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FOCA Certification Leaflet (CL)

Helicopter operations with night vision imaging systems

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Table of Contents (ToC)

List of abbreviations and acronyms

The following abbreviations and acronyms are within this Certification Leaflet:

Abbreviations	Acronyms
AEO	all-engines-operative
AFM	aircraft flight manual
AMC	acceptable means of compliance
AOC	air operator certificate
CAT	commercial air transport
CL	certification leaflet
CPL	commercial pilot licence
CRM	crew resource management
CS	certification specifications
DG	dangerous goods
DPATO	defined point after take-off
DPBL	defined point before landing
EFB	electronic flight bag
EC	European Community
ELT	emergency locator transmitter
ERP	emergency response plan
EU	European Union
FOCA	Federal Office of Civil Aviation
FATO	final approach and take-off area
FC	flight crew
FCL	flight crew licensing
FSTD	Flight simulation training device
FFS	full flight simulator
FI	flight instructor
FMS	flight management system

Abbreviations	Acronyms
FTL	flight and duty time limitations
GM	Guidance Material
GPS	global positioning system
GPWS	ground proximity warning system
H	helicopter
HEMS	helicopter emergency medical service
HHO	helicopter hoist operation
HIGE	hover in ground effect
HOGE	hover out of ground effect
HUMS	health usage monitor system
ICAO	International Civil Aviation Organization
IDE	instrument, data equipment
IFR	instrument flight rules
IGE	in ground effect
IMC	instrument meteorological conditions
IR	Implementing Rule
IR	instrument rating
JAA	Joint Aviation Authorities
JAR	Joint Aviation Requirement
kt	knots
LDA	landing distance available
LDP	landing decision point
LVO	low visibility operation
MCTOM	maximum certified take-off mass
MEL	minimum equipment list

Abbreviations	Acronyms
MLR	manuals, logs and records
MMEL	master minimum equipment list
MNPS	minimum navigation performance specifications
MOPSC	Maximum operational passenger seating configuration
NM	nautical miles
NPA	notice of proposed amendment
NVD	night vision device
NVG	night vision goggles
NVIS	night vision imaging system
OAT	outside air temperature
OEI	one-engine-inoperative
OGE	out of ground effect
OM	operations manual
OPC	operators proficiency check
ORO	organisation requirements for air operations
PBN	performance-based navigation
PIC	pilot-in-command
PIS	public interest site
POH	pilot's operating handbook
PCDS	personnel carrying device system
RAD	radio altimeter
RCC	rescue coordination centre
RNAV	area navigation
ROD	rate of descent
RTODRH	rejected take-off distance required (helicopters)
RTODAH	rejected take-off distance available (helicopters)

Abbreviations	Acronyms
RVSM	reduced vertical separation minima
SAR	search and rescue
SMM	safety management manual
SMS	safety management system
SOP	standard operating procedure
SPA	operations requiring specific approvals
SPO	specialised operations
STC	supplemental type certificate
TAWS	terrain awareness warning system
TC	technical crew
TC	type certificate
TCAS	traffic collision avoidance system
TDP	take-off decision point
TODAH	take-off distance available
TODRH	take-off distance required
UMS	usage monitoring system
V_2	take-off safety speed
VMC	visual meteorological conditions
VFR	visual flight rules
VTOL	vertical take-off and landing
VTOSS	take-off safety speed
VMC	visual meteorological conditions
ZFM	zero fuel mass

Definitions for terms used in this Certification Leaflet

'Aided night vision imaging system (NVIS) flight' means, in the case of NVIS operations, that portion of a visual fl light rules (VFR) fl light performed at night when a crew member is using night vision goggles (NVG).

'alternative means of compliance' means those means that propose an alternative to an existing acceptable means of compliance or those that propose new means to establish compliance with Regulation (EC) No 216/2008 and its Implementing Rules for which no associated AMC have been adopted by the Agency;

'category A with respect to helicopters' means a multi-engined helicopter designed with engine and system isolation features specified in the applicable airworthiness codes and capable of operations using take-off and landing data scheduled under a critical engine failure concept that assures adequate designated surface area and adequate performance capability for continued safe flight or safe rejected take-off in the event of engine failure;

'category B with respect to helicopters' means a single-engined or multi-engined helicopter that does not meet category A standards. Category B helicopters have no guaranteed capability to continue safe flight in the event of an engine failure, and unscheduled landing is assumed;

'congested area' means in relation to a city, town or settlement, any area which is substantially used for residential, commercial or recreational purposes;

'crew member' means a person assigned by an operator to perform duties on board an aircraft;

'final approach and take-off area (FATO)' means a defined area for helicopter operations, over which the final phase of the approach manoeuvre to hover or land is completed, and from which the take-off manoeuvre is commenced. In the case of helicopters operating in performance class 1, the defined area includes the rejected take-off area available;

'flight simulation training device (FSTD)' means a training device which is:

(a) in the case of aeroplanes, a full flight simulator (FFS), a flight training device (FTD), a flight and navigation procedures trainer (FNPT), or a basic instrument training device (BITD);

(b) in the case of helicopters, a full flight simulator (FFS), a flight training device (FTD) or a flight and navigation procedures trainer (FNPT);

'ground emergency service personnel' means any ground emergency service personnel (such as policemen, firemen, etc.) involved with helicopter emergency medical services (HEMSs) and whose tasks are to any extent pertinent to helicopter operations;

'helicopter' means a heavier-than-air aircraft supported in flight chiefly by the reactions of the air on one or more power-driven rotors on substantially vertical axes;

'HEMS crew member' means a technical crew member who is assigned to a HEMS flight for the purpose of attending to any person in need of medical assistance carried in the helicopter and assisting the pilot during the mission;

'HEMS flight' means a flight by a helicopter operating under a HEMS approval, the purpose of which is to facilitate emergency medical assistance, where immediate and rapid transportation is essential, by carrying:

(a) medical personnel;

(b) medical supplies (equipment, blood, organs, drugs); or

(c) ill or injured persons and other persons directly involved;

'HEMS operating base' means an aerodrome at which the HEMS crew members and the HEMS helicopter may be on stand-by for HEMS operations;

'HEMS operating site' means a site selected by the commander during a HEMS flight for helicopter hoist operations, landing and take-off;

'hostile environment' means:

(a) an environment in which:

(i) a safe forced landing cannot be accomplished because the surface is inadequate;

(ii) the helicopter occupants cannot be adequately protected from the elements;

(iii) search and rescue response/capability is not provided consistent with anticipated exposure; or

(iv) there is an unacceptable risk of endangering persons or property on the ground;

(b) in any case, the following areas:

(i) for overwater operations, the open sea areas north of 45N and south of 45S designated by the authority of the State concerned;

(ii) those parts of a congested area without adequate safe forced landing areas;

'local helicopter operation' means a commercial air transport operation of helicopters with a maximum certified take-off mass (MCTOM) over 3 175 kg and a maximum operational passenger seating configuration (MOPSC) of nine or less, by day, over routes navigated by reference to visual landmarks, conducted within a local and defined geographical area specified in the operations manual;

'maximum operational passenger seating configuration (MOPSC)' means the maximum passenger seating capacity of an individual aircraft, excluding crew seats, established for operational purposes and specified in the operations manual. Taking as a baseline the maximum passenger seating configuration established during the certification process conducted for the type certificate (TC), supplemental type certificate (STC) or change to the TC or STC as relevant to the individual aircraft, the MOPSC may establish an equal or lower number of seats, depending on the operational constraints;

'medical passenger' means a medical person carried in a helicopter during a HEMS flight, including but not limited to doctors, nurses and paramedics;

'night' means the period between the end of evening civil twilight and the beginning of morning civil twilight or such other period between sunset and sunrise as may be prescribed by the appropriate authority, as defined by the Member State.

'night vision goggles (NVG)' means a head-mounted, binocular, light intensification appliance that enhances the ability to maintain visual surface references at night.

'night vision imaging system (NVIS)' means the integration of all elements required to successfully and safely use NVGs while operating a helicopter. The system includes as a minimum: NVGs, NVIS lighting, helicopter components, training and continuing airworthiness.

'NVIS crew member' means a technical crew member assigned to an NVIS flight

'NVIS flight' means a flight under night visual meteorological conditions (VMC) with the flight crew using NVGs in a helicopter operating under an NVIS approval.

'non-hostile environment' means an environment in which:

(a) a safe forced landing can be accomplished;

(b) the helicopter occupants can be protected from the elements; and

(c) search and rescue response/capability is provided consistent with the anticipated exposure.

In any case, those parts of a congested area with adequate safe forced landing areas shall be considered non-hostile;

'operating site' means a site, other than an aerodrome, selected by the operator or pilot-in-command or commander for landing, take-off and/or external load operations;

'operation in performance class 1' means an operation that, in the event of failure of the critical engine, the helicopter is able to land within the rejected take-off distance available or safely continue the flight to an appropriate landing area, depending on when the failure occurs;

'operation in performance class 2' means an operation that, in the event of failure of the critical engine, performance is available to enable the helicopter to safely continue the flight, except when the failure occurs early during the take-off manoeuvre or late in the landing manoeuvre, in which cases a forced landing may be required;

'operation in performance class 3' means an operation that, in the event of an engine failure at any time during the flight, a forced landing may be required in a multi-engined helicopter and will be required in a single-engined helicopter;

'pilot-in-command' means the pilot designated as being in command and charged with the safe conduct of the flight. For the purpose of commercial air transport operations, the 'pilot-in-command' shall be termed the 'commander';

'public interest site (PIS)' means a site used exclusively for operations in the public interest;

'safe forced landing' means an unavoidable landing or ditching with a reasonable expectancy of no injuries to persons in the aircraft or on the surface;

'technical crew member' means a crew member in commercial air transport HEMS, HHO or NVIS operations other than a flight or cabin crew member, assigned by the operator to duties in the aircraft or on the ground for the purpose of assisting the pilot during HEMS, HHO or NVIS operations, which may require the operation of specialised on-board equipment

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CL 0 Introduction

All Certification Leaflets (CL) are intended to assist the organisation/operator in the implementation of relevant matters into the activities and document system of the organisation/operator, as well as to ensure compliance with legal requirements. It is to be considered a tool for the organisation/operator in order to ease processes of obtaining required and defined acceptances, approvals and authorisations issued by the Federal Office of Civil Aviation (FOCA). Using the CL will facilitate establishing compliance with defined requirements and will lead through the respective certification or variation process. This is achieved by the presentation of key questions to be used by the organisation/operator to question completeness and compliance of the information contained in the respective document system by performing a self-assessment prior to submitting the documentation to the FOCA.

