European Union Aviation Safety Agency

Comment-Response Document (CRD) 2021-02

RELATED NPA: 2021-02 — RMT.0726 – SUBTASK 1
17.12.2021

Table of contents

1. Summary of the outcome of the consultation

Eighty-three comments were received from 18 stakeholders. Table 1 shows the number of comments received per commenter:

COMMENTERS	# OF COMMENTS
+kopter	1
Alex Scerri	1
British Helicopter Association (BHA)	18
Civil Aviation Authority (CAA) Finland	1
CAA Norway	1
Direction générale de l'aviation civile (DGAC)[1] France	1
European Helicopter Association (EHA)	4
Federal Aviation Administration (FAA)	3
Garmin International	3
General Aviation Manufacturers Association (GAMA)	27
International Commission for Alpine Rescue (ICAR)	1
Luftfahrt Bundesamt (LBA)[2]	8
Sikorsky Aircraft	1
Swedish Transport Agency (Transportstyrelsen)	1
Transport Canada Civil Aviation (TCCA)	12
Total	**83**
Airbus Helicopters	Comments consolidated with GAMA comments
Bell	
Leonardo Helicopters	

Table 1

Table 2 shows the number of comments per topic:

NPA 2021-02 SEGMENTS	# OF COMMENTS
General comments and other sections	26
CS 27.631	9
AMC1 27.631	10
CS 29.631	1
AMC1 29.631	7
CS 27.631 and CS 29.631	2
AMC1 27.631 and AMC1 29.631	3
Impact assessment (IA)	24
Quality	1
Total	**83**

Table 2

[1] 'Directorate General for Civil Aviation' or 'Civil Aviation Authority' in English.

[2] 'Federal Aviation Office' or 'National Civil Aviation Authority' (of Germany) in English.

Two-thirds of the comments came from industry and the rest from national competent authorities (NCAs). Apart from general comments, industry mainly commented on the proposed certification specifications (CSs) and acceptable means of compliance (AMC) as well as the impact assessment (IA), and the NCAs on the IA, as shown in Table 3:

# OF COMMENTS	Industry	NCAs	Others	Total
General comments and other sections	17	8	1	**26**
CS 27.631 and CS 29.631	7	4	1	**12**
AMC1 27.631 and AMC1 29.631	17	3	0	**20**
IA	12	12	0	**24**
Quality	1	0	0	**1**
Total	**54**	**27**	**2**	**83**

Table 3

A quarter of the comments received were accepted, another quarter were noted, and the remainder of the comments were not accepted, as shown in Table 4:

	ACCEPTED	PARTIALLY ACCEPTED	NOTED	NOT ACCEPTED	Total
# of comments	19	4	21	39	**83**
percentage	23 %	5 %	25 %	47 %	**100 %**

Table 4

Thirty comments affected the proposed regulatory text (one-third of the total number of comments mainly came from industry). EASA improved and clarified the regulatory text based on eight comments (mainly on AMC1 27.631 and AMC1 29.631). Table 5 below shows the number of comments received per individual CSs and AMC as well as EASA's position:

Proposed changes to regulatory text							
	Industry		**NCAs**		**Others**		
	CS 27.631 and CS 29.631	*AMC1 27.631 and AMC1 29.631*	*CS 27.631 and CS 29.631*	*AMC1 27.631 and AMC1 29.631*	*CS 27.631 and CS 29.631*	*AMC1 27.631 and AMC1 29.631*	
# of comments	6	17	3	3	1	0	
Total							**30**
EASA's position							**Total**
# Accepted	1	3	0	1	0	0	**5**
# Partially accepted	0	2	0	1	0	0	**3**
# Not accepted	5	12	3	1	1	0	**21**

Table 5

Twenty-four comments were received on the IA (equally divided between industry and NCAs). Half of the comments were not accepted and one-third were noted. EASA accepted and partially accepted four comments to correct a calculation and some IA text in NPA 2021-02:

Impact assessment (IA)			
	Industry	**NCAs**	**Total**
# of comments	12	12	**24**
EASA's position			
Accepted	1	2	**3**
Partially accepted	1	0	**1**
Noted	3	4	**7**
Not accepted	7	6	**13**

Table 6

The individual comments and responses to them are contained in Chapter 2 of this Comment-Response Document (CRD) 2021-02. Appendix A of CRD 2021-02 includes Attachment #1, which contains the comments by Transport Canada (see also Comment 59).

Section 2.4 of the Explanatory Note to ED Decision 2021/016/R includes a summary of the main comments received and of the most significant changes to the text proposed in the related NPA 2021-02.

Please note that all comments to CRD 2021-02 are provided under the single header 'General Comments' as NPA 2021-02 was not segmented in the CRT and, therefore, it was impossible to comment on individual segments.

2. Individual comments and responses

In responding to the comments, the following terminology is applied to attest EASA's position:

(a) **Accepted** — EASA agrees with the comment and any proposed change is incorporated into the text;

(b) **Partially accepted** — EASA either partially agrees with the comment or agrees with it but the proposed change is partially incorporated into the text;

(c) **Noted** — EASA acknowledges the comment, but no change to the text is considered necessary; and

(d) **Not accepted** — EASA does not agree with the comment or proposed change.

(General Comments)	-

comment	*1* comment by: *CAA-Norway TFH* The Norwegian CAA - Luftfartstilsynet - has reviewed the NPA and supports it. A large fleet of CS-27 helicopters are operated in Norway and there are lots of birds. Hence the exposure is high. A review of Mandatory Occurrence Reports shows a number of bird strikes but none found which have resulted in major damage.
response	Noted EASA thanks you for your support. The European Co-ordination Centre for Accident and Incident Reporting Systems (ECCAIRS) (including Norwegian data) was accounted for in the cost-benefit analysis (CBA) performed in the impact assessment (IA) of NPA 2021-02.

comment	*2* comment by: *ICAR International Commission for Alpine Rescue, Air Rescue Commission Vice-President* General comment: — should you include small drones as a new kind of birds? — in that case maximum altitude of 8000 ft may not be enough in mountaneous areas.
response	Not accepted This new rule does not address drone strikes. The objective of the rule is to improve the safety of small-rotorcraft occupants in the event of a bird strike.

EASA derived the CS 27.631 bird strike specification from CS 29.631, which has demonstrated its effectiveness for the reinforced rotorcraft windshield. CS 29.631 sets the maximum altitude for the evaluation to 8 000 ft. The same maximum altitude is specified in CS 27.631. According to EASA's occurrence database IORS (Internal Occurrence Reporting System), 93 % of the bird strike occurrences took place below 3 500 ft.

Regarding drone strikes, EASA is working on a research project to evaluate the 'Vulnerability of Manned Aircraft to Drone Strikes'. The objective of this project is to provide design requirements and test standards for future drones to be placed on the EU market in order to minimise the consequences of the possible impact of drones with manned aircraft.

comment *3* comment by: *Alex Scerri*

The Atkins report, referenced in the NPA, states in the conclusions that "The certification requirements for CS-23 Commuter Aircraft (2 lb, windshield only) and CS-29 Transport Helicopters (1 kg) result in an undesirably large proportion of bird strikes (5 to 11%) above the certification value. The equivalent value for CS-25 aircraft is around 0.3%."

CS-27 and CS-29 aircraft operate in the same airspace as CS-25 aircraft and mostly in the highest risk band of 3,000 ft and below, where over 90% of bird strikes occur. Also by the nature of their operation, these aircraft will spend a greater part of their flying lifetime over congested areas where any inflight catastrophic failure, or even a case of PDA, have a greater chance of affecting nonparticipating third parties on the ground.

As EASA is taking the commendable step to increase bird strike impact resistance, the opportunity should be taken to take the bird mass to CS-25 standard rather than an incremental step. Retrofitting impact resistance into airframes in the future always proves technically challenging and hence costly and may be one of the reasons why bird strike resistance standards have remained static for many years in GA aircraft.

response

Not accepted

For the specific case of rotorcraft, the *Atkins* report was based on a much smaller data sample compared to the ARAC RBSWG report[3] or EASA's occurrence database on which NPA 2021-02 is built. The CS-29 rotorcraft are more likely to operate in the CS-23 and CS-25 aircraft airspace compared to the CS-27 rotorcraft that are addressed in NPA 2021-02. The ARAC RBSWG report and EASA's occurrence database IORS (Internal Occurrence Reporting System) have demonstrated the effectiveness of the current CS 29.631 requirement, including for bird weight.

[3] Federal Aviation Administration (FAA) ROTORCRAFT BIRD STRIKE WORKING GROUP RECOMMENDATIONS TO THE AVIATION RULEMAKING ADVISORY COMMITTEE (ARAC), Revision B, 8 May 2019 (https://www.faa.gov/regulations_policies/rulemaking/committees/documents/index.cfm/document/information/documentID/3964).

