



**EASA**  
European Aviation Safety Agency

# EASA views on Rotorcraft bird strike threat.

***Herdrice HERESON***

*Rotorcraft Structures Expert*  
**herdrice.hereson@easa.europa.eu**

*10<sup>th</sup> Rotorcraft Symposium-6/12/2016*

**Your safety is our mission.**

An agency of the European Union 



# Agenda

- Recent accident/serious incidents due to bird strike.
- Bird strike requirement-Reminder.
- Analysis of EASA database on bird strike.
- Way forward :
  - ARAC Rotorcraft bird strike working group.
  - EASA certification memorandum.
- RPAS, next challenge for the future.



# Helicopter fatal accident due to bird strike

4<sup>th</sup> Jan 2009: Sikorsky S-76C++ helicopter (N748P) crash (Louisiana), 8 fatalities.

A Red-tailed hawk of 1.1kg/2.4lbs fractured the windshield and interfered with engine fuel controls causing a sudden loss of power to both engines.

Factors having contributed to the accident:

- Windshield not certified to bird strike requirement
- Lack of protections on engine fuel control handles.
- Lack of a warning system to alert the flight crew of a low-rotor-speed condition.
- Lack of flight crew training for simultaneous dual-engine failure.





# Helicopter serious incident due to bird strike



5th July 2011-A109C left windshield shattered by a Herring Gull (aw. 1.1kg/2.4lbs) impact. Pilot minor injuries. The co-pilot took control for an Emergency landing.  
Source : AAIB Bulletin 3/2012

13<sup>th</sup> June 2016: Robinson R44, similar event.

The rotorcraft lost approximately 700ft in altitude whilst the crew dealt with the incident. They declared a MAYDAY and returned to base for an uneventful landing. No injury.  
Source : AAIB Bulletin 11/2016



Factors having contributed to the serious incidents:  
Windshield not certified to bird strike requirement



# Bird strike requirement-Reminder.

Back in 1996, the FAA 14 CFR Part 29 amendment 40 was issued to have transport category rotorcraft certified for capability of continue safe flight and landing (CAT A) or safe landing (CAT B) and no windshield penetration (AC29.631) after impact with:



- 1kg/2.2lbs bird @ min (VH; Vne) up to 8000ft along the flight path.
- No requirement for Normal category rotorcraft (Jar/CS/Part 27)

20 years after the rule introduction, only a small proportion of the helicopter worldwide fleet has been designed and certified to bird strike requirement.

Most of the existing rotorcraft fleet, newly manufactured and new derivative rotorcraft are not required to meet this standard.



# Analysis of EASA database on bird strike.



UK and North America bird strike occurrences for all aircraft types  
(193 occurrences on rotorcraft)



540 bird strike occurrences on EASA certified, operated in EU+ EU TC flying outside of Europe



1990

2007

2016

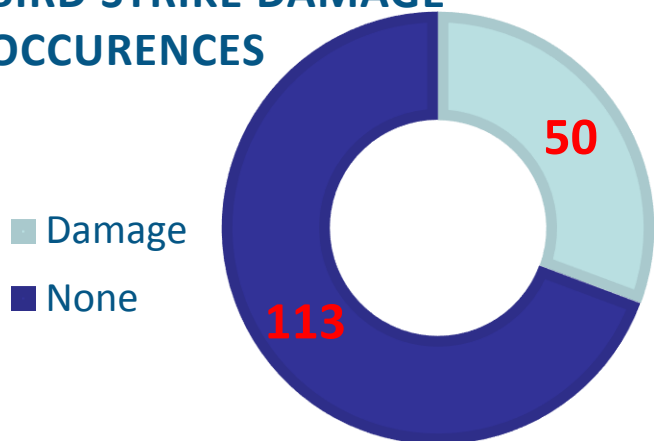
\*DATA collection: **Richard Canis**-EASA Safety management department



# EASA database: Bird strike consequences

➤ 163 occurrences with reliable reporting

## BIRD STRIKE DAMAGE OCCURENCES



« Safe landing » can be questionable

| Consequence on flight               | % of occ. |
|-------------------------------------|-----------|
| Emergency landing                   | 4.2%      |
| Aborted take-off                    | 3.0%      |
| Mission aborted                     | 11.5%     |
| Precautionary landing               | 16.4%     |
| Helicopter shut down for inspection | 18.2%     |
| None                                | 46.7%     |

Small rotorcraft are more likely to suffer from damage compare to large rotorcraft (even if not certified). In 3 cases, windshield vulnerability to bird strike has caused pilot incapacity due to minor injuries (co-pilot took control).

