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Safety Division - Flight Operations

FOCA AltMOC

Alternative Means of Compliance

Helicopter operations over a hostile environment located outside a congested area

This document is an „Alternative Means of Compliance“ issued by FOCA.

The purpose of this Alternative Means of Compliance (AltMOC) is to establish compliance with Regulation (EC) No 216/2008 and CAT.POL.H.420.

Scope	Helicopter operations over hostile environment located outside congested area
Who is concerned	Helicopter operators
valid from	2014-09-30
Purpose	compulsory

Document Reference	COO.2207.111.2.1921765
Registration No.	BAZL / 311.122-AOC HEL/00016/00004/00004
Prepared by	SBHE, SBFF
Released by	SB AFS 2014-09-30
Distribution	Internal/External

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This document is an

Alternative Means of Compliance (AltMOC) issued by FOCA

according

Regulation (EU) No 1178/2011 (Air Crew), ARA.GEN.120, or
Regulation (EU) No 965/2012 (Air Operations), ARO.GEN.120
Regulation (EU) No 965/2012 (Air Operations), ORO.GEN.120
Regulation (EU) No 965/2012 (Air Operations), CAT.OP.MPA.137
Regulation (EU) No 965/2012 (Air Operations), CAT.POL.H.400
Regulation (EU) No 965/2012 (Air Operations), CAT.POL.H.410
Regulation (EU) No 965/2012 (Air Operations), CAT.POL.H.420,
ED Decision 2014/029/R, EASA, AMC1 to CAT.POL.H.420
Regulation (EU) No 965/2012 (Air Operations), CAT.POL.H.305

Preliminary Information

What is an AltMOC issued by FOCA?

The EASA homepage on the internet states (as of end 2013):

"'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;

(Regulation (EU) No 1178/2011, Air Crew, Annex I Definitions (9); and the identical text in Regulation (EU) No 965/2012, Air Operations, Annex I, Definitions (9))"

"Since AMC are non-binding, competent National Aviation Authorities (NAAs) may choose alternative means to comply with the rules of the Implementimng Regulations pursuant to the EASA Basic Regulation (EU) No 216/2008."

The implementing rules for Aircrew licensing and Air Operations describe the process to be used by regulated persons and competent authorities when they intend to use AltMOC to comply with the rules.

ARA.GEN.120 and ARO.GEN.120 establish the obligations of competent authorities when adopting AltMOCs that can be used by the regulated persons under their oversight. One of those obligations is to notify EASA of such AltMOCs.

For more information from EASA on AMC and AltMOCs, please consult the FAQ."

To these statements FOCA would like to add the following additional information:

AltMOC may not only be issued as alternative to an alredy existing AMC. FOCA may as well publish AltMOC that cover issues where no AMC is available. Therefore, the term „alternative" may be slightly missleading in some cases.

AltMOC may be seen as an administrative ordinannnce in traditional Swiss legal doctrine. However, conditions, issuing power and legal effects are pure products of Union legislation. Legal practitioners, attorneys and courts in Switzerland, therefore, should not attempt to categorize AltMOC under traditional national principles of administrative law. They should always bear in mind that AltMOC are genuine legal instruments of he EU aviation safety regulation.

What are the effects of an AltMOC issued by FOCA?

AltMOC issued by FOCA have basically the same legal status and effect as AMC. Except that the author of AltMOC is not EASA but FOCA. AltMOC are not evaluated by EASA in advance but are only reviewed during regular standardisation. Therefore, once released by FOCA, AltMOC become immediately applicable to all parties under Swiss jurisdiction. In other words, they immediately may be used as an alternative to existing AMC or they must be used if no such AMC is available. In either case they provide presumption of conformity with the essential requirements and the implementing rules.
However, AltMOC do not have cross-border effect: an operator under foreign jurisdiction has no legal claim to his Competent Authority to allow use of an AltMOC issued by FOCA. And FOCA will not automatically accept in its jurisdiction the use of AltMOC issued by foreign Competent Authorities.

