. Carry case
    f. Lens paper
    g. Battery pack:
        - Authorised batteries
        - Battery life
    h. Lens caps
    i. Neck cord
    j. Inspection/maintenance records
3. Additional Equipment
    a. Helmet
    b. Quick release mount
    c. Counterweight bag
    d. Supplemental lighting.
4. Monocular Components and Operational Sequence:
    a. Objective lens
    b. Image intensifier tubes:
        - Photocathode
        - Microchannel Plate (MCP)
        - Phosphor screen
        - Image inverter
        - Eyepiece lens
5. NVG Functions and Pre-Flight Inspections:
    a. Binocular Assembly:
        - Vertical adjustment knob
        - Eye span (interpupillary distance) adjustments
        - Fore/aft adjustments
    b. Tilt adjustment lever
    c. Objective Focus ring
    d. Eyepiece Focus ring

e. Lock release button
f. Low battery indicator light
g. Pre-flight checks:
    - Mounting/Dismounting NVG to/from helmet
    - Low battery indicator check
    - Adjusting the NVG for operation:
        - Focussing procedure.

6. NVG Visual Deficiencies:
    a. Unacceptable Defects:
        - Shading
        - Edge glow
        - Flashing, flickering or intermittent operation.
    b. 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:
    a. 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. ACs
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. AFM
    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
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

1. Any procedures specific to the operator's operation such as:
    a. Winching
    b. Over water operations
    c. Low level searching
    d. Snow landings.

### 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

### En route

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.

### 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 is made up of a ground and flight training segment and will be conducted by an appropriately trained NVIS fight instructor. All NVIS flight instructor training should emphasise 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 to avert any hazardous conditions.

To be eligible for the issue of a NVIS Training and Checking approval, a B or D flight instructor must be certified by an examiner for night instruction and endorsed for NVIS training and checking approval. Refer NTC 91.273, section 3.3.

### 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 ACs 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

NVIS flight instructor trainees are to review appendix II theory subjects in their 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) an 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 – Rotorcraft Flight Manual Supplement Template for NVIS

When developing NVIS RFMS, the applicant should consider the information contained in the following documents, as appropriate to the NVIS certification basis:

- FAA - AC 27-B Section 27.1581 and MG 16 section (g)
- FAA - AC 29-2C Section 29.1581 and MG 16 section (g)
- EASA - EASA CM No.: CM-FT-001 Issue 03, Annex 2 - Example of NVIS RFM appendix.

***Note:*** *Flight Manual Supplements can only be produced as part of a modification approval by CAA or a delegation holder operating within a Part 146 Aircraft Design Organisation. This template gives technical content only. There are other format requirements which a Part 146 Aircraft Design Organisation will be familiar with. Information quoted in* ***bold*** *is expected to be in the RFMS verbatim.*

**1. GENERAL**

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

*Add the following limitation*

**"Any future modification, including role or mission specific equipment, involving a light emitting or reflecting device requires reassessment of the cockpit to ensure its compatibility with night vision imaging system (NVIS) operations."**

**2. LIMITATIONS**

*Add the following limitation if the aircraft has category A procedures and category A profiles were not certificated as part of the NVIS approval.*

**"Category A operations are prohibited when using NVG"**

2.1 NVG Compatibility:

The following NVGs are compatible with this cockpit lighting system: In this section, list the make and model of the NVGs used to determine compatibility. For example, if the NVIS airworthiness approval holder shows its lighting system is compatible with ITT F4949 Class A and B NVGs, L-3 M949, Class A and B NVGs, and Nivisys NVAG 6 NVGs, then the NVG compatibility list can be as follows:

2.1.1 NVGs that meet the performance requirements of TSO-C164. This covers NVG manufactured under a TSOA. 2.1.2 <Make, Model, and Part No. of NVG>. List the ITT/ExcelisF 4949 and Litton/Northrop-Grumman/L-3/Insight M949 NVG part numbers used to determine compatibility. If the NVIS airworthiness approval is a foreign validation, coordinate with the validating authority to add foreign NVGs found compatible with the lighting system.