It is important to understand that the FOCA will use the identical CL when evaluating regulatory compliance with a specific requirement. The CL is also used as a checklist when performing the authorities' technical inspection/assessment during the certification or variation process. The questions used by the organisation/operator during the self-assessment are identical to those used by the inspector during the evaluation process.

0.1. Purpose of this CL

The purpose of this certification leaflet is to provide:

- an overview of the general requirements of an NVIS approval;
- guidance on the possibility of developing the necessary NVIS content of the operations manual;
- a self-assessment tool for organisations to verify compliance with the relevant legal requirements; and
- a certification tool for the competent authority to conduct document evaluation regarding compliance with the relevant legal requirements.

0.2. Scope

The material in this CL covers all aspects of requirements for NVIS approval. It will help the applicant to implement the necessary content in the company's operations manuals to comply with the requirements. The questions in this CL are derived from the relevant implementing rules (IR), their related applicable means of compliance (AMC) and guide material (GM). Different (e.g. company's solution) means of compliance are subject to a separate certification process.

Other specific approvals, often used in connection with NVIS operations (e.g. HEMS and HHO), are also open to "standard" commercial activities, and therefore form the content of different CLs.

The examples provided in this CL may be incomplete and solely represent one possible means of how to provide the required data. An organisation must add further information or adapt the examples to their specific needs in accordance with the necessary requirements.

Definitions for terms used in are listed on page "DEF 1 and 2" or are outlined and explained within the reference boxes.

0.3. Terms and Conditions

When used throughout the Certification Leaflet the following terms shall have the meaning as defined below:

Term	Meaning	Reference
shall, must, will	These terms express an obligation, a positive command.	EC English Style Guide: Ch. 7.19
may	This term expresses a positive permission.	EC English Style Guide: Ch. 7.21
shall not, will not	These terms express an obligation, a negative command.	EC English Style Guide: Ch. 7.20
may not, must not	These terms express a prohibition.	EC English Style Guide: Ch. 7.20
need not	This term expresses a negative permission.	EC English Style Guide: Ch. 7.22
should	This term expresses an obligation when an acceptable means of compliance should be applied.	EASA Acceptable Means of Compliance publications FOCA policies and requirements
could	This term expresses a possibility.	http://oxforddictionaries.com/ definition/english/could
ideally	This term expresses a best possible means of compliance and/or best experienced industry practice.	FOCA recommendation

Note: To highlight an information or editorial note, a specific note box is used.

- The use of the male gender should be understood to include male and female persons.

0.4. Legal and Reference

This CL is based on the legal references listed below:

Legal Reference	Issue	Subject
State the legal documents	Date of Issue	Brief description of the content
Basic Regulation (EC) No 216/2008	20.02.2008	Common rules in the field of civil aviation and establishing a European Aviation Safety Agency
Commission Regulation (EU) No 965/2012	05.10.2012	Technical requirements and administrative procedures related to air operations Annex I: DEF; Annex II: Part-ARO; Annex III: Part-ORO; Annex IV: Part-CAT; Annex V: Part-SPA
Commission Regulation (EU) No 1178/2011	03.11.2011	Technical requirements and administrative procedures related to civil aviation aircrew Annex I: Part-FCL; Annex II: Conversion of existing national licences and ratings; Annex III: Acceptance of Licences of third countries; Annex IV: Part-MED
Commission Regulation (EU) No 748/2012	03.08.2012	Implementing rules for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations
AMC & GM to Regulation Air Operations Annex III / Part-ORO	25.11.2012	Regulation Air Operations Annex III / Part-ORO: “Organisation Requirements Air Operations: Acceptable Means of Compliance (AMC) and Guidance Material (GM) to Part-ORO
AMC & GM to Regulation Air Operations Annex V / Part-SPA	19.04.2012	Regulation Air Operations Annex III / Part-SPA: “NVIS Approval”: Acceptable Means of Compliance (AMC) and Guidance Material (GM) to Part-SPA

0.5. Organisation/Operator Responsibilities

Helicopters shall only be operated for the purpose of NVIS operations if the operator has been approved by the competent authority.

To obtain such approval by the competent authority, the operator shall:

- operate in CAT and hold a CAT AOC in accordance with Annex III (Part-ORO);
- demonstrate to the competent authority compliance with the requirements contained in Subpart SPA.NVIS (H).

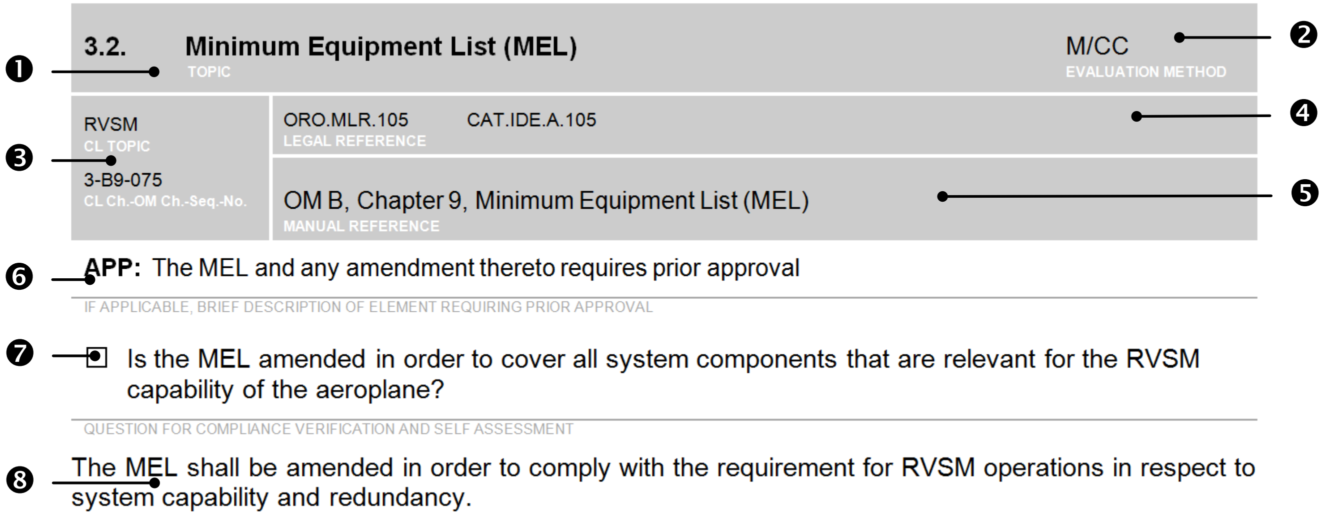
In addition to the requirements for commercial air-transport operations (CAT), NVIS operations must be compliant with a set of additional and different elements. Some of these elements are subject to a separate approval (e.g. operations to/from public interest sites).

The operator is responsible for ensuring that NVIS operations remain in compliance with the requirements of the applicable IR's and AMCs/GMs.

Note: Note: Manuals must be structured in accordance with the relevant regulation: ORO.MLR.100 / AMC1 ORO.MLR.100 / AMC 3 ORO.MLR.100

0.6. Format of the CL

The CL consists of a standardised modular reference box system. The following presentation provides details of the defined format:



❶	Topic: subject description
❷	FOCA evaluation method
❸	FOCA / Topic Reference Number which may be used as identification in addition to interlink between this leaflet and the Document Evaluation Report (Finding Report). The Number consists of a combination of: - a subject code related to the specific topic/ theme; and - sequence number in the respective chapter of the CL. The above example 3-B9-075 indicates: RVSM = CL regarding RVSM Specific Approval, 3 = CL section; B9 = OM chapter under evaluation (here OM-B, Chapter 9.), followed by 075 = sequence number.
❹	Associated legal reference and/ or reference to other relevant publications including information on formal Acceptance (ACC) or Approval (APP) where applicable.
❺	Reference to the Part(s), Chapter(s) and/or Subchapters of the organisation’s document systems or manual system as required by the applicable Part.
❻	If the legal provision requires a formal approval, a short description of the content of this approval is provided.
❼	Questions for self-assessment and compliance verification.
❽	Provides instructions, provisions, regulatory requirements, guidelines, acceptable means of compliance and examples of current best practice.

CL 1 Requirements related to NVIS

1.1. Specific approvals for specific operations

A commercial air transport operator (AOC holder) has to comply with the relevant provisions of Annex V (Part SPA) to EU Regulation No. 965/2012 when operating an aeroplane or helicopter for a specific operation (e.g. performance based navigation (PBN); minimum navigation performance (MNPS); reduced vertical separation minima (MNPS).

The FOCA is the competent authority for operators applying for specific approval and whose principal place of business is in Switzerland.

Part SPA (Annex V) to EU Regulation No 965/2012, divided into 10 subparts, contains operator requirements for operations requiring specific approvals:

- Subpart A contains general requirements (applicable to all specific approvals);
- Subparts B to J contain the requirements for each specific approval.

> **Note:** Only CAT operators may apply for operations with night vision goggles (NVIS); helicopter hoist (HHO) and helicopter emergency medical service (HEMS).

1.2. Basic Regulation (EC) No 216/20081

The consolidated version of the Basic Regulation (EC) No 216/2008 of the European Parliament and of the Council states, as one of the essential requirements, those operators shall only operate an aircraft for the purpose of commercial air transport (hereinafter 'CAT') operations as specified in Annexes III and IV.

CAT operators shall comply with the relevant provisions of **Annex V** (SPA.NVIS) when operating helicopters used for commercial air transport with night vision imaging system (NVIS).

1.3. Implementing Rules and Acceptable Means of Compliance

At the moment, Implementing Rules have been set in force for Air Crew and Air Operations only. Those for ATM/ANS are currently in the legislative process. Those for Airworthiness will follow in the future.

AMCs are defined as non-binding standards adopted by the Agency to illustrate means to establish compliance with the Basic Regulation and its Implementing Rules.

The AMCs issued by the Agency are not of a legislative nature; therefore they cannot impose obligations on regulated persons who decide to show compliance with the applicable requirements by other means. However, as the intention of the lawmaker's legislator in providing such material is to ensure legal certainty and contribute to uniform implementation, it must define competent authorities so that regulated persons complying with an Agency AMC can be recognised as complying with the law. This is why the adoption of such material by the EASA is subject to an open rulemaking process as prescribed by Article 52 of the Basic Regulation.

> **Note:** The questions attached to the boxes within this CL are based on Implementing Rules, AMCs and GMs. According to Swiss law, AMCs are as binding as IRs.

1.4. Elements of the NVIS requiring approval

The following elements of the NVIS operation require prior approval by FOCA:

- Airworthiness approval of helicopter and all associated NVIS equipment
- Training and checking programmes.

CL 2 Documentation and information – content of the operations manual (OM)

The operator shall ensure that, as part of its risk analysis and management process, risks associated with the NVIS environment are minimised by specifying in the operations manual: selection, composition and training of crews; levels of equipment and dispatch criteria; and operating procedures and minima, such that normal and likely abnormal operations are described and adequately mitigated.

