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PROTECȚIA AERONAVELOR ȘI MOTOARELOR ACESTORA LA IMPACTUL PĂSĂRILOR

Dragoș POPA, Dragoș D. POPA, Traian TOMESCU,
Ligia PETRESCU

AIRCRAFT PROTECTION AT ENGINE BIRD STRIKE

„Bird Strike Prevention Systems” is defining the integrated concept of aircrafts protection at the strike with the bird and it contains measures that are taken for airplanes and also for airports. The bird strike is a dangerous and also common event, which happens often at ground or low altitude, the dangerous phases of landing/take-off. The bird strike can provoke light damage but it can also provoke engine malfunction leading to stop, with obvious consequences for the flight safe.

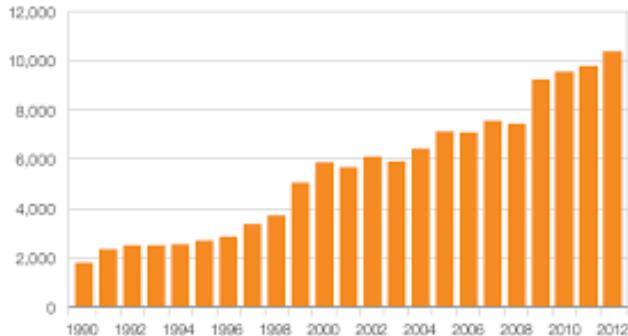
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1. Introduction

Bird strikes are a lesser hazard to aviation than other well-known hazards such as loss of control in flight, controlled flight into terrain, and runway excursions, but they can present risk that needs to be addressed. The first bird strike was recorded by the Wright brothers in 1905, and the aviation wildlife hazard has been a risk to aviation ever since. The January 15, 2009, ditching of US Airways flight 1549 on the Hudson River in Weehawken, New Jersey, was the dramatic result of dual engine thrust loss arising from an airborne encounter with a flock of Canada geese. Although Boeing airplanes meet and exceed the government regulations for bird strikes, accidents and serious incidents

can occur. Aviation wildlife hazards encompass birds on the ground and in flight. Operators and flight crews should be aware of the risk of bird strikes, prevention strategies and what actions to take following a bird strike.

Number of reported bird strikes to civil aircraft in US, 1990–2012



Source: Federal Aviation Administration

Fig.1 Number of reported bird strike

According to Bird Strike Committee USA, an organization that was formed in 1991 to facilitate the exchange of

information and promote the collection and analysis of accurate wildlife strike data, bird and other wildlife strikes cause more than \$650 million in damage to U.S. civil and military aviation annually. In addition, bird strikes put the lives of crew members and passengers at risk — more than 200 people have been killed worldwide as a result of wildlife strikes since 1988. The Bird Strike Committee takes a similar data-driven approach to the bird strike issue that organizations such as the Commercial Aviation Safety Team (CAST) takes to reduce commercial aviation fatality risk. (See www.cast-safety.org.) Bird-strike damage can be quite severe and can shut down jet engines.

1.1. Locations of bird-strike damage

Three-quarters of bird strikes involve the wing or engines, but they can damage almost any part of an airplane.

1.2. Common concept about bird strikes

- Birds don't fly at night.
- Birds don't fly in poor visibility, such as in clouds, fog, rain, or snow.
- Birds can detect airplane landing lights and weather radar and avoid the airplane.
- Airplane colours and jet engine spinner markings help to repel birds.

- Birds seek to avoid airplanes because of aerodynamic and engine noise.
- Birds dive to avoid an approaching airplane.

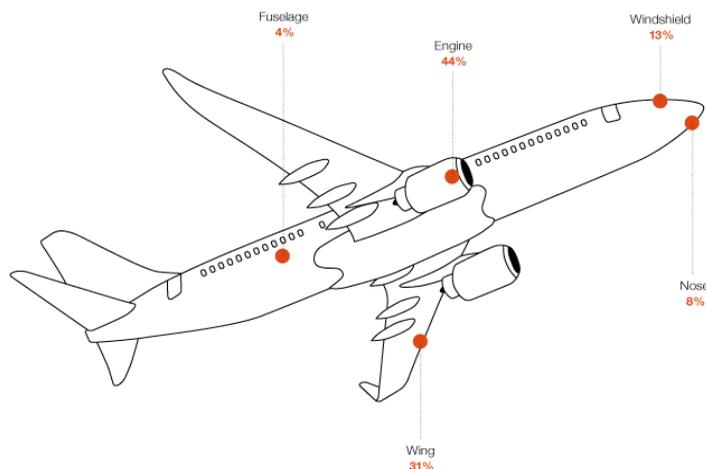


Fig. 2
Aircraft
location of
bird strike
damage

1.3. Airport strategies

- Use **pyrotechnics** daily to drive the birds away.
- **"The flash bang kind of stuff immediately gets their attention and pushes them away."** Bangers and screamers make a loud explosion, others make a whistling sound, while some emit sparks
 - different birds respond to different things and some even take flight at the mere sight of the wildlife vehicle.
- **Sonic Devices:** uses intermittent distress calls to frighten away birds for good. The birds recognize the area as a "danger zone" to repel animals up to 30 acres.
- **Bird Aversion Liquid:** Bird aversion liquids such as **Bird Stop** liquid are creating an invisible barrier that irritates a bird's trigeminal system for a potent yet harmless effect. Simply apply the substance to the grass, turf, & other surfaces to keep pest birds from feeding, loitering, and landing.
- **Visual Scares:** Multiple visual scare products are available to deter pest birds. These deterrents are quick and easy to install while still being cost effective and low maintenance. By using life-like and intimidating predator replicas and scares, pest birds will be forced of your property.

