Comment-Response Document 2016-01

Appendix
to ED Decision 2018/007/R

RELATED NPA: 2016-01 — RMT.0120 (27&29.008) — 14.6.2018

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1. Summary of the outcome of the consultation

EASA received a significant number of comments on NPA 2016-01, which led to some changes to the certification specifications (CSs) that were proposed. An explanation of how the comments affected the final text of the CSs and associated acceptable means of compliance (AMC) can be found in Section 2.4 of the Explanatory Note to Decision 2018/007/R.

The comments that were received can be summarised into the following areas:

Proportionality for rotorcraft that only require emergency flotation systems

Some commenters stated that the proposed requirements for specific load requirements and for the water entry behaviour of the rotorcraft to be substantiated for an emergency flotation system (EFS) (not full ditching certification) were excessive for rotorcraft that would only fly over non-hostile sea areas and that there was a need for greater proportionality. Furthermore, it was pointed out that the use of FAA AC material (MG10) as AMC to set certification requirements was inappropriate.

Irregular wave testing specification

Comments were received from industry relating to uncertainty as to how to implement the probabilistic capsize resistance test specification in practice.

Post-capsize survivability features

A significant number of comments were received during the consultation of NPA 2016-01 regarding the 'post-capsize survivability features'. Some stakeholders considered that the proposed amendment was too prescriptive, as the only identified means of compliance in the AMC was the provision of an 'air pocket', and another design (emergency breathing systems) was specifically ruled out.

Some stakeholders also challenged the technical feasibility of providing an 'air pocket' through the enhancement of the EFS. A number of technical challenges were identified, and these include the potential for:

— inadvertent deployment of the modified EFS, resulting in a catastrophic event (e.g. flotation units needing to be closer to the main rotor to achieve the required floating attitude);

— hot exhaust gases acting upon the flotation units' stowage location(s), setting unachievable standards for material selection;

— aerodynamic disturbance in the complex area close to the main rotor due to the protruding volume for the higher-mounted stowed flotation units;

— the need to design for potential damage to a high-mounted flotation unit by the main rotor immediately after inflation and before the main rotor has stopped turning.

In their comments, helicopter designers expressed serious concerns about the above items, and particularly in regard to the introduction of an additional catastrophic hazard. The main concern related to the potential for the inadvertent deployment of a high-mounted flotation unit close to the main rotor. Helicopter manufacturers stated that the technical challenge posed by needing to design a device with high integrity to prevent any inadvertent deployment in the vicinity of the main rotor was excessive.

Definitions and terminology

Comments were received on the definition of a ditching itself. Comments were also received requesting to clarify the use of the term 'ditching emergency exit'. This term has existed for many years in CS-27 and CS-29, and is used when specifying the additional exit requirements for rotorcraft certified with ditching provisions.

Structural aspects

A significant number of comments were received on the ability to interpret the structural ditching provisions and the terminology that was proposed.

Under-fuselage chevrons

Comments were received on the appropriateness of a CS provision for under-fuselage chevrons on all rotorcraft certified for emergency flotation or full ditching.

Some commenters proposed that this should be a helicopter offshore operations (HOFO) operational requirement within the Air OPS Regulation.

2. Individual comments and responses

In responding to comments, a standard terminology has been applied to attest EASA's position. This terminology is as follows:

(a) **Accepted** — EASA agrees with the comment and any proposed amendment is wholly transferred to the revised text.

(b) **Partially accepted** — EASA either agrees partially with the comment, or agrees with it but the proposed amendment is only partially transferred to the revised text.

(c) **Noted** — EASA acknowledges the comment but no change to the existing text is considered necessary.

(d) **Not accepted** — The comment or proposed amendment is not shared by EASA.

(General Comments)	-

comment	*8* comment by: *Aerossurance*
	We are supportive of the intent of this NPA because of the large number of offshore passenger movements by helicopter.
response	Noted. EASA appreciates Aerossurance's support for this NPA.

comment	*26* comment by: *Aerossurance* At the highly helpful EASA workshop on this NPA, held in April 2016, it was noted that certain potential design solutions not explicitly currently covered by the AMC could be subject to an AltMOC application. We are of the view that where a provision requires new solutions (e.g. that have not yet entered service on any helicopter) that the objective based requirements and their AMC should be flexible enough now so as to minimise the need for Special Conditions/Equivalent Safety Findings or AltMOCs. AMC orientated around yet to be fully proven solutions could result in the unintended consequence of this NPA institutionalising sub-optimal solutions, restricting safety enhancements/innovation and causing unnecessary delay in the introduction of new types for offshore service.
response	Noted. The discussion about AltMOC applications at the subject workshop was in reference to a particular proposed requirement text which was revised before the NPA was published. The proposed requirement text was revised because it was considered to be too prescriptive. The issue raised during this discussion has therefore been resolved.

comment	*66* comment by: *EUROCONTROL*

	The EUROCONTROL Agency has no comment to make on NPA 2016-01 concerning 'Helicopter ditching and water occupant survivability'.
response	Noted. EASA appreciates Eurocontrol's support for this NPA.
comment	*70* comment by: *NHF Technical committee* NHF welcomes the NPA and in general support the work of improving safety for passengers and crew after helicopter ditching. NHF support using the helicopter design as a primary aid to ensure proper safety of the passengers and crew, as long as this does not introduce new risks. Design and safety requirements, related to this NPA, should be of the same standard, both for small (CS27) and large aircrafts (CS 29). Therefore any comments given by NHF related to paragraphs in CS 27, may be directly related to same subject/paragraphs in CS 29, and vice versa.
response	Not accepted. EASA appreciates the NHF Technical Committee's support for this NPA. EASA understands that NHF feels that CS-27 and CS-29 rotorcraft standards should be the same in the subject area, and the NHF comments have been considered accordingly. However, as it is apparent in the NPA proposals, and the replies to many other comments in this CRD, EASA cannot agree with this position. CS-27 and CS-29 standards differ in many areas and EASA sees no reason for this not to be the case for ditching requirements.
comment	*75* comment by: *Robinson Helicopter Company* The NPA does not correctly identify the magnitude of the impact on smaller (non-Category A) CS-27 helicopters. Section 4.1.3 titled "Who is affected?" provides a summary of the European offshore fleet and lists only multiengine helicopters. The revised ditching requirements, however, will affect single-engine helicopters performing operations over water as is evident from the EASA commercial operation regulations: *CAT.IDE.H.320 All helicopters on flights over water — ditching.* *…* *(b) (b) Helicopters shall be designed for landing on water or certified for ditching in accordance the relevant airworthiness code or fitted with emergency flotation equipment when operated in:…* *(3) (3) performance class 3 on a flight over water beyond safe forced landing distance from land.* Single-engine helicopters are currently used for over-water sight-seeing flights, charter flights between small islands in the Mediterranean Sea, and fish spotting as a few examples, i.e. conditions where the water is not a hostile environment. These helicopters are typically fitted with emergency flotation equipment but not fully certified for ditching, following the guidance of AC 27-1B MG 10. The NPA replaces the existing guidance with significant aspects

	of the revised ditching requirement for emergency flotation equipment. The cost and practicalities of compliance with the new requirements are likely to be prohibitive. Basic emergency flotation systems have been in use on smaller CS-27 rotorcraft for many years and offer significant safety benefits even without some of the ditching-specific items such as water impact velocity considerations and evaluation of exits in the capsized condition. Eliminating the ability to certify simple, proven, real-world-usable floatation systems may result in a reduction rather than an enhancement in safety.
response	Noted. The NPA proposals for emergency flotation equipment approval for a CS-27 non-CAT A rotorcraft do require flotation system ditching water entry loads (but not loads imposed on the rotorcraft itself) and that overall rotorcraft behaviour be substantiated. This is not required by the existing MG10 guidance. However, the NPA does not propose an evaluation of exit usability in the capsized condition. The former was seen as correcting a long standing inadequacy of MG10.

comment	*127* comment by: *Aerossurance* At the highly helpful EASA workshop on this NPA, held in April 2016, it was commenting that defining a survivable water impact is problematic. While we would agree it is problematic to create a fully comprehensive set of practical criteria, the greatest opportunity for safety improvement is in the area of SWIs. The definition of a reasonable SWI impact criteria to assess design against is preferable to having no criteria and hoping to get a secondary benefit in SWIs from certification criteria applied to ditchings that only require performance or functionality in event of a ditching.
response	Noted. Studies of SWIs have shown the range and variability of key impact parameters (e.g. vertical and longitudinal speed) to be too great to design for them explicitly. Furthermore, studies of EFS crashworthiness have clearly demonstrated that the most effective approach for effecting improvement is through flotation unit redundancy. It is therefore sufficient to require redundancy without specifying any speeds or loads.

comment	*162* comment by: *DGAC France* Please note that DGAC has no specific comments on the NPA 2016-01 "Helicopter ditching and water impact occupant survivability"
response	Noted. EASA appreciates DGAC France’s support for this NPA.

comment	*256* comment by: *AIRBUS HELICOPTERS* Please find here enclosed Airbus Helicopters (AH) Group comments to the EASA NPA 2016-01 published on 23rd of March, 2016. In general, although AH considers that many of the amendments proposed in this NPA would be beneficial to the safety of rotorcraft operating offshore, our main issues are:

Post capsize survivability: AH does not agree with the means of compliance proposed in AMC (air gap).
Stability demonstration on irregular waves: The test program proposed in AMC is questionable on different topics
Water entry: Water entry conditions need some clarifications.
Emergency evacuation: CS and AMC recommendations tend to 2 different ditching emergency procedures, depending on the operational scenario. This needs to be highlighted in AMC.

These comments will be detailed here after in front of each concerned paragraph.

response

Noted.

The points raised here by Airbus Helicopters will be handled under the specific comments raised elsewhere.

comment

288 comment by: *Bell Helicopter*

Comment General: The NPA is raising the bar for any type of flotation system (ditching or not). Under CS-27 there would be three levels:

1. EFS that needs to meet the structural ditching requirements of 27.563 and ditching requirements of 27.801, based on AMC 27 MG10.
2. EFS with ditching that needs to meet the structural ditching requirements of 27.563 and ditching requirements of 27.801 plus new egress and equipment requirements in CS-27.
3. Category A EFS which needs to meet the structural ditching requirements of 27.563 and ditching requirements of 29.801 (including side floats/air pocket) plus new egress and equipment requirements in CS-27 and part of CS-29.

Recommendation: The regulations need be scalable to allow for simple EFS based on current requirements. The recommendation would be to have the following for CS-27 and CS-29 to allow for a safety continuum.
Under CS-27:

1. Simple EFS that meets the buoyancy requirements of 27.801 based on current MG10 guidance.
2. EFS with ditching requirements that meets the structural ditching requirements of 27.563 and ditching requirements of 27.801.
3. EFS with full ditching capability which meets the structural ditching requirements of 27.563, the ditching requirements of 27.801 plus CS-27 egress and equipment requirements (no requirement to meet any CS-29 requirements).

response

Partially accepted.

A scaled approach of lesser stringency than that proposed in the NPA is now adopted. However, the lower end of this scale is not as low as the commenter proposes.

The commenter is proposing that the least stringent standard (presumably to gain credit against the operational requirement for emergency flotation certification, as opposed to full ditching certification) should retain the current floats and attachments structural standard of MG10, namely that no specific water landing conditions are specified, and that float and attachment loading during subsequent movement in waves is also not specified.

Instead, it has been agreed in the rulemaking working group that a more justifiable standard for emergency flotation certification is to require that CS 27.563 structural standards be met, but only for the floats themselves and their attachments to the helicopter, and that the stability of the helicopter be shown in irregular waves, with the same allowable probability of capsize as that required for CS-29 (10 %).

For full ditching certification, the requirements of CS 27.563 shall be met for the complete helicopter, stability of the helicopter shall be shown in irregular waves, with a the same allowable probability of capsize as that required for CS-29 (3.0 %), and a reduced set of equipment requirements relative to CS-29 shall be provided (i.e. no auto arm of the EFS or enhanced illuminated markings of emergency exits ('HEELS') required).

In regard to the allowable probability of capsize, in both cases, it is to be noted that the reason for the value being equal to that for large helicopters should not be seen as unexpectedly stringent for CS-27. Rather, the value required for CS-29 has in fact been pragmatically alleviated, in order to reach the practicable limit for demonstration via scale model testing. Following the withdrawal of the requirement for 'post capsize survivability features" (see the response to Comment 345) the appropriate value for CS-29 would have been 0.03 %, but as stated, this would have been impracticable. In the interim, until the results from the focused research are available (see the response to Comment 345), a value equal to that required by CS-27 is considered to provide an acceptable level of safety.

For Category A helicopters, the same requirements as for CS-29 apply in all aspects.

New paragraph CS 27.802 has been created. (See the response to Comment 338 with its content following this approach regarding structural requirements).

This scaled approach is considered to provide a reasonable balance between safety and the practicalities of providing design capability in the smaller CS-27 helicopter types.

comment

289 comment by: *Bell Helicopter*

Comment General: Under CS-29 there would be two levels:

1. EFS that needs to meet the structural ditching requirements of 29.563 and ditching requirements of 29.801 (including side floats/air pocket), based on AMC 29 MG10.
2. EFS with ditching that needs to meet the structural ditching requirements of 29.563 and ditching requirements of 29.801 plus new egress and equipment requirements in CS-29.

Recommendation: Under CS-29:

1. Simple EFS that meets the buoyancy requirements of 29.801 based on current MG10 guidance.
2. EFS with ditching requirements that meets the structural ditching requirements of 29.563 and ditching requirements of 29.801.
3. EFS with full ditching capability which meets the structural ditching requirements of 29.563, the ditching requirements of 29.801 plus CS-29 egress and equipment requirements.

response

Partially accepted.

After deliberation, it has been concluded that there was not the same justification for a scaled approach to certification with CS-29 emergency flotation and full ditching provisions as there was for the equivalent standards in CS-27 (see the reply to Comment 288).

	However, it is accepted that for emergency flotation certification (as opposed to full ditching certification), there is reason to have some form of reduced requirement. After deliberation, it was concluded by the rulemaking group that for helicopters with a passenger seating capacity of 9 or less, only the floats and their attachments to the helicopter must be shown to be compliant with structural requirements, and not the helicopter itself. For helicopters with a passenger seating capacity of 10 or more, compliance must be shown with the same structural requirements as for full ditching certification. New paragraph CS 29.802 has been created. (See the response to Comment 338 with its content following this approach regarding structural requirements).
comment	*290* comment by: *Bell Helicopter* Comment: Because both CS-27 & 29 have eliminated the possibility of a simple flotation system, this has the potential to reduce availability these systems and reduce the level of safety for operators who do not want the expense (and additional weight) of ditching capability. In addition for CS-29 all flotation systems would need a side float/air pocket configuration. Recommendation: Operating rules, OGP standards, etc. should be used to dictate the level of safety required in different hostile or non-hostile environments. Private and general aviation operators should be able to choose the level of safety they desire for their personnel safety and not be forced to choose between safety and weight and cost.
response	Partially accepted. Operational rules do dictate the level of flotation equipment required for flights over hostile and non-hostile sea areas and the subject rulemaking activity has no effect on these requirements. However, it is acknowledged that the RMT.120 NPA proposals were excessive in respect to the requirements for emergency flotation approval. After consideration, EASA is in agreement that for CS-27, and CS-29 rotorcraft with a seating capacity of 9 or less, only the flotation units and their attachments to the rotorcraft need withstand the loads specified in CS 27.563 or CS 29.563 as appropriate. For CS-29 rotorcraft with a passenger seating capacity above 9, the rotorcraft must comply with CS 29.563. This has been clarified in new paragraphs CS 27.802 and CS 29.802, which were created in response to comment 338. These changes set less onerous certification standards for the smaller helicopters, as desired by the commenter.
comment	*291* comment by: *Bell Helicopter* Comment: MG-10-The first sentence states, “This section pertains to emergency flotation systems used to provide buoyancy for rotorcraft not specifically certificated for ditching but performing over-water operations.” Section c. (5) states, “Buoyancy requirements for emergency flotation systems should be a minimum of 25 percent excess buoyancy at maximum internal gross weight.” Recommendation: MG 10 is not applicable for ditching certification.

response	Noted. The commenter is correct: the current MG10 is not applicable for ditching certification, it is only applicable to rotorcraft needing to comply with the operational requirement to be equipped with an emergency flotation system.
comment	*292* comment by: *Bell Helicopter* Comment: The NPA and the RIA were written using existing fleet data. The conclusions in the RIA are not valid for the new, modern aircraft that would be required to meet these regulations. Rotorcraft with "real" Category A performance, improved reliability and improved situational awareness will have a much less likelihood of either a ditching or a water impact. Based on the values quoted in the RIA, it is also questionable on whether or not the development testing and optimization of additional floats installed on the upper fuselage of the helicopter was adequately accounted for. OEMs typically spend a great deal of time in flight testing optimizing the upper surfaces of the helicopter, and adding protrusions in these areas will not be a straightforward as it sounds. Recommendation: EASA is requested to reassess the conclusions within the RIA assuming modern aircraft which have greater performance, reliability and situational awareness.
response	Not accepted. Whilst it is to be expected that future rotorcraft accident statistics will show improvement, due to the design factors quoted by the commenter, it is by no means a certainty that this will transpire. Furthermore, there is reason to believe that operational factors will continue to pose an appreciable safety risk. EASA, therefore, feels that the conclusions of the RIA are not questionable to a degree warranting a reinvestigation.
comment	*293* comment by: *Bell Helicopter* Comment: The summary of main impacts costs is too low by an order of magnitude. Recommendation: Need to include both development costs and implementation costs into the summary
response	Not accepted. The economic costs quoted in the RIA are taken from data supplied by helicopter manufacturers. In the absence of contradictory data being supplied, EASA feels that the conclusions of the RIA are not questionable to a degree warranting a reinvestigation.
comment	*294* comment by: *Bell Helicopter* Comment: Issues with global harmonization. Manufacturers under US and Canadian states of design will still be able to develop products to current regulations but not get EASA ditching certification. Manufacturers in the EU will have no choice but to meet the EASA rules. Recommendation: Ensure a level playing field.

response	Noted. The commenter is incorrect. Manufacturers based in North American or European jurisdictions will be able to gain approval to either both EASA and North American certification requirements, or to just the latter. There is no uneven playing field.
comment	*295* comment by: *Bell Helicopter* Comment: The NPA has hidden the real intent of the proposed changes which is to improve safety for a "survivable" water entry and not ditching. EASA is open about this intent and argue that the reason the rules were not developed for survivable water impact was because they cannot define what a survivable water impact would be. Recommendation: Use a safety continuum model whereby there would be scalable requirements with full ditching capability accounting for the "survivable water impact" philosophy.
response	Partially accepted. See the responses to Comments 288 and 289.
comment	*321* comment by: *Aerossurance* We note here is no reason that issue / carriage of equipment such as Cat A EBS (for example) could not be made a limitation in the RFM for operation offshore to require such equipment irrespective of any operational requirements if necessary to achieve certification requirements.
response	Noted. The commenter is correct. A requirement could be developed to require that passengers and/or crew be provided with EBS, via a mandated RFM limitation.
comment	*424* comment by: *General Aviation Manufacturers Association* Attachment **#1** The attached letter was submitted by GAMA/ASD, along with 93 appended comments. This submission was the result of 6 helicopter manufacturers' collaborative discussions and agreement on the nature of comments to be made against NPA 2016-01. The GAMA/ASD covering letter summarizes the helicopter manufacturing industry's overall thoughts and concerns regarding the NPA and has thus been included in this CRD. However, the 93 comments appended to the GAMA/ASD letter were also submitted directly to EASA by individual helicopter manufacturers and will therefore not be duplicated in this CRD.
response	Noted. EASA has studied the GAMA letter and has concluded that in fact all the points raised therein are answered by the replies provided against the 93 appended comments. It is proposed that these replies be accepted as the response to the letter.

EXECUTIVE SUMMARY	p. 1

comment	*406* comment by: *Flying Club President* I experienced an engine failure in a hostile environment in a single engined helicopter without floats at 400nm south of Cape Horn in the Drake Passage. It was not a problem, and evacuation was straightforward and survival was slightly awkward but not unreasonably so after 9.5hrs with sea temperatures of 1 degree Celsius. Since this does not appear to be reflected in the statistical analysis then a flawed and erroneous result will follow. **This sort of activity is reasonable private leisure activity and preventing it represents a further erosion of citizens to enjoy the benefits of living in a 'free society'.** There is a duty of those engaged with this process to inform themselves and not act in an overbearing way against the interests of Private Citizens. Furthermore I am aware of 3 other ditching in the sea with private helicopters without floats where there was no survival issue.
response	Noted. The commenter's point is noted; however, the requirement for a helicopter to be equipped with an emergency flotation system is covered by operational regulations. These regulations set flotation system standards of differing levels depending on whether the sea areas being overflown are classified as hostile or non-hostile, and whether the intended route exceeds at any point a particular flying time to, or distance from, land. The subject RMT.0120 in no way affects these operational regulations.

2. Explanatory note	p. 6-21

comment	*1* comment by: *ENAV* NA
response	Noted. It is assumed this comment was entered in error.

comment	*3* comment by: *Luftfahrt-Bundesamt* 1) page 10, chapter 2.5, table 1: The economic impacts state that in Option 1 "500 000" are "Insignificant" but "300 000" (a lesser value) are "Very low". This seems to be wrong. 2)

page 16, headline "CS 29.783": The next sentence mentions that "it has been moved to CS29.803(c)(3)." But not the whole paragraph has been moved but only the subparagraph (h). So the headline should be "CS 29.783(h)"

response

Accepted

1) The reference to 'Very low' in the column for Option 3 is an error. This should have read 'Insignificant'. It is to be noted that the figure '0.0001 %' in the column for Option 3 is also an error. This should read '0.001 %' With these two amendments made to table 1, the information for Option 3 is then in line with Table 4.13, which is correct, and which appears later in the NPA presenting the same data. The errors appear in the explanatory note to the NPA, and thus, formal correction is not considered necessary.
2) The commenter is correct in that a title 'CS 29.783(h)' might have been clearer. However, this is part of the explanatory note to the NPA, and thus, formal correction is not considered necessary.

comment

76 comment by: *Robinson Helicopter Company*

2.4. List of definitions used in this NPA:

"Emergency Landing on Water" is no longer used and is replace by either "Ditching" or "Safe forced landing". The given definition of "Safe forced landing" is either an "Unavoidable landing" or "Ditching". An "Emergency Landing on Water" was previously used to identify a forced landing onto water that did not involve ditching and consequently there is no longer a term to identify this situation. The term "Unavoidable landing" is not a good replacement for "Emergency landing" since almost any "Emergency landing" could be avoided (e.g. the case of an emergency landing due to fuel exhaustion that could have been avoided by checking the fuel quantity before flight).

The following items should be clarified.

- If the landing is "deliberately executed", does this cover power failure scenarios (e.g. autorotation to water)? An autorotation to water following a power failure in a CS-27 rotorcraft is probably not "deliberately executed" because: 1) The timeframe for decision making is very short, and 2) There is no option other than the water landing.
- If the water landing is "with the intent of abandoning the rotorcraft as soon as practicable", many of the seakeeping requirements become less important. Seakeeping need only be maintained briefly during occupant egress. However, a more common and possibly safer course of action, particularly for smaller CS-27 rotorcraft operating closer to shorelines, would be to remain with the floating rotorcraft until assistance arrives. The definition of "ditching" appears to exclude this scenario.

response

Partially accepted/Not accepted/Partially accepted.

1) The term 'Safe Forced Landing' was included in the list of definitions in error. This term was not proposed for use by the NPA in any CS-27 or CS-29 regulation or AMC text. However, this is part of the explanatory note to the NPA, and thus, formal correction is

	not considered necessary. 2) It is not understood why the commenter believes an autorotation to water with a CS-27 rotorcraft, following an engine failure, would not be deliberately executed. 3) It is agreed that the definition of ditching does not include the scenario whereby the occupants may decide to stay inside the rotorcraft. However, EASA considers this as an exceptional decision by the crew/occupants and sees no reason to change this long standing part of the definition.
comment	*166* comment by: *Zodiac Evacuation Systems division - France* A Definition of "capsize" should be added. Recommandation : Capsize: The most stable floating attitude of the helicopter
response	Not accepted. After due consideration of this comment, it was concluded that the meaning of capsize is sufficiently obvious as to require no definition.
comment	*167* comment by: *Zodiac Evacuation Systems division - France* For better understanding of the regulation, the definitions should be added to the AMC recommandation : Add definitions in the AMC
response	Noted. Definitions are included in the relevant AMCs.
comment	*225* comment by: *Sikorsky Aircraft Corporation* The data provided in Section 4 does not support the results of the RIA. See comments to Section 4.
response	Noted. Please see the responses to the referenced comments.
comment	*278* comment by: *Argentina Air line Pilot Association* DITCHING EMERGENCY EXIT: "...from a capsized and flooded rotorcraft" change for "...from a rotorcraft." because of the chopper may stay floating, with uncertain time available to escape, and use emergency exit for saving time or for normal exit door locked, and so on.
response	Partially accepted. The confusion that is evident from this comment as well as points raised by other comments to the NPA, have resulted in agreed changes to the usage of the term ‘ditching emergency exit’.

The NPA proposed that the term 'ditching emergency exit' be retained in essentially the same way as before, but with an increased number of these exits being required. The intent was to provide for much improved ability to rapidly escape from the flooded cabin of a capsized helicopter (i.e. as is likely in a water impact). In order to make this intent clear, these exits have now been designated as 'underwater emergency exits'.

The term 'ditching emergency exit' has, however, now been utilised for the exits required by the new requirement CS 29.801(c). These exits are required to enable passengers to easily step directly into the life rafts whilst the helicopter remains upright. This is the expected condition following a ditching.

It is to be noted that these two exit designations, along with the nominal 'emergency exit' as required for all helicopters, irrespective of whether they are approved for ditching, are not exclusive. A particular exit may be provided for the purposes of just one of the three designations, any two, or all three.

comment

279 comment by: *Argentina Air line Pilot Association*

RETAINING LINE: "... The short retaining line es provided to pisition the raft during occupant transfer from the rotorcraft to the life raft. The long retaining line es provided to allow the life raft to drift away from the rotorcraft but remain attached thereto, thus facilitating survivor(s) location by rescuers. Both retaining lines are designed to release the life raft without damage should the rotorcraft sink."

1. *Transferring pax from chopper to life raft directly is almost impossible or dangerous. IMPOSSIBLE in many times when life raft inflate in the opposite side (except double side life raft, but is not the rule). DANGEROUS because of CO2 cilinder(s) in the raft, if you jump over raft: you can injured yourself, or brake the raft, or both. On the other side, if chopper has short time floating without capsizing (depending on sea state) short retaining is* ***unnecessary or dangerous.*** *If short line automatic release fails, you haven't enougt time to cut the line using specific knife on board of raft (if you find it). Worse at night.*
2. *Suggestion: eliminate short retaining line that joint life raft to chopper, and instruct every passenger or leader passenger to pass or jump ALWAYS from chopper to water, and after, get into a raft.*

response

Not accepted.

Direct entry to a life raft is highly desirable, because subsequent survival can be compromised by becoming wet. Furthermore, climbing into a life raft from the water is difficult and places additional stress upon the survivor.

Automatic release of the retaining lines, in the event of the helicopter sinking, is feasible, and is already required by CS-27 and CS-29 for the currently required single line. The change to the certification specifications is only to clarify that two lines are required, as is current practice.

EASA sees no reason why future helicopter designs cannot be such that direct passenger entry into the life raft is facilitated.

3.2.1. Draft amendment to CS-27 — Book1 p. 22

comment

234 comment by: *FAA*

Name of Subpart C should not be changed.	Do not remove "REQUIREMENTS"

response

Accepted.

The title of Subpart C will not be changed.

CS 27.563 Structural ditching provisions p. 22-23

comment

168 comment by: *Zodiac Evacuation Systems division - France*

CS27.563 (a)
The meaning of mean wave surface (through all 563) is not clear. Are the speeds to be considered as ground speeds?

recommandation : Clarify the meaning of mean wave surface/requirement.

response

Accepted.

The text of CS 27.563(a) has been extensively revised. The lack of clarity cited by the commenter has been resolved.

comment

203 comment by: *UK CAA*

Page No: 22 & 29

Paragraph No: CS 27.563 Structural Ditching Provisions (a), AMC 27.563 (a)(1)(iii) and AMC 27.563 (b)(3)

Comment:

The reference to two-thirds rotor lift should be deleted.

Justification:

The removal of two-thirds rotor lift is justified and recommended in Appendix B, Item 9 (see page 199). This has been incorporated in AMC 27.801 (b)(10) on page 31, but not in the above references.

Proposed Text:

Modify the existing text as follows (deleted text ~~struck through~~):

CS 27.563 (a) *Forward-speed landing conditions.* The rotorcraft must initially contact the most critical wave for reasonably probable water conditions at forward velocities from zero up to 56 km/h (30 knots) in likely pitch, roll, and yaw attitudes. The rotorcraft limit vertical - descent velocity may not be less than 1.5 metres per second (5 ft/s) relative to the mean water surface. ~~Rotor lift may be used to act through the centre of gravity during water entry throughout the landing impact. This lift may not exceed two-thirds of the design maximum weight. A maximum forward velocity of less than 30 knots may be used in design if it can be demonstrated that the forward velocity selected would not be exceeded in a normal one-engine-out touchdown.~~

AMC 27.563 (a)(1)~~(iii) A rotor lift of not more than two-thirds of the design maximum weight may be used to act through the rotorcraft's centre of gravity during water entry.~~

AMC 27.563 (b)(3) The landing structural design consideration should be based on water entry ~~with a rotor lift of not more than two-thirds of the maximum design weight acting through the rotorcraft's centre of gravity~~ under the following conditions:

response

Not accepted.

The reason to remove an allowance to assume a rotor lift of two thirds the maximum design weight (i.e. as discussed in Appendix B, Item 9 of the NPA) was in regard to the water entry scale model testing, not for the ditching structural aspects.

comment

235 comment by: *FAA*

CS 27.563	Proposed (provision/requirement) language is not required to be changed. These are requirements, not provisions. (This comment applies to multiple occurrences in the proposed language)	Leave wording unchanged.
CS 27.563(b)(1)	Keep the first part of the sentence proposed for deletion. Recommend the language "...creating restoring moments to compensate 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(d). Maximum roll and pitch angles determined from compliance with CS 27.801(d) may be used, if significant, to determine the extent of immersion of each float." is advisory in nature, and should be moved to the AMC.	Keep "The highest likely buoyancy load must include consideration of a partially immersed float." Remove the remainder of the paragraph as proposed.

response

Accepted.

It is accepted that the change from 'requirement' to 'provision' is confusing because the latter term is used extensively to mean design features. The text has been revised to revert

	back to the term 'requirement' where appropriate. In regard to CS 27.563(b)(1), it is to be noted that the responses to other comments have resulted in an extensive revision of CS 27.563. The issue raised by the commenter has been resolved by this revision.

comment	*267* comment by: *AIRBUS HELICOPTERS* See our comment n° 265 on CS 29.563 (a).
response	Partially accepted. See the response to Comment 265.

comment	*296* comment by: *Bell Helicopter* Comment 27.563: Structural ditching provisions is unclear Recommendation: Structural ditching provisions needs to be reviewed for impact
response	Accepted. This requirement has been revised in order to improve clarity.

comment	*297* comment by: *Bell Helicopter* Comment: The requirement 27.563(a) states for the most critical wave. This is inconsistent for irregular waves – i.e. rogue wave? Recommendation: The requirement for the most critical wave needs re-wording
response	Accepted. This requirement has been revised in order to improve clarity. The term 'most critical wave' is no longer used.

CS 27.783 Doors p. 23

comment	*298* comment by: *Bell Helicopter* Comment: This wording used in this new paragraph is not consistent with the conversion to irregular wave certification. By definition of the irregular wave spectrum, there are "rogue waves", so demonstrating that the doors will remain open and secure in the most severe sea conditions would be very difficult. The flotation requirements use a probabilistic approach in using irregular waves, this requirement does not. Recommendation: Recommend clearer definition on "most severe sea condition" with respect to irregular wave spectrum.
response	Not accepted.

	This text was introduced because the similar text already found in CS-29 (ref. CS 29.783(h)) was considered also appropriate to CS-27 types. The original text was changed from '[…] in sea conditions prescribed for ditching' to '[…] in the most severe sea conditions covered by the certification with ditching provisions'. This was done to be in line with text of similar usage in other places. It is not considered to change the original meaning. Problems have not been found in the past in agreeing how compliance with this requirement in CS-29 may be shown. The requirement must be seen as being related to real sea conditions that might be encountered during a ditching. EASA sees no reason to suppose that there will be problems in showing compliance in the context of a CS-27 rotorcraft.

CS 27.801 Ditching p. 23-24

comment	*4* comment by: *Luftfahrt-Bundesamt* 3) page 24, addition of subparagraph (g) to CS 27.801: This new text includes an explanation why the underside of a rotorcraft must be marked with a series of high-visibility chevrons. All requirements to mark emergency exits at the outside have the same reason ***but this reason isn't mentioned. Such an explanation "to assist the rescue services in establishing the location and orientation of a*** capsized rotorcraft" isn't a technical requirement and should be transferred to the AMC/GM. 4) page 24, addition of subparagraph (h) to CS 27.801: Usually the requirements which contents a flight manual have is summarised in paragraph CS 27.1581 and subsequent. The requirements which performance information need to be mentioned in the flight manual is written in paragraph CS 27.1587. It is not clear why this method is changed and a requirement of a content of the flight manual is mentioned in Subpart D - Design and Construction.
response	Partially accepted. It is correct that the reason for a marking, such as the subject chevrons, should not be included in the requirement. However, other comments have been received in regard to the chevron markings and it has been agreed that the requirement for these markings will be placed in the operational rules. All reference to chevron markings is thus removed and the issue raised by this comment is thus resolved. See Comment 236. The requirement for the sea conditions to which rotorcraft has been substantiated with ditching provisions to be included in the performance information section of the RFM will be moved to CS 27.1587
comment	*77* comment by: *Robinson Helicopter Company* Paragraph (c): The requirement for automatic arming and disarming coordinated with flight envelope limitations on float deployment adds significant complexity to system design and introduces the possibility of failure of the automatic arming system. There may be cases such as flight

over land where automatic arming is not desirable in order to minimize the possibility of inadvertent deployment. Arming and disarming at flight crew discretion is more flexible and adaptable to real-world operating conditions.

The requirement for automatic deployment following water entry also introduces complexity and the possibility of inadvertent deployment (e.g. during a maintenance washing procedure). For a "deliberately executed" emergency water landing, it is reasonable to assume that the flight crew will have deployed the floats prior to water contact.

A functional hazard assessment for a system that includes automatic arming and deployment of floats will almost certainly have a hazardous failure mode or possibly even a catastrophic failure mode. Reliability requirements for such systems and the implications for simple helicopters that otherwise do not have equipment with that level of failure mode criticality should have been included in the regulatory impact assessment since this would have significant implications for, among other considerations, HIRF and lightning qualification.

There is a very large difference in the target probability of capsize with and without mitigation. This is based on an assumption that capsize with occupants still inside the rotorcraft is inevitable. It treats designs more prone to capsize but incorporating mitigations such as breathing systems as equivalent in safety to capsize-resistant designs. Given the lack of a controlled environment during forced water landings, minimizing the probability of capsize has a far greater likelihood of providing safety benefits than any post-capsize mitigation. Consequently this revision to the regulation could lead to a reduction in safety for a ditching. This is particularly true in less than extreme sea conditions where industry-standard float designs can do a good job of keeping the helicopter upright. The accident database shows that calmer sea conditions are the more common situation. An allowable capsize probability of 29% with mitigation is not consistent with the overall NPA objective of enhanced water landing safety. Comments to Appendix B provide a more detailed analysis of issues associated with the proposed capsize probabilities.

Paragraph (h):

"RMF" should be "RFM".

response

Partially accepted.

After due consideration, EASA accepts that it would be excessive to require CS-27, non-Category A types to be provided with automatic arming of the emergency flotation system. CS 27.801 will be amended accordingly.

However, an automatic deployment system for emergency flotation, with the required level of integrity, is considered to be both feasible within the constraints of producing such a rotorcraft and also essential in order to provide for improved safety in the event of a water impact. This requirement will therefore remain.