(Different matters are AltMOC developed and requested by an ATO, operator or regulated person and which are not issued but only approved by FOCA. These have effect for the applicant only. Third parties must submit a complete application for their own including full proof that their AltMOC fulfils the legal requirements.)

AltMOC may motivate EASA to initialise own rule making aiming at additional IR or additional AMC. The start of such rule making procedure does senso stricto not have any effect on the AltMOC until the time where a revised IR or a new AMC legally replaces the AltMOC. However, such rule making activities might increase the likelihood that CA accept the underlying foreign AltMOC.

Log of Revision (LoR)

Date	Issue	Revision	Highlight of Revision
19.08.2014	1	0	First Issue
11.11.2014	1	1	First Issue, first revision
09.12.2015	1	2	Editorial adjustments

List of Effective Pages

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List of Abbreviations

The following abbreviations are within this Alternative Means of Compliance:

Abbreviation	Definition
AltMOC	Alternative Means of Compliance
AMC	Acceptable Means of Compliance
AN	Air Navigation
ARA	Authority Requirements for Aircrew
ARO	Authority Requirements for Air Operations
ATO	Approved Training Organisations
CAT	Commercial Air Transport
CPL	Commercial Pilot Licence
DGAC	Direction générale de l'aviation civile
DOC	Document
e.g.	exemplī grātiā, for example
EASA	European Aviation Safety Agency
EU	European Union
FAQ	Frequently Asked Questions
FC	Flight Crew
FOCA	Federal Office of Civil Aviation
FSTD	Flight Simulation Training Device
ft	Feet
GEN	General
GM	Guidance Material
H	Helicopter
h/c	Helicopter
HEMS	Helicopter Emergency Medical Service
HT	Heavy Twin
i.e.	id est, that is
ICAO	International Civil Aviation Organization
IDE	Instrument, Data, Equipment
IMC	Instrument Meteorological Conditions
IR	Implementing Rule
JAA	Joint Aviation Authorities
JAR	Joint Aviation Requirements
LT	Light Twin
MOPSC	Maximum Operational Passenger Seating Configuration
MPA	Motor Powered Aircraft
MT	Medium Twin
N	North
NAA	National Aviation Authority
No	Number
NPA	Notice of Proposed Amendement
OGP	International Association of Oil & Gas Producers
OP	Operational Procedures
OPC	Operator Proficiency Check
OPS	Operations
ORO	Organisation Requirements for Air Operations
POL	Aircraft Performance and Operating Limitations
S	South
SE	Single Engine
SET	Single-Engine Turbine
SPA	Operations requiring Special Approval
STC	Supplemental Type Certificate
TC	Type Certificate
UMS	Usage Monitoring System
VEMD	Vehicle Engine Monitoring Display

Abbreviation	Definition
VwVG	Verwaltungsverfahrengesetz - Administrative Procedure Act, APA

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AltMOC 0 Introduction

The intend of this AltMOC is to establish compliance with CAT.POL.H.420 by Alternative Means of Compliance in order to justify the operation of single-engined helicopters over mountainous areas within Switzerland.

0.1. Purpose of this AltMOC

The purpose of this Alternative means of compliance (AltMOC) is to establish compliance with Regulation (EC) No 216/2008 and CAT.POL.H.420.

0.2. Scope

AMC1 to CAT.POL.H.420, published by EASA, does allow single-engined helicopter operations over mountainous areas only when the outcome of an engine failure in a twin-engined helicopter will be the same as in a single-engined helicopter.

Assumption: A comparison between single-engined and multi-engined helicopter to justify such operations is only needed, if multi-engined helicopters provide significant advantage in safety compared with single-engined helicopters, when operated over/within mountainous terrain by day.

Basis of establishing AltMOC is the verification of the assumption above and the stakeholder impact of the AMC1 to CAT.POL.H.420 and a risk assessment by analysing data and documents from different sources. Further questions regarding the proportionality of a fleet change are analysed.