Relevant extracts from the operations manual shall be made available to the organisation for which the HEMS is being provided.

Additionally to the general content as required by AMC3 ORO.MLR.100 the operations manual (OM) or the special operating procedure (SOP) acc. AMC1 SPA.GEN.105(a) shall include:

Content		Subchapter	CL	OM	Reference
1	Definitions, Introduction	• Definition of: o "NVIS"; o "NVIS crew member", o "NVIS flight", o "Aided night vision imaging system (NVIS) flight' • Difference between aided and unaided flight at night	4.1	A0.1.4 or SOP	SPA.NVIS.100
2	Risk analysis and management process (information and documentation)	• risk analyse for NVIS operations • hazards and risks associated with the NVIS environment • The operator shall ensure that, as part of its risk analysis and management process, are minimised by specifying in the operations manual: o selection, o composition and training of crews; o levels of equipment and dispatch criteria; o operating procedures and minima, such that normal and likely abnormal operations are described and adequately mitigated • normal and likely abnormal operations are described and adequately mitigated risks associated with the HEMS environment, regarding operational requirements.	4.9	A0.X A1.X A2.X A4.X A5.X A6.X A7.X D2.X OMM 3.X OMM 4.X or SOP	SPA.NVIS.140
3	Equipment	• Helicopter's equipment, • equipment to be carried and its limitations • the minimum equipment list (MEL) entry covering the equipment specified • helicopter's NVIS compatible lightning • back-up/secondary power source • Radio altimeter, • procedures for continuing airworthiness contain the necessary information for carrying ongoing maintenance and inspections on NVIS equipment, covering at least:	4.2	A8.X B1.1.1 B8.X B9.X or SOP CAME	SPA.NVIS.110 AMC1 SPA.NVIS.110(b), (f)

		o helicopter windscreen and transparencies; o NVG lighting; o NVGs and o any additional equipment that supports NVIS operations. • Miscellaneous equipment			
5	NVIS operating minima	• Definition of "NVIS operating minima"	4.4	A8.X A12.X ASOP	SPA.NVIS.120
7	Operating Procedures Normal, abnormal, emergency procedures	• Normal operation; • pre- and post-flight procedures and documentation; • procedures when one crew member is wearing NVG and/or procedures when two or more crew members are wearing NVGs; • Qualification – authorisation list (operator specifications) • single-pilot NVIS operation limited to the en-route phase of a flight; • a crew of at least one pilot and one NVIS technical crew member • procedures for the transition to and from NVIS flight; • use of the radio altimeter on an NVIS flight; • in-flight procedures for assessing visibility, to ensure that operations are not conducted below the minima stipulated for o non-assisted night VFR operations; o weather minima, taking the underlying activity into account; and o the minimum transition heights to/from an NVIS flight • guidance on/for: o take-off and landing procedures at previously unsurveyed HEMS operating sites; o the selection of the HEMS operating site (surveyed and unsurveyed); o routes for regular flights to surveyed sites, including the minimum flight altitude; • the safety altitude for the area overflown; • Abnormal operation o Discrepancies to standards procedures • Emergency procedures o procedures to be followed in case of inadvertent entry into cloud.	4.3 4.4 4.5	A1.X A2.X A4.X A5.X A8.X A12.X B3 B4 B5 B6 B7 B11 D2.X or SOP	SPA.NVIS.130 AMC1 SPA.NVIS.130(f)(1) GM1 SPA.NVIS.130(e) SPA.HEMS.140 AMC1 SPA.HEMS.140
7	Crew requirements	• selection criteria of crew members; • conditions for assignment to duties; • minimum experience for the commander/PIC and FI;	4.6 4.7 4.8	A4.1.X A5.2.1 A5.5.X A6	SPA.NVIS.130 AMC1 SPA.NVIS.130(f)(1) GM1 SPA.NVIS.130(e)

		• initial and operational training; • recency e.g.: 3 NVIS flights in the last 90 days for all crew members; • minimum crew; • Crew composition, • Crew training and checking syllabus/ programme: o initial training; o operational training; o conversion training; o difference training; o familiarization training; o recurrent trailing; o refresher training • crew coordination concept; • tasks of the NVIS technical crew member; • require to complete operational training.		B2.X B9.X D2.1 D2.3 or SOP	AMC1 ORO.TC.110

CL 3 Specific approvals

3.1.	**General requirements** TOPIC				M/CC EVALUATION METHOD
HEMS CL TOPIC	SPA.GEN.100 LEGAL REFERENCE	SPA.GEN.105	SPA.GEN.110	SPA.GEN.115	SPA.GEN.120
3-OMA0-05 CL Ch.-OM Ch.-Seq.-No.	OM A, chapter 0.X “introduction“ OM A, chapter 0.2 “system of amendment and revision” MANUAL REFERENCE				

IF APPLICABLE, BRIEF DESCRIPTION OF ELEMENT REQUIRING PRIOR APPROVAL

General:

☐ Does the commercial air transport (CAT) operator have its principle place of business in Switzerland?

☐ Has the operator applying for a specific approval provided the required documentation and information:

- the name, address, mailing address of the applicant and
- a description of the intended operation?

☐ Has the operator provided the following evidence:

- compliance with the requirements of the applicable Subpart and
- the relevant elements defined in the data established in accordance with Regulation (EC) No 748/2012 have been taken into account.

☐ Does the operator retain records related to the required documentation for the approval at least for the duration of the SPA operation?

☐ Is the scope of activity that the operator (AOC holder) is approved to conduct documented and specified in the operations specifications to the AOC?

☐ Does the operator require himself to provide the FOCA with the relevant documentation when conditions of a specific approval are affected by changes?

☐ Does the operator specify that the SPA only remains valid if the operator remains in compliance with the requirements associated with the SPA and the relevant elements in accordance with Regulation (EC) No 748/2012?

QUESTION FOR COMPLIANCE VERIFICATION AND SELF ASSESSMENT

DOCUMENTATION (AMC1 SPA.GEN.105(a))

(a) Operating procedures should be documented in the operations manual.

(b) If an operations manual is not required, operating procedures may be described in a procedures manual (SOP).

CL 4 Night vision imaging system (NVIS) operations

4.1.	**NVIS operations** TOPIC	M/CC EVALUATION METHOD
NVIS CL TOPIC	SPA.NVIS.100 LEGAL REFERENCE	
4-OMA-005 CL Ch.-OM Ch.-Seq.-No.	OM A, chapter 0.1.4 ”explanations and definitions” MANUAL REFERENCE	

APP: Helicopter operations under VFR at night with the aid of NVIS

IF APPLICABLE, BRIEF DESCRIPTION OF ELEMENT REQUIRING PRIOR APPROVAL

☐ Is the operation in CAT and does operator hold a CAT AOC in accordance with Annex III (Part-ORO)?

☐ Has the operator demonstrated compliance with the requirements in Subpart H (NVIS)?

☐ Has the operator successfully integrated all elements of the NVIS?

QUESTION FOR COMPLIANCE VERIFICATION AND SELF ASSESSMENT

Definitions

‘Aided night vision imaging system (NVIS) flight’ means, in the case of NVIS operations, that portion of a visual flight rules (VFR) flight performed at night when a crew member is using night vision goggles (NVG).

‘NVIS flight’ means a flight under night visual meteorological conditions (VMC) with the flight crew using NVGs in a helicopter operating under an NVIS approval.

4.2.	**Equipment requirements for NVIS operations** TOPIC	M/CC/IN EVALUATION METHOD
NVIS CL TOPIC 4-OMA/B-010 CL Ch.-OM Ch.-Seq.-No.	SPA.NVIS.110 (EC) No 748/2012 LEGAL REFERENCE	
	OM A, chapter 8.X ”installation and use” OM B, chapter 1.1.1 ”certification” OM B, chapter 8.X ”configuration deviation list” OM B, chapter 9.X ”minimum equipment list” MANUAL REFERENCE	

IF APPLICABLE, BRIEF DESCRIPTION OF ELEMENT REQUIRING PRIOR APPROVAL

General:

☐ Has the helicopter's NVIS equipment been issued with the relevant airworthiness approval in accordance with Regulation (EC) No 748/2012?

☐ Is the helicopter equipped with radio altimeter capable of emitting an audio warning below a pre-set height and a visual warning at a height selectable by the pilot, instantly discernible during all phases of NVIS flight?

☐ Is the helicopter certified for NVIS operations (e.g. based on a STC)?

QUESTION FOR COMPLIANCE VERIFICATION AND SELF ASSESSMENT

Radio Altimeter (AMC 1 SPA.NVIS.110(b))

An analogue type display presentation may be, for example, a representation of a dial, ribbon or bar, but not a display that provides numbers only. An analogue type display may be embedded into an electronic flight instrumentation system (EFIS).

Radio altimeter should:

- be of an analogue type display presentation that requires minimal interpretation for both an instantaneous impression of absolute height and rate of change of height;
- be positioned to be instantly visible and discernable from each cockpit crew station;
- have an integral audio and visual low height warning that operates at a height selectable by the pilot; and
- provide unambiguous warning to the crew of radio altimeter failure.

The visual warning should provide:

- clear visual warning at each cockpit crew station of height below the pilot-selectable height; and
- adequate attention-getting-capability for typical NVIS operations.

The audio warning should:

- be unambiguous and readily cancellable;
- not extinguish any visual low height warnings when cancelled; and
- operate at the same pilot-selectable height as the visual warning.

Modification or maintenance to the helicopter (GM1 SPA.NVIS.110(f))

It is important that the operator reviews and considers all modifications or maintenance to the helicopter with regard to the NVIS airworthiness approval. Special emphasis needs to be paid to modification and maintenance of equipment such as light emitting or reflecting devices, transparencies and avionics equipment, as the function of this equipment may interfere with the NVGs.

4.3.	**Equipment requirements for NVIS operations** TOPIC	M/CC/IN EVALUATION METHOD
NVIS CL TOPIC 4-OMA/B-15 Ch.-OM Ch.-Seq.-No.	SPA.NVIS.110 LEGAL REFERENCE	
	OM A, chapter 8.X "operating procedures" OM B, chapter 8.X "configuration deviation list" OM B, chapter 9.X "minimum equipment list" CAME MANUAL REFERENCE	

IF APPLICABLE, BRIEF DESCRIPTION OF ELEMENT REQUIRING PRIOR APPROVAL

☐ Have the night vision goggles (NVG) a back-up/secondary power source (e.g. battery pack)?

☐ Are the NVG appropriate attached to a helmet?

☐ Are the required NVG for the operation of the same type, generation and model?