The erroneous 'RMF' will be corrected.

comment

96 comment by: *Aerossurance*

As resistance to water impact is mentioned in 801(c) it is entirely reasonable that it is included in 801(b) also. Clearly what is practical and achievable in the case of water impacts will be less than in a ditching and defining a survivable water impact test case is more

	difficult, however as fatalities have predominately been caused in water impacts we fell this would be an important change. Suggested wording: Each practicable design measure, compatible with the general characteristics of the rotorcraft, must be taken to minimise the probability in the event of either a ditching or a survivable water impact, that the behaviour of the rotorcraft would cause immediate injury to the occupants or would make it impossible for them to escape.
response	Not accepted. CS 27.801(b) is concerned with the behaviour of the rotorcraft during the initial water entry phase of a ditching. It is intended that the applicant should investigate whether there may be unfortunate tendencies that might negate other design assumptions made, such as the degree of transient submersion leading to excessive loads. This should be done for water entry parameters within the ditching envelope. As explained in the NPA, a survivable water impact on the other hand cannot be defined and so it would be impracticable to require the investigation to include the associated water entry parameters.
comment	*170* comment by: *Zodiac Evacuation Systems division - France* for section CS 27.801 (c) As the criteria of a water impact is not clearly defined, it is not possible to show compliance to this requirement. recommandation : for section CS 27.801 (c)(1) Replace "must" by "should" (or "shall optimize") as a water impact criteria is not defined. for section CS 27.801 (c)(2) and (3) "must" is acceptable for section CS 27.801 (g) this section is limiting to a specific means of compliance recommandation : Reword specification to give high visibility chevrons as a possible means of compliance but allowing for other solutions.
response	Partially accepted/Not accepted. In regard to CS 27.801(c)(1), it is explained in the AMC that the applicant should consider the disrupting effects of a water impact on the integrity of the emergency flotation system and, where practicable, design the system installation to withstand those effects. It is not expected that a quantitative assessment of the effects should be made. Changes have been made to CS 27.801 (c)(1) to make this intent clearer. See also the responses to Comments 236 and 263. In regard to the chevron markings, other comments have been received and it has been agreed that the requirement for these markings will be placed in the operational rules. See

	Comment 236. All reference to chevron markings is thus removed and the issue raised by this comment thus no longer remains. However, as chevron markings have been applied to many helicopters operating offshore for many years, it is considered unlikely that any other form of marking will be considered acceptable when discussions take place for the development of an operational rule.
comment	*204* comment by: *UK CAA* **Page No:** 24 **Paragraph No:** CS 27.801 Ditching (e) **Comment:** The statement "With capsize mitigation" in the bottom left cell of the table needs to be qualified. **Justification:** The risk assessment presented at Item 10 in Appendix B of NPA 2016-01 (starting on page 200) from which the corresponding target probability of capsize is derived assumes that the consequences of capsize are mitigated to no worse than CS 27.1309 major. If they are not, a different target probability of capsize would be required. **Proposed Text:** Add to the existing text as follows (new text <u>underlined</u>): With capsize mitigation <u>to no worse than CS 27.1309 major</u>.
response	Noted. EASA agrees with the point raised by this comment, i.e. the meaning of 'With capsize mitigation' is not clear. However, the decision to remove the requirement for 'post-capsize survivability features' (see the response to Comment 345) from CS-29 led to a reappraisal of the overall approach to setting capsize resistance targets for both CS-27 and CS-29, and mitigation of capsize is no longer mentioned in either CS. The point raised by this comment is thus now solved.
comment	*236* comment by: *FAA*

CS 27.801(c)(1)	Wording is not clear.	Reword to "be designed, constructed and installed to perform their intended function, considering the effects of loads in 27.563;"
CS 27.801(g)	This is an operational requirement, and does not belong in CS 27.	Remove (g) and possibly add to operational requirements
CS 27.801(h)	Typo	RMF should be RFM

response

1. Partially accepted/Accepted/Accepted.
2. Partially accepted – The wording of CS 27.801(c)(1) has been changed to better convey its intent (See also response to Comment 170). However, the change does not make reference to CS 27.563, which the helicopter must comply with in any case.
3. Accepted – Although no particular reason could be found for the subject markings to be considered as clearly appropriate to only be mandated via an operational requirement, after discussions within EASA, it was agreed to follow this approach as the safety intent can equally be achieved.
4. Accepted – The error has been corrected.

comment *259* comment by: *AIRBUS HELICOPTERS*

See our comment n° 258 on CS 29.801 (e).

response

Noted.
See the response to Comment 258.

comment *264* comment by: *AIRBUS HELICOPTERS*

See our comment n° 263 on CS 29.801 (c).

response

Noted.
See the response to Comment 263.

comment *270* comment by: *AIRBUS HELICOPTERS*

See our comment n° 269 on CS 29.801 (d).

response

Accepted/Partially accepted/Noted.
See the response to Comment 269.

comment *299* comment by: *Bell Helicopter*

	Comment: The intent of the new provision is unclear. 27.563 already include the loads for ditching, so this would imply some other type of assessment? Recommendation: Requirement should be reworded to clarify the intent and should not refer to water impact.
response	Partially accepted. See the response to Comment 263.

comment	*300* comment by: *Bell Helicopter* Comment: Text 27.801(c)(2) is confusing. Intent is that the floats be automatically armed before water entry and not rely on pilots to arm the floats prior to water impact. Recommendation: Requirements should be simplified and less prescriptive.
response	Accepted. The intent is as the commenter suggests and a simpler text has been adopted, indicating this intent.

comment	*301* comment by: *Bell Helicopter* Comment: The wording suggests that the floats must automatically arm when within the boundaries of the envelope defined for approved flight with floats (‘’restricted envelope’). Manual arming is in fact a required feature in order to meet the safety criteria for inadvertent float inflation. If automatically armed, this would expose a higher risk of inadvertent deployment throughout the restricted envelope which would result in a safety reduction. Ditching by definition is a deliberately executed emergency landing on water per the RFM procedures. Arming the floats is in the procedures. This is an attempt to address issues with water impact, and it is questionable whether or not automatic arming would solve it. If the helicopter is flown into (or enters) the water at a speed above the envelope limit, the floats would not be automatically armed. Recommendation: Is this requirement necessary? 801(c)(3) states automatic deployment following water entry.
response	Not accepted. It is considered to be practicable to design a sufficiently reliable automatic disarming/arming system. The main reason for introducing a requirement for automatic disarming/arming is to address the water impact case, where it is believed that lives have been lost due to floats not being armed. Using only an airspeed switch to disarm/arm the floats, however, would not address the high speed ‘fly-in’ case cited in the comment. However, this case can be covered by arming the floats as the aircraft descends though an appropriate height threshold. This height could likely be chosen to be below that of virtually all helidecks. Additional explanation/clarification has been added to AMC 29.801(c)(2)(iii).

comment	*302* comment by: *Bell Helicopter*

	27.801(d) Comment: Testing of entry into water and sea conditions. Recommendation: Need to establish a position
response	Noted. See the response to Comment 269.

comment	*303* comment by: *Bell Helicopter* Comment 27.801(d): Given that ditching is a deliberate emergency landing, it is expected to be controlled by the pilot to the extent possible during an autorotation touchdown. The requirement to conduct powered model testing of the entry is questionable; there is no way to control the flare and subsequent run on into the water in a model test. Further, the pilot flying the helicopter is going to aim for what he believes is the best spot to set the helicopter down, and again there is no way in a model test to simulate this. This requirement does not provide any valuable demonstration of the helicopter's capability to conduct a safe ditching water entry and should be removed give: 1. Each helicopter must demonstrate it's capability to execute a power off landing during certification; 2. There has not been any problems with water entry for the ditchings on record (that I am aware of); 3. Model testing of the helicopter's behavior on water entry is not representative of an actual controlled water entry. Recommendation: Recommend deleting the entire Requirement, or rewording it to show by analysis only.
response	Not accepted. See the response to Comment. 269.

comment	*304* comment by: *Bell Helicopter* Comment: 27.801(e) Probability of capsize used to determine the amount of testing required is confusing and over complicated. Recommendation: Need to establish a position
response	Noted. The staff of a competent model basin facility should have no difficulty in understanding or implementing the specification (e.g. calculating the required run durations). This was confirmed by the majority of responses to the test specification when comments were sought from these organisations.

comment	*305* comment by: *Bell Helicopter* Comment: 27.801(e) The probabilistic approach proposed using the random generated spectrum suggests that the testing is going to be a "luck of the draw" occurrence. If a capsize does occur, then an oceanographer can review the data and make a determination on whether or not the test is considered a pass or fail. This results in a somewhat subjective assessment, and is therefore by default something very difficult to design for. None of the

OEMs in the WG were comfortable with the proposed approach.
Recommendation: Recommend that a suitable "sample" spectrum be defined such that the test is pass or fail based on the actual model performance during the test. There are examples within the current regulations where assumed spectra are tested to be representative of in service use.

response

Not accepted.

It is assumed that the commenter is requesting a 'sample time-series' (rather than a 'sample spectrum'), meaning that each helicopter design would experience the very same wave sequence.

It is to be noted that water waves are a dispersive wave system, which means that different wave period components advance at different speeds. This means that the wave elevation time series changes spatially.

The wave spectrum (energy period distribution) might be the same in different locations in a wave basin, but the wave time series will be different. This is evident from linear wave theory, and is true in the ocean and in a wave basin.

Consequently, to reproduce a specified time series in a particular wave basin, one must set up the wave-maker such that the desired time series is produced at the model location. The required movement of the wave-maker paddle to produce the time series can, in theory, be calculated from;

(a) the wave-maker paddle transfer function, and

(b) the linear wave dispersion equations.

But unfortunately, only very small amplitude waves behave as per the linear wave equations, and linear dispersion theory is poor at taking the time series of a real wave train measured at one point in the basin and predicting the time series that will be experienced a few wavelengths further down the basin. The effect gets worse the steeper the waves.

In steep waves, there are strong wave-wave interaction effects and other non-linear physics (e.g. wave breaking), which have a strong influence.

It would be possible to create a long 'sample' wave time series in a particular basin for the helicopter tests, but it would probably be virtually impossible to reproduce the same time series in a wave basin with a different geometry and/or a different wave-maker design.

Thus, the choice of a 'sample' time series would force all helicopter capsize model testing to be conducted in one designated wave basin. This might in itself have some benefits, but the choice of the basin is likely to be difficult and contentious.

In addition, it is far from clear how the 'sample' wave time series would be selected from the infinite number of possibilities.

comment

306 comment by: *Bell Helicopter*

Comment: Text 27.801(e) referring to the jettisoning of fuel has been removed. The jettisoning of fuel will not add to the buoyancy of the helicopter, but will likely raise the helicopter's centre of gravity (CG), reducing stability, and may also create an additional hazard to occupants.

	Recommendation: Complete agreement. This is an overdue change that removes a regulation deleterious to rotorcraft safety.
response	Noted. EASA appreciates Bell Helicopters' support for this change to the regulations.

comment	*307* comment by: *Bell Helicopter* Comments: 27.801(f) "probable pressures" is not definitive and would require consultation with oceanographers to come up with the probable pressures associated with certification to a significant wave height. It should be fairly easy to generate a table which would correlate the pressure with the significant wave height to ensure a level and clear design criteria. Recommendation: Recommend adding a table of "probable pressure" values corresponding to 6 – 8 significant wave heights.
response	Not accepted. The 'probable local pressures' will be dependent on the particular helicopter design and thus, they cannot be provided as proposed.

comment	*308* comment by: *Bell Helicopter* Comment: The requirement in 27.801(g) to add chevrons as part of a ditching configuration is not appropriate under the certification rules. Recommendation: Requirements for specific paint schemes should be included in an amendment to the operating rules. This is similar to the operating rules for markings surrounding egress points.
response	Partially accepted. It is agreed that the proposed chevron should be seen in the same light as the required markings around emergency exits. However, these latter markings are required by the certification specifications. However, other comments have been received in regard to the chevron markings and it has been agreed that the requirement for these markings will be placed in the operational rules. All reference to chevron markings has been thus removed and the issue raised by this comment is thus resolved. See the response to Comment 236.

comment	*309* comment by: *Bell Helicopter* Comment 27.801(h): Nit noid, but this actually should go into 27.1587 (or a new 27.158x) Recommendation: Move to correct Section of CS 27.
response	Accepted. See the response to Comment 4

comment	*329* comment by: *Leonardo* Auto deployment of floats is considered sensible and is already employed by many manufacturers. Auto-arm, however, may introduce additional hazards due to the possibility of inadvertent inflation at any point in the flight envelope - i.e. potentially catastrophic. It is felt that this has not been properly considered and is especially disproportionate with

	regard to Part 27 rotorcraft. Contrasting Chevrons is a paint scheme issue and seems to have little to do with certification
response	Partially accepted. 1. See the response to Comment 77. 2. It is not understood why the commenter believes that there is no safety issue for which the subject chevrons provide a mitigation. However, other comments have been received in regard to the chevron markings and it has been agreed that the requirement for these markings will be placed in the operational rules. All reference to chevron markings is thus removed.

comment	*408* comment by: *CAA-N* Probabilities of Capsize should be rounded up to perhaps 3% (or maybe even 5%/ 1/20 odds) and 30% (1/3 odds even) as the uncertainities in determining them are significant.
response	Accepted. Percentage probability figures will be rounded up to 3.0 % and 30.0 %.

CS 27.805 Flight crew emergency exits p. 24-25

comment	*9* comment by: *Aerossurance* For clarity and to ensure means of compliance are discussed only in AMC, suggest replace "shown by test, demonstration, or analysis" by "demonstrated". This assumes 'demonstrate' is a generic term, as in 'demonstrate compliance', applicable to which ever means are considered acceptable in the AMC.
response	Not accepted. EASA finds it better that the text clearly indicates that no approaches to showing compliance are considered a priori to be unacceptable.

comment	*12* comment by: *Aerossurance* Delete the unspecific adjective "rapid" or clarify a specific objective.
response	Not accepted. The intent is considered to be clear.

comment	*13* comment by: *Aerossurance* Unlike normal markings, the black and yellow markings are expected to be of use in poor visibility underwater by potentially disoriented occupants. False 'targets' could hamper a prompt escape. Consider adding: "Black and yellow markings of any type should not be used anywhere else in the cockpit where they might delay the successful location of such operating devices or other controls to be operated underwater."

response	Not accepted. Although there may be other black/yellow markings in the flight crew area (e.g. hatching to outline fire extinguisher switches, life raft/emergency flotation deployment controls, cargo hook manual jettison switches), such markings will not be close to emergency exits, and/or will be of such an appearance that they are not likely to be confused by flight crew.

comment	*67* comment by: *NHF Technical committee* Change text to include cockpit; Furthermore, the means of access to and of opening each flight crew emergency exit must be provided using conspicuous illuminated markings that illuminate automatically and are designed to remain visible with the rotorcraft capsized and the cabin *and/or cockpit* flooded.
response	Accepted. The text will be revised in line with the intent of this comment.

comment	*78* comment by: *Robinson Helicopter Company* The requirement for automatically illuminated exit markings will add significant complexity to most CS-27 rotorcraft which currently have no illuminated exit markings. Also, the requirement that the illumination function in a capsized, flooded cabin will introduce requirements for a dedicated, waterproof electrical supply and sealed connectors. For most CS-27 rotorcraft the emergency exits are the same as the normal exits and are located immediately adjacent to occupant seats. Familiarity and proximity can alleviate the need for illumination in these designs.
response	Partially accepted. After due consideration, EASA has concluded that it is perhaps too onerous for CS-27 Non-Category A rotorcraft to be required to provide automatically illuminated emergency exit markings of the nature explained in the AMC to the proposed amendment to CS 27.805(c) (commonly known as 'HEEL'). However, this was not the conclusion for rotorcraft certificated to CS-27 Category A. Furthermore, it was noted that the exit markings in the passenger cabin required by CS 27.807(a) are already required by CS 27.807(b)(3) to be such that the exit can be located in darkness. CS 27.807(d) further requires that these markings continue to function with the rotorcraft capsized and the cabin submerged. It was noted, however, that such exit markings have not been required for flight crew emergency exits. Although familiarity and proximity arguments can be used when considering flight crew emergency exits, the severe disorientation inherent in a capsize situation will also affect flight crew. Because markings that function in darkness, and when submerged, are already required for the passenger cabin, it was concluded that no argument of excess complexity could be made against similar markings being provided for the flight crew emergency exits because the waterproof electrical supply, for instance, could relatively simply be extended to the flight crew exits. CS 27.805(b) has been therefore amended to require flight crew emergency exits be 'marked so as to be readily located and operated even in darkness' in order to align with CS 27.807(b)(3), and CS 27.805(c) is amended to require these markings 'to remain visible if the rotorcraft is capsized and the cockpit is submerged', in order to bring flight crew emergency exit markings into line with the existing requirements for markings in the

passenger cabin.
The text requiring 'conspicuous illuminated markings' (i.e. intended to require the more conspicuous 'HEEL' type markings) has been removed from CS 27.805(c)
For consistency, and as requested by Comment 79, the same text has also been removed from the new CS 27.807(d)(4), which previously required the 'HEEL' lighting for the passenger cabin.
The higher level of illuminated markings will however still be required for CS-27 Category A types, via Appendix A.
It is to be noted that if only emergency flotation is desired, no underwater illumination capability will be required, because the above referenced paragraphs are only applicable if 'certification with ditching provisions' is requested.

comment

205 comment by: *UK CAA*

Page No: 24 & 25

Paragraph No: CS 27.805 Flight crew emergency exits (c)

Comment:

The CS should require that flight crew emergency exit operating devices must be accessible with inertia reel seat belts locked.

Justification:

The exit will not fulfil its purpose if the flight crew member cannot reach the operating device. It is possible for inertia reel seat belts to lock in an accident (e.g. G-WNSB), restricting the movement of the flight crew member.

Proposed Text:

Add to the existing text as follows (new text underlined):

"… The operating device for each ditching emergency exit (pull tab(s), operating handle, etc.) must be marked with black and yellow stripes, and must be accessible with the flight crew member's seat belts locked."

response

Partially accepted.
On investigation, EASA did not find evidence that seat belt inertia reel locking had been an adverse safety issue in the accident quoted by the commenter. Furthermore, no other evidence of the problem suggested in this comment could be found.
However, EASA agrees that the general point raised, i.e. accessibility to exit operating devices whilst seated, is an important issue. It is agreed that CS 27.805(c) will be amended to specify that the accessibility must be shown for the range of flight crew anthropometric dimensions and for all possible post-crash conditions of crashworthy seats.

comment

237 comment by: *FAA*

CS 27.805(c)	Proposed language does not address designs with no operating	Replace the final sentence with "Operational marking for each ditching

	device, such as simple pushout window with no pull tab.	emergency exit must consist of black and yellow contrasting colors."

response

Partially accepted.
CS 27.805(c) has been amended in order to cover designs with no 'operational device' but the requirement that the black and yellow markings be in the form of stripes has been retained in the interests of a consistent marking philosophy, irrespective of the detailed design of the emergency exit.

comment *310* comment by: *Bell Helicopter*

Comment: The requirement for Flight Crew Exits is not clear
Recommendation: Provide clarity to the requirement

response

Noted.
This comment provides no indication of how the clarity of the subject requirement might be improved.

comment *363* comment by: *Leonardo*

It is not clear how to demonstrate this for jettisonable doors or windows above a certain size due to water pressure

response

Noted.
It is assumed the commenter means that, for some designs, it might not be clear how substantiation can be provided for rapid operation underwater, bearing in mind the effects of water pressure.
This is understood. However, it is the responsibility of the applicant to substantiate that their design is suitable for its intended purpose.

comment *409* comment by: *CAA-N*

Requirement for marking by black and yellow stripes may be too prescriptive. It could be argued that other combinations may be just as visible. It should be reworded to required combinations that are visible and conspicuous under water. This comment is applicable for all "Black and Yellow" requirements. AMC may specify "Black and Yellow" markings.

response

Not accepted.
EASA believes that standardisation, as far as is practicable, should be sought in regard to emergency exit interfaces with the user. In the light of this, the arguably prescriptive requirement for black and yellow striped markings is considered to be justified.

CS 27.807 Passenger emergency exits p. 25-26

comment	*43* comment by: *Aerossurance* In (b)(1) add at the end "as a minimum".
response	Not accepted. It is not understood how the proposed addition would improve the meaning or clarity of the sentence.

comment	*44* comment by: *Aerossurance* (c), as means of compliance, should be covered by the AMC and directly linked to (a) or (b) as required.
response	Not accepted. This subparagraph has not been amended. The subparagraph is considered to have the valuable purpose of clarifying that the proper functioning of an emergency exit cannot be fully shown without performing tests.

comment	*45* comment by: *Aerossurance* 27.807(d)(4) includes the expression "means of access to it". This appears to imply lighting the route to the exit. Suggest considering if this is necessary in Part 27 helicopters but if so the AMC is should be expanded to cover this feature.
response	Partially accepted. The requirement to illuminate the means of access to the exit could be questioned in the case of a CS-27 type. However, this text has been deleted for other reasons (see the response to Comment 78) and so the issue is resolved.

comment	*68* comment by: *NHF Technical committee* Type and operation. Add bulletpoint: 5. Be possible to open by hand, even if there are differensial pressure acting on the emergency exit.
response	Not accepted. The load created by differential water pressure on an emergency exit, during and after capsizing of a helicopter, would in some conditions be of a magnitude infeasible to be a design case for the opening of the exit. However, the conditions for the highest differential loading on the exit will be those where some air remains at that location. This will provide a compensating factor for the issue raised by the comment. However, this comment has highlighted another aspect of emergency exit usage in a ditching situation. Some offshore helicopter operators and/or training organisations have instructed passengers to open emergency exits, as a matter of course, immediately after a ditching, even if the exits in question are not likely to be used during life raft boarding from a helicopter remaining upright. This instruction has been given in order to provide for the best prospect of underwater escape should the helicopter unexpectedly capsize during life raft boarding. After consideration, it is decided that the AMC text will be added to highlight the advisability of including this training element in the manufacturer's documentation provided to the operator.

comment

79 comment by: *Robinson Helicopter Company*

As with CS 27.805, the requirement for illuminated markings may be prohibitive and unnecessary on small, CS-27 rotorcraft with cabin layouts similar to standard automobile interiors.

response

Partially accepted.
See the response to Comment 78.

comment

238 comment by: *FAA*

CS 27.807(d)(2)	Using "Optimized" in the language is difficult to certify. Use the word "designed"	Change "optimised" to "designed"
CS 27.807(d)(4)	This is intended to mandate HEELS type lighting. The rule should require backlighting, and be more specific to what "illuminated markings" means.	
CS 27.807(d)(5)	Proposed language does not address designs with no operating device, such as simple pushout window with no pull tab. ?? Add to 27.805 as well.	Reword to "(5) Operational marking for each ditching emergency exit must consist of black and yellow contrasting colors."

response

1. Accepted. The change will be made as proposed.
2. Not accepted. It is to be noted that the text pertaining to 'HEEL' type lighting has been removed (see the response to Comment 78) and so the comment is no longer applicable.
3. Partially accepted (see the reply to Comment 237). The same amendment as that made to CS 27.805(c) has been made to CS 27.807(d)(5).

comment

280 comment by: *Argentina Air line Pilot Association*

CS 27.807 Passenger emergency exits (a) (3) has same information than (d); then (a) (3) should be deleted to repeat information unnecessary.

response

Not accepted.
When approval with emergency flotation (rather than with ditching provisions) is desired, there is a need for a CS-27 requirement that a least one emergency exit on each side of the fuselage is useable and unaffected by the emergency flotation system. CS 27.807(a)(3) serves this purpose. CS 27.807(d) is only applicable for helicopters certificated with ditching provisions.

comment

311 comment by: *Bell Helicopter*

	Comment: The provision in 27.807(a)(3) for ditching emergency exits to be completely above the waterline has been removed. Recommendation: Agreement. Rotorcraft with "wet floors" do not need emergency exits to be completely above the waterline, since the water level inside the cabin might be at the same level as outside.
response	Noted. EASA appreciates Bell helicopters' support for this change.

comment	*312* comment by: *Bell Helicopter* Comment: The requirement in 27.807(d) Passenger Emergency Exits is unclear Recommendation: Need to establish a position
response	Noted. This comment provides no indication of how the subject requirement might be improved in clarity.

comment	*313* comment by: *Bell Helicopter* Comment: 27.807(d) Passenger emergency exits requirement means max 4 abreast seating in the cabin. Recommendation: Be less prescriptive in the requirement
response	Not accepted. It is the intention that, broadly speaking, "5 plus abreast" seating layouts should be prohibited in the future. As explained in the AMC text, it is intended that no passenger should be in a worse position than the second one to escape from a capsized helicopter.

comment	*314* comment by: *Bell Helicopter* Comment: In 27.807(d)(2 the word "optimized" is too subjective Recommendation: Change to: "Ditching emergency exits, including their means of operation, markings, lighting and accessibility, must be designed for use in a flooded and/or capsized cabin."
response	Accepted. Change will be made as proposed.

comment	*365* comment by: *Leonardo* (d) (2) Delete "The design of" and change "optimised" to "designed for"
response	Accepted. Change will be made as proposed.

CS 27.1411 General p. 26

comment	*281* comment by: *Argentina Air line Pilot Association*

	CS 27.1411 General. To avoid confusion or inaplicability regulations, I suggest to modify this text as follow: "Required safety equipment to be used by the crew in an emergency, must be accessible." The short size of rotorcraft inside CS 27 (small chopper than 7.000 lbs) avoid take on board any stowage for emergency equipment.
response	Not accepted. The change to this paragraph is only to remove the references to ditching related equipment (flares and life raft release controls) in order to be more consistent, i.e. the title of CS 27.1411 is 'General', whereas 'Ditching equipment' should be covered by CS 27.1415. To change the overall message of CS 27.1411(a), i.e. the deletion of 'readily', would be beyond the scope of the RMT.120.

CS 27.1415 Ditching equipment p. 26-27

comment	*69* comment by: *NHF Technical committee* NHF fully support this paragraph, as it already is a customer requirement by the major oil and gas producers in Norway. (Norwegian oil and Gas guideline 066). Deployment handle for liferaft when helicopter is in the capsized position is a very important improvement, as the passengers will not be able to deploy liferaft in any other ways, without diving below the helicopter.
response	Noted. EASA appreciates the NHF Technical committee support for this change.

comment	*80* comment by: *Robinson Helicopter Company* The requirement to provide life raft deployment controls for both cabin occupants and survivors in the water for a capsized rotorcraft will add significant complexity to small CS-27 rotorcraft (both internal cabin and exterior fuselage controls would be required).
response	Not accepted. EASA does not see how for small CS-27 rotorcraft, it can be argued that a reduced ability to deploy life rafts can be defended. In the context of new helicopter designs, it will be feasible to design for multiple controls, without excessive complexity.

comment	*172* comment by: *Zodiac Evacuation Systems division - France* CS27.1415 (a) How do we link ditching level of the helicopter with the existing ETSO of the life rafts and life suit ? - In CS 2C505 : the wave height and wind are already defined in the ETSO - In CS 2C504 : there is no sea condition definition. recommandation : Clarify the requirement
response	Accepted. Life rafts are the only category of ditching equipment for which there are different design

standards in regard to sea condition substantiation (i.e. ETSO C70b vs. ETSO 2C505). The text of CS 27.1415, and the associated AMC, is thus revised to recognise this.
There are no such differing standards for immersion suits.

comment

239 comment by: *FAA*

CS 27.1415(c)	It is understood that the word "demonstrated" as used, could consist of physical demonstrations, analysis, or a combination of both.	Add clarification of the requirement in the AMC

response

Accepted.
In order to avoid the potential for confusion regarding the meaning of 'demonstrate', all such references have been changed to 'substantiate' where it is intended that analysis is acceptable.

comment

282 comment by: *Argentina Air line Pilot Association*

CS 27.1415 Ditching equipment
(a) delete "Ditching equipment" because of is under same title.
(b) "Life preservers are stowed..." that is impossible. We are speaking about small rotorcraft without places or lockers to stowed neigther life preservers nor anithing. I suggest delete (b).

response

Not accepted.
1. Although this comment has some validity, making the change as proposed would create some rather awkward wording, without real improvement.
2. The commenter is incorrect to suggest that no CS-27 type helicopters have stowage provisions for life preservers. Where operational rules allow, life preservers do not need to be worn at all times, and they are then stowed in locations such as below seats.

comment

283 comment by: *Argentina Air line Pilot Association*

CS 27.1415 (c) I suggest to change "...life raft, can be reliably deployed with the rotorcraft in any reasonably foreseeable floating attitude, include capsized, and in the sea conditions chosen for showing compliance with CS 27.801 (e)." for "...life raft."
Remainder text is unnecessary repetitive.

response

Not accepted.
The comment regarding repetition is not understood.
The paragraph firstly covers the reachability of the operating handles, considering all floating attitudes, and secondly covers the ability of the raft itself to deploy, considering floating attitudes and the additional dynamic conditions created by movement of the rotorcraft in the relevant sea conditions and the effects of wind, waves, etc.

comment

284 comment by: *Argentina Air line Pilot Association*

	CS 27.11415 Ditching equipment. This article also speak about short and long retaining line as in 2.4 Definitions. Obviously, in my sight, this one has same mistakes, and should be modified in a same way (Cmt#279). More than this, in this article, speak about long retaining lines that "... must be weak enough to break before submerging the EMPTY life raft to which attached". If release system to avoid life raft to sink is only based in retaining line 'weak enough', that kind of line will not able to joint raft and keep together waiting help.
response	Not accepted. See the response to Comment 279.

comment	*315* comment by: *Bell Helicopter* Comment: Operating regulation has been specified. Recommendation: Change to refer to “operating rules” and not the specific regulation.
response	Accepted. All references to ‘Regulation (EU) No 965/2012’ are replaced with ‘the applicable operating rule’.

comment	*316* comment by: *Bell Helicopter* Comment: Requirement in 27.1415(b) is very prescriptive and will limit designs that have other means to ensure life rafts are deployed after water entry (i.e. automatic life raft deployment) Recommendation: Requirement should be rewritten to consider other possibilities for the deployment of life rafts.
response	Partially accepted. It is assumed that the commenter is referring to CS 27.1415(c). There is no text in CS 27.1415(c) that prohibits an automatic life raft deployment design. However, it is EASA’s position that manual remote controls should be provided in every case. Manual deployment should be provided to cater for the case of failure of the automatic deployment features. However, the associated AMC text is revised to clarify that automatic life raft deployment will be acceptable in addition to manual deployment, but not instead of it.

comment	*317* comment by: *Bell Helicopter* Comment: In 27.1415(c) it is unclear if a physical demonstration is being requested. Recommendation: Text should be revised to clarify the intent. The regulation should only identify the requirement to have a system that will ensure life rafts are deployed in any sea condition either automatically or manually by all occupants and not have an adjective to suggest a specific means to demonstrate compliance.
response	Accepted. In order to remove the impression that a physical demonstration will always be required, the term “demonstrated” has been replaced with ‘substantiated’. See also the response to Comment 239.

comment	*318* comment by: *Bell Helicopter* Comment: Just a subtle point, but I struggled with how to set the break strength of the lines – they must be strong enough to not break in rough weather (seas and winds), yet weak enough to break if the helicopter sinks. I asked this question during the WG meetings, but never received an answer. And, given that per the NPA the helicopter can't sink with it's most critical "float unit" removed, why do we need to have it break if the helicopter sinks? Recommendation: Remove the requirement for the rope to break if the helicopter sinks, or provide some other specific criteria which identifies how this can be shown.
response	Not accepted. This is a concept that has been in CS-27, and other airworthiness codes, for many years (Ref. CS 27.1415(c)) and EASA is not aware of any associated problems in showing compliance or in actual ditching situations. The requirement is also set in the life raft ETSOs. The breaking load of the line or its attachment can be designed to a relatively high value (thus ensuring the raft is held to the helicopter securely) because the release load only needs to be less than that required to draw the raft (which has a high buoyancy) dangerously low in the water. Although helicopter ditchings, in which the emergency flotation system inflates, rarely result in a sinking, it is considered a sensible design precaution to have the raft release, without needing intervention from the survivors, should that happen.

comment	*366* comment by: *Leonardo* Remote raft deployment (from cockpit / cabin or outside the aircraft) reliably and with the helicopter in any attitude - It must be demonstrated" suggests a physical demonstration. Wording should be clarified to ensure that this can be "shown by design / inspection / analysis
response	Accepted. See the response to Comment 239.

CS 27.1470 Emergency locator transmitter p. 27

comment	*63* comment by: *Aerossurance* For total clarity, change "including crash sensors" to "including impact and water immersion sensors".
response	Partially accepted. It is accepted that the term 'crash sensor' is too limiting. However, in order to cover all types of possible sensor choice, just the word 'crash' will be deleted.

comment	*319* comment by: *Bell Helicopter* Comment: Operating regulation has been specified. Recommendation: Change to refer to 'operating rules' and not the specific regulation.
response	Accepted. See the response to Comment 315.

CS 27.1561 Safety equipment p. 27-28

comment

285 comment by: *Argentina Air line Pilot Association*

10. Amend CS 27.1561 as follows:
CS 27.1561 Safety equipment
(c) and (d) are includes in (a) and (b). I suggest to delete (c) and (d).

response

Partially accepted.
The revisions to CS 27.1561 were made in order to align it with CS 29.1561, because in regard to marking of safety equipment, no justification for a difference between the two codes could be seen. The more expansive wording of CS-29 was taken as a basis, which led to the addition of subparagraphs (c) and (d) to CS 27.1561. Some other small editorial changes were made, with CS 27.1561 and CS 29.1561 then becoming identical.
It is not agreed that the two new subparagraphs add no additional meaning.
However, upon reviewing the text again, it was noticed that subparagraph (d) could be questioned. Namely, the meaning of 'survival equipment' as opposed to 'safety equipment', is not clear, the marking for identification should apply to all equipment anyway, and the difference between 'operating instructions' and identification for 'method of operation' is not understood.
Combination of all of these concepts into a single subparagraph (c) is therefore considered to be appropriate, and this change will be made.

Appendix C — Criteria for Category A p. 28

comment

240 comment by: *FAA*

Appendix C	Under "If certification of an emergency flotation system alone is requested by the applicant, the following provisions of CS 29 must also be met in addition to the ones of this CS:" should be moved to 27.801 and only include a subset of CS 27.801 requirements. This is due to the fact that an emergency flotation system alone does not meet the full ditching requirements of CS 27.801 and apply to all emergency floation systems, not just in Cat A.	Move to CS 27.801(k) as "(k) If certification of an emergency flotation system alone is requested by the applicant, sub-paragraph (c), (e), (f), and (h) apply."

response

Partially accepted.
The commenter raises a valid point. After consideration, it was decided to create a new paragraph, CS 27.802, to cover emergency flotation.

comment

322 comment by: *Bell Helicopter*

Comment: Adding the requirements from CS29 for ditching is not appropriate for CS27 Category A. If the intent is to cover North Sea wind farms, the operating rules for these

	types of operations should dictate what level of safety is expected rather than having the aircraft standards dictate the requirements. This change has the potential to eliminate CS27 Category A aircraft from obtaining ditching certification due to the feasibility of meeting these requirements in a small rotorcraft. The additional weight penalties associated with meeting these requirements are not sustainable for aircraft which are already weight restricted. The Category A requirements of CS 27 are intended to provide for engine isolation and single engine performance. They are not used to increase the level of safety for all aspects. If operators desire a higher level of safety they have the option to purchase CS29 rotorcraft for these types of operations. Recommendation: The level of safety of CS27 is not the same as CS29 (even for Category A). Remove the CS29 ditching requirements from CS27 Appendix C or consider removing the weight limit for CS27.
response	Not accepted. The CS-29 requirements chosen for applicability to CS-27 Cat A helicopters have been revised relative to the NPA proposals, and are considered appropriate. (See the response to Comment 288).

comment	*337* comment by: *Leonardo* Despite early egress and model feasibility studies which demonstrated the principle, the integration issues around the air pocket concept remain unproven and have not been formally demonstrated by any OEM. Only one float manufacturer seems to be attempting this (One Atmosphere - Australia), while other flotation system suppliers appear to remain unconvinced of the practicality. The intended benefits appear overstated, meanwhile it is clear that fuselage designs to accommodate such a system and meet the rules may need to be significantly different in future (size, height, seating capacity etc). This will have a particularly disproportionate impact on Part27 Cat A designs. It is considered that if the perceived benefits are significant then the requirement should be market driven - i.e. specified by the operators in future contracts.
response	Noted. See the response to Comment 345.