0.3. Terms and Conditions

When used throughout the AltMOC 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. List of References

This AltMOC is based on:

Reference	Issue	Subject
Commission Regulation (EC) No 216/2008	20.02.2008	REGULATION (EC) No 216/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on common rules in the field of civil aviation and establishing a European Aviation Safety Agency,and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC
Commission Regulation (EC) No 965/2012 • ARO.GEN.120 • ORO.GEN.120 • CAT.OP.MPA.137 • CAT.POL.H.400 • CAT.POL.H.410 • CAT.POL.H.420 • CAT.POL.H.305	05.10.2012	COMMISSION REGULATION (EU) No 965/2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council
Operations en classe de performance 3 en zone hostile non habitée disposition «autres zone d'operation» http://www.developpement-durable.gouv.fr/Transport- public-par-helicopteres.html	02.07.2014	CAT.POL.H.420 B)3) conformité réglementaire et évaluation des risques, DGAC, 2014
EASA, Notice of Proposed Amendment 2014-18 http://hub.easa.europa.eu/crt/docs/viewnpa/id_270	17.07.2014	Commercial air transport aeroplane operations at night or in IMC using single-engined turbine aeroplane
Airbus Helicopters/Eurocopter, Powerplant sudden in-service power loss calculations	13.11.2013	Calculations for ECUREUIL AS 350 B3/EC 130 B4-T2 – Arriel 2 B-B1-D
Airbus Helicopters/Eurocopter, Information Notice, No 2192-I-00, https://www.eurocopter.com/techpub/FO/scripts/myFO_login.php	13.07.2010	Eligibility for operations without an assured safe forced landing capability - SA315 B (Lama), SE3160 (Alouette III), SA316 B/C (Alouette III) - ARTOUSTE III B/B1/D Engines.
Airbus Helicopters/Eurocopter, Information Notice, No 2191-I-00, https://www.eurocopter.com/techpub/FO/scripts/myFO_login.php	08.07.2012	Eligibility for operations without an assured safe forced landing capability, AS350 B, BA, B1, B2 - ARRIEL 1B/1D/1D1 Engines.
Airbus Helicopters/Eurocopter, Information Notice, No 2189-I-00, https://www.eurocopter.com/techpub/FO/scripts/myFO_login.php	13.07.2012	Eligibility for operations without an assured safe forced landing capability, EC120 B - ARRIUS 2F Engines.
Airbus Helicopters/Eurocopter, IN, No 2190-I-00, https://www.eurocopter.com/techpub/FO/scripts/myFO_login.php	24.12.2013	Eligibility for operations without an assured safe forced landing capability - AS350 B3 - ARRIEL 2B, 2B1, 2D Engines.

0.5. Organisation/Operator Responsibilities

With reference to the AltMOC concerned, include provisions and statements related to the responsibilities of the organisation/operator.

AltMOC 1 Background

1.1. Implementing Rule – CAT.POL.H.420

According to CAT.POL.H.420 (a) operations over a non-congested hostile environment without a safe forced landing capability with turbine-powered helicopters with an MOPSC of six or less shall only be conducted if the operator has been granted an approval by the competent authority, following a safety risk assessment performed by the operator. Before such operations take place in another Member State, the operator shall obtain an endorsement from the competent authority of that State.

CAT.POL.H.420 (b)

To obtain and maintain such approval the operator shall:

(1) only conduct these operations in the areas and under the conditions specified in the approval;
(2) not conduct these operations under a HEMS approval;
(3) substantiate that helicopter limitations, or other justifiable considerations, preclude the use of the appropriate performance criteria; and
(4) be approved in accordance with CAT.POL.H.305 (b).

CAT.POL.H.420 (c)

(c) Notwithstanding CAT.IDE.H.240, such operations may be conducted without supplemental oxygen equipment, provided the cabin altitude does not exceed 10 000 ft for a period in excess of 30 minutes and never exceeds 13 000 ft pressure altitude.