No accident recorded since the Atkins report (9 accidents /7 acc.with fatalities).

Bird strike is not a major cause of accident but it is a growing safety and economic hazard.



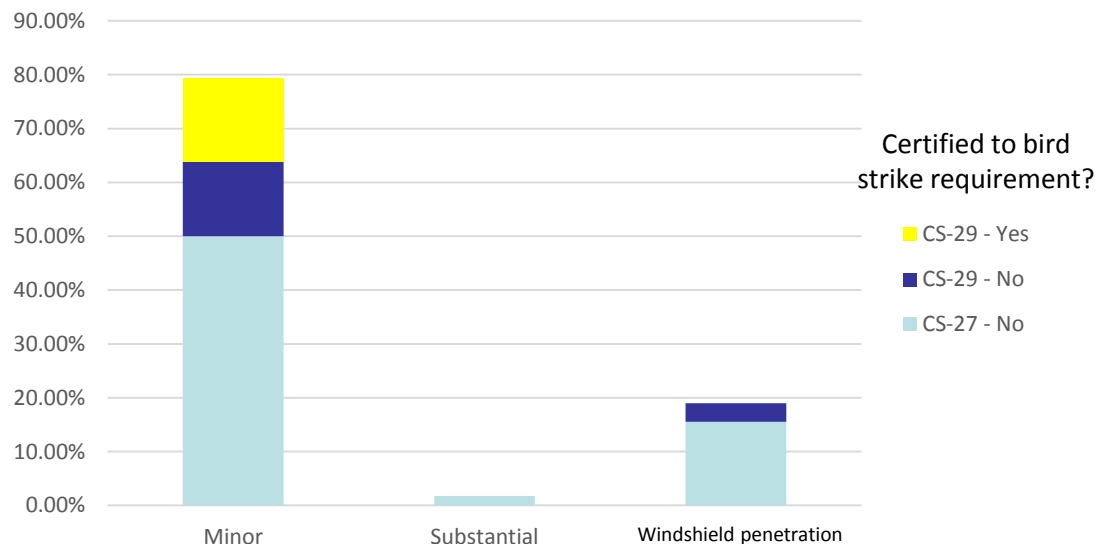
# EASA database :Bird strike damage location and severity

## Damage location

|                      |     |
|----------------------|-----|
| Front Windshield     | 28% |
| Radome/nose/fuselage | 20% |
| Main rotor           | 13% |
| Tail rotor/structure | 5%  |
| Others               | 34% |

% occ. with damage

## Damage severity



Bird strike impact have mainly caused minor damages aside from 2 substantial damages recorded (see definition in appendix).

Certified rotorcraft suffer from minor damages only.

On non-certified rotorcraft, when the front windshield is damaged, bird penetration occurs almost systematically.

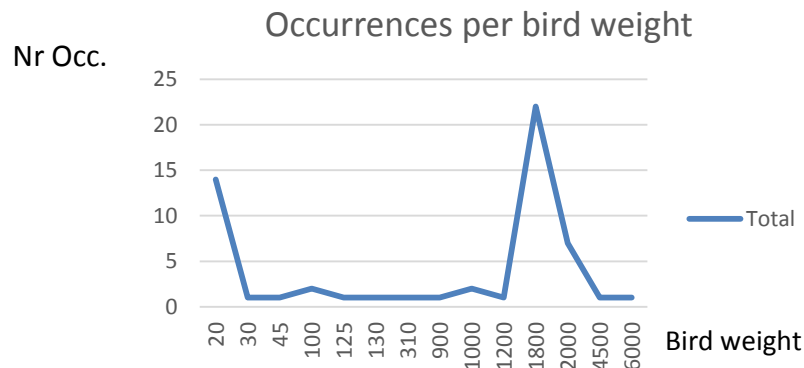




# EASA database: Bird threat evaluation

The majority of the impacts occurred en-route , at cruise speed.

Several damaging impacts are recorded with birds heavier than the existing requirement of 1kg bird.



