European Union Aviation Safety Agency

Notice of Proposed Amendment 2020-16

in accordance with

Articles 6(3), 7 and 8 (Standard procedure: public consultation) of MB Decision No 18-2015

Helicopter ditching and water impact occupant survivability

RMT.0120 (27&29.008)

EXECUTIVE SUMMARY

The objective of this Notice of Proposed Amendment (NPA) is to mitigate the safety risks linked to the operation of helicopters for extended time periods over water.

Previous studies and accident investigations into helicopter ditching and water impact events had highlighted the need to enhance the certification specifications for helicopters (CS-27, CS-29) in order to improve the level of safety of future helicopter designs. As part of RMT.0120, changes were introduced to CS-27 and CS-29 at Amendment 5 to improve the probability of survival for occupants in the event of either a helicopter ditching or a survivable water impact.

An assessment has been conducted by the European Union Aviation Safety Agency (EASA) of the appropriateness of requiring design improvements to existing helicopter designs and the in-service helicopter fleet based on the above-mentioned specifications introduced in CS-27 and CS-29.

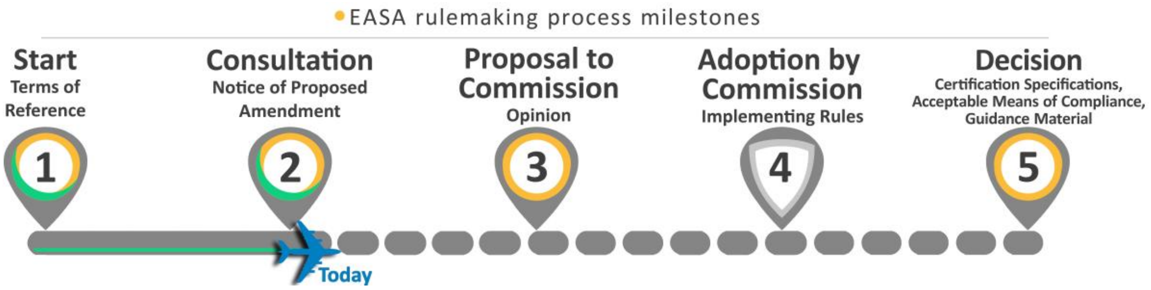
Based on that assessment, this NPA proposes to amend Part-26 and CS-26 to require the following design improvements[1]:

— Easier identification of the operating mechanisms for emergency ditching underwater exits;
— Provision of remote life raft deployment;
— Substantiated sea conditions for capsize resistance in the rotorcraft flight manual (RFM);
— Verified easy opening force for emergency ditching underwater exits;
— Life raft attachment means of a sufficient length to prevent damage to the life raft;
— Easy access to life preservers;
— Automatic illumination of emergency ditching underwater exits;
— Improved ratio of passengers to emergency ditching exits;
— Verified robustness of existing emergency flotation systems to resist damage in the event of a water impact;
— Automatic deployment and arming (if required) of the emergency flotation system.

In addition, this NPA also proposes some minor improvements to the certification specifications for new applications for certification for ditching and emergency flotation to improve the clarity of the previous amendments.

The proposed amendments are expected to increase safety with a minimal economic impact on helicopter operators and helicopter manufacturers.

Action area:	Rotorcraft		
Related rules:	Part-26, CS-26, CS-27 and CS-29		
Affected stakeholders:	DAHs and helicopter operators		
Driver:	Safety	**Rulemaking group:**	Yes
Impact assessment:	Yes	**Rulemaking Procedure:**	Standard



24/10/2012	23.12.2020	2021 Q3	2023 Q1	2023 Q1

[1] It should be noted that this list is not exhaustive and not all of these improvements are applied to small non-Category A helicopters or helicopters that are not required to be certified with ditching provisions (i.e. emergency flotation system only).

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1. About this NPA

1.1. How this NPA was developed

EASA has developed this NPA in line with Regulation (EU) 2018/1139[2] (the 'Basic Regulation') and the Rulemaking Procedure[3]. This rulemaking activity is included in the European Plan for Aviation Safety (EPAS) 2020-2024 under Rulemaking Task (RMT).0120. The text of this NPA has been developed by EASA based on the input of Rulemaking Group (RMG) RMT.0120. It is hereby submitted to all interested parties[4] for consultation.

1.2. How to comment on this NPA

Please submit your comments using the automated **Comment-Response Tool (CRT)** available at **http://hub.easa.europa.eu/crt/**[5].

The deadline for submission of comments is **31 May 2021**.

1.3. The next steps

Following the closing of the public commenting period, EASA will review all the comments received.

Based on the comments received, EASA will consider the need to propose amendments to Annex I (Part-26) to Regulation (EU) 2015/640[6] and, if necessary, issue an opinion. The opinion will be submitted to the European Commission, which will use it as a technical basis in order to in order to take a decision on whether or not to amend Regulation (EU) 2015/640.

If the Commission decides that Regulation (EU) 2015/640 should be amended, EASA will issue a decision in order to amend the Certification Specifications and Guidance Material for Additional airworthiness specifications for operations (CS-26) and the Certification Specifications and Acceptable Means of Compliance for small and large helicopters (CS-27 and CS-29 respectively).

The comments received on this NPA and the EASA responses to them will be reflected in a comment-response document (CRD). The CRD will be published on the EASA website[7].

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2 Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency, and amending Regulations (EC) No 2111/2005, (EC) No 1008/2008, (EU) No 996/2010, (EU) No 376/2014 and Directives 2014/30/EU and 2014/53/EU of the European Parliament and of the Council, and repealing Regulations (EC) No 552/2004 and (EC) No 216/2008 of the European Parliament and of the Council and Council Regulation (EEC) No 3922/91 (OJ L 212, 22.8.2018, p. 1) (https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1535612134845&uri=CELEX:32018R1139).

3 EASA is bound to follow a structured rulemaking process as required by Article 115(1) of Regulation (EU) 2018/1139. Such a process has been adopted by the EASA Management Board (MB) and is referred to as the 'Rulemaking Procedure'. See MB Decision No 18-2015 of 15 December 2015 replacing Decision 01/2012 concerning the procedure to be applied by EASA for the issuing of opinions, certification specifications and guidance material (http://www.easa.europa.eu/the-agency/management-board/decisions/easa-mb-decision-18-2015-rulemaking-procedure).

4 In accordance with Article 115 of Regulation (EU) 2018/1139, and Articles 6(3) and 7 of the Rulemaking Procedure.

5 In case of technical problems, please contact the CRT webmaster (crt@easa.europa.eu).

6 Commission Regulation (EU) 2015/640 of 23 April 2015 on additional airworthiness specifications for a given type of operations and amending Regulation (EU) No 965/2012 (OJ L 106, 24.4.2015, p. 18) (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32015R0640&qid=1607346568098).

7 https://www.easa.europa.eu/document-library/comment-response-documents

2. In summary — why and what

2.1. Why we need to amend the rules — issue/rationale

Helicopters are naturally unstable when floating on water, with a tendency to capsize and remain inverted due to their high centres of gravity in relation to their centres of buoyancy. To counter this natural instability and to provide opportunities for the occupants to escape, most helicopters used in offshore operations are required by Regulation (EU) No 965/2012[8] (hereinafter referred to as the 'Air OPS Regulation') to be fitted with an emergency flotation system (EFS), normally in the form of inflatable bags that are only deployed immediately before or after water entry. An EFS is designed for a controlled ditching, but may also provide some protection when the helicopter is sinking after a water impact event.

A capsize creates particular hazards for occupants. The cockpit/cabin quickly fills with water, leading to an inability to breathe, thus creating urgency to escape. This is a particular concern in cold water, where it is well established that the time necessary for escape can exceed an occupant's breath-hold time. A capsize may also lead to occupant disorientation which would further hinder escape. Operational experience has shown that drowning has been the most frequent cause of death following helicopter ditchings and survivable water impacts.

Following a number of helicopter ditching and water impact events in the 1980s and 1990s, and subsequent reports compiled by the United Kingdom Civil Aviation Authority (UK CAA)[9], the Federal Aviation Administration (FAA)[10] and others, the Joint Aviation Authorities (JAA)/FAA initiated two separate studies[11] to identify possible improvements in the design provisions, in order to increase the probability of survival for occupants. These studies, completed in 2000, contain multiple recommendations.

The JAA/FAA categorised these recommendations as referring either to:

(a) advisory circular (AC)/AMC changes only;

(b) changes requiring a new rulemaking task; or

(c) future research.

The JAA/FAA initiated the AC/AMC changes as part of the scheduled updates that were published in FAA AC 27-1B and AC 29-2C Change 2 (April 2006). However, due to the establishment of EASA, Change

[8] Commission Regulation (EU) No 965/2012 of 5 October 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 (OJ L 296, 25.10.2012, p. 1) (https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1593529495409&uri=CELEX:32012R0965).

[9] — CAP 491 — Helicopter Airworthiness Review Panel (HARP), UK CAA, June 1984.
— CAP 641 — Review of Helicopter Offshore Safety and Survival (RHOSS), UK CAA, February 1995.
— CAA Paper 96005 — Helicopter Crashworthiness, UK CAA, July 1996.

[10] — DOT/FAA/CT-92/13 — Rotorcraft Ditchings and Water Related-Impacts that Occurred from 1982 to 1989, Phase I, FAA, 1993.
— DOT/FAA/CT-92/14 — Rotorcraft Ditchings and Water Related-Impacts that Occurred from 1982 to 1989, Phase II, FAA, 1993.

[11] — JAA/FAA — Report of the Joint Harmonization Working Group on Water Impact Ditching Design and Crashworthiness (WIDDCWG), January 2000.
— JAA HOSS Working Paper HOSS/WP-99/8.5 — Helicopter Safety and Occupant Survivability Following Ditching or Water Impact, JAA, June 2000.

2 was not processed further by the JAA, and was never formally adopted in Europe until November 2008, when it was incorporated in Amendment 2 to CS-27 and CS-29.

On receipt of the JAA/FAA recommendations mentioned above, EASA created RMT.0120. This RMT was not immediately initiated due to the need to undertake research, particularly on the practicality of the 'side-floating' concept, which was initiated in 2007. The 'side-floating' concept was a solution identified in research commissioned by the UK CAA as one means of preventing helicopter total inversion by fitting additional floats high up on the side of the cabin (see Chapter 6.3, CAA Paper 97010).

In 2010, initial reports from the European Helicopter Safety Team (EHEST), and in particular from the European Helicopter Safety Implementation Team addressing rulemaking issues (EHSIT-ST-R), highlighted 3 of the top 10 rulemaking activities as related to ditching/water impacts. RMT.0120 was therefore given higher priority in EASA's Rulemaking Programme (RMP). A dedicated workshop was also organised by EASA in 2011 in association with the fifth annual EASA Rotorcraft Symposium.

RMT.0120 was formally initiated by EASA in October 2012. The aim of the task was to take a holistic approach to ditching, water impact and survivability, although its prime focus remained on design-related measures.

At the end of Phase 1 of RMT.0120 in June 2018, EASA published CS-27 and CS-29 Amendment 5, which included a comprehensive set of provisions requiring design improvements that better protect helicopter occupants in case of ditching and water impact. These new provisions are applicable to new applications for design certification.

Phase 2 of RMT.0120 started at the end of 2018 with the task to consider the retrospective application of the design improvements that were included in CS-27 and CS-29 Amendment 5. EASA re-established a Rulemaking Group of experts and affected stakeholders to support this activity.

<u>Safety recommendations</u>

The following safety recommendations (SRs) addressed to EASA from aircraft accident investigation report(s) published by the designated safety investigation authority[12], are considered during this RMT.

AS332 Super Puma G-WNSB accident in Sumburgh, UK on 23 August 2013:

> 'UNKG-2016-017: It is recommended that, where technically feasible, regulatory changes introduced by the European Aviation Safety Agency Rule Making Task RMT.120 are applied retrospectively to helicopters currently used in offshore operations.'

AS332 Super Puma G-WNSB accident in Sumburgh, UK on 23 August 2013:

> 'UNKG-2016-026: It is recommended that the European Aviation Safety Agency requires that, for existing helicopters used in offshore operations, a means of deploying each life raft is available above the waterline, whether the helicopter is floating upright or inverted.'

G-REDW EC225 LP Super Puma, 34 nm east of Aberdeen, Scotland, UK, on 10 May 2012 and G-CHCN, EC225 LP Super Puma 32 nm southwest of Sumburgh, Shetland Islands, UK on 22 October 2012:

[12] Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/EC (OJ L 295, 12.11.2010, p. 35) (http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1479716039678&uri=CELEX:32010R0996).

'UNKG 2014-018: It is recommended that the European Aviation Safety Agency amend the regulatory requirements to require that the long mooring line on liferafts fitted to offshore helicopters is long enough to enable the liferaft to float at a safe distance from the helicopter and its rotor blades.'

OH-HCI, S76C, Tallinn Bay, Estonia 10 August 2005:

'It is recommended that FAA and EASA will introduce the means requiring fitting helicopters operating on regular passenger flights with floats automatically inflating in contact with water.'

AS332 Super Puma G-WNSB accident in Sumburgh, UK on 23 August 2013:

'UNKG-2016-018: It is recommended that the European Aviation Safety Agency amend the Certification Specifications for rotorcraft (CS-27 and 29) to require the installation of systems for the automatic arming and activation of flotation equipment. The amended requirements should also be applied retrospectively to helicopters currently used in offshore operations'

G-TIGH, AS332L, UK North Sea on 14 March 1992:

'CAA should consider amending certification requirements …. To include a suitable system for manual and automatic inflation of emergency hull flotation equipment and that this requirement should also apply to helicopter types in service'

G-REDU EC225 LP Super Puma, near the Eastern trough area project central production facility platform in the North Sea on 18 February 2009:

'UNKG-2011-065: It is recommended that the European Aviation Safety Agency considers amending certification requirements for rotorcraft, that are certified in accordance with ditching provisions, to include a means of automatically inflating emergency flotation equipment'

G-BIJF, Bell 212, Dunlin Alpha, UK on 12 August 1981 (not assigned to EASA):

'The flexible pipe on the Bell 212 emergency flotation equipment be modified to permit a greater degree of structure distortion before the pipe ruptures.'

2.2. What we want to achieve — objectives

The overall objectives of the EASA system are defined in Article 1 of the Basic Regulation. This proposal will contribute to the achievement of the overall objectives by addressing the issues outlined in Section 2.1.

The specific objectives of this proposal are:

(a) to improve, with cost-efficient solutions, the safety of helicopter occupants in case of a ditching or a survivable water impact event; and

(b) to improve the clarity of the technical provisions related to the certification of helicopters for ditching or emergency flotation.

2.3. How we want to achieve it — overview of the proposals

The proposed changes provide a comprehensive package of safety improvements, which have been considered to be both feasible and pragmatic.

The following requirements are proposed for helicopters that are operated for extended time periods over water:

— Black/yellow marking for operating handles for all helicopters

In a capsized helicopter, passengers and flight crew will be able to more easily identify the operating handle for an emergency exit whilst underwater and in the dark.

— Black/yellow marking for emergency controls used underwater for all helicopters

Emergency controls will be marked with the method of operation and be marked with yellow and black stripes if they may have to be operated underwater.

— Remote life raft deployment (cockpit, cabin, from water) for large CS-29 helicopters only (ditching approval only)

The life raft will be required to reliably deploy in any foreseeable floating attitude, including capsized, from either inside the ditched helicopter, or if it has capsized, then survivors can deploy the life raft from outside the helicopter whilst in the water.

— Substantiated sea conditions for capsize resistance in the rotorcraft flight manual (RFM)

The flight crew and operators will be made aware of the sea conditions substantiated relating to the certification obtained with ditching or emergency flotation provisions.

— The effort required to open each emergency 'egress route' shall not be exceptional for CS-27 Category A and CS-29 helicopters only

In a capsized helicopter, emergency exits for the passengers and flight crew will be provided to enable rapid escape, i.e. an exceptional effort would not be required to open the exit after the mechanism is operated.

— The life raft attachment lines (short and long) should be of a suitable length to prevent damaging the life raft or putting the life raft in a dangerous position for all helicopters

When deployed, the life raft is able to be retained at a distance from the helicopter to allow occupants to enter and then float at a safe distance from the ditched helicopter, lowering the risk of damage to the life raft.

— Life preservers to be within easy reach of each seated occupant for all helicopters

If not already worn during the flight, life preservers will be easily found and reached by passengers.

— Automatic illumination of emergency ditching underwater exits for CS-27 Category A and CS-29 helicopters

In a capsized helicopter, passengers will be able to more easily find the emergency exits underwater and in the dark.