☐ Do the procedures for continuing airworthiness contain the necessary information for carrying ongoing maintenance and inspections on NVIS equipment, covering at least:

- helicopter windscreen and transparencies;
- NVG lighting;
- NVGs and
- any additional equipment that supports NVIS operations?

QUESTION FOR COMPLIANCE VERIFICATION AND SELF ASSESSMENT

4.4.	**NVIS operating minima** TOPIC	M/CC EVALUATION METHOD

NVIS CL TOPIC 4-OMA-020 CL Ch.-OM Ch.-Seq.-No.	SPA.NVIS.120 LEGAL REFERENCE
	OM A, chapter 8.X ”operating minima” OM A, chapter 8.X “operating procedures” OM A, chapter 12.X ”rules of the air” MANUAL REFERENCE

IF APPLICABLE, BRIEF DESCRIPTION OF ELEMENT REQUIRING PRIOR APPROVAL

☐ Does the operations manual require the same VFR weather minima for NVIS operation than for standard VFR operations (according national VVR or for HEMS according SPA.HEMS.120)?

☐ Has the operator established the minimum transition height from where a change to/from aided flight may be continued?

QUESTION FOR COMPLIANCE VERIFICATION AND SELF ASSESSMENT

Operating minima for NVIS conducted in HEMS

Example - Operating minima – VFR night

A commander/PIC shall only take-off if current and available meteorological reports (METAR) and forecasts (TAF) indicate that the meteorological conditions along the route or that part of the route to be flown under VFR will, at the appropriate time, be such as to render compliance with the limitations according the table “HEMS operating minima”.

A commander/PIC shall abort the flight and return to base or an alternative landing place (aerodrome, other base, hospital sites, and operating site) where a safe landing is possible, when weather conditions fall below the cloud base or visibility minima shown in table “HEMS operating minima”.

Table “HEMS operating minima”

1 Pilot	
Night	
Cloud base	Visibility
1’200 ft (**)	3’000 m

(**) During the en-route phase, cloud base may be reduced to 1’000 ft for short periods.

Minima for night VFR flight (with or without NVIS)

The minimum visibility is 3’000 m and the minimum cloud base is 1’200 m (1’000m for short duration).

4.5.	**Crew requirements - selection, experience, operational training, recency** TOPIC	M/CC/IN EVALUATION METHOD
NVIS CL TOPIC 4-OMA/D-025 CL Ch.-OM Ch.-Seq.-No.	SPA.NVIS.130 LEGAL REFERENCE OM A, chapter 1.X ”duties and responsibilities” OM A, chapter 2.X ”operational control and supervision” OM A, chapter 4.X ”crew composition” OM A, chapter 5.X ”qualification requirements” OM D, chapter 2.X ”training syllabi” MANUAL REFERENCE	

APP: NVIS training and checking syllabi

IF APPLICABLE, BRIEF DESCRIPTION OF ELEMENT REQUIRING PRIOR APPROVAL

General:

☐ Selection: Has the operator established selection criteria for crew member regarding the NVIS tasks?

☐ Trainee’s experience: Does the operator require in the OM A or D at least 20 hours night VFR as pilot in command/commander before commencing training?

☐ Instructors: Does the operator require following experience and qualification for NVIS instructors:

- flight instructor (FI(H)) or type rating instructor (TRI(H)) with the applicable type rating on which NVIS training will be given; and
- logged at least 100 NVIS flights or 30 hours’ flight time under NVIS as PIC/commander?

☐ Does the operator require that pilots flying NVIS have completed the operational training, NVIS procedures contained in the OM?

QUESTION FOR COMPLIANCE VERIFICATION AND SELF ASSESSMENT

Definition

‘NVIS crew member’ means a technical crew member assigned to an NVIS flight.

Example - Selection criteria of flight crew member

New crew members undergo an assessment process. Based on flight hours, experience and qualification, candidates are assessed for suitability. After an interview led by the flight operations manager and/and crew training manager, the candidate performs a computer based test. Evaluation criteria during the interview are CRM skills, suitable attitude and maturity of the candidate.

Formal criteria flight crew:

- *Age;*
- *CPL(H) or ATPL(H);*
- *Flight hours on turbine helicopters as PIC;*
- *Language (D, F or I).*

Formal criteria technical crew:

- *are at least 18 years of age;*
- *medical certificate class 2 (initial only);*

- *have been checked as proficient to perform all assigned duties in accordance with the procedures specified in the OM A XY, OM D XY*.

Qualification

Successful completion of training in accordance with the NVIS procedures contained in the operations manual and relevant experience in the role and environment under which NVIS are conducted.

Recency

All pilots and NVIS technical crew members conducting NVIS operations have to complete three NVIS flights in the last 90 days. Recency may be re-established on a training flight in the helicopter or an approved full flight simulator (FFS), which shall include the elements of training and checking syllabus in OM D XY.

Example - Experience before starting training

A trainee for NVIS must have at least 20 hours night VFR as PIC/commander before commencing training.

4.6.	**Crew requirements for NVIS operations** TOPIC	M/CC/IN EVALUATION METHOD
NVIS CL TOPIC 4-OMA-30 Ch.-OM Ch.-Seq.-No.	SPA.NVIS.130 LEGAL REFERENCE	
	OM A 4.1.X “crew composition” OM A 5.2.1 “qualification PIC/commander” OM A 5.5.X “qualification of NVIS technical crew member” MANUAL REFERENCE	

IF APPLICABLE, BRIEF DESCRIPTION OF ELEMENT REQUIRING PRIOR APPROVAL

- ☐ Recency: Does the operator require at least 3 NVIS flights in the last 90 days for all crew members according the training and checking syllabus (in FFS or helicopter)?
- ☐ Minimum crew: Does the operator require a minimum crew of a least one pilot and one NVIS technical crew member for operations to HEMS operating sites?
- ☐ Single-pilot operation: Is the single-pilot NVIS operation limited to the en-route phase of a flight?

QUESTION FOR COMPLIANCE VERIFICATION AND SELF ASSESSMENT

Example - Recency

All pilots and NVIS technical crew members conducting NVIS operations have to complete three NVIS flights in the last 90 days. Recency may be re-established on a training flight in the helicopter or an approved full flight simulator (FFS), which shall include the elements of training and checking syllabus in OM D XY.

4.7.	**Crew requirements for NVIS operations** TOPIC	M/CC/IN EVALUATION METHOD
NVIS CL TOPIC 4-OMA/D-35 Ch.-OM Ch.-Seq.-No.	SPA.NVIS.130 LEGAL REFERENCE OM A 5.5 “qualification of NVIS technical crew member” OM D 2.1 “training for flight crew” OM D 2.3 “training for NVIS technical crew member” MANUAL REFERENCE	

IF APPLICABLE, BRIEF DESCRIPTION OF ELEMENT REQUIRING PRIOR APPROVAL

- ☐ Does the operator’s NVIS ground training and flight training syllabi include all the subjects as required (acc. example syllabi below) and are the syllabi part of the OM?
- ☐ Does the operator require the same ground training for flight crew and NVIS technical crew members?
- ☐ Has the operator defined which parts of the flight training are relevant for technical crew members (acc. example syllabi below)?
- ☐ Crew coordination: Does the operator require that all crew members familiar and qualified with all aspects of NVIS flight (according their tasks and responsibility)?
- ☐ Have they to demonstrate competency in those areas, both on the ground and in flight?

QUESTION FOR COMPLIANCE VERIFICATION AND SELF ASSESSMENT

TRAINING GUIDELINES AND CONSIDERATIONS (GM1 SPA.NVIS.130(f))

Purpose

The purpose of the GM is to recommend the minimum training guidelines and any associated considerations necessary for the safe operation of a helicopter while operating with night vision imaging systems (NVISs).

To provide an appropriate level of safety, training procedures should accommodate the capabilities and limitations of the NVIS and associated systems as well as the restraints of the operational environment.

Assumptions

The following assumptions were used in the creation of this material:

Most civilian operators may not have the benefit of formal NVIS training, similar to that offered by the military. Therefore, the stated considerations are predicated on that individual who has no prior knowledge of NVIS or how to use them in flight. The degree to which other applicants who have had previous formal training should be exempted from this training will be dependent on their prior NVIS experience.

While NVIS are principally an aid to flying under VFR at night, the two- dimensional nature of the NVG image necessitates frequent reference to the flight instruments for spatial and situational awareness information. The reduction of peripheral vision and increased reliance on focal vision exacerbates this requirement to monitor flight instruments. <u>Therefore, any basic NVIS training syllabus should include some instruction on basic instrument flight.</u>

Two-tiered approach: basic and advance training

To be effective, the NVIS training philosophy would be based on a two-tiered approach: basic and advanced NVIS training. The basic NVIS training would serve as the baseline standard for all individuals seeking an NVIS endorsement. The content of this initial training would not be dependent on any operational requirements. The training required for any individual pilot should take into account the previous NVIS flight experience. The advanced training would build on the basic training by focusing on developing specialised skills required to operate a helicopter during NVIS operations in a particular operational environment. Furthermore, while there is a need to stipulate minimum flight hour requirements for an NVIS endorsement, the training should also be event-based. This necessitates that operators be exposed to all of the relevant aspects, or events, of NVIS flight in addition to acquiring a minimum number of flight hours. NVIS training should include flight in a variety of actual ambient light and weather conditions.

NVIS - flight and technical crew training and checking syllabi

Examples

NVIS flight crew training syllabus – topics and content:

- *NVIS working principles, eye physiology, vision at night, limitations and techniques to overcome these limitations;*
- *preparation and testing of NVIS equipment;*
- *preparation of the helicopter for NVIS operations;*
- *normal and emergency procedures including all NVIS failure modes;*
- *maintenance of unaided night flying;*
- *crew coordination concept specific to NVIS operations;*
- *practice of the transition to and from NVG procedures;*
- *awareness of specific dangers relating to the operating environment; and*
- *risk analysis, mitigation and management.*

NVIS flight crew checking syllabus contents – topics and content:

- *night proficiency checks, including emergency procedures to be used on NVIS operations; and*
- *line checks with special emphasis on the following:*
  - *local area meteorology;*
  - *NVIS flight planning;*
  - *NVIS in-flight procedures;*
  - *transitions to and from night vision goggles (NVG);*
  - *normal NVIS procedures; and*
  - *crew coordination specific to NVIS operations?*

NVIS technical crew member training and checking syllabi topics and content:

- *NVIS working principles, eye physiology, vision at night, limitations, and techniques to overcome these limitations;*
- *duties in the NVIS role, with and without NVGs;*
- *the NVIS installation;*
- *operation and use of the NVIS equipment;*
- *preparing the helicopter and specialist equipment for NVIS operations;*
- *normal and emergency procedures;*
- *crew coordination concepts specific to NVIS operations;*

- *awareness of specific dangers relating to the operating environment; and*
- *risk analysis, mitigation and management.*

Training differences between flight crew and NVIS technical crew member

Due to the importance of crew coordination, it is imperative that all crew members are familiar with all aspects of NVIS flight. Furthermore, these crew members have task qualifications specific to their position in the helicopter and areas of responsibility. To this end, they have demonstrate competency in those areas, both on the ground and in flight. Therefore the ground training is the same for flight crew and NVIS technical crew members as described in the ground training syllabus (OM D XY). The NVIS technical crew members are involved in the relevant parts of the flight training (marked by "" in the flight training syllabus) as defined for flight crew members.*

NVIS syllabus - ground training areas of instruction for flight crew and technical crew member
(acc GM2 SPA.NVIS.130(f), crew requirements)

The following table includes the detail NVIS ground training for flight crew and NVIS technical crew members as instructed by (company name).