Based on the ARAC RBSWG report, there is no justification to increase the bird weight requirement above 1 kg as the mean weight (mass) of all birds involved in strikes with CS-29 rotorcraft was found to be 1.05 kg (2.3 lb), which is very close (104.5 %) to the requirement of the current rule. This conclusion was also validated based on data from EASA's occurrence database IORS. Consequently, the CS 27.631 bird weight specification is harmonised with the existing CS 29.631 requirement.

comment *4* comment by: *+kopter*

Page 8, comment on the AMC1 27.631:

"(1) the windshield directly in front of the occupants, and its supporting frame, should be capable of withstanding a bird impact without penetration;"

— 'non penetration' is obviously a rather simple criteria. However, it is not the only one possible to comply with the proposed new rule: 'to ensure a safe landing after an impact upon the windshield'

Indeed experience has shown that windshields can be seriously damaged by a birdstrike. The bird is, as well, severely damaged during the impact. Then, in case of a penetration, bird fragments could be falling down onto the cockpit floor without preventing a safe landing. Indeed, the kinetic energy of the bird is significantly absorbed by the impact on the windows with their deformation / cracked. Thus, the remaining energy of bird fragments that penetrate the cockpit is largely reduced and would not harm the crew or prevent them to land safely.

The 'no penetration' criteria should be removed from the AMC.

response

Not accepted

EASA's occurrence database IORS (Internal Occurrence Reporting System) and accident reports provide clear evidence that fragments due to windshield penetration on CS-27 rotorcraft caused pilot and/or occupant injuries (see Section 4.1.1, page 13 of NPA 2021-02): 'windshield penetration after a bird impact caused fragments to enter the cockpit'.

The non-penetration of the windshield is an important criterion to fulfil, which has demonstrated its effectiveness on CS-29 rotorcraft.

comment *5* comment by: *LBA*

General aspects: LBA comment:

We miss in this NPA technical aspects, e.g if the really useful great helicopter windshields can withstand the required impact and remains supporting the really useful

good surrounding view of the pilot, or how does the risk of bird strikes changes with height over ground.

1) How to achieve: Page 5 and 6

LBA comment:

You just mention one method to achieve your goal which is defined in 2.2. You exclude any other solution to ensure the safe landing.

It is very difficult to impossible to prevent windshield penetration for any bird mass and impact velocity. It seems to be more feasible to exclude the possibilities of movement of power levers, fuel shut-off switches and rotor brake levers into a position which is not conformable with continuous controlled powered flight. Referencing the NTSB accident report no. CEN09MA117, an installed sheet metal shield in front of the power levers could have prevented the fatal outcome of the bird strike.

2) "applicable to the windshields" Page 6, 8, 9

LBA comment:

In section 2.3 first paragraph you describe that you want to introduce a " bird strike protection certification specification (CS) applicable to the windshields of newly designed rotorcraft with seats for six or more passengers". But in the proposed rule itself you extent your own proposal. In Section 3.1 you wrote down the proposed rule wording. You don't only require that the windshield needs to withstand an impact of a 1-kg-bird. Your require "to ensure the safe landing after an impact upon the windshield". This extension is also visible in the proposed wording of AMC1 27.631 in which not only the windshield needs to be evaluated but also "any systems and equipment (including their controls) that are essential to ensure safe landing".

The result is that your description of your way forward is extended by the proposed wording of the rule.

3) "engine" Page 9

LBA comment:

Section 3.1, AMC1 27.631 letter (b) is related "multiple bird strikes" upon the engines and that the engines needs to withstand them. Which part of the proposed wording of CS 27.631 is the reference for this "acceptable means of compliance", particular you only want to introduce a CS applicable to the windshields for CS 27 rotorcraft?

4) impact velocity; Page 8, 9

LBA comment:

In Section 3.1, AMC1 27.631 you mention a note which tries to clarify some aspects of the impact speed. We propose the following wording of this note:

"Note: the maximum horizontal velocity (V H) varies as a function of the density altitude; therefore, it is necessary to define the altitude range within which the V H must be considered.

	For the determination of the impact velocity of the bird the corresponding airspeed (V_H resp. V_NE) must be considered in terms of true airspeed (TAS)." **5) Safety risk assessment: 4.1.1; Page 12** **LBA comment:** It is obvious that no European data base is available for the decision on introducing this new rule. Also the EASA/*Atkins* Report uses the data base of North America. **Page 16:** **LBA comment:** 5) General corrections necessary on page 16 Two references are missing on page 16, in the first line under (5) you mention two times Tier-II and you wrote "w indshields" which lead to an interesting line change. **Page 18** **LBA comment:** 6) General corrections necessary on page 18 On page 18 one reference is missing and in table 8 last column you insert a minus although the difference is positive.
response	**'General aspects'** Noted The technical aspects can be found in the ARAC RBSWG and EASA/*Atkins* reports that are referred to in Section 6 of NPA 2021-02. The objective of NPA 2021-02 is to propose a well-founded bird strike specification to ensure safe landing for CS-27 rotorcraft after a bird impact on the windshield, as well as related AMC for both CS-27 and CS-29 requirements. The CS 27.631 specification is derived from CS 29.631, which has shown its effectiveness. Regarding the risk of bird strikes changing with height, data are available in the ARAC RBSWG report (please refer to pages 43 and 44).
	1) How to achieve: Page 5 and 6 Not accepted The non-prescriptive CS 27.631 specification on safe landing after a bird impact on the windshield fulfils the safety objective 'to improve rotorcraft occupant safety in the event of a bird strike', as in Section 2.2 of NPA 2021-02. The related AMC provides a means to comply with that specification, but it is not the only possible means. The applicant is responsible for defining the technical solutions to meet the requirements. Such a means of compliance has shown its effectiveness for the certification of CS-29 rotorcraft to which CS 29.631 is applicable.

The CS 27.631 specification and the acceptable means of compliance in AMC 27.631(a)(2) were drafted to adequately address the S76C++ accident that is described in CEN09MA117.

2) "applicable to the windshields" Page 6, 8, 9

Accepted

EASA acknowledges that the explanation provided in the first paragraph of Section 2.3 could indeed be misleading. The text should read as follows:

'As described in Sections 2 and 4 of this NPA, most of the bird strike damage that occurred on CS-27 rotorcraft was in the windshield. The new proposed CS 27.631 extends CS-27 by introducing a bird strike protection certification specification (CS) to ensure a safe landing after a bird impact on the windshield of newly designed rotorcraft with six or more passenger seats. Based on the outcome of the impact assessment, this new CS is not considered economically viable for CS-27 rotorcraft with seating capacities of less than six passengers.'

3) "engine" Page 9

Accepted

AMC1 27.631 and AMC1 29.631 were restructured accordingly as point (b) of AMC1 27.631 and AMC1 29.631 in NPA 2021-02 did not contain means of compliance. The link with the existing and applicable engine requirements on multiple bird strikes is therefore introduced as a note into both AMC.

4) impact velocity; Page 8, 9

Partially accepted

CS 27.631 and CS 29.631 now include the reference to TAS for the determination of V_H and V_{NE}.

5) Safety risk assessment: 4.1.1; Page 12

Not accepted

The *Atkins* report is based solely on US data but the NPA 2021-02 includes data on Europe as well.

Page 16:

Accepted

The missing reference in point (4) of Section 4.4.2 should read: '(see Table 5 on page 17)'.

The first sentence of point (5) of Section 4.4.2 should read: 'Based on historical data, EASA assumed that new types of Tier-I, Tier-II, and Tier-III rotorcraft will be launched onto the market every 10, 10, and 7 years respectively.'

The missing reference in the second paragraph of Section 4.5.1 should read: 'Table 5, page 17'.

The word 'windshield' should not be broken in the last sentence of the second paragraph of Section 4.5.1.

Page 18

Accepted

The missing reference in Section 4.5.4 should read: 'Table 7', and the minus in front of the value for Option 3 in Table 8 should be removed.

comment *6* comment by: *Oliver DISMORE*

Executive Summary. See subsequent Page 19 comment on sensitivity analysis as to whether the proposed CS should be applicable to 'Tier II' helicopters as well, in view of potential mode of operation in mountain SAR, police and lower capability HEMS operations.

Executive Summary. While the emphasis is on protection of pilot and other occupants, the secondary effect on 3rd Parties on the ground is also worthy of mention.

General comment. Many of the provisions of this RMT are also applicable to helicopter v. drone incidents and may be worthy of addressing here or at least cross-referencing. From an industry point of view there is growing concern in this area.

response

Executive Summary #1

Not accepted

CS 27.631 provides a rotorcraft design specification dependent on the rotorcraft passenger seat capabilities, which is therefore not related to the type of operation leading to cabin reconfiguration.

EASA published on 19 April 2021 Safety Information Bulletin (SIB) No 2021-07 on 'Bird Strike Risk Mitigation in Rotorcraft Operations' for all rotorcraft types.