— Improved ratio of passengers to emergency ditching exits (one pair of emergency exits per four passengers) for all helicopters

In a capsized helicopter, passengers will have an emergency underwater exit for each pair of passengers, and they will not have to wait for more than one passenger to exit the capsized helicopter before making their underwater escape.

— Determination of the robustness of existing emergency flotation systems to consider possible damage

The integrity of the EFSs can be maximised when the design of the EFS considers the possibility of what damage could occur in the event of a water impact. An assessment of the installation and routing of EFS components, electrical connections and gas lines to maximise the possibility of a successful EFS deployment in the event of a water impact will be conducted. Design changes may be required to be installed for newly produced helicopters as a result of this assessment.

— Automatic deployment of the emergency flotation system for all helicopters

In the event of entry into water (ditching or water impact), the EFS must automatically deploy.

— Automatic arming of the emergency flotation system for CS-27 Category A and CS-29 helicopters

If the system that automatically deploys the EFS is disarmed during flight (to prevent a potential safety issue from the inadvertent deployment of the EFS), then the rearming of the EFS automatic deployment system must not rely upon any pilot action. This is only applicable to helicopters where the inadvertent deployment of the EFS could cause a safety issue, or where safe flight with the EFS deployed has not been demonstrated for the full envelope.

In addition to the retrospective requirements listed above, EASA also proposes improvements and clarifications to the changes introduced into CS-27 and CS-29 at Amendment 5.

These include improvements of the CS and AMC text for:

— emergency exit marking;

— structural ditching and emergency flotation provisions;

— flight crew emergency exits.

2.4. What are the expected benefits and drawbacks of the proposals

The proposed regulatory changes will improve the safety of offshore helicopter operations and provide a pragmatic balance of the associated minimal economic impact, and with no environmental or social impact.

For the full impact assessment of the alternative options, please refer to Chapter 4.

2.5. List of definitions used in this NPA

— DITCHING: an emergency landing on water, deliberately executed in accordance with RFM procedures, with the intent of abandoning the rotorcraft as soon as practicable.

— UNDERWATER EMERGENCY EXIT: an emergency exit designed and installed to facilitate rapid occupant escape from a capsized and flooded rotorcraft.

— EMERGENCY FLOTATION SYSTEM (EFS): a system of floats and any associated parts (gas cylinders, means of deployment, pipework and electrical connections) that is designed and installed on a rotorcraft to provide buoyancy and flotation stability in a ditching. The EFS includes any additional floats which only have a function following a capsize.

— EMERGENCY LANDING ON WATER: no longer used as a defined term and replaced by either 'Ditching' or 'Safe forced landing'.

— EMERGENCY LOCATOR TRANSMITTER (ELT): a generic term describing equipment which broadcasts distinctive signals on designated emergency frequencies and, depending on the application, may be automatically activated by impact or be manually activated. An ELT may take different forms.

— RETAINING LINE (sometimes known as a static line, mooring line or painter line): a chord that is attached between a life raft and the rotorcraft. Two retaining lines are typically fitted, a short one and a long one. The short retaining line is provided to position the raft during occupant transfer from the rotorcraft to the life raft. The long retaining line is provided to allow the life raft to drift away from the rotorcraft but remain attached to it, thus facilitating rescuers locating the survivor(s). Both retaining lines are designed to release the life raft without damage should the rotorcraft sink.

— SAFETY EQUIPMENT: installed equipment aimed directly at preventing risks to human life (e.g. a fire extinguisher, an evacuation slide, emergency flotation system, emergency cabin lighting, ELT, and signalling devices).

— SEA STATE (SS): a classification of sea conditions established by the World Meteorological Organization (WMO). As the WMO no longer recommends the use of sea states, the term is used in this NPA only in a historic context. SS has been replaced by significant wave height (H_s).

— SIGNIFICANT WAVE HEIGHT (H_s): the average value of the height (vertical distance between trough and crest) of the highest third of the waves present.

— SURVIVABLE WATER IMPACT: a water impact with a reasonable expectancy of no incapacitating injuries to a significant proportion of persons inside the rotorcraft, and where the cabin and cockpit remain essentially intact.

—WATER IMPACT: unintentional contact with water or exceeding the demonstrated ditching capability for water entry.

3. Proposed amendments and rationale in detail

The text of the amendment is arranged to show deleted, new or amended, and unchanged text as follows:

— deleted text is ~~struck through~~;

— new or amended text is highlighted in blue;

— an ellipsis '[…]' indicates that the rest of the text is unchanged.

3.1. Draft regulation (draft EASA opinion) amending Regulation (EU) 2015/640

Amend Article 2 as follows:

Article 2

Definitions

For the purposes of this Regulation,

(a) 'maximum operational passenger seating configuration' shall mean the maximum passenger seating capacity of an individual aircraft, excluding crew seats, established for operational purposes and specified in the operations manual.

(b) 'large aeroplane' means an aeroplane that has the Certification Specifications for large aeroplanes 'CS-25' or equivalent in its certification basis;

(c) 'large helicopter' means a helicopter that has the Certification Specifications for large rotorcraft 'CS-29' or equivalent in its certification basis;

(d) 'small helicopter' means a helicopter that has the Certification Specifications for small rotorcraft 'CS-27' or equivalent in its certification basis;

(e) 'small category A helicopter' means a small helicopter that also has the additional CS-29 provisions as referenced in CS-27 Appendix C or equivalent in its certification basis;

(f) 'Category A with respect to helicopters' means a multi-engined helicopter as defined by Regulation (EU) No 965/2012;

(~~d~~g) 'low-occupancy aeroplane' means an aeroplane that has a maximum operational passenger seating configuration of:

(1) up to and including 19 seats, or;

(2) up to and including one third of the maximum passenger seating capacity of the type certified aeroplane, as indicated in the aeroplane type-certificate data sheet (TCDS), provided that both of the following conditions are met:

(a) the total number of passenger seats approved for occupancy during taxiing, take-off or landing does not exceed 100 per deck;

(b) the maximum operational passenger seating configuration during taxiing, take-off or landing in any individual zone between pairs of emergency exits (or any dead-end zone) does not exceed one third of the sum of the passenger seat allowances for the emergency exit pairs bounding that zone (using the passenger seat allowance for each emergency exit pairs as defined by the applicable certification basis of the aeroplane). For the purpose of determining compliance with this zonal limitation, in the case of an aeroplane that has deactivated emergency exits, it shall be assumed that all emergency exits are functional.

(h) 'hostile sea environment' means the geographical area as defined by Regulation (EU) No 965/2012;

Amend Annex I (Part-26) as follows:

26.410 Emergency controls operated underwater

Operators of small helicopters and large helicopters that are, in accordance with point CAT.IDE.H.320(a) of Regulation (EU) No 965/2012, required to be designed for landing on water or certified for ditching, shall ensure that all the emergency controls that need to be operated underwater are marked with the method of operation and are marked with yellow and black stripes.

26.415 Underwater emergency exits

(a) Operators of small helicopters and large helicopters that are, in accordance with point CAT.IDE.H.320(a) of Regulation (EU) No 965/2012, required to be designed for landing on water or certified for ditching shall ensure that:

(1) it is possible for occupants to easily identify the means to operate all the underwater emergency exits to facilitate egress in the case of a ditching or capsize;

(2) passenger seats are aligned in relation to the underwater emergency exits required in accordance with point (3) in such a way to facilitate the escape of passengers in the event of the helicopter capsizing and the cabin becoming flooded; and

(3) an underwater emergency exit is available on each side of the rotorcraft for each unit (or part of a unit) of four passenger seats unless the emergency underwater exit is large enough to permit the simultaneous egress of two passengers side by side.

(b) Operators of small Category A helicopters and large helicopters that are, in accordance with point CAT.IDE.H.320(a) of Regulation (EU) No 965/2012, required to be designed for landing on water or certified for ditching, shall ensure that:

(1) all the emergency exits, including flight crew emergency exits, and any door, window or other opening suitable to be used for the purpose of underwater escape, remain operable in an emergency; and

(2) An automatic means is provided to easily identify the periphery of the apertures of all underwater emergency exits in all lighting conditions. Such markings must be designed to remain visible if the helicopter is capsized or the cabin is submerged.

26.420 Flight over water emergency equipment

(a) Operators of small helicopters and large helicopters that are required to comply with the requirements of points CAT.IDE.H.300, NCC.IDE.H.227 or SPO.IDE.H.199 of Regulation (EU) No 965/2012 shall ensure that each life raft has a means to hold the inflated life raft near the helicopter, and an additional means to keep the inflated life raft attached to the helicopter further away at a distance that would not pose a danger to the life raft itself or the persons on board. In the event that the helicopter becomes totally submerged, both of these means of retention shall break before the helicopter submerges even when the life raft is empty.

(b) Operators of large helicopters that are required by point SPA.HOFO.165(d) of Regulation (EU) No 965/2012 to have an installed life raft shall ensure that the life raft(s):

(1) are remotely deployable, with the means to deploy the life raft(s) located within easy reach of the flight crew, occupants of the passenger cabin and any survivors in the water, with the helicopter in an upright floating or capsized position; and

(2) can be reliably deployed with the helicopter in any reasonably foreseeable floating attitude, including capsized, and in the substantiated sea conditions for capsize resistance.

(c) Operators of small helicopters and large helicopters that are, in accordance with point CAT.IDE.H.320(a) of Regulation (EU) No 965/2012, required to be designed for landing on water or certified for ditching shall ensure that stowage provisions are provided that accommodate one life preserver for each helicopter occupant within easy reach of each occupant while seated, unless occupants are always required to wear them whilst on board the rotorcraft.

26.425 Provision of substantiated sea conditions

(a) A holder of a type certificate for a small helicopter or large helicopter shall ensure that the substantiated sea conditions for capsize resistance and any associated information relating to the ditching certification or emergency flotation provisions are provided in the rotorcraft flight manual (RFM) and provided to all operators.

(b) A holder of a supplemental type certificate for an emergency flotation system that is installed on a small helicopter or large helicopter shall ensure that the substantiated sea conditions for capsize resistance and any associated information relating to the ditching certification or emergency flotation provisions are provided in the RFM and provided to all operators.

26.430 Emergency flotation system resistance to damage

(a) Operators of small helicopters and large helicopters that have their first individual certificate of airworthiness issued on or after yy xxxx 20XX and that are, in accordance with point CAT.IDE.H.320(a) of Regulation (EU) No 965/2012, required to be designed for landing on water or certified for ditching, shall ensure that if the helicopter includes a stowed emergency flotation system, the effects on the successful deployment and retention of the system as a result of possible damage from a water impact are minimised in the design.

(b) Operators of small helicopters or large helicopters with stowed emergency flotation systems that are installed for the first time on or after yy xxxx 20XX that are required, in accordance with CAT.IDE.H.320(a), to be certified for ditching, shall ensure that the effects on the successful deployment and retention of the systems as a result of possible damage from a water impact are minimised in the design.

26.435 Automatic deployment of an emergency flotation system

(a) Operators of small helicopters that are required, in accordance with point CAT.IDE.H.320(a) of Regulation (EU) No 965/2012, to be designed for landing on water or certified for ditching shall ensure that if an emergency flotation system is installed and is stowed during flight, then it shall automatically deploy as a result of entry into water.

(b) Operators of small Category A helicopters and large helicopters that are required, in accordance with point CAT.IDE.H.320(a) of Regulation (EU) No 965/2012, to be designed for landing on water or certified for ditching shall ensure that if an emergency flotation system is installed and stowed during flight, then it shall automatically deploy as a result of entry into water and shall not rely on any pilot action during flight.

3.2. Draft certification specifications (draft EASA decision)

Draft text

Amend CS-26 as follows:

CS 26.410 Emergency controls operated underwater

Compliance with point 26.410 of Part-26 is demonstrated by complying with CS 27.1555(d)(2) of CS-27 at Amendment 5 or later, or the equivalent, or CS 29.1555(d)(2) of CS-29 at Amendment 5 or later or the equivalent respectively.

CS 26.415 Underwater emergency exits

(a) Compliance with point 26.415(a)(1) of Part-26 is demonstrated by complying with CS 27.805(c) and CS 27.807(d)(5) of CS-27 at Amendment 5 or later or the equivalent, or CS 29.811(h)(2) of CS-29 at Amendment 5 or later or the equivalent respectively.

Each operational device (pull tab(s), operating handle, 'push here' decal, etc.) of underwater emergency exits provided for flight crew or passengers must be marked with black and yellow stripes.

(b) Compliance with points 26.415(a)(2) and (3) of Part-26 is demonstrated by complying with CS 27.807(d)(1) of CS-27 at Amendment 5 or later or the equivalent or CS 29.807(d)(1) of CS-29 at Amendment 5 or later or the equivalent respectively.

(c) Compliance with point 26.415(b)(1) of Part-26 is demonstrated by complying with CS 27.805(c) of CS-27 at Amendment 5 or later or the equivalent, CS 29.805(c) of CS-29 at Amendment 5 or later or the equivalent respectively, and with CS 27.807(b)(2) and (d) of CS-27 at Amendment 5 or later or the equivalent, CS 29.807(d) of CS-29 at Amendment 5 or later respectively, CS 29.809(c) of CS-29 at Amendment 5 or later or the equivalent respectively, or with the following:

Underwater emergency exits for flight crew and passengers must be proven by test, demonstration, or analysis to provide for rapid escape with the helicopter in the upright floating position or capsized and must not require exceptional effort to open with the helicopter capsized and the cabin or cockpit flooded. The means to open an underwater emergency exit must be simple and obvious, must not require any exceptional effort, and must be evaluated.

(d) Compliance with point 26.415(b)(2) of Part-26 is demonstrated by complying with CS 29.811(h)(1) of CS-29 at Amendment 5 or later, or the equivalent, or with the following:

Underwater emergency exits for flight crew and passengers must be provided with highly conspicuous illuminated markings that are provided along the periphery of each underwater emergency exit that illuminate automatically and give a clear indication of the aperture and are designed to remain visible with the helicopter capsized and the cabin or cockpit flooded. The markings must be sufficient to highlight the full periphery. The additional illuminated markings must remain visible for at least 10 minutes following rotorcraft flooding. The method chosen to automatically activate the system (e.g. water immersion switch(es), tilt switch(es), etc.) must illuminate the markings immediately, or be already illuminated, when a capsize of the helicopter is inevitable.

CS 26.420 Flight over water emergency equipment

(a) Compliance with point 26.420(a)(1) of Part-26 is demonstrated by complying with CS 27.1415(b)(2) of CS-27 at Amendment 5 or later, or the equivalent, or CS 29.1415(b)(2) of CS-29 at Amendment 5 or later, or the equivalent respectively, or with the following:

Each life raft must be attached to the helicopter by a short retaining line to keep it alongside the helicopter and a long retaining line designed to keep it attached to the helicopter. Both retaining lines must be weak enough to break before submerging the empty life raft to which they are attached. The long retaining line must be of sufficient length that a drifting life raft will not be drawn towards any part of the helicopter that would pose a danger to the life raft itself or the persons on board.

(b) Compliance with point 26.420(b) of Part-26 is demonstrated by complying with CS 29.1415(b)(1) and CS 29.1561(a) and (c) of CS-29 at Amendment 5 or later, or the equivalent, or with the following:

(1) For life raft activation, the following must be provided for each life raft:

(i) primary activation: manual activation control(s), readily accessible to each pilot on the flight deck whilst seated;

(ii) secondary activation: activation control(s) accessible from the passenger cabin with the rotorcraft in the upright or capsized position; if any control is located within the cabin, it must be protected from inadvertent operation; and

(iii) tertiary activation: activation control(s) accessible to a person in the water, with the rotorcraft in any foreseeable floating attitude, including capsized.

It is acceptable for two of the manual activation functions from (i) to (iii) to be incorporated into one control.

(2) Automatic life raft activation is permitted (e.g. triggered by water immersion), however, this capability must be provided in addition to the required manual activation controls.

Mitigation must be provided to address inadvertent deployment in flight and the potential for damage to the life raft from turning rotors during deployment on the water.

(3) Placards must be installed, of appropriate sizes, numbers and locations, to highlight the location of each of the above life raft activation controls. All reasonably foreseeable rotorcraft floating attitudes must be considered when locating these placards.

(c) Compliance with point 26.420(c) of Part-26 is demonstrated by complying with CS 27.1415(c) of CS-27 at Amendment 5, or later, or the equivalent, or CS 29.1415(c) of CS-29 at Amendment 5 or later or the equivalent respectively.

CS 26.425 Provision of substantiated sea conditions

Compliance with point 26.425 of Part-26 is demonstrated by complying with CS 27.1587(b)(3) of CS-27 at Amendment 5 or later, or the equivalent, or CS 29.1587(c) of CS-29 at Amendment 5 or later or the equivalent respectively.

