European Union Aviation Safety Agency

Notice of Proposed Amendment 2021-02

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

Rotorcraft occupant safety in the event of a bird strike

RMT.0726 — SUBTASK 1

EXECUTIVE SUMMARY

The objective of this Notice of Proposed Amendment (NPA) is to improve rotorcraft occupant safety in the event of a bird strike.

This NPA proposes to introduce a new risk-based certification specification to prevent windshield penetration on small rotorcraft (CS-27) with higher passenger capacities.

The new proposed CS.27.631 is similar to CS 29.631 on safe landing, but is only applicable to the windshield.

The proposed amendments are expected to increase the safety of rotorcraft operations.

Action area:	Design and production		
Related rules:	CS-27, CS-29		
Affected stakeholders:	Design organisation approval (DOA) holders		
Driver:	Safety	**Rulemaking group:**	No
Impact assessment:	Yes	**Rulemaking Procedure:**	Standard

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1. About this NPA

1.1. How this NPA was developed

The European Union Aviation Safety Agency (EASA) developed this NPA in line with Regulation (EU) 2018/1139[1] (the 'Basic Regulation') and the Rulemaking Procedure[2]. This rulemaking activity is included in the European Plan for Aviation Safety (EPAS) 2021–2025[3] under Rulemaking Task (RMT).0726. This RMT is carried out in two phases, and therefore divided into two subtasks, as follows:

— **Subtask 1** introduces a new risk-based certification specification to prevent windshield penetration on small rotorcraft (CS-27) with higher passenger capacities. This new proposed CS.27.631 is intended to be similar to CS 29.631 on safe landing, but is only applicable to the windshield. 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).

— **Subtask 2** will assess whether it is necessary to implement a proportionate retrospective application of bird strike protection certification specifications (CSs) to the existing rotorcraft fleets and/or to the future production of already type-certified rotorcraft. This subtask will be conducted with the support of an RMG.

This NPA covers only Subtask 1 of RMT.0726. The text of this NPA has been developed by EASA. It is hereby submitted to all interested parties for consultation[4].

1.2. How to comment on this NPA

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

The deadline for the submission of comments is **25 May 2021**.

1.3. The next steps

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

After considering the comments received, EASA will issue a decision in order to amend the Certification Specifications for Small Rotorcraft (CS-27) and the Certification Specifications for Large Rotorcraft (CS-29).

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

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

[3] https://www.easa.europa.eu/newsroom-and-events/news/european-plan-aviation-safety-2021-2025-published

[4] In accordance with Article 115 of Regulation (EU) 2018/1139, and Articles 6(3), 7 and 8 of the Rulemaking Procedure.

[5] In case of technical problems, please send an email to crt@easa.europa.eu with a short description.

The comments received on this NPA and the EASA responses to them will be reflected in a comment-response document (CRD). The CRD will be published on the EASA website[6].

[6] https://www.easa.europa.eu/document-library/comment-response-documents

2. In summary — why and what

Bird strikes that cause damage to rotorcraft or harm their occupants (passengers or pilots) are random events. Several factors are involved, including the intersection of the bird and rotorcraft flight paths, the mass of the bird, the speed of the rotorcraft, and the part of the rotorcraft struck by the bird.

To manage this risk, all those aspects can be controlled:

— by having the design and testing of the aircraft driven by certification specifications;

— by applying operational mitigating recommendations (e.g. on speed limitations and restricting the aircraft's flight profile); and,

— to a limited extent, by reducing the populations of birds near operation sites.

To mitigate the potential consequences of a bird strike on rotorcraft, the Joint Aviation Authorities (JAA) included a bird protection certification specification in the first release of the European Requirements for Large Rotorcraft (JAR-29), issued in 1993.

The requirement is contained in point 29.631 of JAR-29, which was incorporated into the initial release of CS 29.631. According to that CS 29.631, the design of large rotorcraft ensures:

— continued safe flight and landing for Category A rotorcraft, or

— safe landing for Category B rotorcraft,

following an impact with a 2.2-pound (1.0-kg) bird at maximum horizontal velocity (V_H) or velocity never exceed (V_{NE}), whichever is less.

So far, no bird strike protection provisions have been introduced into the EASA Certification Specifications for Small Rotorcraft (CS-27), or by the Federal Aviation Administration (FAA) into the respective US requirements (Code of Federal Regulations CFR 14, Part 27).

In the last decade, EASA has observed an upward trend in the numbers of bird strikes to the windshield area of rotorcraft with a force of impact that, in some cases, directly endangered the rotorcraft occupants and increased the risk to safe rotorcraft operations. Bird penetration into the cockpit and cabin areas has become increasingly common for rotorcraft without protection, elevating the probability of serious injuries to the occupants or fatalities. Moreover, in numerous cases, a direct bird impact on the pilot led to partial or complete incapacitation of the pilot, often increasing the risk of a loss of control of the rotorcraft and, therefore, of fatalities.