3.2.2. Draft amendment to CS-27 — Book 2, AMC 27.563 Structural ditching provisions p. 28-30

comment	*5* comment by: *Luftfahrt-Bundesamt* 5) page 28 and subsequent: "Introduction of AMC 27.xxx" CS-27 Book 2 refers to FAA AC 27-1B Change 2 and states that the following AMC 27 changes/adds the FAA AC. The AMC.351 and AMC 27.865 explain in the "introduction" section that the AMC "gives further guidance" or that it is an addition. The new AMC doesn't explain the status. Is it the only AMC? Does this AMC overwrite or amend the FAA AC? Is it still allowed to use the FAA AC instead of the AMC? There isn't any introduction section in any AMC Section and therefore no status explanation - only in some.
response	Accepted.

	The NPA was in error because it did not provide any indication in some cases as to whether the AMC text was intended to supplement or replace the corresponding FAA AC text. This has been corrected.
comment	*206* comment by: *UK CAA* **Page No:** 28 **Paragraph No:** AMC 27.563 Structural Ditching Provisions (a)(1)(ii) **Comment:** The descriptions of the horizontal and vertical velocities are not entirely clear. **Justification:** It was agreed in RMT.0120 that it would no longer be necessary to take account of water particle velocity. The definitions of horizontal and vertical velocities need to correctly reflect this. Note that this is also to ensure consistency with AMC 27.801 (c)(5)(i) & (ii) on page 34. **Proposed Text:** Modify the existing text as follows (new text underlined, deleted text ~~struck through~~): (ii) The ground speed~~velocity relative to the wave surface~~ should be in a range of 0–56 km/h (30 kt) with a ~~vertical~~ descent rate of not less than 1.5 m/s (5 ft/s) ~~relative to the mean wave surface~~. No account need be taken of the wave particle velocity.
response	Partially accepted. Both the requirement CS 27.563 and its associated AMC have been revised extensively following various comments received. The new texts provide better clarification in regard to the velocities to be considered when showing compliance with the structural ditching provisions, and it is believed that the concern raised by this comment has been addressed.
comment	*207* comment by: *UK CAA* **Page No:** 29 **Paragraph No:** AMC 27.563 Structural Ditching Provisions (b)(3)(i) & (iv) **Comment:** The descriptions of the horizontal and vertical velocities are not entirely clear. **Justification:** It was agreed in RMT.0120 that it would no longer be necessary to take account of water particle velocity. The definitions of horizontal and vertical velocities need to correctly reflect this. Note that this is also to ensure consistency with AMC 27.801 (c)(5)(i) & (ii) on page 34.

Proposed Text:

Modify the existing text as follows (new text underlined, deleted text ~~struck through~~):

(i) ~~forward velocities~~ ground speed of 0–56 km/h (30 kt) ~~relative to the mean wave surface~~;

(iv) ~~vertical~~ descent rate ~~velocity~~ of 1.5 m/s (5 ft/s) or greater ~~relative to the mean wave surface~~.

response

Partially accepted.
See the response to Comment 206.

comment

241 comment by: *FAA*

AMC 27.563 (a)(1)(ii)	The concept of wave particle velocity does not clarify analysis requirements. This is a test demonstration, and the airspeed and descent speed are what matters	Remove "No account need be taken of the wave particle velocity."

response

Accepted.
This sentence has been removed.

comment

268 comment by: *AIRBUS HELICOPTERS*

See our comment n° 265 on CS 29.563 (a).

response

Accepted.
See the response to Comment 265.

comment

323 comment by: *Bell Helicopter*

Comment: AMC material usually adds clarity to terms used in the regulations. This does not. The use of descriptors used in “most critical wave”, “probable sea condition”, and “likely pitch, roll and yaw attitudes” are not sufficiently specific with respect to irregular wave spectrums. As discussed previously, how is the most critical wave defined (i.e. rogue wave)? Same applies to probable sea conditions, and likely attitudes.

Recommendation: Recommend clarifying (quantifying) the descriptors used in the AMC.

response

Accepted.
See the response to Comment 206.

AMC 27.801 — Ditching p. 30-36

comment

71 comment by: *NHF Technical committee*

AMC 27.801

(b) Explanation
Comment to point (6): Still the system must be designed to prevent unintentional deployment during flight. Either by crew or by technical system failure.
Unitentional deployment of EFS should never in any phase of flight endanger flight safety. (EFS folding into rotor, engines etc.)

response

Not accepted.
It is not agreed that inadvertent deployment at high speed must necessarily be shown to be safe. However, the required system safety assessment of the EFS design must substantiate that inadvertent deployment, at any speed, is appropriately unlikely.

comment

72 comment by: *NHF Technical committee*

AMC 27.801
(c) Procedures
Comment to item (2) (iii): EFS should by design never endager flight safety, even with unintentional deployment.

AMC 27.801
(c) Procedures
Addition of text to item (2) (viii): Special caution must be made to prevent puncture of floats, either in flight or in the sea, from other sharp objects, such as antennas, scoops, doors, handles or other items installed near the floats.

response

Not accepted/Accepted.
In regard to paragraph (c)(2)(iii), see the response to Comment 71.
In regard to paragraph (c)(2)(viii), text broadly as proposed is added.

comment

73 comment by: *NHF Technical committee*

AMC 27.801
(c) Procedures
Comment to item 5: NHF welcomes real test, and not only theoretical calculations.

response

Noted.
EASA appreciates NHF's support for this part of the AMC.

comment

105 comment by: *Aerossurance*

In AMC 2x.801(a)(1) replace abandoning with evacuating (or 'egressing') for consistency with other text.

response

Not accepted.
EASA understands the point made by this comment. However, this choice of text is a long standing part of the definition and no real advantage is seen in its revision.

comment

106 comment by: *Aerossurance*

In AMC 2x.801(a)(2) amend the description of the EFS to be more expansive and non-exclusive:

	(e.g. gas cylinders, gas generators, sensors, controls, means of deployment, pipework and electrical connections)
response	Partially accepted. The addition of 'e.g.' at the beginning of the list of example items constituting the EFS is agreed to be a desirable change for the reasons given in the comment. However, expansion of the list is not agreed as being required.

comment	*107* comment by: *Aerossurance* Change last sentence of 2x.801(a)(2) to be more encompassing (for example to capture designs that use internal or integral buoyancy features): The EFS includes any additional floats or other features which provide a flotation function following capsize.
response	Partially accepted. The intent of the proposed change is agreed. However, the sentence in question has been removed anyway, as a consequence of other comments received.

comment	*108* comment by: *Aerossurance* The exact intent and possible value AMC 2x.801(b)(7) is unclear (configuration management of the build standard or standards to be certified is a normal and integral certification activity).
response	Accepted. The paragraph has been deleted.

comment	*112* comment by: *Aerossurance* It would be undesirable for endless wave climate studies to be required for each new offshore exploration campaign. NNS wave climate was selected as a default, reasonable worst case wave climate. For clarity, either in 2x.801(b)(8) reference the clearer explanation in AMC 2x.801(e)(a)(2) or replace 'also select alternative/additional sea areas' with 'may select less conservative wave climates as an alternative or addition'. This wording would more clearly allow both less demanding conditions (but with geographic restrictions) if the applicant was minded to restrict their product or additional geographically limited conditions to be added (with more relevant local performance data).
response	Not accepted. It is considered that the current text conveys the intent clearly enough.

comment	*114* comment by: *Aerossurance* In AMC 2x.801(b)(12) remove the words "although this was inconclusive in previous research". While past research can help inform designers, the success or failure of past research projects is not directly relevant to the potential compliance and performance of a future design. This text has the unintended consequence of potentially discouraging future

	safety enhancing innovation.
response	Accepted. The text in question has been deleted.

comment	*120* comment by: *Aerossurance* It is suggested that further text is necessary to clarify the difference between AMC 2x.801(c)(ii)(B) and (C) (which seems to deal with partial deployment).
response	Not accepted. It is assumed that the comment is in relation to paragraph 2x.801(c)(1)(ii)(B) and (C). It is considered sufficiently clear that (B) refers to the condition of fully inflated floats, and (C) refers to the transient condition during inflation.

comment	*123* comment by: *Aerossurance* AMC 2x.801(c)(1)(iii)(B) contains both the terms 'normal' and 'excessive'. Suggest both should be 'normal' for consistency.
response	Accepted. The intent of the proposed change has been achieved, by simply deleting the word ‘excessive’.

comment	*125* comment by: *Aerossurance* AMC27.801(c)(4) makes references to 'establishing' multiple procedures but it is not immediately evident which provision requires their promulgation (perhaps 27.801(h), although that does not explicitly reference procedures per se).
response	Not accepted. It is considered obvious that this section discusses procedures that must be provided for insertion in the RFM.

comment	*128* comment by: *Aerossurance* It is suggested that AMC27.801(c)(5)(iii) is expanded to clarify what effects of the damage are being 'considered' and why.
response	Not accepted. The effects to be considered will be obvious when the particular probable damage for the helicopter in question is determined. However, after consideration, it was found appropriate to delete ‘tail boom’ from the list of examples.

comment	*174* comment by: *Zodiac Evacuation Systems division - France* AMC27.801 (b) (12) How is the mean level of water defined (a mean of all water lines or a mean for each water line)?

	Is the water level applicable for float punctured compartement scenario? recommandation : Clarify the requirement
response	Accepted. Clarification of the intent has been provided.

comment	*176* comment by: *Zodiac Evacuation Systems division - France* AMC27.801 (C) (7) The requirement is too subjective. Who will decide when a demonstration is required and for what reasons would a demonstration be required? recommandation : Clarify the requirement to better explain when a test is needed in order to ensure a level playing field.
response	Not accepted. It is to be noted that this text has been taken from the pre-existing FAA AC 27-1B. By the nature of the issue, it is not considered feasible to define when a demonstration will be required.

comment	*208* comment by: *UK CAA* **Page No:** 31 **Paragraph No:** AMC 27.801 Ditching (b)(9) **Comment:** Certification by comparison with a similar rotorcraft type should only be permitted where the comparison rotorcraft has been certificated using the new test procedure detailed in AMC 27.801(e). **Justification:** The current test procedures have been discredited and no further credit should be taken for any results so obtained. **Proposed Text:** Modify the existing text as follows (new text underlined, deleted text ~~struck through~~): (9) Tests with a scale model of the appropriate ditching configuration should be conducted in a wave tank to demonstrate satisfactory water entry and flotation stability characteristics. Appropriate allowances should be made for probable structural damage and leakage. Previous model tests and other data from rotorcraft of similar configurations that have already been substantiated based on ~~equivalent~~ test conditions equivalent to AMC 27.801(e) may be used to satisfy the ditching provisions.

response

Partially accepted.
The text has been modified to clarify that in the case of flotation stability, any previous test data should have been performed using test conditions equivalent to those of AMC 27.801(e).

comment

242 comment by: *FAA*

AMC 27.801(b)(10)	The 2/3 lift language was left in the rule.	Remove "(10) CS-27 Amendment X removes a potential source of confusion and simplifies the tests necessary for showing compliance with CS 27.801(d), by removing the reference to two-thirds lifts."
AMC 27.801(b)(14)(ii)	Discussion of final configurations must be shown to be compliant to ditching requirements.	Replace "...should be reviewed after…" with "…should be shown to be compliant after …"

response

1. Accepted. However, it is to be noted that the reference to two-thirds lift was to be found in AC 27-1B, not the CS-27 rule.
2. Accepted. The proposed text is an improvement.

comment

286 comment by: *Argentina Air line Pilot Association*

AMC 27.801
Ditching
(a) Definitions
(1) must be identical with "Ditching" definition in 2.4 in which you use "practicable" instead "practical" now.
(2) must be identical with "Emergency flotation system (EFS)" definition in 2.4, in which you use "...which only have a function following capsize." instead "... which provide a function only following capsize."

If anyone may have small differences, as the time goes up, we are going to find absolutely different definitions suddenly.

response

Accepted.
The change proposed for (a)(1) has been made.
The change proposed for (a)(2) is no longer necessary because the sentence has been removed due to there no longer being a requirement that might lead to additional floats being installed. (See the response to Comment 345).

comment

287 comment by: *Argentina Air line Pilot Association*

CS 27.801 Ditching
.
..

(c) Procedures
(1) 'Flotation system design' **is not a procedure.**
(2) 'Flotation system inflation': (i) to (viii) **are all design, not procedure.**
(3) 'Injury prevention during and following water entry': **is not a procedure; is a risk assessment.**
(4) 'Water entry conditions and procedures': Test to discover better angle to ditch, in calm sea or in the most severe sea condition. **It´s not a procedure, but test.**
(5) 'Water entry test': another test to discover behavoir and capability of rotorcraft to remain upright, and so on. TEST AGAIN. On the other hand: **this test is with or without EFS installed?**

response

Not accepted.
The use of the term 'procedure' in the context of a sub-heading in AMC text is established from FAA AC-1B, and has also been used for the AMC. This is different from a procedure used in the operation of the helicopter. This is not considered to constitute a risk of confusion by applicants for design approval with ditching or emergency flotation provisions.
In regard to the last point raised, water entry testing should be performed in the intended rotorcraft configuration.

comment

324 comment by: *Bell Helicopter*

Comment 27.801(a)(1): Deletion of "The rotorcraft is assumed to be intact prior to water entry with all controls and essential systems, except engines, functioning properly" from the existing ditching definition would suggest you could not assume this. If the aircraft was not intact with all essential systems functioning properly, then the result would likely be a water impact.

Recommendation: Delete this phrase from ditching definition.

response

Partially accepted.
The point raised by this comment is accepted, although the proposed change is not (it is assumed the comment meant the re-instatement of the subject phrase).
The definition will instead be revised as follows (deleted text shown as strikethrough, new text in italic) – 'Ditching: a~~n~~ *controlled* emergency landing …..'

comment

325 comment by: *Bell Helicopter*

Comment AMC 27.801(b)(4): This suggests that ditching needs to include transmission failures, lightning strikes etc. You can not design – show successful ditching following these type failures / occurrences.
Recommendation: Clarification on the desired intent.

response

Accepted.
The subject text ('(e.g. engine ….. strike etc.)') has been deleted.

comment

326 comment by: *Bell Helicopter*

Comment AMC 27.801(b)(12): The phrase "This is permissible, provided that the mean level of water in the cabin is limited to below seat cushion height" would appear inconsistent with the side floating concepts being put forward.

	Recommendation: Delete phrase, or re-word to be consistent with other proposed floating solutions.
response	Not accepted. This section is concerned with the helicopter floating upright, post ditching, not capsized.

comment	*327* comment by: *Bell Helicopter* Comment AMC 27.801(b)(13): Phrase "and are expected to become an operational limitation on normal operations" does not belong in the regulations. Suggesting an operational limitation in the design requirements is not appropriate. Recommendation: Delete phrase
response	Accepted. The referenced text has been deleted.

comment	*328* comment by: *Bell Helicopter* Comment AMC 27.801(c)(2)(ii): The material provides criteria for manual inflation. Is this in disagreement with the requirement for auto inflation? Recommendation: Provide clarification of the intent
response	Not accepted. There is no intention to prohibit a manual means of inflation, in addition to the required automatic inflation.

comment	*330* comment by: *Bell Helicopter* Comment AMC 27.801(c)(2)(iii) : The guidance states must automatically de-arm for conditions where inadvertent inflation has not been shown to be non hazardous using parameters such as height and speed. For flight over land, these parameters will not be enough (i.e. Cat A departures / arrivals, H-V demonstrations etc.). Recommendation: Provide clarification of the intent
response	Not accepted. The intent of this subparagraph is to cover the general issue created by many current inflation systems, namely that they should achieve acceptable safety by means of a manual 'arm/disarm' feature. It is made clear that this will not be accepted for new designs. It is considered that the point raised in regard to Cat A departures, arrivals, H-V demonstrations etc. will be sufficiently clear to an applicant, in any case, without the need for further clarification, and that this raises no contradiction with the text as written.

comment	*331* comment by: *Bell Helicopter* Comment AMC 27.801(c)(4&5): See comments on Regulation for water entry testing Recommendation: Provide clarification of the intent
response	Accepted. See the response to Comment 269.

comment	*332* comment by: *Bell Helicopter* Comment AMC 27.801(c)(9)(iv): Providing information in the RFM on attitude, speed etc is OK, but wave position does not belong in the RFM. This could get folks in trouble. Recommendation: Delete wave position
response	Accepted. The referenced text has been deleted.

comment	*339* comment by: *Leonardo* Additional regulations for Cat A "ditching equipped" helicopter inserted. - particularly relating to certification of an emergency flotation system alone MG10 is replaced by more onerous requirements of CS27.801 (b) to (h) for non - Category A and CS29.801 (b) to (j) for Category A. This means both Cat A and non Cat A types with EFS only will need to be tested for water entry behaviour and need to conform to the new flotation seaworthiness test requirements in irregular waves. Cat A aircraft with EFS only will additionally need to be able to demonstrate a "breath hold" mitigation iaw CS29.801 and also not sink following loss of a complete flotation unit. The new requirements are disproportionate for Part 27 rotorcraft, not recognising the limitations and needs of the small helicopter manufacturers and operators. Safety in casual overwater operations may be reduced due to owners choosing to operate non EFS fitted aircraft. Overall it is strongly considered that all the changes are heavily tailored to commercial overwater operations and are disproportionate for the normal Part 27 type of operation fied by the operators in future contracts.
response	Noted. The commenter makes no proposals for change. However, it is to be noted that other comments received have led to an appreciable revision in regard to the requirements for CS-27 types with only approval for emergency flotation. The only requirements, for both non-Category A and Category A approval, are that the emergency floats and their attachments must meet the structural requirements of CS 27.563 (i.e. not the rotorcraft itself) and that the seakeeping performance of the helicopter must be tested to the irregular wave test specification, but with a higher acceptable capsize probability of 10.0 % (3.0 % for ditching).

AMC 27.801(e) — Model test method for post-ditching flotation stability p. 36-47

comment	*74* comment by: *NHF Technical committee* AMC 27.801(e) Model test method for post-ditching flotation stability (a) Explanation Comment to item (6) second paragraph: If additional emergency flotation units are fitted higher up on the fuselage, there must at least be a double safety feature, preventing unintentional deployment during flight.

response

Noted.
The commenter is correct in pointing out that the fitment of flotation units higher on the fuselage requires the effects of inadvertent in-flight inflation to be carefully considered and mitigated. The acceptance of a particular system architecture will be subject, amongst other things, to the generation of an acceptable system safety assessment. See also the response to Comment 71.

comment

81 comment by: *Robinson Helicopter Company*

It is not clear what "mitigation" means for the case of a helicopter that is not to be certified for ditching, but must meet the requirements of CS 27.801(e) as a consequence of the new AMC 27 MG 10. Mitigation is defined as follows:

Mitigation may be provided either by an RFM limitation that for all flights requiring the rotorcraft be certified for ditching, all occupants are equipped with and trained in the use of an approved emergency breathing system (EBS) that is capable of rapid underwater deployment, or by the post-capsize survivability features of CS 29.801(i).

Since an RFM limitation referencing ditching is not appropriate for a helicopter not being certified for ditching, there is an absence of information provided for helicopters not certified for ditching. It does not appear that small, CS-27 helicopters were given full consideration here. If not being certified for ditching changes the allowable capsize probability or eliminates the requirement for mitigation, this should be clarified.

response

Partially accepted.
It is to be noted that the requirements for a helicopter to be approved with emergency flotation are now to be found in the newly created CS 27.802. (See the response to Comment 290).
It is also to be noted that the mention of 'mitigation' has been removed. (See the response to Comment 204).
The allowable capsize probability for a helicopter certificated for emergency flotation is higher than that allowed for certification for ditching, and this is clearly shown in the requirements CS 27.801(e) and CS 27.802(c) respectively.
The requested clarification is thus provided.

comment

178 comment by: *Zodiac Evacuation Systems division - France*

AMC27.801 (e)(a) (2)

Who will decide the wave data to be used for a specific region and based on what requirement?
recommandation :
Clarify the requirement

Table 2- Norther North Sea wave climate is not the correct title
recommandation : Change to Table 1

	Who will decide if the random waves used are representative of the region selected? There is also a risk a specific pattern would not include the most critical condition. recommandation : Provide a standard wave sequence to be tested in the AMC to ensure that all helcopters are tested with the same conditions
response	Not accepted/Accepted/Not accepted. The use of long sequences of irregular waves and the determination of the probability of capsize, as explained in the AMC, will result in appropriate wave data being utilised. The commenter does not give any indication of the areas of the model test method that are unclear. The identified error in the title of the table will be corrected See the response to Comment 305.

comment	*180* comment by: *Zodiac Evacuation Systems division - France* AMC27.801 (e)(b) (1)(i) The requirement is not specific enough with regards to existing aircraft buoyancy . recommandation : The requirements for a part to be considered as buoyant should be added. For example : parts that entrap a volume of air need to be crash resistant (tyres, gas cylinders...) All other volumes should be considered as floodable
response	Not accepted. The situation of interest here is ditching, not a crash (water impact). Items considered to be buoyant do not therefore necessarily need to be substantiated as being crash resistant.

comment	*182* comment by: *Zodiac Evacuation Systems division - France* AMC27.801 (e)(b) (1)(ii) On most of our stability test campaigns, at least 5 conditions are selected because of the different conditions which can cause problemes (max weight, min weight, highest Z coordinates, max Y deportation.....). No condition contains all of the extreme conditions which is why at least 5 points are chosen. Which conditions should be prioritized if only 2 mass conditions are selected? recommandation : Clarify the requirement
response	Accepted. In order to keep the test programme as short as possible, it was considered that two extreme loading cases would likely encompass or closely approximate the worst condition, and that these two conditions would be a consistent way of testing all helicopters.

	This has now been clarified.

comment	*184* comment by: *Zodiac Evacuation Systems division - France* AMC27.801 (e)(b) (2) This requirement is specific on the wrong points. It is trying to give sugestion on criteria of a test facility which should be used instead of expressing the real need (ensuring we have a good wave form). recommandation : Provide a tolerance which the wave patern/shape should have in order to be considered compliant.
response	Not accepted. Tolerances could only be set if there were established tolerances commonly specified for scale model wave tank testing, or there was a rational way of setting such a tolerance for scale model helicopter testing. In light of this, it is considered inadvisable to provide tolerances.

comment	*186* comment by: *Zodiac Evacuation Systems division - France* AMC27.801 (e)(b) (3)(iii) Who will decide if the random wave used are representative? There is also a risk a specific pattern would not include the most critical condition. recommandation : Provide a standard wave sequence to be tested in the AMC to ensure that all helcopters are tested with the same conditions From experience on previous stability campaigns, on light weight configurations, when the CoG is high with respect to the CoB and a large portion of the fuselage is out of the water, wind can cause the model to capsize. Therefore wind is not always beneficial and can be penalysing depending on the test condition. recommandation : Review the water tank stability test procedure.
response	Not accepted. Regarding the provision of a standard wave sequence, see the response to Comment 305. In regard to wind simulation, it is EASA's experience that wind aligned with the waves is a stabilising influence that tends to weathervane an unrestrained helicopter into the waves, and thus, reduce the incidence of capsizes. A simple minimising potential energy argument indicates that a vessel will naturally turn beam-on to the sea in the absence of wind or other external forces. However, given the relatively short waterline length of a ditched helicopter, this effect might be very weak.

The thinking behind leaving out wind effects in the helicopter model test specification is to make the testing simpler and easier to perform, and making it a pure test of resistance to capsize in beam waves.

Whilst recognising that this may not be an entirely realistic situation, it is considered to be a reasonable way of comparing different EFS and helicopter designs in a consistent manner.

The specification requires the helicopter to be restrained to be beam-on to the waves so it would be possible to add wind to the test, and at the same time prevent the beneficial weathervaning, and thus, include the additional capsizing wind overturning moment mentioned in the comment.

However, blowing wind over models in wave basins is notoriously difficult to achieve with good stable flow quality. The wind boundary layer and the turbulence levels are very unlikely to be realistic of the wind over the ocean. Even controlling the mean wind speed at the model within a reasonable range can be very difficult.

Including wind thus adds a significant additional uncertainty in comparing the performance of different helicopters in different wave basins.

comment	*260* comment by: *AIRBUS HELICOPTERS* See our comment n°258 on CS 29.801.
response	Noted. See the response to Comment 258.

comment	*333* comment by: *Bell Helicopter* Comment: Too complicated – see comments on Regulation Recommendtion: Clarify position
response	Partially accepted. Revisions to AMC to CS 27.801(e) have been made. EASA expects that they will provide the clarification desired by this commenter.

comment	*340* comment by: *Leonardo* The probabilistic approach and the need for a qualified oceanographer to interpret the tests and determine pass / fail is likely to be a source of confusion. It is not clear how easily EASA will be able to interpret certification evidence provided to them by different applicants. Side-on constraint is considered overly conservative and may be unrealistic. Some helicopter types "weather cock" head on to the waves even without headwind. The tank test spec should allow for this to be shown and then allow tethering to nose to give nose-on to wave constraint where applicable.
response	Not accepted/Accepted. It is not understood why the commenter feels that a qualified oceanographer will be needed

	to interpret test results. There is nothing in the test specification to suggest this. In regard to the wave tank scale model restraint method, it is understood that a capsize event whilst restrained would beg the question as to whether the restraint had contributed to the event. The test specification has therefore been revised to allow; — in the event of a capsize event, for the model to be re-submitted to the same waves as a free floating model. If a capsize is then shown not to occur, testing can be continued as if the capsize event had not occurred. — alternatively, all testing to be performed with a free-floating model. In this case, however, additional testing constraints are applicable. These are also now explained in the test specification.

AMC 27.805(c) — Flight crew emergency exits p. 48

comment	*334* comment by: *Bell Helicopter* Comment AMC 27.805(a): States exits should be designed for escape following a ditching or water impact. Can not design for water impact. Recommendation: Delete water impact requirement.
response	Accepted. The text has been revised accordingly.
comment	*335* comment by: *Bell Helicopter* Comment AMC 27.805(b)(3): Likely damage…such as loss of tailboom. Suggests that tailbooms will fall off during ditching. Recommendation: Re-word to state items that fail ditching structural analysis. Remove reference to tailboom.
response	Accepted. The text has been revised as proposed.
comment	*362* comment by: *Leonardo* It is not clear how to demonstrate that "Flight Crew exits must function well as ditching exits, including when capsized" for jettisonable doors or windows above a certain size due to water pressure
response	Noted. See the response to Comment 363.

AMC 27.807(d) — Ditching emergency exits for passengers p. 48-51

comment	*23* comment by: *Aerossurance* To ensure no inappropriate design assumption, in (b)(9), change ‘by a gloved hand’ to ‘by both a gloved or bare hand’.

response	Accepted. A revision to this sentence has been made, as broadly as proposed.

comment	*27* comment by: *Aerossurance* Change text in second para of (a) to say: "The availability of such 'push-out' windows has been required by some air operations regulations". This is both to avoid the inappropriate use of mandate as a verb and to avoid confusion in the context of this paragraph (as written the sentence implies that these operational regulations require passengers use these windows rather than requiring such 'push-out' windows are fitted).
response	Accepted. The proposed change has been made.

comment	*28* comment by: *Aerossurance* (b)(1) should either refer to the CS-27 provision OR (better) the appropriate text from (a) should be moved to (b)
response	Not accepted. The change proposed by this comment is not seen as providing any benefit.

comment	*31* comment by: *Aerossurance* (b)(2) appears to be explanatory rather than procedural so should be moved to (a). It also may have the unintended consequence of encouraging minimum size exits, even in circumstances where only one person can reasonably expected to arrive at the exit at a time (e.g. because of other cabin seating layout reasons).
response	Not accepted. The change proposed by this comment is not seen as providing any benefit. The unintended consequence mentioned by the commenter is not understood. Exits that only just meet the minimum size requirement will be acceptable, but in most cases, a somewhat larger exit will probably be provided, which will not pose the risk highlighted. It is accepted that a ‘double size’ exit might be provided, but this must be double the minimum size requirement. The subject text intends to point out that exits a little smaller than a ‘double size’ exit would raise the concern of a potential for blockage, and as such, the text is deemed useful.

comment	*35* comment by: *Aerossurance* In (b)(4) remove demonstration as in the context it is covered by test and all the means listed are for the purpose of demonstration. This assumes 'demonstrate' is a generic term, as in 'demonstrate compliance', applicable to which ever means are considered acceptable in the AMC.
response	Not accepted. The text in question is taken from AC 27-1B. There may be ways to demonstrate the lack of interference with flotation devices that might not obviously fit the description of test, and the text thus provides additional confidence that all reasonable methods will be accepted.

comment	*36* comment by: *Aerossurance* (b)(4) includes a statement "In the event that an analysis is insufficient or a given design is questionable, a demonstration may be required. Such a demonstration...". This uses "demonstrate" ambiguously, does not refer to inspection (as per the first sentence) and uses the vague expression "questionable". Suggest "In the event that an analysis or inspection is insufficient, the design is novel or similar to a design with poor experience in ditchings or survivable water impacts, a test may be required. Such a test...".
response	Partially accepted. It is accepted that adding 'or inspection', as suggested, will improve clarity of the intent of this sentence, and this change will be made. Following on from this, it is also accepted that the use of the word 'demonstration' in the second sentence appears to rule out the use of a 'test'. This will be changed to 'test or demonstration' (two places). However, the reasons for a design to be considered 'questionable' will clearly include those proposed by the commenter, but a design may also be 'questionable' for other reasons that would be impracticable to predict and summarise. The use of the word 'questionable' will therefore be retained.

comment	*38* comment by: *Aerossurance* In the first sentence of (b)(4) delete "demonstration" and change "show" to "demonstrate". This assumes 'demonstrate' is a generic term, as in 'demonstrate compliance', applicable to which ever means are considered acceptable in the AMC.
response	Partially accepted. Other comments have been received related to the use of the word 'demonstrate' (and 'demonstration'). In order to remove potential for confusion, all such references have been changed to 'substantiate' (and 'substantiation'). Where demonstration is still used, it is considered to involve the use of hardware, i.e. not an analysis, calculation etc. In line with this, 'show' will be changed to 'substantiate', but no other change will be made.

comment	*46* comment by: *Aerossurance* 27.807(d)(4) includes the expression "means of access to it". This appears to imply lighting the route to the exit. Suggest considering if this is necessary in Part 27 helicopters but if so the AMC is should be expanded to cover this feature.
response	Partially accepted. It has been accepted that the markings proposed by CS 27.807(d)(4), i.e. the so called 'HEEL' lighting should not be required by CS-27. This requirement has been removed. (See the response to Comment 78). However, it is to be noted that CS-27 Category A helicopters should still be required to have this lighting, via Appendix A.

comment	*47* comment by: *Aerossurance* In (b)(11) the last sentence appears to presume an approximately rectangular exit. Suggest: "The markings should be sufficient to highlight the full periphery."
response	Noted.

	This comment is no longer applicable due to this subject requirement being removed. (See the responses to Comments 78 and 46). The referenced AMC text has thus also been deleted.

comment	*272* comment by: *AIRBUS HELICOPTERS* See our comment n°271 on AMC 29.807(d)
response	Noted. See the response to Comment 271.

comment	*341* comment by: *Leonardo* What should trigger "HEELS" illumination (e.g. crash switch/ immersion...?) Lighting the means of opening is not always feasible
response	Noted. This comment is no longer valid, due to the requirement for 'HEELS' illumination having been removed from CS-27. (See the responses to Comment 78). However, a response to the similar comment regarding CS-29 can be found under Comment 349.

AMC 27.1415 — Ditching equipment p. 53-55

comment	*188* comment by: *Zodiac Evacuation Systems division - France* AMC27.1415 (b) how are the different sea conditions used to certify ditching equipement such as life raft, life preserves (ETSO 2C503/2C504/2C505)... linked to the sea condition of the ditching provision certification? If it is planned to update specific ETSO regulations, what is the planning for their update and what should be done until these regulations are updated? recommandation : None
response	Noted. Life rafts are the only category of ditching equipment for which there are different design standards in regard to sea condition substantiation (i.e. ETSO C70b vs. ETSO 2C505). The text of CS 27.1415, and the associated AMC, is thus revised to recognise this. There are no such differing standards for life preservers. See also the responses to Comments 172 and 173. Work to update the ETSO standards will be performed, based on the recommendations made in the NPA. This work has already begun.

comment	*190* comment by: *Zodiac Evacuation Systems division - France* AMC27.1415 (b)(1)(iii)

This paragraph is too complicated and subjective.

recommandation :
Recommend giving specific conditions (the most penalysing one) that need to be tested for life raft deployment

response

Not accepted.

Reliable deployment of life rafts is clearly important and the AMC points out that several parameters need to be considered. It is not, however, considered to be possible to determine and define what would be the most critical condition for any helicopter and life raft stowage/deployment design.

comment

192 comment by: *Zodiac Evacuation Systems division - France*

AMC27.1415 (b)(1)(V)(A)

Due to the risk involved with the life raft activating at the wrong moment, the conditions in order to automatically inflate the life rafts need to be given in order to reduce the risk of damage to the life raft or for the occupants during egress of the helicopter.

recommandation :
Add condition need for automatic inflation

response

Partially accepted.
It is not considered appropriate to define how an automatic life raft deployment system should be designed. However, this comment has prompted a revision to this AMC in that the proposal in the NPA was that automatic life raft deployment could be an alternative to manual controls for the flight crew. This was not intended, and has now been removed. Automatic life raft deployment is now explained as an acceptable additional deployment mode, and it is pointed out that the system design must consider mitigation for inadvertent deployment as well as for intended deployment, bearing in mind the potential for damage from turning rotors.

AMC 27.1470 — Emergency locator transmitters (ELTs) p. 55-61

comment

57 comment by: *Aerossurance*

Last para of (d)(1)(i) is verbose/rambling/in-direct. It would be better to describe a bi-axial sensor arrangement as optimal. We also believe the term "unique solution" should be "ideal solution"

response

Partially accepted.
See the response to Comment 56.

comment

58 comment by: *Aerossurance*

(d)(3)(i) erroneously uses the term "Aircraft Flight Manual". Replace with "Rotorcraft Flight Manual".

response	Accepted. The proposed change has been made.

comment	*60* comment by: *Aerossurance* Add to (d)(4)(ii) a check of the hydrostatic sensor (only the G-switch is included)
response	Partially accepted. The comment is well noted; however, the sentence has been revised to refer to all sensors, rather than to specify any particular type.

comment	*65* comment by: *Aerossurance* Adjust title of (d)(5) to reflect both RFM and RFMS.
response	Accepted. The title has been changed. This section has also be revised to remove unnecessary repeated references to the two types of manual.

comment	*194* comment by: *Zodiac Evacuation Systems division - France* AMC27.1470 (c) The way the deifinitions are writen is misleading. There are only two types of ELT (S) class A or B. recommandation : Remove section 4 and 5 and indent the definitions into section 3.
response	Accepted. A revision will be made as proposed.

comment	*277* comment by: *AIRBUS HELICOPTERS* See our comment n°276 on AMC 29.1470
response	See the response to Comment 276.

AMC 27.1561 — Safety equipment p. 62

comment	*155* comment by: *Aerossurance* AMC 2x.1561(b)(5) refers to 'marked in bold letters'. Suggest 'marked clearly' as 'bold' may imply merely a type of type face and pictograms may be more appropriate in some circumstances.
response	Accepted. This text has been revised to avoid use of the word ‘bold’ and also revised to better explain the intent of the previously used term ‘permanently’.