CS 26.430 Emergency flotation system resistance to damage

Compliance with point 26.430 of Part-26 is demonstrated by:

(a) the inclusion of CS 27.801(c)(1) of CS-27 at Amendment 5 or later, or the equivalent, or CS 29.801(c)(1) of CS-29 at Amendment 5 or later, or the equivalent certification specification in the existing type certificate of the helicopter or supplemental type certificate of the emergency flotation system; or

(b) the type certificate holder of the helicopter or the supplemental type certificate holder of the emergency flotation system determining whether the effects on the successful deployment and retention of the system as a result of possible damage from a water impact are minimised and taken into consideration through the evaluation of the functionality of the emergency flotation system in the event of a water impact. The design of the emergency flotation system must, as far as is practicable, in terms of complexity of design changes and any associated weight penalty:

(1) have system components that are located away from the major effects of structural deformation;

(2) maximise the use of flexible pipes/hoses;

(3) avoid passing pipes/hoses or electrical wires through bulkheads that could act as 'guillotines' when the structure is subject to water impact loads; and

(4) for large helicopters and small Category A helicopters certified with ditching provisions, include redundant or distributed systems.

Design changes that are considered by EASA to be practicable based upon the determination above must be subsequently incorporated into the design.

CS 26.435 Automatic deployment of an emergency flotation system

(a) Compliance with point 26.435(a) of Part-26 is demonstrated by complying with CS 27.801(c)(2) of CS-27 at Amendment 5 or later, or the equivalent, or with the following:

(1) An emergency flotation system that is stowed in a deflated condition during normal flight must have a means of automatic deployment following water entry. The means to automatically deploy the emergency flotation system must operate irrespective of whether or not inflation prior to water entry is the intended operation mode. If a manual means of inflation is provided, the emergency flotation system activation switch must be located on one of the primary flight controls and must be safeguarded against inadvertent actuation.

(2) Activation of the emergency flotation system upon water entry (irrespective of whether or not inflation prior to water entry is the intended operation mode) must result in an inflation time short enough to prevent the rotorcraft from becoming excessively submerged.

(b) Compliance with point 26.435(b) of Part-26 is demonstrated by complying with CS 29.801(c)(2) of CS-29 at Amendment 5 or later, or the equivalent or with the following:

An emergency flotation system that is stowed in a deflated condition during normal flight must have a means of automatic deployment following water entry that does not rely on any pilot action during flight. The inflation system of the emergency flotation system must have an appropriately low probability of spontaneous or inadvertent actuation in flight conditions for which float deployment has not been demonstrated to be safe. If this is achieved by disarming the inflation system, this must be achieved by the use of an automatic system employing appropriate input parameters. The choice of input parameters, and the architecture of the system, must be such that rearming of the system occurs automatically in a manner that will assure the inflation system functions as intended in the event of a water impact. It is not acceptable to specify any pilot action during flight.

Amend CS-27 as follows:

CS 27 Appendix C Criteria for Category A

[…]

If certification of an emergency flotation system alone is requested by the applicant, the following requirements of CS 29 must also be met in addition to the ones of this CS:

~~29.801(g) – Ditching~~ 29.802(d) – Emergency flotation

[…]

Amend CS-29 as follows:

CS 29.801 Ditching

[…]

(e) The rotorcraft must be shown to resist capsize in the sea conditions selected by the applicant. The probability of capsizing in a 5-minute exposure to the sea conditions must be substantiated to be less than or equal to 3.0 % with a fully serviceable emergency flotation system and 30.0 % with the critical float compartment failed, with 95 % confidence. Allowances must be made for probable structural damage and leakage.

CS 29.811 Emergency exit marking

[…]

(h) If certification with ditching provisions is requested by the applicant, in addition to the markings required by (a) above:

(1) each required passenger and flight crew underwater emergency exit ~~required by CS 29.805(c) or CS 29.807(d)~~, its means of access and its means of opening, must be provided with highly conspicuous illuminated markings that illuminate automatically and are designed to remain visible with the rotorcraft capsized and the cabin or cockpit, as appropriate, flooded; and

(2) each operational device (pull tab(s), operating handle, 'push here' decal, etc.) for these emergency exits must be marked with black and yellow stripes.

3.3. Draft acceptable means of compliance and guidance material (draft EASA decision)

AMC 27.563 Structural ditching and emergency flotation provisions

[…]

(a) Explanation.

[…]

(3) For floats intended to be deployed after water contact, CS 27.563(b)(2) defines the applicable load condition for entry into water, ~~requires the floats and their attachments to the rotorcraft to be designed to withstand the loads generated when entering the water~~ with the floats in their intended condition.

CS 27.563(b)(2) also includes the need for consideration of ~~S~~simultaneous vertical and drag loading on the floats and their attachments ~~should be considered~~ to account for the rotorcraft moving forward through the water during float deployment.

The vertical loads should be those resulting from fully immersed floats unless it is shown that full immersion is unlikely. If full immersion is shown to be unlikely, the determination of the highest likely buoyancy load should include consideration of a partially immersed float creating restoring moments to compensate for the upsetting moments caused by side wind, unsymmetrical rotorcraft loading, water wave action, rotorcraft inertia, and probable structural damage and leakage considered under CS 27.801(e) or 27.802(c). The maximum roll and pitch angles established during compliance with CS 27.801(e) or 27.802(c) may be used, if significant, to determine the extent of immersion of each float.

When determining this, damage to the rotorcraft that could be reasonably expected should be accounted for.

The drag loads should be those resulting from movement of the rotorcraft through the water at 10.3 m/s (20 knots).

[…]

(b) Procedures

(1) The floats and the float attachment structure should be substantiated for ~~rational~~ limit and ultimate loads. Additionally, any rotorcraft structure whose failure would impair flotation, capsize resistance or cabin egress should be substantiated for limit and ultimate ditching loads, unless the effects of these failures are accounted for in the investigation of the probable behaviour of the rotorcraft during water entry, flotation, and the capsize resistance demonstrations.

A review of the likely damage to the structure in the vicinity of the floats should be carried out, including consideration of splintering and sharp edges. The risk from such damage of puncture or improper functioning of the floats during water entry and flotation should be minimised.

[…]

AMC to CS 27.801(e) and 27.802(c) Model test method for flotation stability

[…]

(a) Explanation

[…]

(2) Model test wave conditions

[…]

Table 1 — Northern North Sea wave climate

	Spectrum shape: JONSWAP, peak enhancement factor γ = 3.3			
	Significant wave height H_s	Mean wave period T_z	Significant steepness $S_s = 2\pi H_s/(gT_z^2)$	H_s probability of exceedance P_e
~~Intact flotation system~~	6 m	7.9	1/16.2	1.2 %
	5.5 m	7.6	1/16.4	2 %
	5 m	7.3	1/16.6	3 %
	4.5 m	7.0	1/17.0	5 %
	4 m	6.7	1/17.5	8 %
	3.5 m	6.3	1/17.7	13 %
	3 m	5.9	1/18.1	20 %
	2.5 m	5.5	1/18.9	29 %
	2 m	5.1	1/20.3	43 %
	1.25 m	4.4	1/24.2	72 %

AMC 27.805(c) Flight crew emergency exits

[…]

(b) Procedures

[…]

(8) The dimensions of each flight crew underwater emergency exit should, as a minimum, be equal to those of a Type IV exit (0.48 m x 0.66 m or 19 in. x 26 in.) or, if of non-rectangular shape, should be capable of admitting an ellipse of 0.48 m x 0.66 m or 19 in. x 26 in.

GM 26.415(a)(1) Underwater emergency exits

To make it easier to recognise underwater, the operating device for the underwater emergency exit should have black and yellow markings with at least two bands of each colour of approximately equal widths. Any other operating feature, e.g. highlighted 'push here' decal(s) for openable windows, should also incorporate black-and-yellow-striped markings.

GM 26.415(a)(2) and (a)(3) Underwater emergency exits

The objective is for no passenger to be in a worse position than the second person to egress through an exit in the event of a capsize. The time available for evacuation is very short in such situations, and the provision of sufficient underwater emergency exits and ensuring that no occupant should need to wait for more than one other person to escape before being able to make their own escape will minimise the passengers' time to escape. The provision of an underwater emergency exit in each side of the fuselage for each unit (or part of a unit) of four passenger seats will make this possible, provided that the seats are positioned relative to the exits to maximise the probability of safe egress.

With regard to the location of the seats relative to the exits, the most obvious layout that maximises the achievement of the objective that no passenger is in a worse position than the second person to egress through an exit is a four-abreast arrangement with all the seats in each row located appropriately and directly next to the emergency exits. However, this might not be possible in all rotorcraft designs due to issues such as limited cabin width, the need to locate seats such as to accommodate normal boarding and egress, and the installation of items other than seats in the cabin. Notwithstanding this, an egress route necessitating movement such as along an aisle, around a cabin item, or in any way other than directly towards the nearest emergency exit, to escape the rotorcraft is not considered to be compliant with this provision.

GM 26.415(b)(1) Underwater emergency exits

A possible design solution for the provision of sufficient underwater emergency exits may be to use the passenger cabin windows as additional emergency egress means by including a jettison feature. The jettison feature may be provided by modifying the elastomeric window seal such that its retention strength is either reduced, or can be reduced by providing a removable part of its cross section, i.e. the so-called 'push out' window.

Exceptional effort is considered to be effort in excess of the range of 18 to 22.5 kg (40 to 50 pounds). Additionally, it is recommended that a person of slight stature, in the 41 to 50 kg (90 to 110 pound) weight range, should be used for the exit opening demonstration/tests.

GM 26.415(b)(2) Underwater emergency exits

Disorientation of occupants may result in the normal emergency exit markings in the cockpit and passenger cabins being ineffective following the rotorcraft capsizing and the cabin flooding.

The additional markings of underwater emergency exits may be in the form of illuminated strips that give clear indications in all environments (e.g. at night, underwater) of the location of the underwater emergency exits.

GM 26.420(a) Flight over water emergency equipment

In accordance with CS 26.420, each life raft must be equipped with two retaining lines to be used for securing the life raft to the helicopter. The short retaining line should be of such a length as to hold the raft at a point next to an upright floating helicopter such that the occupants can enter the life raft directly without entering the water. If the design of the helicopter is such that the flight crew cannot enter the passenger cabin, it is acceptable for them to take a more indirect route when boarding the life raft. After life raft boarding is completed, the short retaining line may be cut, and the life raft then remains attached to the rotorcraft by means of the long retaining line.

The length of the long retaining line should not result in the life raft taking up a position which could create a potential puncture risk or hazard to the occupants, such as directly under the tail boom, tail rotor or main rotor disc.

GM 26.420(c) Flight over water emergency equipment

No provision for the stowage of life preservers is necessary if Regulation (EU) No 965/2012 mandates the need for constant-wear life preservers.

GM 26.435(b) Automatic deployment of an emergency flotation system

The disarming of an emergency flotation system is typically required at high airspeeds, and could be achieved automatically using an airspeed switch. However, this would retain the possibility of inadvertent flight into the water at high airspeed, with the risk that the floats would not deploy. This scenario could be addressed by providing an additional or alternative means of rearming the floats as the helicopter descends through an appropriate height threshold. A height below that of the majority of offshore helidecks could be chosen in order to minimise exposure to inadvertent activation above the demonstrated float deployment airspeed.

4. Impact assessment (IA)

4.1. What is the issue

Experience has shown that in otherwise survivable helicopter ditchings and water impact events, there have been drowning fatalities due to the inability of the occupants to rapidly escape from a capsized and submerged cabin or, after having successfully escaped, their inability to subsequently survive until they can be rescued. Such fatalities could have been avoided.

Helicopters are naturally unstable when floating on the water, with the tendency to capsize and remain inverted due to their high centres of gravity in relation to their centres of buoyancy. To counter this natural instability and to provide opportunities for the occupants to escape, most of the helicopters used in offshore operations are required by the Air OPS Regulation to be fitted with an EFS, normally in the form of inflatable bags that are only deployed immediately before or after water entry. The EFS is designed for a controlled ditching, but may also provide some protection when the helicopter is sinking in a water impact event.

A capsize creates particular hazards to the occupants. The cockpit/cabin quickly fills with water, leading to an inability to breathe, thus creating an urgency to escape. This is a particular concern in cold water, where it is well established that the time necessary for escape can exceed an occupant's breath-hold time. A capsize may also lead to occupant disorientation, which would further hinder escape. Operational experience has shown that drowning has been the greatest cause of death following helicopter ditchings and survivable water impacts.

4.1.1. Safety risk assessment

Accident statistics

A database of known helicopter ditching and water impact events was established for Phase 1 of this RMT. It contains a primary database, consisting of worldwide events to western-built helicopters over a 10-year period (2003–2012), together with a secondary database of North Sea occurrences over the longer period of 1976–2002.

These databases were used as the basis for the justification to amend CS-27 and CS-29 for newly certified helicopters in Phase 1. The analysis of these databases can be found in the Regulatory Impact Assessment (RIA) used to support NPA 2016-01[13], which was published for Phase 1 of this RMT.

In order to ensure consistency, the primary 2003-2012 database was used as the starting point for the safety assessment for Phase 2 of this RMT. However, this database was updated to include helicopter ditchings, survivable water impacts (SWIs) and non-survivable water impacts (NSWIs) for the period 2003-2018. It should be noted that there is a lag in the inclusion of accidents in this database due to the ongoing accident investigations and the subsequent publication of the accident reports.

Each of the occurrences has been categorised as either a:

— ditching or emergency water landing (ELW); or

— survivable water impact (SWI); or

— non-survivable water impact (NSWI).

[13] Section 4.1.2 of NPA 2016-01 https://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2016-01.

The distribution of the occurrence categories is illustrated in Figures 4.1 and 4.2 below:

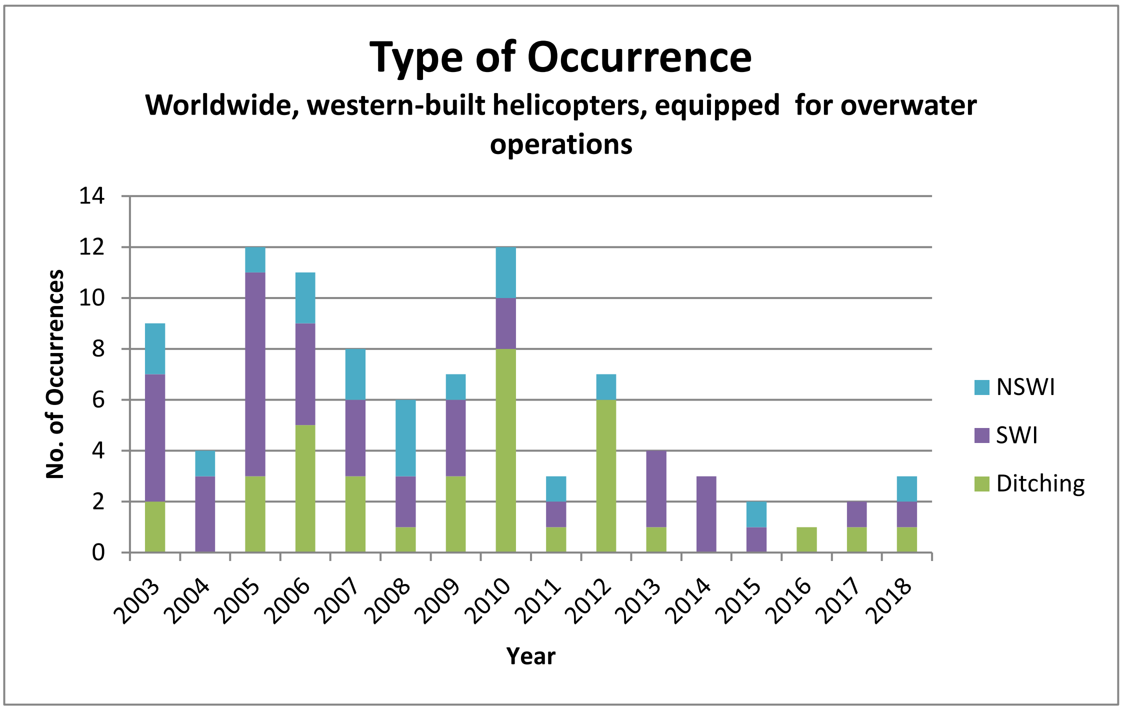


Figure 4.1 — Distribution of occurrence types by year (2003–2018, worldwide)

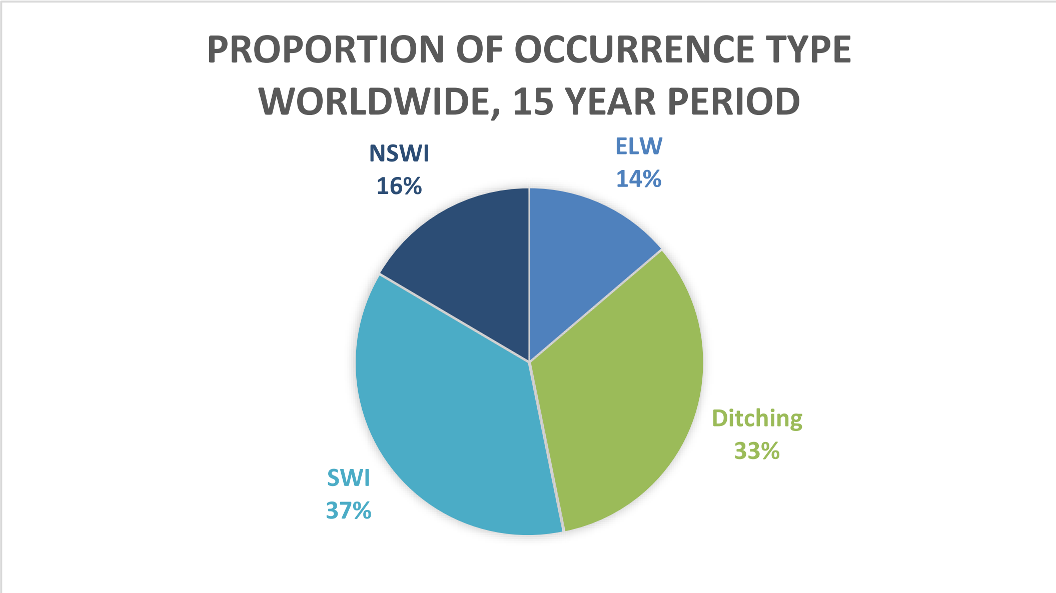


Figure 4.2 — Proportion of events by category (2003–2018, worldwide)

Figure 4.3 shows the breakdown of fatal accidents and the numbers of fatalities based on the types of occurrence.