The upward trend in the numbers of bird strike occurrences is confirmed by data that are stored in EASA's occurrence database.

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

Bird strikes may not be considered as major causes of fatal accidents. However, they represent a growing safety risk due to the emergency landings and possible occupant injuries, caused by windshield penetration on rotorcraft that are not designed to be protected.

For a more detailed analysis of the issues addressed by this NPA, please refer to Section 4.1 of the Impact Assessment (IA).

2.2. What we want to achieve — objectives

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

The specific objective of this NPA is to improve rotorcraft occupant safety in the event of a bird strike.

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

CS 27.631 Bird strike (new)

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

This proposed CS is derived from CS 29.631 on bird strike protection, which has proven to be effective in preventing bird penetration into the cockpit, which could preclude safe landing.

AMC 27.631 Bird strike (new)

This new proposed AMC 27.631 to CS 27.631 provides an acceptable means of compliance (AMC) to said CS. This AMC is based on the new proposed AMC 29.631 to CS 29.631.

CS 29.631 Bird strike (amended)

This certification specification has been amended in order to reflect the wording improvements proposed in CS 27.631. The proposed rewording, however, does not change the technical contents and it is limited to editorial improvement.

AMC 29.631 Bird strike (new)

The review of the bird strike events during the last 10 years on CS-29 rotorcraft that were compliant with CS 29.631 confirmed the effectiveness of this CS and of the related AMC. In fact, no fatalities or significant injuries have been recorded on large rotorcraft that were compliant with CS 29.631.

For this reason, this NPA does not propose to amend CS 29.631. However, EASA recognised that some of the lessons learned during recent certification processes would further clarify the intent of CS 29.631 and ensure a level playing field among applicants. For this reason, this NPA proposes to introduce a new AMC 29.631 to CS 29.631 to supersede the similar provisions of the FAA Advisory Circular AC 29-2C (currently referred to as an EASA AMC).

The new proposed AMC 29.631 is expected to clarify and improve the means of demonstrating compliance with CS 29.631. However, it does not invalidate the processes that are already followed by original-equipment manufactures (OEMs) during the certification of large rotorcraft.

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

Compliance with this proposed CS would ensure effective protection of the occupants of CS-27 rotorcraft in the event of a bird strike and allow safe landing, if necessary.

Therefore, the proposed amendments are expected to have an appreciable safety benefit, no social or environmental impacts, and only a slight impact on certification costs.

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

3. Proposed amendments

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

— deleted text is ~~struck through~~;

— new or amended text is highlighted in blue;

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

3.1. Draft certification specifications (draft EASA Decision)

CS 27.631 Bird strike

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 V_{NE} or V_H (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.

AMC1 27.631 Bird strike

This AMC provides means to demonstrate the remaining capability of the rotorcraft after a bird impact, as required by CS 27.631.

(a) The following parts of the rotorcraft should be evaluated for the event of a single bird strike as follows:

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

(2) any systems and equipment (including their controls) that are essential to ensure a safe landing and are installed near the windshield and its supporting frame should remain operative in case of shock loads resulting from a bird strike.

(b) The capability to withstand multiple bird strikes should only be evaluated for engines. For further guidance, refer to CS-E 800 *Bird Strike and Ingestion*.

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.

CS 29.631 Bird strike

The rotorcraft must be designed to ~~as~~ensure ~~capability of~~a continued safe flight and landing (for Category A) or a safe landing (for Category B) after an impact with 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 V_{NE} or V_H (whichever is ~~the~~ less~~er~~) at altitudes up to 2438 m (8 000 ft). Compliance must be shown by tests, or by analysis based on tests that are carried out on sufficiently representative structures of similar design.

AMC1 29.631 Bird strike

This AMC provides means to demonstrate the remaining capability of the rotorcraft after a bird impact, as required by CS 29.631, and supersedes the Federal Aviation Administration (FAA) Advisory Circular AC 29-2C, Section 29.631 *Bird strike*.

(a) The following parts of the rotorcraft should be evaluated for the event of a single bird strike as follows:

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

(2) other structures, systems, and equipment should also be evaluated: areas of impact of particular interest are flight control surfaces (including the main and tail rotors) and any exposed flight control system components; however, the final selection of the areas to be evaluated should result from a comprehensive hazard analysis based on:

(i) the damage to the structures, equipment or systems that are exposed to the trajectory of the bird, considering conservative assumptions; and

(ii) the criticalities of those exposed items and their capability to ensure a continued safe flight and landing (for Category A) or a safe landing (for Category B).

When performing the hazard analysis, the direct and induced effects of a bird strike should be considered:

— 'direct effects': to ensure the integrity of the structures and the functionality of the systems or equipment (also considering shock loads) that are critical for a continued safe flight and landing (for Category A) or a safe landing (for Category B), as applicable; and

— 'induced effects': to examine the possible consequences of the ejection of pieces from the structures, systems or equipment that are struck by a bird on other structures, systems, and equipment.