AMC 27 MG10 — Advisory material for substantiation of an emergency flotation system (EFS) alone p. 63

comment	*82* comment by: *Robinson Helicopter Company* By eliminating AC27-1B MG 10, the NPA effectively eliminates the path for certifying emergency floatation systems with anything less than full ditching provisions. Basic emergency floatation systems have been in use on smaller CS-27 rotorcraft for many years and offer significant safety benefits without some of the ditching-specific items such as water impact velocity considerations and evaluation of exits in the capsized condition. Eliminating the ability to certify simple, proven, real-world-usable floatation systems may result in a reduction rather than an enhancement in safety.
response	Noted. Certification with emergency flotation, as opposed to full ditching provisions, was not removed by the proposals in the NPA.

comment	*336* comment by: *Bell Helicopter* Comment: The NPA hides the fact that all EFS would need to meet ditching requirements. AMC 27 MG10 is revised to require meeting the ditching requirements of 27.563 and 27.801(b) to (h). For CS-27 this means needing to meet the structural and ditching requirements for a simple EFS. It is feasible that kits and STCs will not be able to be developed at a low cost and will therefore not be available and result in safety equipment not being available for small aircraft or private operators who only occasionally fly over water. A low cost, simple alternative must be made available. Recommendation: Use the safety continuum model whereby there would be scalable requirements which would allow for allow for simple flotation safety equipment.
response	Accepted. In response to Comment 338, a new requirement (CS 27.802) has been created. In line with the principle of a safety continuum model, this requirement clarifies that compliance with the structural requirements of CS 27.563 need only be shown for the flotation units and their attachments to the rotorcraft.

comment	*338* comment by: *Bell Helicopter* Comment: The text added to MG-10 which replaces the existing MG-10 is imposing certification requirements through Advisory Material: “Regulation (EU) No 965/2012 may allow for the installation of only emergency flotation equipment, rather than certification for full ditching provisions. However, the provisions for certification of the emergency flotation equipment in such a case remain the same as those for full ditching certification, i.e. compliance with the ditching provisions of CS 27.563 and CS 27.801(b) to (h) should be shown.”

	Recommendation: The applicable requirements for non-ditching applications need to be addressed in CS-27 and not in advisory material. Furthermore, see previous comments, requirements for simple floatation systems should not have to meet the requirements of 27.863 and 27.801.
response	Accepted. It is agreed that the usage of guidance material (i.e. MG10) to set a design requirement is inappropriate. A new requirement paragraph, CS 27.802, has been created, referencing an appropriate subset of the applicable paragraphs for ditching, thus now handling in the design code this lower level of equipment of overwater flight, as allowed by operational regulations.

3.2.3. Draft amendment to CS-29 — Book 1 p. 63

comment	*243* comment by: *FAA* Name of Subpart C should not be changed. Do not remove "REQUIREMENTS"
response	Accepted. The title of Subpart C will not be changed.

CS 29.563 Structural ditching provisions p. 63-64

comment	*169* comment by: *Zodiac Evacuation Systems division - France* CS29.563 (a) The meaning of mean wave surface (through all 563) is not clear. Are the speeds to be considered as ground speeds? recommandation : Clarify the meaning of mean wave surface/requirement.
response	Accepted. See the response to Comment 168, which despite being in regard to CS 27.563, is equally applicable to this comment.

comment	*209* comment by: *UK CAA* **Page No:** 63, 70 & 71 **Paragraph No:** CS 29.563 Structural Ditching Provisions (a), AMC 29.563 (a)(1)(iii) and AMC 29.563 (b)(3) **Comment:**

The reference to two-thirds rotor lift should be deleted.

Justification:

The removal of two-thirds rotor lift is justified and recommended in Appendix B, Item 9 (see page 199). This has been incorporated in AMC 29.801 (b)(10) on page 73, but not in the above references.

Proposed Text:

Modify the existing text as follows (deleted text ~~struck through~~):

CS 29.563 (a) *Forward -speed landing conditions.* The rotorcraft must initially contact the most critical wave for reasonably probable water conditions at forward velocities from zero up to 56 km/h (30 knots) in likely pitch, roll, and yaw attitudes. The rotorcraft limit vertical -descent velocity may not be less than 1.5 metres per second (5 ft/s) relative to the mean water surface. ~~Rotor lift may be used to act through the centre of gravity during water entry throughout the landing impact. This lift may not exceed two-thirds of the design maximum weight. A maximum forward velocity of less than 30 knots may be used in design if it can be demonstrated that the forward velocity selected would not be exceeded in a normal one-engine-out touchdown.~~

AMC 29.563 (a)(1)~~(iii) A rotor lift of not more than two-thirds of the design maximum weight may be used to act through the rotorcraft's centre of gravity during water entry.~~

AMC 29.563 (b)(3) The landing structural design consideration should be based on water entry ~~with a rotor lift of not more than two-thirds of the maximum design weight acting through the rotorcraft's centre of gravity~~ under the following conditions:

response

Not accepted.

See the response to Comment 203, which despite being in regard to CS 27.563, is equally applicable to this comment.

comment

226 comment by: *Sikorsky Aircraft Corporation*

The proposed change to the definition of ditching should be completed by defining regulations for Survivable Water Impact (SWI) certification; ex. 29.565. See comments for 29.801.

response

Not accepted.

See the response to Comment 227, which despite being in regard to CS-27, is equally applicable to this comment.

comment

244 comment by: *FAA*

CS 29.563	Proposed (provision/requirement) language is not required to be changed. These are requirements, not provisions. (This comment applies to multiple occurances in the proposed language)	Leave wording unchanged

CS 29.563(b)(1)	Keep the first part of the sentence proposed for deletion. Recommend the language "...creating restoring moments to compensate 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(d). Maximum roll and pitch angles determined from compliance with CS 27.801(d) may be used, if significant, to determine the extent of immersion of each float." is advisory in nature, and should be moved to the AMC.	Keep "The highest likely buoyancy load must include consideration of a partially immersed float." Remove the remainder of the paragraph as proposed.

response

Accepted.

It is accepted that the change from ‘requirement’ to ‘provision’ is confusing because the latter term is used extensively to mean design features. The text is revised to revert back to the term ‘requirement’ where appropriate.
In regard to CS 29.563(b)(1), it is to be noted that the response to other comments has resulted in an extensive revision of CS 27.563. The issue raised by the commenter has been resolved by this revision.

comment

265 comment by: *AIRBUS HELICOPTERS*

The speed used for water entry calculation should be an indicated air speed since it is a controlled ditching and IAS is the available data to the crew.

The use of mean wave surface is unclear. It can be understood as a flat surface.

“*No account need to be taken of the wave particle velocity*” is unclear too. Physical phenomena include wave propagation and particle velocities.
If no particle velocity is considered, it is equivalent to a stationary body of water which does not represent reality. Realistic conditions should be preferred.

response

Accepted.

EASA recognises that the requirement and AMC texts proposed in the NPA could have been clearer.

These texts have been revised, and the points raised in this comment have been addressed.

comment

342 comment by: *Leonardo*

"Most critical wave" means most critical steepness.

Vertical descent velocity is absolute i.e remove "relative to the mean water surface"

	See also comments on AMC29.563
response	Accepted. This and other comments have resulted in appreciable revisions to CS 29.563 and the associated AMC. The issues raised by this comment have been resolved.

comment	*344* comment by: *Bell Helicopter* Comment: Structural ditching provisions is unclear Recommendation: Needs to be reviewed for impact
response	Accepted. This requirement has been revised in order to improve clarity.

comment	*346* comment by: *Bell Helicopter* Comment 29.563(a): The requirement states for the most critical wave. This is inconsistent for irregular waves – i.e. rogue wave? Recommendation: The requirement needs re-wording
response	Accepted. See the response to Comment 297, which despite being in regard to CS 27.563(a), is equally applicable to this comment.

CS 29.783 Doors p. 64

comment	*245* comment by: *FAA*

CS 29.783(h)	Do not move to CS 29.803(c)(3). This is a door requirement.	Do not remove, but replace with new language in CS 29.803(c)(3)

response	Accepted. It is accepted that this requirement is better placed in CS 29.783, as it refers to a door design requirement.

CS 29.801 Ditching p. 64-65

comment	*6* comment by: *Luftfahrt-Bundesamt* 6) page 65, subparagraph (g) and (h) to CS 29.801: the same comments as in 3) and 4)
response	Partially accepted.

	See the response to Comment 4, which despite being in regard to CS 27.801, is equally applicable to this comment.
comment	*95* comment by: *Aerossurance* As resistance to water impact is mentioned in 801(c) it is entirely reasonable that it is included in 801(b) also. Clearly what is practical and achievable in the case of water impacts will be less than in a ditching and defining a survivable water impact test case is more difficult, however as fatalities have predominately been caused in water impacts we fell this would be an important change. Suggested wording: Each practicable design measure, compatible with the general characteristics of the rotorcraft, must be taken to minimise the probability in the event of either a ditching or a survivable water impact, that the behaviour of the rotorcraft would cause immediate injury to the occupants or would make it impossible for them to escape.
response	Not accepted. See the response to Comment 95, which despite being in regard to CS 27.801, is equally applicable to this comment.
comment	*97* comment by: *Aerossurance* The last sentence of 29.801(d) is repeated in 29.801(e). At very least one can be eliminated (perhaps both as this is material more appropriate for AMC).
response	Partially accepted. This text in CS 29.801(e) has been deleted. However, it is not agreed that this text is more appropriate as AMC text.
comment	*130* comment by: *Aerossurance* We are supportive of CS29.801(i) being an objective based requirement rather than a prescriptive requirement for specific design features or concepts.
response	Noted. EASA appreciates Aerossurance's support for the reference proposal.
comment	*131* comment by: *Aerossurance* CS29 would be clearer if CS29.801(i) was incorporated into CS29.803.
response	Noted. This suggestion perhaps has merit; however, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research

	into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).
comment	*132* comment by: *Aerossurance* A weakness in 29.801(i) currently is that objective is not linked directly (or indirectly in AMC) to a standardised, quantitative 'acceptable' maximum breath hold duration. Research in relatively standardised conditions shows that breath hold varies massively between individuals. It also varies with water temperature due to the cold shock effect (among other factors). This means that maintaining a fair consistent objective across multiple applicants making different assumptions based on different data sources will be challenging and may result in the more diligent applicant being penalised for realistic conservatism. It is suggested that the rule making team consider setting a maximum 'acceptable' breath hold time (in the provision a requirement or in the AMC as guidance) as a basis for consistent analysis. Please see other comments on AMC 29.801(i) and compliance verification.
response	Noted. Whilst the points raised may be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345)
comment	*153* comment by: *Aerossurance* AMC29.801(c)(5) makes references to 'establishing' multiple procedures but it is not immediately evident which provision requires their promulgation (perhaps 29.801(h), although that does not explicitly reference procedures per se).
response	Not accepted. The procedures referred to in this section of the AMC are the ditching procedures required in order to safely operate the helicopter over water. These procedures are required, amongst other regulations, by CS 29.1585(a).
comment	*171* comment by: *Zodiac Evacuation Systems division - France* for section CS 29.801 (c) As the criteria of a water impact is not clearly defined, it is not possible to show compliance to this requirement. recommandation : for section CS 29.801 (c)(1) Replace "must" by "should" (or "shall optimize") as a water impact criteria is not defined. for section CS 29.801 (c)(2) and (3) "must" is acceptable for section CS 29.801 (g)

	this section is limiting to a specific means of compliance recommandation : Reword specification to give high visibility chevrons as a possible means of compliance but allowing for other solutions.
response	Partially accepted/Not accepted. See the response to Comment 170, which despite being in regard to CS 27.801, is equally applicable to this comment.

comment	*196* comment by: *Zodiac Evacuation Systems division - France* CS29.801 (e) Currently the way this requirement is written, it is stated that the preferred evacuation position is with the helicopter in the non capsized position however current systems will more than likely capsize and therefore the capsize position shall be considered. This is removing the possibility to design a system which will not capsize or is already in the most stable position when upright while being compliant to the rest of this NPA. Which if this could be done would allow us to remain in the preferred upright for evacuation (as is the case for non cat A CS 27 floats). If the objective of this requirement is to improve survivability in case of SWI, it should be noted that the problem with this logic is that the floats are designed to resist ditching loads and in case of an SWI which can be over the ditching loads, there is the possibility of losing all the lower floats which would cause the H/C to sink. recommandation : as in CS 27 add the table in section CS 27.801 (e) giving the possibility to show no capsize mitigation with a probability of 2.9% for non punctured case and 29% for punctured case
response	Partially accepted. In fact the acceptable probabilities proposed by the commenter are those finally chosen, although rounded up to 3.0 % and 30.0% (see the response to Comment 408). However, it is to be noted that these figures are not chosen for the reasons put forward by the commenter.

comment	*197* comment by: *Zodiac Evacuation Systems division - France* CS29.801 (J) The definition of complete ditching floatation unit is not clear. For example Case 1: 1 gas cylinder per float --> We consider the loss of one float bag.

	Case 2: 1 bottle for 2 floats --> Do we consider the loss of 1 float or the loss of both floats? Recommandation: Clarifiy meaning of complete ditching floatation unit
response	Accepted. A 'Complete ditching flotation unit' means a discrete, independently located float. The qualifying term 'complete' means that the entire structure of the flotation unit must be considered and not limited to any segregated compartments. As the commenter suggests, depending on the inflation system architecture, damage at the location of a flotation unit might have effects on the ability of other flotation units to inflate or remain inflated. Additional sections in AMC 29.801 and AMC 29.802 are introduced to provide guidance for compliance.

comment	*210* comment by: *UK CAA* **Page No:** 65 **Paragraph No:** CS 29.801 Ditching (i) **Comment:** I. The rule should require that the post-capsize survivability features must reduce the consequences of a capsize to no worse than CS 29.1309 major. II. The rule should require that the survivability features be crash resistant. **Justification:** I. The target probability of capsize of 29 % stated in CS 29.801 Ditching (e), is contingent on the consequences of capsize being no worse than major. If worse than major, a lower target probability of capsize must be applied which would significantly impact the scope of the testing required. II. The majority of the lives saved quoted in the RIA (38/55) relate to survivable water impacts; the post-capsize survivability features will not deliver the safety benefit claimed in the RIA if they do not function following a survivable water impact. **Proposed Text:** Add to the existing text as follows (new text <u>underlined</u>): The rotorcraft design must incorporate appropriate post-capsize survivability features to enable all passenger cabin occupants to safely egress the rotorcraft, taking into account the human breath hold capability. <u>The features provided must be shown by analysis or test to reduce the consequences of capsize to no worse than CS 29.1309 major, and must be resistant to or tolerant of likely damage in the event of a survivable water impact.</u>
response	Noted.

This suggestion perhaps has merit; however, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment

227 comment by: *Sikorsky Aircraft Corporation*

The proposed change to the definition of ditching should be completed by defining regulations for Survivable Water Impact (SWI) certification. Ditching and SWI are two different events and as such should be addressed with different requirements to ensure proper definition and assessment of safety. As is shown in the accident database, all ditching events have resulted in successful egress of the helicopter by all occupants. Definition of SWI certification regulations which result in survivability statistics of SWI events resembling that of Ditching events would be a marked improvement in safety. New regulation for SWI (ex. 29.802) should be constructed in such a way as to encourage designs which result in helicopters remaining upright and stable following a SWI. Regulations which are similar to the proposed changes to 29.563 and 29.801 in this NPA, arranged into new SWI regulation would support clear definition of increased safety enhancements. Coupling with updates to Operational Rules would ensure proper application adding to the effectiveness of the updates.

response

Not accepted.
As explained in the NPA, separate SWI-based regulation was not followed, mainly due to the inherent difficulty in adequately defining an SWI. Hence, the approach adopted has been to address SWIs by improving the ditching CS; in other words, to regulate for the SWI case implicitly, by raising the ditching CS explicitly.
□□□□□□□□ase, it is difficult to imagine a design approach that could lead to high confidence of a helicopter remaining upright and stable following an SWI. Overall configuration and mass distribution aspects make it inevitable that □□capsize□□□□□□□□□□□□□□□□□□□□□□□□the most benign □□□□□□□□□□

comment

246 comment by: *FAA*

CS 29.801(c)(1)	Wording is not clear.	Reword to "be designed, constructed and installed to perform their intended function, considering the effects of loads in 29.563;"
CS 29.801(g)	This is an operational requirement, and does not belong in CS 29.	Remove (g) and possibly add to operational requirements
CS 29.801(i)	Referencing breath hold capability in a rule is not enforceable. This will be widely interpreted by applicants, and will lead to much confusion, and variation around the world. The reason for the rule change may be due to breath hold capability, but it does not need to be in the rule language.	Remove ", taking into account the human breath hold capability". This is unnecessary language.
CS 29.801	Address the case of appliants wanting	Add CS 29.801(k) as "(k) If

	certification of emergency flotation systems without full ditching capability.	certification of an emergency flotation system alone is requested by the applicant, sub-paragraph (c), (e), (f), and (h) apply."

response

1. Partially accepted – The wording of CS 29.801(c)(1) has been changed to better convey its intent (See also response to Comment 170). However, the change does not make reference to CS 29.563, which the helicopter must comply with in any case.

2. See the response to Comment 236.

3. It is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

4. Partially accepted – a new paragraph, CS 29.802, has been created to cover the case of Emergency Flotation approval (i.e. not full ditching approval).

comment

258 comment by: *AIRBUS HELICOPTERS*

Attachment #2

CS27 and CS29 introduce the use of irregular waves and probability for stability demonstration.

CS27.801e: "*The rotorcraft must be shown to resist capsize in the sea conditions selected by the applicant. The probability of capsize in a 5-minute exposure to the sea conditions must be demonstrated to be less than or equal to the target probability of capsize given in the following table, with 95 % confidence*."

CS29.801e: "*The rotorcraft must be shown to resist post-ditching capsize in the sea conditions selected by the applicant. The probability of capsize in a five-minute exposure to the sea conditions must be demonstrated to be less than or equal to the target probability of capsize of 29 % with 95 % confidence. Scoops, flaps, projections, and any other installed feature likely to affect the hydrodynamic characteristics of the rotorcraft must be taken into account. Allowances must be made for probable structural damage and leakage.* "

Associated test program is proposed in AMC27.801e and AMC29.801e.
Previously (AC29.801), the demonstration was recommended on regular waves having a wave height related to the certification sea state and wave steepness between 1:8 and 1:12.5 depending on the rotorcraft certification category. Associated wind was generally considerate in the demonstrations.
In AMC27 and AMC29, the test program recommends testing irregular waves using typical North Sea spectrum (JONSWAP) defined by significant wave height Hs and mean wave period

Tz. Applicant can chose the significant wave height he wants to certify.

It is accepted that regular waves are not fully representative of given sea state. However, when full representativeness cannot be reached, the purpose of certification rules is to propose a conservative approach.
The use of irregular waves introduces:
- Insurance that the helicopter will be exposed to a realistic range of wave frequencies.
- Breaking waves, depending on the chosen values of Hs and Tz.

It is important to remind that infinity of different wave's time series can be derived from a given spectrum because phases are randomly selected.

The test program proposed in AMC27.801 and AMC29.801 raises the following comments:

1. Floating helicopter generally has a relatively stiff behavior in the sea due to its high natural roll frequency. Its stability is more affected by steep waves or breaking waves than by the exposition to a range of frequency.
The use of irregular waves is a guaranty to have statically the helicopter facing some of these waves.
However, it is not proven that this approach is more conservative than the previous AC29.801 which recommends testing the helicopter in the most severe expected regular waves of one associated sea state.

2. AMC recommends that "*No wind simulation is to be used*" because "*Wind generally has a tendency to redirect the rotorcraft nose into the wind/waves, thus reducing the likelihood of capsize*". AH experience shows that wind does not always tend to stabilize the helicopter and can be an aggravating factor for capsize.

3. AMC recommends that "*the model is to be attached to the model restraint system"* in order to remain perpendicular to the wave propagation direction.
This kind of attachment is usually done for ship model test where the size of the model is comparable to the size of the waves and where the model is "heavy".
For the recommended helicopter tests, the size of the helicopter is little in front of the waves to be simulated and similitude laws make the model mass is very low (few kg for lightest configurations).
It is difficult to define a retaining system having no significant influence on the very light mass helicopter model behavior.

4. Regarding the test realization, from the wave spectrum defined in AMC, a wave time series should first be defined using aleatory phases. This wave time series is usually simulated before to ensure that the test facility is able to generate it. If yes, the waves are generated. If not, for example because of wave maker power issue (probable for the given spectra in AMC), the time series is rejected and another is defined.
Therefore, it is not proven that the test specification in AMC is fully independent on the test facility chosen since each facility as its own wave maker with different characteristics.

5. Test duration is very high and becomes prohibitive for CS27 where 2.9% capsize probability is required.
The attached graphics shows the necessary time duration according to AMC in order to demonstrate 2.9% capsize probability with 95% likelihood, depending on the number of capsize observed during the tests (up to 2 capsize events). Considered scale is 1:10.

	Test facilities are usually able to perform around 20 minutes runs before waves reflection on the walls become an issue. Then, a basin relaxation time (usually around 20 minutes) is needed before performing another run. Therefore, around 1.5 days in the facility might be needed to test 1 configuration (mass / center of gravity / inertia / floats configuration / fuselage configuration). Several configurations are usually tested during a development. The associated test time is very important. It implies planning and cost issues because there are few facilities able to perform this kind of tests.
response	Noted. The key points taken from this comment are the following; 1. It is not proven that the proposed approach is more conservative than the previous AC 29.801, which recommends testing the helicopter in the most severe expected regular waves of one associated sea state. 2. Airbus Helicopters' experience shows that wind does not always tend to stabilize the helicopter and can be an aggravating factor for capsize. 3. It is difficult to define a retaining system that has no significant influence on the behaviour of a very light mass helicopter model. 4. Regarding the test realization, from the wave spectrum defined in the AMC, a wave time series should first be defined using random phases. This wave time series will usually be simulated first in order to ensure that the test facility will be able to generate it. If it is concluded that this will not be possible, for example because of a wave maker power issue (probable for the given spectra in the AMC), the time series is rejected and another is defined. Therefore, it is not proven that the test specification in the AMC is fully independent of the test facility chosen, since each facility has its own wave maker with different characteristics. 5. The test duration is very high and becomes prohibitive for CS-27 types, where a 2.9 % capsize probability is required. The attached graphics shows the necessary time duration according to the AMC in order to demonstrate a 2.9 % capsize probability with 95 % likelihood, depending on the number of capsize events observed during the tests (up to 2 capsize events). The considered scale is 1:10. Test facilities are usually able to perform around 20-minute runs before wave reflection on the walls becomes an issue. Then, a basin relaxation time (usually around 20 minutes) is needed before performing another run. Therefore, around 1.5 days in the facility might be needed to test 1 configuration (mass/centre of gravity/inertia/floats configuration/fuselage configuration). Several configurations are usually tested during a development programme. The associated test time is very important. It implies planning and cost issues because there are few facilities able to perform this kind of test.

Responses

1. The Rulemaking Group sought a realistic test that can be linked to the risk of capsize, not necessarily a 'more conservative' approach. There is no accepted definition of 'most severe expected regular waves of one associated sea state'. Furthermore, the regular wave approach has been discredited (Ref. Report CAA 2005/06).
This report includes a detailed explanation of why the regular wave test is misleading, but briefly it can be summarised as follows:

a. Intact ditched helicopters (and boats) do not capsize in regular waves. They only capsize in breaking waves.

b. So-called regular waves do not exist in nature, nor do they exist in model basins except for waves of very small amplitudes.

c. When wave basins attempt to generate a steep regular wave, it does not propagate unchanged along the basin. Although it may start as a sinusoidal 'line' frequency spectrum at the paddle, the wave energy moves into side bands that cause a beating effect – alternating high and low amplitudes. The high amplitude waves break and cause further energy exchange across the frequencies. The rate at which this process occurs depends on many specific wave-maker/basin properties.

d. Thus the best resistance to capsize for a particular helicopter design will be achieved in the wave basin that can generate the highest/steepest regular wave that is not yet breaking. Furthermore, in any particular basin, the best resistance to capsize will be achieved the closer the model is placed to the wave-maker. The 'regular wave' capsize test might therefore be regarded as more a measure of the basin wave generation performance than the helicopter capsize performance.

2. See the response to Comment 186.

3. The natural frequency of the restraint system needs to be much lower than the wave frequencies. Given the low mass of the helicopter, this needs to be a restraint with low stiffness. Some basins might use servo-winch systems to achieve the required stiffness properties.

4. Provided that the waves measured at the model location conform to the spectrum requirements and are non-repeating during the required duration, then there should be no significant difference between model basins. Occasional wave-maker stroke/power limits experienced whilst generating a wave spectrum have surprisingly little effect on the wave time series measured away from the wave-maker because of the dispersive nature of water waves.

5. The testing time figures provided in the comment appear to be correct. EASA does not feel that this magnitude of testing time is unreasonable.

comment

262 comment by: *AIRBUS HELICOPTERS*

CS 29.801 (j): "*It must be shown that the rotorcraft will not sink following functional loss of the largest complete ditching flotation unit.* "

	Comment: Taking into account that floats generally have a gas loss rate (very low), this requirement will be unfeasible if there is no associated duration. Associated functional duration should be introduced.
response	Accepted. It is not intended that the rotorcraft needs to float longer in the subject condition than if the flotation system is undamaged. The AMC text will be added to clarify this.

comment	*263* comment by: *AIRBUS HELICOPTERS* One of the purposes of the regulation evolution is to introduce water impact consideration. It especially requires resistance to water impact. CS 27.801c & CS 29.801c (1): "*Emergency flotation systems (…) must (…) be designed to be resistant to damage from the effects of a water impact (i.e. crash);*" Comment: It is not possible to size a system to water impact effects if the water impact conditions are unknown. “Resistant to damage” should be replaced by: " *design precautions must be taken to minimize the effects of water impact on EFS.*"
response	Partially accepted. CS 29.801(c)(1) has been revised along the lines proposed. See also the responses to Comments 170 and 236.

comment	*269* comment by: *AIRBUS HELICOPTERS* CS27.801d & CS29.801d: "*The probable behaviour of the rotorcraft during and following a ditching in a water landing must be investigated by scale model tests or by comparison with rotorcraft of similar configuration for which the ditching characteristics have already been substantiated by equivalent model tests.*" Comments: - Means of compliance should be moved to AMC in order to maintain performance based regulation. - While a dedicated test program is proposed for afloat stability, no indication on the water entry tests are done in AMC regarding water entry tests. - Representativeness of such model test for water entry is questionable.
response	Partially accepted. – CS 27.801(d) and CS 29.801(d) have been revised to remove aspects concerned with means of compliance, i.e. model testing versus comparison with existing data, and the need to consider scoops, flaps etc. These aspects have been transferred to the appropriate AMC section. – There already existed some AMC material in AMC 27.801 and AMC 29.801. This has however been expanded. – The commenter’s opinion as to the representativeness of scale model testing is noted. It is still considered that such testing does have merit and it has been retained. It is to be noted, however, that previously generated data for designs of similar characteristics may be used as

	the basis for a comparative substantiation, with no new testing.
comment	*343* comment by: *Leonardo* Auto deployment is considered sensible and is already employed by many manufacturers. Auto-arm, however, may introduce additional hazards due to the possibility of inadvertent inflation at any point in the flight envelope - i.e. potentially catastrophic. Contrasting chevrons are a paint scheme issue and not related to certification.
response	Not accepted. An automatic deployment system for emergency flotation, with the required level of integrity, is considered to be both feasible and essential in order to provide for improved safety in the event of a water impact. Such a system already existed on a type-certificated helicopter. This requirement will therefore remain. In regard to chevron markings, see the response to Comment 329.
comment	*345* comment by: *Leonardo* Despite early egress and model feasibility studies which demonstrated the principle, the integration issues around the air pocket concept remain unproven and have not been formally demonstrated by any OEM. Only one float manufacturer seems to be attempting this (One Atmosphere - Australia), while other flotation system suppliers appear to remain unconvinced of the practicality. The intended benefits appear overstated, meanwhile it is clear that fuselage designs to accommodate such a system and meet the rules may need to be significantly different in future (size, height, seating capacity etc). It is considered that if the perceived benefits are significant then the requirement should be market driven - i.e. specified by the operators in future contracts. Implications of complete non-obstruction of Type 4 exits have not been fully considered - this will require larger seat spacing than current designs.
response	Noted. The points raised by this comment, and others, have been considered extensively by EASA and it has been concluded that some final questions do remain regarding the detailed feasibility of providing post-capsize survivability features as suggested by the proposed CS 29.801(i) and its associated AMC. After careful consideration, it was decided that focused research would be commissioned by EASA, aimed at generating the required feasibility justification. In order not to delay the incorporation of other important and unrelated safety improvements into CS-27 and CS-29, it has been decided that CS 29.801(i), and its associated AMC text, will be removed from the initial package of changes, and associated required adjustments made to other requirements (e.g. the allowable capsize probabilities of CS 29.801(e)) and various parts of the AMC text. A later amendment to CS-29 will be initiated when the required justification has been obtained via the focused research.

comment	*347* comment by: *Bell Helicopter* Comment 29.801(c)(1): The intent of the new provision is unclear. 29.563 already includes the loads for ditching, so this would imply some other type of assessment? Recommendation: Requirement should be reworded to clarify the intent. i.e.: "be designed to minimize the possibility of damage due to water impact."
response	Accepted. The subject requirement has been revised to better indicate the intent.

comment	*348* comment by: *Bell Helicopter* Comment 29.801(c)(2): Text is confusing. Intent is that the floats be automatically armed before water entry and not rely on pilots to arm the floats prior to water impact. Recommendation: Requirements should be simplified and less prescriptive. i.e.: have an automatic means of arming prior to water entry.
response	Accepted. CS 29.801(c)(2) has been deleted and its intent incorporated, in the way proposed by the comment, into CS 29.801(c)(3) (which is consequently renumbered).

comment	*350* comment by: *Bell Helicopter* Comment 29.801(c)(2): The wording suggests that the floats must automatically arm when within the boundaries of the envelope defined for approved flight with floats ("restricted envelope"). Manual arming is in fact a required feature in order to meet the safety criteria for inadvertent float inflation. If automatically armed, this would expose a higher risk of inadvertent deployment throughout the restricted envelope which would result in a safety reduction. Ditching by definition is a deliberately executed emergency landing on water per the RFM procedures. Arming the floats is in the procedures. This is an attempt to address issues with water impact, and it is questionable whether or not automatic arming would solve it. If the helicopter is flown into (or enters) the water at a speed above the envelope limit, the floats would not be automatically armed. Recommendation: Is this requirement necessary? 801(c)(3) states automatic deployment following water impact.
response	Not accepted. See the response to Comment 343.

comment	*352* comment by: *Bell Helicopter* Comment 29.801(d): Testing of entry into water and sea conditions is unclear. Recommendation: A position needs to be established
response	Noted. See the response to Comment 269.

comment	*353* comment by: *Bell Helicopter* Comment 29.801(d): Given that ditching is a deliberate emergency landing, it is expected to be controlled by the pilot to the extent possible during an autorotation touchdown. The requirement to conduct powered model testing of the entry is questionable, there is no way to control the flare and subsequent run on into the water in a model test. Further, the pilot flying the helicopter is going to aim for what he believes is the best spot to set the helicopter down, and again there is no way in a model test to simulate this. This requirement does not provide any valuable demonstration of the helicopter's capability to conduct a safe ditching water entry and should be removed give: 1. Each helicopter must demonstrate it's capability to execute a power off landing during certification; 2. There has not been any problems with water entry for the ditchings on record 3. Model testing of the helicoter's behavior on water entry is not representative of an actual controlled water entry. Recommendation: Deleting the entire Requirement, or rewording it to show by analysis only.
response	Not accepted. See the response to Comment 269.

comment	*355* comment by: *Bell Helicopter* Comment 29.801(e): Probability of capsize used to determine the amount of testing required is confusing and over complicated. Recommendation: Need to establish a position
response	Not accepted. The staff of a scale model basin testing facility should have no difficulty in understanding or implementing the specification (e.g. calculating the required run durations). This was confirmed by the majority of responses to the test specification when comments were sought from these organisations.

comment	*356* comment by: *Bell Helicopter* Comment 29.801(e): The probabilistic approach proposed using the random generated spectrum suggests that the testing is going to be a "luck of the draw" occurrence. If a capsize does occur, then an oceanographer can review the data and make a determination on whether or not the test is considered a pass or fail. This results in a somewhat subjective assessment, and is therefore by default something very difficult to design for. None of the OEMs in the WG were comfortable with the proposed approach. Recommendation: Recommend that a suitable "sample" spectrum be defined such that the test is pass or fail based on the actual model performance during the test. There are examples within the current regulations where assumed spectra are tested to be representative of in service use.
response	Not accepted.

	See the response to Comment 305.
comment	*369* comment by: *Bell Helicopter* Comment 29.801(e): Text referring to the jettisoning of fuel has been removed. The jettisoning of fuel will not add to the buoyancy of the rotorcraft, but will likely raise the helicopter's CG, reducing stability, and may also create an additional hazard to occupants. Recommendation: Complete agreement. This is an overdue change that removes a regulation deleterious to rotorcraft safety.
response	Noted. EASA appreciates Bell Helicopter's support for this change.
comment	*370* comment by: *Bell Helicopter* Comment 29.801(f): "probable pressures" is not definitive and would require consultation with oceanographers to come up with the probable pressures associated with certification to a significant wave height. It should be fairly easy to generate a table which would correlate the pressure with the significant wave height to ensure a level and clearly design criteria. Recommendation: Recommend adding a table of "probable pressure" values corresponding to 6 – 8 significant wave heights.
response	Not accepted. See the response to Comment 307, in regard to a similar comment regarding the corresponding CS-27 change.
comment	*371* comment by: *Bell Helicopter* Comment 29.801(g): The requirement to add chevrons as part of a ditching configuration is not appropriate under the certification rules. Recommendation: Requirements for specific pain schemes should be included in an amendment to the operating rules. This is similar to the operating rules for markings surrounding egress points.
response	Partially accepted. See the response to Comment 308.
comment	*372* comment by: *Bell Helicopter* Comment 29.801(h): This requirement actually should go into 29.1587 (or a new 29.158x) Recommendation: Move to correct Section of CS 29.
response	Accepted. The requirement for sea conditions to which rotorcraft has been substantiated with ditching provisions to be included in the performance information section of the RFM will be moved to CS 29.1587
comment	*373* comment by: *Bell Helicopter*

Comment 29.801(i): The requirement hides the need to have a float configuration that will always maintain part of the aircraft out of the water for any EFS systems (ditching or not)
Recommendation: Bell considers these items to be low technical maturity for unproven safety benefits and recommends that the industry establishes a position considering:

- Feasibility, maturity of side float concept
- Additional side float hazards
- Effect of side floats on engines and performance
- Development costs vs safety benefits
- Feasibility and impact of configurations for CS-27 Cat A and smaller CS-29

response

Noted.
The referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment

410 comment by: *CAA-N*

To the new (c). There is no mention of a limit to how low the maximum float deployed airspeed may be. If this speed is low and limits the speed at which the floats may be armed, it will reduce the safety by making it very impractical to use the full potential of EFS for normal operations in congested airspace with over water arrivals and departures (SPA.HOFO.110(b)(9)). It may also introduce a need for the crew to perform non-essential tasks in critical phases of flight. Automatic arming/disarming may mitigate this.
(h) What is the consequence of this inclusion with regards to it being a limitation (ref the discussion of "prohibit" vs. "consider" in 5.2 below). Aircraft may be used for a variety of roles and any limitation would apply to all types of operations (including SAR).

response

Not accepted.
The intention of the new CS 29.801(c) is that the EFS will deploy automatically in the event of a ditching or a water impact, with no pilot action being required after take-off. The wording of this requirement has been revised to clarify this. The maximum safe speed for EFS deployment is thus not critical.
The data is not required to be a limitation in the RFM. It has been agreed that CS 29.801(h) should be deleted and its intent moved to CS 29.1587, to be consistent with other RFM data requirements.