- **Bird Balls: Floating Bird Balls** are a great option for airport retention ponds.

These balls eliminate waterfowl like ducks, geese, and gulls by completely covering the water's surface to prevent pest water birds from landing.

- **Bird Control Program:** Bird-X's complete **Airport Control System** acts as a multi-sensory attack against bird infestation.

The system consists of 4 different bird control products including the Mega Blaster PRO, Critter Blaster PRO, Goose Buster, & Bird Stop. Together, these systems attack wildlife with 3 different scare sound sources.

1.4. The flight crew should consider

Delaying the take-off or landing when fuel permits. Advise the tower and wait for airport action before continuing.

Take off or land on another runway that is free of bird activity, if available.

Discuss bird strikes during takeoff and approach briefings when operating at airports with known or suspected bird activity.

Be extremely vigilant if birds are reported on final approach. If birds are expected on final approach, plan additional landing distance to account for the possibility of no thrust reverser use if a bird strike occurs.

1.5. Flight crews and maintenance

Line personnel are encouraged to report all bird strikes because data are essential to quantify and manage the hazard. Reporting bird strikes enables aviation authorities to monitor the risk to aviation and the effectiveness of wildlife hazard mitigation measures.. Bird-strike data also help researchers understand the nature of strikes and develop a scientific approach to reduce the cost and safety consequences of bird strikes.

In the event of a bird strike, maintenance personnel should follow the appropriate maintenance procedures for bird strike inspection in the Airplane Maintenance Manual.

The bird strike should be reported by the flight crew in the pilot's log or by the maintenance crew in the maintenance log.

After a bird strike, the airplane should be inspected for possible damage to airplane structure and airplane systems.

1.6. When the aircraft are in flight, the crew can detect a bird strike

Visual: Birds seen in close proximity to the airplane or colliding with the airplane, bird remains on windshield, cracked windshield.

Tactile: Vibration of airframe or engine, thrust loss, asymmetric thrust, increased drag, abnormal airplane handling characteristics.

Auditory: Noise of strike or noise attributed to resulting damage: engine surging, compressor stalls, aerodynamic noise from damaged radome, loss of pressurization from pressure vessel penetration.

Olfactory: Smoke, odor, or cooked bird smell.

Engine indications: Reduction or fluctuation in primary power parameter (e.g., engine pressure ratio, fan speed, or equivalent), abnormal fuel flow, abnormal engine vibration monitoring (e.g., error vector magnitude or equivalent), engine failure, engine exceedances.

Flight instruments: Loss of data or erroneous indications arising from damage to air data sensors or angle-of-attack sensors.

Other airplane systems or structure affected directly by a strike: Damaged communications or navigation antennas, damage to exposed electrical wiring or hydraulic lines, damaged radome or weather radar, broken landing lights, or cascading and multiple effects from sensor damage or engine damage.

1.7. Bird strike system report must contain

Airplane model and series designation, airplane serial number or registration, phase of flight, speed and altitude of the airplane, geographical location of the airplane, date and time of day, origin and destination airport, number and species of bird observed and struck, impact locations of strikes and damage on airplane, effect on flight (e.g., rejected take-off, air turn back, diversion).

1.8. Emergency Response Plan – ERP to a bird strike in flight conditions

1. Immediate action
 - a. Fly the airplane and maintain control
 - b. Monitor flight and engine instruments
2. Engine failure, thrust loss or severe engine damage
 - a. Attempt to restart engine

- b. Shut down engine according FM
3. Strong engine vibration
 - a. Reduce thrust, reduce vibration
 - b. Shut down engine
4. Engine ingestion and abnormal engine indications
 - a. Air turn back or land as soon is possible
5. Suspected or engine ingestion and normal indications
 - a. Air turn back or land as soon as possible
 - b. Re-evaluate decision, extended range operations – attention the degradation may manifest later in the flight.

2. Romania – Bird Strike Events

For this report the following materials have been used:

Trimestral reports from 2015 sent by airports from Romania, in conformity with stipulation from : *“art. 3, alin. (2) of OMT nr. 1309/ 2014 privind măsuri pentru aplicarea Regulamentului (UE) nr. 139/ 2014 al Comisiei din 12 februarie 2014 de stabilire a cerințelor tehnice și a procedurilor administrative referitoare la aerodromuri în temeiul Regulamentului (CE) nr. 216/ 2008 al Parlamentului European și al Consiliului”*.