Please also refer to the response to Comment 19.

Executive Summary #2

Noted

Although not mentioned in the Executive Summary of NPA 2021-02, it is assumed that third parties are also covered when ensuring safe landing.

General comment

Noted

Drone strikes are beyond the scope of RMT.0726. However, EASA is aware of industry's growing concern about drone collision with manned aircraft. EASA is therefore working on a research project to evaluate the 'Vulnerability of Manned Aircraft to Drone Strikes'. The objective of this project is to provide design requirements and test standards for future drones to be placed on the EU market in order to minimise the consequences of the possible impact of drones with manned aircraft.

comment *7* comment by: *Oliver DISMORE*

Missing Reference in header

response

Accepted

The missing reference in the headers of pages 3 and 4 should read: '1. About this NPA'.

comment *8* comment by: *Oliver DISMORE*

Page 3. End of Subtask 1. Statement left hanging with missing rationale. i.e. Considered the conclusions etc. as sufficient evidence.

Page 3. End of Subtask 2. Amend: ...with the support of a~~n~~ RMG.

response

End of Subtask 1.

Accepted

The last sentence of paragraph 'Subtask 1' in Section 1.1 should read:

'This subtask is conducted without the support of a rulemaking group (RMG) as EASA considered the conclusions of the Aviation Rulemaking Advisory Committee Rotorcraft Bird Strike Working Group (ARAC RBSWG) as valid based on an EASA cost-benefit analysis (CBA).'

End of Subtask 2.

Not accepted

'an RMG' is correct. When the indefinite article is used before an acronym or initialism, the choice of form (a or an) depends on pronunciation, not on spelling.

comment *9* comment by: *Oliver DISMORE*

Page 4. Missing Reference in header.

response

Accepted

The missing reference in the headers of pages 3 and 4 should read: '1. About this NPA'.

comment *10* comment by: *Oliver DISMORE*

Page 5. Paragraph 2. Add: ...therefore, of fatalities including to those on the ground.

Page 5. Paragraph 2.1. Amemd: ...landings and possible occupant/3rd Party injuries...

response

Page 5. Paragraph 2.

Noted

Although not mentioned in the Executive Summary of NPA 2021-02, it is assumed that third parties are also covered when ensuring safe landing.

Page 5. Paragraph 2.1.

Not accepted

No occurrence of third-party fatalities was reported.

comment *11* comment by: *Oliver DISMORE*

Page 6. Paragraph 2.3. Add: 'area' after windshield

response

Not accepted

EASA sees no benefit in the proposed modification, which may confuse the reader.

comment *12* comment by: *Oliver DISMORE*

Page 6. Paragraph 2.3. Economic viability. Is this based on retrofit action or design from new as they are different dynamics?

Page 6. Paragraph 2.3. Amend (grammar): with seating capacities of ~~less~~ fewer than six passengers.

Page 6. Paragraph 2.3. General Comment. There are helicopters in use in mountain SAR, police operations and lower intensity HEMS which fall below this number and are particularly at risk. E.g. Current AS350 & AS355 variants and replacements in train as all operators seek to reduce costs of replacements. The nature of these operations puts them at higher risk of birdstrikes which is not necessarily visible in the granularity of the data available.

response

Page 6. Paragraph 2.3. Economic viability.

Noted

NPA 2021-02 proposes a new specification only for newly type-certified rotorcraft.

Page 6. Paragraph 2.3. Amend (grammar)

Accepted

In the first paragraph of Section 2.3, 'less' should be replaced with 'fewer'.

Page 6. Paragraph 2.3. General Comment.

Noted

Please refer to the response to Comment 6 '**Executive Summary #1**'.

comment

13 comment by: *Oliver DISMORE*

Page 16. Sub Paragraph (4). Missing references.

Page 16. Paragraph 4.5.1. Missing references.

response

Accepted

The missing reference in point (4) of Section 4.4.2 should read: '(see Table 5 on page 17)', and the missing reference in Section 4.5.4 should read: 'Table 7'.

comment

14 comment by: *Oliver DISMORE*

Page 17. Centre of page. Missing references.

response

Accepted

The missing reference should read: '(see Table 6)'.

comment

15 comment by: *Oliver DISMORE*

Page 18. Social Impact. Propose: Public perception of risk of harm to 3rd parties on the ground

Page 18. Paragraph 4.5.4. Missing reference

response

Page 18. Social Impact.

Not accepted

EASA considers the change in the 'public perception of risk of harm to third parties on the ground' negligible as there is no data on third parties involved in accidents due to bird strikes.

Page 18. Paragraph 4.5.4. Missing reference

Accepted

The missing reference in Section 4.5.4 should read: 'Table 7'.

comment

16 comment by: *Oliver DISMORE*

Page 19. Paragraph 4.6.2. The sensitivity analysis has considered the effect of increased accident rates on the cost v. benefit balance but not the potential for reduced cost of implementation. In the latter case, either the non-recurring cost estimate or projected sales may be out by a factor which brings Tier II into scope in particular.

This category of aircraft is broadly cost neutral yet an area of particular interest to higher risk users identified earlier.

Although introduced earlier in the document, there is no further consideration of retrofitting which requires the same analysis.

response

Not accepted

NPA 2021-02 proposes a certification specification for newly type-certified rotorcraft (Subtask 1 of RMT.0726). EASA will address the retrofitting aspect under Subtask 2 of RMT.0726 (not yet undertaken).

The cost estimates were provided by European and US rotorcraft manufacturers. A sensitivity analysis would have been carried out if new evidence of lower costs had been provided.

comment

19 comment by: *FAA*

#	Document Name	Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution	Comment Type (Conceptual, Editorial, or Format)	Disposition/Response to Comment

1	NPA 2021-02	8	3.1	six to nine passenger seats	for harmonization purposes, Part 27 generally does not mandate criteria by the number of passengers	change the specification to read "when required by operating rules". This will prevent problems that occur when the passenger configuration is changed in service.	conceptual	
2	NPA 2021-02	8	3.1	CS 27.631 Bird Strike	From EASA's proposed rule and cost-benefit analysis, it appears that implementing bird strike standards for Tier II, 3-5 passengers, is a total cost after benefits of EUR152,641 with Tier I total cost after benefit of EUR1,477,966. Upon further review, EASA may determine this cost to be negligible, and elect to	Consider changing CS 27.631 to include Tier I and II as follows: "Rotorcraft with a maximum of six to nine passenger seats must be designed to ensure a safe landing after an impact upon the windshield by a 1.0-kg (2.2-lb) bird when the velocity of the rotorcraft (relative to the bird along the flight path of the rotorcraft) is equal to VNE	conceptual	

					apply the regulation to both Tier I and II. Such an approach would align with the ARAC Rotorcraft Bird Strike Working Group's initial recommendations.	or VH (whichever is less) at altitudes up to 2438m (8000 feet). Compliance must be shown by tests, or by analysis based on tests that are carried out on sufficiently representative structures of similar design."		
3	NPA 2021-03	18	4.6		Change the conclusion of the cost benefit calculation to include the following points.	Add the following: Implementing bird strike for Tier II, 3-5 passengers, is a total cost after benefits of Euro 152,641 with Tier I, 0-2 passengers, a total cost after benefit of EUR1,477,966. This cost is negligible, and the regulation should be implemented on Tier I and II, essentially	conceptual	

						all part 27 rotorcraft. These were part of the initial recommendations of the RBSWG report Rev B, pg 30. It only takes 1 fatality in Tier I or II to exceed the minimal cost to implement this rule. EASA should take the risk of more serious injuries and fatalities into consideration with the negligible effect of the total cost to society of only EUR 152,641 for Tier II and EUR 1,477,966 for Tier I aircraft. The next bird strike that leads to a serious injury in a Tier II or a single fatality in a Tier I would be cost beneficial to		

						society, let alone the individuals seriously injured or killed.		

response

Comment #1

Not accepted

The number of passenger seats is one of the applicability criteria of CS 27.1(a). As such, this criterion is used in CS 27.631 for rotorcraft certification.

The certification of a rotorcraft compliant with CS 27.631 would not be invalidated in case of a reconfiguration to reduce the number of passenger seats below six as long as the type design maximum number of passenger seats remains unchanged.

Comment #2

Not accepted

The choice of Tier-III rotorcraft was based on a far more favourable net present value (+EUR 4 104 512, which was corrected to +EUR 4 611 515, please refer to the response to Comment 52) than the negative net present values for Tier-I and Tier-II rotorcraft. As the benefit was based on conservative assumptions, it would not be appropriate to change the outcome of the impact assessment (IA). Additionally, the ARAC RBSWG members unanimously concluded that such a change would have a non-negligible impact on Tier-I and Tier-II rotorcraft weight[4].

Please note that the proposed text change under the 'Proposed Resolution' column is not consistent with the comment made.