(b) The capability to withstand multiple bird strikes should only be evaluated for engines. For further guidance, refer to CS-E 800 *Bird Strike and Ingestion*.

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.

4. Impact assessment (IA)

4.1. What is the issue

While provisions for the bird strike protection of new large rotorcraft have been in place since 1993 (e.g. Joint Aviation Authorities JAR-29, followed in 1996 in the USA by Part 29, Amendment 40), no such provisions were adopted for small rotorcraft in JAR-27, or in the US Part 27. As a result, the percentage of in-service rotorcraft featuring bird strike protection is very low (see Table 1 below) because the EU- and US-certified fleets comprise mostly rotorcraft that were not certified in accordance with the latest bird strike protection provisions (all CS-27, JAR-27, and Federal Aviation Regulation (FAR) FAR-27 rotorcraft, large rotorcraft, and FAR-29 rotorcraft as per 14 Code of Federal Regulations CFR 14, Part 29, Amendment 40).

As of the beginning of October 2019, the in-service rotorcraft fleets were composed as follows:

Table 1 — EU and US rotorcraft fleet composition[7]

Rotorcraft category	EU rotorcraft fleet (2019)	US rotorcraft fleet (2017)
Small rotorcraft (=> no bird strike protection)	4 856 (84.1 %)	9 819 (91 %)
Large rotorcraft not compliant with CS 29.631 (=> no bird strike protection)	431 (7.4 %)	758 (7 %)
Large rotorcraft compliant with CS 29.631 (=> bird strike protected)	483 (8 %)	202 (2 %)
Total	5 770 (100 %)	10 779 (100 %)

Since 2009, there have been increasing numbers of recorded occurrences involving non-compliant rotorcraft where rotorcraft bird impacts had an adverse effect on safety.

In the European Union, the upward trend in the numbers of rotorcraft bird strike occurrences is confirmed by the data that is stored in EASA's occurrence database (see Figures 1 and 2 below[8]).

7 In October 2019, the total fleet of EASA Member State (MS) operators was 5 898 rotorcraft. The additional 128 rotorcraft that are not included in the total are the following:
- 123 with no EASA type certificate (TC) (mostly Russian rotorcraft);
- 4 in certification: 3 Airbus H160 and 1 Kopter SH09; and
- 1 with a revoked type certificate data sheet (TCDS) (Leonardo (PZL-Swidnik) Kania), in 'temporary storage'.

