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AAIB
Air Accidents Investigation Branch

AAIB Bulletin S2/2023 *SPECIAL*

Accident

Aircraft Type and Registration:	Airbus A321-253NX, G-OATW
No & Type of Engines:	2 CFM International SA LEAP-1A33 turbofan engines
Year of Manufacture:	2020 (Serial no: 10238)
Date & Time (UTC):	4 October 2023 at 1151 hrs
Location:	London Stansted Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 11 Passengers - 9
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to several cabin windows and impact damage to the left horizontal stabiliser
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	54 years
Commander's Flying Experience:	4,905 hours (of which 2,300 were on type) Last 90 days - 128 hours Last 28 days - 27 hours
Information Source:	AAIB Field Investigation

Introduction

This Special Bulletin is published to raise awareness of a recent occurrence in which several cabin windows on an Airbus A321 were damaged by high power lights used during a filming event. The damage was discovered after takeoff on the aircraft's next flight. Work is ongoing with the aircraft manufacturer and operator to fully understand the properties of the lights used and how this risk can be managed in future.

Aircraft owners and operators should consider the hazard posed by such activities to minimise the risk of aircraft damage.

History of the flight

The aircraft was scheduled to embark on a multi-day charter away from base with a flight crew consisting of three pilots, an engineer, a load master and six cabin crew. The first sector was a positioning flight from London Stansted Airport to Orlando International Airport, Florida. In addition to the 11 crew there were nine passengers on board who were all employees of the tour operator or aircraft operating company. The passengers sat together in the middle of the aircraft just ahead of the overwing exits.

The aircraft departed a few minutes ahead of schedule and took off from Runway 22. Several passengers recalled that after takeoff the aircraft cabin seemed noisier and colder than they were used to. As the aircraft climbed through FL100 and the seatbelt signs were switched off, the loadmaster, who had been seated just in front of the other passengers, walked towards the back of the aircraft. He noticed the increased cabin noise as he approached the overwing exits and his attention was drawn to a cabin window on the left side of the aircraft. He observed that the window seal was flapping in the airflow and the windowpane appeared to have slipped down[1]. He described the cabin noise as 'loud enough to damage your hearing'. Figure 1 shows the window in flight.

The loadmaster told the cabin crew and then went to the flight deck to inform the commander. At this stage the aircraft was climbing past FL130, there were no abnormal indications on the flight deck and the aircraft pressurisation system was operating normally. The flight crew stopped the climb at FL140 and reduced airspeed whilst the engineer and then the third pilot went to look at the window. Having inspected the window, it was agreed the aircraft should return to Stansted. The cabin crew told the passengers to remain seated and keep their seatbelts fastened, and reminded them about the use of oxygen masks if that became necessary.

The cabin was quickly secured and the flight crew initiated a descent, first to FL100 and then to FL90. They established the aircraft in a hold whilst they completed the overweight landing checklist, confirmed landing performance and briefed for the return to Stansted. The approach and landing on Runway 22 were uneventful. Landing at 1151 hrs, the total flight time was 36 minutes. With the airport RFFS in attendance the aircraft taxied to the apron, where the passengers disembarked normally.

Having parked and shut down, the crew inspected the aircraft from the outside and saw that two cabin windowpanes were missing and a third was dislodged. During the flight the crew had only been aware of an issue with a single windowpane. The cabin had remained pressurised normally throughout the flight.

[1] The crew were not aware if this was only the outer pane or both panes.

Figure 1

View of the left side cabin window aft of the overwing exit

Previous activity

The day before the occurrence flight the aircraft had been used for filming on the ground, during which external lights had been shone through the cabin windows to give the illusion of a sunrise. The lights were first shone on the right side of the aircraft for approximately five and a half hours, with the light focused on the cabin windows just aft of the overwing exits. The lights were then moved to the left side of the aircraft where they illuminated a similar area on the left side for approximately four hours. Photographs taken during filming showed six sets of flood lights on both sides of the aircraft. Figure 2 shows the lights positioned on the left of the aircraft.

Figure 2

Flood lighting on the left side of the aircraft

Recorded information

The aircraft was fitted with an FDR and CVR which were removed and successfully downloaded at the AAIB. The flight was captured on both recorders and the CVR confirmed reports from the flight crew interviews.