Item	***Subject Area***	***Subject Details***	***Time***
1	*General anatomy and characteristics of the eye*	***Anatomy**:* *• Overall structure of the eye* *• Cones* *• Rods* ***Visual deficiencies:*** *• myopia* *• hyperopia* *• astigmatism* *• presbyopia* ***Effects of light on night vision & NV protection physiology:*** *• Light levels* *– illumination* *– luminance* *– reflectance* *– contrast* *• Types of vision:* *– photopic* *– mesopic* *– scotopic* *• Day versus night vision* *• Dark adaptation process:* *– dark adaptation* *– pre-adaptive state* *• Purkinje shift* *• Ocular chromatic aberration* *• Photochromatic interval*	*1 hour*

2	*Night vision human factors*	*Night blind spot (as compared to day blind spot)* *• Field of view and peripheral vision* *• Distance estimation and depth perception:* *– monocular cues* *– motion parallax* *– geometric perspective* *– size constancy* *– overlapping contours or interposition of objects* *• Aerial perspective:* *– variations in colour or shade* *– loss of detail or texture* *– position of light source* *– direction of shadows* *• Binocular cues* *• Night vision techniques:* *– off -centre vision* *– scanning* *– shapes and silhouettes* *• Vestibular illusions* *• Somatogyral illusions:* *– leans* *– graveyard spin* *– coriolis illusion* *• Somatogravic illusions:* *– oculographic illusions* *– elevator illusion* *– oculoagravic illusions* *• Proprioceptive illusions* *• Dealing with spatial disorientation* *• Visual illusions:* *– auto kinetic illusion* *– confusion with ground lights* *– relative motion* *– reversible perspective illusion* *– false vertical and horizontal cues* *– altered planes of reference* *– height /depth perception illusion* *– flicker vertigo* *– fascination (fixation)*	*1hour*

		– *structural illusions* – *size-distance illusion* • *Helicopter design limitations:* – *windscreen condition* – *helicopter instrument design* – *helicopter structural obstruction* – *interior lights* – *exterior lights* • *Self-imposed stresses:* – *drugs* – *exhaustion* – *alcohol* – *tobacco* – *hypoglycaemia* – *injuries* – *physical fitness* • *Stress & fatigue:* – *acute vs. chronic* – *prevention* • *Hypoxia issues and night vision* • *Weather/environmental conditions:* – *snow (white-out)* – *dust (brown-out)* – *haze* – *fog* – *rain* – *light level* • *Astronomical lights (moon, star, northern lights)* • *Effects of cloud cover*	
3	NVIS general characteristics	• *Definitions and types of NVIS:* – *light spectrum* – *types of NVIS* • *Thermal-imaging devices* • *Image-intensifier devices* • *Image-intensifier operational theory* • *Types of image intensifier systems:* – *generation 1* – *generation 2* – *generation 3*	*1 hour*

		– generation 4 *– type I / II* *– class A & B minus blue filter* *• NVIS equipment* *– shipping and storage case* *– carrying case* *– binocular assembly* *– lens caps* *– lens paper* *– operators manual* *– power pack (dual battery)* *– batteries* *• Characteristics of NVIS:* *– light amplification* *– light intensification* *– frequency sensitivity* *– visual range acuity* *– unaided peripheral vision* *– weight* *– flip-up device* *– break-away feature* *– neck cord* *– maintenance issues* *– human factor issues* *• Description and functions of NVIS components:* *– helmet visor cover and extension strap* *– helmet NVIS mount and attachment points* *– different mount options for various helmets* *– lock release button* *– vertical adjustment knob* *– low battery indicator* *– binocular assembly* *– monocular tubes* *– fore and aft adjustment knob* *– eye span knob* *– tilt adjustment lever* *– objective focus rings* *– eyepiece focus rings* *– battery pack*	

4	*NVIS care & cleaning*	*• Handling procedures* *• NVIS operating instructions:* *– pre-mounting inspection* *– mounting procedures* *– focusing procedures* *– faults* *• Post-flight procedures;* *• Deficiencies: type and recognition of faults:* *– acceptable faults* *black spots* *chicken wire* *fixed pattern noise (honeycomb effect)* *output brightness variation* *bright spots* *image disparity* *image distortion* *emission points* *– unacceptable faults:* *shading* *edge glow* *fishing, flickering or intermittent operation* *• Cleaning procedures* *• Care of batteries* *• Hazardous material considerations;*	*1 hour*
5	*Pre- & post-flight procedures*	*• Inspect NVIS* *• Carrying case condition* *• Nitrogen purge due date* *• Collimation test due date* *• Screens diagram(s) of any faults* *• NVIS kit: complete* *• NVIS binocular assembly condition* *• Battery pack and quick disconnect condition* *• Batteries life expended so far* *• Mount battery pack onto helmet:* *– verify no LED showing (good battery)* *– fail battery by opening cap and LED illuminates* *(both compartments)* *• Mount NVIS onto helmet* *• Adjust and focus NVIS*	*1 hour*

		• Eye-span to known inter-papillary distance *• Eye piece focus ring to zero* *• Adjustments:* *– vertical* *– fore and aft* *– tilt* *– eye-span (fine-tuning)* *• Focus (one eye at a time at 20 ft, then at 30 ft from an eye chart)* *– objective focus ring* *– eye piece focus ring* *– verify both images are harmonised* *– read eye-chart 20/40 line from 20 ft* *• NVIS mission planning* *• NVIS light level planning* *• NVIS risk assessment*	
6	*NVIS terrain interpretation and environmental factors*	*• Night terrain interpretation* *• Light sources:* *– natural* *– lunar* *– solar* *– starlight* *– northern lights* *– artificial* *– cultural* *– infra-red* *• Meteorological conditions:* *– clouds/fog* *– indications of restriction to visibility:* *– loss of celestial lights* *– loss of ground lights* *– reduced ambient light levels* *– reduced visual acuity* *– increase in video noise* *– increase in halo effect* *• Cues for visual recognition:* *– object size* *– object shape* *– contrast* *– ambient light*	*1 hour*

		– color *– texture* *– background* *– reflectivity* *• Factors affecting terrain interpretation:* *– ambient light* *– flight altitudes* *– terrain type* *• Seasons* *• Night navigation cues:* *– terrain relief* *– vegetation* *– hydrographical features* *– cultural features*	
7	*NVIS training & equipment requirements*	*Cover the relevant regulations and guidelines that pertain to night and NVIS flight to include as a minimum:* *• Crew experience requirements;* *• Crew training requirements;* *• Airspace requirements;* *• Night / NVIS MEL;* *• NVIS / night weather limits;* *• NVIS equipment minimum standard requirements.*	*1 hour*
8	*NVIS emergency procedures*	*Cover relevant emergency procedures:* *• Inadvertent IMC procedures* *• NVIS goggle failure* *• Helicopter emergencies:* *– with goggles* *– transition from goggles*	*1 hour*
9	*NVIS flight techniques*	*Respective flight techniques for each phase of flight for the type and class of helicopter used for NVIS training*	*1 hour*
10	*Basic instrument techniques*	*Present and confirm understanding of basic instrument flight techniques:* *• Instrument scan* *• Role of instruments in NVIS flight* *• Unusual attitude recovery procedures*	*1 hour*
11	*Blind cockpit drills*	*Perform blind cockpit drills:* *• Switches* *• Circuit breakers* *• Exit mechanisms* *• External / internal lighting* *• Avionics*	*1 hour*

NVIS syllabus - flight training areas of instruction for flight crew and technical crew member
(acc. GM3 SPA.NVIS.130(f) Crew requirements)

*The following table includes the detailed NVIS flight training as instructed by (company name). Relevant flight training for NVIS technical crew member is marked by "*****".*

Item	***Subject Area***	***Subject Details***	***Time***
1	*******Ground operations*	• *NVIS equipment assembly* • *Pre-flight inspection of NVISs* • *Helicopter pre-flight* • *NVIS flight planning:* – *light level planning* – *meteorology* – *obstacles and known hazards* – *risk analysis matrix* – *CRM concerns* – *NVIS emergency procedures review* • *Start-up/shut down* • *Goggling and degoggling*	*1 hour*
2	*General handling*	• *Level turns, climbs, and descents* • *For helicopters, confined areas and sloped landings* • *******Operation specific flight tasks* • *******Transition from aided to unaided flight* • *******Demonstration of NVIS related ambient and cultural effects*	*1 hour*
3	*Take-off s & landings*	• *At both improved illuminated areas such as airports/ airfields and unimproved unlit areas such as open fields* • *Traffic pattern* • *Low speed manoeuvres for helicopters*	*1 hour*
4	*Navigation*	*Navigation over variety of terrain and under different cultural lighting conditions*	*1 hour*
5	*Emergency procedures*	• *******Goggle failure* • *******Helicopter emergencies* • *******Inadvertent IMC* • *Unusual attitude recovery*	*1 hour*

4.8.	**Crew requirements for NVIS operations** TOPIC	M/CC/IN EVALUATION METHOD

NVIS CL TOPIC 4-OMA/B/D-40 Ch.-OM Ch.-Seq.-No.	SPA.NVIS.130 LEGAL REFERENCE OM A, chapter 5.5 “qualification of other operations personnel” OM B, chapter 2.X “checklist” OM B, chapter 9.X „minimum equipment list” MANUAL REFERENCE

IF APPLICABLE, BRIEF DESCRIPTION OF ELEMENT REQUIRING PRIOR APPROVAL

☐ Has the other personnel (e.g. medical passenger, ground personnel) who are involved or support NVIS operations also to receive an adequate training in their areas of expertise (e.g. light discipline within the helicopter and on ground)?

☐ Are the NVIS equipment minimum requirements (training) defined?

☐ Is a NVIS pre-flight briefing/checklist available (content as within the example below)?