CS 29.803 Emergency evacuation p. 65

comment

137 comment by: *Aerossurance*

We understand the intent of the term 'step directly' is to focus applicants on a method of life raft entry that is, for want of a better term, non-acrobatic(!). While that intent is appropriate this may prove challenging for literal compliance in helicopters with low headroom or where full advantage is taken of a wet floor to increase stability and result in inadvertently introducing potentially sub-optimal boarding procedures, such exiting the cabin to an external ledge before boarding. We suggest this is re-worded 'enter directly' and the AMC expanded if required to explain acceptable options.

response

Not accepted.
In order to reduce the difficulty of boarding a life raft, especially when in severe sea conditions, the intention of this new requirement is best explained by the wording “step directly”.
It is not understood why this might lead to a sub-optimal design.

comment

198 comment by: *Zodiac Evacuation Systems division - France*

CS29.803 (C) (1)
Specifiy in upright position or even after capsize

A test to show compliance to this requirement would be complicated to perform safely.
recommandation : A method of demonstating what is required by this requirement should be added in the AMC.

response

Accepted.
It was not the intention that an actual demonstration should necessarily be required. It is expected that in the majority of cases, an assessment of the helicopter’s overall exit layout, EFS design and life raft size, shape and deployment characteristics will suffice. This requirement has been revised to reflect this intention.

comment

231 comment by: *Sikorsky Aircraft Corporation*

The added requirements for egress contradict the updated requirements of 29.801(e) which ensure the rotorcraft will not capsize. The requirements added as CS 29.803(c) should be required if the requirements of CS 29.801(e) are not properly substantiated.

response

Not accepted.
Absolute resistance to capsize cannot be achieved and CS 29.801(e) does not require this. Furthermore, the new requirements of CS 29.803 provide additional safety for the non-capsized case.

comment

247 comment by: *FAA*

CS 29.803(c)(1)	It is understood that the word "demonstrated" as used, could consist of physical demonstrations, analysis, or a combination of both.	Add clarification of the requirement in the AMC
CS 29.803(c)(1)	Rule intended to say that access is direct, not climbing onto a sponson for example.	At end of sentence after "water", add "… or stepping onto external step or structure"
CS 29.803(c)(1)	No need to provide an i.e.	Remove " (i.e. crash)"
CS 29.803(c)(2)	This is an unnecessary requirement. Other paragraphs already apply.	Remove 29.803(c)(2)

CS 29.803(c)(3)	This is a door requirement, and is more appropriate in CS 29.783	Don't move from CS 29.783(h)

response

Partially accepted.

1. In order to avoid the potential for confusion regarding the meaning of 'demonstrate', all such references have been changed to 'substantiate' where it is intended that analysis is acceptable.
2. Whilst it is expected that use of such items as an external step will not be required in order to meet the intent of the subject requirement, it is not considered necessary to rule this out. Such designs may provide the necessary ease of life raft boarding.
3. This comment would appear to have been made in error. The text '(i.e. crash)' does not appear in the subject requirement.
4. Although the commenter is correct to point out that all the listed requirements apply in any case, it is considered useful to make this fully clear in the light of the subject emergency exit being a new requirement.
5. The intent of the subject requirement has been restored to CS 29.783.

comment

360 comment by: *Leonardo*

"It must be demonstrated" suggests a physical demonstration. Wording should be clarified to ensure that this can be "shown by design"

response

Accepted.
In order to avoid the potential for confusion regarding the meaning of 'demonstrate', all such references have been changed to 'substantiate'.

comment

374 comment by: *Bell Helicopter*

Comment 29.803(c): Requirement is to demonstrate egress to a life raft. The can be interpreted as needing to test in all sea conditions egress to a life raft. If this is not the intent the requirement should be changed to reflect the real intent.
Recommendation: Requirement should be reworded to remove 'demonstrate'.
i.e.: passengers must be able to evacuate the rotorcraft and step directly into any of the required life rafts, without first entering the water following a ditching in all sea conditions for which ditching capability is requested by the applicant.

response	Accepted. See the response to Comment 198.

comment	*375* comment by: *Bell Helicopter* Comment 29.803(c): “without first entering the water” is inconsistent with the other Regulations within the NPA. Recommendation: The verbiage “without first entering the water” should be deleted.
response	Accepted. The proposed change has been made.

CS 29.805 Flight crew emergency exits p. 66

comment	*10* comment by: *Aerossurance* For clarity and to ensure means of compliance are discussed only in AMC, suggest replace "shown by test, demonstration, or analysis" by "demonstrated". This assumes 'demonstrate' is a generic term, as in 'demonstrate compliance', applicable to which ever means are considered acceptable in the AMC.
response	Not accepted. Other commenters have proposed that ‘demonstrate’ does in fact suggest a physical demonstration, e.g. with a mock-up and human test subjects. It is not the intent to rule out, for instance, a design assessment, and thus the text will not be changed.

comment	*11* comment by: *Aerossurance* Delete the unspecific adjective "rapid". The ability to egress sufficiently quickly is covered by 801(c).
response	Not accepted. The reference to 801(c) is not understood. This paragraph is not related to occupant egress. The term ‘rapid’ is considered to be useful to reinforce the intent.

comment	*211* comment by: *UK CAA* **Page No:** 66 **Paragraph No:** CS 29.805 Flight crew emergency exits (c) **Comment:** The rule should match CS 27.805 in terms of marking of the operating device. The rule should also require that flight crew emergency exit operating devices must be accessible with inertia reel seat belts locked. **Justification:**

The operating device needs to be marked with black and yellow stripes in order to be visible under water. The exit will not fulfil its purpose if the flight crew member cannot reach the operating device. It is possible for inertia reel seat belts to lock in an accident (e.g. G-WNSB), restricting the movement of the flight crew member.

Proposed Text:

Add to the existing text as follows (new text underlined):

The operating device for each ditching emergency exit (pull tab(s), operating handle, etc.) must be marked with black and yellow stripes, and must be accessible with the flight crew member's seat belts locked.

response

Partially accepted.
In regard to marking with black and yellow stripes, this is covered by CS 29.811(h).
On investigation, EASA did not find any evidence that seat belt inertia reel locking had been an adverse safety issue in the accident quoted by the commenter. Furthermore, no other evidence of the problem suggested in this comment could be found.
However, EASA agrees that the general point raised, i.e. accessibility to exit operating devices whilst seated, is an important issue. It is agreed that CS 29.805(c) will be amended to specify that the accessibility must be shown for the range of flight crew anthropometric dimensions and for all possible post-crash conditions of crashworthy seats.

comment

248 comment by: *FAA*

CS 29.805(c)	The requirement to not be obstructed by water or flotation devices should be maintained	Do not remove "not be obstructed by water or flotation devices after a ditching." Or, use language similar to CS 29.807(d)(2) "Flotation devices, whether stowed or deployed, may not interfere with or obstruct the ditching emergency exits."

response

Not accepted.
The commenter makes a valid point in that it is important to ensure that water pressure and/or flotation devices do not adversely affect the operation and use of the flight crew emergency exits. However, it is considered that the text 'provide for rapid escape when the rotorcraft is in the upright floating position or capsized' sets the same intent, and to retain the text mentioned by the commenter would constitute excessive duplication.

comment

361 comment by: *Leonardo*

It is not clear how this is to be demonstrated for jettisonable doors or windows above a certain size due to water pressure

response

Noted.
It is assumed the commenter means that, for some designs, it might not be clear how substantiation can be provided for rapid operation underwater, bearing in mind the effects of water pressure.
This is understood. However, it is the responsibility of the applicant to substantiate that their

	design is suitable for its intended purpose.

comment	*376* comment by: *Bell Helicopter* Comment 29.805(c): Flight Crew Exits is unclear Recommendation: Need to establish a position
response	Noted. The commenter does not provide any indication of what is considered to be unclear.

CS 29.807 Passenger emergency exits p. 66

comment	*19* comment by: *Aerossurance* For clarity and to ensure means of compliance are discussed only in AMC, suggest replace "shown by test, demonstration, or analysis" by "demonstrated". This assumes 'demonstrate' is a generic term, as in 'demonstrate compliance', applicable to which ever means are considered acceptable in the AMC.
response	Not accepted. Other commenters have proposed that ‘demonstrate’ does in fact suggest a physical demonstration, e.g. with a mock-up and human test subjects. It is not the intent to rule out, for instance, a design assessment, and thus, the text will not be changed.

comment	*20* comment by: *Aerossurance* For clarity and to ensure means of compliance are discussed only in AMC, suggest replace "shown by test, demonstration, or analysis" by "demonstrated".
response	Not accepted. Other commenters have proposed that ‘demonstrate’ does in fact suggest a physical demonstration, e.g. with a mock-up and human test subjects. It is not the intent to rule out, for instance, a design assessment, and thus, the text will not be changed.

comment	*40* comment by: *Aerossurance* In (a)(3) change "show by test, demonstration or analysis" to "demonstrated" and rely on the AMC to define means of compliance. This assumes 'demonstrate' is a generic term, as in 'demonstrate compliance', applicable to which ever means are considered acceptable in the AMC.
response	Not accepted. The reference to (a)(3) is not understood. CS 29.807(a)(3) has not been amended and does not contain the quoted text.

comment	*41* comment by: *Aerossurance*

	In (d) replace "and must be proven by test, demonstration or analysis" to "must be demonstrated" and rely on AMC to describe means of compliance. This assumes 'demonstrate' is a generic term, as in 'demonstrate compliance', applicable to which ever means are considered acceptable in the AMC.
response	Not accepted. Other commenters have proposed that 'demonstrate' does in fact suggest a physical demonstration, e.g. with a mock-up and human test subjects. It is not the intent to rule out, for instance, a design assessment, and thus, the text will not be changed.

comment	*49* comment by: *Aerossurance* Suggest adding: When an exit is provided that is sufficiently large for simultaneous exit means of operation should be accessible to both adjacent occupants.
response	Partially accepted. The intent of this comment is accepted; however, it is considered preferable to achieve this intent by inserting additional text in the AMC to CS 29.809.

comment	*50* comment by: *Aerossurance* In (d)(1) suggest adding to first sentence "...and be visible to every associated passenger while seated".
response	Not accepted. It is considered that CS 29.811 already covers this point.

comment	*51* comment by: *Aerossurance* To avoid any cabin configuration with a longitudinal divide or obstruction, suggest adding in (d)(1): "All passengers in each unit should have access to both exit."
response	Not accepted. There is a general requirement that all passengers should have access to each emergency exit (CS 29.813), and thus, the obstruction issue raised by the commenter would be unacceptable in any case.

comment	*54* comment by: *Aerossurance* Add a requirement into (b)(10) that the adjacent passengers should be able to reach the handle while strapped into their seat with the inertia reel locked (so that they can have hold of the handle before unstrapping).
response	Noted. This would appear to be a duplicate of Comment 53, which is made against CS 29.809, and which is the more appropriate requirement. See the response to Comment 53.

comment	*230* comment by: *Sikorsky Aircraft Corporation* The NPA does not include substantiation for reducing the required exit size for 10 or more

	PAX from Type III to Type IV. Given that the NPA does not mandate external storage of life rafts but does mandate larger life rafts, there exists a potential conflict in the ability to get larger life rafts out the exits. This proposed change has the potential of increasing events if it is made retroactive as advised in Section 5. Recommendations for future rulemaking. It will reduce the number of passengers which can be carried thereby increasing the number of aircraft which must be used to support off-shore operations. This will increase (significantly) the number of flights which increases the likelihood of events. Given that the data shows all passengers successfully exited the aircraft after a ditching event, this change does not increase the likelihood of survival. Review of the data of SWI shows a large number of incapacitated occupants. Increasing the number of exits will not increase survivability of unconscious occupants. Given the misrepresentation of the events of flight GZCH it is questionable if the NPA properly reviewed the incident data. (See comments to Section 4. Regulatory impact assessment (RIA))
response	Not accepted. Whilst 'external' life raft location is not specifically required, remote deployment is required (i.e. manhandled life rafts will no longer be acceptable). It is difficult to see how an applicant could successfully propose a design that locates a life raft inside the fuselage and utilises an emergency exit aperture for its deployment. Potential for interference with passenger use of the emergency exit would either rule out such a design or force it to be of a very sophisticated design. The changes to CS-29 do not cover retroactive application of the new requirements. Retroactive application will be the subject of a second exercise, and the issues raised by the commenter would certainly need to be addressed and resolved before any application of the new emergency exit requirements could be applied.

comment	*377* comment by: *Bell Helicopter* Comment 29.807(d)(1): The provision for ditching emergency exits to be completely above the waterline has been removed. Recommendation: Agreement. Rotorcraft with "wet floors" do not need emergency exits to be completely above the waterline, since the water level inside the cabin might be at the same level as outside.
response	Noted. EASA appreciates Bell Helicopter's support for this change.

CS 29.809 Emergency exit arrangement p. 66-67

comment	*15* comment by: *Aerossurance* In (j)(2) clarify which doors (rather than say 'any'). Either link to "any non-jettisonable exit used in the demonstration of 29.803(c)(1)" or the more expansive "any exit that might be opened after a ditching"
response	Not accepted. It is not understood why either of the two proposals made by the commenter would be an improvement. The first does not cover the case of, for instance, a jettisonable door that can

	also be opened without jettisoning it. The second introduces the need for judgement as to which doors 'might' be opened after a ditching.
comment	*212* comment by: *UK CAA* **Page No:** 67 **Paragraph No:** CS 29.809 Emergency exit arrangement (j) **Comment:** The CS should require that ditching emergency exits not be susceptible to jamming in the event of distortion of the fuselage. **Justification:** Most of the avoidable fatalities have resulted from survivable water impacts where the rotorcraft structure will likely be subject to loads in excess of normal ditching load, and where the rotorcraft is virtually certain to capsize immediately. It is therefore essential that the ditching emergency exits are of a design that is not susceptible to jamming. **Proposed Text:** Add to the existing text as follows (new text underlined): (1) the design of ditching emergency exits, including their means of operation, markings, lighting and accessibility, must be optimised for use in a flooded and capsized cabin, and must not be susceptible to jamming in the event of distortion of the fuselage;
response	Not accepted. CS 29.809(e) requires, in any case, that the probability of any emergency exit jamming should be minimised.
comment	*249* comment by: *FAA* CS 29.809(j)(1) | Using "Optimized" in the language is difficult to certify. Use the word "designed" | Change "optimised" to "designed"
response	Accepted. The requested change has been made.
comment	*273* comment by: *AIRBUS HELICOPTERS* CS 29.809a "*Push-out*" is too prescriptive and could be removed.
response	Accepted.

	The term ‘push-out window’ has been changed to ‘openable window’. Other usage of the term ‘push-out window’ in requirements and AMC text has been removed.
comment	*274* comment by: *AIRBUS HELICOPTERS* CS 29.809j2 : "*it must be possible to egress the rotorcraft when capsized, with any door in the open and locked position*". Comment: The rationale for this requirement is that a passenger could try to escape using the same way he entered the helicopter or the same way he is used to follow to go out. Therefore, “any door” should be replaced by “usual entrance for passengers”. It might be impossible to open a door after ditching, especially if wet floor concept proposed in AMC is followed. Therefore, adapted wording would be “(…) with usual entrance for passengers that can be opened after ditching (…)”
response	Not accepted. The rationale of this requirement text is not as the commenter suggests. Many current helicopter designs incorporate sliding doors, which overlap emergency exits when open, thus rendering them unusable. This is a potentially unsafe design.
comment	*364* comment by: *Leonardo* Delete "The design of" and change "optimised" to "designed for"
response	Accepted. The requested change has been made.
comment	*378* comment by: *Bell Helicopter* Comment 29.809(j): The requirement for an Emergency Exit Arrangement is unclear Recommendation: A position needs to be established
response	Noted. This comment provides no indication of how the clarity of the subject requirement might be improved.
comment	*379* comment by: *Bell Helicopter* Comment 29.809(j)(1): The word “optimized” used in the text is too subjective. Recommendation: Change the text to: “Ditching emergency exits, including their means of operation, markings, lighting and accessibility, must be designed for use in a flooded and/or capsized cabin.”
response	Accepted. The text has been revised such that the intent of the requested change is satisfied.
comment	*380* comment by: *Bell Helicopter*

	Comment 29.809(j)(2): - "capsized with any door in the open and locked position" means that emergency windows in doors must align with other cabin emergency windows when the door is open and locked. This is overkill if the door is not to be used as an emergency exit. Recommendation: A position needs to be established
response	Not accepted. Experience has shown that doors may be opened by passengers in a ditching even if the passengers are briefed not to open them. Thus, this new requirement is considered to be a necessary improvement to the regulations.

comment	*411* comment by: *CAA-N* The introduction of a requirement for handholds etc. should be assessed for possible snagging hazard. (also relevant to some other CSs, such as 29.813, 29.1411)
response	Accepted. Additional text has been added to AMC 29.809 and AMC 29.813 to cover this issue.

CS 29.811 Emergency exit marking p. 67

comment	*14* comment by: *Aerossurance* Unlike normal markings, the black and yellow markings are expected to be of use in poor visibility underwater by potentially disoriented occupants. False 'targets' could hamper a prompt escape. Consider adding: "Black and yellow markings of any type should not be used elsewhere in the cabin where they might delay the successful location of such operating devices."
response	Not accepted. Although there may be other black/yellow markings in the flight crew area (e.g. hatching to outline fire extinguisher switches, life raft/emergency flotation deployment controls, cargo hook manual jettison switches) such markings will not be close to emergency exits, and/or will be of such an appearance that they are not likely to be confused by flight crew.

comment	*221* comment by: *Sikorsky Aircraft Corporation* The NPA lacks substantiation for changing the color of ditching emergency exits. Further, Table B-1, Item 31 lists the mitigation of the risk as “standardization of emergency exits”. The current standard for emergency exits is Red. Strong substantiation needs to be provided to support changing a long standing standard.
response	Not accepted. The only regulatory standard for the colour of the means of opening emergency exits relates to Type I and II emergency exits only. Such exits are unusual on helicopters and, in any case, are unlikely to be proposed as emergency exits that are intended to function underwater. The colour red is of low visibility in the dark. The introduction of a requirement for black/yellow markings is therefore considered to be justified.

comment	*250* comment by: *FAA*

CS 29.811(h)(1)	This is intended to mandate HEELS type lighting. The rule should require backlighting, and be more specific to what "illuminated markings" means.	
CS 29.811(h)(2)	Proposed language does not address designs with no operating device, such as simple pushout window with no pull tab.	Replace CS 29.811(h)(2) with "Operational marking for each ditching emergency exit must consist of black and yellow contrasting colors."

response

Partially accepted.
The text has been changed in order to better point out that the subject illuminated markings must be more highly conspicuous than those required by CS 29.811(a). Guidance as to what this means is already provided in the associated AMC text.
See the reply to Comment 237. The same amendment as that made to CS 27.805(c) has been made to CS 29.811(h)(2).

comment

349 comment by: *Leonardo*

What should trigger "HEELS" illumination?
Lighting the means of opening is not always feasible

response

Noted.
The AMC text associated with the subject requirement provides some indication of methods that might be used to trigger the illumination. However, it is considered inappropriate to provide further detail, as this might be seen as a restriction on design choices.
Highlighting the means of opening is a critical aspect for operating the exit rapidly, and although achieving this might be challenging in some cases, this is not a valid reason to amend the AMC text.

comment

412 comment by: *CAA-N*

Requirement for marking by black and yellow stripes may be too prescriptive.
It could be argued that other combinations may be just as visible. It should be reworded to required combinations that are visible and conspicuous under water. This comment is applicable for all "Black and Yellow" requirements. AMC may specify "Black and Yellow" markings.

response

Not accepted.
There is a need for both increased underwater visibility and some degree of standardisation. The black/yellow marking requirement provides both.

CS 29.812 Emergency lighting p. 67

comment

16 comment by: *Aerossurance*

	For clarity change "equal to the width of the emergency exit where an evacuee is likely to make first contact with the ground or life raft outside the cabin" to "equal to the width of the emergency exit, both for where an evacuee is likely to make first contact with the ground outside the cabin and for where they are likely to make first contact when boarding the life raft".
response	Partially accepted. It is agreed that the simple addition of 'or life raft' to the pre-existing text of CS 29.812(b) does not result in an optimum text. A change along the lines proposed has been made.

comment

251 comment by: *FAA*

CS 29.812(b)	Since "or life raft" is being added to the requirement, "ground surface" needs to be clarified as well	After "ground surface" add "or life raft entry point"

response

Partially accepted.
It is agreed that the simple addition of 'or life raft' to the pre-existing text of CS 29.812(b) does not result in an optimum text. A change adding the requested clarification has been made.

CS 29.813 Emergency exit access p. 68

comment

232 comment by: *Sikorsky Aircraft Corporation*

See comments to CS 29.807(d)(1).

response

Not accepted.
See the response to Comment 230

comment

381 comment by: *Bell Helicopter*

Comment 29.813(d) : The text is prescribing "handholds"
Recommendation: Text could be made less prescriptive by changing text to: "a means must be provided to assist with cross cabin egress"

response

Accepted.
The text has been amended, as broadly as proposed.

CS 29.1415 Ditching equipment p. 68-69

comment	*85* comment by: *NHF Technical committee* Comment to item (2): NHF fully support this paragraph, as it already is a customer requirement by the major oil and gas producers in Norway. (Norwegian oil and Gas guideline 066). Deployment handle for liferaft when helicopter is in the capsized position is a very important improvement, as the passengers will not be able to deploy liferaft in any other ways, without diving below the helicopter.
response	Noted. EASA appreciates the NHF technical Committee's support for this change.

comment	*173* comment by: *Zodiac Evacuation Systems division - France* CS29.1415 (a) How do we link ditching level of the helicopter with the existing ETSO of the life rafts and life suit ? - In CS 2C505 : the wave height and wind are already defined in the ETSO - In CS 2C504 : there is no sea condition definition. recommandation : Clarify the requirement
response	Accepted. Life rafts are the only category of ditching equipment for which there are different design standards in regard to sea condition substantiation (i.e. ETSO C70b vs. ETSO 2C505). The text of CS 29.1415, and the associated AMC, is thus revised to recognise this. There are no such differing standards for immersion suits.

comment	*199* comment by: *Zodiac Evacuation Systems division - France* CS29.1415 (b) (2) This requirement is too subjective recommandation : To clarify "any reasonably foreseeable floating attitude" and in which case the activation handles should be considered
response	Not accepted. The AMC text associated with this requirement provides clarification.

comment	*213* comment by: *UK CAA* **Page No:** 69 **Paragraph No:** CS 29.1415 Ditching equipment (b)(1) **Comment:** At least two life rafts must be installed. This used to be clear in the CS text, but now isn't.

Justification:

A minimum of two life rafts are required in case one is rendered unusable due to puncturing (increasingly likely with the increasing use of carbon fibre in rotorcraft construction), or because either one cannot be deployed due to high winds (the life raft on the windward side of the rotorcraft will be blown against the side of the rotorcraft and unusable).

Proposed Text:

Add to the existing text as follows (new text underlined):

"(1) The number of life rafts installed must be no less than two and no smaller than that stipulated in Regulation (EU) No 965/2012. …"

response

Accepted.
Although operational regulations may allow for a single raft to be carried in some cases, after further consideration, it is concluded that for a CS-29 helicopter, a design requirement for a minimum of two rafts is justified.
The subject requirement has been amended to reflect this.

comment

215 comment by: *UK CAA*

Page No: 69

Paragraph No: CS 29.1415 Ditching equipment (c)

Comment:

Constant wear life preservers must be clearly mandated. The purpose/relevance of this new text is not clear.

Justification:

It is not possible to don a life preserver in due time in the cramped environment of a helicopter cabin, especially where immersion/survival suits are required and/or in the event of capsize.

Proposed Text:

Modify the existing text as follows (deleted text struck through):

(c) If life preservers are stowed, they must be installed in a way that they are readily available to the crew and passengers. The stowage provisions for life preservers must accommodate one life preserver for each occupant for which certification for ditching is requested by the applicant ~~.Life preservers. If Regulation (EU) No 965/2012 allows for life preservers not to be worn at all times, they must be stowed within easy reach of each occupant while seated in the rotorcraft.~~

response

Not accepted.
Operational rules do not require constant-wear life preservers in all cases. It is considered

	that the text is appropriate to cover operational cases where life preservers may be stowed.

comment

252 comment by: *FAA*

CS 29.1415(b)(2)	It is understood that the word "demonstrated" as used, could consist of physical demonstrations, analysis, or a combination of both.	Add clarification of the requirement in the AMC

response

Accepted.
In order to avoid the potential for confusion regarding the meaning of ‘demonstrate’, all such references have been changed to ‘substantiate’ where it is intended that analysis is acceptable.

comment

351 comment by: *Leonardo*

If more than one life raft is installed, they must be approximately equal in size and accommodate all occupants in one at overload - This is too prescriptive as occasionally, three or more liferafts may be fitted and for good reason they may be of different sizes (e.g. individual rafts for the crew).

response

Not accepted.
Crew should not be provided with rafts that are separate from those for the passengers because they have an essential role in ensuring the continued survival of the passengers after egressing the helicopter.

comment

367 comment by: *Leonardo*

Remote raft deployment (from cockpit / cabin or outside the aircraft) reliably and with the helicopter in any attitude - It must be demonstrated" suggests a physical demonstration. Wording should be clarified to ensure that this can be "shown by design / inspection / analysis

response

Accepted.
The text has been revised, using ‘substantiated’ instead to indicate that a physical demonstration will not necessarily be required.

comment

382 comment by: *Bell Helicopter*

Comment 29.1415: Operating regulation has been specified.
Recommendation: Change to refer to “operating rules” and not the specific regulation.

response

Accepted.
See the response to Comment 315.

comment

383 comment by: *Bell Helicopter*

Comment 29.1415(b): Requirement is very prescriptive and will limit designs that have other

	means to ensure life rafts are deployed after water entry (i.e. automatic life raft deployment) Recommendation: Requirement should be rewritten to consider other possibilities for the deployment of life rafts
response	Partially accepted. There is no text in CS 29.1415(b) that prohibits an automatic life raft deployment design. However, it is EASA's position that manual remote controls should be provided in every case. Manual deployment should be provided to cater for the case of failure of the automatic deployment features. However, the associated AMC text is revised to clarify that automatic life raft deployment will be acceptable in addition to manual deployment, but not instead of it.

comment	*384* comment by: *Bell Helicopter* Comment 29.1415(b): It is unclear if a physical demonstration is being requested. Recommendation: Text should be revised to clarify the intent. The regulation should only identify the requirement to have a system that will ensure life rafts are deployed in any sea condition either automatically or manually by all occupants and not have an adjective to suggest a specific means to demonstrate compliance.
response	Accepted. See the response to Comment 367.

comment	*413* comment by: *CAA-N* No mention of mitigation of the difficulty experienced by crews to launch the upwind life raft (e.g. LN-OBP) rendering half the life raft capacity potentially unusable "by design". This has been reported a problem even with wind speeds as low as 25 kts. However, wind is mentioned in AMC 29.1415 (b)(1).
response	Noted. The difficulty of launching a raft on the upwind side of a helicopter was considered by the rulemaking group. However, no feasible mitigation was identified, other than placing life rafts on both sides of the helicopter. The AMC material associated with this requirement highlights this point.

CS 29.1470 Emergency locator transmitter (ELT) p. 69

comment	*62* comment by: *Aerossurance* For total clarity, change "including crash sensors" to "including impact and water immersion sensors".
response	Same as 63.

comment	*385* comment by: *Bell Helicopter* Comment: Operating regulation has been specified. Recommendation: Change to refer to "operating rules" and not the specific regulation.

response	Accepted. See the response to Comment 315.

CS 29.1555 Control markings p. 69-70

comment	*222* comment by: *Sikorsky Aircraft Corporation* Same comment as CS 29.811
response	Not accepted. See the response to Comment 221.

3.2.4. Draft amendment to CS-29 — Book 2, AMC 29.563 Structural Ditching Provisions p. 70-71

comment	*7* comment by: *Luftfahrt-Bundesamt* 7) page 70, related AMC: the same comment as in 5)
response	Accepted. The NPA was in error because it did not provide any indication in some cases as to whether the AMC text was intended to supplement or replace the corresponding FAA AC text. This has been corrected.

comment	*216* comment by: *UK CAA* **Page No:** 70 **Paragraph No:** AMC 29.563 Structural Ditching Provisions (a)(1)(ii) **Comment:** The descriptions of the horizontal and vertical velocities are not entirely clear. **Justification:** It was agreed in RMT.0120 that it would no longer be necessary to take account of water particle velocity. The definitions of horizontal and vertical velocities need to correctly reflect this. Note that this is also to ensure consistency with AMC 29.801 (c)(6)(i) & (ii) on page 77. **Proposed Text:** Modify the existing text as follows (new text underlined, deleted text ~~struck through~~): (ii) The ground speed~~velocity relative to the wave surface~~ should be in a range of 0–56 km/h (30 kt) with a ~~vertical~~ descent rate of not less than 1.5 m/s (5 ft/s) ~~relative to the mean wave surface~~. No account need be taken of the wave particle velocity.
response	Partially accepted.

Both the requirement CS 29.563 and its associated AMC have been revised extensively following various comments received.
The new text provides better clarification in regard to the velocities to be considered when showing compliance with the structural ditching provisions and it is believed that the concern raised by this comment has been addressed.

comment

217 comment by: *UK CAA*

Page No: 71

Paragraph No: AMC 29.563 Structural Ditching Provisions (b)(3)(i) & (iv)

Comment:

The descriptions of the horizontal and vertical velocities are not entirely clear.

Justification:

It was agreed in RMT.0120 that it would no longer be necessary to take account of water particle velocity. The definitions of horizontal and vertical velocities need to correctly reflect this. Note that this is also to ensure consistency with AMC 29.801 (c)(6)(i) & (ii) on page 77.

Proposed Text:

Modify the existing text as follows (new text underlined, deleted text ~~struck through~~):

(i) ~~forward velocities~~ ground speed of 0–56 km/h (30 kt) ~~relative to the mean wave surface~~;

(iv) ~~vertical-~~descent rate ~~velocity~~ of 1.5 m/s (5 ft/s) or greater ~~relative to the mean wave surface~~.

response

Partially accepted.
See the response to Comment 216

comment

253 comment by: *FAA*

AMC 29.563 (a)(1)(ii)	The concept of wave particle velocity does not clarify analysis requirements. This is a test demonstration, and the airspeed and descent speed are what matters	Remove "No account need be taken of the wave particle velocity."

response

Accepted.
This sentence has been removed.

comment

266 comment by: *AIRBUS HELICOPTERS*

See our comment n°265 on CS 29.563 (a).

response

Accepted.
See the response to Comment 265.

comment

354 comment by: *Leonardo*

The "simplification" is confusing. LH proposed wording is included below to further clarify the intent to consider only the wave steepness of the most critical wave, and then determine impact speeds and angles relative to that surface. The wave shape and speed can be ignored and impact treated as onto a flat surface. Analysis is an acceptable means of deriving the loads. It is also proposed to remove the confusing, almost duplicated wording in the "procedures" section:

LH Proposed rewording to clarify new AMC29.563 (Changes in Red):

Draft amendment to CS-29 — Book 2
1. Create a new AMC 29.563 as follows:

AMC 29.563
Structural Ditching Provisions
(a) Explanation. This AMC includes specific structural conditions to be considered to support the overall ditching provisions of CS 29.801. These conditions are to be applied to rotorcraft for which certification with ditching provisions is requested by the applicant.

(1) The ~~forward-speed~~ landing conditions are specified as follows:

(i) The rotorcraft should contact water with a steepness defined as that of the most critical wave in the ~~probable~~ sea conditions for which certification with ditching provisions is requested by the applicant in the likely pitch, roll, and yaw attitudes that would reasonably be expected to occur in service; autorotation, run-on landing, or one-engine-inoperative flight tests, or validated simulation, as applicable, should be used to confirm the attitude selected.

(ii) The wave is to be considered as a stationary body of water.

(iii) The forward velocity relative to the wave surface should be in a range of 0–56 km/h (30 kt) with a vertical-descent rate of not less than 1.5 m/s (5 ft/s) relative to the ~~mean~~ wave surface. ~~No account need be taken of the wave particle velocity.~~

(iv) A rotor lift of not more than two-thirds of the design maximum weight may be used to act through the rotorcraft's centre of gravity during water entry.

(v) The above conditions may be simulated or tested using a calm horizontal water surface to give an equivalent impact normal velocity relative to the water surface.
.....
.....
(b) Procedures

(1) The rotorcraft support structure, structure-to-float attachments, and floats should be substantiated for rational limit and ultimate ditching loads.

(2) The most severe sea conditions for which certification with ditching provisions is requested by the applicant are to be considered. The sea conditions should be selected in accordance with AMC 29.801(e).

~~(3) The landing structural design consideration should be based on water entry with a rotor lift of not more than two-thirds of the maximum design weight acting through the rotorcraft's centre of gravity under the following conditions:~~
~~(i) forward velocities of 0–56 km/h (30 kt) relative to the mean wave surface;~~
~~(ii) the rotorcraft pitch attitude that would reasonably be expected to occur in service; autorotation, run-on landing, or one-engine-inoperative flight tests, or validated simulation, as applicable, should be used to confirm the attitude selected;~~
~~(iii) likely roll and yaw attitudes; and~~
~~(iv) vertical descent velocity of 1.5 m/s (5 ft/s) or greater relative to the mean wave surface.~~

(4~~/~~3) Landing load factors and water load distribution may be determined by water drop tests or validated analysis.

(5~~/~~4) Auxiliary or emergency float loads should be determined by full immersion or by the use of restoring moments required to compensate for upsetting moments caused by side wind, asymmetrical rotorcraft landing, water wave action, rotorcraft inertia, and probable structure damage and punctures considered under CS 29.801. Auxiliary or emergency float loads may be determined by tests or analysis based on tests.

(6~~/~~5) Floats deployed after water entry are required to be substantiated by tests or analysis for the specified immersion loads (same as for (4) above and for the specified combined vertical and drag loads).

response

Partially accepted.
In response to other comments received, an extensive revision of CS 29.563 and its associated AMC has been made.
The issue raised by the commenter has been resolved by this revision.

comment

386 comment by: *Bell Helicopter*

Comment AMC 29.563(a)(1)(i): AMC material usually adds clarity to terms used in the regulations. This does not. The use of descriptors used in "most critical wave", "probable sea condition", and "likely pitch, roll and yaw attitudes" are not sufficiently specific with respect to irregular wave spectrums. As discussed previously, how is the most critical wave defined (rogue wave)? Same applies to probable sea conditions, and likely attitudes.
Recommendation: Recommend clarifying (quantifying) the descriptors used in the AMC.

response

Accepted.
In response to other comments received, an extensive revision of CS 29.563 and its associated AMC has been made.
The issue raised by the commenter has been resolved by this revision.