[4] Federal Aviation Administration (FAA) ROTORCRAFT BIRD STRIKE WORKING GROUP RECOMMENDATIONS TO THE AVIATION RULEMAKING ADVISORY COMMITTEE (ARAC), Revision B, 8 May 2019 (https://www.faa.gov/regulations_policies/rulemaking/committees/documents/index.cfm/document/information/documentID/3964).

Comment #3

Not accepted

The conclusion of the IA is based on the results of the cost-benefit analysis (CBA) and other considerations. Only Option 3 has a positive net present value.

One more fatality would mean an eleven-times-higher accident rate for Tier-I rotorcraft, and a roughly seventy-percent-higher accident rate for Tier-II rotorcraft. These rates seem unrealistic. A sensitivity analysis would have been carried out if new evidence of higher accident rates had been provided.

Besides the CBA, EASA also considered other factors, e.g. the technical feasibility and potential for additional recurring costs for Tier-I and Tier-II rotorcraft.

comment

20 comment by: *Swedish Transport Agency, Civil Aviation Department (Transportstyrelsen, Luftfartsavdelningen)*

Thank you for the opportunity to comment on NPA 2021-02 Rotorcraft occupant safety in the event of a bird strike. Please be advised that there are no comments from the Swedish Transport Agency.

response

Noted

comment

21 comment by: *Airbus Helicopters*

Airbus Helicopters comments on this NPA have been consolidated with GAMA/ASD RTR members and submitted to EASA by GAMA.

response

Noted

comment

22 comment by: *Sikorsky Aircraft*

Sikorsky concurs with the content of this NPA.

response

Noted

comment

23 comment by: *DGAC France*

Please note that DGAC France has no specific comments on this NPA.

response | Noted

comment | *24* comment by: *Garmin International*

Section 3.1 CS 27.631 Page 8:

As written, the regulation applies to all rotorcraft regardless of seating capacity. This contradicts the intention of the NPA stated in Section 2.3 that the bird strike protection certification specification is to be applicable to the windshields of newly designed rotorcraft with seats for six or more passengers.

As written, the regulation applies to rotorcraft models not intended for CS 27.631 certification with seating capacity less than 6.

CS 27.631 should read -

Rotorcraft with six or more passenger seats must be designed to ensure a safe landing after an impact upon the windshield by a 1.0-kg (2.2-lb) bird when the velocity of the rotorcraft (relative to the bird along the flight path of the rotorcraft) is equal to VNE or VH (whichever is less) at altitudes up to 2438 m (8 000 feet). Compliance must be shown by tests, or by analysis based on tests that are carried out on sufficiently representative structures of similar design.

response | Accepted

CS 27.631 is changed accordingly to avoid this confusion.

comment | *25* comment by: *Garmin International*

AMC1 27.631 (a)(2) Page 8:

There is insufficient clarity regarding evaluation of systems and equipment installed near the windshield.

Is the AMC1 27.631 intention to apply to equipment installed in the rotorcraft instrument panel or just the instrument panel itself?

If the intent is to apply to the equipment, then AMC1 27.631 should include the following in section (a)(2) -

Equipment qualified to Category B, Test Type R of DO-160 section 7 meets the requirements of CS 27.631 when installed in instrument panel.

response | Not accepted

The means of compliance in AMC 27.631(a)(2) relates to the effect of shock loads on critical equipment installed near the windshield (equipment essential to ensure a safe landing). The effect of a bird strike on critical equipment depends on the rotorcraft

	design. Therefore, the evaluation of this effect is the responsibility of the applicant for rotorcraft certification as CS 27.631 and AMC 27.631 apply to the rotorcraft design and not to the equipment.
comment	*26* comment by: *Garmin International* **AMC1 29.631 Bird strike (a)(2)(i) Page 9:** There is insufficient clarity regarding evaluation of systems and equipment installed near the windshield. Is the AMC1 29.631 intention to apply to equipment installed in the rotorcraft instrument panel or just the instrument panel itself? If the intent is to apply to the equipment, then AMC1 29.631 should include the following in section (a)(2)(i) - Equipment qualified to Category B, Test Type R of DO-160 section 7 meets the requirements of CS 29.631 when installed in instrument panel.
response	Not accepted Please refer to the response to Comment 25.
comment	*27* comment by: *General Aviation Manufacturers Association* Note: The following Industry comments are submitted by GAMA on behalf of Airbus Helicopters, Bell Flight and Leonardo Helicopters. General: Some relevant terms are not explicitly defined in the NPA: e.g. windshield, frame "«windshield» should be clearly defined: e.g. is it related to the main windscreen(s) only? upper/lower windows should be explicitly excluded, if this is the case. «frame»: to which extent should the surrounding structure be considered? e.g. interface mounting frame only, limited to the structural junction of the windshield? or maybe the structural portion in direct contact with the windshield? Fuselage frame should be explicitly excluded, if this is the case." We suggest the inclusion of clear definitions of the relevant terms: e.g. windshield, frame (at least in relevant AMC section).
response	Not accepted The analysis supporting RMT.0726 is related to a bird strike on the windshield, which is usually the main windscreen on conventional rotorcraft, located in front of the

	occupants. The windshield supporting frame depends on the rotorcraft design. Both windshield and its supporting frame are design-dependent.
comment	*28* comment by: *General Aviation Manufacturers Association* Section 2.3, CS 27.631 Rotorcraft designed for 7 occupants can transport 5 or 6 passengers depending on whether 1 or 2 pilots are required, therefore to level the playing field it is suggested to use total number of occupants being 7 or more. We suggest alignment with the ARAC RBSWG recommendation: Change to "Rotorcraft with 7 or more occupants…". Mark consistent reference to either occupants or passengers through-out the document.
response	Not accepted The tiers in the ARAC RBSWG[5] report are based on rotorcraft passenger seats. This is consistent with the applicability criterion in CS 27.1(a).
comment	*29* comment by: *General Aviation Manufacturers Association* Section 3.1, CS 27.631 and CS 29.631 Bird strike The wording "VNE or VH (whichever is less)" is confusing when referring to the airspeed which needs to be considered. The intent of this wording isn't clear. Why use the lesser of VH or VNE which can be misinterpretted? We recommend clarifying the intent of the current wording to "...*when the velocity of the rotorcraft (relative to the bird along the flight path of the rotorcraft) is the maximum achievable (VNE or VH) in level flight at altitudes up to 8,000 feet*.".
response	Not accepted V_H is frequently reached in operation, and V_{NE} is rarely reached in level flight. However, in seldom cases, some helicopters can reach a V_H, which is higher than the defined V_{NE}. Specifying the lower speed between V_H and V_{NE} would limit the demonstration speed to V_{NE} for these seldom cases. Hence, CS 27.631 and CS 29.631 rightly state to select 'V_{NE} or V_H 'True Airspeed' (TAS), whichever is less'.

[5] Federal Aviation Administration (FAA) ROTORCRAFT BIRD STRIKE WORKING GROUP RECOMMENDATIONS TO THE AVIATION RULEMAKING ADVISORY COMMITTEE (ARAC), Revision B, 8 May 2019 (https://www.faa.gov/regulations_policies/rulemaking/committees/documents/index.cfm/document/information/documentID/3964).

comment	*30* comment by: *General Aviation Manufacturers Association* Section 3.1, CS 27.631 Bird strike The wording should reflect that bird strike is considered only for forward flight. Helicopters fly in all directions, but VH and VNE are highest and most critical for bird strike in forward flight. Bird strike is not considered for sideward or rearward flight. We recommend adding the word "*forward*" to the following sentence as highlighted: …*when the velocity of the rotorcraft (relative to the bird along the* ***forward*** *flight path of the rotorcraft*) ..."
response	Not accepted As the velocity of the rotorcraft must be considered 'along the flight path of the rotorcraft' and as V_H or V_{NE} cannot be reached in sideward and rearward flight, further clarification is not necessary. In addition, CS 29.631 has never been misinterpreted so far.

comment	*31* comment by: *General Aviation Manufacturers Association* Section 3.1, CS 27.631 Bird strike Rotorcraft designed for 7 occupants can transport 5 or 6 passengers depending on whether 1 or 2 pilots are required, therefore to level the playing field it is suggested to use total number of occupants being 7 or more. We suggest to align with the ARAC RBSWG recommendation. We suggest that CS 27.631 is changed to read: "*Rotorcraft with a total number of occupants of 7 or more…*".
response	Not accepted Please refer to the response to Comment 28.

comment	*32* comment by: *General Aviation Manufacturers Association* Section 3.1, AMC1 27.631 Bird strike The following wording seems ambiguous: "the windshield directly in front of the occupants....". It is understood windshields are in the front of the aircraft whereas windows are on the sides of the aircraft. But the current wording could lead to confusion in the event of a side facing passenger seat. Is the term "directly in front of the occupants" needed?