QUESTION FOR COMPLIANCE VERIFICATION AND SELF ASSESSMENT

Example - NVIS equipment minimum requirements (training) (GM1 SPA.NVIS.130(f))

Minimum equipment lists and standard NVIS equipment requirements are stipulated in the MEL of the helicopter. Beside the MEL the following procedures and minimum equipment requirements have to be considered:

- *NVIS: the following is recommended for minimum NVIS equipment and procedural requirements:*
- *back-up power supply;*
- *NVIS adjustment kit or eye lane;*
- *use of helmet with the appropriate NVG attachment; and*
- *both the instructor and student should wear the same NVG type, generation and model.*

Example - NVIS pre-flight briefing/checklist

Item	***Subject***
1	*Weather:* • *METAR/TAF* • *Cloud cover/dew point spread/precipitation*
2	*OPS:* • *NOTAMs* • *DABS* • *ASTA* • *Publications (IFR/VFR backup/maps);* • *Goggles adjusted (acc. defined procedures/test set)*
3	*Ambient light:* • *Moon rise/set/phase/position/elevation* • *Light-level, % illumination and millilux (MLX) for duration of flight* • *Recommended minimum MLX: 1.5*
4	*Mission:*

	• *Mission outline* • *Terrain appreciation* • *Surface (sand, fresh snow, risk of “white/brown-out”)* • *Detailed manoeuvres* • *Decisions (criteria for continuation/aborting the mission)* • *Flight timings* • *Start/airborne/debrief* • *Airspace coordination for NVIS* • *Obstacles/minimum safe altitude* • *NVIS goggle up/degoggle location/procedure* • *Instrument IFR checks*
5	*Crew:* • *Crew day/experience* • *Crew position* • *Equipment: NVIS, case, video, fl ashlights* • *Lookout duties: left hand seat (LHS) – from 90° left to 45° right, RHS – from 90° right to 45°left;* • *Calling of hazards/movements landing light* • *Transfer of control terminology* • *Below 100 ft AGL – pilot monitoring (PM) ready to assume control*
6	*Helicopter:* • *Configuration* • *Fuel* • *CG* • *performance*
7	*Emergencies:* • *NVIS failure: cruise and low level flight* • *Tasks of PIC/commander, instructor, technical crew member* • *Inadvertent IMC/IFR recovery* • *Helicopter emergency: critical & non-critical* • *Radio call*

4.9.	Information and documentation TOPIC	M/CC/IN EVALUATION METHOD
NVIS CL TOPIC 4-OMA/D/OMM-045 CL Ch.-OM Ch.-Seq.-No.	SPA.NVIS.140 LEGAL REFERENCE	
	OM A, chapter 0.X ”general” OM A, chapter 1.X ”organization and responsibilities” OM A, chapter 2.X ”operational control and supervision” OM A, chapter 4.X ”crew composition” OM A, chapter 5.X ”qualification requirements” OM A, chapter 6.X ”crew health precautions” OM A, chapter 7.X ”flight time limitations” OM D, chapter 2.X ”training syllabi and checking programmes” OMM, chapter 3.X ”duties, responsibilities and accountabilities” OMM, chapter 4.X ”hazard identification and risk management” MANUAL REFERENCE	

IF APPLICABLE, BRIEF DESCRIPTION OF ELEMENT REQUIRING PRIOR APPROVAL

General:

☐ Does the operator ensure that, as part of its risk analysis and management process, risks associated with the NVIS environment are minimised by specifying in the operations manual:

- selection; composition and training of crews;
- levels of equipment and dispatch criteria; and
- operating procedures and minima, such that normal and likely abnormal operations are described and adequately mitigated?

☐ Does the operations manual include crew coordination procedures, including:

- flight briefing;
- procedures when one crew member is wearing NVG and/or procedures when two or more crew members are wearing NVGs;
- procedures for the transition to and from NVIS flight;
- use of the radio altimeter on an NVIS flight; and
- inadvertent instrument meteorological conditions (IMC) and helicopter recovery procedures, including unusual attitude recovery procedures;
- the NVIS training syllabus?

☐ Does the operations manual include:

- in-flight procedures for assessing visibility, to ensure that operations are not conducted below the minima stipulated for
- non-assisted night VFR operations;
- weather minima, taking the underlying activity into account; and
- the minimum transition heights to/from an NVIS flight?

QUESTION FOR COMPLIANCE VERIFICATION AND SELF ASSESSMENT

CL 5 Guidance - NVIS concept

EASA has published in a document **(GM1 SPA.NVIS.140)** describing the NVIS system (e.g. technology, use, operational aspects, environmental influences, normal and emergency procedures. This document could be used as a source for the establishment of the operation manuals' content (including the training) and as a reference guide.

Excerpts

5.1. NVIS capabilities

NVIS generally provides the pilot an image of the outside scene that is enhanced compared to that provided by the unaided, dark-adapted eye. However, NVIS may not provide the user an image equal to that observed during daylight. Since the user has an enhanced visual capability, situational awareness is generally improved.

5.2. Critical elements

The following critical elements are the underlying assumptions in the system description for NVIS:

- aircraft internal lighting has been modified or initially designed to be compatible;
- environmental conditions are adequate for the use of NVIS (e.g. enough illumination is present, weather conditions are favorable, etc.);
- the NVIS has been properly maintained in accordance with the minimum operational performance standards;
- a proper pre-flight has been performed on the NVIS confirming operation in accordance with the continued airworthiness standards and training guidelines; and
- the pilot(s) has been properly trained and meets recency of experience requirements.

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

5.3. Situation awareness

Situation awareness, being defined as the degree of perceptual accuracy achieved in the comprehension of all factors affecting an aircraft and crew at a given time, is improved at night when using NVG during NVIS operations. This is achieved by providing the pilot with more visual cues than is normally available under most conditions when operating an aircraft unaided at night. However, it is but one source of the factors necessary for maintaining an acceptable level of situational awareness.

5.4. Environment detection and identification

An advantage of using NVIS is the enhanced ability to detect, identify, and avoid terrain and/or obstacles that present a hazard to night operations. Correspondingly, NVIS aid in night navigation by allowing the aircrew to view waypoints and features. Being able to visually locate and then (in some cases) identify objects or areas critical to operational success will also enhance operational effectiveness. Finally, use of NVIS may allow pilots to detect other aircraft more easily.

5.5. Emergency situations

NVIS generally improve situational awareness, facilitating the pilot's workload during emergencies. Should an emergency arise that requires an immediate landing, NVIS may provide the pilot with a means of locating a suitable landing area and conducting a landing. The pilot must determine if the use of NVIS during emergencies is appropriate. In certain instances, it may be more advantageous for the pilot to remove the NVG during the performance of an emergency procedure.

5.6. NVG design characteristics

There are limitations inherent in the current NVG design.

5.6.1 Visual acuity

The pilot’s visual acuity with NVGs is less than normal daytime visual acuity.

5.6.2 Field of view

Unaided field of view (FOV) covers an elliptical area that is approximately 120° lateral by 80° vertical, whereas the field of view of current Type I NVG systems is nominally 40° and is circular. Both the reduced field of view of the image and the resultant decrease in peripheral vision can increase the pilot’s susceptibility to misperceptions and illusions. Proper scanning techniques must be employed to reduce the susceptibility to misperception and illusions.

5.6.3 Field of regard

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

5.6.4 NVG weight & centre of gravity

The increased weight and forward CG projection of head supported devices may have detrimental effects on pilot performance due to neck muscle strain and fatigue. There also maybe an increased risk of neck injury in crashes.

5.6.5 Monochromatic image

The NVG image currently appears in shades of green. Since there is only one color, the image is said to be “monochromatic”. This color was chosen mostly because the human eye can see more detail at lower brightness levels when viewing shades of green. Color differences between components in a scene helps one discriminate between objects and aids in object recognition, depth perception and distance estimation. The lack of colour variation in the NVG image will degrade these capabilities to varying degrees.

5.6.6 Ambient or artificial light

The NVG requires some degree of light (energy) in order to function. Low light levels, non-compatible aircraft lighting and poor windshield/window light transmissibility, diminish the performance capability of the NVG. It is the pilot’s responsibility to determine when to transition from aided to unaided due to unacceptable NVG performance.

5.7. Physiological and other conditions

5.7.1 Cockpit resource management

Due to the inherent limitations of NVIS operations, there is a requirement to place emphasis on NVIS related cockpit resource management (CRM). This applies to both single and multi-pilot cockpit environments. Consequently, NVIS flight requires effective CRM between the pilot(s), controlling agencies and other supporting personnel. An appropriate venue for addressing this issue is the pre-flight NVIS mission brief.

5.7.2 Fatigue

Physiological limitations that are prevalent during the hours of darkness along with the limitations associated with NVGs, may have a significant impact on NVIS operations. Some of these limitations are the effects of fatigue (both acute and chronic), stress, eyestrain, working outside the pilot's normal circadian rhythm envelope, increased helmet weight, aggressive scanning techniques associated with NVIS, and various human factors engineering concerns that may have a direct influence on how the pilot works in the aircraft while wearing NVGs. These limitations may be mitigated through proper training and recognition, experience, adaptation, rest, risk management, and proper crew rest/duty cycles.

5.7.3 Over-confidence

Compared to other types of flight operations, there may be an increased tendency by the pilot to over-estimate the capabilities of the NVIS.

5.7.4 Spatial orientation

There are two types of vision used in maintaining spatial orientation: central (focal) vision and peripheral (ambient) vision. Focal vision requires conscious processing and is slow, whereas peripheral information is processed subconsciously at a very fast rate. During daytime, spatial orientation is maintained by inputs from both focal vision and peripheral vision, with peripheral vision providing the great majority of the information. When using NVGs, peripheral vision can be significantly degraded if not completely absent. In this case, the pilot must rely on focal vision to interpret the NVG image as well as the information from flight instruments in order to maintain spatial orientation and situation awareness. Even though maintaining spatial orientation requires more effort when using NVGs than during daytime, it is much improved over night unaided operations where the only information is obtained through flight instruments. However, anything that degrades the NVG image to a point where the horizon is not visualised and/or ground reference is lost or significantly degraded will necessitate a reversion to flight on instruments until adequate external visual references can be established. Making this transition quickly and effectively is vital in order to avoid spatial disorientation. Additionally, added focal task loading during the operation (e.g., communications, looking at displays, processing navigational information, etc.) will compete with the focal requirement for interpreting the NVG image and flight instruments. Spatial disorientation can result when the task loading increases to a point where the outside scene and/or the flight instruments are not properly scanned. This potential can be mitigated to some extent through effective training and experience.

