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|  | Report of Flight Incident |
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| **Overview** | SATA A320 at Funchal on Jun 20th 2011, flock of birds ingested by both engines, bird strike opens forward cargo door |
| **Flight Number** | S4-680 |
| **Incident ICAO** | A320 |
| **Incident Date** | 20/06/2021 |
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| **Incident Report** | |

A SATA International Airbus A320-200, registration CS-TKJ performing flight S4-680 from Funchal (Portugal) to Copenhagen (Denmark) with 105 passengers and 7 crew, just rotated for takeoff from runway 05 when the airplane went through a flock of sea gulls causing a number of birds being ingested into both engines (CFM56) causing both engines to vibrate and a number of sea gulls hitting wings, fuselage and landing gear causing the forward cargo door to open. The aircraft climbed out safely and returned to Funchal for a safe landing on runway 05 about 15 minutes after departure.  
  
The airport reported the birds were sitting on the runway despite ultrasound equipment to scare the birds away and flew up when the aircraft went through the flock.  
  
A replacement Airbus A320-200 is currently estimated to reach Copenhagen with a delay of 5:15 hours.  
  
Both engines suffered a number of damaged fan blades but received no downstream damage. Both fans needed replacement of almost half the number of fan blades.  
  
Portugal's GPIAA reported that both engines suffered high amplitude vibrations however without significant loss of power. The airplane climbed to safety altitude and immediately returned for a safe overweight landing. During roll out the forward cargo door was observed open confirmed by cockpit indications. Blood traces were found on various parts of the aircraft, a number of fan blades of both engines were damaged, borescopic inspections revealed no damage in the compressors, combustion chambers or turbines.  
  
Aviation sources reported at least one sea gull hit the door handle of the forward cargo door and rotated the handle into the open position causing the forward cargo door to open.  
  
On Jun 22nd 2021 Portugal's GPIAAF released their final summary report releasing following conclusions and comments into the serious incident were:  
  
Traces of blood at multiple points along the lower fuselage, wings and landing gear as well as the finding of several seagull carcasses on the runway allows the investigation to conclude that the aircraft encountered a flock of seagulls during the take-off run, some of which struck the fuselage and were ingested in the engines.  
  
One of the birds directly struck the forward cargo door handle flap, penetrating the recess and forcing the handle out.  
  
In 2009, the European Aviation Safety Agency (EASA) published a study on bird population trends and their impact on aviation safety, covering a period from 1999 to 2008.  
  
The study assessed the location on the aircraft where damage was sustained as a result of the bird strike and determined that in 44% of cases the engines were affected, by far the most frequent part of the aircraft. The wing, windshield and nose of the aircraft followed with 31%, 13% and 8% respectively.  
  
The least frequent location of the aircraft to get struck by birds was the fuselage which occurred in just 4% of the events included in the study.  
  
Yet, even the most improbable occurrences can in time manifest themselves as was the case of a bird striking a rapidly moving aircraft directly on the forward cargo door handle flap, which has a total surface area of 66 cm2.  
  
The analysis conducted of the door handle demonstrated that once exposed to the air flow, the aerodynamic drag force is sufficient to overcome the cargo door locking mechanism, and ultimately result in the unlatching of the door, as was the case in the event.  
  
Despite the damage sustained by the fan, the engines continued to operate with negligible loss of thrust. The fan blades remained operational and there was no separation despite the intense vibration.  
  
The intense vibration caused the crew concern about the imminent failure of one or both engines. As such, the crew’s decision to land immediately was the safest course of action given the circumstances, despite manoeuvring at low altitude over the sea and only becoming aware that the door was open, once they were already on the ground.  
  
Being a native of Madeira and a seasoned pilot with over 9000 landings at Funchal probably contributed towards the Captain’s decision and swift actions to return to the airport, in little over 3 minutes after getting airborne.  
  
Bird strikes have been a hazard since the early days of aviation. Orville Wright, one of the famous Wright brothers, is reported to have experienced a bird strike in the spring of 1905 when he was conducting an experimental flight over a field in Ohio.  
  
On the 29th of January 2012, the crew of an Air France A319 were on final approach to Algiers when at about 100ft the crew hear a thud followed by a change to the aerodynamic noise. During rollout, at approximately 80kts, they received the DOOR FWD CARGO ECAM alert and when they reached the stand, the forward cargo door handle was found to have shifted outside of its recess, in an unlocked position. The vent flap was also partially open but the cargo door itself remained flush with the fuselage, in a latched condition.  
  
Similar to the event in Funchal, the bird strike in Algiers left traces of blood immediately aft and within the handle recess. However, in this event the movement of the handle was not sufficient to unlatch the door. The fact that it occurred at the final moments of the flight, with the aircraft already in a lower energy state, may explain the different outcome to the SATA event in Funchal.  
  
Although it is impossible to entirely eliminate thethreat posed by bird strikes, several mitigating measures can be taken to reduce the concentration of birds in the vicinity of aerodromes and repel them from the movement areas.  
  
