



EASA

European Aviation Safety Agency

EASA views on Rotorcraft bird strike threat.

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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

4th 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

13th 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

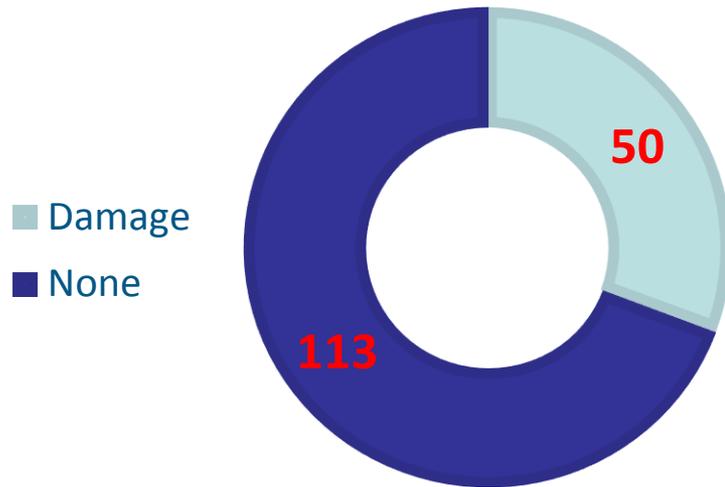
*DATA collection: **Richard Canis**-EASA Safety management department



EASA database: Bird strike consequences

➤ 163 occurrences with reliable reporting

BIRD STRIKE DAMAGE OCCURENCES



« Safe landing » can be questionable

Emergency landing	4.2%
Aborded take-off	3.0%
Mission aborded	11.5%
Precautionary landing	16.4%
Helicopter shut down for inspection	18.2%
None	46.7%

CONSEQUENCE ON FLIGHT

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).

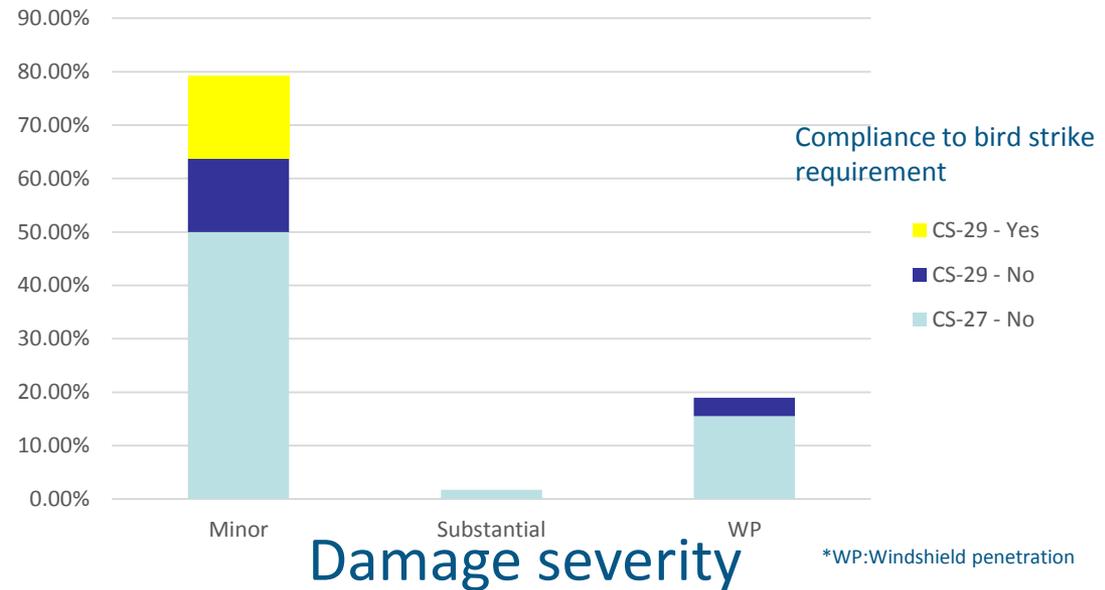
No accident recorded since the Atkins report (9 accidents /7 acc.with fatalities).

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



Damage location

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



Bird strike impact have mainly caused minor damages aside from 2 substantial damages recorded (see definition ICAO annexe 13 in appendix).

Certified rotorcraft suffer from minor damages only.