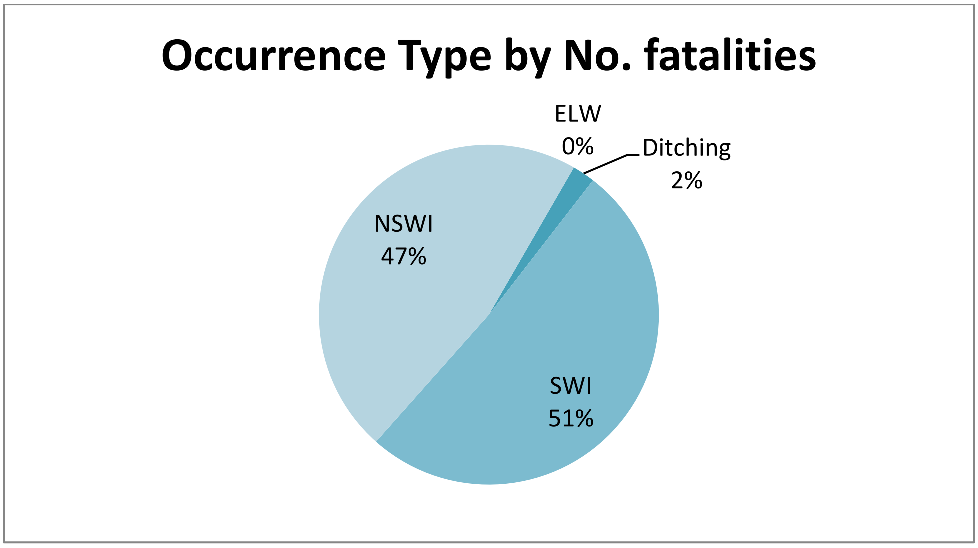


Figure 4.3 — Proportion of fatalities by occurrence category (2003–2018, worldwide)

The greatest proportion of fatalities have occurred in SWIs, which made up some 51 % of occurrences worldwide in the 15-year period (2003–2018), equating to 95 fatalities. This is closely followed by NSWIs at 47 %, which equates to 87 fatalities.

Ditching events have resulted in only a few fatalities. In the 15-year period worldwide, 3 ditching events resulted in fatalities. However, these figures may be misleading, as a pilot's decision whether to ditch may be influenced by the environment, and, in particular, the sea conditions existing at the time. The pilot's decision not to ditch the helicopter if there are adverse sea conditions may result in an NSWI (as happened with C-GZCH, for example).

A look at the trend in fatal accidents and fatal accidents excluding NSWIs, over the 15-year period, shows a reduction in the number of accidents in both categories (see Figures 4.4 and 4.5 below).

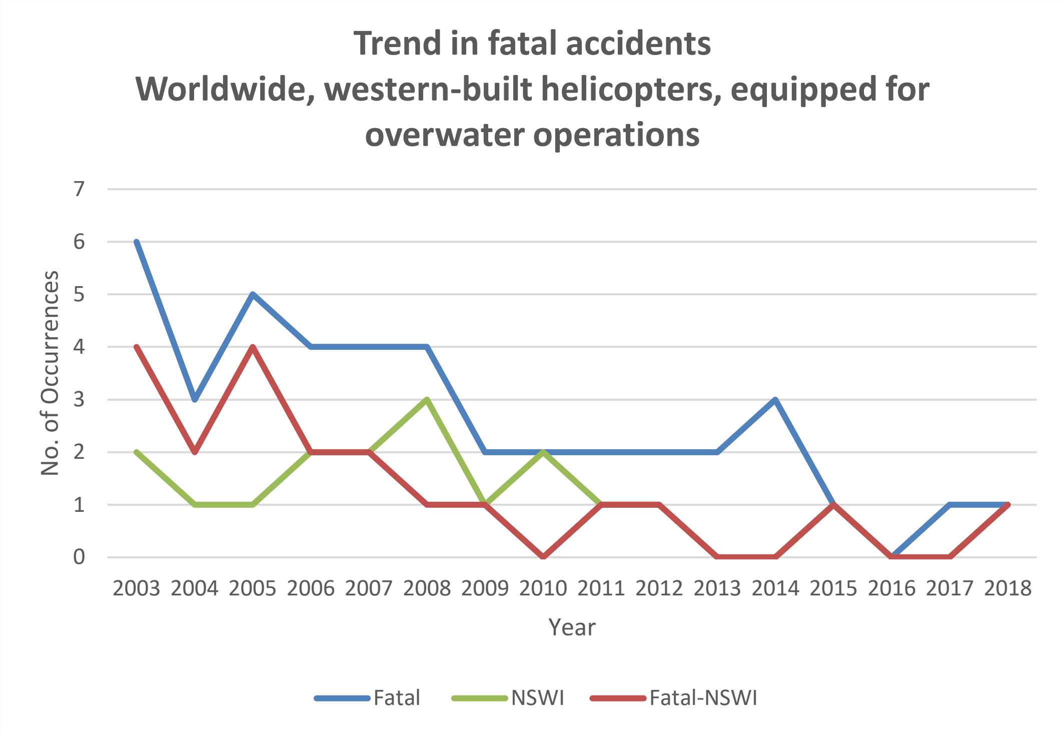


Figure 4.4 — Trend in fatal offshore accidents (2003–2018, worldwide)

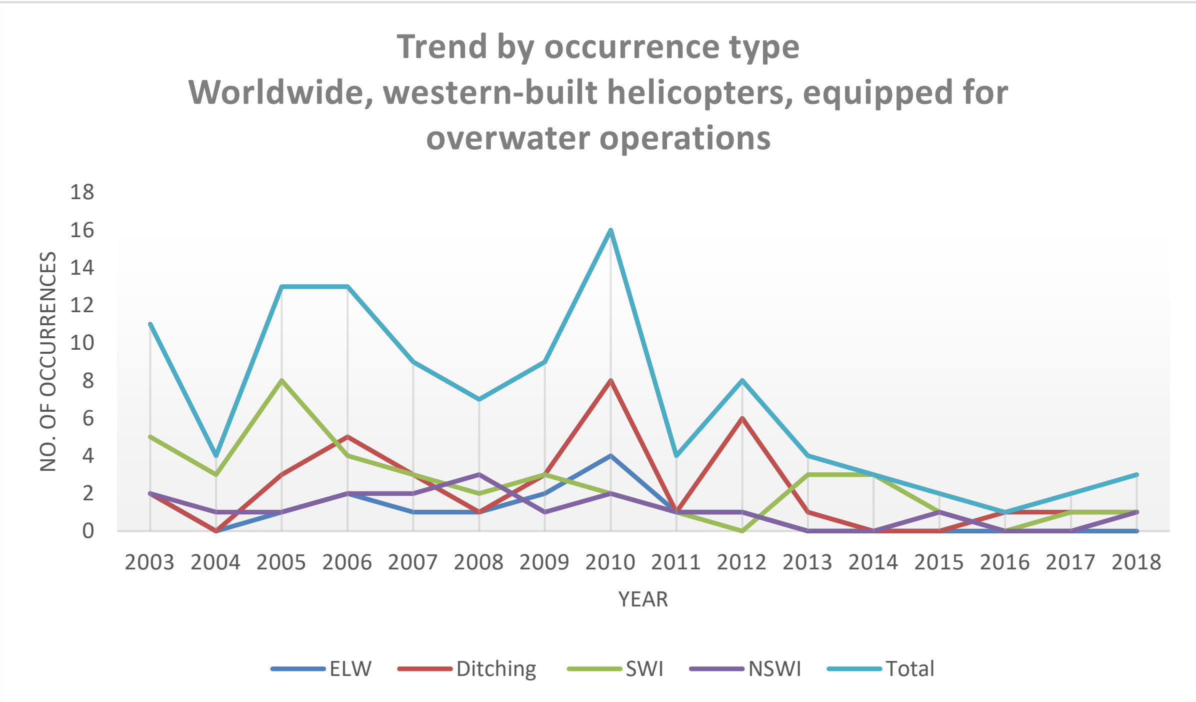


Figure 4.5 — Trend of occurrence types (2003–2018, worldwide)

In order to evaluate the safety risk related to helicopter ditching and water impacts, the EASA safety occurrence database from 2003-2018 was analysed to identify accidents and incidents that could be mitigated by the proposed regulatory changes contained within this NPA in a similar manner to Phase 1 of this RMT (reference NPA 2016-01).

The analysis of worldwide events involving helicopter ditching and water impacts relating to CS-27 (small), CS-27 Category A[14] and CS-29 (large) rotorcraft showed that during the period of 2003-2018, there were the following number of accidents and related fatalities:

Event	Number of events	Fatalities
Ditching	36	4
SWI	40	95
NSWI	18	87

Table 4.1 — Breakdown of rotorcraft events and fatalities 2003-2018

<u>Safety recommendations</u>

The following safety recommendations (SRs) addressed to EASA from aircraft accident investigation report(s) published by the designated safety investigation authority are considered during this RMT.

AS332 Super Puma G-WNSB accident in Sumburgh, UK, on 23 August 2013:

'UNKG-2016-017 It is recommended that, where technically feasible, regulatory changes introduced by the European Aviation Safety Agency Rule Making Task RMT.120 are applied retrospectively to helicopters currently used in offshore operations.'

AS332 Super Puma G-WNSB accident in Sumburgh, UK, on 23 August 2013:

'It is recommended that the European Aviation Safety Agency requires that, for existing helicopters used in offshore operations, a means of deploying each life raft is available above the waterline, whether the helicopter is floating upright or inverted.'

OH-HCI, S76C, Tallin Bay Estonia:

'It is recommended that FAA and EASA will introduce the means requiring fitting helicopters operating on regular passenger flights with floats automatically inflating in contact with water.'

G-WNSB, AS332, UK North Sea:

'UNKG-2016-018: It is recommended that the European Aviation Safety Agency amend the Certification Specifications for rotorcraft (CS-27 and 29) to require the installation of systems for the automatic arming and activation of flotation equipment. The amended requirements should also be applied retrospectively to helicopters currently used in offshore operations'

G-REDW EC225 LP Super Puma, 34 nm east of Aberdeen, Scotland, UK on 10 May 2012 and G-CHCN, EC225 LP Super Puma 32 nm southwest of Sumburgh, Shetland Islands, UK on 22 October 2012:

'UNKG 2014-018: It is recommended that the European Aviation Safety Agency amend the regulatory requirements to require that the long mooring line on liferafts fitted to offshore helicopters is long enough to enable the liferaft to float at a safe distance from the helicopter and its rotor blades.'

Safety recommendations not directly addressed to EASA:

[14] 'Category A with respect to helicopters' means a multi-engined helicopter designed with engine and system isolation features specified in the applicable certification specification 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.

G-TIGH, AS332L, UK North Sea:

'CAA should consider amending certification requirements …. To include a suitable system for manual and automatic inflation of emergency hull flotation equipment and that this requirement should also apply to helicopter types in service'

G-BIJF, Bell 212, Dunlin Alpha (not assigned to EASA):

'The flexible pipe on the Bell 212 emergency flotation equipment be modified to permit a greater degree of structure distortion before the pipe ruptures.'

4.1.2. Who is affected

These changes will affect manufacturers of helicopters intended for offshore operations, suppliers of the associated equipment to enable such operations, and operators of these helicopters.

An estimate of the size of the current helicopter offshore fleet within Europe is shown in Table 4.2 below. This indicates that there are 355 helicopters being used in 12 EASA Member States and the UK.

Country	Fleet
UK	129
Norway	73
France	51
Germany	28
Belgium	21
Netherlands	15
Italy	9
Ireland	9
Denmark	8
Portugal	5
Romania	4
Spain	2
Switzerland	1
Total	355

Table 4.2 — Offshore helicopter fleet (2018) in Europe[15]

The split between small CS-27 helicopters, small CS-27 category A helicopters and large CS-29 helicopters used for offshore operations and registered in Europe can be determined as:

— for **small CS-27 helicopters** , 25 out of 355 (7 %); and

— for **small CS-27 Category A** helicopters, 31 out of 355 (9 %); and

— for **large CS-29 helicopters** , 299 out of 355 (84 %).

[15] This includes all EASA Member States and the United Kingdom. Source: Cirium and feedback from NAAs.

4.1.3. How could the issue/problem evolve

The design requirements and acceptable means of compliance applicable to helicopter ditching that were introduced into certification specifications in CS-27 and CS-29 in Phase 1 of this RMT will provide significant safety improvements to newly certified rotorcraft.

However, it is recognised that the safety improvements will take a long time to become prevalent in the offshore helicopter fleet. This has been demonstrated by historical safety improvements that have been introduced. The challenge of increasing the number of helicopters that have improved ditching provisions that are compliant with the latest certification specifications stems from the following:

— Helicopters have long in-service lives and therefore are not replaced for a considerable time;

— Helicopter types have long production runs, and legacy types continue to be produced for long periods if there continues to be a market for them;

— Derivatives from previously certified designs are not necessarily required to comply with the latest certification specifications.

For the reasons above, it can be seen that based upon projections, it will take a considerable time period for newly certified helicopters with improved ditching provisions to become widespread in the offshore fleet.

If no retrospective action is taken, then there will not be any significant improvements in the safety of the helicopter offshore operations in Europe in the short or mid-term.

Another factor to consider is that the use of helicopters for offshore operations could increase if more wind farms are installed offshore. These offshore windfarms require the use of helicopters to deliver maintenance teams.

There could also be an increase in the number of offshore flight hours per year in Europe as oil fields are discovered further from land, which also increases the time spent flying over hostile seas.

4.2. What we want to achieve — objectives

The overall objectives of the EASA system are defined in Article 1 of the Basic Regulation.

The specific objective of this proposal is to improve the probability of survival for occupants in the event of either a helicopter ditching or a survivable water impact through the implementation of cost-efficient design solutions in **newly produced** helicopters (production cut-in), and **possible retrofits** into the existing helicopters that are used for helicopter offshore operations in EASA Member States.

More specifically, the objective of this RMT and Phase 2 is to reduce the number of fatalities that result from helicopter survivable water impacts and ditching. It was recognised during the development of the improved certification specifications in CS-27 and CS-29 in Phase 1 of this RMT that due to the number of variables, it is difficult to define the specific parameters of a survivable water impact and implement means to fully mitigate an adverse outcome of these events. For this reason, in the same manner as in Phase 1, the provisions that are proposed for Part/CS-26 provide mitigation for helicopter ditching events, and also provide improvements for helicopters in the event of a survivable water impact. The exceptions to this are the provisions in Part/CS-26 that relate to Option 2 ‘Determination of the robustness of the EFS’, where the robustness of the system is assessed for possible weaknesses in the event of a survivable water impact, taking into account best design practices.

For Options 1, 2, 3 and 4, the mitigating effects from the proposed changes in Part/CS-26 in terms of the reduction of fatalities were considered for the specific scenarios of relevant accidents. It should be noted that not all of the fatalities of the helicopter survivable water impacts and ditching can be prevented by the provisions proposed for inclusion in Part/CS-26 by this NPA.