Could it be reworded? Is there an example of a windshield not directly in front of the occupants?

We recommend clarifying that this is only referencing the front windshield and not any side windows in the event of a side facing seat.

response

Not accepted

This wording is used for consistency within other EASA rules, e.g. MOC VTOL.2250(f) in the 'Means of Compliance with the Special Condition VTOL', Issue 2, and in CS 23.2320(b).

comment *33* comment by: *General Aviation Manufacturers Association*

Section 3.1, AMC1 27.631 Bird strike

Note at the bottom doesn't make sense. "Note: the maximum horizontal velocity (VH) varies as a function of the density altitude; therefore, it is necessary to define the altitude range within which the VH must be considered."

The regulation states that altitudes up to 8,000 ft must be considered. What is the purpose of this note?

We recommend to remove the note or clarify how this changes the wording in the regulation.

response

Accepted

The objective of this note was to clarify the need to define the altitude range within which V_H must be considered for the evaluation. EASA acknowledges that the sentence does not meet the objective. Therefore, the related AMC were modified accordingly, and the note was changed into a recommendation with improved wording.

comment *34* comment by: *General Aviation Manufacturers Association*

Section 3.1, AMC1 27.631 Bird strike

The AMC does not provide expected attitude to be considered.

Debate about expected attitude can lead to multiple test and analysis iterations. Whereas the cost impact assessment for incorporation of changes to CS 27.631 is marginal it is suggested to simply the AMC for CS 27.631.

It should be clarified that the expected aircraft attitude of x=0 deg, y=0 deg, z= 0 deg is acceptable for the evaluation of bird strikes on the windshield.

response

Not accepted

For compliance demonstration, the applicant should define the rotorcraft attitude corresponding to the speed in level flight. This is the common practice of demonstrating compliance with CS 29.631.

comment *35* comment by: *General Aviation Manufacturers Association*

Section 3.1, AMC1 27.631(a)

The AMC does not provide expected temperature envelope to be considered.

The material properties of transparencies can vary with temperature. Consideration of the complete temperature envelope may make implementation of bird proof windows impractical and testing throughout the temperature envelope will require multiple iterations. Other solutions could require heated windsheilds which would add significant cost and complexity. Whereas the cost impact assessment for incorporation of changes to CS 27.631 is marginal it is suggested to simply the AMC and a single acceptable temperature should be specified.

It should be clarified that a temperature of 20C +/- 5C is acceptable for demonstration of compliance for CS 27.631.

response

Not accepted

For compliance demonstration, the applicant should determine the critical temperature as that temperature depends on the windshield composition.

comment *36* comment by: *General Aviation Manufacturers Association*

Section 3.1, AMC1 27.631(b)

Assessment of Bird Strikes on engines is not applicable per CS 27.631.

Evaluation for engines is not applicable per the proposed CS 27.631, so AMC which discusses evaluation for multiple strikes on the engine is not applicable and not appropriate for CS 27 and should only be identified in CS-E. Furthermore clarification can be provided to state that events unrelated to bird strike do not need to be considered.

We recommend the revision of AMC1 27.631(b) as follows: "The capability to withstand multiple bird strikes does not need to be evaluated. A dual threat of a bird strike and a separate event which is not a secondary effect of the bird strike, such as lightning strike or engine failue, does not need to be evaluated.".

response

Partially accepted

AMC 27.631 and AMC 29.631 were restructured accordingly as point (b) of AMC1 27.631 and AMC1 29.631 in NPA 2021-02 did not contain means of compliance. The link with the existing and applicable engine requirement on multiple bird strikes is therefore introduced as a note into both AMC.

As AMC are means to demonstrate compliance with the related CS, they do not have to indicate what the applicant does not need to evaluate.

comment *37* comment by: *General Aviation Manufacturers Association*

Section 3.1, CS 29.631 Bird strike

The wording should reflect that bird strike is considered only for forward flight.

Helicopters fly in all directions, but VH and VNE are highest and most critical for bird strike in forward flight. Bird strike is not considered for sideward or rearward flight.

We recommend adding the word "forward" to the following sentence:

"…*when the velocity of the rotorcraft (relative to the bird along the "**forward**" flight path of the rotorcraft) is equal to*...".

response

Not accepted

Please refer to the response to Comment 30.

comment *38* comment by: *General Aviation Manufacturers Association*

Section 3.1, AMC1 29.631(a)(1) (page 9)

The AMC does not provide the expected temperature envelope to be considered.

The material properties of transparencies can vary with temperature. Consideration of the complete temperature envelope may make implementation of bird proof windows impractical and testing throughout the temperature envelope will require multiple iterations. To avoid multiple test iterations a single acceptable temperature for compliance demonstration should be provided.

It should be clarified that a temperature of 20C +/- 5C is acceptable for demonstration of compliance.

response

Not accepted

Please refer to the response to Comment 35.

comment	*39* comment by: *General Aviation Manufacturers Association* Section 3.1, AMC1 29.631(a)(2) Assessment of structure, systems and equipment is based on areas that are exposed to birds. Clarification should be provided to remove ambiguity. Add "exposed" as follows: "…*other* ***exposed*** *structure, systems, and equipment*…"
response	Accepted 'exposed' is introduced into the text as suggested.

comment	*40* comment by: *General Aviation Manufacturers Association* Section 3.1, AMC1 29.631(a)(2)(i) The AMC does not define trajectory or exposed areas, but uses the term "conservative assumptions". Rationale for the proposed changes to AMC 29.631 includes "...*lessons learned during recent certification processes would further clarify the intent of CS 29.631 and ensure a level playing field among applicants*." The expected impact attitude and definition of exposed areas should be clarified. Expected attitude for bird impact should be clarified in the AMC as the normal cruise attitude of the aircraft. The exposed areas should be defined as only the areas that are exposed based on the normal cruise attitude of the aircraft.
response	Not accepted The applicant should define the helicopter attitude in level flight at V_H or V_{NE}, whichever is less, and should perform a detailed hazard analysis to identify the exposed area, structure, and system to be evaluated in the bird strike assessment as they may be design-specific.

comment	*41* comment by: *General Aviation Manufacturers Association* Section 3.1, AMC1 29.631(b) Compliance as required by 29.631 requires assessment after impact with a single 1 kg (2.2 lb.) bird. Multiple bird strikes on the engine are not applicable under CS 29. Evaluation of multiple bird strikes on engines is not applicable per the current or proposed CS 29.631, so AMC which discusses evaluation for multiple strikes on the engine is not applicable and not appropriate for CS 29 and should only be identified in

CS-E. Furthermore clarification can be provided to state that events unrelated to bird strike do not need to be considered.

We recommend the revision of AMC1 27.631(b) as follows: "*The capability to withstand multiple bird strikes does not need to be evaluated. A dual threat of a bird strike and a separate event which is not a secondary effect of the bird strike, such as lightning strike or engine failue, does not need to be evaluated*.".

response

Partially accepted

Please refer to the response to Comment 36.

comment *42* comment by: *General Aviation Manufacturers Association*

Section 3.1, AMC1 29.631 Bird strike

The following wording seems ambiguous: "...t*he windshield directly in front of the occupants*....".

It is understood windshields are in the front of the aircraft whereas windows are on the sides of the aircraft. But the current wording could lead to confusion in the event of a side facing passenger seat. Is the term "*directly in front of the occupants*" needed? Could it be reworded? Is there an example of a windshield not directly in front of the occupants?

We recommend clarifying that this is only referencing the front windshield and not any side windows in the event of a side facing seat.

response

Not accepted

Please refer to the response to Comment 32.

comment *43* comment by: *General Aviation Manufacturers Association*

Section 3.1, AMC1 29.631 Bird strike

Note at the bottom doesn't make sense. "*Note: the maximum horizontal velocity (VH) varies as a function of the density altitude; therefore, it is necessary to define the altitude range within which the VH must be considered.*".

The regulation states that altitudes up to 8,000 ft must be considered. What is the purpose of this note?

We recommend the removal of the note or clarify how this changes the wording in the regulation.

response

Accepted

Please refer to the response to Comment 33.

comment

44 comment by: *General Aviation Manufacturers Association*

Section 3.1 AMC1 27.631 (a)(2) and AMC1 29.631(a)(2)(ii)

The proposed NPA fails to consider the impact to the avionics industry, and the TSO/ETSO structure of equipment certification caused by these methods of compliance. The proposed NPA would require essential avionics – primarily IFR flight displays, associated sensors, navigation and communication equipment to be included in the bird strike testing. This essentially creates a unique qualification test for the avionics that is specific to the installation, and the configuration of avionics hardware. This would imply an obligation to repeat testing any time the avionics hardware design changes, or is replaced by new models of equipment.