5.7.5 Depth perception & distance estimation

When flying, it is important for pilots to be able to accurately employ depth perception and distance estimation techniques. To accomplish this, pilots use both binocular and monocular vision. Binocular vision requires the use of both eyes working together, and, practically speaking, is useful only out to approximately 100 ft. Binocular vision is particularly useful when flying close to the ground and/or near objects (e.g. landing a helicopter in a small landing zone). Monocular vision can be accomplished with either eye alone, and is the type of vision used for depth perception and distance estimation when viewing beyond approximately 100 ft. Monocular vision is the predominant type of vision used when flying fixed wing aircraft, and also when flying helicopters and using cues beyond 100 ft. When viewing an NVG image, the two eyes can no longer provide accurate binocular information, even though the NVG used when flying is a binocular system. This has to do with the way the eyes function physiologically (e.g. accommodation, stereopsis, etc.) and the design of the NVG (i.e. a binocular system with a fixed channel for each eye). Therefore, binocular depth perception and distance estimation tasking when viewing terrain or objects with an NVG within 100 ft is significantly degraded. Since monocular vision does not require both eyes working together, the adverse impact on depth perception and distance estimation is much less, and is mostly dependent on the quality of the NVG image. If the image is very good and there are objects in the scene to use for monocular cueing (especially objects with which the pilot is familiar), then distance estimation and depth perception tasking will remain accurate. However, if the image is degraded (e.g., low illumination, airborne obscurants, etc.) and/or there are few or unfamiliar objects in the scene, depth perception and distance estimation will be degraded to some extent. In summary, pilots using NVG will maintain the ability to accurately perceive depth and estimate distances, but it will depend on the distances used and the quality of the NVG image. Pilots maintain some ability to perceive depth and distance when using NVGs by employing monocular cues. However, these capabilities may be degraded to varying degrees.

5.7.6 Instrument lighting brightness considerations

When viewing the NVG image, the brightness of the image will affect the amount of time it takes to adapt to the brightness level of the instrument lighting, thereby affecting the time it takes to interpret information provided by the instruments. For example, if the instrument lighting is fairly bright, the time it takes to interpret information provided by the instruments may be instantaneous. However, if the brightness of the lighting is set to a very low level, it may take several seconds to interpret the information, thus increasing the heads-down time and increasing the risk of spatial disorientation. It is important to ensure that instrument lighting is kept at a brightness level that makes it easy to rapidly interpret the information. This will likely be brighter than one is used to during unaided operations.

5.7.7 Dark adaptation time from NVG to unaided operations

When viewing an NVG image, both rods and cones are being stimulated (i.e., mesopic vision), but the brightness of the image is reducing the effectiveness of rod cells. If the outside scene is bright enough (e.g., urban area, bright landing pad, etc.), both rods and cones will continue to be stimulated. In this case there will be no improvement in acuity over time and the best acuity is essentially instantaneous. In some cases (e.g., rural area with scattered cultural lights), the outside scene will not be bright enough to stimulate the cones and some amount of time will be required for the rods to fully adapt. In this case it may take the rods one to two minutes to fully adapt for the best acuity to be realised. If the outside scene is very dark (e.g., no cultural lights and no moon), it may take up to five minutes to fully adapt to the outside scene after removing the NVGs. The preceding are general guidelines and the time required to fully adapt to the outside scene once removing the NVG depends on many variables: the length of time the NVG has been used, whether or not the pilot was dark adapted prior to flight, the brightness of the outside scene, the brightness of cockpit lighting, and variability in visual function among the population. It is important to understand the concept and to note the time requirements for the given operation.

5.8. Complacency

Pilots must understand the importance of avoiding complacency during NVG flights. Similar to other specialised flight operations, complacency may lead to an acceptance of situations that would normally not be permitted. Attention span and vigilance are reduced, important elements in a task series are overlooked, and scanning patterns, which are essential for situational awareness, break down (usually due to fixation on a single instrument, object or task). Critical but routine tasks are often skipped.

5.8.1 Experience

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 is a result of proper training coupled with numerous NVIS operations. An experienced NVIS pilot is 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, holistic NVIS training programme that exposes the pilot to NVIS operations conducted under various moon angles, percentage of available illumination, contrast levels, visibility levels, and varying degrees of cloud coverage. A pilot should be exposed to as many of these variations as practicable during the initial NVIS qualification programme. Continued exposure during the NVIS recurrent training will help strengthen and solidify this experience base.

5.8.2 Operations

Operations procedures should accommodate the capabilities and limitations of the systems described above in this GM as well as the restraints of the operational environment. All NVG operations should fulfill all applicable requirements in accordance with Regulation (EC) No 216/2008.

5.8.3 Pilot eligibility

About 54% of the civil pilot population wears some sort of ophthalmic device to correct vision necessary to safely operate an aircraft. The use of inappropriate ophthalmic devices with NVGs may result in vision performance decrement, fatigue, and other human factor problems, which could result in increased risk for aviation accidents and incidents.

5.9. Operating environment considerations

5.9.1 Weather and atmospheric obscurants

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

5.9.2 Weather

During NVIS operations, pilots can see areas of moisture that are dense (e.g., clouds, thick fog, etc.) but may not see areas that are less dense (e.g., thin fog, light rain showers, etc.). The inability to see some areas of moisture may lead to hazardous flight conditions during NVIS operations and will be discussed separately in the next section.
The different types of moisture will have varying effects and it is important to understand these effects and how they apply to NVIS operations. For example:

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

2. Light rain or mist may not be observed with NVIS but will affect contrast, distance estimation, and depth perception. Heavy rain is more easily perceived due to large droplet size and energy attenuation.

3. Snow occurs in a wide range of particle sizes, shapes, and densities. As with clouds, rain, and fog, the denser the airborne snow, the greater the effect on NVG performance. On the ground, snow has mixed effect depending on terrain type and the illumination level. In mountainous terrain, snow may add contrast, especially if trees and rocks protrude through the snow. In flatter terrain, snow may cover high contrast areas, reducing them to areas of low contrast. On low illumination nights, snow may reflect the available energy better than the terrain it covers and thus increase the level of illumination.

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

5.9.3 Deteriorating weather

It is important to remain cognizant of changes in the weather when using NVGs. It is possible to “see through” areas of light moisture when using NVGs, thus increasing the risk of inadvertently entering IMC. Some ways to help reduce this possibility include the following:
1. Be attentive to changes in the NVG image. Halos may become larger and more diff use due to diffraction of light in moisture. Scintillation in the image may increase due to a lowering of the

illumination level caused by the increased atmospheric moisture. Loss of scene detail may be secondary to the lowering illumination caused by the changing moisture conditions.
2. Obtain a thorough weather brief with emphasis on NVG effects prior to flight.
3. Be familiar with weather patterns in the flying area.
4. Occasionally scan the outside scene. The unaided eye may detect weather conditions that are not detectable to the NVG. Despite the many methods of inadvertent instrument meteorological conditions (IMC) prevention, one should have established IMC recovery procedures and be familiar with them.

5.9.4 Airborne obscurants

In addition to weather, there may be other obscurants in the atmosphere that could block energy from reaching the NVG, such as haze, dust, sand, or smoke. As with moisture, the size and concentration of the particles will determine the degree of impact. Examples of these effects include the following:
1. high winds during the day can place a lot of dust in the air that will still be present at night when the wind may have reduced in intensity;
2. forest fires produce heavy volumes of smoke that may cover areas well away from the fire itself; 3. the effects of rotor wash may be more pronounced when using NVGs depending on the material (e.g. sand, snow, dust, etc.); and
4. pollution in and around major cultural areas may have an adverse effect on NVG performance.

5.10. Winter operations

Using NVGs during winter conditions provide unique issues and challenges to pilots.

5.10.1 Snow

Due to the reflective nature of snow, it presents pilots with significant visual challenges both en-route and in the terminal area. During the en-route phase of a flight the snow may cause distractions to the flying pilot if any aircraft external lights (e.g., anti-collision beacons/strobes, position lights, landing lights, etc.) are not compatible with NVGs. In the terminal area, whiteout landings can create the greatest hazard to unaided night operations. With NVGs the hazard is not lessened, and can be more disorienting due to lights reflecting from the snow that is swirling around the aircraft during the landing phase. Any emergency vehicle lighting or other airport lighting in the terminal area may exaggerate the effects.

5.10.2 Ice fog

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

5.10.3 Icing

Airframe ice is difficult to detect while looking through NVGs. The pilot will need to develop a proper crosscheck to ensure airframe icing does not exceed operating limits for that aircraft. Pilots should already be aware of icing indicator points on their aircraft. These areas require consistent oversight to properly determine environmental conditions.

5.10.4 Low ambient temperatures

Depending on the cockpit heating system, fogging of the NVGs can be a problem and this will significantly reduce the goggle effectiveness. Another issue with cockpit temperatures is the reduced battery duration. Operations in a cold environment may require additional battery resources.

5.11. Illumination

NVGs require illumination, either natural or artificial, to produce an image. Although current NVG technology has significantly improved low light level performance, some illumination, whether natural or artificial, is still required to provide the best possible image.

5.11.1 Natural illumination

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

5.11.2 Moon phase

The moon provides the greatest source of natural illumination during night time. Moon phase and elevation determines how much moonlight will be available, while moonrise and moonset times determine when it will be available. Lunar illumination is reported in terms of percent illumination, 100% illumination being full moon. It should be noted that this is different from the moon phase (e.g., 25% illumination does not mean the same thing as a quarter moon). Currently, percent lunar illumination can only be obtained from sources on the Internet, military weather facilities and some publications (e.g. Farmers Almanac).

5.11.3 Lunar azimuth and elevation

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

5.11.4 Shadowing

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

5.11.5 Benefits of shadows

Shadows alert aircrew to subtle terrain features that may not otherwise be noted due to the reduced resolution in the NVG image. This may be particularly important in areas where there is little contrast differentiation; such as flat featureless deserts, where large dry washes and high sand dunes may go unnoticed if there is no contrast to note their presence. The contrast provided by shadows helps make the NVG scene appear more natural.

5.11.6 Disadvantages due to shadows

When within a shadow, terrain detail can be significantly degraded, and objects can be regarding flight in or around shadowed areas is the pilot’s response to loss of terrain detail. During flight under good illumination conditions, a pilot expects to see a certain level of detail. If flight into a shadow occurs while the pilot is preoccupied with other matters (e.g., communication, radar, etc.), it is possible that the loss in terrain detail may not have been immediately noted. Once looking outside again, the pilot may think the reduced detail is due to an increase in flight altitude and thus begin a descent – even though already at a low altitude. Consideration should be given during mission planning to such factors as lunar azimuth and elevation, terrain type (e.g., mountainous, fl at, etc.), and the location of items significant to operation success (e.g., ridgelines, pylons, targets, waypoints, etc.). Consideration of these factors will help predict the location of shadows and the potential adverse effects.