4.3. How it could be achieved — options

Table 1: Selected policy options

Option No	***Short title***	**Description**
0	No change	No policy change (no change to the rules; risks remain as outlined in the issue analysis).
1	Comprehensive safety improvements	Amend Part-26 and CS-26 to mandate the implementation of a set of comprehensive safety improvements, for all in-service small CS-27 and large CS-29 helicopters performing operations for which ditching or emergency flotation approval is required. In addition to the retrospective requirements, improvements and clarifications to the changes introduced in CS-27 and CS-29 at Amendment 5 are included in this option.
2	Determination of the robustness of the EFS	Amend Part-26 and CS-26 to mandate the determination of the resistance to water impact damage of the EFS, for all small CS-27 and large CS-29 helicopters still in-production and performing operations for which ditching approval is required. Subsequently, any identified inadvisable feature is to be re-designed, and the design change implemented in newly produced helicopters or new installations of EFS for operations which require ditching approval in accordance with the Air OPS Regulation.
3	Automatic arm and deploy	Amend Part-26 and CS-26 to mandate a means of automatic deployment of the EFS following water entry, for all in-service small CS-27 and large CS-29 helicopters performing operations for which ditching approval is required. Furthermore, for all in-service small CS-27 Category A and large CS-29 helicopters, this automatic deployment shall not rely on any pilot action during flight.
4	Irregular wave testing	Amend Part-26 and CS-26 to mandate the re-evaluation of EFS for capsize resistance, using the new irregular wave test standard, for all small CS-27 and large CS-29 helicopters performing operations for which ditching or emergency flotation approval is required. If the previously claimed limiting sea conditions cannot be justified, then either a re-design of the EFS appropriately or a modification of the claimed limiting sea conditions would be required.

4.3.1. Option 1: Comprehensive safety improvements

Option 1 provides a comprehensive package of safety improvements, which are considered to be both feasible and pragmatic. These were reviewed by EASA in collaboration with the RMT.0120 RMG, which was made up of representatives from helicopter manufacturers, national aviation authorities (NAAs), helicopter associations, helicopter operators and EASA experts. The reason for collating these safety improvements into a package is the challenge of individually assessing each element in isolation. As a whole, the safety benefit from these improvements can be holistically and qualitatively considered, whereas this would not be apparent if they were individually assessed.

In order to introduce an element of proportionality, only a limited number of these safety improvements would be required for helicopters that only perform limited operations over water. Helicopters that operate greater than 10 minutes from land over non-hostile waters are only required by the Air OPS Regulation to be installed with a certified EFS.

In addition, in order to ensure proportionality, some provisions are only proposed for more complex types such as small CS-27 Category A and large CS-29 helicopters. In some cases, it was not considered to be pragmatic to require the major modification of simple CS-27 helicopters. Furthermore, it was determined that these types of helicopters are not operated for extended periods over water.

Therefore the provisions of Option 1 have been divided into those for:

— helicopters that perform operations for which ditching approval is required,

— helicopters that perform operations for which only an EFS is required in accordance with CAT.IDE.H.320[16], and

— improvements to the clarity of the changes introduced into CS-27 and CS-29 in Amendment 5.

The following SRs would be addressed by the publication of the Part-26 and CS-26 requirements associated with Option 1:

— UNKG-2016-017, AS332, Super Puma G-WNSB accident in Sumburgh, UK, on 23 August 2013;

— UNKG-2016-026, AS332 Super Puma G-WNSB accident in Sumburgh, UK, on 23 August 2013; and

— UNKG 2014-018, G-REDW EC225 LP Super Puma, 34 nm east of Aberdeen, Scotland, UK, on 10 May 2012 and G-CHCN, EC225 LP Super Puma 32 nm southwest of Sumburgh, Shetland Islands, UK, on 22 October 2012.

4.3.1.1 Helicopters that perform operations for which ditching approval is required

The following will be required for helicopters that perform operations for which ditching approval is required under Option 1:

— <u>Black/yellow marking for operating handles</u>

All operating handles for underwater emergency exits will be required to be yellow/black in order to easily identify the means to operate the exit. It is of paramount importance that when an occupant approaches an exit, its means of operation is clear.

[16] Those operating >10 minutes from land over non-hostile water or performance class 2 when taking off or landing over water or performance class 3 on a flight over water beyond safe forced lading distance from land.

Reference CS 27.805(c), CS 27.807(d)(5), CS 29.811(h)(2).

— Black/yellow marking for emergency controls used underwater for all helicopters

Emergency controls must be marked with the method of operation and be marked with yellow and black stripes if they need to be operated underwater.

Reference CS 27.1555(d)(2), CS 29.1555(d)(2)

— Remote life raft deployment (cockpit, cabin, from water) (mandated for CS-29 only)

It important that survivors can successfully deploy the life raft after a ditching or water impact. For this reason, a means to remotely deploy the life raft must be provided in the cockpit and/or cabin, and external to the helicopter in all floating attitudes.

Mandated for CS-29 only (ditching approval only). Reference CS 29.1415(b)(1)

— Substantiated sea conditions for capsize resistance in the RFM

The RFM must include the sea conditions substantiated relating to the certification obtained with ditching or emergency flotation provisions, so that the operators and flight crew are aware of the limitations of the helicopter.

Reference CS 27.1587(b)(3), CS 29.1587(c).

— The effort required to open each emergency 'egress route' shall not be exceptional (mandated for CS-27 Category A and CS-29 only)

The Air OPS Regulation requires that all suitable openings (i.e. windows) in rotorcraft be made 'openable' and thus available for escape, i.e. in addition to the emergency exits required by the current rules. The current Air OPS Regulation does not define the criteria for an exit to be 'openable', however, the AMC to CS-27 and CS-29 define this to be in the order of a 50 lb force. In order to ensure that the current designs are compliant, it should be verified that the opening forces of underwater emergency exits of CS-27 Category A and CS-29 helicopters are compliant with an opening force of this order.

Applicable to CS-27-Category A and CS-29 helicopters only.

Reference CS 27.805(c), CS 29.805(c), CS 27.807(b)(2), CS 29.809(c).

— The life raft attachment lines (short and long) must be of a suitable length to prevent damaging the life raft or putting the life raft in a dangerous position.

In the event of a ditching or water impact where the life raft is deployed, the life raft is tethered to the helicopter by two lines attached to suitably secure points on the helicopter fuselage. One short line is used to keep the raft close to the helicopter, and a long line, which, once the short line has been released or cut, allows the raft to move away from the helicopter, but stays attached to aid rescuers in locating the raft.

If the long line is not of a sufficient length, then it is possible that the life raft can drift into the helicopter structure and be damaged or punctured. It is for this reason that the life raft attachment long line must be of a sufficient length to prevent damage.

Reference CS 27.1415(b)(2), CS 29.1415(b)(2).

— Life preserver within easy reach of each seated occupant

In the offshore environment, passengers and flight crew are required by the Air OPS Regulation to wear deflated life preservers during the flight that can be deployed in the event of a ditching or water impact. However, the wearing of life preservers during the flight is not mandated by the Air OPS Regulation for all other types of operation over water, and it is possible that the life preservers could be stowed somewhere in the helicopter. It is important that the life preservers are within the reach of the occupants in the event of a ditching or water impact to ensure that they can be worn.

Reference CS 27.1415(c), CS 29.1415(c).

— Automatic illumination of underwater emergency exits

In the case of a capsized and flooded helicopter cabin, an occupant will become rapidly disorientated. In such circumstances, visually locating, moving towards, and operating an emergency exit will be best aided by illuminated markings which outline the entire exit aperture, and which provide a clear highlight as to the exact location of the operating device (handle, pull tab, etc.). Prior to the amendment of CS-27 and CS-29, these markings were not required, or did not have these characteristics.

However, such markings have been installed on rotorcraft equipped for ditching for many years in response to action by NAAs. It is important to formalise this requirement for existing helicopters and for operators that have not voluntarily complied with this requirement.

Applicable to CS-27 Category A and CS-29 helicopters only

Reference CS 29.811(h)(1).

— Improved ratio of passengers to underwater emergency exits (one pair of emergency exits per four passengers) and alignment of seat rows with underwater emergency exits.

Studies and experience from recent accidents have shown that there is a very low likelihood of being able to egress from a capsized helicopter if an underwater emergency exit has already been used by two occupants (third person out). Therefore, in order to maximise the likelihood of egress and survival, the seats in the cabin should be arranged such that all passengers can then have the opportunity to be no later than the second person to escape through an exit, i.e. with a nominal four-abreast seating layout. This can be achieved by requiring an underwater emergency exit to be provided on each side of the rotorcraft for each unit or part of a unit of four passengers. Additionally, the seat rows must be aligned with the underwater emergency exits to best facilitate escape.

Reference CS 27.807(d)(1), CS 29.807(d)(1), CS 29.813(d)(1)

4.3.1.2 Helicopters that perform operations for which only an EFS is required (that operate > 10 minutes from land over non-hostile water)

The following provisions from 4.3.1.1 above should be required for helicopters that perform operations for which only an EFS is required:

— The life raft attachment long line must be of a sufficient length to prevent damaging the life raft or putting the life raft in a dangerous position.

Reference CS 27.1415(b)(2), CS 29.1415(b)(2)

— A life preserver must be within easy reach of each seated occupant.

Reference CS 27.1415(c), CS 29.1415(c)

— The substantiated sea conditions for capsize resistance must be in the RFM.

Reference CS 27.1587(b)(3), CS 29.1587(c).

4.3.1.3 Improvements and clarifications to the amendments introduced in CS-27 and CS-29 at Amendment 5

In order to ensure the clarity of the certification specifications and AMC that are applicable for the certification of new designs for ditching or emergency flotation, minor improvements have been developed to the amendments that were introduced into CS-27 and CS-29 at Amendment 5.

4.3.2. Option 2: Determination of the robustness of the EFS

The primary purpose of the EFS is to keep the helicopter afloat following a controlled landing on water, i.e. a ditching. Historically, these systems have tended to be much less effective when a helicopter crashed onto water, either because they were damaged by the impact, or because they had to be manually activated by the pilot who may have been incapacitated by the impact. This option considers the possible damage to the EFS in the event of water impact.

While it is considered that a capsize may be inevitable in a water impact event, the correct functioning of the EFS remains essential to ensure that the rotorcraft remains on or close to the water surface. If the rotorcraft were to sink, then providing an air source within the cabin (such as an emergency breathing system (EBS)) might be ineffective, as the occupant would have much further to travel to reach the surface. Experience has shown that a rotorcraft only sinks when the EFS has failed to deploy. There is evidence that the successful deployment of only a single EFS bag can be sufficient to prevent sinking.

From a water impact standpoint, the integrity of the EFS can be maximised when the design of the EFS considers the possibility of what damage could occur in the event of a water impact. Although it is difficult to define the actual design case for a water impact, it is possible to consider the best practice when it comes to the installation and routing of EFS components, electrical connections and gas lines. This best practice has evolved over time as experience has been gained from water impact events. However, it is not certain that this best practice has been considered for all previous designs.

It is for this reason that the determination of the robustness of existing designs of EFSs (including supplemental type certificates (STCs)) must be conducted in order to identify any potential weakness in the design and provide design changes that mitigate their effects in order to maximise the possibility of a successful EFS deployment in the event of a water impact.

For CS-27 and CS-29 helicopters with ditching approval, Amendment 5 added the following requirement:

‘(c) An emergency flotation system that is stowed in a deflated condition during normal flight must:

(1) be designed such that the effects of a water impact (i.e. crash) on the emergency flotation system are minimised’.

Reference CS 27.801(c)(1) and CS 29.801(c)(1).

The related AMC material provides further guidance to consider the location of the system components, use of redundancy, use of flexible pipes/hoses and to avoid a 'guillotine' effect:

'When showing compliance with CS 27/29.801(c)(1), and where practicable, the design of the flotation system should consider the likely effects of water impact (i.e. crash) loads. For example:

(a) locate system components away from the major effects of structural deformation;

(b) use redundant or distributed systems;*

(c) use flexible pipes/hoses; and

(d) avoid passing pipes/hoses or electrical wires through bulkheads that could act as a guillotine' when the structure is subject to water impact loads.'

Note*: Applicable to CS-29 and CS-27 Category A.

Analysis has confirmed that it would not be feasible to retroactively implement this provision in in-service helicopters, as this could involve extensive removal of existing equipment unrelated to the EFS in order to remove and install redesigned components. Furthermore, it is possible that an intrusion to make some modifications could have a negative safety effect by disturbing the installation of existing systems. One such example is the replacement of a rigid pipe with a flexible pipe running through a bulkhead opening together with other hydraulic tubing and electrical wirings. Additionally, there are a significant number of different configurations of helicopters in-service due to repair, modifications or STC installations, and therefore it could not be guaranteed that a design modification would be compatible with all in-service helicopters.

For the reasons stated above, this option will only consider the possibility of implementing any possible design changes that result from the assessment on newly produced helicopters or newly manufactured EFS kits, for rotorcraft requiring ditching approval.

The following SR would be addressed by the publication of the Part-26 and CS-26 requirements associated with Option 2:

— G-BIJF, Bell 212, Dunlin Alpha, UK on 12 August 1981 (not assigned to EASA).

4.3.3. Option 3: Automatic arming and deployment of the EFS

In the event of a water impact, the time for flight crew to react before impact may be very short, and after impact, the flight crew may be incapacitated and unable to deploy the EFS.

It has been established that most helicopters engaged in offshore operations in European waters have already been voluntarily equipped with an automatic means to activate or deploy the EFS (e.g. an automatic float deployment system (AFDS)) for many years now, and service experience has not revealed any problems with these systems.

In order to meet the required safety objectives, the inadvertent activation of the rotorcraft's EFS in flight must either be shown to present no unacceptable hazard in any possible flight condition <u>or</u> to have a sufficiently low probability of inadvertent inflation that is shown to be commensurate with the likely hazard.

This is usually achieved by flight test evidence of the benign effects of deployment up to a certain airspeed, and then by instructing the flight crew to manually disarm the system above a certain speed.

The overall safety objective can be achieved due to the significantly lowered probability of the disarmed system's inadvertently deploying.

However, the availability of the EFS when needed relies on the flight crew manually rearming the system when lower speeds are again reached. In the case of a water impact, in particular, there is no guarantee that this can be performed in time.

Therefore, in order to ensure the availability of the EFS to be deployed in the event of a water impact, it is essential that a means of automatically arming and disarming the EFS is provided. Alternatively, it can be demonstrated that there would be no adverse safety effects if the EFS inadvertently deployed at any point in the full flight envelope, and therefore there is no need to disarm the EFS during the flight.

CS-27 and CS-29 Amendment 5 added the provision that all helicopters certified for ditching must have a means of automatic deployment of the EFS at water entry ('auto-deploy'). Additionally, for small CS-27 Category A and large CS-29 helicopters, this automatic deployment must not rely on any pilot action during flight:

'(c) An emergency flotation system that is stowed in a deflated condition during normal flight must:

(1)…

(2) have a means of automatic deployment following water entry.'

Reference CS 27.801(c)(2)

'(c) An emergency flotation system that is stowed in a deflated condition during normal flight must:

(1)…

(2) have a means of automatic deployment following water entry. Automatic deployment must not rely on any pilot action during flight.'

Reference CS 29.801(c)(2).

As mentioned, most operators of offshore helicopters operated in the EU have already voluntarily installed EFS auto-deployment systems using water immersion switches on their helicopters, with no negative in-service experience. Therefore, mandating this requirement for all helicopter types would only impact a sub-set of helicopter types that have not already installed EFS auto-deployment systems.

It is considered that mandating an auto-deployment of an EFS in isolation would not improve safety if it is not armed. The requirement that automatic deployment must not rely on any pilot actions would be applicable to small CS-27 Category A and large CS-29 helicopters only.

Currently there are four helicopter types on which the EFS is permitted to be always armed with no flight envelope restrictions. Therefore, for these types, the automatic deployment of the EFS does not rely on any pilot action during flight (i.e. the EFS is armed before take-off and disarmed on landing). Additionally, one helicopter type is known to have a system for automatic arming and disarming of the EFS ('auto-arm') based on flight speed. Therefore, these five helicopter types already comply fully with the 'auto-arm' requirement.

The following SRs would be addressed by the publication of the Part-26 and CS-26 requirements associated with Option 3:

— OH-HCI, S76C, Tallinn Bay, Estonia 10 August 2005;

— UNKG-2016-018, AS332, Super Puma G-WNSB accident in Sumburgh, UK, on 23 August 2013;

— G-TIGH, AS332L, UK North Sea on 14 March 1992; and

— UNKG-2011-065, G-REDU EC225 LP Super Puma, near the Eastern trough area project central production facility platform in the North Sea on 18 February 2009.