Currently when an avionics manufacturer modifies hardware design or adjusts manufacture processes, the impact to the TSO/ETSO qualification, primarily defined by RTCA DO-160, is evaluated to see what retesting must be done at the unit level to approve the change. Since the requirement at the equipment level would not be known or defined in standard terms, this NPA would imply an obligation to repeat bird strike testing for each installation of the TSO/ETSO equipment – creating multiple unique qualifications of the equipment. Furthermore with the current rate that avionics equipment changes due to obsolescence and other factors, and the number of critical systems for IFR flight included in most flight decks, the obligation on the part of the helicopter manufacturer to repeat bird strike testing each time any one of the pieces of equipment changes becomes an incredible cost and burden to the industry. For example, a review of the avionics hardware changes that have occurred over the last ten years on a single model of rotorcraft shows bird strike testing would have had to be repeated 6 times in that time frame had this MoC been in effect.

A further impact on the industry would be the burden placed on Part 145 facilities that provide flight deck avionics upgrades. The proposed AMCs would require the applicant to repeat bird strike to verify the shock load survival of the replacement avionics. This would be impractical to this part of the industry, and would obstruct the installation of safety enhancing technology.

The proposed MOCs should clearly specify that avionics equipment covered by TSO/ETSO or equivalent RTCA DO-160 qualification is not required to be included in physical bird strike testing. Furthermore, if EASA believes there is need to address the issue of shock to this equipment caused by bird strike, it is recommended that EASA sponsor the development of a recommended procedure to quantify the impact at the equipment level. Those results can then be used to define classifications of operational shock testing in RTCA DO-160 section 7. In this way there would be a means to define the requirement and qualify future replacement equipment. This might be similar to

defining airframe HIRF attenuation using SAE ARP-5583A methods, which can then be used to establish the classifications used for RTCA-DO-160 section 20 equipment tests.

Although the NPA provides extensive data on bird strike incidents, there is no data provided to correlate these bird strikes to precipitated failures of TSO/ETSO equipment. As such this NPA fails to support a conclusion that current TSO/ETSO equipment design and qualification practices are inadequate. NPA section 4.4.1. cites the 2009 S-76C accident (N748P) as an example case of "malfunction of critical equipment", but that accident involved the displacement of controls by the impact (Fire "T" handle controls and ECL levers), and not a failure of DO-160 qualified equipment. It would seem EASA should be prepared to show specific data related to incidents of shock-based equipment failures following bird-strike before imposing changes to equipment qualification methods.

response

Not accepted

Please refer to the response to Comment 25.

comment

45 comment by: *General Aviation Manufacturers Association*

Section 3.1 (Page 8)

Further clarification should be provided regarding applicability of FAA AC 27-1B, for Bird strike aspects, as an acceptable means of compliance as mentioned in EASA CS27 book 2.

Indeed, FAA AC 27-1B.573 (f)(6)(ii)(C)(3) dealing with "Discrete Source Damage" substantiation refers erroneously to bird strike although bird strike requirement was not existing at the time of the AC 27 introduction in the EASA CS27 regulation.(3) Discrete Source Damage. The structure should be able to withstand limit static loads (considered as ultimate loads) and fatigue loads, which are reasonably expected during a completion of a flight on which damage resulting from obvious discrete source occurs (e.g., hail damage, bird strike, uncontained engine failure, and uncontained high energy rotating machinery failure). The extent of damage should be based on a rational assessment of service mission and potential damage relating to each discrete source.

Option 1 (preferred): Remove the reference to bird strike from FAA AC 27-1B.573 (f)(6)(ii)(C)(3).

Option 2 (pending option 1): EASA to clarify in the AMC 27.631 that the composite damage tolerance requirements are not applicable for a discrete source of damage caused by a bird strike.

response

Not accepted

AMC1 27.631 provides means to comply with CS 27.631 and does not relate to CS 27.573.

The comment will be considered under RMT.0128 'Regular update of CS-27&29, and CS-VLR'.

comment *46* comment by: *General Aviation Manufacturers Association*

Section 4.4.2 Data Collection, (5) Penetration rate of newly certified CS-27 rotorcraft (page 16)

The assessment that lead to the extrapolation of average 10 or **7 years interval between new TCs** for Tier I, II and III CS-27 models should be explicitly reviewed in the NPA. This input data could significantly change Net Safety Benefit results (sensitivity analysis).

Extrapolation from hystorical data for future predictions should be carefully evaluated, according to hypothesis on possible boundary conditions changes and market outlook.

This is particularly true for predictions over vast timeframe (in this case, 30 years): for example, VTOL/UAM are already introducing huge variations in the "vertical flight" market and disruptive changes are expected in the in the next years.

Explicitly review/assess the 10/7 years intervals for new TCs, and include in the NPA the hystorical data set on which it was based; include also justifications on why these assumptions are considered to be vaild over a 30 years time-span.

response

Not accepted

The historical data suggests a more frequent launch of new types than assumed in NPA 2021-02. For Tier-I, Tier-II, and Tier-III rotorcraft, the historical data suggests 8, 4, and 3 years, respectively. A less frequent launch was used in NPA 2021-02 based on current experience in certification projects and on future expectations.

comment *47* comment by: *General Aviation Manufacturers Association*

Section 4.4.2 Data Collection, (4) Observed period (Page 16)

The selection of a **30-years time span** over which benefit/costs of possible intervention are evaluated shall be explicitly reviewed/re-assessed in the NPA. This assumption could lead to non-realistic conclusions and is therefore pivotal for Cost Benefit Analysis (CBA) results.

Evaluation over the next 30 years is a huge difference with respect to the assumptions framework of ARAC RBSWG report (+10 years), over which NPA evaluations are mainly based. This "deviation" from ARAC BSGWG should be carefully evaluated and justified in the NPA. Extrapolation from hystorical data for future predictions should be carefully evaluated, according to hypothesis on possible boundary conditions changes and market outlook. This is particularly true for predictions over vast timeframe (in this

case, 30 years): for example, VTOL/UAM are already introducing huge variations in the "vertical flight" market and disruptive changes are expected in the in the next years.

Explicitly review/re-assess the 30 years time-frame and include justification on why results can still be considered vaild over a wider period with respect to ARAC assumptions/results.

ARAC RBSWG reported a great variation in bird strike events reporting from 2009 (ref. Figure 4 ARAC, page 14): from avg. 30 events per year (1996-2008) up to 223 events per year in 2011-2015. This is why ARAC considered the reporting data from the 2009-2016 subset only when assessing costs/benefits of add/modify birdstrike regulations (ref. Page 15 ARAC); and this is probably also one of the reasons why **ARAC limited the evaluation to +10 years period only**, since:

1. It was based over data from 7.17 years period only --> avoid high extrapolation errors, and
2. High variation in reporting (more than +600% in few years) --> additional significant changes in reporting could potentially happen over a wider time span (> 10 years).

response

Not accepted

CS 27.631 applies to newly type-certified rotorcraft that are assumed to be launched every 7 to 10 years. Rotorcraft have a service life of several decades. Therefore, the assessment period must be long enough to allow for evaluating the changes in the fleet composition and fully assessing the impact of the new CS 27.631.

There is no strong evidence that a 'disruptive change' might happen or that such change would result in small rotorcraft going into early retirement or in the market collapsing.

comment

48 comment by: *General Aviation Manufacturers Association*

Section 4.5.1 Safety Impact, Table 5 — Main assumptions for the estimation of safety benefits per accident (Page 17)

The value of "Value of prevented fatalities per accident (A × EUR 3.5 M)" for Option 3 Tier III is not consistent with the other reported values.

Tier I: A = 0.2, Value = 3.5 x 0.2 = 673,750 €

Tier II: A = 0.3, Value = 3.5 x 0.3 = 1,155,000 €

Tier III: A = 0.4, Value = 3.5 x 0.4 = 1,443,750 € (in NPA: 1,458,333 €)

Please update the calculated values in Table 5, as follows:

Average number of fatalities per accident (A):

Tier I = 0.19 (= 1.75 x 11%)

Tier II = 0.33 (= 3.00 x 11%)

Tier III = 0.41 (= 3.75 x 11%)

response

Not accepted

The values in the table are correct. The apparent error is due to the rounded values for the average number of fatalities per accident in Table 5 (0.2, 0.3, and 0.4). The precise values for Tier-I, Tier-II, and Tier-III rotorcraft, are 0.1925, 0.3300, and 0.4167, respectively.

comment

49 comment by: *General Aviation Manufacturers Association*

Section 4.5.1 Safety Impact, Table 5 and Table 6 (Page 17)

"Accident rate per flight hour" (Table 5) and "*Number of accidents*" (Table 6): comparing these 2 values would require information on the considered EU fleet (and the assumptions on its evolution over 30 years).

e.g. Tier I: accident rate = 1.83E-07, no. accidents = 0.3

- No. Accidents / Accident rate = 1.64E+06 FH (flight hours);
- FH per year = 1.64E+06 /30 years = 5.46E+04 FH;
- FH per day = 5.46E+04 /365 days per year = **150 FH per day**, over which fleet size?