1.2. Acceptable Means of Compliance – AMC1 CAT.POL.H.420 (a)

According to AMC1 CAT.POL.H.420, established by EASA, two cases which are deemed to be acceptable for the alleviation under the conditions of CAT.POL.H.420 for the en-route phase of the flight are:

- flights over mountainous areas and
- remote areas.

The both cases (areas) already having been considered by the JAA in comparison to ground transport in the case of remote areas and respectively to multi-engined helicopters in the case of mountainous areas are:

1.2.1 Remote areas – AMC1 CAT.POL.H.420 (a)(1)

Remote area operation is acceptable when alternative surface transportation does not provide the same level of safety as helicopter transportation. In this case, the operator should demonstrate why the economic circumstances do not justify replacement of single-engined helicopters by multi- engined helicopters.

1.2.2 Mountainous areas – AMC1 CAT.POL.H.420 (a)(2)

Current generation twin-engined helicopters may not be able to meet the performance class 1 or 2 requirements at the operational altitude; consequently, the outcome of an engine failure is the same as a single-engined helicopter. In this case, the operator should justify the use of exposure in the en-route phase.

1.2.3 Other areas of operation – AMC1 CAT.POL.H.420 (b)

Within Switzerland operations over hostile environment will be conducted mainly over mountainous areas. Therefore, other areas of operation are less important and will not be addressed in this AltMOC.

AltMOC 2 Purpose

AMC1 to CAT.POL.H.420, published by EASA, does allow single-engined helicopter operations over mountainous areas only when the outcome of an engine failure in a twin-engined helicopter will be the same as in a single-engined helicopter.

This condition is not achievable

- During the en-route phase of an operation the outcome of an engine failure in a twin-engined helicopter will not be the same as in a single-engined helicopter. In the event of an engine failure during the en-route flight, a forced landing will be required in a single-engined helicopter while a multi-engined helicopter is usually able to continue the flight (e.g. controlled descent or even maintaining the altitude) or is at least powered by the remaining engine.
- Therefore, operations over mountainous areas with single-engined helicopter are not justifiable with AMC1 to CAT.POL.H.420 published by EASA. Consequently, such operations have to be conducted with multi-engined helicopters.

The purpose of this AltMOC is to establish compliance with CAT.POL.H.420 by Alternative Means of Compliance (AltMOC) in order to justify the operation of single-engined helicopters over mountainous areas within Switzerland.

Assumption

A comparison between single-engined and multi-engined helicopter to justify such operations is only needed, if multi-engined helicopters provide significant advantage in safety compared with single-engined helicopters, when operated over/within mountainous terrain by day.

Basis of establishing AltMOC is the verification of the assumption above and the stakeholder impact of the AMC1 to CAT.POL.H.420 and a risk assessment by analysing data and documents from different sources. Further questions regarding the proportionality of a fleet change are analysed.

2.1. Use of single-engined helicopters – Impact of the new rule

According to Airbus Helicopters (Eurocopter), half of the European fleet (49,2 %) is composed of single-engined helicopters (2265 h/c versus a total of 4605). 59 % of the single-engined fleet represent Eurocopter helicopters. They are mainly operated in France, Germany, Italy, Norway, Sweden, Switzerland and UK. 28 % of the Eurocopter fleet qualify as old generation helicopters.

A large number of the helicopters used in general aviation is also used for commercial air transport but rarely for aerial work missions. At the same time, 20 % of the activity of aerial work operators consists of passenger transport missions. Approximately 50 % of single-engined helicopters are used for passenger transport. All operators perform passenger transport missions, even aerial work operators. A helicopter is not dedicated to one mission only.

Consequently, the current requirements are too restrictive with regard to operations with single-engined helicopters as:

- most of the commercial air transport operators and private owners will not be able to move to twin engined helicopters for economical reasons. As a consequence, the whole helicopter sector will be jeopardised, including all the beneficial services provided to society.
- operators of old generation helicopters are not in a position to renew their fleet. (Keeping their old helicopters will prevent them from the benefit of the latest safety standards).