4.3.4. Option 4: Irregular wave testing

The objective of flotation stability is to ensure that the helicopter, once ditched and floating on the water, remains in an upright and stable position for sufficient time to allow occupants to egress into the life rafts. The experience to date in reaching this objective is mixed. In most ditchings, the helicopters have remained upright for long periods of time, well in excess of the time needed for occupant egress, and in exceptional cases, in high-sea conditions. However, most ditching experience has been in relatively calm conditions, and this has led to uncertainties as to the appropriateness of the rules and methods of compliance demonstration that were applied to current designs.

A new methodology was developed in CS-27 and CS-29 at Amendment 5 that uses a probabilistic approach, which defines a safety target, and then links the severity of a capsize to the expected sea conditions in the area of operation to derive a minimum certification standard. The applicant would be at liberty to select the sea conditions to be approved, provided that the conditions that are demonstrated are then those that are stipulated in the RFM.

Furthermore, the previous provisions indicated testing in regular waves. The results from previous helicopter model capsize tests in regular waves could be considered to be brought into question. An undamaged helicopter will normally only capsize in breaking waves. The steepness at which regular waves break in a wave test basin depends primarily on the motion of the wave maker, the distance travelled by the waves, and the presence of spurious waves in the basin. The results from model tests in breaking ‘regular’ waves are therefore likely to depend more on the wave basin's properties than on the characteristics of the helicopter.

The irregular-wave criterion that was included in CS-27 and CS-29 at Amendment 5 is considered to offer a more realistic measure of the likely actual performance of a helicopter ditched in the sea.

This option considers whether it would be appropriate to retroactively test the flotation stability of existing designs using the irregular-wave criterion and methodology that is included in CS-27 and CS-29 Amendment 5 (and beyond). This would require a scale model of the helicopter to be produced and then tested in an appropriate wave tank basin to establish whether it meets the requirements for the probability of a capsize within a given timeframe.

Alternatively, it would be reasonable to expect existing EFS designs to be able to maintain upright stability in Sea State 4 (4 m significant wave height). A limitation in the RFM for a helicopter type could be introduced as an alternative to conducting the wave tank testing using the irregular-wave criterion and methodology. This would subsequently impose an operational limitation on operators, as they would not be able to operate in sea conditions that are in excess of Sea State 4.

CS-27 and CS-29 Amendment 5 added the following requirement for resistance to capsize for helicopters with ditching approval and emergency flotation approval:

‘The rotorcraft must be shown to resist capsize in the sea conditions selected by the applicant. The probability of capsizing in a 5-minute exposure to the sea conditions must be substantiated to be less than or equal to 3.0 % with a fully serviceable emergency flotation system and 30.0 % with the critical float compartment failed, with 95 % confidence.'

Reference CS 27.801(e), CS 29.801(e).

'The rotorcraft must be shown to resist capsize in the sea conditions selected by the applicant. The probability of capsizing in a 5-minute exposure to the sea conditions must be demonstrated to be less than or equal to 10.0 % with a fully serviceable emergency flotation system, with 95 % confidence. No demonstration of capsize resistance is required for the case of the critical float compartment having failed.'

Reference CS 27.802(c), CS 29.802(c).

The associated new AMC specified that testing to meet this requirement should be with irregular waves.

Retroactive application of these requirements would require helicopter types to be re-tested to the new irregular wave methodology, revealing types with any stability deficiencies. If deficiencies were found, the EFS would need to be redesigned, or operational restrictions applied.

4.3.5. Discarded options

A detailed review of the changes that were included in CS-27 and CS-29 Amendment 5 was conducted by EASA with the support of the RMT.0120 RMG, which was made up of representatives from helicopter manufacturers, NAAs, helicopter associations, helicopter operators and EASA experts. This review was conducted to assess the feasibility of retroactive application of the amendments in CS-27 and CS-29.

Following this analysis and review, it was not considered feasible to justify the applicability of some candidate items (i.e. airworthiness requirements in CS-27 and CS-29) for retroactive implementation, for the following reasons:

— Excessive, and therefore unfeasible, design modifications required (if the requirement is not already met with the current design);

— The overall safety improvement from implementing the phase I specific requirement is very limited for the affected helicopter types, compared with the cost and burden of any redesign necessary, and the compliance demonstration;

— The safety benefit is limited to a very small number of helicopters out of the total European fleet, and therefore the burden of retroactive application is disproportional compared with the global safety improvement.

4.3.5.1 Excessive design modification

Although in many cases, it is expected that the requirements listed below could be met by some in-service helicopters, the amount of redesign or reconfiguration necessary for those unable to meet these requirements renders the retroactive application of these requirements unfeasible.

— <u>One underwater emergency exit in each side of the rotorcraft, meeting a minimum specified size for each unit (or part of a unit) of four passenger seats</u>

For helicopters that are not already compliant, a significant redesign of the fuselage would be necessary to increase the size of the exits. Therefore, retroactive application of this size requirement is considered to be unfeasible. (The minimum number of exits is included in the comprehensive safety improvements).

Applicable to ditching approval only.

Reference CS 27.807(d)(1), CS 29.807(d)(1).

— Flight crew emergency exit opening/jettisoning controls to be accessible for all pilot heights, with and without seat 'stroked'

If not already compliant, this would require modification of the location of the flight crew emergency exit opening/jettisoning controls, and subsequently, the door mechanism.

Applicable to ditching approval only.

Reference CS 27.805(c), CS 29.805(c).

— Flight crew emergency exits to be shown to be resistant to jamming.

If not already compliant, this could require modifications to the airframe structure to reduce the fuselage deformation.

Applicable to ditching approval only.

Reference CS 27.805(c), CS 29.805(c).

— Passenger underwater emergency exits to be provided with adjacently located handholds

The very nature of the handholds demands that they be robustly attached to the fuselage structure, and their location and shape must be carefully designed. Whilst this would be relatively easy to achieve with a new helicopter design, it would most likely prove to be effectively impossible to achieve with an existing type, if provisions for such handholds are not already included in the design.

Applicable to ditching approval only.

Reference CS 27.807(d)(3), CS 29.809(j)(3).

— Means to be provided to assist cross-cabin egress when capsized

Such means might include features intrinsic to the cabin interior, such as seats or dedicated handholds. For helicopters that are not already compliant, a significant redesign of the seats may be necessary, including their requalification, or the addition of handholds that must be robustly attached to the fuselage structure.

Applicable to ditching approval only.

CS-29 only; not applicable to CS-27.

Reference CS 29.813(d)(2)

— The helicopter must not sink with the critical flotation unit lost.

The relevant manufacturers have confirmed that the current in-service helicopters are most likely to be able to meet this requirement. However, the compliance demonstration that is necessary is very costly and burdensome. Additionally, in the unlikely case that compliance is not demonstrated, a significant redesign of the EFS would be necessary, and therefore unfeasible to apply retroactively.

Applicable to ditching approval and emergency flotation approval.

CS-27 Category A and CS-29 only; not applicable to CS-27 non-Category A.

Reference CS 29.801(g). CS 29.802(d)

— Passengers must be able to step directly into any of the required life rafts.

A review was performed, and some examples were found of in-service helicopters with overall geometries, with the EFS deployed, which would prevent compliance with this requirement. A significant redesign of the helicopter, EFS or life rafts of these helicopter types would be necessary, making the retroactive application of this requirement unfeasible.

Application to ditching approval only.

CS-27 Category A and CS-29 only; not applicable to CS-27 non-Category A.

Reference CS 29.803(c)(1).

— Passengers must be able to egress via the nearest emergency exit or 'egress route' with any door in the open and secured position.

For helicopters that do not currently meet this requirement, significant redesigns of the door, or the window locations, or limitations on the number of passengers would be necessary. Therefore, retroactive application of this requirement is not feasible.

Applicable to ditching approval only.

CS-27 Category A and CS-29 only; not applicable to CS-27 non-Category A.

Reference CS 29.809(j)(2).

— Life rafts to be remotely deployable, with controls accessible from the cockpit, cabin and from the water, with the helicopter upright or capsized or in any foreseeable floating attitude (discarded for CS-27 helicopters with ditching approval and all helicopters with emergency flotation approval)

This requirement has been justified as part of the comprehensive safety improvements for CS-29 helicopters with ditching approval. Although the safety benefit of this requirement is appreciable, the current European fleet of CS-27 types has a wide range of equipment fits regarding life raft deployment, and thus the costs of upgrading to the newer standard for all life raft installations would be extensive, and for some life raft kits, may not be feasible due to their incompatibility with the helicopter configuration. Additionally, the safety benefit was far outweighed by the costs and burden of the redesign and the compliance demonstration for helicopters with only emergency flotation approval.

Applicable to ditching and emergency flotation approval.

Discarded for CS-27 ditching approval and all helicopters with emergency flotation approval.

Reference CS 27.1415(b)(1), CS 29.1415(b)(1)

4.3.5.2 Limited safety improvement per helicopter type

The following requirements were discarded from retroactive applicability due to the safety benefit being minimal for the affected current European fleet.

— <u>Helicopters to meet the revised structural ditching and emergency flotation provisions</u>

In CS-27 and CS-29 Amendment 5, the structural requirements were extensively revised, primarily to improve the clarity of the safety issues to be addressed without any change in the technical content. The only exception is that floats unintendedly un-deployed at initial water contact should not suffer damage that would prevent proper deployment and functioning following the initial water entry. The majority of the affected sub-set of helicopters, i.e. helicopters with EFSs intended to be deployed before water entry, were judged most likely to already be compliant. Therefore, retroactive application of this requirement would require an unnecessary burden, for minimal safety benefit.

Applicable to ditching and emergency flotation approval.

Reference CS 27.563, CS 29.563.

— <u>ELT installations to follow the new guidance material.</u>

CS-27 and CS-29 Amendment 5 clarified that a helicopter ELT installation must be designed to be resistant in a crash to damage that might compromise its subsequent functionality. Extensive design advice in this regard is provided in an associated AMC. The Amendment 5 change was prompted by reported examples of ELT installations that did not function as desired in emergency situations. However, in the majority of these examples, the overall outcome of the accident was not adversely affected, i.e. the helicopter was located quickly. Therefore, the safety benefit was judged to be insufficient to justify the costs of the redesign and retrofit, if necessary.

As required by OPS rules.

Reference AMC 27.1470 and AMC 29.1470.

— <u>Life rafts to be suitable for use in all sea conditions covered by the certification approval for ditching or emergency flotation</u>

There are various aviation equipment standards for life rafts, including older NAA standards (e.g. UK CAA Specification 02), ETSO/TSO standards for life rafts for use in fixed and rotary wing applications (latest version ETSO/TSO-C70b), and ETSO-2C505 (no FAA equivalent) specifically intended to cover helicopter life rafts that might be needed to support survival in more adverse sea conditions. The current European fleet of helicopters operating over water is therefore equipped with a variety of different life rafts approved against one of these standards. ETSO-2C505 calls for more stringent requirements in terms of occupant masses and sea conditions compared with ETSO/TSO-C70b. Although ETSO-2C505 appears to require higher performance in adverse sea conditions, it is judged by industry that the seakeeping performance of these rafts is equivalent; the main difference being the buoyancy requirement to accommodate a higher occupant mass. It is to be noted that this freeboard advantage is most likely to be of real benefit only in the case of a life raft overload combined with a puncture of the life raft. Whilst this situation may occur, it has a relatively low probability. Therefore, retroactive application of this requirement would result in a limited safety improvement compared with the high cost of investigating the actual performance of a raft, in relation to the higher standard, and the development/certification/retrofit costs in the event of the investigation finding shortfalls.

Applicable to ditching and emergency flotation approval.

Reference CS 27.1415(b)(3) and 29.1415(b)(3).

4.3.5.3 Safety benefit limited to a small number of helicopters

The following requirements were discarded because the cost, complexity and potential weight penalty of their retroactive application was disproportionately large compared with the safety benefit that would be achieved, due to the small population of helicopters that would be affected.

— <u>All underwater 'egress routes' to have a defined maximum operating effort (discarded for CS-27 non-Category A only)</u>

This requirement was justified as part of the comprehensive safety improvements for CS-27 Category A and CS-29 helicopters. However, the burden of showing compliance, and the potential weight penalty of any necessary design change, are not commensurate with the low number of small CS-27 non-Category A helicopters with ditching approval that would be affected by this requirement.

Applicable to ditching approval only.

Discarded for CS-27 non-Category A helicopters only.

Reference CS 27.805(c), CS 27.807(b)(2), CS 27.807(d).

— <u>Flight crew exit markings to be provided with illumination that remains functioning underwater (discarded for CS-27 non-Category A)</u>

The cost and complexity of implementing flight crew exit markings that would remain functioning underwater on CS-27 non-Category A helicopters with ditching approval, where currently no illumination is provided, would far outweigh the potential safety benefit due to the limited number of helicopters that would be affected.

Applicable to ditching approval only.

CS-27 non-Category A only; not applicable to CS-27 Category A and CS-29.

Reference CS 27.805(c).

— <u>If non-jettisonable doors are used for emergency egress, they must stay open in the chosen sea conditions (discarded for CS-27).</u>

This requirement has long been present in large CS-29 helicopters, and is also required by Air OPS Regulation SPA.HOFO.165 'Additional procedures and equipment for operations in a hostile environment'. The CS-27 European helicopter types with ditching approval also typically designate push-out windows as passenger underwater emergency exits, and not non-jettisonable doors. Therefore, the affected fleet size and emergency exits impacted by the retroactive application of this requirement is very small, compared with the disproportionately large costs of retroactive implementation.

Applicable to ditching approval only.

Discarded for CS-27 only; already applicable to CS-29.

Reference CS 27.783(c).

— The remaining life raft must accommodate all the occupants in overload after the largest life raft is lost (discarded for CS-29 only).

CS-29 at Amendment 5 introduced a requirement that there be no less than two life rafts provided, which are of a size such that after loss of one life raft of the largest rated capacity, the remaining raft has an overload capacity sufficient to accommodate all the helicopter occupants. This airworthiness requirement is an extension of Air OPS Regulation point CAT.IDE.H.300(b), which requires the same standard, but only for helicopters carrying more than 11 persons. Therefore, retroactive application of this requirements would impact a small sub-set of CS-29 helicopters, i.e. those with 11 or less occupants, and therefore the global safety improvement is minimal compared with the burden of redesign or reconfiguration if the helicopter is not already compliant.

Applicable to ditching and emergency flotation approval.

CS-29 only; not applicable to CS-27.

Reference CS 29.1415(b)(4).

4.4. Methodology and data

4.4.1. Methodology applied

Option 0 and 1 were analysed using multi-criteria analysis, which allows options to be compared by scoring them against a set of criteria. This methodology allows impacts to be compared from a qualitative point of view, which is the only assessment feasible for Option 1.

For the scoring of the impacts, a scale of – 10 to + 10 is used to indicate the negative and positive impacts of each option (i.e. from 'very high' to 'very low' negative/positive impacts). The intermediate levels are termed 'high', 'medium' and 'low', providing a total of ten levels in each direction (ten in the positive and ten in the negative one), with a 'no impact' score also being possible.

Options 2, 3 and 4 were analysed using cost-benefit analysis (CBA) and cost-effectiveness analysis (CEA).

A CBA quantifies all the impacts in monetary terms, e.g. the safety in terms of the avoided fatalities, the economic impacts in terms of compliance costs for the industry, etc. The outcome of a CBA is expressed in terms of the net present value of the analysed options.

A CEA, on the other hand, defines the net cost per prevented fatality, i.e. the cost associated with preventing one fatality. It is most suitable when the assessment has a main fixed goal, which cannot be monetised, or is difficult to monetise, such as the value of preventing a fatality.

4.4.2. Data collection

Various data sources have been used, which are listed below:

— Safety data: as previously presented, a review was conducted of the occurrences present in the EASA occurrences database between 2003 and 2018. These occurrences were collected through the Internal Occurrence Reporting System and from the European Central Repository database, and they concern helicopter ditchings or water impacts.

— A questionnaire was used to collect information, and it targeted the NAAs of the EASA Member States. It was distributed to the relevant stakeholder advisory bodies of EASA. The purpose of this questionnaire was to establish the affected fleet of helicopters that are operated offshore or over water for extended periods. In total, 12 NAAs responded to the questionnaire which contributed to the affected fleet provided in paragraph 4.1.2.