Bird species that were involved were small birds like sparrow and starling, medium sized birds like dove, hawk, crow, kingfisher, owl and also big sized birds like wild goose.

No damage was reported at the aircrafts that had “Bird Strike” events.

Table 1 Birds strike on Romanian Airports

Bird Strike Events on Romanian Airports													Table 1
Month	01	02	03	04	05	06	07	08	09	10	11	12	
2011	1	1	1	4	10	15	19	39	16	7	3	8	124
2012	7	2	7	3	15	10	15	38	14	11	3	5	130
2013	7	2	8	4	12	10	29	38	33	13	3	3	162
2014	3	3	4	7	20	32	41	40	26	29	8	5	218
2015	7	6	9	19	13	11	16	14	18	8	7	6	134

3. New strategies against bird strike

Bird-aircraft strikes are representing a significant safety hazard to aircraft, pilots and passengers and, according to government's

studies, cost military and commercial aviation over \$2 billion each year due to aircraft loss and damage, out-of-service delays and lost lives.



Fig. 6 Detects MERLIN Aircraft Birdstrike Avoidance

Radar system is the first and only production bird strike radar system and is the most advanced and widely-used technology available for bird-aircraft strike hazard (BASH) management and for real-time detection, tracking and alerting of hazardous bird activity at commercial airports, military airfields, and military training and bombing ranges.

The MERLIN radar is proven, operational technology with over 140 MERLIN systems currently operating at sites worldwide in aviation safety and environmental applications.

MERLIN has a documented record in reducing bird strikes, increasing safety and reducing aircraft damage and delay costs at both military and commercial airfields.

MERLIN is also the only bird radar system to have been evaluated and certified for real-time, tactical flight safety use by the US government (includes NASA and the USAF certifications and approvals) and is the only bird radar approved for and in use at a commercial airport control tower under national flight safety standards.

4. Type of aircraft engine damage



Fig.8

Different type of bird strike aircraft and engine damage



5. Conclusions

- Aviation safety experts are saying that is not enough to build an integrated environment of protection against “bird strike”.

- After "swallowing" a smallish goose (formally up to 3.65kg) the engine must still pull at least half of the thrust for at least 14 minutes, and must not become dangerous for the plane (no fire, no uncontained failure).
- After ingesting a flock of ducks (16 birds no more than 0.85kg each) the engine must still work for about 20 minutes.
- There have been several changes to the bird ingestion requirements for certification since the A320 engine was certified in 1996. However, once an engine is certified there is no need to demonstrate compliance to the updated requirements; the engine remains certified as it was.
- The latest update to these requirements was in 2007, prior to the Hudson accident. To answer your question: no, there have not been any changes to the bird strike testing requirements of engines in the aftermath of the Hudson accident.

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- [4] * * * *OMT nr. 1309/ 2014 privind măsuri pentru aplicarea Regulamentului (UE) nr. 139/ 2014 al Comisiei din 12 februarie 2014 de stabilire a cerințelor tehnice și a procedurilor administrative referitoare la aerodromuri.*
- [5] * * * *Regulamentul (CE) nr. 216/ 2008 al Parlamentului European și al Consiliului.*

Dr.Ing.Euring Dragoș POPA
 SETEC-AGIR, București, România
 Inginerie electrică, automatizări de bord de aviație, expert tehnic extrajudiciar
 și consultant SETEC AGIR,
 e-mail: tudodei@yahoo.com

Student Dragos D. POPA
 UPB-IE, București, România
 Inginerie electrică, electronică de putere și acționări electrice

student, UPB
e-mail: dragospopa420@gmail.com

Ing.dipl. Traian TOMESCU
AGIR - Braşov, România
Inginerie aerospaţială – aparate de bord
e-mail: traian_tomescu@yahoo.com

Ing.dipl. Tudor TOMESCU
AGIR - Braşov, România
Inginerie aerospaţială

Dr.Ing. Ligia PETRESCU
SETEC-AGIR, Bucureşti, România
Inginerie aerospaţială, design, expert tehnic extrajudiciar
şi consultant SETEC AGIR
e-mail: ligiapetrescu@yahoo.com

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„Sistemul de prevenire Bird Strike“ defineşte conceptul integrat de protecţie a aeronavelor la impactul cu pasărilor şi conţine măsuri care sunt luate pentru avioane şi, de asemenea, pentru aeroporturi. Impactul păsărilor este un eveniment periculos şi, de asemenea, comun, care se întâmplă de multe ori la sol sau altitudine joasă, periculoase fiind fazele de aterizare/decolare. Impactul păsărilor poate provoca lovituri, rupturi de învelişuri, îndoituri (vezi figura 8), dar poate provoca, de asemenea şi funcţionarea defectuoasă a motorului ceea ce duce la oprirea acestora, cu consecinţe evidente pentru siguranţa zborului.