AMC 29.801 Ditching p. 72-80

comment	*25* comment by: *Aerossurance* (c)(8)(i) states that "additional flotation units" should "meet the same standards of float design". It would be highly beneficial to avoid misunderstanding if the specific provisions were listed here. Care should be taken when doing this. The term "additional flotation units" is not specifically defined and should not equate exclusively to EFS style equipment. We note that some past proposals have involved forms of low density buoyant material and permanent inflated 'internal floats and appropriate requirements for such solutions should be considered now.
response	Noted. This suggestion perhaps has merit; however, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment	*86* comment by: *NHF Technical committee* Comment to point (6): Still the system must be designed to prevent unintentional deployment during flight. Either by crew or by technical system failure. Unitentional deployment of EFS should never in any phase of flight endanger flight safety. (EFS folding into rotor, engines etc.)
response	Noted. It is agreed that unintentional deployment of the EFS in flight must either be shown to not endanger flight safety or be shown to be sufficiently unlikely.

comment	*87* comment by: *NHF Technical committee* AMC 29.801 (c) Procedures Comment to item (1) (ii) (C): EFS should by design never endager flight safety, even with unintentional deployment. AMC 29.801 (c) Procedures Addition of text to item (2): Special caution must be made to prevent puncture of floats, either in flight or in the sea, from other sharp objects, such as antennas, scoops, doors, handles or other items installed near the floats.
response	Noted. It is agreed that unintentional deployment of the EFS in flight must either be shown to not endanger flight safety or be shown to be sufficiently unlikely. Accepted Additional text has been added to AMC 29.801, (c) Procedures, along the lines proposed.

comment	*88* comment by: *NHF Technical committee*

	AMC 29.801 (c) Procedures Comment to item (6) Water entry tests: NHF welcomes real test, and not only theoretical calculations.
response	Noted. NHF's comment is noted.

comment	*90* comment by: *NHF Technical committee* c) Procedures Comment to point (8) (i): Still the system must be designed to prevent unintentional deployment during flight. Either by crew or by technical system failure. Unitentional deployment of EFS should never in any phase of flight endanger flight safety. (EFS folding into rotor, engines etc.)
response	Noted. The referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment	*91* comment by: *NHF Technical committee* Comment to item (9): NHF fully support the considerations done in this NPA related to sufficient means of compliance of CS 29.801(i) reasons, of use of EBS.
response	Noted. EASA appreciates this support; however, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment	*98* comment by: *Aerossurance* In AMC 2x.801(a)(1) replace abandoning with evacuating (or 'egressing') for consistency with other text.
response	Not accepted. See the response to Comment 105.

comment	*103* comment by: *Aerossurance* Change last sentence of 2x.801(a)(2) to be more encompassing (for example to capture designs that use internal or integral buoyancy features): The EFS includes any additional floats or other features which provide a flotation function

	following capsize.
response	Partially accepted. EASA agrees with the intent of the proposed change. However, the sentence in question has been removed anyway, as a consequence of other comments received.

comment	*104* comment by: *Aerossurance* In AMC 2x.801(a)(2) amend the description of the EFS to be more expansive and non-exclusive: (e.g. gas cylinders, gas generators, sensors, controls, means of deployment, pipework and electrical connections)
response	Partially accepted. The addition of 'e.g.' at the beginning of the list of example items constituting the EFS is agreed to be a desirable change for the reasons given in the comment. However, expansion of the list is not agreed as being required.

comment	*109* comment by: *Aerossurance* The exact intent and possible value AMC 2x.801(b)(7) is unclear (configuration management of the build standard or standards to be certified is a normal and integral certification activity).
response	Accepted. The paragraph has been deleted.

comment	*113* comment by: *Aerossurance* It would be undesirable for endless wave climate studies to be required for each new offshore exploration campaign. NNS wave climate was selected as a default, reasonable worst case wave climate. For clarity, either in 2x.801(b)(8) reference the clearer explanation in AMC 2x.801(e)(a)(2) or replace 'also select alternative/additional sea areas' with 'may select less conservative wave climates as an alternative or addition'. This wording would more clearly allow both less demanding conditions (but with geographic restrictions) if the applicant was minded to restrict their product or additional geographically limited conditions to be added (with more relevant local performance data).
response	Not accepted. It is considered that the current text conveys the intent clearly enough.

comment	*115* comment by: *Aerossurance* In AMC 2x.801(b)(12) remove the words "although this was inconclusive in previous

	research". While past research can help inform designers, the success or failure of past research projects is not directly relevant to the potential compliance and performance of a future design. This text has the unintended consequence of potentially discouraging future safety enhancing innovation.
response	Accepted. The text in question has been deleted.

comment	*117* comment by: *Aerossurance* AMC 29.801(b)(14): To avoid confusion replace 'remains on the surface' with 'does not sink' (the subject of the para).
response	Accepted. The suggested change has been made.

comment	*119* comment by: *Aerossurance* AMC 29.801(b)(15): unless these are to be in the RFM limitations section replace 'expected to' with 'may'.
response	Partially accepted. The intent of this comment is accepted. However, in response to a different comment (ref. Comment 392), the text is removed in any case.

comment	*121* comment by: *Aerossurance* It is suggested that further text is necessary to clarify the difference between AMC 2x.801(c)(ii)(B) and (C) (which seems to deal with partial deployment).
response	Not accepted. It is assumed that the comment is in relation to paragraph 2x.801(c)(1)(ii)(B) and (C). It is considered sufficiently clear that (B) refers to the condition of fully inflated floats, and (C) refers to the transient condition during inflation.

comment	*124* comment by: *Aerossurance* AMC 2x.801(c)(1)(iii)(B) contains both the terms 'normal' and 'excessive'. Suggest both should be 'normal' for consistency.
response	Accepted. The intent of the proposed change is achieved by simply deleting the word 'excessive'.

comment	*126* comment by: *Aerossurance* AMC29.801(c)(5) makes references to 'establishing' multiple procedures but it is not

	immediately evident which provision requires their promulgation (perhaps 29.801(h), although that does not explicitly reference procedures per se).
response	Not accepted. It is considered obvious that this section is discussing procedures that must be provided for insertion in the RFM.

comment	*129* comment by: *Aerossurance* It is suggested that AMC29.801(c)(6)(iii) is expanded to clarify what effects of the damage are being 'considered' and why.
response	Not accepted. The effects to be considered will be obvious when the particular probable damage for the helicopter in question is determined. However, after consideration, it was found appropriate to delete ‘tail boom’ from the list of examples.

comment	*133* comment by: *Aerossurance* AMC 29.801(c)(8) and (9) relate to AMC to 29.801(i). (8) optimistically focuses on a sole means of compliance (a cabin air pocket) which has not yet been fully demonstrated in practice and has been studied in only limited research into small elements of the overall concept (focused on ditchings not SWIs - see below), with significant unresolved issues still remaining from recommendations of those research reports (including EASA.2007.C16 - see NPA page 160). We would assess the cabin air pocket concept postulated as TRL 3 / 4 (even having considered recent R&D activity in Australia). The text currently is primarily focused on specification of certain design features of this unproven, solution but we are not convinced that the key aspects of likely designs are fully covered. We believe insufficient assessment has been made of whether this concept can be applied to new designs without introducing deterioration in other performance and unintended consequences (seat belt release and inadvertent upper float deployments have been identified by UK AAIB and prior research as potential problems). As the NPA identifies, the opportunity for reducing fatalities is in SWIs not ditchings. We believe AMC 29.801(c)(8) is critically flawed as it does not sufficiently address the crashworthiness of the cabin air pocket and the associated design features (EFS, other escape features and airframe) such that it has a reasonable chance of being available to provide a safety benefit when needed. We have not seen any evidence that such crashworthiness is likely to be provided with the level of assurance that appears to have been assumed in the Regulatory Impact Assessment. For example one offshore helicopter accident scenario that in the Regulatory Impact Assessment results in a significant life saving opportunity, the 12 March 2009 Canadian S-92A accident, the fuselage failed above the windows in a way that no usable air pocket would have survived. We are also concerned that insufficient attention has been paid to the training and human

behavioural aspects of a fundamental change to escape philosophy in the event of a post-ditching capsize and the expectation of a certain escape method in the event of an SWI that may not occur due to airframe and EFS damage (noting that EASA.2007.C16 [NPA page 160] comments on the need for ergonomic studies). Currently offshore passengers are trained to orientate themselves to their nearest window as their prime escape route (one means to minimise disorientation). In the cabin air pocket concept they are expected to trust an air pocket exists and that natural buoyancy will take them there. In the case of a SWI this trust may not be well founded as noted above due to impact damage.

We also believe insufficient attention has been paid to the probability of physically escaping from the cabin air pocket in a state that would allow survivors to successfully board a raft and await rescue. While some studies have raised the issue of injury during an escape from a cabin air pocket (see UK CAA 2010/10 [NPA page 156]), the effect of even minor extra injuries in reducing occupants ability to survive until rescued has not, to our knowledge, been scientifically studied.

We also note that some 'side floating' concepts may reduce access to some life rafts (see UK CAA 2010/10 [NPA page 156] and EASA.2007.C16 [NPA page 160]), which is likely to be particularly critical in an SWI with the added risk that some of the rafts may have been damaged on impact.

We note that training and human behaviour has been used in AMC 29.801(c)(9) 'against' Cat A EBS, whereas they are not considered in AMC 29.801(c)(8) in relation to a cabin air pocket. We expand on this point constructively in another comment.

(9) discusses but denigrates one survival feature that has been deployed in service and used successfully by survivors in a number of military and civil accidents around the world. UK CAA Paper 2003/14 (see NPA p 157) describes the significant extension they give underwater survival times and their ability to bridge the gap between breath-hold time and escape time. This is a design feature that has inherent crashworthiness and redundancy in so far as independent systems are issued to each occupant. We would assess Cat A EBS / CA-EBS as TRL 8 / 9.

We note that in March 2016 the UK AAIB made recommendation 2016-019 following the accident to G-WNSB to introduce a side floating concept (a specific cabin air pocket implementation). However we also note recommendation 2016-016 on gathering realistic escape data from trials to address the inadequate information from accidents on survivor behaviour.

Appendix B Items 10 and 19 makes unduly optimistic assumptions on training/human behaviour and mitigation crashworthiness in relation to EFS modification and unduly pessimistic assumptions on these in relation to EBS.
In particular the assumption that a modified EFS would result in a reduction to Major is not borne out by past accidents (e.g. the 2009 S-92A accident where the separation of the cabin roof above the windows is noted by TSB) and means this remains Hazardous.

While we hope that the air pocket concept does mature to be a realistic option to aid the objective of 29.801(i) and provide practical safety benefit in-service we feel that AMC 29.801(c)(8) is currently too prescriptive (and therefore not compliant with the current EASA rule making philosophy) and unjustifiably optimistic whereas AMC 29.801(c)(9) is too negative. The rule making team should rebalance these two paragraphs.

Unless realistic AMC is provided for 29.801(i) it is possible that delays will occur in the ditching certification of new large helicopters (or even a delay seeking ditching certification) that will delay the introduction of other new safety features and improvement enhancements leaving existing helicopters in service longer.

response

Noted.

This points raised by this comment have been considered at length by EASA.

It is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features that are the subject of this AMC text. (See the response to Comment 345).

comment

134 comment by: *Aerossurance*

AMC 29.801(c)(8)(i) describes 'consideration' of automatic deployment of inflatable 'additional buoyancy' in relation to avoiding damage to the floats or impact debris. The AMC should be expanded to include the possible effect on stability of an upright helicopter, escaping passengers and deployed liferafts if such floats are deployed prior to capsize.

response

Noted.

Whilst the points raised may be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features (See the response to Comment 345).

comment

135 comment by: *Aerossurance*

AMC 29.801(c)(8)(i) should be expanded to discuss how the time to reach a 'stable' condition in the event of a capsize should be considered. If for example a design could in any realistic circumstance roll beyond the inverted position (one or more times) before becoming stable not only would this submergence time need to be counted against the breath hold time but the ensuing level of disorientation and psychological stress (with its attendant reduction in breath hold performance) would need to be considered.

response

Noted.

Whilst the points raised may be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment

136 comment by: *Aerossurance*

In relation to AMC 29.801(c)(8)(ii), it should be emphasised that the ability to have a wet floor as described in AMC 29.801(b)(12) offers the possibility to achieve levels of stability not

	previously, reducing the probability of capsize and leaving all windows above the waterline for rapid egress.
response	Noted. Whilst the point raised may be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment	*138* comment by: *Aerossurance* AMC 29.801(c)(8)(iii): The seats must be considered BOTH in the stoked and un-stroked position. This is because a post ditching capsize is likely to feature un-stroked seats that will partially constrain the upper portion of the air pocket.
response	Noted. Whilst the point raised may be valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment	*140* comment by: *Aerossurance* In AMC 29.801(c)(8)(iii) we note the reference to the 'static waterline'. In practice the water surface within the cabin will be 'dynamic' as the fuselage itself will not be static in relation to the water surface. We are not aware of past research that has examined this aspect in detail and how occupants of a cabin air pocket will be effected. However it is reasonable to expect that some survivors in a cabin air pocket will be briefly submerged several times before exit, reducing their ability each time to successfully egress the air pocket. Therefore we believe it is appropriate that AMC 29.801(c)(8)(v) contains specific reference to an acceptable time to egress the cabin air pocket.
response	Noted. Whilst the points raised may be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment	*141* comment by: *Aerossurance* In AMC 29.801(c)(8)(iii)-(v): It is also reasonable to expect that some passengers will activate their life jackets in the air pocket (for reasons similar to that postulated in AMC 29.801(c)(9)(iv) among others) and it should be possible for any passenger in each row or group of seats successfully exist with an inflated life jacket, without adversely affecting the chances of survival of any other passenger.
response	Noted. Whilst the points raised may in be fully or in part valid, it is to be noted that the referenced

	paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).
comment	*142* comment by: *Aerossurance* AMC 29.801(c)(8)(v): Reference is made to the possible depth of operating handles underwater. In practice these are likely to be above the waterline and potentially above the heads of survivors. It is important to verify that exits can be realistically ejected without damage to the EFS and do not fall into the cabin below.
response	Noted. Whilst the points raised may in be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).
comment	*143* comment by: *Aerossurance* AMC 29.801(c)(8)(vi): Other ditching requirements include criteria were the most critical float has failed too. As the cabin air pocket concept potentially introduces additional extra deploying flotation devices, each with their own potential for deployment failures or damage, and is (based on the past accident analysis) primarily of safety benefit in the event of a SWI in which impact related damage is more likely, it would be appropriate for this AMC to consider the affect loss of a critical float on EFS capability on the size of the available air pocket.
response	Noted. Whilst the points raised may in be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).
comment	*144* comment by: *Aerossurance* AMC 29.801(c)(9): Delete the word 'limited' in para 2 as unnecessarily judgemental and negative (all mitigations have some performance boundaries).
response	Noted. Whilst the point raised may in be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).
comment	*145* comment by: *Aerossurance* AMC 29.801(c)(9): Delete the words in para 2 'but it should not...' onwards. CS-29.801(i) is

an objective based requirement that involves successful application off a number of egress related design features not just those that provide access to breathable air (as ease and rapidity of egress also contribute). EBS is a survival feature that has been deployed in service and used successfully by survivors in a number of military and civil accidents around the world. This is a design feature that has inherent crashworthiness and redundancy in so far as independent systems are issued to each occupant. It also has a capacity to directly mitigate cold shock. We would assess Cat A EBS / CA-EBS as TRL 8 / 9 (substantially higher than that of a cabin air pocket).

response

Noted.

Whilst the point raised may in be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment

146 comment by: *Aerossurance*

AMC 29.801(c)(9)(i): While this statement is in itself correct it is used in an unduly negative sense, as all survival, safety and exit mechanism equipment depends on its successful use and prior training (and the cabin air pocket will also depend on individual ability to successfully compete an escape).

We do however note that UK CAA, in response to an enquiry from an offshore passenger has made the following statement in relation to equipment now in use in the UKCS:

The new EBS is based on the military PSTASS (Passenger Short Term Air Supply System) equipment which was designed to be used with no training at all. The requirement for dry training was considered to be conservative, and also allowed the equipment to be introduced sooner. The industry is working towards wet training with the new EBS.

https://www.caa.co.uk/Blog-Posts/Offshore-helicopter-operations/

Hence, although we strongly believe practical dry and wet EBS training is important, we view this public UK CAA statement as supporting our position that both AMC 29.801(c)(9)(i) and (ii) are unduly negative.

These 'reasons' should either be removed or re-framed as considerations (on training) for all solutions to 29.801(i). We note in particular that HUET training will need to realistically address cabin air pocket egress in future if it is not to introduce negative learning.

response

Noted.

Whilst the point raised may in be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment

147 comment by: *Aerossurance*

AMC 29.801(c)(9)(ii): While this statement is in itself correct it is used in an unduly negative

sense, as all survival, safety and exit mechanism equipment depends on its successful use and prior training (and the cabin air pocket will also depend on individual ability to successfully compete an escape).

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Hence, although we strongly believe practical dry and wet EBS training is important, we view this public UK CAA statement as supporting our position that both AMC 29.801(c)(9)(i) and (ii) are unduly negative.

These 'reasons' should either be removed or re-framed as considerations (on training) for all solutions to 29.801(ii). We note in particular that HUET training will need to realistically address cabin air pocket egress in future if it is not to introduce negative learning.

response

Noted.
Whilst the points raised may in be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment

148 comment by: *Aerossurance*

AMC 29.801(c)(9)(iii): While this statement is in itself correct it is used here in an unduly specific negative sense against one possible solution, as it affects all aspects of egress and all means of compliance with 29.801(i). We suggest this is deleted.

response

Noted.

Whilst the point raised may in be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment

149 comment by: *Aerossurance*

AMC 29.801(c)(9)(iv): While this statement is in itself correct it is used here in an unduly specific negative sense against one possible solution, as it effects all means of compliance with 29.801(i). In practice we believe that the availability of a Cat A EBS will reduce panic as each occupant will have their own independent air supply, will allow egress from the nearest exit and mitigate against either a non-existent or unusable air pocket too. We suggest this is retained in a modified format, but as a consideration for all solutions, with it specifically noted that Cat A EBS provides a reliable source of air for occupants irrespective of impact

	damage to the rotorcraft, even in cases of cold shock.
response	Noted. Whilst the points raised may in be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345)

comment	*150* comment by: *Aerossurance* AMC 29.801(c)(9)(v): This statement is also applicable to occupants egressing through their adjacent window, as per their current training, and not using a cabin air pocket (if one is available). We believe this is a spurious point, targeted unfairly at one possible egress option an should be deleted.
response	Noted. Whilst the points raised may in be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment	*151* comment by: *Aerossurance* AMC 29.801(c)(9)(vi): This statement is also unnecessarily negative against one possible means of compliance and should be deleted. We note no text in AMC29.801(c)(8) for example that considers the injuries the 'lower' passengers might receive as 'upper' passengers release themselves.
response	Noted. Whilst the points raised may in be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment	*152* comment by: *Aerossurance* AMC 29.801(c)(10): please define / explain 'critical occupant egress capabilities'.
response	Not accepted. The text in question has been taken from existing guidance material (FAA AC 29-2C) and its intent is considered to be sufficiently clear.

comment	*154* comment by: *Aerossurance* AMC29.801(c)(5) makes references to 'establishing' multiple procedures but it is not immediately evident which provision requires their promulgation (perhaps 29.801(h),

	although that does not explicitly reference procedures per se).
response	Not accepted. The procedures referred to in this section of the AMC are the ditching procedures required in order to safely operate the helicopter over water. These procedures are required, amongst other regulations, by CS 29.1585(a). NOTE; This comment is identically worded to Comment 126 from the same commenter. It has been assumed that the AMC paragraph being referred to is in fact AMC29.801(c)(6).

comment	*165* comment by: *Aerossurance* AMC 29.801(c)(8) and (9) relate to AMC to 29.801(i). There is no discussion of a compliance verification methodology that supports the objectives in 29.801(i).
response	Noted. Whilst the point raised may be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment	*175* comment by: *Zodiac Evacuation Systems division - France* AMC29.801 (b) (12) How is the mean level of water defined (a mean of all water lines or a mean for each water line)? Is the water level applicable for float punctured compartement scenario? recommandation : Clarify the requirement
response	Accepted. Clarification of the intent has been provided.

comment	*177* comment by: *Zodiac Evacuation Systems division - France* AMC29.801 (C)(10) The requirement is too subjective. Who will decide when a demonstration is required and for what reasons would a demonstration be required? recommandation : Clarify the requirement to better explain when a test is needed in order to ensure a level playing field.
response	Not accepted. It is to be noted that this text has been taken from the pre-existing FAA AC 29-2C. By the

	nature of the issue, it is not considered feasible to define when a demonstration will be required.
comment	*200* comment by: *Zodiac Evacuation Systems division - France* AMC 29.801 (b)(5) The fact that operators are using equipement beyond the certification limitations of the equipement does not justify increasing the requirements for ditching equipement. Adding equipement such as upper floats to be compliant with air pocket recommandation will impact the reliability of the aircraft and will not reduce the risk of failure if it is used beyond its certification scope.
response	Noted. Whilst the points raised may in be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).
comment	*201* comment by: *Zodiac Evacuation Systems division - France* AMC 29.801 (C)(8) Based on the justification reports available, the technical maturity of this concept needs to be investigated further before being included into the regulation. If it is added and the concept proves to be impossible, this could block further devolpements or create extra developement cost. recommandation : Further investigate this concept before including it into regulations
response	Noted. Whilst the points raised may in be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).
comment	*218* comment by: *UK CAA* **Page No:** 73 **Paragraph No:** AMC 29.801 Ditching (b) Explanation (9) **Comment:** Certification by comparison with a similar rotorcraft type should only be permitted where the comparison rotorcraft has been certificated using the new test procedure detailed in AMC 29.801(e).

Justification:

The current test procedures have been discredited and no further credit should be taken for any results so obtained.

Proposed Text:

Modify the existing text as follows (new text underlined, deleted text ~~struck through~~):

(9) Tests with a scale model of the appropriate ditching configuration should be conducted in a wave tank to demonstrate satisfactory water entry and flotation stability characteristics. Appropriate allowances should be made for probable structural damage and leakage. Previous model tests and other data from rotorcraft of similar configurations that have already been substantiated based on ~~equivalent~~ test conditions equivalent to AMC 29.801(e) may be used to satisfy the ditching provisions.

response

Partially accepted.

The text has been modified to clarify that in the case of flotation stability, any previous test data should have been performed using test conditions equivalent to those of AMC 29.801(e).

comment

219 comment by: *UK CAA*

Page No: 73

Paragraph No: AMC 29.801 Ditching, (b) Explanation (13)

Comment:

This AMC material should explicitly reference the air pocket solution as the default means of compliance with CS 29.801 (i).

Justification:

Throughout the December 2011 EASA Ditching Workshop and the nine formal meetings of EASA RMT.0120 held over a period of three years, the air pocket scheme was the only solution identified. This scheme, in the side-floating helicopter version, has been extensively researched by both EASA and UK CAA and shown to be both practical and effective. All issues associated with this scheme raised during the RMT.0120 meetings have been answered, and a system is currently being developed and certificated by an Australian manufacturer in conjunction with the Australian civil (CASA) and military authorities. It is important that the air pocket scheme be presented as the preferred means of compliance with the corresponding rule (CS 29.801 (i)) to ensure that any alternative solutions are subject to full and proper scrutiny via the AltMOC process. Note that the UK AAIB has recommended (SR 2016-019) that EASA mandate a version of the air pocket concept (the side-floating helicopter scheme).

Proposed Text:

Add to the existing text as follows (new text underlined):

According to CS 29.801(i), the rotorcraft design should incorporate post-capsize survivability features. These features should be realised by providing a post-ditching capsize floating attitude which will create an air pocket in the passenger cabin large enough for and accessible to all passengers with the emergency flotation system fully intact and with the critical float compartment failed.

The probability of capsize used in the post-ditching stability tests does not preclude capsize, and a probability of 29 % has been retained even when operating within the sea conditions approved for ditching. The target probability of capsize of 29 % requires that the consequences of capsize be no worse than CS 29.1309 major. Without any mitigation, the consequences of capsize correspond to CS 29.1309 catastrophic. In order to provide risk mitigation if a rotorcraft were to capsize, suitable design provisions are required to allow more time for egress as escape time will exceed breath hold capability of at least some of the occupants for typical rotorcraft cabin layouts and in typical sea temperatures. While this will offer a safety benefit if a rotorcraft were to capsize post-ditching, the main safety benefit comes in survivable water impact events where the rotorcraft will likely capsize immediately. It therefore follows that the post-capsize survivability features should, as far as is practicable, function following a survivable water impact where damage to the emergency floatation system can be expected.

response

Noted.

Whilst the points raised may in be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment

220 comment by: *UK CAA*

Page No: 78 & 79

Paragraph No: AMC 29.801 Ditching, (c) Procedures (8)

Comment:

This AMC material should promote the side-floating helicopter scheme as the default means of compliance with CS 29.801 (i).

Justification:

The side-floating scheme is superior to the alternative ‘raised-floats’ scheme because:

I. The side-floating helicopter scheme has been extensively researched over many years by both EASA and UK CAA and shown to be both practical and effective. The raised-floats scheme has not been researched or tested.
II. A side-floating scheme is currently being developed and certificated by an Australian manufacturer in conjunction with the Australian civil and military authorities. No comparable work is being performed for the raised-floats scheme.
III. The side-floating scheme provides a greater increase in overall emergency floatation

system crashworthiness through the addition of redundant floatation; the raised-floats version does not add any floatation. This is especially significant as most of the lives to be saved by the NPA accrue from survivable water impacts where the key factor is post impact operability of the emergency flotation system.

IV. Modelling studies performed by independent experts have demonstrated that the side-floating scheme can be expected to maintain a usable air pocket in 75 % to 85 % of survivable water impact scenarios. No studies are known to have been performed for the raised-floats scheme, but it is very likely that it will be less effective in this regard as the scheme lacks the floatation unit redundancy provided by the side-floating scheme.

V. The side-floating scheme provides above water escape routes for occupants, facilitating egress. The raised-floats scheme would require occupants to make an underwater escape from the air pocket which is inherently more stressful and hazardous, especially in the dark.

Note also that the UK AAIB has recommended (SR 2016-019) that EASA mandate a version of the air pocket concept (the side-floating helicopter scheme).

Proposed Text:

Modify the existing text as follows (new text underlined, deleted text ~~struck through~~):

(8) ~~One method of meeting t~~The post-capsize survivability provisions of CS 29.801(i) should be met by providing ~~is to create~~ a post-capsize rotorcraft floating attitude which will create an~~d~~ air pocket in the passenger cabin. This can most effectively be achieved by means of additional buoyancy placed high up on the cabin wall(s) to create a reversionary side-floating attitude with the windows providing above water escape routes. The side-floating helicopter scheme provides a post-capsize air pocket and increases the crashworthiness of the emergency floatation system by increasing floatation unit redundancy.

An air pocket will remove the time pressure for escape. Passengers will not need to immediately escape through a ditching emergency exit. They can utilise the air in the pocket for continued survival during the time needed for all to make their escape.

(i) The required additional buoyancy should not be placed in a location vulnerable to damage or likely to detach (e.g. the tail boom), but located away from the normal flotation units such as high up on the side of the fuselage in the form of passive buoyancy (e.g. buoyant cowlings), or redundant flotation units (or both). Any use of additional flotation units should be considered as part of the emergency flotation system and meet the same standards of float design. Consideration will need to be given to the automatic activation of additional floats and the inflation sequence to avoid possible damage from turning rotor blades or impact debris.

(ii) An alternative means of compliance may be to relocate the existing flotation units higher up on the sides of the fuselage to form the ‘wet floor’ concept. An air pocket would then form if the rotorcraft were to fully invert. If this scheme is adopted, appropriate means of escaping from the air pocket (underwater escape) should be provided, and the crash resistance of the scheme should be demonstrated by analysis or test to be equivalent to the side-floating scheme.

(iii) The size and shape of the air pocket should be sufficient to accommodate all

passengers. A minimum volume per passenger, in the form of an elliptical column of 70 cm x 50 cm (27 in. x 19 in.) and height of 30 cm (1~~1~~2 in.) relative to the static waterline should be established and demonstrated as fitting into the air pocket, including with the critical float compartment failed. This will accommodate all passengers up to and including those classified as extra-broad (shoulder width ≥ 68.6 cm). As the rotorcraft will have capsized, seats will consume a significant amount of otherwise useable volume and this will need to be taken into consideration in the non-stroked position.

(iv) The air pocket should be accessible and immediately available without passengers needing to cross seat backs. Where the cabin is divided by the presence of seat backs, a sufficient volume of air to accommodate all passengers seated within that row should be provided. E.g., if there are three seats facing a further three seats, the minimum between-row air pocket should accommodate six passengers (six of the elliptical columns should fit). If all seats are forward-facing, and there are four seats in each row, the minimum air pocket should accommodate four passengers (four of the elliptical columns should fit).

(v) Egress from the air pocket will ideally be via exits with a significant portion remaining above the water line. It should be substantiated that egress is feasible, for ~~instance~~ example, that opening of the exit will remain reasonably easy (e.g. ~~not involve the need to find~~ the opening handle can be reached from the surface of the water in the air pocket ~~under an appreciable water depth~~) and that seats or other cabin items provide sufficient stepping points, if needed. Alternatively, if exits with a significant portion above the waterline will not be available, or the opening handle/handles is/are difficult to find, or if other obstacles to egress exist, it may be acceptable to mitigate this by an RFM limitation entry requiring all occupants to be provided with and trained in the use of a suitable emergency breathing system (EBS). This will allow occupants to deploy the EBS when in the air pocket, and then escape using its benefits. The provision of sufficient light in the air pocket to enable preparation for egress and actual egress, including at night, should be ensured.

(vi) Due to the unknown extent of damage, and inability to realistically predict the amount ~~of it,~~ that may occur in a survivable water impact event, the air pocket should satisfy the above design considerations in the ditching case, including with a single float compartment failed. For the side-floating helicopter scheme, ~~S~~such a design is expected to provide an adequate air pocket within the cabin in a high proportion of water impact events albeit the size and location of this air pocket cannot be predicted with any level of confidence.

response

Noted.

Whilst the points raised may in be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment

254 comment by: *FAA*

AMC 29.801(b)(10)	The 2/3 lift language was left in the rule.	Remove "(10) CS-27 Amendment X removes a potential source of confusion and simplifies the tests necessary for showing

		compliance with CS 29.801(d), by removing the reference to two-thirds lifts."
AMC 29.801(b)(16)(ii)	Discussion of final configurations must be shown to be compliant to ditching requirements.	Replace "...should be reviewed after…" with "…should be shown to be compliant after …"

response

1. Accepted. However, it is to be noted that the reference to two-thirds lift was to be found in AC 29-2C, not the CS-29 rule.
2. Accepted. The proposed text is an improvement.

comment

257 comment by: *AIRBUS HELICOPTERS*

In AMC 29.801, an air pocket in the cabin is presented to be the main acceptable mean of compliance to this requirement. It is also noted that it can be achieved by means of additional buoyancy.
AMC29.801 (…): " *One method of meeting the post-capsize survivability provisions of CS 29.801(i) is to create a post-capsize rotorcraft floating attitude which will create and air pocket in the passenger cabin. This can be achieved by means of additional buoyancy. (…)*"

a) <u>Technical feasibility of the a predictable air gap in the fuselage</u>:

AMC29 indicates that the additional buoyancy should be located "*high up on the side of the fuselage in the form of buoyant cowlings or redundant flotation units (or both)".*
Important volumes of buoyancy are needed in this zone to achieve the presence of air pocket (EASA.2007.C16 - Study on helicopter ditching and crashworthiness).
Such volumes should be inflated volumes because passive buoyancy would not be sufficient.

The integration of such volumes high up on the side of the fuselage has several constraints that are not solved today:

- It implies important inflatable volumes near the rotor:

AMC29 recommends that additional buoyancy should *"meet the same standards of float design*" and that "*consideration will need to be given to the automatic activation of additional floats and the inflation sequence to avoid possible damage from turning rotor blades or impact debris*".
Standard floats inadvertent deployment may be catastrophic above a certain speed. To achieve the associated probability, the system is disarmed above a given speed, manually or automatically. There is a high level of confidence in the demonstration of associated safety objectives because simple and fully independent hardware mechanisms are used.
Inadvertent inflation of additional volumes near the rotor would be catastrophic whatever the speed. Additional complex safety barriers should be designed to reach the associated probability and they should remain operative after ditching and during capsize if it happens. This is very challenging to reach both availability and in flight safety in this case. Beyond the quantitative objectives, complexity will introduce a risk of Common Mode errors which does not exist when simple items are used.

- This integration zone is usually a hot zone:
The first consequence is an increased pressure in the float if inflated in flight. With current float fabric, the resulting pressure would be higher than the float burst pressure ((EASA.2007.C16 - Study on helicopter ditching and crashworthiness).
The second consequence is the need to develop new fabric for floats that can handle high temperatures and that are currently not available.

- Blades can be damaged during capsize and the additional buoyancy elements are likely to be consequently damaged. It can compromise the existence of air pocket and the punctured floats in front of the emergency exits could make difficult the evacuation from the helicopter.
If damaged when the helicopter is in the up-right position, they can also make difficult the evacuation before capsize.

- Addition of high buoyancy elements has a negative impact on the up-right stability by moving up the helicopter center of gravity and by increasing the surface exposed to the wind.

- The position of the helicopter once inverted is highly dependent on numerous parameters: the opening or not of the doors and emergency exits, the possible entrapment of air into some parts or equipments, the consideration of the blades as a mass and as a buoyant volume once inverted or not, the damages to be considered on the airframe and on standard floatation system (damaged / lost)…
Consequently, it is very hard to predict where the air pocket would be and if it would be available for occupants or not. Some scenarios could even lead to a helicopter nose down or tail down in the water with an air pocket not available resulting in a worse passengers evacuation capability than in the capsize situation.

To summarize, the integration of high buoyancy volumes recommended by the new proposed AMC29 introduces new failure conditions. The global safety benefit balance is affected consequently. Beyond the fact that the very low occurrence of the events makes difficult to draw exact numbers, it is not clear there is a global safety benefit from the installation of those elements.

Also, even if “pod” floats technology is currently available; their integration high up on the fuselage is an innovation with a low level of maturity regarding all the aforementioned design constraints.

b) <u>Alternative with an EBS</u>:

Emergency breathing systems (EBS) were identified as an acceptable mitigation mean to capsize in CAP 1145 . They do not introduce the failure conditions described for the high additional buoyancy volumes.
However, AMC29 clearly recommend that it should not be considered alone as being sufficient.
AMC29.801 "(…) *Emergency breathing systems (EBSs) that are capable of being quickly deployed underwater do exist. This type of personal protective equipment (PPE) may provide a limited level of mitigation for the issues related to human breath hold capability, but it should not be considered alone as being sufficient means of compliance with CS 29.801(i) (…)"*

EASA justifications are:

"(i) such equipment relies on an individual's ability to deploy and use the EBS, and utilise prior training;"
AH answer: Since an air pocket precise location and even existence for all passengers is barely predictable, this rationale also applies to the air pocket recommendation. Occupants would have to know an air pocket may exist, find it , move to it, place the head in it, take some time to develop a strategy on how to evacuate, swim again towards an exit (not necessarily the nearest one after a decision is made to try to finally escape) and then evacuate the helicopter. In addition, it should be considered that, similarly, survivability relies today on the ability of occupants to find, deploy and use a life jacket.

"*(ii) the effectiveness of such equipment in the absence of a mandate for practical training is questionable;"*
AH answer: Air pocket possible locations would depend on helicopter whereas EBS would always be near the occupants. The training for EBS use is consistent with existing training OPITO (Offshore Petroleum Industry Training Organization) procedures with the rebreather also worn on the chest and does not change the logic of emergency evacuation (use the nearest exit, take a reference with the hand close to the window would it be a hand hold or a seat and so on). EBS is attached to the body, simple to deploy (mouth piece velcroed close to the mouth) even after the capsize underwater. The training to correctly reach an air pocket would also be needed to make it effective. The air pocket accessibility considering potential obstacles (seats, equipment or debris floating ..) and different layout is unknown. Restoring breath hold capability to allow people to think more clearly is a good thing (doable with EBS or air pocket) but doing so by increasing the time to escape the helicopter from the air pocket may not be a winning strategy if the helicopter starts sinking. The human factors "don't make the survivor think but act" shall be considered: instead of thinking too much on which path to take to escape once in an air gap, the survivor must escape the fuselage as fast as possible to maximize his chances of survival.
The location of the air pocket may differ from one helicopter to another making the potential future training specific to each machine the personnel will fly on. This is less likely to happen with a CAT-A standard approved EBS design similar whatever the helicopter design. In addition training to using an EBS could be made standard by the oil and gas companies to their personnel flying on helicopters, based on safety promotion with approved OPITO-based content and training organizations. Also information placards or brochures describing how to use an EBS could be given to the helicopter occupants as it is the case for life jackets.

"(iii) individual physiological variations will affect the duration of use of the EBS;"
AH answer: Here again, since air pocket location and size are very difficult to predict, its access would certainly depend on the individual's physiology (breath hold, hyperventilation). An EBS can be deployed underwater without any change to the existing intuitive tendency to go for the nearest exit.

"(iv) human behaviours in an emergency, including panic and inaction, will affect the likelihood of successful usage;
(v) an individual may be overtaken by the desire to escape, without using the EBS, and eventually fail to escape due to the human breath hold limitation; and
(vi) conversely, an individual sitting immediately next to an exit may in fact be in the most advantageous position for escaping immediately, but may delay the overall evacuation by deploying their EBS, thus further compromising the successful escape of another individual

acting as described in (v) above."
AH answer: Unclear procedures with different possibilities (to escape or to find the air pocket) may be a complicating factor and may increase panic or inaction. An individual may also go to the air pocket instead of escaping directly the helicopter. It might compromise other occupants' escape and all could be blocked in a part of the helicopter with no air if the air pocket moves.

c) Conclusion:
To summarize, it is not clear why EBS are not considered as an acceptable means of compliance in the new proposed AMC29.
The NPA introduces increased safety level for floatation system, increased emergency exits number, improved emergency exits jettison devices, hand holds, marking, and lighting. Those improvements, combined with EBS, provide a higher level of safety in case of ditching, even in case of capsize. EBS could meet the category "A" performance (which has the advantages of rapid deployment, possible deployment under water, very little breathing resistance, single handed deployable, purge capability, breath hold in case the unit runs out after several minutes and proven benefits in real accidents).