8 These figures are from the EASA occurrence database and include EU operators, EU TCs, and occurrences in EASA MSs.

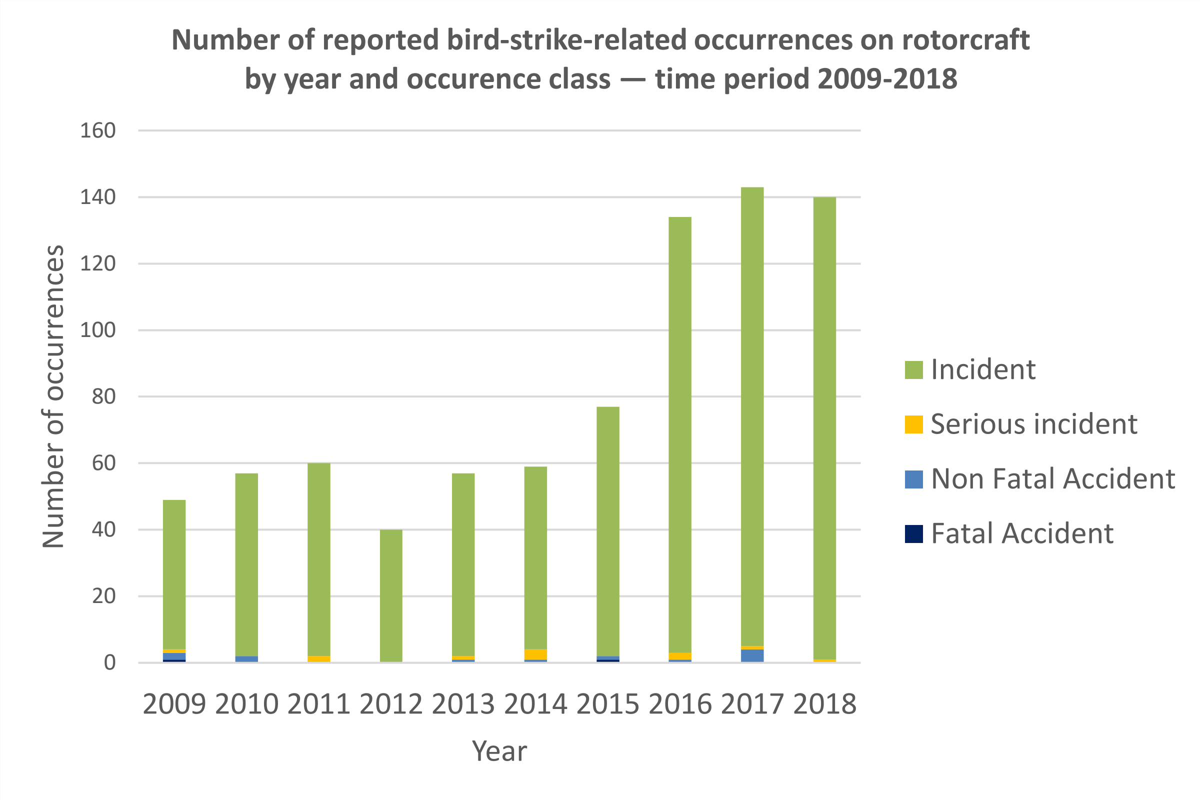

Figure 1 — Rotorcraft bird strike occurrences in EASA's occurrence database

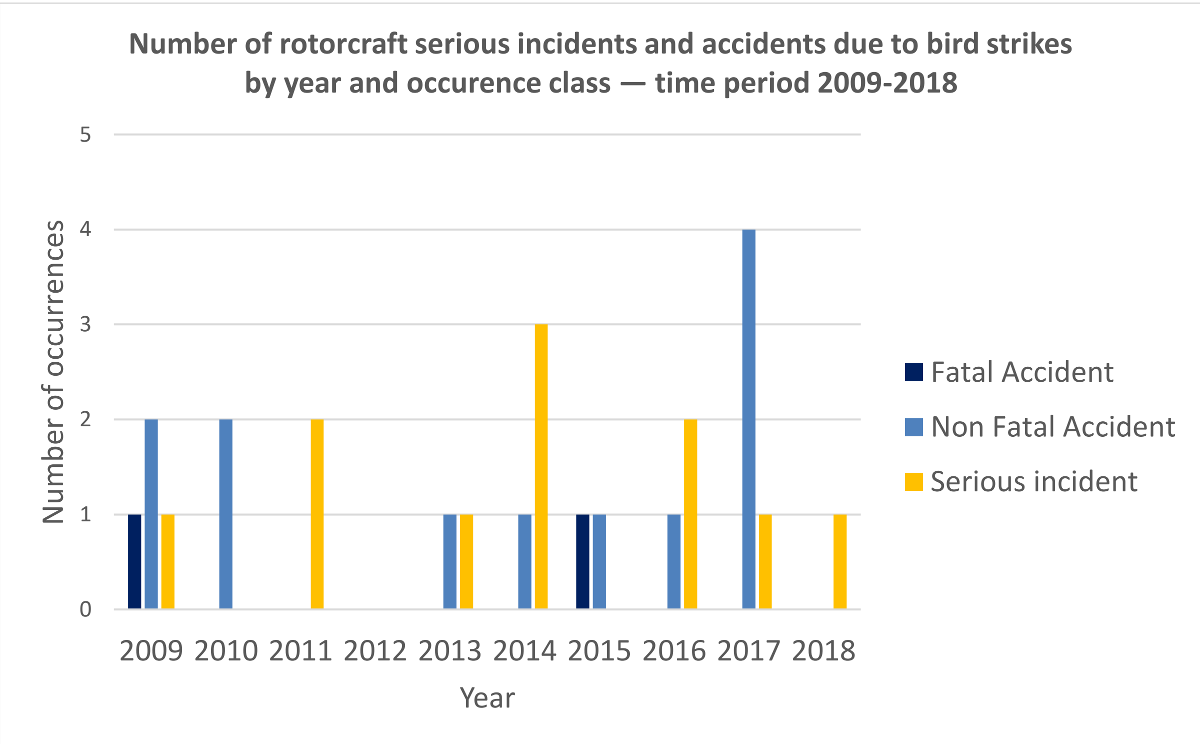

Figure 2 — Rotorcraft serious incidents and accidents due to bird strikes in EASA's occurrence database

In addition to showing the upward trend in the numbers of rotorcraft bird strike occurrences, Figure 2 indicates that bird strikes are not major causes of fatal accidents. They present a growing safety risk due to their unpredictable effects on non-reinforced windshields, causing direct injuries to occupants and emergency landings in unsafe conditions.

To address this safety risk, in 2016, the FAA assigned to the Aviation Rulemaking Advisory Committee (ARAC) the task of producing recommendations on how to:

— improve bird strike protection rulemaking, policy, and guidance for normal-category rotorcraft; and

— evaluate the existing bird strike protection standards for transport-category rotorcraft.

The ARAC established the Rotorcraft Bird Strike Working Group (RBSWG) to give advice and recommendations. EASA participated in the ARAC RBSWG as a non-voting member.