Please provide additional information on the evaluation behind the output Tables (Table 5 and 6), clarifying the consideration on EU fleet evolution (ref. ARAC RBSWG reported specific assumptions for the US fleet).

response

Noted

The average annual flight hours are estimated for each tier based on information received from manufacturers of various types of rotorcraft.

The relevant fleet size is the number of new deliveries of newly type-certified rotorcraft. It increases every year as there are more compliant types on the market and as the compliant in-service small rotorcraft accumulate in the fleet. The total number of compliant deliveries during the 2020-2050 period for Tier-I, Tier-II, and Tier-III rotorcraft would be 635, 1669, and 1099 rotorcraft, respectively. Out of these deliveries, the model forecasted 500, 1388, and 911 rotorcraft to be still in service in 2050.

The table below shows the evolution of the small-rotorcraft fleet of the EASA Member States (MSs):

Year	Tier I			Tier II			Tier III		
	Total fleet	Thereof compliant	Flight hours	Total fleet	Thereof compliant	Flight hours	Total fleet	Thereof compliant	Flight hours
2020	755	0	0	2 302	0	0	1 765	0	0
2021	771	0	0	2 350	0	0	1 802	0	0
2022	787	1	505	2 400	3	882	1 840	2	563
2023	804	4	1 486	2 450	10	2 504	1 879	6	1 675
2024	820	8	2 924	2 502	19	5 002	1 918	11	3 324
2025	838	13	4 777	2 554	32	8 271	1 958	19	5 505
2026	855	19	6 998	2 608	48	12 263	1 999	28	8 222
2027	873	27	9 565	2 662	66	16 770	2 041	40	11 465
2028	892	35	12 478	2 718	87	22 101	2 084	53	15 231
2029	910	44	15 743	2 775	112	28 387	2 128	68	19 557
2030	929	54	19 140	2 834	138	34 909	2 173	85	24 381
2031	949	65	22 975	2 893	168	42 443	2 218	105	29 909
2032	969	77	27 178	2 954	201	50 567	2 265	126	35 932
2033	989	90	31 570	3 016	236	59 211	2 312	150	42 583
2034	1 010	103	30 870	3 079	273	58 158	2 361	175	41 878
2035	1 031	118	41 296	3 144	314	78 151	2 411	202	57 202
2036	1 053	134	46 734	3 210	358	88 876	2 461	232	65 317
2037	1 075	151	52 575	3 278	406	100 455	2 513	263	74 038
2038	1 098	169	58 869	3 346	456	112 711	2 566	297	83 351
2039	1 121	189	65 651	3 417	511	125 864	2 620	333	93 263
2040	1 144	211	72 951	3 488	570	140 004	2 675	372	103 817
2041	1 168	234	80 666	3 562	633	155 104	2 731	413	115 066
2042	1 193	258	88 857	3 636	699	171 001	2 788	457	127 030
2043	1 218	283	97 347	3 713	770	187 845	2 847	504	139 667
2044	1 243	309	106 271	3 791	844	205 498	2 906	553	152 998
2045	1 269	337	115 596	3 870	923	224 238	2 967	606	167 088
2046	1 296	367	125 427	3 952	1 006	244 061	3 030	661	181 966
2047	1 323	397	135 790	4 035	1 095	264 939	3 093	719	197 584
2048	1 351	430	146 724	4 119	1 187	286 888	3 158	780	214 000
2049	1 379	464	158 180	4 206	1 285	309 957	3 225	844	231 225
2050	1 408	500	170 147	4 294	1 388	334 288	3 292	911	249 280

comment

50 comment by: *General Aviation Manufacturers Association*

Section 4.5.4 Cost impact, Table 7 - title (Page 18)

The incorrect caption has been used: "*Comparison of cost for EASA MS operators*". This should be: "*Comparison of cost for EASA TC Holders*".

Development and Certification costs are not related to Member State Operators - they are usually in charge to TC Holders.

Please update the caption accordingly.

response

Partially accepted

The title of Table 7 should read: 'Table 7 — Comparison of development costs'.

comment

51 comment by: *Bell*

Bell Comments are included with comments provided by GAMA.

response

Noted

comment

52 comment by: *General Aviation Manufacturers Association*

Section 4.5.4 Cost impact, Table 7 — Comparison of costs for EASA MS operators (Page 18)

Calculation of 4 %-discounted non-recurrent costs to be checked: results for Tier I and Tier II are ok, while Tier III result seems to be not consistent (applying the same formulas that provide exactly the same results for Tier I and II, lead to different result for Tier III).

NPA: 4,611,515 €, while the correct calculation would lead to 4,114,079 €

Please check this calculation and possibly review values.

Method used:

- annuity = non-reccuring cost / interval years;
- annuity discounted multipling by 1/(1+4%)^(years) and
- then discounted annuities are cumulated up to year 2050.

response

Accepted

The 'Total non-recurring costs in the 2020-2050 period (4-% discount rate)' should be EUR 4 114 080 for Tier-III rotorcraft (instead of EUR 4 611 515).

This correction does not change the conclusion of the cost-benefit analysis (CBA) as the net present value should be EUR 4 601 947 (instead of EUR 4 104 512).

comment *53* comment by: *General Aviation Manufacturers Association*

Section 4.5.4. Cost impact (Page 18)

Recurring costs are not included in the Impact Assessment, but they could be relevant for large fleet operators.

The recurring cost of each new Tier III CS-27 rotorcrafts will be higher due to birdstrike resistant windshield; this should be as well considered in the Impact Assessment.

Please consider recurring costs in your calculations.

response

Not accepted

The weight penalty is considered negligible for newly type-certified Tier-III rotorcraft. Therefore, the related operational cost is also considered negligible.

comment *54* comment by: *General Aviation Manufacturers Association*

Section 4.5.4. Cost impact (Page. 18)

ARAC RBSWG concluded that weight increase would be negligible in terms of variation of "$/FH", considering the effects of weight increase vs. rotorcraft gross weight.

From operators point of view, the weight increase should also be considered with respect to payload, reducing the available payload capacity.

	The additional weight due to birdstrike resistant windshield would reduce the payload available. We suggest that the weight increase vs. payload should also be evaluated (and possibly included in the analysis).
response	Not accepted The weight penalty is considered negligible for newly type-certified Tier-III rotorcraft. Therefore, payload capacity is not expected to decrease.

comment	*55* comment by: *Traficom_CAA-FI* Comments consist of the experiences of my colleagues who have flying experience on numerous helicopters and planes. Myself has experience and knowledge of gyrocopters and survey flights at 100 feet. Based on the comments, it would seem everyone's experiences are mainly similar. When the airspeed is about 100 knots or below, then bigger birds such as hawks, eagles, goose, gulls, etc., have time to avoid aircraft. As far as small birds are concerned, they are unable to or not enough time to swerve within the aforementioned speed range. I think the ability of birds to spot a helicopter is worse than that of an airplane. In addition, for the helicopter, the rotor airflow can draw birds flying overhead into the rotor or fuselage. For the gyrocopter, the rotor represents a quite large surface area and a risk for bird collisions from the front sector. For small helicopters and gyrocopters, it is challenging or even impossible to design a windshield to be resistant to bird collisions, so if aircraft of this group have a need to operate low, there should be serious thought about using a helmet. For bigger helicopters, there is a better chance of designing a reinforced windscreen and windshield washing system, but even with these, the use of a helmet could be justified, especially if commercial operations is involved.
response	Noted The new specification in CS 27.631 is applicable to rotorcraft with 6 to 9 passenger seats (not with fewer seats). EASA published on 19 April 2021 Safety Information Bulletin (SIB) No 2021-07 on 'Bird Strike Risk Mitigation in Rotorcraft Operations' for all rotorcraft types.

comment	*56* comment by: *European Helicopter Association* *Ref CS27.631* In the North Sea, Sea Gulls are the biggest risk and they can grow to 1.5Kgs and the S76 crash in Louisiana involved a Red Kite which can grow to 1.3 Kgs. Is the certification sufficient with a bird of 1Kg as the base line? *Ref. pag. 11* The document argues that the rate of helicopter birdstrikes incidents is increasing in the EASA database by a magnitude given in a graph, especially from 2014 onwards. 2014 was the year that the legislation on MORs was strengthened and is the increase a result of this (more reporting) rather than an actual increase in the number of incidents? With an increase in incidents you would expect a proportional increase in injuries and accidents yet except for a couple of spikes, the data given does not show this. Helicopter numbers are increasing slowly, we probably do not know where we are on the flight hours increase. However, bird populations are decreasing. Probably the 2 cancel each other out unless bird habits have changed (more come inland or transiting lower), there is no science which says that. We suspect increase reporting is a result of the increase used of safety management systems. *Ref. Pages 7 and 18* The legislation may result in toughened windscreens and maybe reinforcement of the windscreen surrounding structure. Notwithstanding the possibility of modern and lighter materials, this will often result in a increase in weight of the airframe. More weight equals more fuel burn. It will be negligible but throughout the NPA says there is no environmental impact. More fuel equals more carbon and it should at least say the environmental impact is negligible, not zero as it does currently. *Ref. pag. 16* Orphaned W from the word windscreen which is split over 2 lines at the bottom of the page
response	***Ref CS27.631*** Noted Please refer to the response to Comment 3.
	Ref. pag. 11 Noted The average annual flight hours per rotorcraft remain unchanged in the model, while the fleet grows by 2.1 % per year. The model does not assume an increase or decrease in bird populations.