— The response from the questionnaire was complemented[17] and cross-checked against the Cirium[18] Fleets Analyzer database to which EASA has access. The affected helicopters were selected and extracted using the following filters on 2 July 2018:

- Primary usage (the main use of the aircraft):
  - Off-shore oil and gas support,
  - Off-shore wind farm/other support.
- Aircraft status:
  - In service,
  - In temporary storage.
- Operator country (main headquarters of the operator associated with the aircraft):
  - 32 EASA Member States

4.5. What are the impacts

4.5.1. Safety impact

4.5.1.1 Option 0: No policy change

If none of the specifications that were included in the amendment of CS-27 and CS-29 are applied to the existing designs in production or to the in-service fleet, then there would only be a limited safety improvement. This limited safety improvement would come from future helicopter types that have designs compliant with Amendment 5 or later of CS-27 and CS-29 entering into service and replacing the existing helicopter types. Due to the fact the helicopters have a considerable service life (up to 40 years) and the fact that there are still pre-Amendment 5 designs in production, any safety improvement would take a considerable time to be realised.

In addition, taking no action would not address some of the safety recommendations that have been addressed to EASA.

Based upon this rationale, a neutral safety impact of 0 is considered for Option 0.

4.5.1.2 Option 1: Comprehensive safety improvements

Option 1 provides a comprehensive package of design requirements that would improve safety and that have been considered to be both feasible and pragmatic. The reason for collating these requirements into a package is due to the challenge of individually assessing the impact of each requirement in isolation. As a whole, the safety benefit from these requirements can be holistically

[17] In Cirium's database there were offshore helicopters found in five Member States whose NAAs provided no feedback (Denmark, Italy, Portugal, Spain and Switzerland). These helicopters were added to the relevant fleet.

[18] Cirium has not seen or reviewed any conclusions, recommendations or other views that may appear in this document. Cirium makes no warranties, express or implied, as to the accuracy, adequacy, timeliness, or completeness of its data or its fitness for any particular purpose. Cirium disclaims any and all liability relating to or arising out of use of its data and other content or to the fullest extent permissible by law.

and qualitatively considered, whereas this would not be apparent if the items were individually assessed.

The requirements in Option 1 include:

— Black/yellow marking for operating handle for all helicopters
  — Reference CS 27.805(c), CS 27.807(d)(5), CS 29.811(h)(2).
— Black/yellow marking for emergency controls used underwater for all helicopters
  — Reference CS 27.1555(d)(2), CS 29.1555(d)(2).
— Remote life raft deployment (cockpit, cabin, from water) for large CS-29 helicopters only (ditching approval only)
  — Reference CS 29.1415(b)(1).
— Substantiated sea conditions for capsize resistance in the RFM
  — Reference CS 27.1587(b)(3), CS 29.1587(c).
— The effort required to open each emergency 'egress route' shall not be exceptional for CS-27 Category A and CS-29 helicopters only.
  — Reference CS 27.805(c), CS 29.805(c), CS 27.807(b)(2), CS 29.809(c), CS 27.807(d) CS 29.807(d).
— The life raft attachment lines (short and long) should be of a suitable sufficient length to prevent damaging the life raft or putting the life raft in a dangerous position, for all helicopters.
  — Reference CS 27.1415(b)(2), CS 29.1415(b)(2).
— Life preservers to be within easy reach of each seated occupant for all helicopters
  — Reference CS 27.1415(c), CS 29.1415(c).
— Automatic illumination of underwater emergency exits for CS-27-Category A and CS-29 helicopters
  — Reference CS 29.811(h)(1).
— Improved ratio of passengers to underwater emergency exits (one pair of emergency exits per four passengers) for all helicopters
  — Reference CS 27.807(d)(1), CS 29.807(d)(1).

Compliance with these requirements will provide an overall improvement in safety for the following reasons:

— In a capsized helicopter, passengers will be able to more easily find the emergency exits underwater and in the dark;
— In a capsized helicopter, passengers will be able to easily identify the opening means of the exit, and exceptional effort would not be required to open the exit after the mechanism is operated;
— In a capsized helicopter, passengers will have an underwater emergency exit for each pair of passengers, and they will not have to wait for more than one passenger to exit the capsized helicopter before making their underwater escape;

— If not already worn during the flight, life preservers can be easily found and reached by passengers;

— The life raft can be deployed from either inside the ditched helicopter, or if it has capsized, then survivors can deploy the life raft from outside the helicopter whilst in the water;

  — Note: An SR from the AS332 Super Puma G-WNSB accident in Sumburgh, UK, relates to this requirement.

— When deployed, the life raft is able to float at a safe distance from the ditched helicopter, lowering the risk of damage to the life raft;

— The flight crew and operators are aware of the limitations of the emergency flotation systems as they are published in the RFM.

It is considered that applying these design improvements to the existing in-service offshore helicopter fleet will provide a positive safety improvement, and prevent fatalities and drownings in the event of a ditching or a water impact.

Offshore helicopter operators have already recognised the safety benefits from some of these design improvements and have already implemented some of them. In addition, some of these design improvements are required by the Air OPS Regulation for operators who conduct offshore operations (HOFO). However, there would still be a positive safety benefit for operators who have not implemented these design improvements, or for operators who conduct operations over water that are not required to comply with offshore Air OPS Regulation requirements.

The additional clarifications to the changes introduced into CS-27 and CS-29 in Amendment 5 will also provide some limited safety benefits through the avoidance of any misunderstandings of the required provisions for certification for ditching or emergency flotation.

A medium positive safety improvement of **+4** that would prevent fatalities is considered.

4.5.1.3 Option 2: Determination of the robustness of the EFS

The fatal accidents included in the RMT.0120 Phase 1 analysis (reference NPA 2016-01), together with the relevant more recent accidents for which the final reports are available, were reviewed to identify those for which some design improvements related to the EFS could have potentially modified the outcome. The result is summarised below:

	EASA MS 2003 to 2014*	**Worldwide** *(exc. European MS)* **2003 to 2014**	**North Sea before 2003**
Number of accidents	**1**	2	2
Potential number of fatalities prevented	**1**	5	6

* Only accidents from European Member States between 2003 and 2014 were included in the CBA below.

4.5.1.4 Option 3: Automatic arming and deployment of the EFS

The fatal accidents included in the RMT.0120 Phase 1 analysis (reference NPA 2016-01), together with the relevant more recent accidents for which the final reports are available, were reviewed to identify those for which 'auto-arm' and 'auto-deploy' of the EFS could have potentially modified the outcome.

The result is summarised below:

	EASA MS 2003 to 2014*	**Worldwide** *(exc. European MS)* **2003 to 2014**	**North Sea before 2003**
Number of accidents	**3**	2	3
Potential number of fatalities prevented	**10**	4	5

* Only accidents from EASA Member States between 2003 and 2014 were included in the CBA below.

4.5.1.5 Option 4: Irregular wave testing

Based on a typical CS-29 seating arrangement and the assumption that all the passengers located at an exit will successfully egress, and that 50 % of the remaining passengers will successfully egress the helicopter with the use of the EBS, the safety impact of irregular wave testing is as follows:

— Probability of a ditching event: 3.4e-6 per FH*

— Probability of a sea condition greater than Sea State 4: 0.098*

— Probability of capsize in Sea State greater than 4: 1.0

Capsize probability: 3.33e-7/FH

Note*: Reference NPA 2016-01 was used for consistency between the RIAs of Phase 1 and Phase 2. Based upon a review of the occurrences since NPA 2016-01, it was established that there was no need to adjust the probability of a ditching event.

Number of fatalities assumed per capsize: 3

This was the input to the CBA, and was assessed as the safety benefit of preventing fatalities (caused by drowning) due to the capsize of a ditched helicopter based upon the probability of the helicopter ditching.

4.5.2. Environmental impact

For all the options that were considered, there were no environmental impacts foreseen from the proposed regulatory changes.

4.5.3. Social impact

For all the options that were considered, there were no social impacts foreseen from the proposed regulatory changes.

4.5.4. Economic impact

4.5.4.1 Option 0: No policy change

This option would result in no additional costs for helicopter manufacturers or operators in terms of requiring any modifications or changes to the helicopters either in production or currently in-service.

Overall, Option 0 is considered to have a neutral economic impact of **0**.

4.5.4.2 Option 1: Comprehensive safety improvements

The economic impact of the proposed pragmatic design requirements has been assessed to be negligible for the following reasons:

— The change of the marking of the operating handle to black/yellow would only require a minimal change of the design.

— Introducing a remote means of deploying the life raft (cockpit, cabin, from water) would only be required for large CS-29 helicopters, and such a means is already installed on some helicopter types. This design change would not require significant modification of the helicopter, and could be achieved using a remote cable design, or by the addition of an operating handle directly on the life raft.

— An amendment to the RFM to include the substantiated sea conditions for capsize resistance would involve minimal costs, and has already been mandated by an Airworthiness Directive (2014-0188R4).

— Checking the maximum opening effort of all emergency exits of CS-27 Category A and CS-29 helicopters would only require a one-off substantiation through a simple test or analysis.

— A change to the length of the life raft attachment long line would require a simple change to the length of the existing rope/cord.

— Life preservers should already be stowed to be within easy reach of each seated occupant for all helicopters. These are usually worn by occupants for offshore operations.

— The automatic illumination of underwater emergency exits for CS-27 Category A and CS-29 helicopters would require the installation of widely available underwater lighting modifications. Helicopters that currently operate offshore in accordance with the offshore Air OPS Regulation (HOFO) are already required to have underwater emergency exits with automatic illumination, therefore there would only be a limited economic impact for operators that wish to conduct overwater operations that are not covered by the Air OPS Regulation (HOFO). A survey of the NAAs could not identify any operators that conduct these operations.

— The improved ratio of passengers to underwater emergency exits (one pair of emergency exits per four passengers) would have a minor economic impact on some helicopter types due to a potential reduction in the number of passengers in the order of 1 or 2. However, this requirement has already been implemented for offshore operations in accordance with the Air OPS Regulation (HOFO). Therefore, there would only be a limited economic impact for operators that wish to conduct overwater operations not covered by the Air OPS Regulation HOFO). A survey of the NAAs could not identify any operators that conduct these operations.

It is considered that these changes would have a very low negative economic impact for operators. However, as mentioned above, operators that already conduct offshore operations in accordance with the Air OPS Regulation (HOFO) have already implemented the changes with the most significant economic impact.

Holistically, the economic impact of Option 1 is considered to be a very low negative impact of **-2**.

4.5.4.3 Option 2: Determination of the robustness of the EFS

The assumptions for the economic impact are summarised below.

Costs per helicopter type:

— The cost of performing the assessment, documenting the analysis and the subsequent discussion with and acceptance by EASA was estimated to be EUR 100 000 per helicopter type.

— It was assumed that the more recently certified helicopters and kits would already incorporate the best standard of EFS design, and therefore would not require further modification. For older helicopter types or kits, it was assumed that some minor changes would be identified that could be implemented into the production line or newly installed kits. Therefore, overall it was estimated that 50 % of the helicopter types would need minor changes, costing EUR 100 000 per aircraft type.

— The cost of the design change implementation in production or for newly delivered kits was assumed to be equal to EUR 0, as the expected changes would be configuration changes or replacements of components.

This requirement would be applicable to CS-27 and CS-29 helicopters, in-production with ditching approval:

— 17 affected helicopters types were identified.

CBA

Based upon the assumed costs above, a CBA was conducted which is summarised below:

OPTION 2: DETERMINATION OF THE ROBUSTNESS OF THE EFS 2022–2048; all costs and benefits are present values discounted with a 4 % rate		
Description	**Production cut-in**	**Full retrofit**
Total development and certification costs	€2 550 000	€3 450 000
Retrofit and installation costs	0	*Not feasible*
Number of prevented fatalities (2022–2048)	1.8	3.8
Value of prevented fatalities	€2 911 645	€7 614 254
Net present value	€361 645	*NA*
Cost per prevented fatality	**€3 065 277**	*NA*

Based upon a value of prevented fatality of EUR 3.5M, the CBA of Option 2, 'Determination of the robustness of the EFS', is positive for in-production helicopters.

The helicopter fleet data of this option is in Appendix A.

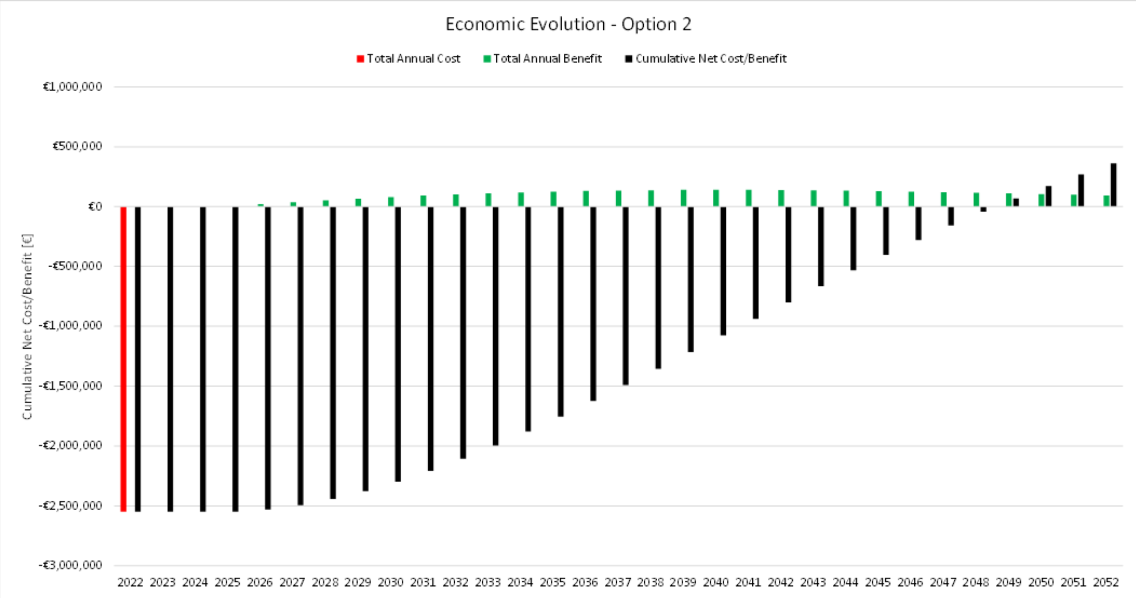


Figure 4.6: Cash flow chart of Option 2: Determination of the robustness of the EFS (production cut-in)

4.5.4.4 Option 3: Automatic arming and deployment of the EFS

The assumptions for the economic impact are summarised below.

Costs per helicopter type:

— Auto-arm: EUR 750 000 per helicopter type for the development and certification of the system.

— Auto-arm: Implementation cost of EUR 50 000 per helicopter.

— Auto-deploy: Although a cost is associated with the development of such a system, it is considered to be low when compared with the cost of developing an auto-arm system. Additionally, the retroactive application of this part of the requirement is limited to a small sub-set of helicopter types. Therefore, for this reason, the cost of development of an auto-deploy system was not included in the cost analysis.

As previously clarified, this requirement would only be applicable to small CS-27 Category A and large CS-29 helicopters, with ditching approval:

— 16 in-service helicopters types were identified, of which 5 types can be excluded from the analysis, as they already comply with the auto-arm requirement.

CBA[19]

Based upon the assumed costs above, a cost-benefit analysis was conducted, which is summarised below:

[19] 2022–2048; all costs and benefits are present values discounted with a 4 % rate.

OPTION 3: Auto-arm and auto-deploy 2022–2048; all costs and benefits are present values discounted with a 4 % rate		
Description	**Production cut-in**	**Full retrofit**
Total development and certification costs	€6 750 000	€8 250 000
Retrofit and installation costs	€7 892 550	€21 486 232
Number of prevented fatalities (2022–2048)	13.2	28.5
Value of prevented fatalities	€21 933 065	€58 176 383
Net present value	€7 290 515	€28 440 151
Cost per prevented fatality	**€2 336 606**	**€1 788 987**

Based upon a value of prevented fatality of EUR 3.5M, the CBA for Option 3 for EFS auto-arm and auto-deploy is positive for both in-production and in-service helicopters.

The helicopter fleet data of this option is in Appendix A.