4.1.1. Safety risk assessment

As stated in Section 4.1, bird penetration into the cockpit and cabin areas has become increasingly common for rotorcraft without protection, elevating the probability of serious injuries to occupants, fatalities or accidents.

Moreover, a direct bird impact on the pilot led to partial or complete incapacitation of the pilot in numerous cases, often increasing the risk of loss of control of the rotorcraft and, therefore, of fatalities.

These issues have been confirmed by several accident/incident reports and various studies including:

— EASA/Atkins *Bird Strike Damage & Windshield Bird Strike*, Final Report, 5078609-rep-03, Version 1.1[9];

— ICAO ELECTRONIC BULLETIN, *2008-2015 WILDLIFE STRIKE ANALYSES (IBIS)*, EB 2017/25, 12 May 2017[10]; and

— FAA ROTORCRAFT BIRD STRIKE WORKING GROUP RECOMMENDATIONS TO THE AVIATION RULEMAKING ADVISORY COMMITTEE (ARAC), Revision B, 8 May 2019[11].

These reports reinforced the outcomes of a previous study, *Wildlife Strikes to Civil Aircraft in the United States 1990-2005*, Cleary, Dolbeer, & Wright, June 2006,[12] based on 15 years of data, which concluded the following:

— rotorcraft were significantly more likely to be damaged by bird strikes than aeroplanes;

— windshields of rotorcraft were more frequently struck and damaged than windshields of aeroplanes; and

— rotorcraft bird strikes were more likely to lead to injuries to crew or passengers than aeroplane bird strikes.

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9 https://www.easa.europa.eu/sites/default/files/dfu/Final%20report%20Bird%20Strike%20Study.pdf

10 https://www.icao.int/safety/IBIS/2008%20-%202015%20Wildlife%20Strike%20Analyses%20(IBIS)%20-%20EN.pdf

11 ARAC Rotorcraft Bird Strike Working Group Recommendations to the Aviation Rulemaking Advisory Committee (ARAC), Revision B, 8 May 2019.

12 https://digitalcommons.unl.edu/cgi/viewcontent.cgi?referer=http://www.google.it/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwi_pMWyvovqAhVQ6aQKHfiuCFIQFjACegQIBRAB&url=http%3A%2F%2Fdigitalcommons.unl.edu%2Fcgi%2Fviewcontent.cgi%3Farticle%3D1006%26context%3Dbirdstrikeother&usg=AOvVaw0vFnmuFgXkW96qFOvWVp_F&httpsredir=1&article=1006&context=birdstrikeother

Related safety issues

The occurrence reporting rate of rotorcraft bird strike events has significantly increased since the Airbus A320-214 ditching in the Hudson River after striking a flock of Canada geese in January 2009. This event contributed to increasing the awareness of this risk within the aviation industry.

In the same month, January 2009, a Sikorsky S-76C N748P crashed in Louisiana, causing nine casualties including one severe injury after a windshield failure due to a bird strike and the subsequent malfunction of critical equipment.

The EASA occurrence database[13] recorded one fatal accident in 2017 that caused seven casualties after the crash of the AS350 B3 (a European rotorcraft), which was operated by Himalayan Heli Services Pvt. Ltd in India (VT-JKB final report). While en route to the Sanjhi Chat helipad, the rotorcraft suddenly turned back after a bird strike, probably to make an emergency landing towards a nearby open space. The pilot was stunned and suffered from impaired vision. During its descent, the rotorcraft hit some electric cables at the edge of an open space. The rotorcraft became entangled in the electric cables, toppled, and impacted the ground. The rotorcraft was destroyed and consumed by a post-impact fire.

No other fatalities due to bird strikes have ever been recorded. However, EU and US databases indicate that bird strike penetration into the cockpit is becoming extremely common, and that it could potentially compromise continued safe flight and landing.

One of the most recent events recorded in EASA's occurrence database while this NPA was being prepared involved a Bell 429 M-YMCM, which experienced a bird strike in the United Kingdom. The windscreen shattered and debris entered the cockpit, injuring the occupant in the left seat, who required hospital treatment. The Air Accidents Investigation Branch (AAIB) issued three reports after similar events on rotorcraft that were certified to the normal-category standards: N109TK (AAIB Bulletin 3/2012), G-ODAZ (AAIB Bulletin 6/2014), and G-BZBO (AAIB Bulletin 11/2016).

4.1.2. Who is affected

Design organisations that design new rotorcraft types.

4.1.3. How could the issue/problem evolve

Most of the EU- and US-operated rotorcraft do not feature bird-strike-resistant windshields (see also Table 1 above). In the absence of corrective actions, the rotorcraft fleet without bird strike protection will grow faster, as only the CS-29 rotorcraft that are compliant with CS 29.631 will be protected. Hence, the overall exposure to the risk will increase. Therefore, the number of fatal accidents and severe injuries due to windshield penetration will grow.

4.2. What we want to achieve — objectives

The objective of this NPA is to improve rotorcraft occupant safety in the event of a bird strike.