- In the Atkins report Kinetic Energy (KE) was considered to be a better indicator of damage likelihood/severity than bird mass. For CS-29 Transport Helicopters, the KE of 5 to 11% of bird strikes were evaluate to be above the certification value.
- EASA database needs further analysis to confirm or not this tendency.



# EASA database: Lesson learned from data scrutiny

- Bird strike is not a major cause of accident but it is a growing safety and economic hazard
- Front fuselage section (including windshield) and the main rotor are mostly damaged.
- The lack of requirement for CS-27 rotorcraft category is reflected in a higher rate of damage with frequent vulnerability of the windshield.
- Risk of occupant/crew injury on non-certified rotorcraft is a concern due to windshield vulnerability.
- A bird strike requirement for CS-27 aircraft categories would reduce bird strike damage rate and prevent windshield penetration (mostly with weight and cost penalties).
- Further analysis of EASA database is needed to confirm or not tendency of having Kinetic Energy higher than CS29 certification values for impact with birds bigger >1kg.



# Way forward: ARAC Rotorcraft Birdstrike Working Group

EASA is a participant in the Rotorcraft Birdstrike Working Group tasked by FAA to provide to Aviation Rulemaking Advisory Committee (ARAC) by October 2017, recommendations on bird strike protection for part 27 and 29 airworthiness standards improvement.

|               | New TC  | Newly manufactured  | Existing rotorcraft fleet  |
|---------------|---|---|--|
| Part 27       | <b>Task 1-</b> Define new bird strike protection requirements   | <b>Task 2-</b> Made the requirement in Task 1 effective via §27.2 | <b>Task 5-</b> Incorporate bird strike protection improvements and standards |
| Part 29       | <b>Task3-</b> Enhance the §29.631 standard in light of increases in bird weight and increased exposure to bird strikes. | <b>Task 4-</b> Made the requirement in Task 3 effective via §29.2 |  |
| <b>Task 6</b> | Consider existing non-traditional bird strike protection technology for Tasks 1 through 5.                              |   |  |
| <b>Task 7</b> | Provide policy and guidance for Tasks 1 through 6.  |   |  |
| <b>Task 8</b> | Estimate cost, safety improvements/benefits linked to the recommendations of tasks 1 to 6.                              |   |  |

[https://www.faa.gov/regulations\\_policies/rulemaking/committees/documents/index.cfm/document/information/documentID/2742](https://www.faa.gov/regulations_policies/rulemaking/committees/documents/index.cfm/document/information/documentID/2742)

Further rulemaking process might follow at FAA and EASA.



# Way forward: EASA Certification memorandum on bird strike for Rotorcraft

By the end of 2016, EASA will develop a certification memo. to clarify EASA's expectations when showing compliance to the bird strike requirement ( CS29). The following should be considered:

## 1-Direct effect

### All areas/zones prone to bird strike

Front fuselage (including temperature effect on windshield)  
Main/tail rotors including blades, hub, mast, controls  
PFCS  
Engine/ ECS air intakes and MGB cowling  
Tail structure and control surfaces  
External equipment(Hoist, emergency floats...)

## 2-Induced effect

### Reference to FHA, FMECA (§1309, §547)

Parts detachment impact on primary structure, critical parts.  
Embedded critical system/equipment condition.

## 3-Continuous Safe flight and landing

### Pass/failed criteria:

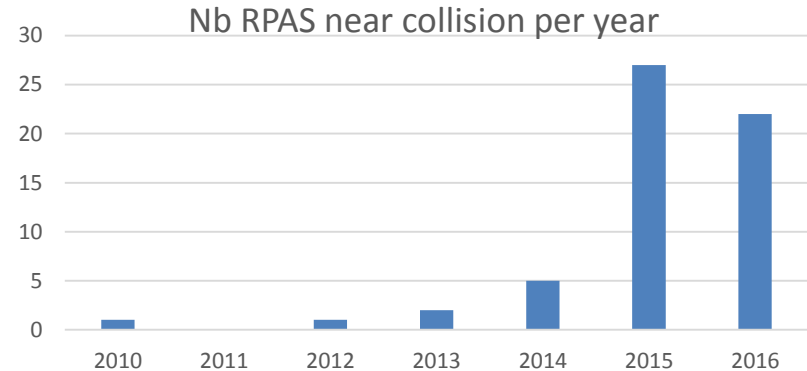
No windshield penetration and residual strength capability after damage-§307,§321,§775)  
Functional critical systems /equipment (§1309(b5(vi)B).  
Residual strength capability+ damage tolerance substantiation for damaged PSEs (§29.571, §29.573).  
No flutter/resonance (§629, §241) after impact...