***Note:*** *If the NVIS lighting system is shown to be only compatible with Class B NVGs, then add a limitation to use only Class B NVGs.*

2.2 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 operations with Night Vision Goggles (NVGs). The Operator must be authorised by the Director to conduct NVG operations."**

2.3 Training:

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

**"Crew members required to use NVGs during an NVG flight operation in this aircraft must meet the minimum accepted training, recency and competency levels detailed in the operator's procedures."**

2.4 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
- List other aircraft equipment identified in the airworthiness approval required for NVG operation like curtains separating the cockpit from the passenger cabin, chin bubble mats
- If a design method (e.g., chin mats) is used to block the light from entering the cockpit, a caution such as the one below may be required.

Only add requirements for chin mats or other light blocking items, like curtains, if they are required by the airworthiness approval. Do not add generic statements or "if needed" statements to the limitations section of the RFMS.

***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."*

2.5 Minimum Crew Requirements:

2.5.1 Landing. An additional NVG trained crew member must be equipped with and use NVGs during landing to assist in obstacle identification and clearing.

2.5.2 Take-off. An additional NVG trained crew member must use NVGs during take-off from unimproved sites to assist in obstacle identification and clearance if operational conditions permit (i.e., patient status allows).

***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 an approach and departure from an unimproved landing area."**

2.6 Incompatible NVIS Lights

Specifically identified installed lighting in the cockpit and cabin that the airworthiness approval did not modify and that are not useable during NVG operations. Additionally, include instructions on the use of non-NVIS lighting modified carry-on equipment (e.g. cell phones, mission equipment, medical equipment) during NVG operations. For example, instructions should be the following or similar:

**"Use of non-NVIS modified carry-on or personal equipment in the cockpit and cabin is prohibited during NVG operations."**

The following statements can be included in case there is a curtain available to block potential incompatible light sources from the cabin.

**"Use of non-NVIS modified carry-on or personal equipment in the cockpit is prohibited during NVG operations."**

**"The pilot must coordinate with other crewmembers and passengers before the use of non-NVIS modified carry-on equipment is used during**

**NVG operations in the cabin. In case incompatible lights are to be used during flight, the curtain must be installed prior to initiating the flight."**

2.7 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.

## 4. NORMAL PROCEDURES

4.1 Pre-flight:

- Check windshield, windows, and chin bubble windows for suitability (e.g., scratches, crazing, cleanliness)
- Check filter condition for fogging, crazing, cracking, etc., which impairs unaided readability of the instrument or gauge to which the filter is applied
- Check NVIS lighting for light leakage and compatibility
- NVG adjustment and alignment
- Check function of additional NVIS equipment

- Interior configuration check for NVIS equipment (e.g., deselect incompatible light sources)
- Exterior configuration check for NVIS equipment (e.g., position lights, taxi and landing light, search light are selected to correct mode, if applicable)
- Adjust lighting as required.

***Note:*** *Add any other items relevant to the NVIS installation.*

4.2 In-flight:

- Control of cockpit and external NVIS illumination. Adjust lighting, as required
- Transition to aided flight from unaided flight (and vice versa) as necessary
- Radar altimeter and additional equipment procedures, as necessary.

***Note****: Add any other items relevant to the NVIS installation.*

4.3 Post Flight:

Report any defects or discrepancies (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.*

# Appendix VIII – Instructions for Continued Airworthiness (ICA) Templates for NVIS

ICA must contain the information necessary for carrying out ongoing maintenance and inspections on NVIS equipment installed in the rotorcraft. At a minimum ICA should include the following:

1. The maintenance manual for the appliance, system or accessory. If this is not included in the ICA then clear reference is to be made to maintenance manuals, or documents supporting the maintenance of the appliance system, including limitations or servicing schedules.
2. Maintenance Instructions and Inspection Requirements. These must include:

a) Periodic inspections to ensure the NVIS lighting system is still NVG-compatible, and the configuration of the aircraft still complies with the approved data. An acceptable method is the inclusion of an annual or time-interval inspection procedure, as per DO-275 Section 5.5. These requirements should then be included or referenced in the operator's maintenance schedule.