(Eurocopter, 4th EASA Rotocraft Symposium – Cologne, 09 December 2010)

2.2. Risk assessment – Demonstration of compliance

Alternative means of compliance to those adopted by the Agency may be used by an operator to establish compliance with Regulation (EC) No 216/2008 and its Implementing Rules.

In order to demonstrate that the Implementing Rules are met, a risk assessment should be completed and documented. The result of this risk assessment should demonstrate that an equivalent level of safety to that established by the Acceptable Means of Compliance (AMC) adopted by the Agency is reached.

2.3. Single-engined versus multi-engined helicopters

For operations within the mountainous areas of Switzerland, the existing AMC1 to CAT.POL.H.420 accepts alleviation under the conditions of CAT.POL.H.420 only if current generation twin-engined helicopters may not be able to meet the performance class 1 or 2 requirements at the operational altitude. Respectively, if the outcome of an engine failure is the same as a single-engined helicopter.

If one engine of a twin-engined helicopter fails during the en-route phase of the flight, the helicopter is in most circumstances able to continue the flight within at least performance class 2. If the turbine of a single-engined helicopter fails, a forced landing will be required. Therefore, the outcome of such an event is better in a multi-engined helicopter. Consequently, according to AMC1 to CAT.POL.H.420, such operations have to be conducted with multi-engined helicopters.

AltMOC 3 The elements fo the risk assessment

The risk assessment process according to the example of GM CAT.POL.H.420 consists of the application of three principles:

- a safety target;
- a helicopter reliability assessment; and
- continuing airworthiness.

This AltMOC adds a further principle as part of the risk assessment:

- time limitation for the operation over hostile environment.

3.1. The safety target

3.1.1 Engine failure rates per flying hour - Helicopter

According to GM1 CAT.POL.H.420, the main element of the risk assessment when exposure was initially introduced by the JAA into JAR-OPS 3 (NPA OPS-8), was the assumption that turbine engines in helicopters would have failure rates of about 1:100 000 per flying hour – which would permit (against the agreed safety target of 5×10^{-8} per event) an exposure of about 9 seconds for twin-engined helicopters and 18 seconds for single-engined helicopters during the take-off or landing event.

Operators requiring an approval according to CAT.POL.H.420 shall use helicopters equipped with powerplants not exceeding 1 sudden power loss rate per 100,000 engine hours in a 5-year moving window.

According to Airbus Helicopters, the following helicopters/engines do meet the requirements regarding the engine reliability:

- AS350 B, BA, B1, B2 - ARRIEL 1B/1D/1D1 Engines
- AS350 B3 - ARRIEL 2B, 2B1, 2D Engines
- EC120 B - ARRIUS 2F Engines
- SA315 B (Lama), SE3160 (Alouette III), SA316 B/C (Alouette III) - ARTOUSTE III B/B1/D Engines

An EASA Study on single-engined helicopter operations over hostile environment, presented at the 7th Rotorcraft Symposium on 05 December 2013, has calculated the turbine engine failure rate as:

$$0.74 \times 10^{-5} \text{ per flight hour}$$

Airbus Helicopters (Eurocopter) has calculated the sudden in-service power loss rate, based on the data given by the engine manufacturer (Turbomeca). Within the period 2008 to 2012 the ECUREUIL AS350 B3/EC 130 B4-T2 – Arriel 2 B-B1-D has accumulated 2'189'400 engine flight hours, which resulted in 4.1 power losses. The sudden power loss rate for the helicopter/engine is:

$$0.18 \times 10^{-5} \text{ per engine hour}$$

3.1.2 Engine failure rates per flying hour – aeroplanes

The specific objective of NPA 2014-18, published on 17 July 2014 by EASA, is to allow commercial air transport of single-engined turbine aeroplane in IMC or during night operations in Europe, through cost-efficient rules which mitigate the risks linked to an engine failure to a level comparable with similar operations with twin-engined aeroplanes.