[13] Internal Occurrence Reporting System (IORS).

4.3. How it could be achieved — options

The ARAC RBSWG performed an extensive analysis of the bird strike risk to rotorcraft. To carry out a proportionate quantitative cost-benefit analysis (CBA), it divided CS-27 rotorcraft into three tiers, as follows:

Table 2

CS-27/Part 27 — Tier I	CS-27/Part 27 — Tier II	CS-27/Part 27 — Tier III
0-2 passenger seats	3-5 passenger seats	6-9 passenger seats[14]

This approach allowed a better evaluation of the differences in costs and benefits resulting from the size of the rotorcraft and the intended market.

The ARAC RBSWG CBA showed that a new certification specification (CS) introducing bird strike protection for rotorcraft belonging to Tier I or Tier II would not be economically viable.

According to the ARAC RBSWG report, the only viable option would be to introduce a new CS for CS-27 rotorcraft with 6 to 9 passenger seats (Tier III), which would ensure a safe landing in the event of a bird strike on the windshield.

This ARAC RBSWG recommendation for CS-27 is reflected in Option 3 of the following table:

Table 3

Option No	*Short title*	Description
0	Do nothing	No policy change. No change to the rules; risks remain as outlined in the issue analysis (refer to Section 4.1.3).
1	Amend CS-27 (Tier I)	Amend CS-27 to introduce a new CS similar to CS 29.631, applied only to the windshield of Tier-I rotorcraft (0-2 passenger seats). Safe landing only is considered for CS-27.
2	Amend CS-27 (Tier II)	Amend CS-27 to introduce a new CS similar to CS 29.631, applied only to the windshield of Tier-II rotorcraft (3-5 passenger seats). Safe landing only is considered for CS-27.
3	Amend CS-27 (Tier III)	Amend CS-27 to introduce a new CS similar to CS 29.631, applied only to the windshield of Tier-III rotorcraft (6-9 passenger seats). Safe landing only is considered for CS-27.

Note: the actual number of passengers to be considered for the applicability of the new CS will result from the CBA performed by EASA.

[14] The maximum number of passengers for CS-27 rotorcraft is 9.

4.4. Methodology and data

EASA performed a full CBA for the relevant rotorcraft fleet of EASA Member State (MS) operators. The CBA used estimates for the costs and the potential safety benefits from the ARAC RBSWG CBA, adapted to the characteristics of the EASA MS fleet.

4.4.1. Methodology applied

The CBA quantified and monetised the most significant costs and benefits of the proposed measures. An option is considered to be justified when the value of the benefits exceeds the value of the costs (i.e. there is a net benefit). All things being equal, the best option is the one with the highest net benefit.

4.4.2. Data collection

While concurring with the ARAC RBSWG methodology, EASA repeated the CBA to assess and compare the viability of Options 1, 2, and 3.

The main assumptions made by the ARAC RBSWG to conduct their CBA were assessed and endorsed, with the exception of the following adjustments that were needed, to better reflect the EU framework:

(1) <u>Estimation of prevented fatalities/injuries</u>

According to the ARAC RBSWG, the value of the benefits due to prevented fatalities or injuries was assumed to be:

— USD 9.9 M for prevented fatalities;

— USD 2 504 700 for prevented serious injuries; and

— USD 29 700 for prevented minor injuries.

The above values have been adjusted as follows to be more in line with the values typically assumed for EASA IAs:

— EUR 3.5 M for prevented fatalities;

— EUR 201 250 for prevented serious injuries; and

— no value for prevented minor injuries.

(2) <u>Discount rate</u>

While the ARAC RBSWG assumed that the discount rate is 7 %, EASA adjusted this value to 4 % in accordance with the current EU practice.

(3) <u>Estimation of rotorcraft flight hours</u>

Assessing the 10-year-projected economic benefits, the ARAC RBSWG assumed the Part 27 rotorcraft annual flight hours that were factored up from the under-reported flight hours using:

— the Federal Aviation Administration (FAA) forecast algorithm; and

— the FAA aerospace forecast of 2.5-% increase per annum in flight hours.

Due to the lack of official data, the EU CS-27 rotorcraft annual flight hours were estimated based on the average annual flight hours information that is received from manufacturers for each of their types in service in EASA MSs. The total annual flight hours were calculated by multiplying the number of each type of rotorcraft in service by the average annual flight hours of the given type.

Regarding the forecast for the annual growth rate, EASA used a 2.1-% annual growth rate in accordance with the latest available forecasts.

(4) Observed period

While the ARAC RBSWG considered an observation period of 10 years, the EASA CBA took into account an observation period of 30 years (from 2020 to 2050). The reason for the longer period of analysis is that new types are launched infrequently in the relatively narrow categories of rotorcraft types (see **Error! Reference source not found. Error! Reference source not found.**).