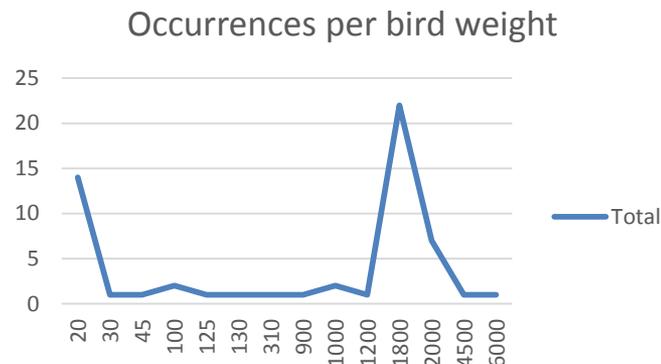
On non-certified rotorcraft, when the front windshield is damaged, bird penetration occurs almost systematically (19 % of the damages).



EASA database: Bird threat evaluation

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

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



- In Atkins report Kinetic Energies (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 above the certification value.
- EASA database need further fine 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.
- Introduction of bird strike requirement for CS-27 aircraft categories would reduce statistics on bird strike damage rate and prevent windshield penetration (mostly with weight and cost penalties).
- Kinetic Energies is still a better indicator of damage likelihood than bird mass.
- Reporting in EASA database needs further fine tuning to confirm or not the increase tendency of having KE higher than CS29 certification values for impact with birds bigger >1kg.



Way forward: ARAC Rotorcraft Birdstrike Working Group

EASA is participant in the Rotorcraft Birdstrike Working Group tasked by FAA to provide to ARAC by October 2017, recommendations on bird strike protection rulemaking, policy and guidance for part 27 and 29 airworthiness standards improvement.

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

EASA and FAA database will be used.

Further rulemaking process might follow at FAA and EASA.



Way forward: EASA CM 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. The following should be considered:

1-Direct effect

All areas/zones prone to bird strike including:

- 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)

- Impact consequence of parts detachment on primary structure, critical parts.
- Consequence of impact loads, bird penetration, structure deformation on embedded critical system/equipment condition (avionics equipment, servo-actuators...)

3-Continuous Safe flight and landing-

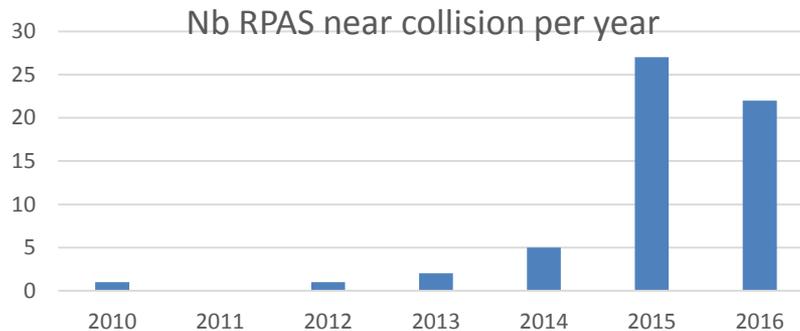
Pass/failed criteria

- No windshield penetration. Damaged windshield must be capable to sustain aerodynamic loads (§307,§321,§775)
- Functionality of nearby critical systems and controls (§1309(b5(vi)B).
- Residual strength capability+ Damage tolerance substantiation for damaged metallic and composite PSEs (§571, §573).
- No flutter/resonance (§629, §241) after impact.



RPAS, next challenge for the future

- <https://www.youtube.com/watch?v=IOYHaIYQERw>
- No record of collision between helicopter and RPAS in EASA database.
- But occurrences of RPAS near collision with Helicopter has very much increased.



- Transport category rotorcraft requirement on bird strike gives some basic protection to impact damage but will not be sufficient to address impacts with RPAS (RPAS kinetic energy, side impacts...).
- RPAS technologie poses a regulatory challenge as aviation safety rules are not adapted to drone operation.
- An EASA Task Force has assessed the risks associated to collision between RPAS and manned aircraft. Research program will be launched end of 2016 to support further decision. See EASA Website.
- Refer also to Stefan Ronig presentation on **Drones – Regulator Views**



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 advice 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 harmonizing compliance demonstration to bird strike on transport category rotorcraft.
- In addition, EASA already launched actions to addressed the risk of collision with RPAS which are stronger, faster, stiffer source of discrete damage to rotorcraft.



Questions?





ICAO Annexe 13 damage 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.