Regarding SET-IMC operations, turbine engine reliability AMC1 SPA.SET-IMC.105(a) requires a rate of turbine engine in-flight shutdown, or loss of power for all causes, such that a forced landing is inevitable, of less than 10 per million flight hours:

$$1 \times 10^{-5} \text{per flight hour}$$

3.1.3 Engine failure rates per flying hour – aeroplanes versus helicopters

Both analyses (see above) indicate a very low engine failure rate for turbine engined helicopters. Those failure rates are better than required according to GM1 CAT.POL.H.420 and for commercial air transport aeroplane operations at night or, in IMC using single-engined turbine aeroplane.

The required turbine engine reliability for single-engined turbine aeroplane compared with the turbine engine reliability for single-engined helicopter indicates an approximately 5 times better result for the

Airbus Helicopter fleet (AS350/EC130, Arriel 2 B-B1-D) and an approximately 1.4 times better result for the whole single-engined turbine helicopter fleet (EASA study).

3.1.4 Economic justification (GM1 CAT.POL.H.420 (b) (1))

According to GM1 CAT.POL.H.420, the approval to operate with high risk of endangering helicopter occupants should therefore only be granted against a comparative risk assessment (i.e. compared to other means of transport the risk is demonstrated to be lower), or where there is no economic justification to replace single-engined helicopters by multi-engined helicopters.

A French study (mandated by DGAC France) on hostile operations with CP3 helicopters comes to the following conclusions:

- Transport operations with single-engined helicopters over hostile area contribute about 25 % to total turnover, single- and twin-engined helicopters combined (approximately € 20 millions on a total of over € 80 millions)
- CAT with single-engined helicopters over hostile area contributes to more than half of the turnover of operations of single-engined helicopters (up to almost € 20 millions). The other half of revenue deriving from "single-engine operations" result from the specific activities (up to € 17 millions);
- Single-engine CAT transport contributes 30 % to revenues in CAT (€ 20 millions to € 67 millions).

By not allowing single-engine operations over hostile area this will cause an important loss of revenue which may endanger the economic survival of many operators. Furthermore, single-engined helicopters will be used to a considerably lesser extent and not to their potential.

The number of single-engined helicopters operated in CAT under the provisions over hostile area in France amounts to approximately 110 (helicopters mainly not dedicated to CAT).

In case of a mandatory fleet renewal with twin-engined helicopters, based on a total number of 110 helicopters and based on an average cost of acquisition of € 2 millions for i.e. a helicopter Twin, this would amount to an investment of approximately € 100 millions.

Furthermore, it should be noted that the exclusive use of fully Twin CAT fleets would result in an increase in the cost charged to the customer. FOCA estimates the minimum ratio twin-engined helicopter and single-engined helicopter approximately from 1.6 to 3 or 4. This would have a negative economic impact on CAT operations.

Compared to France, Switzerland would be more affected by limiting the operation to twin-engined helicopters, due to the higher number of single-engined helicopters operated in Switzerland.

3.1.5 Risk of other means of transport

Some places within mountainous areas (e.g. mountain landing sites, mountain huts) could only be reached by trails, cable cars or snowmobiles. Therefore, the risk of the passenger transport by single-engined helicopters may be lower compared to other means of transport.

3.2. Continuing airworthiness

According to GM1 CAT.POL.H.420, mitigating procedures consist of a number of elements:

- the fulfilment of all manufacturers' safety modifications;
- a comprehensive reporting system (both failures and usage data); and
- the implementation of a usage monitoring system (UMS).

Each of these elements is to ensure that engines, once shown to be sufficiently reliable to meet the safety target, will sustain such reliability (or improve upon it). The monitoring system is felt to be particularly important as it had already been demonstrated that when such systems are in place it inculcates a more considered approach to operations. In addition, the elimination of 'hot starts', prevented by the UMS, itself minimises the incidents of turbine burst failures.