As a conclusion, AH's position is that the safety improvements proposed by this NPA, together with cat A EBS, are more efficient than an air pocket requirement, taking into account the low level of maturity of this concept , the difficulties to predict its exact location and volume and the failure conditions it introduces.
AH proposal is to include EBS cat A in the mandatory equipment for certification with ditching provisions. It could be done in a similar way to what is done for liferaft, life vests and ELT for use in liferafts. In addition, the EASA Air Operations regulation (EU reg n° 965/2012) could be updated in order to mandate EBSs and the associated EBS use instructions placards or brochures for offshore operations.
Actions could be also conducted by EASA in the aim of encouraging oil and gas companies to organize helicopter occupants' training on water escape with EBS.

response

Noted.
Whilst the points raised may be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment

357 comment by: *Leonardo*

Despite early egress and model feasibility studies which demonstrated the principle, the integration issues around the air pocket concept remain unproven and have not been formally demonstrated by any OEM. Only one float manufacturer seems to be attempting this (One Atmosphere - Australia), while other flotation system suppliers appear to remain unconvinced of the practicality. The intended benefits appear overstated, meanwhile it is clear that fuselage designs to accommodate such a system and meet the rules may need to be significantly different in future (size, height, seating capacity etc). This will have a particularly disproportionate impact on Part27 Cat A designs. It is considered that if the perceived benefits are significant then the requirement should be market driven - i.e. specified by the operators in future contracts.

response

Noted.

	See the response to Comment 345.
comment	*387* comment by: *Bell Helicopter* Comment AMC 29.801(a)(1): Deletion of "The rotorcraft is assumed to be intact prior to water entry with all controls and essential systems, except engines, functioning properly" from the existing ditching definition would suggest you could not assume this. If the aircraft was not intact with all essential systems functioning properly, then the result would likely be a water impact. Recommendation: Delete this phrase from ditching definition.
response	Partially accepted. The point raised by this comment is accepted, although the proposed change is not (it is assumed the comment meant the re-instatement of the subject phrase). The definition will instead be revised as follows (deleted text shown as strikethrough, new text in italic) – 'Ditching: a~~n~~ *controlled* emergency landing …..'
comment	*388* comment by: *Bell Helicopter* Comment AMC 29.801(b)(4): This expands on comment from above; suggesting ditching needs to include transmission failures, lightning strikes etc. You can not design to show successful ditching following these type failures / occurrences. Recommendation: Clarification of position requested.
response	Accepted. The subject text ('(e.g. engine ….. strike etc.)') has been deleted.
comment	*389* comment by: *Bell Helicopter* Comment AMC 29.801(b)(12): The phrase "This is permissible, provided that the mean level of water in the cabin is limited to below seat cushion height" would appear inconsistent with the side floating concepts being put forward. Recommendation: Delete phrase, or re-word to be consistent with other proposed floating solutions.
response	Not accepted. This section is concerned with the helicopter floating upright, post-ditching, not capsized.
comment	*390* comment by: *Bell Helicopter* Comment AMC 29.801(b)(13): This paragraph tries to justify the requirement for both stability model testing and post-capsize survivability; you should not need both. It states this is really required for survivable water impacts. Recommendation: Need to define position. This will be a challenge for designing for water impacts.
response	Noted. Whilst the point raised may be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment	*391* comment by: *Bell Helicopter* Comment AMC 29.801(b)(14): This paragraph refers to the requirement for water impact. Recommendation: Need to define position; a challenge for designing for water impact.
response	Not accepted. This paragraph does not require the design to meet any criteria related to a quantified severity of water impact. It just requires substantiation that the rotorcraft will not sink following functional loss of one flotation unit.

comment	*392* comment by: *Bell Helicopter* Comment AMC 29.801(b)(15): Phrase "and are expected to become an operational limitation on normal operations" does not belong in the regulations. Suggesting an operational limitation in the design requirements is not appropriate. Recommendation: Delete phrase.
response	Accepted. The referenced text has been deleted.

comment	*393* comment by: *Bell Helicopter* Comment AMC 29.801(c)(2)(ii): Text refers to water impact. Recommendation: Provide clarification of intent
response	Not accepted. The only point made in this paragraph in regard to water impact is that of preventing the rotorcraft from sinking. The intent of this is considered to be clear.

comment	*394* comment by: *Bell Helicopter* Comment AMC 29.801(c)(2)(iv): The material provides criteria for manual inflation. Is this in disagreement with the requirement for auto inflation? Recommendation: Provide clarification of the intent
response	Not accepted. The text starts '**If** a manual means of inflation is provided ….'. This is not in contradiction with the requirement for auto inflation.

comment	395 comment by: *Bell Helicopter* Comment AMC 29.801(c)(2)(v): The guidance states must automatically de-arm for conditions where inadvertent inflation has not been shown to be non hazardous using parameters such as height and speed. For flight over land, these parameters will not be enough (i.e. Cat A departures / arrivals, H-V demonstrations etc.) Recommendation: Provide clarification of intent
response	Partially accepted. The intent is to ensure that the floats are armed in the event of a water impact when there is often insufficient time for, and/or flight crew workload prohibits, manual arming.

	If disarming of the inflation system above a certain speed is required because inadvertent deployment has not been shown to be safe at all speeds, it is intended that this should only be achieved with an automatic disarming and re-arming system. A height parameter input to the automatic system may also be required in order to assure the arming of the inflation system in the case of a high speed water impact. However, the commenter's point is well taken, i.e. that the circumstances mentioned involve low and slow flight, but nevertheless inadvertent EFS inflation would be hazardous. However, the exposure to these specific conditions is time-limited and most probably safety targets can be met without disarming the inflation system. Therefore, whilst retaining the overall intent of assuring a functioning inflation system whenever required, without relying on pilot actions during flight, the subject text has been revised. The overall objectives are described, but it is no longer specifically mentioned that the inflation system must be disarmed during all conditions where inadvertent deployment has not been shown to be safe.

comment	*396* comment by: *Bell Helicopter* Comment AMC 29.801(c)(5&6): See comments on Regulation for water entry testing Recommendation: Provide clarity on position
response	Partially accepted. See the response to Comment 269.

comment	*397* comment by: *Bell Helicopter* Comment AMC 29.801(c)(8): Text is too prescriptive on air pockets. Recommendation: Bell believes there may be other means to comply
response	Noted. Whilst the points raised may be fully or in part valid, it is to be noted that the referenced paragraph has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment	*398* comment by: *Bell Helicopter* Comment AMC 29.801(c)(12)(iv): Providing information in the RFM on attitude, speed etc is OK, but wave position does not belong in the RFM. This could get folks in trouble. Recommendation: Delete wave position
response	Accepted. The referenced text has been deleted.

comment	*414* comment by: *CAA-N* Additional buoyancy may be provided by the use of closed cell foam or equivalent as part of the construction of the airframe.
response	Noted. It is agreed that the use of 'passive' buoyancy, by means of closed cell foam, or equivalent, may be a desirable design choice.

AMC 29.801(e) Model test method for post-ditching flotation stability p. 81-91

comment	*2* comment by: *QinetiQ* As a model test provider, i am concerned that the model test procedure does not consider the likely maximum irregular wave height able to be provided by a model basin for a model scale of 1:15. Model test providers have to be able to test at the scale which allows them to generate the require sea conditions, with a large enough model to be able to accurately represent the scaled weights and inertias. Typically model basins are able to generate irregular waves of the order of 0.4m significant wave height. For a medium sized helicopter say of 5te unladen and 15m long, a 1:15 scale model will result in a 1m long model which should weigh 1.5kg - impossible to achieve a robust model in this weight using a carbonfibre skin on balsa frame, but would result in scaled irregular waves within the 0.4m limit for a JONSWAP seastate 6. Whereas an achieveable model mass is likely at 1:7 scale, but the wave height achievable means it is only possible to test to a sea state 4. I would very much like to discuss this further - please contact me to do so.
response	Not accepted. CAA Paper 2005/06 Appendix A cites helicopter capsize model tests performed at scales in the range 1:8 – 1:28, so it is difficult to see why helicopter models cannot be built and tested at a scale of 1:15.
comment	*89* comment by: *NHF Technical committee* AMC 29.801(e) NHF welcomes real test, and not only theoretical calculations.
response	Noted. EASA appreciates the NHF technical Committee's support for this change.
comment	*179* comment by: *Zodiac Evacuation Systems division - France* AMC29.801 (e)(a) (2) Who will decide the wave data to be used for a specific region and based on what requirement? recommandation : Clarify the requirement Table 2- Norther North Sea wave climate is not the correct title recommandation : Change to Table 1 Who will decide if the random waves used are representative of the region selected? There is also a risk a specific pattern would not include the most critical condition.

	recommandation : Provide a standard wave sequence to be tested in the AMC to ensure that all helcopters are tested with the same conditions
response	Not accepted/Accepted/Not accepted. The use of long sequences of irregular waves and the determination of the probability of capsize, as explained in the AMC, will result in appropriate wave data being utilised. The commenter does not give any indication of the areas of the model test method that are unclear. The identified error in the title to the table will be corrected. See the response to Comment 356.

comment	*181* comment by: *Zodiac Evacuation Systems division - France* AMC29.801 (e)(b) (1)(i) The requirement is not specific enough with regards to existing aircraft buoyancy . recommandation : The requirements for a part to be considered as buoyant should be added. For example : parts that entrap a volume of air need to be crash resistant (tyres, gas cylinders...) All other volumes should be considered as floodable
response	Not accepted. The AMC in question concerns flotation performance post-ditching, not post-crash. There is therefore no justification for requiring the buoyant parts of the scale model to represent only those parts of the helicopter that could be guaranteed to survive a crash (water impact). However, the represented buoyant volumes must, of course, be guaranteed to survive a ditching.

comment	*183* comment by: *Zodiac Evacuation Systems division - France* AMC29.801 (e)(b) (1)(ii) On most of our stability test campaigns, at least 5 conditions are selected because of the different conditions which can cause problemes (max weight, min weight, highest Z coordinates, max Y deportation.....). No condition contains all of the extreme conditions which is why at least 5 points are chosen. Which conditions should be prioritized if only 2 mass conditions are selected? recommandation : Clarify the requirement
response	Partially accepted. It is considered that the two extreme loading cases presented will likely encompass the worst condition, and that these two conditions will be a consistent way of testing all helicopters.

	It has been clarified that a mid C of G position should be selected for each mass condition.
comment	*185* comment by: *Zodiac Evacuation Systems division - France* AMC29.801 (e)(b) (2) This requirement is specific on the wrong points. It is trying to give sugestion on criteria of a test facility which should be used instead of expressing the real need (ensuring we have a good wave form). recommandation : Provide a tolerance which the wave patern/shape should have in order to be considered compliant.
response	Not accepted. The ability to set a tolerance would be dependent on: (a) there being established tolerances commonly specified in model tests, or (b) there being a rational way of setting such a tolerance for helicopter tests. Neither of these is the case, so any tolerance set would be quite arbitrary. Also in this context, it is not clear whether 'wave pattern/shape' is a reference to the spectrum shape, or to the wave elevation profile or time series. If the latter, then see the response to Comment 356.
comment	*187* comment by: *Zodiac Evacuation Systems division - France* AMC29.801 (e)(b) (3)(iii) Who will decide if the random wave used are representative? There is also a risk a specific pattern would not include the most critical condition. recommandation : Provide a standard wave sequence to be tested in the AMC to ensure that all helcopters are tested with the same conditions From experience on previous stability campaigns, on light weight configurations, when the CoG is high with respect to the CoB and a large portion of the fuselage is out of the water, wind can cause the model to capsize. Therefore wind is not always beneficial and can be penalysing depending on the test condition. recommandation : Review the water tank stability test procedure.
response	Not accepted. In regard to using a 'standard wave sequence, see the response to Comment 356. In regard to the issue of simulating wind, if aligned with the waves, this will be a stabilising

	influence tending to weathervane an unrestrained helicopter into the waves, and thus, it will reduce the incidence of capsize. A simple minimising potential energy argument indicates that a vessel will naturally turn beam-on to the sea in the absence of wind or other external forces. However, given the relatively short waterline length of a ditched helicopter, this effect might be very weak. The thinking behind leaving out wind effects in the helicopter model test specification is to make the testing simpler and easier to perform, and making it a pure test of resistance to capsize in beam waves. Whilst recognising that this may not be an entirely realistic situation, it is considered to be a reasonable way of comparing different EFS and helicopter designs in a consistent manner. The specification requires the helicopter to be restrained to be beam-on to the waves, so it would be possible to add wind to the test, and at the same time prevent the beneficial weathervaning, and thus include the additional capsizing wind overturning moment mentioned in the comment. However, blowing wind over models in wave basins is notoriously difficult to achieve with good stable flow quality. The wind boundary layer and the turbulence levels are very unlikely to be realistic of the wind over the ocean. Even controlling the mean wind speed at the model within a reasonable range can be very difficult. Thus, including wind adds a significant additional uncertainty in comparing the performance of different helicopters in different wave basins.
comment	*261* comment by: *AIRBUS HELICOPTERS* See our comment n°258 on CS 29.801.
response	Noted. See the response to Comment 258.
comment	*358* comment by: *Leonardo* The probabilistic approach and the need for a qualified oceanographer to interpret the tests and determine pass / fail is likely to be a source of confusion. It is not clear how easily EASA will be able to interpret certification evidence provided to them by different applicants. Side-on constraint is considered overly conservative and may be unrealistic. Some helicopter types 'weather cock' head on to the waves even without headwind. The tank test spec should allow for this to be shown and then allow tethering to nose to give nose-on to wave constraint where applicable.
response	Not accepted/Accepted. See the response to Comment 340.
comment	*399* comment by: *Bell Helicopter* Comment AMC 29.801(e): Proposal is too complicated. Addressed in previous comments on Regulation. Recommendation: Provide clarification of position

response	Partially accepted. The subject AMC has been revised in several areas in response to other specific comments. It is now considered to be as clear and concise as is practicable.

AMC 29.803(c) Emergency evacuation p. 93

comment	*275* comment by: *AIRBUS HELICOPTERS* AMC 29.803 "*(…) The general arrangement of most rotorcraft and the location of the deployed life rafts will be such that the normal entry/egress doors will best facilitate life raft entry (…)*" Comment: Wet floor may make impossible the use of the door. Ditching emergency exit compliant with all the requirements, but not exactly the door should remain an acceptable mean of compliance.
response	Accepted. The subject sentence has been revised as follows: *'The general arrangement of most rotorcraft and the location of the deployed life rafts ~~will~~ **may** be such that the normal entry/egress doors will best facilitate life raft entry (…)'.* This clarifies that it is not intended that the normal entry/egress door must be the chosen means of compliance

comment	*400* comment by: *Bell Helicopter* Comment AMC 29.803(c): "egress with a very low risk of water entry" is inconsistent with the proposed regulations. Recommendation: Clarify wording.
response	Not accepted. It is not understood why the quoted text is inconsistent with the proposed regulations. With future helicopter designs, it should be feasible to provide a way to enter a life raft, with the helicopter floating upright, with a low risk of entering the water.

comment	*415* comment by: *CAA-N* See comment to CS 29.1415
response	Not accepted. See the response to Comment 416.

AMC 29.805 Flight crew emergency exits p. 93-94

comment	*401* comment by: *Bell Helicopter* Comment AMC 29.805(a): States that exits should be designed for escape following a ditching or water impact. Can not design for water impact. Recommendation: Delete reference to water impact.

response	Not accepted. The intention of this sentence is not to set any specific design criteria, but simply to highlight that the flight crew exits may be needed following a water impact, where immediate capsize is highly likely. The choice of the wording "… designed for use …" is clear, and no need for revision is seen.

comment	*402* comment by: *Bell Helicopter* Comment AMC 29.805(b)(3): "Likely damage…such as loss of tailboom" suggests that tailbooms will fall off during ditching. Should be reworded to state items that fail ditching structural analysis. Recommendation: Re-word. Remove reference to tailboom.
response	Accepted. The reference to 'tail boom' has been removed.

AMC 29.807(d) Ditching emergency exits for passengers p. 94-95

comment	*29* comment by: *Aerossurance* (b)(1) should either refer to the CS-29 provision OR (better) the appropriate text from (a) should be moved to (b)
response	Not accepted. The change proposed by this comment is not seen as providing any benefit.

comment	*32* comment by: *Aerossurance* (b)(2) appears to be explanatory rather than procedural so should be moved to (a). It also may have the unintended consequence of encouraging minimum size exits, even in circumstances where only one person can reasonably expected to arrive at the exit at a time (e.g. because of other cabin seating layout reasons).
response	Not accepted. The change proposed by this comment is not seen as providing any benefit. The unintended consequence mentioned by the commenter is not understood. Exits that only just meet the minimum size requirement will be acceptable, but in most cases, a somewhat larger exit will probably be provided, which will not pose the risk highlighted. It is accepted that a 'double size' exit might be provided, but this must be double the minimum size requirement. The subject text is intended to point out that exits a little smaller than a 'double size' exit would raise the concern of potential for blockage, and as such is seen as being useful.

comment	*33* comment by: *Aerossurance* In (b)(4) remove demonstration as in the context it is covered by test and all the means listed are for the purpose of demonstration. This assumes 'demonstrate' is a generic term, as in 'demonstrate compliance', applicable to which ever means are considered acceptable in the AMC.

response	Not accepted. The text in question is taken from AC 29-2C. There may be ways to demonstrate the lack of interference with flotation devices that might not obviously fit the description of test, and thus the text provides additional confidence that all reasonable methods will be accepted.

comment	*37* comment by: *Aerossurance* (b)(4) includes a statement "In the event that an analysis is insufficient or a given design is questionable, a demonstration may be required. Such a demonstration...". This uses "demonstrate" ambiguously, does not refer to inspection (as per the first sentence) and uses the vague expression "questionable". Suggest "In the event that an analysis or inspection is insufficient, the design is novel or similar to a design with poor experience in ditchings or survivable water impacts, a test may be required. Such a test...".
response	Partially accepted. It is accepted that adding 'or inspection', as suggested, will improve clarity of the intent of this sentence, and this change will be made. Following from this, it is also accepted that the use of the word 'demonstration' in the second sentence appears to rule out the use of a 'test'. This will be changed to 'test or demonstration' (two places). However, reasons for a design to be considered 'questionable' will clearly include those proposed by the commenter, but may also be for other reasons that would be impracticable to predict and summarise. The use of the word 'questionable' will therefore be retained.

comment	*39* comment by: *Aerossurance* In the first sentence of (b)(4) delete "demonstration" and change "show" to "demonstrate". This assumes 'demonstrate' is a generic term, as in 'demonstrate compliance', applicable to which ever means are considered acceptable in the AMC.
response	Partially accepted. Other comments have been received related to the use of the word 'demonstrate' (and 'demonstration'). In order to remove the potential for confusion, all such references have been changed to 'substantiate' (and substantiation). Where 'demonstration' is still used, it is considered to involve the use of hardware, i.e. not an analysis, calculation etc. In line with this, 'show' will be changed to 'substantiate' but no other change will be made.

comment	*52* comment by: *Aerossurance* Add a requirement into(b)(10) the adjacent passengers should be able to reach the handle while strapped into their seat with the inertia reel locked (so that they can have hold of the handle before unstrapping).
response	Noted. This would appear to be a duplicate of Comment 53, which has been made against CS 29.809, and which is the more appropriate requirement. See the response to Comment 53.

comment	*164* comment by: *Aerossurance*

	Change text in second para of (a) to say: "The availability of such 'push-out' windows has been required by some air operations regulations". This is both to avoid the inappropriate use of mandate as a verb and to avoid confusion in the context of this paragraph (as written the sentence implies that these operational regulations require passengers use these windows rather than requiring such 'push-out' windows are fitted).
response	Accepted. The proposed change has been made.

comment	*271* comment by: *AIRBUS HELICOPTERS* The NPA requires an evacuation through type IV emergency exits (CS27&CS29.807d: *one on each side per unit of 4 passengers*). On the other hand, it recommends to have all passengers evacuating through one exit (AMC29.803c: "*the general arrangement of most rotorcraft and the location of the deployed life rafts will be such that the normal entry/egress doors will best facilitate life raft entry*"). It might imply two different ditching emergency procedures depending on the operational scenario. This possibility should be written in AMC in order to avoid any misunderstanding.
response	Accepted. Additional text has been added to AMC 29.809(d) to cover the point raised by this comment.

AMC 29.809 Emergency exit arrangement p. 95-97

comment	*22* comment by: *Aerossurance* To ensure no inappropriate design assumption, in (b)(9), change "by a gloved hand" to "by both a gloved or bare hand".
response	Accepted. A revision to this sentence (it is assumed (b)(5) was in fact intended) has been made, as broadly as proposed.

comment	*24* comment by: *Aerossurance* If it conceivable that the aircraft could float on its side with exits above the waterline, then it is reasonable to expect the handholds will be used both for leverage when opening the exit but also as a means of climbing through the exit. The strength requirements of these should be addressed here or in 801(j).
response	Not accepted. As noted elsewhere, the requirement for a helicopter to float on its side has been removed. However, the strength requirements for an item such as a handhold would in any case be covered by the fundamental requirement that an item must be appropriate for its intended function (Ref. CS 29.1301). It is not considered to be either required or appropriate to specify particular strength requirements.

comment	*53* comment by: *Aerossurance*

	Add a requirement into (b)(6) that the adjacent passengers should be able to reach the handle while strapped into their seat with the inertia reel locked (so that they can have hold of the handle before unstrapping).
response	Partially accepted. See the response to Comment 49.

AMC 29.811(h) Ditching emergency exit markings p. 97

comment	*48* comment by: *Aerossurance* In (b)(1) the last sentence appears to presume an approximately rectangular exit. Suggest: "The markings should be sufficient to highlight the full periphery."
response	Accepted. The proposed change has been made.

comment	*223* comment by: *Sikorsky Aircraft Corporation* Same comment as CS 29.811
response	Not accepted. See the response to Comment 221.

comment	*359* comment by: *Leonardo* What should trigger "HEELS" illumination? Lighting means of opening is not always feasible.
response	Noted. See the response to Comment 349.

AMC 29.813 Emergency exit access p. 98

comment	*233* comment by: *Sikorsky Aircraft Corporation* Insufficient definition of requirements for cross cabin handholds.
response	Accepted. Text has been added to AMC 29.813(b)(3) to provide the requested information.

comment *255* comment by: *FAA*

AMC 29.813	Assure cross cabin egress allows use of seat handholds and seat rails if inverted.	In AMC 29.813 (b)(3) add "Handholds can be attached to or part of interior monuments or seats, such as headrests or seat legs, if shown to be appropriate for use as handholds.

response	Accepted. The proposed change has been made.

comment	*403* comment by: *Bell Helicopter* Comment AMC 29.813(a): This text, refers to survivable water impact. Can not design for this. There is also an inconsistency with the explanation and the other regulations. i.e. if an air pocket is provided then breath hold time, immediate egress etc are not as critical as defined here. Recommendation: Clarify position
response	Noted. The text in question, and the requirement for which it is providing guidance, is not setting any design requirements that are related to why a helicopter might capsize (i.e. following a ditching versus a water impact). Furthermore, it is to be noted that the requirement that might have led to an air pocket has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

AMC 29.1411 Safety equipment — General p. 98-100

comment	*55* comment by: *Aerossurance* This AMC contains several references to life rafts despite a note saying the provisions for rafts are in 27.1415. Suggest clarification required.
response	Accepted. All references to life rafts are now transferred to CS 27.1415.

AMC 29.1415 Ditching equipment p. 100-102

comment	*189* comment by: *Zodiac Evacuation Systems division - France* AMC29.1415 (b) how are the different sea conditions used to certify ditching equipement such as life raft, life preserves (ETSO 2C503/2C504/2C505)... linked to the sea condition of the ditching provision certification? If it is planned to update specific ETSO regulations, what is the planning for their update and what should be done until these regulations are updated? recommandation :

	None
response	Noted. Life rafts are the only category of ditching equipment for which there are different design standards in regard to sea condition substantiation (i.e. ETSO C70b vs. ETSO 2C505). The text of CS 29.1415, and the associated AMC, is thus revised to recognise this. There are no such differing standards for life preservers. See also responses to Comments 172 and 173. Work to update the ETSO standards will be performed, based on the recommendations made in the NPA. This work has already begun.

comment	*191* comment by: *Zodiac Evacuation Systems division - France* AMC29.1415 (b)(1)(iii) This paragraph is too complicated and subjective. recommendation : Recommend giving specific conditions (the most penalising one) that need to be tested for life raft deployment
response	Not accepted. The availability of life rafts is a critical survival aspect. Careful assessment of deployment reliability must therefore be carried out. The many varied aspects to be considered in such an assessment, as outlined in the AMC, will be specific to each helicopter and life raft installation design. It was not considered feasible to define specific conditions, such as a most critical case.

comment	*193* comment by: *Zodiac Evacuation Systems division - France* AMC29.1415 (b)(1)(Vi)(A) Due to the risk involved with the life raft activating at the wrong moment, the conditions in order to automatically inflate the life rafts need to be given in order to reduce the risk of damage to the life raft or for the occupants during egress of the helicopter. recommandation : Add condition need for automatic inflation
response	Partially accepted. See the response to Comment 192.

comment	*416* comment by: *CAA-N* (b) Standards for crew life preservers/life vests should consider HES issues, as there are numerous reports of neck-/back problems probably due to inadequate design and weight/weight distribution. The requirement to carry EBS would increase the problem.
response	Partially accepted. Although the issues mentioned in this comment are appreciated, specific design

	considerations for PPE equipment should be covered by the associated ETSO standard, not by the AMC to the rotorcraft design standards. The points raised by this comment will be transmitted to the working group tasked with developing revisions to the life jacket ETSO.

AMC 29.1470 Emergency locator transmitters (ELTs) p. 103-109

comment	*56* comment by: *Aerossurance* Last para of (d)(1)(i) is verbose/rambling/in-direct. It would be better to describe a bi-axial sensor arrangement as optimal. We also believe the term "unique solution" should be "ideal solution"
response	Partially accepted. This paragraph has been revised in order to make it more succinct. This revision also addresses the two specific points raised in this comment.

comment	*59* comment by: *Aerossurance* (d)(3)(i) erroneously uses the term "Aircraft Flight Manual". Replace with "Rotorcraft Flight Manual".
response	Accepted. The proposed change has been made.

comment	*61* comment by: *Aerossurance* Add to (d)(4)(ii) a check of the hydrostatic sensor (only the G-switch is included)
response	Partially accepted. The comment is well noted; however, the sentence has been revised to refer to all sensors, rather than to specify any particular type.

comment	*64* comment by: *Aerossurance* Adjust title of (d)(5) to reflect both RFM and RFMS.
response	Accepted. The title has been changed. This section has also been revised to remove unnecessary repeated references to the two types of manual.

comment	*195* comment by: *Zodiac Evacuation Systems division - France* AMC29.1470 (c) The way the deifinitions are writen is misleading. There are only two types of ELT (S) class A or B. recommandation : Remove section 4 and 5 and indent the definitions into section 3.

response

Accepted.
A revision will be made as proposed.

comment

276 comment by: *AIRBUS HELICOPTERS*

AMC 27.1470 & AMC 29.1470
(…) *"The structure on which an ELT is mounted should not be likely to separate in case of a crash, such as a rotorcraft tail boom. However, this does not apply to ELT(s), which should be installed or stowed in a location that is conspicuously marked and readily accessible, or should be integral to a buoyant device such as a life raft, depending on whether it is Class A or B."* (…)

An ELT (AF, AP) could be installed in a tail boom, which may separate in case of accident, provided that there is not any separation between the ELT and its associated antenna. This first sentence could be replaced by: "An ELT transmitter and its antenna shall be installed in such a manner that the break of the coaxial cable between them is minimized".

AMC 27.1470 & AMC 29.1470
(…) *in general, in the case of a helicopter installation, if the equipment has been designed to be installed on fixed-wing aircraft, the equipment manufacturer has historically recommended the installation to be oriented with an angle of 45 degrees with respect to the main longitudinal axis.*(…)

This may need re-wording in order to avoid misunderstandings: horizontal position is the recommended position for a fixed wing aircraft, 45° for a rotorcraft.

AMC 27.1470 & AMC 29.1470
(…) *Ideally, for the 121.5-MHz ELT antenna, a separation of 2.5 metres from antennas receiving very high frequency (VHF) communications and navigation is sufficient to minimise unwanted interference. The 406 MHz ELT antenna should be positioned at least 0.8 metres from antennas receiving VHF communications and navigation to minimise interference.* (…)

For information, it is impossible to reach on most helicopters. It should be mentioned that the absence of interference should be verified, especially if this criterion is not reached.

AMC 27.1470 & AMC 29.1470
(…) *Coaxial cables connecting the antenna to the ELT unit should not cross rotorcraft production breaks.*(…)

The objective of the requirement is fully shared. However, it is too demanding. The sentence could be completed as follows:
"… or it shall be proved that the break at the level of the production break is very unlikely in case of a survival accident."

AMC 27.1470 & AMC 29.1470
(…) *In some helicopters, where an ADELT is installed aft of the transport joint in the tail boom,*

	any disruption of the tail rotor drive shaft has the potential to disrupt or disconnect the ADELT wiring. From accident investigations, it can be seen that if tail boom becomes detached, an ADELT that is installed there, aft of the transport joint, will also become detached before signals from sensors triggering its deployment can be received. *Therefore, it is recommended to install the ADELT forward of the transport joint of the tail boom.* (…) The objective is to have an ADELT fulfilling its function, whatever the survival helicopter accident. We can imagine an ADELT installed on a tail boom and perfectly working even in case of tail boom ejection.
response	1) Partially accepted. The section in question has been revised in order to remove the prescriptive text opposing the mounting of an ELT on a part of the rotorcraft that might separate in a crash. An alternative way to preserve the overall intent of preserving ELT functionality post-crash is outlined. However, the text revision proposed in the comment is not used. 2) Accepted. This section has been reworded and now provides the requested clarity. 3) Noted. The commenter's point is understood; however, the subject text makes it clear that the separation mentioned is to be seen as an 'ideal' situation. 4) Not accepted. This is an important aspect of ELT installation design, as confirmed by adverse accident experience. 5) Noted. Text has been added to the referenced section to modify the recommendation along the lines proposed. Furthermore, the text revisions introduced under 1) above also provide relevant additional clarification of the overall safety intent.

AMC 29.1555 Control markings p. 109

comment	*224* comment by: *Sikorsky Aircraft Corporation* Same comment as CS 29.811
response	Not accepted. See the response to Comment 221.

AMC 29.1561 Safety Equipment p. 109-110

comment	*156* comment by: *Aerossurance* AMC 2x.1561(b)(5) refers to 'marked in bold letters'. Suggest 'marked clearly' as 'bold' may imply merely a type of type face and pictograms may be more appropriate in some circumstances.
response	Accepted. This text has been revised to avoid use of the word 'bold' and also revised to better explain

	the intent of the previously used term 'permanently'.

AMC 29.MG10 Advisory material for substantiation of an emergency flotation system (EFS) alone p. 110

comment	*404* comment by: *Bell Helicopter* Comment AMC 29 MG10: The NPA hides the fact that all EFS would need to meet ditching requirements. AMC 29 MG10 is revised to require meeting the ditching requirements of 29.563 and 29.801(b) to (j). This means needing to meet structural and ditching requirements for all EFS (including capsize requirements). It is feasible that kits and STCs will not be able to be developed at a low cost and will therefore not be available and result in safety equipment not being available for small aircraft or private operators who only occasionally fly over water. A low cost, simple alternative must be made available. Recommendation: Use the safety continuum model whereby there would be scalable requirements which would allow for allow for simple flotation safety equipment.
response	Accepted. In response to Comment 405, a new requirement (CS 29.802) has been created. In line with the principle of a safety continuum model, this requirement clarifies that compliance with the structural requirements of CS 29.563 need only be shown for the flotation units and their attachments to the rotorcraft for rotorcraft with a passenger seating capacity of 9 or less.
comment	*405* comment by: *Bell Helicopter* Comment AMC 29 MG10: The text added to MG-10 which replaces the existing MG-10 is imposing certification requirements through Advisory Material: "Regulation (EU) No 965/2012 may allow for the installation of only emergency flotation equipment, rather than certification for full ditching provisions. However, the provisions for certification of the emergency flotation equipment in such a case remain the same as those for full ditching certification, i.e. compliance with the ditching provisions of CS 29.563 and CS 29.801(b) to (j) should be shown." Recommendation: The applicable requirements for non-ditching applications need to be addressed in CS-29 and not in advisory material. Furthermore, requirements for simple floatation systems should not have to meet the requirements of 29.863 and 29.801.
response	Accepted. It is agreed that usage of guidance material (i.e. MG10) to set a design requirement is inappropriate. A new requirement paragraph, CS 29.802, has been created, referencing an appropriate subset of the applicable paragraphs for ditching, thus now handling in the design code this lower level of equipment for overwater flight, as allowed by operational regulation.

4. Regulatory impact assessment (RIA) p. 111-142

comment

83 comment by: *Robinson Helicopter Company*

4.1.2. Safety risk assessment

A conclusion of the safety risk assessment that survivable water impact (SWI) events represent an unacceptable risk and must be the prime focus of any regulatory activity does not appear to be supported by the data. The frequency of a SWI and non-survivable water impact (NSWI), repeated below, show the same order of magnitude:
frequency of ditching = 3.1×10^{-6} per flight hour;
frequency of SWI = 3.1×10^{-6} per flight hour; and
frequency of NSWI = 2.0×10^{-6} per flight hour.
Consequently the data shows that improving the survival rate during survivable water impact events would have a limited effect on overall risk during flights over water.

While there may have been a small number of ditching events that resulted in fatalities, this does not necessarily justify enhancing the ditching requirements. The NPA states that there were no fatalities as a consequence of the ditching. The fatalities occurred after the occupants had successfully egressed. Consequently enhanced ditching requirements would not have made these fatalities any less likely.

This section also clearly shows that ditching incidents are not a main source of fatalities. Rather, survivable water impacts are the area where safety improvement is warranted. Rulemaking activity should perhaps focus on minimizing water impacts (e.g. via operating altitude or weather restrictions) rather than on enhancing floatation/ditching regulations which are apparently already sufficient. The rationale for making ditching requirements more rigorous rather than addressing survivable water impacts is that there is an inherent difficulty in adequately defining a survivable water impact. In other words, because it is too difficult to attempt to address the problem of survivable water impacts through design requirements, ditching requirements have been made more arduous in the hope that a by-product will be improved safety during survivable water impacts. Given the magnitude of the regulatory changes that are proposed, the justification for revision given in the safety risk assessment section seems inadequate.

While the risk assessment makes compelling arguments that random wave model tests provide the most accurate simulation of a helicopter's behavior on water, the objective should be to provide a means of demonstrating adequate safety in a manner that is repeatable and cost-effective. While the current model testing requirements may not be representative of true sea conditions and have been criticized by naval architects, they do serve the purpose of providing a consistent measure of resistance to capsizing. This is analogous to crashworthiness regulations where the test requirements such as a 50 ft drop in a horizontal attitude for fuel tanks, or 30g peak triangular deceleration pulse at 60 degrees to the horizontal for seats. These criteria, while unlikely to duplicate an actual accident, attempt to provide a repeatable criteria for safety in a cost effective manner, protecting against conditions that are inherently random. Sea conditions are similarly random, and the NPA does not provide any evidence that adequate safety cannot be achieved by testing using regular waves. Regular waves have the benefit of providing a repeatable test. The statistics show that emergency flotation equipment certified to the regular waves standard have indeed provided adequate safety. If the naval architects are correct in their assessment of regular wave testing as invalid while the statistical data shows adequate safety with current designs, then perhaps the rationale behind model testing in general should be revisited.