(5) Penetration rate of newly certified CS-27 rotorcraft

Based on historical data, EASA assumed that new types of Tier-I, Tier-II, and Tier -II rotorcraft will be launched onto the market every 10, 10, and 7 years respectively. Table 4 provides a summary of the existing situation and the expected trends:

Table 4 — Number of rotorcraft types and new TCs expected in the fleet of EASA MS operators

Description	**Tier I**	**Tier II**	**Tier III**
Number of rotorcraft types in service	5	14	13
Interval between launches of new types	10	10	7

(6) Economic effects of the COVID-19 crisis

The EASA CBA that is described in this NPA was conducted before the COVID-19 crisis, which could have an impact on the economic figures used. However, it is assumed that the COVID-19 crisis will not have a significant impact on this CBA during the observed period of time (2020-2050).

4.5. What are the impacts

4.5.1. Safety impact

The safety impact resulted from calculating the rotorcraft accident rates per flight hour and then estimating the number of future accidents in the rotorcraft fleets of EASA MS operators. The numbers of fatalities and serious injuries that could be prevented were based on the number of projected accidents. The monetised value of the prevented fatalities and serious injuries was calculated by using the value of the prevented fatalities and serious injuries identified in Section 4.4.2.

The main assumptions and estimates that were used to forecast the expected safety benefits are summarised in Table 5 **Error! Reference source not found.**. The benefits of bird-strike-resistant w indshields would be EUR 0.8 M, EUR 1.3 M, and EUR 1.6 M *per accident* for Options 1, 2, and 3 respectively.

Table 5 — Main assumptions for the estimation of safety benefits per accident[15]

Description	Option 1 Tier I	Option 2 Tier II	Option 3 Tier III
Accident rate per flight hour	1.83E-07	1.27E-06	5.12E-06
Average number of passenger seats per rotorcraft	1.5	4	5.5
Average number of crew members per rotorcraft	1	1	1
Average load factor	50 %	50 %	50 %
Average total occupancy per rotorcraft	1.75	3	3.75
Average share of fatalities per accident	11 %	11 %	11 %
Average number of fatalities per accident (A)	**0.2**	**0.3**	**0.4**
Value of prevented fatalities per accident (A × EUR 3.5 M)	EUR 673 750	EUR 1 155 000	EUR 1 458 333
Average share of serious injuries per accident	25 %	25 %	25 %
Average number of injuries per accident	**0.4**	**0.8**	**0.9**
Value of prevented serious injuries per accident	EUR 88 047	EUR 150 938	EUR 188 672
Total value of prevented fatalities and serious injuries per accident	EUR **761 797**	EUR **1 305 938**	EUR **1 647 005**

For the total safety benefit, EASA multiplied the monetised benefits above by the number of expected accidents — see **Error! Reference source not found.**:

Table 6 — Summary of safety benefits for EASA MS operators (2020-2050 discount rate of 4 %)[16]

Description	Option 1 Tier I	Option 2 Tier II	Option 3 Tier III
Number of accidents	0.3	4.3	12.8
Number of prevented fatalities	0.1	1.4	5.3
Number of prevented serious injuries	0.1	3.2	12.0
Value of prevented fatalities (discounted to 2020)	EUR 90 577	EUR 2 085 413	EUR 7 717 121
Value of prevented serious injuries (discounted to 2020)	EUR 11 837	EUR 272 526	EUR 998 905
Total value of prevented fatalities and serious injuries	EUR 102 414	EUR 2 357 938	EUR 8 716 027

15 These main assumptions are based on the work of the ARAC RBSWG. The value of preventing a serious injury is estimated to be 5.75 % of the value of preventing a fatality (EUR 201 250 and EUR 3 500 000 respectively).

16 For discounted values, a 4-% discount rate was used.

4.5.2. Environmental impact

No environmental impacts were identified.

4.5.3. Social impact

No social impacts were identified.

4.5.4. Cost impact

EASA endorsed in its CBA the non-recurring development costs for new windshields as envisaged in Options 1, 2, and 3, and estimated by the TC holders who participated in the ARAC RBSWG.

Considering the estimated number of new types, the total costs of Options 1, 2, and 3 for the various tiers are summarised in **Error! Reference source not found.**:

Table 7 — Comparison of costs for EASA MS operators[17]

Description	Option 1 Tier I	Option 2 Tier II	Option 3 Tier III
Non-recurring development costs per new type	EUR 930 527	EUR 1 478 227	EUR 1 695 657
Interval (in years) between launches of new types	10	10	7
Number of new types in the 2020-2050 period	2.9	2.9	4.1
Total non-recurring costs in the 2020-2050 period	EUR 2 698 527	EUR 4 286 860	EUR 7 024 866
Total non-recurring costs in the 2020-2050 period (4-% discount rate)	EUR 1 580 380	EUR 2 510 579	EUR 4 611 515

4.5.5. General Aviation and proportionality issues

To scale the impact on General Aviation (GA) rotorcraft, the CBA was conducted considering the number of rotorcraft passenger seats, and three tiers were identified accordingly.