3.2.1 Manufacturers' safety modifications

Operators requiring an approval according to CAT.POL.H.420 shall in addition to any modifications or instructions imposed by Mandatory Service Bulletins and/or Airworthiness Directives, take into account any measures as defined by the manufacturers' safety modifications.

3.2.2 Reporting system

Operators requiring an approval according to CAT.POL.H.420 shall implement a comprehensive reporting system (both failures and usage data).

3.2.3 Implementation of a usage monitoring system

Operators requiring an approval according to CAT.POL.H.420 shall implement an engine Usage Monitoring System (UMS) on the helicopter with associated data recording, storage, self-testing, downloading, documenting and storage requirements according to CAT.POL.H.305.

3.3. Time limitations

GM1 CAT.POL.H.420 requires the reliability assessment to ensure that the engine reliability remains at or better than 1×10^{-5}, but neither the Implementing Rule nor the associated AMC limit the time of exposure.

During most commercial operations (CAT) within mountainous area only parts of the flights are conducted over hostile environments. As per the present AltMOC, in order to reduce the risk for a hazardous event, operations over a hostile environment should not take longer than necessary for the operational purpose.

3.4. Risk Mitigation

An approval for operation over hostile environment based on the request of the operator shall contain the following risk mitigation elements and procedures:

- additional pilot training (techniques to minimise the risk, advanced autorotation);
- the reliability assessment: the engine reliability remains at or better than 1×10^{-5};
- continuing airworthiness, mitigating procedures consisting of:
  - the fulfilment of all manufacturers' safety modifications;
  - a comprehensive reporting system (both failures and usage data); and
  - the implementation of a usage monitoring system (UMS); and
- to limit the time period over hostile environment (exposure) to the necessary

3.5. Risk assessment – Conclusion

The specific objective of NPA 2014-18, published on 17 July 2014 by EASA, to allow CAT SET-IMC operations in Europe, underlines the assumption, that engine malfunction related accidents are not a predominant safety concern.

Even if the probability of an engine failure is remote, an engine failure in single-engined helicopters over hostile environment may have a hazardous outcome. Therefore, additional mitigation elements and procedures are required to operate single-engined helicopters over hostile environment.

The fulfilment of the mitigation elements according to CAT.POL.H.420, the associated AMC, GM and the additional time limitation requirement, demonstrate that an equivalent level of safety to that established by the Acceptable Means of Compliance (AMC) adopted by the Agency is reached.

The result of the risk assessment does neither sustain an economical nor a safety justification nor the demands of the proportionality principle to replace single-engined helicopters by multi-engined helicopters.

AltMOC 4 Scope of Application

Companies operating commercially (CAT) with single-engined helicopters over hostile environment are required to comply with CAT.POL.H.420. Therefore, the content of AMC1 to CAT.POL.H.420 to justify the continuation of such operations is applicable. Because the content of the AMC established by the Agency do not justify the operation, operators may use the present AltMOC to establish compliance with Regulation (EC) 216/2008 and the Implementing Rules to CAT.POL.H.420.

AltMOC 5 Definitions

'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.

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

'Exposure time' means the actual period during which the performance of the helicopter with the critical engine inoperative in still air does not guarantee a safe forced landing or the safe continuation of the flight.

'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.

'Hostile environment' means:

a) an environment in which:

- a safe forced landing cannot be accomplished because the surface is inadequate;
- the helicopter occupants cannot be adequately protected from the elements;
- search and rescue response/capability is not provided consistent with anticipated exposure;

or

- there is an unacceptable risk of endangering persons or property on the ground.

b) in any case, the following areas:

- for overwater operations, the open sea areas North of 45°N and South of 45°S designated by the authority of the State concerned;
- those parts of a congested area without adequate safe forced landing areas.

'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.

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

c) a safe forced landing can be accomplished;

d) the helicopter occupants can be protected from the elements; and

e) 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.