b) The schedule shall include a 180-day inspection of the NVG appliance and a 24-month NVIS validation test, or as instructed by the NVG OEM.

c) At the 24-month NVIS validation test, the following shall be performed: a day readability ground test and an aided and unaided flight evaluation.

d) Examples of, or reference to, the periodic inspection check lists to be used.

e) Instructions on how to de-modify and modify instruments and gauges installed to the NVIS and whether this is permitted. This includes the removal of filters or other NVIS modification prior to returning an instrument, gauge, or light to the manufacturer for maintenance.

f) Identification of the different levels of maintenance for the NVIS and who may perform that maintenance.

See RTCA Document DO-275, sections 5.3 and 5.5.2.2.3 for further information.

**Illustrated Parts Breakdown:** At a minimum, the ICA should cover aircraft transparencies (e.g., windscreen, windows), NVIS lighting, and any additional aircraft equipment that support NVIS operations. The NVG manufacturer should have ICA and maintenance schedules for its goggles that the operator should follow. See Appendix IX of this AC for an example/template.

**NVG Storage:** It is recommended that a storage location or compartment is provided on the aircraft to protect the continued airworthiness of the NVGs while not in use. Storing the NVGs in a location that could cause damage to the aircraft or an aircraft component, hinder crashworthiness, or result in loss of the intended function of a component is prohibited.

**Airworthiness Limitations**

The following statement must be included in the Airworthiness Limitations of the ICA:

> **"The Airworthiness Limitations Section is CAA NZ approved and specifies maintenance required under parts 43 and 91 of the Civil Aviation Rules unless an alternative program has been CAA NZ approved."**

**Guidance material**

Depending on the NVIS certification basis, it is recommended to follow the templates below when developing NVIS Instructions for continued airworthiness:

**FAA guidance material for the compilation of NVIS ICAs:**

- Section h. Instructions for Continued Airworthiness (ICA) of FAA AC 27-1B, *Certification of Airworthiness Standards Normal Category Rotorcraft, Miscellaneous Guidance (MG) MG 16, Certification Guidelines for Rotorcraft Night Vision Imaging Systems (NVIS) Aircraft Lighting Equipment*

- Section h. Instructions for Continued Airworthiness (ICA) of FAA AC 29-2C, *Certification of Airworthiness Standards Transport Category Rotorcraft, Miscellaneous Guidance (MG) MG 16, Certification Guidelines for Rotorcraft Night Vision Imaging Systems (NVIS) Aircraft Lighting Equipment*

- FAA order 8110.54A - Instructions for Continued Airworthiness Responsibilities, Requirements, and Contents.

**Guidance for the compilation of NVIS Lighting Maintenance, Repair, and Safety Evaluation**

- NVIS/NVG COCKPIT COMPATIBILITY CHECKLIST

Available on the following website:

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

**EASA guidance material for the compilation of NVIS Inspection Checklist**

- EASA Certification Memorandum Helicopter Night Vision Imaging Systems CM No.: CM-FT-001 Issue 03 Annex 03. Example of Maintenance NVIS Inspection Checklist

Available on the following website:

https://www.easa.europa.eu/en/document-library/product-certification-consultations/cm-ft-001

# Appendix IX – ICA NVIS configuration appendix – Template for NVIS



**APPENDIX X**

## INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

**'Design Change holder name'**

**MODEL 1234**
**HELICOPTERS**
**WITH NVG/NVIS**
**COMPATIBLE**
**LIGHTING SYSTEM**
**DOCUMENT # ICA 1234-01**

APPLICABLE TO AIRCRAFT S/N: 56789, 56788
THE FOLLOWING KITS/STCS ARE REQUIRED TO BE INSTALLED IN THE ABOVE AIRCRAFT S/Ns AS A PREREQUISITE TO THE NVG/NVIS COMPATIBLE LIGHTING SYSTEM INSTALLATION:

EXAMPLES:

| | |
|---|---|
| • Inst Specterlight SX5 | CAANZ approval 12345678 (validation of FAA STC 12345678) |
| • Medical Interior and Medical Battery | CAANZ approval 12345678 |
| • LMN Medical Interior | CAANZ approval 12345679 |
| • Installation Rotor Disc Light | TC Option |
| • Key ALPHA GlX 200 MFD | CAANZ approval 12345668 (validation of FAA STC ST00312NW) |

'OPERATOR'S NAME' CONFIGURATION

## SECTION 1 COCKPIT

(FIGURE 1)

*(insert drawing/picture of cockpit + overhead/ slant console, with numbers for each light emitting equipment)*

| ITEM NO. | APPLICANT P/N | DESCRIPTION | ORIG EQUIP MFG | OEM PART NUMBER | MODEL NUMBER | QTY / SS | NOTES |
|---|---|---|---|---|---|---|---|
| 1 | 1234 | KL 165A VHF COMMUNICATION TRANSCEIVER/NAVIGATION RECEIVER | ALPHA | 069-01033-0101 | KX 165A | 1 | |
| 2 | 5678 | GNC 250XL RECEIVER | BETA | 011-00295-00 | GNC 250XL | 1 | |
| 3 | 9012 | KR 87 ADF RECEIVER | GAMMA | 066-1072-04 | KR 87 | 1 | |
| 4 | 9874 | KN 62A DME | GAMMA | 066-1068-01 | KN 62A | 1 | |
| 5 | 8745 | KT 70 TRANSPONDER | POLLUX | 066-01141-0101 | KT 70 | 1 | |
| 6 | | ANNUNCIATOR, “ICS/ON” | ARCTURUS | LED-7A-14-KB-E05VM | | 1 (REF) | OEM NVG |
| 7 | | RA-335 RAPPLICANTO ALTIMETER INDICATOR | THETA | 7000839-923 | RA-335 | 1 (REF) | OEM NVG |
| 8 | | ENCODER ALTIMETER | BELLATRIX | 3A67.32.20F.05.1.KR | | 1 (REF) | OEM |
| 9 | | MAGNETIC COMPASS (5V) | DELTA | 727-5026/04 | | 1 (REF) | OEM NVG |
| 10 | | MASTER CAUTION LIGHT | DELTA | 720-9300/01.02 | | 1 (REF) | OEM NVG |
| 11 | | ANNUNCIATOR, “RCVRS/ON” | CASTOR | LED-7A-14-KB-E05VN | | 1 (REF) | OEM NVG |
| 12 | | ANNUNCIATOR, “IDS FAN” | ARCTURUS | LED-50-17-SE-E05VW | | 1 (REF) | OEM NVG |
| 13 | 6547 | ELT REMOTE SWITCH | ARTEX | 345-6196-04 | | 1 | SUPPLY MOD |
| 14 | | CHRONOGRAPH CLOCK | DELTA | AT42510H SIRIO MOD # 727-0261/02 | LC-2H | 1 (REF) | OEM NVG |
| 15 | 2313-07 | NVIS ELP, VNE | APPLICANT | | | 1 | |
| 15 | 2345-08 | NVIS ELP, VNE | APPLICANT | | | 1 | ALT P/N |
| 16 | | ANNUNCIATOR, “SPKR/ON” | BELLATRIX | LED-7A-14-KB-E05VP | | 1 (REF) | OEM NVG |

SECTION 2 CABIN LAYOUT

FIGURE 2

*(insert drawing/picture of internal cabin layout, with numbers for each light-emitting equipment)*

TABLE

*(insert Table as per section 1 detailing for each number the equipment characteristics as in Table per section 1)*

SECTION 3 EXTERNAL LIGHTING

FIGURE 3

*(insert drawing/picture of external lighting configuration, with numbers for each light-emitting equipment)*

TABLE

*(insert Table as per section 1 detailing for each number the equipment characteristics as…*