The increase in incidents might indeed be the result of increased reporting. However, the cost-benefit analysis (CBA) takes into account only accidents, and the benefits are based on prevented fatalities and serious injuries.
Ref. Pages 7 and 18 Noted The weight penalty is considered negligible for newly type-certified Tier-III rotorcraft. Therefore, no additional fuel burn is expected and no resulting environmental impact was identified.
Ref. pag. 16 Accepted The word 'windshield' should not be broken in the last sentence of the second paragraph of Section 4.5.1.

comment *59* comment by: *TCCA, National Aircraft Certification*

Attachment #1

Comment 1

Andy Stirzaker

Section 3.1 Page:8

6 to 9 pax Most P27 aircraft are out side this number suggest reducing it to 5 to 10 occupants not pax. The present numbers would leave the R44, R66, Bell 505, AS350 etc outside of the rule. suggestion

Comment 2

Alain Douchant (TCCA)

Figure 1 Page:11

In the caption, it should state the the occurrence is for both CS 27 and CS 29 rotorcraft. Include in the caption ''…occurrence database (including both CS 27 and CS 29 certified aircraft)

Comment 3

Alain Douchant (TCCA)

Figure 2 Page:11

Is there evidence of an upward trend in bird strikes? There was a slight peak in 2017, but the trend went way back down in 2018. May an accompanying graph of actual

casualties (deaths and injuries) be included? That may be a more effective measure to assess the effect of birdstrikes.

Comment 4

Alain Douchant (TCCA)

Section 4.1.1 (1st para)Page:12

"…bird penetration into cockpit and cabin areas has become increasingly common for rotorcraft with protection…". Are ALL bird penetration data included in the data presented in Figure 2? It is not evident that based on the data presented in Figure 2 that bird penetration is "increasingly common".

Comment 5

Alain Douchant (TCCA)

Section 4.1.1 (1st para) Page:13

"…bird strike events had significantly increase…" Is "significantly" justifiable?

Comment 6

Alain Douchant (TCCA)

Section 4.1.3 (1st para) Page:13 "Therefore, the number of fatal accidents and severe injuries due to winshield penetration will grow."

Base on the evidence presented, it is not indicative that number of fatal accidents are increasing. There only TWO fatal accidents in 10 years. After 2016, the number of serious injuries went down.

Comment 7

Alain Douchant (TCCA)

Table 4 Page:16 "interval between launches of new types"

Include the expression "(years)" in the sentence. "interval (years) between launches of new types"

Comment 8

Alain Douchant (TCCA)

Table 5 Page:17

Please explain the use of the expression "average load factor"

Comment 9

Alain Douchant (TCCA)

Table 6 Page:17

Option 3 (as an example): The stated “Value of prevented serious injuries” = 998 905 HOWEVER should it be 12.0 x 188 672 (from Table 5) = 2 264 064? The same applies for the other Options.

Note: the “Value of prevented fatalities” = 7 717 121 (5.3 x 1 458 333 (from Table 5) seems to be correct. The numbers may need to be adjusted.

Comment 10

Alain Douchant (TCCA)

Table 7 Page:18

Revise the numbers for “Total non-recurring costs…” if NR #8 (above comment) is correct.

Comment 11

Andre Luis Fernandes Garcia (TCCA)

Section 3.1 Page:8

Considering that compliance with CS27.631 will be by test, or by analysis based on tests and bird strike is very expensive test, it would be good to include in the AMC 27,631 (as well as for AMC1 29.631) a statement about how to use analysis (finite element analysis) to select the worst location in the windshield to perform the shoot in the test, which could be used later for FEM validation. To minimize numbers of bird strike tests to use FEM prior to the test.

Comment 12

Mark Eley

Section: 4.6.1 Pages:18 and 19

It is common to apply a safety continuum type approach for Part 27 rotorcraft. As a result, the conclusion to include the higher class (Tier III) is warranted. However, it seems like the upper end of Part 27 (especially category A) are a slight step down from Part 29 and should therefore include a broader assessment that includes ensuring continued safe flight and landing. Expand the tier III requirements to assess safe landing, not just occupant protection. Include a Tier II requirement to ensure occupant protection. Creating a scaled approach building towards part 29 requirements.

response

Comment 1

Not accepted

The new CS 27.631 would not affect the R44, R66, Bell 505, and AS350 types if they were new types to be certified after the adoption of CS 27.631. The impact assessment (IA) concluded that only Option 3 is economically viable. EASA published for all rotorcraft types, including those not affected by CS 27.631, Safety Information Bulletin (SIB) No 2021-07 on ‘Bird Strike Risk Mitigation in Rotorcraft Operations’.

Comment 2

Accepted

The title of Figure 1 should read: 'CS-27 and CS-29 rotorcraft bird strike occurrences in EASA's occurrence database' and the title of Figure 2 should read: 'CS-27 and CS-29 rotorcraft serious incidents and accidents due to bird strikes in EASA's occurrence database'.

Comment 3

Not accepted

There is a clear upward trend in the number of bird strike occurrences that were reported in the 2009-2018 period (see Figure 1).

The assessment of the effect of bird strikes is only based on accidents with fatalities and serious injuries (see Table 5). EASA considered this sufficiently relevant although there is no obvious steadily increasing trend.

Comment 4

Noted

Figure 2 does not include all bird penetration data that are mostly reported as incidents, which shows the unpredictable effect of a bird strike.

The objective of the statement in the first paragraph of Section 4.1.1 is to indicate that the risk of bird penetration increases with the number of bird strikes (Figure 1) and that the effect of a bird strike is unpredictable (Figure 2). For each bird strike, there is a risk/probability of penetration and the higher the number of bird strikes, the higher the risk of bird penetration.

The ARAC RBSWG made this observation based on the Federal Aviation Administration (FAA) bird strike incident database. EASA's occurrence database does not invalidate that observation although the amount of data is smaller.

Comment 5

Noted

EASA believes that the term 'significant' is justifiable for the total number of occurrences as in the 2009-2018 period, the number of reported occurrences was increasing by around 12 % annually.

Comment 6

Noted

The model uses a constant accident rate, but the rotorcraft fleet is assumed to grow by 2.1 % annually, which would result in a growing number of occurrences.

Comment 7

Accepted

The second row of Table 4 should read: 'Interval (in years) between launches of new types'.

Comment 8

Noted

The assumed 50 % average load factor indicates that half of the rotorcraft's maximum seating capacity, as in the type certification data sheet (TCDS), is reached during the flight. For example, for Tier-II rotorcraft: 4 passenger seats × 50 % load factor = 2 passengers on board. By adding 1 crew member, the average total rotorcraft occupancy is 3 people.

Comment 9

Not accepted

The calculations in Table 5 of NPA 2021-02 are correct as they are based on average values per accident. However, they do not apply to Table 6, which shows the totals calculated per year between 2020 and 2050, and then discounted to the 2020 values at a 4 % discount rate.

The value of prevented serious injuries was discounted to the 2020 value, which was considered in the calculation, and was calculated considering annual values discounted to the 2020 values.

Comment 10

Not accepted

The numbers do not need to be revised as the assumption was incorrect (please refer to the response to Comment 8).

Comment 11

Not accepted

The applicant should choose the analysis that best suits the compliance demonstration.

	Comment 12 Not accepted EASA participated in the ARAC RBSWG, who made a comprehensive evaluation of different options. Therefore, instead of remaking the evaluation and introducing new options, EASA based its impact assessment (IA), including EU data, on the ARAC RBSWG options proposed for newly type-certified small rotorcraft. Similar to the ARAC RBSWG, EASA used the CS 29.631 specification as a starting point for creating the CS 27.631 specification.
comment	*60* comment by: *Leonardo Helicopters* Leonardo Helicopters provided GAMA with 9 comments to NPA 2021-02, which have been discussed by the Industry and included in the comments submitted by GAMA.
response	Noted

3. Appendix A — Attachments

NAC feedback -Bird Strike EASA NPA- 2021-02 02 Rotorcraft occupant safety.pdf

Attachment #1 to comment #59