'Operation in performance class 1' means an operation in which, 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 in which, 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 in which, 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 is required in a single-engined helicopter.

‘Risk’ is the combination of occurrence, likelihood and severity.

A ‘risk management process’ ensures analysis (in terms of likelihood and severity of occurrence), assessment (in terms of tolerability) and control (in terms of mitigation) of risks to an acceptable level.

‘Risk tolerability matrix’ is a matrix (or table) combining risk likelihood and risk severity.

‘Safety’ means the condition in which risks associated with aviation activities are reduced and controlled to an acceptable level (ICAO Annex 19). According ICAO Doc 9859 AN/474, Safety Management Manual, Third Edition, 'safety' is defined as the state in which the risk of harm to persons or property damage is reduced to and maintained at or below an acceptable level through a continuing process of hazard identification and risk management.

The ‘risk assessment’ matrix is a graphic reproduction of risk as the product of probability on one axis (exposure, frequency or probability) and potential consequences on the other axis (resulting loss). The risk assessment matrix shows an assigned value, and has a broad application for qualitative risk determination as well as graphically presenting risk criteria.

The ‘principle of proportionality’ regulates the exercise of powers by the European Union. It seeks to set actions taken by the institutions of the Union within specified bounds. Under this rule, the involvement of the institutions must be limited to what is necessary to achieve the objectives of the treaties. In other words, the content and form of the action must be in keeping with the aim pursued.

AltMOC 6 Directive

6.1. General

CAT.POL.H.420 requires an approval for operation over hostile environments with helicopters operated in performance class 3. An approval may only be granted by the competent authority, if a safety risk assessment has been performed by the operator.

This AltMOC provides a safety risk assessment performed by FOCA based on the engine reliability results as mentioned in the EASA Study on single-engined helicopter operations over hostile environment, presented at the 7th Rotorcraft Symposium on 05 December 2013.

The risk assessment aims at identifying the value for the severity and the probability of an occurrence. The result is the risk indicator for an occurrence during the en-route flight period. Based on this risk indicator, the risk is classified as acceptable, undesirable or unacceptable on the basis of the matrix (see OD 10: risk assessment).

6.2. Hazards are set out for this analysis

Engine failure in a single-engined helicopter during en-route flight phase.

6.3. Description of the risk

When an engine failure occurs in a single-engined helicopter over hostile environment, the outcome may be hazardous. The risk for an engine failure, 0.74×10^{-5} per flight hour (EASA study) and 0.18×10^{-5} per engine hour (AS 350 B3/EC 130), is remote.

6.4. Risk evaluation

During most commercial operations with single-engined helicopters, parts of the en-route flight phase are conducted over hostile environments. In Switzerland the lack of an adequate landing site to perform an emergency landing (autorotation) is the predominant factor to consider the environment as hostile. Having identified the value for the severity as hazardous (4) and the probability as remote (3) of an occurrence, both values are multiplied. The product of probability on one axis and potential consequences on the other axis, indentifies a qualitative risk value of 12, which is graphically presented within the yellow-zone (see Appendix 10.14).

6.5. Conclusions

A risk of this extent/magnitude is regarded as tolerable.

6.6. Checking requirements

Flight crew members performing single-engined operations over hostile environment are assessed during OPCs for their ability to minimise the risk and conduct autorotation within mountainous environments.

During line checks flight crew members are assessed for their risk management competences in order to minimise the flight phases over hostile environment to the absolute necessary minimum.

AltMOC 7 Concluding note

7.1. Implementation

As Regulation (EU) No 965/2012 will be applicable as of 28 October 2014, the AltMOC shall be implemented by all Swiss CAT operators until this date.

7.2. Exemptions

Operators may deviate from this AltMOC, if they demonstrate with a risk assessment, based on adequate mitigation procedures, that an equivalent level of safety compared to the one established by this AltMOC adopted by FOCA is attained.

7.3. Entry into effect

This AltMOC enters into effect on 28 October 2014.