While much of these measures were already in place at Madeira airport at the time of the event, they were insufficient to prevent a large flock of seagulls from striking the aircraft during the takeoff roll.  
  
Bird strikes, like other operational flight safety hazards need to be the subject of continuous monitoring, review and risk mitigation within the aerodrome’s safety management system similar to the operator’s own risk assessment of the hazards of a particular type of operation or aerodrome.  
  
The GPIAAF described the sequence of events:  
  
The aircraft taxied to runway 05 for take-off and accelerated normally. As it approached rotation speed, about two-thirds down the runway, the aircraft encountered a large flock of seagulls which were perched on the runway surface, at 08:21:50 UTC. As the birds sprung into the air, they struck the aircraft as it was getting airborne, hitting the landing gear, flaps and the lower surfaces of the fuselage and wings.  
  
Some of the birds were ingested into both engines resulting in intense vibration which was felt throughout the aircraft.  
  
The N1 vibration readings displayed on the Electronic Centralized Aircraft Monitor (ECAM) Engine page were flashing and had reached their maximum value.  
  
At 08:22:16 UTC the crew declared mayday and warned the air traffic controller of the possibility of failure of both engines, requesting to return immediately to the airport.  
  
The crew performed a climbing turn to the right and at approximately 900ft (08:22:21 UTC) reduced power on the engines in order to attempt to diminish the vibrations. The aircraft began descending and lost 150ft.  
  
At 08:23:07 UTC, the crew requested to land immediately, which was acknowledged by ATC.  
  
Power was re-applied and the aircraft climbed to approximately 1000ft (08:23:30 UTC) before descending on a right-hand circuit to approach and land on runway 05, maintaining an average airspeed of 150kts.  
  
Despite the vibrations, the engines continued to operate normally and any reduction of thrust was negligible.  
  
The landing gear was initially retracted after takeoff but extended a few seconds later after the decision to land immediately. The flaps/slats configuration remained unchanged since take-off.  
  
The aircraft performed a safe overweight landing on runway 05 at 08:25:06 UTC, in just over 3 minutes since taking-off and suffering the multiple bird strike.  
  
During the landing-roll, as the aircraft decelerated below 80kts, the crew received the DOOR FWD CARGO master caution message on the ECAM’S engine/warning display (E/WD) and the DOOR page automatically appeared on the ECAM’s system display, showing the forward cargo door symbol and indication in amber (08:25:21 UTC).  
  
Soon thereafter, the tower also informed the crew that the forward cargo door was open, while the aircraft was taxiing to the stand.  
  
An aviation enthusiast and photographer positioned in close proximity to the threshold of runway 05, photographed the aircraft as it taxied into position for take-off and subsequently when it returned to land on runway 05. The photos he took of the latter stages of the flight show that the forward cargo door was indeed open.  
  
The GPIAAF described the damage:  
  
Although with no apparent damage, upon arrival on stand, ground support staff found the forward cargo door swung open and the handle in its fully unlocked position.  
  
No injuries were reported among the 105 passengers and 7 crew members who were onboard the aircraft.  
  
The carcasses of several seagulls were recovered from the runway when it was inspected.  
  
Traces of blood were observed at multiple points along the lower fuselage, belly fairing and the lower inboard surfaces of the wings, left-hand inboard flap and left-hand main landing gear strut and door.  
  
Examination of the forward cargo door revealed pronounced blood smear on the surface skin just aft of the handle flap. There was also evidence of blood inside the handle recess, within the door structure. There was no visible damage to the door and no luggage items had ejected the cargo hold.  
  
Engine intake lip and cowlings showed no visible damage or impact marks, but the inner liner had substantial blood smear and tip curl deformation was observed on 9 fan blades on engine number 2 and 12 fan blades on engine number 1. The damage to the fan blades was out of operating limits and these had to be replaced. Boroscopic inspection performed on both engines did not reveal any further damage.  
  
A heavy weight landing inspection was performed but did not find any damage to the aircraft.  
  
The GPIAAF reported that the former GPIAA had rated the occurrence a serious incident and had opened an investigation, however, due to lack of funding was unable to proceed with the investigation. After the creation of the GPIAAF in 2017 an action plan could be established to conclude the investigation. The safety report was closed with this summary report.  
  
The report spends a whole lot analysing the cargo door opening stating, it was the only one known at the time and thus is considered an isolated event. The chances of a bird directly hitting the cargo door handle were computed as extremely improbable. Airbus regarded the event as a "major" one, however stated, had it occurred at a higher cabin pressure it likely could have become "catastrophic". However, had the aircraft been pressurized, the force to move the handle would have been larger than the force needed to rupture the mechanism. In an unpressurized aircraft however simulations and computations showed that it was possible the handle was moved by an impact and aerodynamic forces by airflow around could have further moved the handle into the open position.

Classification of incident: Incident