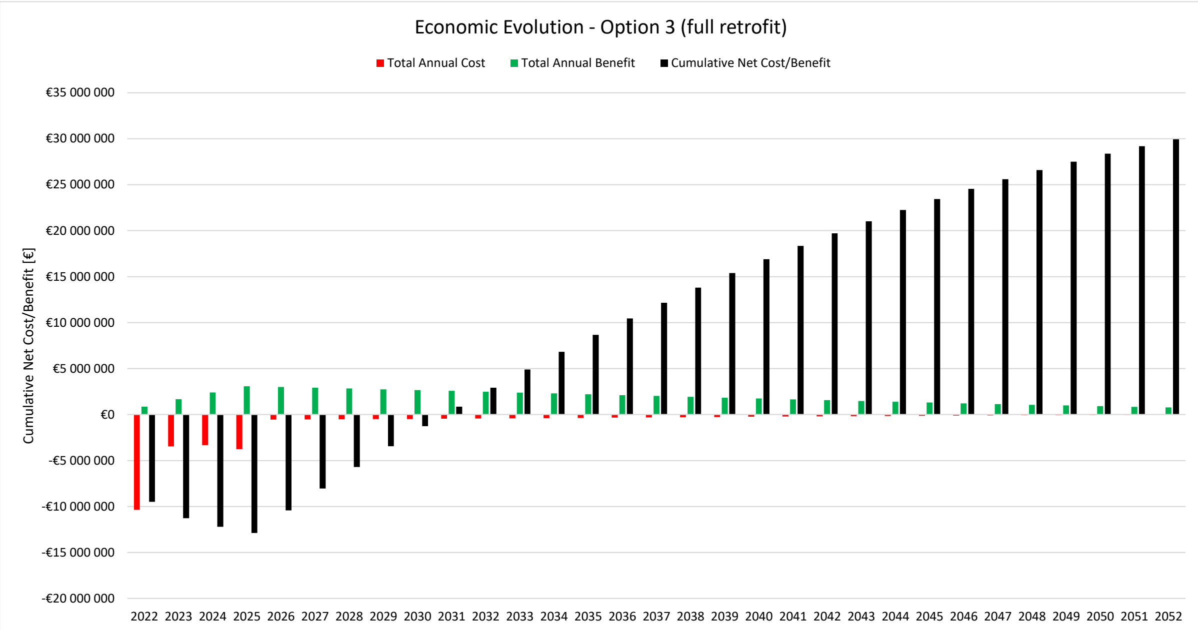


Figure 4.7: Cash flow chart of Option 3: Auto-arm and auto-deploy (production cut-in)

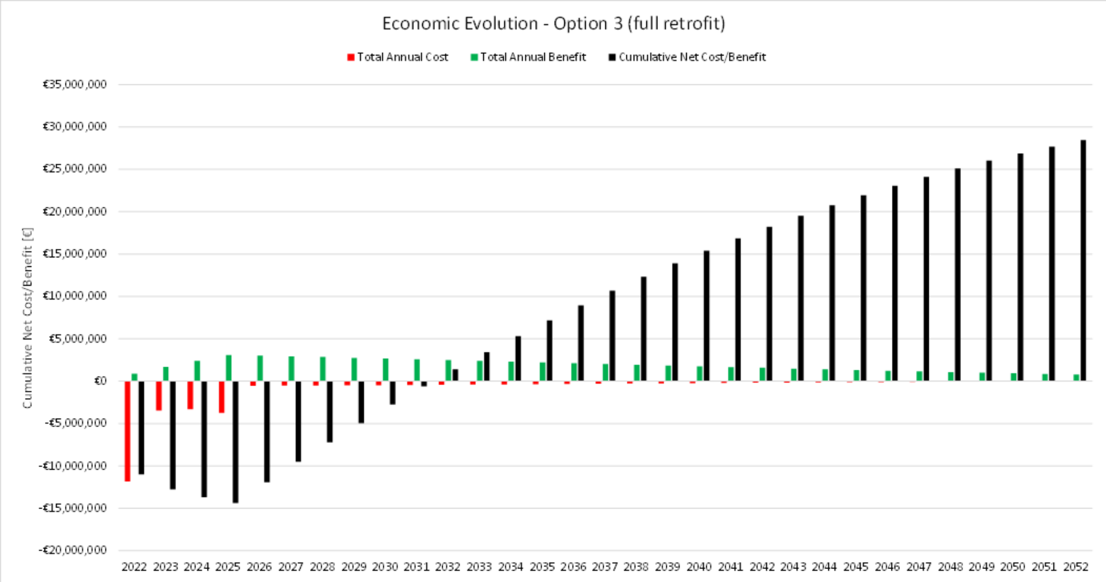


Figure 4.8: Cash flow chart of Option 3: Auto-arm and auto-deploy (full retrofit)

4.5.4.5 Option 4: Irregular wave testing

The assumptions for the economic impact are summarised below.

Costs per helicopter type:

— The cost of performing the wave tank test was estimated to be EUR 500 000 per helicopter type.

— It was assumed that 50 % of the helicopter types would not pass the test, therefore a design change would be required at a cost of EUR 200 000 per type, with further testing (EUR 250 000 per type) and the implementation of the design change (EUR 50 000 per helicopter).

This requirement would be applicable to large CS-29 helicopters in-production with ditching approval:

— 12 affected in-production helicopters types were identified.

CBA

Based upon the assumed costs above, a CBA was conducted, which is summarised below:

OPTION 4: Irregular wave testing 2022–2048; all costs and benefits are present values discounted with a 4% rate		
Description	**Production cut-in**	
Total development and certification costs	€8 700 000	
Retrofit and installation costs	€5 047 635	
Number of prevented fatalities (2022–2048)	2.8	
Value of prevented fatalities	€4 423 895	
Net present value	-€9 323 740	
Cost per prevented fatality	**€10 876 551**	NA

Based upon a value of prevented fatality of EUR 3.5M, the CBA for Option 4, irregular wave testing, was not positive for a production cut-in. Therefore, neither would it be positive for a retroactive implementation.

The helicopter fleet data of this option is in Appendix A.

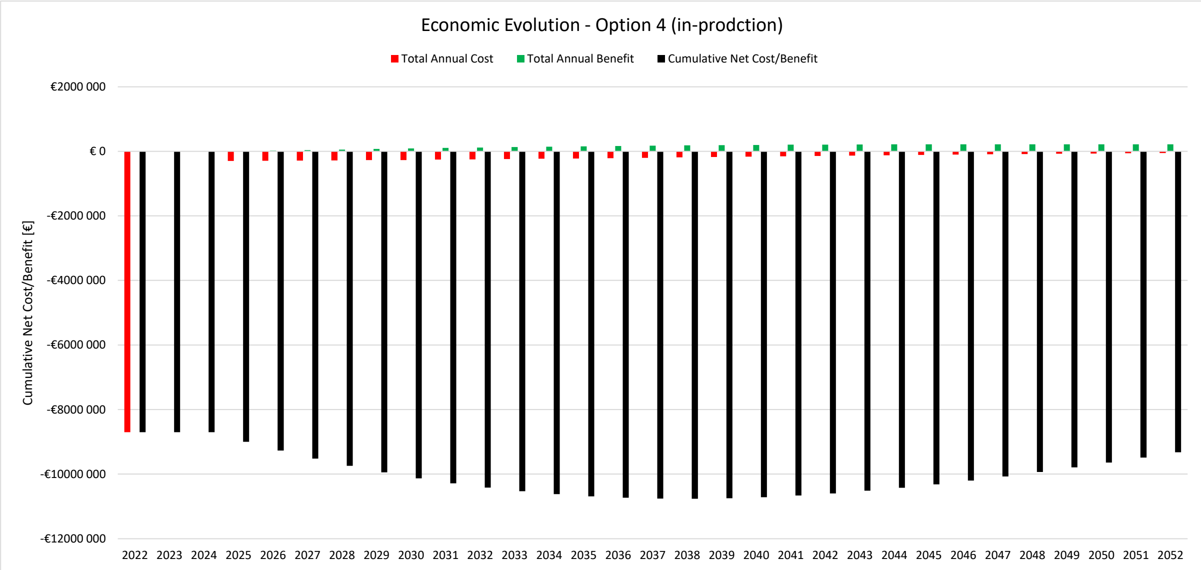


Figure 4.9: Cash flow chart of Option 4: Irregular wave testing (production cut-in)

<u>Question to stakeholders on economic impacts</u>

Stakeholders are invited to provide quantified justification elements on the possible economic impacts of the options proposed, or alternatively to propose another justified solution to the issue.

4.5.5. General aviation and proportionality issues

It is not foreseen that general aviation (GA) will be affected by the proposed changes from options 1 to 4, as these types of helicopter are not used to operate for extended periods more than 10 minutes from land. In addition, the proposed regulatory changes are only applicable to operators that conduct commercial operations.

Proportionality between small CS-27 helicopters, small CS-27 Category A helicopters and large CS-29 helicopters was achieved during the establishment of the changes to CS-27 and CS-29 Amendment 5. These changes were reviewed for application to current helicopter designs, and again, the proportionality of retrospective application was considered. This resulted in not all provisions being applied to simpler small CS-27 helicopters, and less-stringent provisions being applied to small CS-27 Category A helicopters.

It is also recognised that offshore operations, or those that involve extended flight over water, are almost never GA flights.

For these reasons, the effects on GA and proportionality are considered to be neutral.

4.6. Monitoring and evaluation

The monitoring of the effects created by the proposed amendment of Part-26 (and the related amendment of CS-26) will consist of:

(a) experience gathered by EASA on request from type certificate holders and supplemental type certificate holders to verify the review of existing EFS designs for robustness in the event of a water impact;

(b) experience gathered by EASA in requests for the certification of systems that enable the automatic arming and deployment of EFSs;

(c) experience gathered by EASA regarding the requests to approve other design changes to existing designs to comply with the proposed Part-26 changes;

(d) monitoring the number of ditching and water impacts involving helicopters and reviewing the number of fatalities from these events.

Items (a), (b) and (c) depend on the applications received by EASA after the amendment of Part-26/CS-26. A review may be made at the earliest 5 years after the amendment of Part-26/CS-26.

Item (d) will be an ongoing review, but more detailed review may be made at the earliest 5 years after the amendment of Part-26/CS-26 to establish whether there is a positive trend in occupant survivability.

5. Proposed actions to support implementation

— Focused communication for Advisory Body meeting(s) (MAB/SAB/TeB/TEC/COM)

(Advisory Body members)

N/A

— Providing supporting clarifications in electronic communication tools EASA–NAAs (EUSurvey or other)

(Primarily targeted audience: competent authorities)

N/A

— EASA Circulars

(Primarily targeted audience: competent authorities, industry)

N/A

— Detailed explanation with clarification on the EASA web

(Primarily targeted audience: industry, competent authorities)

N/A

— Dedicated thematic workshops/sessions

(Primarily targeted audience: industry, competent authorities)

N/A

— Series of thematic events organised on the regional principle

(Primarily targeted audience: industry, competent authorities)

N/A

— Combination of the above selected means

(industry, competent authorities)

N/A

6. References

6.1. Related regulations

— Commission Regulation (EU) 2015/640 of 23 April 2015 on additional airworthiness specifications for a given type of operations and amending Regulation (EU) No 965/2012 (OJ L 106, 24.4.2015, p. 18–22)

6.2. Related decisions

— ED Decision 2015/013/R of 8 May 2015 adopting Certification Specifications for additional airworthiness specifications for operations (CS-26 – Issue 1)

— Executive Director Decision 2003/15/RM of 14 November 2003 amending Certification Specifications and Acceptable Means of Compliance for Small Rotorcraft (« CS-27 »)

— Executive Director Decision 2003/16/RM of 14 November 2003 amending Certification Specifications and Acceptable Means of Compliance for Large Rotorcraft (« CS-29 »)

6.3. Other reference documents

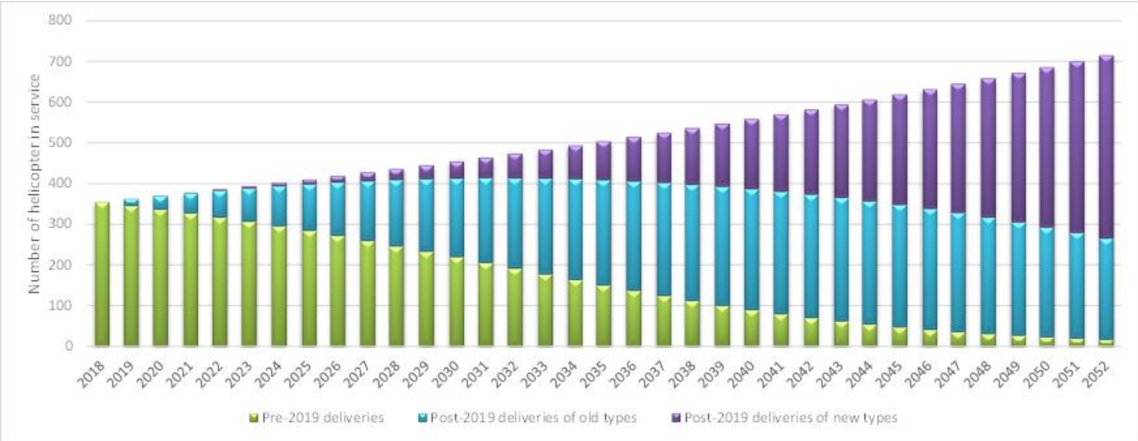
— EASA NPA 2016-01, Helicopter ditching and water impact occupant survivability dated, 23 March 2016.

7. Appendix A

CBA summary

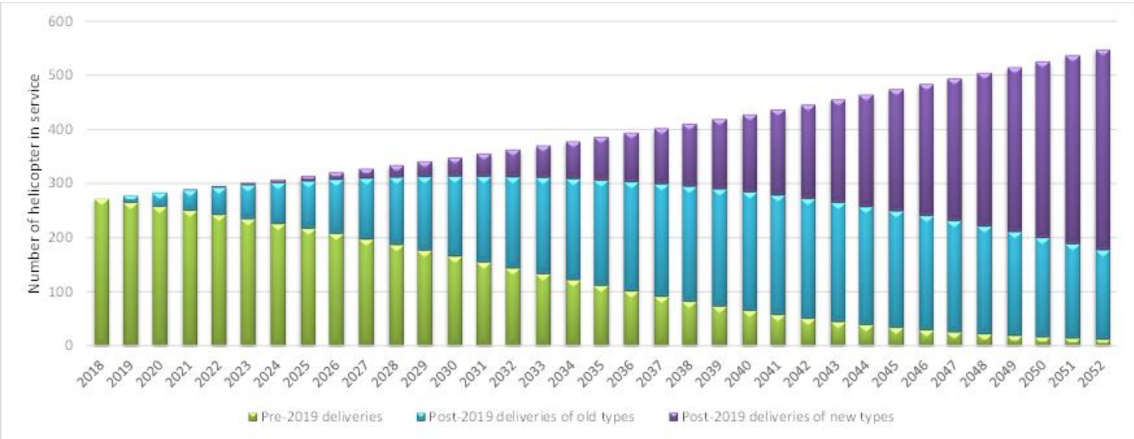
Option 2: Determination of the robustness of the EFS

Determination of the robustness of the EFS: Helicopter fleets



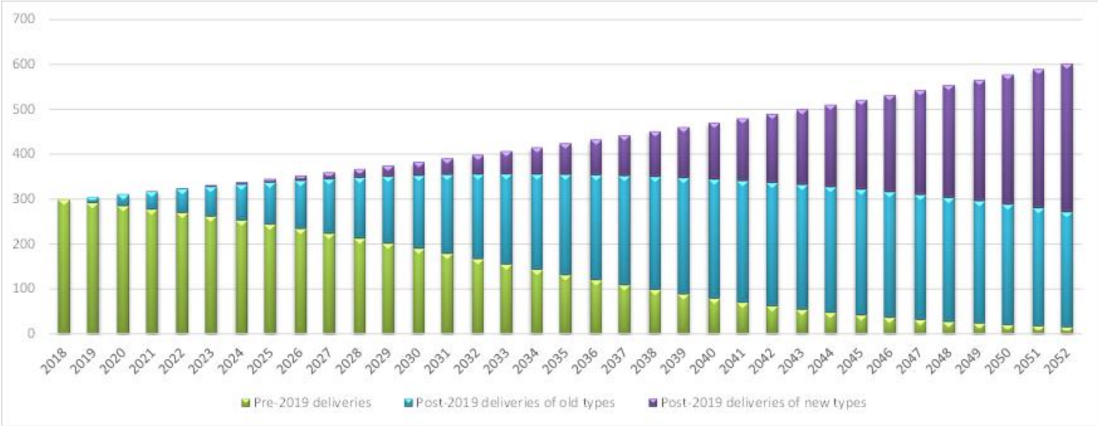
Option 3: Auto-arm and auto-deploy

Auto-arm and auto-deploy: Helicopter fleets



Option 4: Irregular wave testing

Irregular wave testing: Helicopter fleets



8. Quality of the document

If you are not satisfied with the quality of this document, please indicate the areas which you believe could be improved, and provide a short justification/explanation:

— the technical **quality** of the draft proposed rules and/or regulations and/or the draft proposed amendments to them;

— the clarity and readability of the text;

— the quality of the impact assessment (IA);

— application of the 'better regulation' principles[20]; and/or

— others (please specify).

Note: Your replies and/or comments in reply to this section will be considered for internal quality assurance and management purposes only and will not be published in the related CRD.

[20] For information and guidance, see:
- https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox_en
- https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how_en)
- https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox/better-regulation-toolbox_en)