Ultimately the NPA ignores the statistics showing that there have not been any fatalities directly related to ditching and justifies this by stating "Many of the ditchings that have been performed have fortunately occurred when the sea conditions were relatively calm, and therefore, the accident data does not reflect this hazard. This cannot be assumed in the future." If "many" of the ditching events were in calm seas, then apparently there were also some successful ditching events in rough seas. If a ditching was successful in calm seas it does not necessarily follow that it would not have been successful in rough seas. An alternative conclusion that could be drawn from these statistics is that existing ditching regulations are adequate based on the historical record of successful ditchings without fatalities.

4.1.3 Who is affected?

The list is not a complete list of helicopters performing offshore operations. Single-engine helicopters are currently used for over-water sight-seeing flights, charter flights between small islands in the Mediterranean Sea, and fish spotting as a few examples, i.e. conditions where the water is not a hostile environment. These helicopters are typically fitted with basic emergency flotation equipment, not certified for ditching, following the guidance of AC 27-1B MG 10. The NPA proposes to remove MG-10 and thus the NPA has a significant effect on these smaller (non-category A) CS-27 helicopters.

4.1.4 How Could the Issue Problem Evolve?

This section involves highly speculative predictions of future industry developments (including an industry – oil and gas – which interacts with many economic sectors beyond aviation). Such speculation is not directly related to airworthiness or operational safety.

4.5.4 Economic impact

Basing the economic impact on the cost to manufacturers in relation to their revenue is not a conventional approach and does not provide meaningful results. The justification for the approach taken is only that it makes the analysis easy to do. A more valid approach is to look at the economic impact on the end user.

The assumption implicit in the analysis that the manufacturer will spread the development and component costs across the entire fleet is not reasonable. These costs would typically be assigned as an incremental cost to the emergency float installation option. Since emergency float options could be a small fraction of total sales, the impact on the end user will be significantly greater than the analysis shows.

The economic impact analysis also fails to take into account the costs of the additional weight and complexity that the additional equipment required for compliance is likely to add. Increasing the empty weight of an existing helicopter reduces safety by reducing performance, and increases operating costs as a consequence of the increased power required. In some cases the additional weight could make the installation on a particular helicopter infeasible, driving the need to limit the emergency float option to larger helicopters. This has the potential to increase the cost to operators by an order of magnitude. These are possibilities that deserve to be investigated further.

The analysis only considers the cost the requirements have on the manufacturer's production bottom line. However the cost of certification is a major consideration when it

	comes to product improvement of existing, approved designs. The higher the cost of certification, the lower the incentive to implement design improvements that could require recertification. A reduction in certification costs should be treated as a factor that is beneficial to safety and vice versa. Limiting the analysis to the manufacturer's financial bottom line also does not take into account the cost of the additional maintenance required to ensure the complex systems continue to function correctly throughout the life of the helicopter. 4.5.5. General aviation (GA) and proportionality issues The elimination of AC 27-1B MG 10 combined with the revision to the details of the ditching requirements will have a significant effect on CS-27 non-Category A helicopters. Since no data is provided on the number of CS-27 non-Category A helicopters performing overwater operations, it is not possible to verify the claim that the GA sector represents a small proportion of the total operations. However a review of the Rotor Roster database for 2015 indicates that at least 85 Robinson R44 II helicopters equipped with emergency floats are registered in European countries. This is more than any single model listed in table 4.2 (Sikorsky S-92 with 60 in service). 4.5.6 Impact on 'better regulation' and harmonisation This paragraph suggests that meeting the proposed regulations should not be an impediment to validation by FAA. However any discrepancy in regulations introduces a validation item, which complicates the validation process even if the certifying authority's regulations are considered to implement a higher level of safety. Of course validation will be even more difficult if FAA is the certificating authority (using existing regulations and AC-27 MG 10) and EASA the validating authority. When considering effects on harmonization it is necessary to consider validations in both directions, and so the analysis should be focused on how likely it is for other authorities to adopt identical regulations. All that is offered in this case is a "hope" that FAA will adopt similar changes. It is highly desirable for applicants that all EASA NPAs be coordinated with FAA NPRMs and the rulemaking procedures of other airworthiness authorities to ensure that harmonization is maximized. The proposed regulatory changes are significant and controversial and their impact on harmonization would be more accurately described as "substantial" rather than "neutral".
response	Noted. This comment raises several issues, which fall into three main areas, namely; — the validity of the RIA; — the justification for moving away from regular wave testing; and — harmonisation with other airworthiness authorities. These issues are covered in turn below; <u>The validity of the RIA</u>

The commenter asserts that the numerical accident rate data presented indicates only a small effect to be gained from the subject regulation. This is because of all the accidents comprising the data, the survivable water impact (SWI) accidents (where the vast majority of arguably avoidable fatalities have occurred) constitute a minority. Whilst this is true, it is to be noted that the subject data is from only one operational area (UK) because reliable flight hour data does not exist for any other area. The limited conclusions to be drawn from this data are pointed out in the RIA.

The commenter then states that in the light of the magnitude of the regulatory changes proposed, the justification given is inadequate. The approach to introduce regulation aimed at improving SWI survivability but without any clearly quantified effect, by means of requirements presented as ditching requirements, is criticised.

Adverse comment is also raised against the completeness of the 'Who is affected' section and the reliability/accuracy of the statements made in the 'How could the issue/problem evolve?' and 'General aviation (GA) and proportionality issues' sections.

It is acknowledged that some quantified aspects of the RIA could be further refined, and the results of the assessment of the possible future evolution of the overall issues/problem will always be open to question.

Finally, the commenter explains why he believes the economic impact assessment method is flawed. EASA accepts that the method used was not fully optimised for the particular case here concerned, and as a result, refinements will be introduced for the future.

However, it is to be noted that in response to several comments, including this one, (e.g. Comments 322 and 288) the scope of the regulation changes has now been agreed to follow more of a safety continuum approach across the range of helicopter sizes. There will now be a lowered regulatory burden for the types of product made by the commenter's company.

It is considered that this change of scope provides the more measured regulation that the commenter presumably desires.

<u>The validity of regular wave testing</u>

The regular wave approach was discredited in UK CAA report 2005/06. This included a detailed explanation of why the regular wave test is misleading, but it can be briefly summarised as follows:

a. Intact ditched helicopters (and boats) do not capsize in regular waves. They only capsize in breaking waves.

b. So-called regular waves do not exist in nature, nor do they exist in the model basin except for waves with very small amplitudes.

c. When wave basins attempt to generate a steep regular wave, the wave does not propagate unchanged along the basin. Although it may start as a sinusoidal 'line' frequency spectrum at the paddle, the wave energy moves into side bands that cause a beating effect – alternating high and low amplitudes. The high amplitude waves break and cause further energy exchange across the frequencies. The rate at

which this process occurs depends on many specific wave-maker/basin properties.

d. Thus, the best resistance to capsize for a particular helicopter design will be achieved in the wave basin that can generate the highest/steepest regular wave that is not yet breaking.

In any particular basin, the best resistance to capsize will be achieved the closer the model is placed to the wave-maker. The 'regular wave' capsize test might therefore be regarded as more a measure of the basin wave generation performance than the helicopter capsize resistance performance.

Harmonisation
The commenter raises the issue of additional work being involved in validation exercises when airworthiness codes are non-harmonised. This is acknowledged, but it is unfortunately an unavoidable effect whenever regulations are revised

comment

92 comment by: *NHF Technical committee*

Page 142: NHF support the RMG's conclusion.

response

Noted.
EASA appreciates the NHF Technical Committee's support for the RMG's conclusion.

comment

157 comment by: *Aerossurance*

We are supportive of Option 1.
We are supportive of Option 2 provided 801(i) remains a) objective based (i.e. orientated around rapid underwater escape) rather than focused on specific solutions, b) mitigations that have value in SWI when airframe damage occurs are not penalised in favour of mitigations that are vulnerable to damage in an SWI (e.g. cabin air pockets) c) mitigations that do not mitigate against cold water shock are not unduly favoured over mitigations that do (e.g. Cat A EBS) and d) the AMC is not exclusively written around technologies that have a currently inadequate TRL (e.g. cabin air pockets).
We are supportive of Option 3.

response

Noted.
EASA appreciates Aerossurance's support for Options 1 and 3.
In regard to option 2, it is to be noted that the associated requirement has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).

comment

202 comment by: *Zodiac Evacuation Systems division - France*

Based on the conclusion of the regulatory impact assement, it is difficult to see the improvements that will be gained with the proposed ammendments and significant positive safety impact.

The problem seems to come from the fact that since a SWI cannot be deffined, the existing regulation (ditching) has been made more complex without any guarantee of safety

	improvements.
response	Noted. It is difficult to see why the commenter believes that there is no guarantee of safety improvements. EASA believes that it is clear that safety will be improved by the introduction of the finally agreed changes to CS-27 and CS-29. It is true that a defined envelope for SWI could not be identified, and the commenter thinks it problematic that the changes therefore restricted to sections of CS-27 and CS-29 could be described as 'ditching regulations'. However, the term 'ditching' should be seen in the wider context, such as related to helicopters certified with 'ditching' provisions. It is, of course, these helicopters that might be involved in an SWI.

comment	*228* comment by: *Sikorsky Aircraft Corporation* The assertion put forward that the pilots of GZCH decided not to ditch due to sea conditions is not substantiated by Transportation Safety Board of Canada Aviation Investigation Report A09A0016. The report states, "…suspected they had experienced an oil pump or an oil pressure sensor problem…the captain added that they did not believe they had lost all the MGB oil." There is no mention of sea conditions affecting pilot decisions. This distinction is important based upon the summary in Section 4.1.2. Section 4.1.2 summarizes that the proposed regulatory changes address Survivable Water Impacts (SWI) by increasing Ditching certification requirements. To do this, the definition of Ditching is revised. The NPA states one of the reasons for this approach (changing the definition of ditching) is due to pilot hesitation to ditch which is then stated as a reason for NSWI occurrences. Sikorsky is concerned that this change in definition has resulted in poor application of the RIA tools. An example, Table 4.8 assigns a score of 2 (a positive impact) for Option 3 when Tables 4.6 & 4.7 clearly assess Option 3's impact at 0. Tables 4.6 and 4.7 are based upon empirical data review of events. The data shows that irregular-wave testing would not have reduced the number of fatal accidents or lives lost yet the summary presented in Table 4.8 defines the impact on safety of irregular-wave testing as "low positive" (2). Sikorsky is a proponent of irregular-wave testing, but recognizes the data clearly shows it would not improve the safety of Ditching events. It agrees that such testing could increase the survivability rate of SWI. Our recommendation is to re-evaluate the proposed changes relative to new regulations for Survivable Water Impact certification rather than changing Ditching certification regulation (see responses to 29.563 & 29.801). This will enable the proper use of the RIA tools to address the problem. The assessments of 4.1.4 should be reviewed based upon the recent changes in economic conditions. This would likely affect the impact defined in 4.5.4 especially considering the use of 5 year amortization of cost to reduce the percent impact to industry. The current slowdown is projected to last through the time that the research and development for the proposed changes would need to be absorbed. In Section 4.5.4, the cost for development of several of the designs is under quoted. It appears the RIA utilizes supplier development cost as the cost to bring design to market. Design, test, certification and procurement of a system would be significantly greater than a supplier development cost.
response	Noted. The remark in the RIA, which included reference to G-GZCH, was making a general point, i.e. that the historical lack of fatalities in ditching events may be attributable to the fact that

	crew tend to continue for a longer time with the decision to continue flying if the sea conditions are unnerving. If true, such an effect might better explain why the ditchings that do occur tend to end well, rather than the current ditching regulations being fully effective. It is acknowledged that suggesting G-GZCH might be a full or partial example of this, was speculative in the absence of supporting evidence. The commenter correctly states that the NPA explains that the required safety improvements in SWIs are intended to be achieved by improving the CS 'ditching' regulations. However, the commenter then makes statements that the definition of ditching needed to be changed to allow this, and that this change in definition was also related to the suggestion above related to crew hesitation to ditch. This is not correct. The change to the definition of ditching was only made to include helicopter failures other than just the engine(s), in order that all water entry procedure variations be considered when showing compliance with CS 27/29.801. No part of the RIA is dependent on the change of definition. It is therefore not understood why the commenter then contends that the change of definition has resulted in poor use of the RIA tools. The commenter then states that the presented historical data clearly shows that irregular wave testing would not improve the safety of ditching events. Whilst it is true that the data presented involved no fatalities, this does not prove that all future ditchings would be as successful, should EFS continue to be designed to meet unchanged certification rules. In regard to the economic elements of the RIA, the commenter proposes that the recent changes in economic conditions should be taken into account and suggests that the costs for system development are underquoted. Whilst attempting to follow the first point might have theoretical validity, it would be as susceptible to the same charge of speculation regarding future trends as other aspects of the RIA have been. In regard to the second point, it is to be noted that the cost data used was a combined submission received from the helicopter manufacturers in the rulemaking group.
comment	*368* comment by: *Leonardo* LH has concerns that the assumptions made regarding the effectiveness of "Capsize mitigation" appear to be overstated, meanwhile the relative benefits of EBS are unclear. The benefits based on accident statistics for Part27 aircraft in particular do not appear to support the new requirement for Part 27 Cat A aircraft to meet the "post capsize mitigation" requirement.
response	Noted. See the response to Comment 345.
comment	*417* comment by: *CAA-N* There is no definition for SWI. (The statement that there have been no fatalities in ditching is challenged by the 4 fatalities in the 1973 ditching in Norway by a S61. It however needs to be clarified if it should be called a diching, as the autorotation was not successfully completed, perhaps making it a SWI?- outside the scope of data) 4.1.2(a) page 112, states that the prime objective of the RMT focus on survivable water impact, whilst in in the summary in 4.1.2 (c) on page 116 it is said that SWI is addressed by improving on the ditching CS, thus indirectly regulating SWI. This is reflected in 4.2. Objectives. (The primary objective is to improve the safety of helicopter occupants in case of ditching and survivable water impacts.)

	4.1.2 (c) appears to be perhaps too much based on the premise that the frequency off ditchings/SWIs are fixed, unchanging and evenly distributed. This results in no harm when applied to a new CS to provide the passengers with a helicopter with the best possibilities for survival. But it may be somewhat more problematic for the second phase of the RMT, when retrofit/ other measures will be considered for the interim period. Recourses are always limited and the challenge is to prioritise. Should money be invested in survivability issues or rather in design, infrastructure, operational or maintenance issues intended to reduce the number of ditchings/SWIs on the way to where we want to be in the future?
response	Noted. The statement that no fatalities have resulted from ditching in the North Sea might strictly be incorrect as the data assessed goes only as far back as 1976. However, the overall point remains that, historically, ditchings have not represented a significant safety issue. The point regarding the second phase of the RMT is well noted. The issues outlined by the commenter will be taken into account.

5. Recommendations for future rulemaking p. 143-144

comment	*93* comment by: *NHF Technical committee* Comment to page 143, item 5.2; Use of EBS. In relation to practical training for use of EBS, there is several challenges, who need to be properly adressed before making the EBS mandatory. The training must be conducted in a way who is widely recognized and without any danger of introducing new risk.
response	Noted. The practical training issues surrounding the use of compressed air EBS are known to the rulemaking group. At the time of writing this response, one European national authority has mandated its use and is addressing the training needs. It is expected that the situation will be well developed before any applicant might need to show compliance with the new CS-27 and CS-29 provisions with a design incorporating a compressed air EBS.
comment	*158* comment by: *Aerossurance* We are supportive of the need for rule making beyond CS-27/-29 (subject to our comments on Appendix B). We would also be supportive of prompt attention on retrospective survivability improvements.
response	Noted. EASA is appreciative of Aerossurance's support for future rulemaking.
comment	*229* comment by: *Sikorsky Aircraft Corporation* The changes defined in the NPA would pose significant impact to fielded aircraft. The intention to make the defined changes retroactive would be very difficult to achieve as the NPA is currently structured. Defining new regulations for Survivable Water Impact

	certification (See comments for 29.563 & 29.801) would facilitate management of the existing fleet. Coupling the definition of SWI design certification with associated Operational Rules would enable implementation of a retroactive requirement in a way which would reduce economic impact and thereby encourage swift compliance by industry.
response	Noted. Consideration of retroactive application of the changes will involve new assessments and almost certainly some of the proposed amendments for CS-27 and CS-29 will be found to be unjustified.

comment	*407* comment by: *Henrik S. Fjeldsbø* Regarding EBS (meeting CAP 1034 Category A standard) should be mandated for carriage by all occupants. Industri Energi belives this should not be a recommendation for future rulemaking at this stage. This is due the risk introduced to the users. Today there is not a satifactory traning in place for the Cat A EBS. The training is not underwater due to risk of injury. When the training is dry in a classrom the occupants won't have the necessary traning or experience to utilize the Cat A EBS in an emergency situation. In a stressfull situation this may result in panic and potentionally increase the risk of injury/death. For example, there is the risk of using the EBS wrong with the possibility to cause damage to the lungs. There is also the question of only having a short amount og breathing air. When you're out of air, you're out of air. There is also the question about the design of the Cat A EBS wich there have been complaints about. Especially regarding the mout piece. At this stage, Industri Energi therfore prefer to use the rebreather wich is in use in Norway today. The lack of proper training and the increased risk og lung damage is crucial for our view.
response	Noted. EASA is aware of the concerns raised by the commenter. Before any design is approved that involves the use of compressed air ABS, the concerns raised must be addressed. It is understood that one European national authority is working on this, as they have mandated compressed air EBS for passengers for some operations.

comment	*418* comment by: *CAA-N* 5.2 Use of the phrase "prohibit" seems severe. "Consider" or "limit" would seem a more appropriate and a realistic alternative, as aircraft may be used for a multitude of roles, including SAR and other aerial work operations. This is not an "exact science" and a statement of probability would perhaps been more appropriate. This would allow states / operators to continue operations in particular areas/periods of adverse weather accepting a certain exposure to the sea conditions, assessed against the need for additional flights for precautionary evacuation of installations, the necessity of night operations and prolonged days etc. This would be done knowing that the risk is higher, but considered acceptable for the area in question.
response	Partially accepted. It is accepted that certain operations (e.g. SAR, evacuations of installations) may be justified on a risk assessment basis as the commenter suggests. However, this section of the NPA is constructed as an outline proposal and it is expected that

	the risk-based approach is to be considered when such rulemaking is discussed.

6. References p. 145-146

comment	*419* comment by: *CAA-N* Not one Norwegian study or report is referenced. See 7.1
response	Noted. See the response to Comment 420.

7. Appendices, 7.1. Appendix A — Review of previous reports p. 147-166

comment	*420* comment by: *CAA-N* Not one Norwegian study/report appears to have been reviewed here. The following recommendations would have been relevant to mention: NOU 2002:17 3. Crashworthiness: The Committee recommends that the regulations, BSL D 5-2, are made applicable for helicopter and that seat installation according to JAR 29 requirements is considered. 4. Helicopter stability in the sea: -The Committee recommends that JAR-OPS, or alternatively the North Sea countries, adopt requirements for the helicopter's buoyancy and stability when ditching at high sea corresponding to realistic conditions on the Norwegian Shelf (Sea State 6 or higher). -Additional emergency floatation gear must secure that doors and windows stay long enough above water making a quick evacuation possible. -Besides, the Committee recommends the adoption of operational limitations corresponding to the Sea State the helicopter is certified for. The Committee recommends that alliances with the British authorities are built to jointly continue the research work already executed by UK CAA in this field. *Helicopter safety study 3 (HSS-3)* 2.1. Complete thorough criticality analyses (Failure Modes, Effects and Criticality Analysis (FMECA) or similar) before new helicopters are put in service and before the implementation of major modifications 9.1.a Make the safety videos less 'serious' (scaring) and stimulate the passengers to support each other socially, in particular those travelling for the first time and feeling uneasy 9.1.b Consider choice of seat in relation to specific needs as perceived risk varies with seating location 9.1.c Consider a possible weight limit for offshore workers in order to facilitate evacuation in emergency situations 9.1.d Improve the communication equipment in the helicopters and train the pilots to give clear and understandable information (Passenger Announcement; PA) 9.1.e Fasten loose equipment in the cockpit (pilot's suitcase, manuals etc.) 9.1.g Minimize exemptions from recurrent training for helicopter ditching
response	Noted.

It is regrettable that the two quoted reports were not mentioned in the NPA.
EASA is appreciative of CAA-N highlighting in the comment the conclusions of these reports that are of relevance.
In regard to NOU 2002:17, all of the technical points raised (crashworthiness and helicopter stability in the sea) are in fact included in the NPA and the finally agreed package of changes to CS-27 and CS-29. In regard to cooperation with the UK CAA, the establishment of EASA, since the subject report, has ensured that this objective is met.

In regard to Helicopter safety study 3 (HSS-3), although the point raised about FMECA usage is not specifically mentioned in the NPA, there is no reason to believe that new helicopter type certification and major modification approvals do not reliably use all such available tools.

The points raised by 9.1. a to e inclusive are not covered in the NPA. However, it is to be noted that the scope of work for the rulemaking task was limited to airworthiness requirement changes to CS-27 and CS-29. The issues covered by these points are applicable to the operational practices of helicopter operators.

7.2. Appendix B — Risk assessment: risk and mitigation measures associated with helicopter ditching, water impacts and survivability, 7.2.1. Table B-1 — Risk Matrix p. 167-187

comment

84 comment by: *Robinson Helicopter Company*

Item 9 – Prevent capsize

The arguments for the elimination of AC27-1B MG 10 are mostly focused on Category A CS-27 helicopters, but the effects of eliminating MG 10 apply to non-Category A CS-27 helicopters equally.

Item 10 – Improve certification of seakeeping performance

The system safety approach to determining the appropriate probabilities for capsizing during model testing is only as valid as the assumptions on which it is based. The analysis includes several questionable assumptions that bias the outcome. These questionable assumptions are detailed below:

- The analysis assumes that all flights will be performed over the sea conditions for which seakeeping performance is demonstrated, i.e. 100% probability. It is clear from the accident database that this is not the case in reality. Assuming 100% probability of critical sea conditions drives the objective of the regulation towards mitigation of capsize rather than prevention. Had the analysis included a consideration of probability of sea conditions the emphasis on mitigation over prevention would likely be significantly reduced.
- The effects on the occupants for capsizing without an EBS or modified EFS is considered to be catastrophic, requiring a probability of occurrence of no more than 10^{-9}. The effects on the occupants for capsizing with an EBS, but without a modified EFS is considered to be hazardous, requiring a probability of occurrence of no more than 10^{-7}. The effects on the occupants for capsizing with a modified EFS is

considered to be major, requiring a probability of occurrence of no more than 10^{-5}. This is based on a consideration that the risk of drowning is significantly reduced by the addition of these mitigations. The word "significantly" has therefore been quantified to mean that for every capsize event on a helicopter without mitigation it would be acceptable to have 100 capsize events for helicopters with EBS and 10,000 capsize events for helicopters with modified EFS. The benefits of these mitigations appear to be vastly overstated. The discussion of EBS under Item 20 indicates that EBS provides no clear advantage and the discussion of modified EFS indicates that several risks to survival remain.

- The frequency of ditching is given as 3.4×10^{-6} per flight hour based on 12 ditchings over 3.5 million flight hours and references Appendix C. Appendix C contains only a listing of accidents and it is not obvious how 12 ditching events are derived from this data.
- Listing the demonstrated maximum wave height in the performance section of the RFM is assumed to ensure that the probability of a helicopter encountering sea conditions more severe than those for which wave height was demonstrated is zero. This would require pilots to always follow the information provided in the performance section of the RFM and for weather forecasts to always be accurate.
- The probability of a damaged critical flotation compartment is arbitrarily assigned a value of 10%. Setting an arbitrary value for probability of failure eliminates any regulatory incentive to design a system that minimizes the probability of a damaging a flotation compartment. The analysis also assumes that the only effect of a damaged critical flotation compartment is the increase likelihood of capsize. Apparently it is not necessary to consider the possibility of the damaged critical flotation compartment reducing the effectiveness of the capsize mitigation.
- The calculated allowable probability of capsize using a modified EFS is greater than 100%. The analysis is then adjusted to reduce allowable probability of a "Major" hazard from 10^{-5} to 10^{-6} to take into account the possibility that capsize with a modified EFS may actually be more hazardous than "Major". This supports the comments in the second bullet point above, and would have been more appropriately addressed at the beginning of the analysis.
- A reduction in hazard for CS 27 helicopters operating over non-hostile sea, together with an apparent allowance for higher fatality rates on these helicopters, is arbitrarily determined to be two orders of magnitude. Given that EASA policy dictates that there is no difference between CS 27 and CS 29 hazard definitions, this assumption implies that a drowning fatality after capsize is 100 times more likely if the water is very cold. While it is clear there is insufficient data within recorded helicopter accidents to provide a rational estimate for an appropriate number, it seem likely that a rational estimate could be made from other accident data involving drowning.
- Based on Table 6, the reduction in hazard for CS 27 helicopters operating over non-hostile sea apparently reduces the probability of a fatality after capsize for a helicopter without mitigation by two orders of magnitude, reduces the hazard by one order of magnitude if the helicopter has EBS, and does not reduce the hazard at all if the helicopter is equipped with a modified EFS. No explanation is given for this significant difference in the effect of water temperature caused by the type of equipment installed.

A different set of assumptions, no less valid than the ones used in the NPA, could easily

produce required probabilities of capsize exceeding 100% (i.e. no demonstration required) without mitigation for non-Category A CS-27 helicopters.

Application

It is stated that there is a difference in severity classification between CS 27.1309 and CS 29.1309. This is incorrect. There is no severity classification within CS 27.1309. The relevant text from CS 27.1309 is as follows:

(b) The equipment, systems, and installations of a multi-engine rotorcraft must be designed to prevent hazards to the rotorcraft in the event of a probable malfunction or failure.
(c) The equipment, systems, and installations of single-engine rotorcraft must be designed to minimise hazards to the rotorcraft in the event of a probable malfunction or failure.

The applicable guidance, AC 27-1B AC27.1309, also does not include severity classification, although it does include the relationship between descriptive and numerical probabilities. A reference should be cited for the guidance or policy that states "a 'small number' of fatalities remains within the definition of hazardous" for CS 27 helicopters. This does not appear to be consistent with EASA policy.

response

Noted.

The commenter makes no specific proposals to change either the requirement or the AMC text.

Although several criticisms of the methodology and assumptions used are made, in the absence of particular proposals for areas of change, it is difficult to definitively respond to this comment.

However, the comment appears to be aimed primarily at certification for emergency flotation. It is to be noted that in response to other comments, the final requirements for such certification have been made less onerous that those proposed in the NPA (see the response to Comment 288).

comment

421 comment by: *CAA-N*

7.2.1. Table B-1 — Risk Matrix, in item 58 where the issue is "recovery of survivors" there seems to be a misunderstanding or rather a mix with the different issues covered under items 8-20, also confirmed by the reference from item 8 in the discussion in 7.2.2. The prospect of recovery is probably not related to the ditching capability of the helicopter. It is more related to things such as the PPE of the survivor and the capability of the SAR service and the relevant rescue units. The RMT Recommendation to item 58, although concluding with no action, is therefore probably not appropriate. It is also not fully consistent with the discussion of item 58 in 7.2.2. This issue should most likely be a state responsibility, not EASA's. This is also what was concluded in the SPA.HOFO process. (CRD 2013-10, item 2.7 Recommendation A5.)

response

Noted.
The RMT Recommendation in table B-1 against Item 58 is only that no action should (or could) be taken by the RMT.0120.
In the discussion in Section 7.2.2 for Item 58, recommendations are indeed given (and also

	listed in Section 5.2), but these are outside the remit of RMT.120.

7.2. Appendix B, 7.2.2. Discussion on Risk Mitigation p. 188-273

comment	*159* comment by: *Aerossurance* Appendix B Items 10 and 19 makes unduly optimistic assumptions on training/human behaviour and mitigation crashworthiness in relation to EFS modification and unduly pessimistic assumptions on these in relation to EBS. In particular the assumption that a modified EFS would result in a reduction to Major is not borne out by past accidents (e.g. the 2009 S-92A accident where the separation of the cabin roof above the windows is noted by TSB) and means this remains Hazardous.
response	Noted. The assessment of Major for the modified EFS case is in regard to the hazard, i.e. an SWI that leads to the helicopter floating in its intended attitude with air remaining in the cabin that allows the occupants to continue to breathe. This assessment of Major does not assume any likelihood of the modified EFS being able to create this intended floating attitude in a particular water impact. As discussed elsewhere, no way could be found to define the maximum severity of an SWI for design so as to enable the particular damaging effect this would have on a given helicopter and its EFS to be assessed. There will likely still be possible water impacts, approaching the outer limits of survivability, where damage will be enough to likely render a modified EFS unserviceable. This does not mean, however, that a modified EFS would not save lives in many other SWI scenarios. Notwithstanding the above, it is to be noted that the requirement that might lead to a modified EFS has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).
comment	*160* comment by: *Aerossurance* Appendix B Items 20 contains an unsubstantiated opinion about Cat A EBS being only a short to medium term measure in advance of a cabin air pocket or other measure being available. Options such as a cabin air pocket may not survive an SWI in a way that gives a safety benefit nor provide a mitigation against cold shock disrupting the ability to escape to the air pocket, the egress the aircraft. Treating a proven and available mitigation as a temporary measure is inappropriate and may encourage the inappropriate removal of EBS in the future.
response	As explained in the response to Comment 159, it is accepted that an option such as the air pocket might not function in the more severe SWI cases. However, EBS has limitations in all SWI cases, as discussed in the NPA. The aspect of cold shock mentioned in this comment is misleading. There is no need to 'escape to' an air pocket. The air pocket will be immediately available to each occupant. Conversely, cold shock is one of the reasons that EBS is limited in its efficacy. EBS must be donned (a relatively complex action) very quickly after immersion in water, just when cold shock is having its worst effect. The occupant actions needed to get their heads into the air

	pocket are in comparison very simple. Notwithstanding the above, it is to be noted that the requirement that might lead to a modified EFS has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345).
comment	*161* comment by: *Aerossurance* We disagree with the position on Appendix B Item 22. Where the complexity of emergency procedures and the level of risk are both high, then it is appropriate to require experience beyond a safety briefing and for there to be direct Agency involvement in the specification and oversight of that training. The only burden on the air operator with respect to passenger HUET is checking evidence of currency of passengers at check-in. HUET schools already issue credit card training 'certificates' to ease this process and on-line databases are available. Hence the statement on burden is erroneous.
response	Noted. The points raised by this comment are well taken. Following the fatal accident to an AS332 (G-WNSB, 23/08/13) a safety recommendation was addressed to EASA (UNKG-2016-024) also covering the subject of the control of passenger training. It is recommended that operational requirements are amended to mandate underwater escape training for both crew and passengers, to a defined standard and by approved organisations. In response to this safety recommendation, EASA has committed to perform an evaluation of the various aspects and to take action in line with the conclusions.
comment	*163* comment by: *Aerossurance* Appendix B Item 58 requires further examination, we believe, before a regulatory recommendation that can be justified by adequate evidence and risk assessment can be reached.
response	Noted. The commenter's point is noted. Any regulatory action along the lines recommended in the NPA would certainly only be considered after examination of the evidence and a risk assessment, as the comment proposes.
comment	*320* comment by: *Aerossurance* The lives saved in Option 2 would be, we believe very similar, if an option considered only Cat A EBS.
response	Noted. EASA does not believe that the benefits of Cat A EBSs are similar to those of Option 2, for the reasons given in the NPA.

	However, it is to be noted that the proposed requirement associated with Option 2 has been removed from the initial changes to be made to CS-29. (See the response to Comment 345).
comment	*422* comment by: *CAA-N* When EBS is discussed, it is often described as a "thing". (AMC 29.801 Item (9) is a notable exception) This may give the impression that what is required, is to "install" EBS and survival prospects will be improved. It is well known that this is not the case, it is rather a system, which requires, in addition to the right equipment properly worn, maintained and stored, issues such as: a reasonably fit person who has periodically acquired and retained the necessary training to be able to use this competence in a dire situation. Any recommendation regarding EBS should therefore include requirements for training, testing etc. In this context, to conclude that HUET is "Outside of the Agency's competence" appears to be questionable, as is done in item 22 and explained in the discussion in 7.2.2. Item 44 on Sea anchors has not captured the challenge of launching the sea anchor "across the bow". One instance the sea anchor got entangled because the nose of the aircraft as described in procedure pointed 30 degrees across the waves to the left, when the sea anchor mounted on the left was deployed, the helicopter drifted over it. The helicopter however remained upright. (LN-OBP) This should be part of the design considerations for sea anchor equipment.
response	Noted. In regard to EBS, as the commenter mentions, EASA is aware of the points raised, as shown by the contents of the initially proposed AMC 29.801(c)(9). However, it is to be noted that this text has been removed from the initial amendment text, pending the results of focused research into the detailed feasibility of the intended post-capsize survivability features. (See the response to Comment 345.) In regard to sea anchors, no design considerations are proposed for inclusion in the requirement or AMC texts. If an applicant were to propose a sea anchor, this would be dealt with on a case-by-case basis, wherein the issues highlighted in this comment would be investigated.

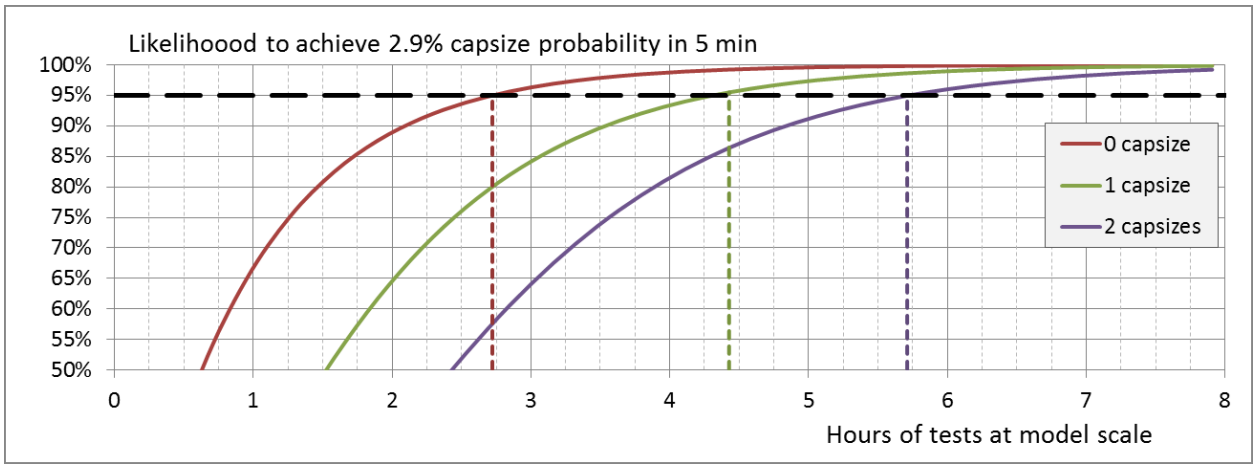
7.3. Appendix C — List of helicopter ditching/water impact occurrences p. 274-280

comment	*423* comment by: *CAA-N* Some Norwegian accidents appears to be missing or have missing information in the secondary period database: (-NOR NS Ditching 9.7.1973 S-61N LN-OQA 0/2 + 4/17 partial loss of TR blade-outside the secondary period) -NOR NS Unkn 23.11.1977 S-61N LN-OSZ 2/2+10/10 Unknown -LN-OQS, the cause was determined to be loss of a main rotor blade due to metal fatigue in the spindle -NOR NS Ditching 15.7.1988 AS332 LN-OMC 0/2 + 0/- Partial loss of MR Blade
response	Noted. It is unfortunate that three of the referenced accidents (LN-OQA, OSZ, OMC) are missing from the NPA database, and that the primary cause of the fourth (LN-OQS) was not recorded. The effect that data from these accidents would have had on the conclusions of the safety

impact assessment has been reviewed. The three missing accidents in question were respectively a water landing involving damage to the flotation system and a capsize (so therefore likely outside the ditching envelope) with 4 fatalities (and as noted in the comment, before the quoted time period for the database), a non-survivable water impact with 12 fatalities, and a ditching in which all occupants survived. No effect on the overall conclusions of the safety impact assessment (i.e. Section 4.5.1 of the NPA) was identified.

3. Appendix A — Attachments

GAMA 16-32 Response to EASA NPA 2016-01.pdf
Attachment #1 to comment #424



Attachment #2 to Comment #258