5.11.7 Sky glow

Sky glow is an effect caused by solar light and continues until the sun is approximately 18 degrees below the horizon. When viewing in the direction of sky glow there may be enough energy present to adversely affect the NVG image (i.e., reduce image quality). For the middle latitudes the effect on NVG performance may last up to an hour after official sunset. For more northern and southern latitudes the effect may last for extended periods of times (e.g., days to weeks) during seasons when the sun does not travel far below the horizon. This is an important point to remember if planning NVG operations in those areas. Unlike sky glow after sunset, the sky glow associated with sunrise does not have an obvious effect on NVG performance until fairly close to official sunrise. The difference has to do with the length of time the atmosphere is exposed to the sun’s irradiation, which causes ionisation processes that release near-IR energy. It is important to know the difference in these effects for planning purposes.

5.11.8 Artificial illumination

Since the NVGs are sensitive to any source of energy in the visible and near infrared spectrums, there are also many types of artificial illumination sources (e.g., flares, IR searchlights, cultural lighting, etc). As with any illumination source, these can have both positive and detrimental effects on NVG utilisation. For example, viewing a scene indirectly illuminated by a searchlight can enable the pilot to more clearly view the scene; conversely, viewing the same scene with the searchlight near or within the NVG field of view will reduce the available visual cues. It is important to be familiar with the effects of cultural lighting in the flying area in order to be able to avoid the associated problems and to be able to use the advantages provided. Also, it is important to know how to properly use artificial light sources (e.g., aircraft IR spotlight). It should be noted that artificial light sources may not always be available or dependable, and this should be taken into consideration during flight planning.

5.11.9 Terrain contrast

Contrast is one of the more important influences on the ability to correctly interpret the NVG image, particularly in areas where there are few cultural features. Any terrain that contains varying albedos (e.g., forests, cultivated fields, etc.) will likely increase the level of contrast in a NVG image, thus enhancing detail. The more detail in the image, the more visual information aircrews have for manoeuvring and navigating. Low contrast terrain (e.g., flat featureless desert, snow-covered fields, water, etc.) contains few albedo variations, thus the NVG image will contain fewer levels of contrast and less detail.

5.12. Aircraft considerations

5.12.1 Lighting

Factors such as aircraft internal and external lighting have the potential to adversely impact NVG gain and thus image quality. How well the windshield, canopy, or window panels transmit near infrared energy can also affect the image. Cleanliness of the windshield directly impacts this issue.

5.12.2 Cockpit ergonomics

While wearing NVGs, the pilot may have limited range of head movement in the aircraft. For example, switches on the overhead console may be difficult to read while wearing NVGs. Instruments, controls, and switches that are ordinarily accessible, may now be more difficult to access due to the extended mass (fore/aft) associated with NVGs.

In addition, scanning may require a more concentrated effort due to limited field of view. Lateral viewing motion can be hindered by cockpit obstructions (i.e. door post or seat back design).

5.12.3 Windshield reflectivity

Consideration within the cockpit and cabin should be given to the reflectivity of materials and equipment upon the windshield. Light that is reflected may interfere with a clear and unobstructed view. Items such as flight suits, helmets, and charts, if of a light colour such as white, yellow, and orange, can produce significant reflections. Colours that impart the least reflection are black, purple, and blue. This phenomena is not limited to windshields but may include side windows, chin bubbles, canopies, etc.

5.12.4 Generic operating considerations

This section lists operating topics and procedures, which should be considered when employing NVIS. The list and associated comments are not to be considered all inclusive. NVIS operations vary in scope widely and this section is not intended to instruct a prospective operator on how to implement an NVIS programme.

5.13. Normal procedures

5.13.1 Scanning

When using NVGs there are three different scan patterns to consider and each is used for different reasons: instrument scan, aided scan outside, and unaided scan outside. Normally, all three are integrated and there is a continuous transition from one to the other depending on the mission, environmental conditions, immediate tasking, flight altitude and many other variables. For example, scanning with the NVG will allow early detection of external lights. However, the bloom caused by the lights will mask the aircraft until fairly close or until the lighting scheme is changed. Once close to the aircraft (e.g., approximately one-half mile for smaller aircraft), visual acquisition can possibly be made unaided or with the NVG. Whether to use the NVG or unaided vision depends on many variables (e.g., external lighting configuration, distance to aircraft, size of aircraft, environmental conditions, etc.). The points to be made are that a proper scan depends on the situation and variables present, and that scanning outside is critical when close to another aircraft. Additionally, for a multi crew environment, coordination of scan responsibilities is vital. Instrument crosscheck scan in order to effect a proper and effective instrument scan, it is important to predict when it will be important.
A start can be made during pre-flight planning when critical phases of flight can be identified and prepared for. For example, it may be possible when flying over water or featureless terrain to employ a good instrument crosscheck. However, the most important task is to make the appropriate decision during flight as conditions and events change. In this case, experience, training and constant attention to the situation are vital contributors to the pilot's assessment of the situation.

5.13.2 NVG scan

To counteract the limited field of view, pilots should continually scan throughout the field of regard. This allows aircrew to build a mental image of the surrounding environment. How quickly the outside scene is scanned to update the mental image is determined by many variables. For example, when flying over fl at terrain where the highest obstacle is below the flight path, the scan may be fairly slow. However, if flying low altitude in mountainous terrain, the scan will be more aggressive and rapid due to the presence of more information and the increased risk. How much of the field of regard to scan is also determined by many variables. For example, if a pilot is anticipating a turn, more attention may be placed in the area around the turn point, or in the direction of the new heading. In this situation, the scan will be limited briefly to only a portion of the field of regard. As with the instrument scan, it is very important to plan ahead. It may, for example, be possible to determine when the scan may be interrupted due to other tasks, when it may be possible to become fixated on a specific task, or when it is important to maximise the outside scan. An important lesson to learn regarding the NVG scan is when not to rely on visual information. It is easy to overestimate how well one can see with NVGs, especially on high illumination nights, and it is vital to maintain a constant awareness regarding their limitations. This should be pointed out often during training and, as a reminder, should be included as a briefing item for NVG flights.

5.13.3 Unaided scan

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

5.13.4 Scan patterns

Environmental factors will influence scan by limiting what may be seen in specific directions or by degrading the overall image. If the image is degraded, aircrew may scan more aggressively in a subconscious attempt to obtain more information, or to avoid the chance of missing information that suddenly appears and/or disappears. The operation itself may influence the scan pattern. For example, looking for another aircraft, landing zone, or airport may require focusing the scan in a particular direction. In some cases, the operation may require aircrew in a multi place aircraft to assign particular pilots responsibility for scanning specific sectors. The restrictions to scan and the variables affecting the scan patter are not specific to night operations or the use of NVGs, but, due to the NVG’s limited field of view, the degree of impact is magnified.

5.14. Pre-flight planning

5.14.1 Illumination criteria

The pilot should provide a means for forecasting the illumination levels in the operational area. The pilot should make the effort to request at least the following information in addition to that normally requested for night VFR: cloud cover and visibility during all phases of flight, sunset, civil and nautical twilight, moon phase, moonrise and moonset, and moon and/or lux illumination levels, and unlit tower NOTAMS.

5.14.2 NVIS operations

An inspection of the power pack, visor, mount, power cable and the binocular assembly should be performed in accordance with the operations manual.
To ensure maximum performance of the NVGs, proper alignment and focus must be accomplished following the equipment inspection. Improper alignment and focus may degrade NVIS performance.

5.14.3 Aircraft pre-flight

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

5.14.4 Equipment

The basic equipment required for NVIS operations should be those instruments and equipment specified within the current applicable regulations for VFR night operations. Additional equipment required for NVIS operations, e.g. NVIS lighting system and a radio altimeter must be installed and operational. All NVIS equipment, including any subsequent modifications, shall be approved.

5.14.5 Risk assessment

A risk assessment is suggested prior to any NVIS operation. The risk assessment should include as a minimum:

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
11. external lighting environment.

5.15. Flight operations

5.15.1 Elevated terrain

Safety may be enhanced by NVGs during operations near elevated terrain at night. The obscuration of elevated terrain is more easily detected with NVGs thereby allowing the pilot to make alternate flight path decisions.

5.15.2 Over-water

Flying over large bodies of water with NVGs is difficult because of the lack of contrast in terrain features. Reflections of the moon or starlight may cause disorientation with the natural horizon. The radio altimeter must be used as a reference to maintain altitude.

5.15.3 Remote area considerations

A remote area is a site that does not qualify as an aerodrome as defined by the applicable regulations. Remote area landing sites do not have the same features as an aerodrome, so extra care must be given to locating any obstacles that may be in the approach/departure path.
A reconnaissance must be made prior to descending at an unlighted remote site. Some features or objects may be easy to detect and interpret with the unaided eye. Other objects will be invisible to the unaided eye, yet easily detected and evaluated with NVGs.

5.15.4 Reconnaissance

The reconnaissance phase should involve the coordinated use of NVGs and white lights. The aircraft's external white lights such as landing lights, searchlights, and floodlights, should be used during this phase of flight. The pilot should select and evaluate approach and departure paths to the site considering wind speed and direction, and obstacles or signs of obstacles.

5.15.5 Sources of high illumination

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

5.15.6 Emergency procedures

No modification for NVG operations is necessary to the aircraft emergency procedures as approved in the operations manual or approved checklist. Special training may be required to accomplish the appropriate procedures.

5.15.7 Inadvertent IMC

Some ways to help reduce the potential for inadvertent flight into IMC conditions are:
1. obtaining a thorough weather brief (including pilot reports);
2. being familiar with weather patterns in the local flying area; and
3. by looking beneath the NVG at the outside scene.

However, even with thorough planning a risk still exists. To help mitigate this risk it is important to know how to recognise subtle changes to the NVG image that occur during entry into IMC conditions. Some of these include the onset of scintillation, loss of scene detail, and changes in the appearance of halos.

5.16. Training

To provide an appropriate level of safety, training procedures must accommodate the capabilities and limitations of the systems described in Section 3 of this GM as well as the restraints of the operational environment. To be effective, the NVIS training philosophy would be based on a two-tiered approach: basic and advanced NVIS training. The basic NVIS training would serve as the baseline standard for all individuals seeking an NVIS endorsement. The content of this initial training would not be dependent on any operational requirements. The advanced training would build on the basic training by focusing on developing specialised skills required to operate an aircraft during NVIS operations in a particular operational environment. Furthermore, while there is a need to stipulate minimum flight hour requirements for an NVIS endorsement, the training must also be event based. This necessitates that pilots be exposed to all of the relevant aspects, or events, of NVIS flight in addition to acquiring a minimum number of flight hours.

5.16.1 Continuing airworthiness

The reliability of the NVIS and safety of operations are dependent on the pilots adhering to the instructions for continuing airworthiness. Personnel who conduct the maintenance and inspection on the NVIS must be qualified and possess the appropriate tools and facilities to perform the maintenance.