# Remotely Piloted Aircraft Systems (RPAS)

## Next challenge for the future

- EASA database: No record of collision between helicopter and RPAS but occurrences near collision has very much increased.



- CS29 rotorcraft requirement on bird strike gives some basic protection to impact damage but might not be sufficient to address impacts with RPAS.
- RPAS technology poses a regulatory challenge as aviation safety rules are not adapted to drone operation.
- EASA created a task force to assess the risk of collision between drones and aircraft (Research program will be launched end of 2016). [Link to Task force report-slide 16.](#)
- For more information see Stefan Ronig presentation on **Drones – Regulator Views for the precautions to limit the risk of collisions**



# Conclusions

- Bird strike is not a major cause of accident but it is a growing safety and economic hazard.
- Recommendation report will be released to ARAC by October 2017 to advise on suitable actions for rotorcraft protection and requirement improvement.
- Further rulemaking activities might follow at FAA and EASA.
- In the mean time, EASA will issue a CM to help harmonise compliance demonstration to bird strike on transport category rotorcraft.



# Questions?





**EASA**  
European Aviation Safety Agency

**Thank you for your attention**

Herdrice HERESON  
Rotorcraft Structure Expert

[herdrice.hereson@easa.europa.eu](mailto:herdrice.hereson@easa.europa.eu)

**Your safety is our mission.**

An agency of the European Union







# Acronym list

- AAIB: [Air Accidents Investigation Branch - GOV.UK](https://gov.uk/air-accidents-investigation-branch)
- AC: Advisory Circular
- CS: Certification Specification
- ECR: [European central repository](#)
- FAR: Federal Aviation Regulation
- IORS: Internal occurrence reporting system
- JAR : Joint Aviation Requirement
- PFCS: Primary flight control system
- PSE: Primary Structural Element
- VH: Maximum speed in level flight at maximum continuous power
- VNE: Velocity Never exceed.



# Usefull links

- Slide3: [http://www.nts.gov/news/press-releases/Pages/NTSB\\_Cites\\_Lack\\_of\\_Bird\\_Strike\\_Resistant\\_Windshield\\_Requirements\\_in\\_Fatal\\_Crash\\_of\\_Helicopter\\_in\\_Louisiana.aspx](http://www.nts.gov/news/press-releases/Pages/NTSB_Cites_Lack_of_Bird_Strike_Resistant_Windshield_Requirements_in_Fatal_Crash_of_Helicopter_in_Louisiana.aspx)
- Slide 4  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/384803/AAIB\\_Bulletin\\_3-2012.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/384803/AAIB_Bulletin_3-2012.pdf)
- Slide 4  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/571566/AAIB\\_Bulletin\\_11-2016.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/571566/AAIB_Bulletin_11-2016.pdf)
- Atkins report:  
<https://www.easa.europa.eu/system/files/dfu/Final%20report%20Bird%20Strike%20Study.pdf>
- Video of Rotorcraft wear collision with RPAS <https://www.youtube.com/watch?v=IOYHaIYQERw>
- **EASA 'Drone Collision' Task Force:**
- <https://www.easa.europa.eu/document-library/general-publications/drone-collision-task-force>



# ICAO damage severity definition

- **Substantial:** The aircraft sustained substantial damage in the accident.
- The aircraft sustained damage or structural failure which:
  - - adversely affected the structural strength, performance or flight characteristics of the aircraft and
  - - would normally require major repair or replacement of the affected component, except for engine failure or damage, when the damage is limited to the engine, its cowlings or accessories; or for damage limited to propellers, wing tips, antennas, tyres, brakes, fairings, small dents or puncture holes in the aircraft skin. ICAO Annex 13.
- Major repair: a repair
  - - (1) That, if improperly done, might appreciably affect weight, balance, structural strength, performance, powerplant operation, flight characteristics, or other qualities affecting airworthiness; or
  - - (2) That is not done according to accepted practices or cannot be done by elementary operations.
- **Minor:** The aircraft sustained minor damage in the occurrence.
- Minor damage: The aircraft can be rendered airworthy by simple repairs or replacement and an extensive inspection is not necessary.