4.6. Conclusion

4.6.1. Comparison of the options

Table 8 provides a comparison of the CBA outcomes from the assessment of Options 1, 2, and 3 (Tiers I, II, and III respectively).

Table 8 — Comparison of Tiers I, II, and III, EASA MS operators, 2020-2050, 4-% discount rate

Description	Option 1 Tier I	Option 2 Tier II	Option 3 Tier III
Value of benefit	EUR 102 414	EUR 2 357 938	EUR 8 716 027
Cost	EUR 1 580 380	EUR 2 510 579	EUR 4 611 515
Net present value (= value of benefit-cost)	-EUR 1 477 966	-EUR 152 641	-EUR 4 104 512

[17] The numbers of new types can only be whole numbers. In the model, however, decimals were used, which express probability: e.g. 0.5 new type means a 50-% probability that a new type will be launched. In that case, 50 % of the development costs would be used in the model. For the discounted value of the costs, a 4-% discount rate was used.

According to Table 8, Options 1 and 2 are not viable, as their net present value is negative.

However, Table 8 shows that in the case of Option 3 (Tier III), the value of the benefit would exceed the cost: it would have a positive safety impact with a low negative economic impact. Hence, the EASA CBA validated the ARAC RBSWG recommendations.

As a conclusion, EASA selected Option 3, limiting the applicability of the new CS to rotorcraft with six or more passenger seats.

Question to stakeholders

Stakeholders are also invited to provide any other quantitative information they may find necessary to bring to the attention of EASA.

As a result, the relevant parts of the IA might need to be adjusted.

4.6.2. Sensitivity analysis

EASA carried out a sensitivity analysis to assess the possible effects of a future increase in the occurrence rate of bird strike accidents on the CBA result.

In the case of Option 1 (Tier-I rotorcraft), the accident rate would need to increase more than 15 times to make the net present value equal to zero. Since such an increase is very unlikely, it was concluded that Option 1 is not sensitive to potential future increases in the bird strike accident rate.

In the case of Option 2 (Tier-II rotorcraft), a 6-% increase in the accident rate would make the net present value equal to zero. In other words, if the bird strike accident rate increased by more than 6 %, the benefits of requiring Tier-II rotorcraft to install windshields with increased bird strike resistance would exceed the costs.

In the case of Option 3 (Tier III rotorcraft), EASA estimated that the certification costs would need to increase by more than 50 % to provide a negative net present value. This possibility, however, is considered improbable based on the inputs provided to the ARAC RBSWG by EU and US manufacturers.

4.7. Monitoring and evaluation

The effectiveness of the proposed amendments to CS-27 will be evaluated as part of the standard monitoring process of occurrences reported to EASA in accordance with Regulation (EU) No 376/2014[18]. As rotorcraft certified in accordance with the new requirements are expected to ensure effective protection in case of a bird strike, the number of windshield failures due to bird strikes leading to occupant injuries or unsafe emergency landings should be negligible.

[18] Regulation (EU) No 376/2014 of the European Parliament and of the Council of 3 April 2014 on the reporting, analysis and follow-up of occurrences in civil aviation, amending Regulation (EU) No 996/2010 of the European Parliament and of the Council and repealing Directive 2003/42/EC of the European Parliament and of the Council and Commission Regulations (EC) No 1321/2007 and (EC) No 1330/2007 (OJ L 122, 24.4.2014, p. 18) (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014R0376&qid=1610974200014).

5. Proposed actions to support implementation

N/a

6. References

6.1. Related regulations

N/a

6.2. Related decisions

— Decision No. 2003/15/RM of the Executive Director of the Agency of 14 November 2003 on certification specifications for small rotorcraft ('CS-27')

— Decision No. 2003/16/RM of the Executive Director of the Agency of 14 November 2003 on certification specifications for large rotorcraft ('CS-29')

6.3. Other reference documents

— FAA ROTORCRAFT BIRD STRIKE WORKING GROUP RECOMMENDATIONS TO THE AVIATION RULEMAKING ADVISORY COMMITTEE (ARAC), Revision B, 8 May 2019

— EASA/Atkins *Bird Strike Damage & Windshield Bird Strike*, Final Report, 5078609-rep-03, Version 1.1

— ICAO ELECTRONIC BULLETIN, *2008-2015 WILDLIFE STRIKE ANALYSES (IBIS)*, EB 2017/25, 12 May 2017

— *Wildlife Strikes to Civil Aircraft in the United States 1990-2005*, Cleary, Dolbeer, & Wright, June 2006

7. Appendix

N/a.

8. Quality of the document

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

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

— the clarity and readability of the text;

— the quality of the impact assessment (IA);

— application of the 'better regulation' principles[19]; and

— others (please specify).

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

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