The aircraft took off from Stansted at 1115 hrs, climbing progressively to a maximum of 14,504 ft[2] at 1123 hrs (Figure 3). The cabin altitude increased during this time, reaching a

[2] Pressure altitude is recorded to a reference pressure of 1013 mb.

recorded maximum of 1,536 ft. The aircraft then descended to 10,000 ft initially, followed by a further descent to 9,000 ft while circling to the north-west of the airport. No pressurisation warnings were recorded during the flight, which landed back at Stansted Airport at 1151 hrs.

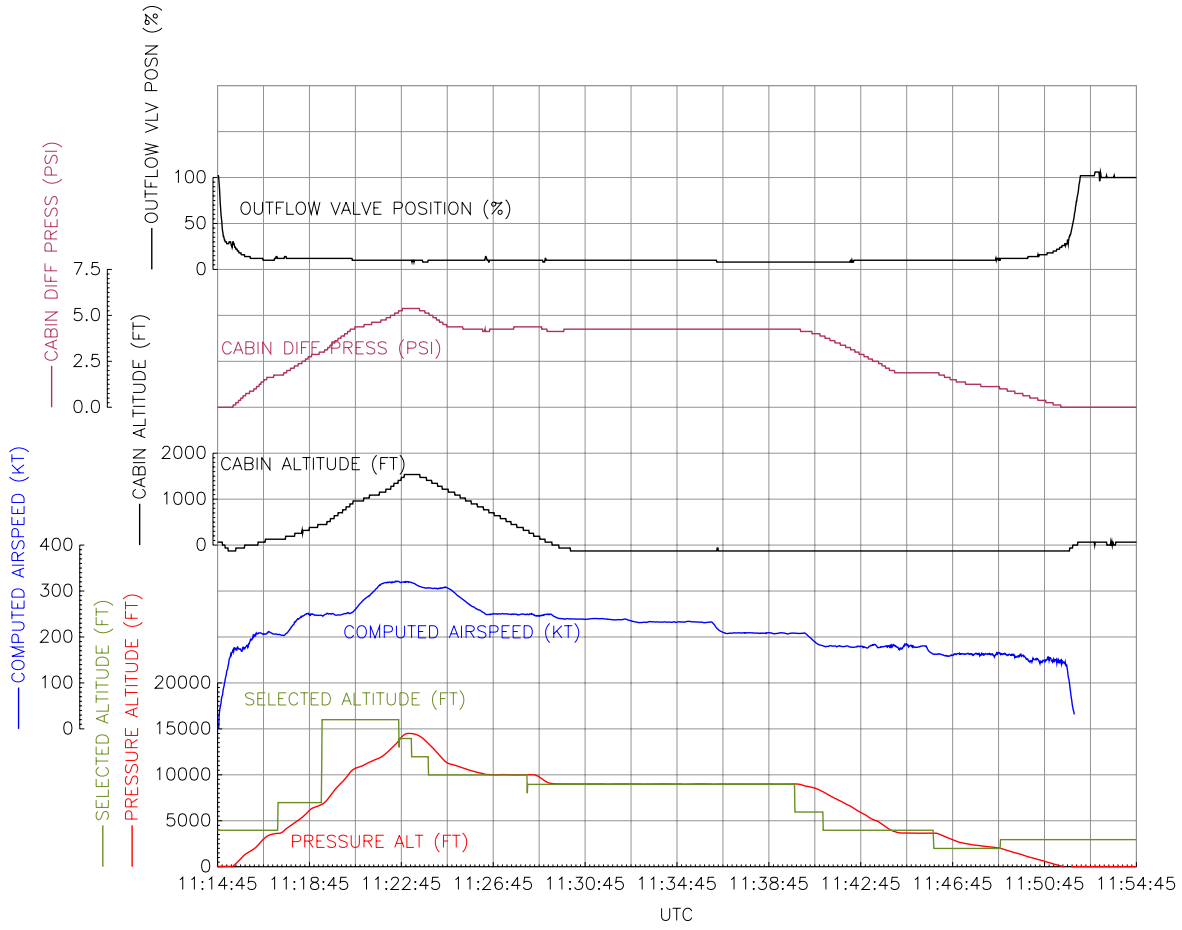

Figure 3

G-OATW FDR data

Aircraft examination

Cabin windows

Two window assemblies[3] were missing, and the inner pane and seal from a third window were displaced but partially retained in the airframe (Figure 4). A shattered outer pane was recovered from the entrance to a rapid-exit taxiway during a routine runway inspection after the aircraft landed.

[3] A window assembly consists of the inner and outer panes, and a rubber seal.

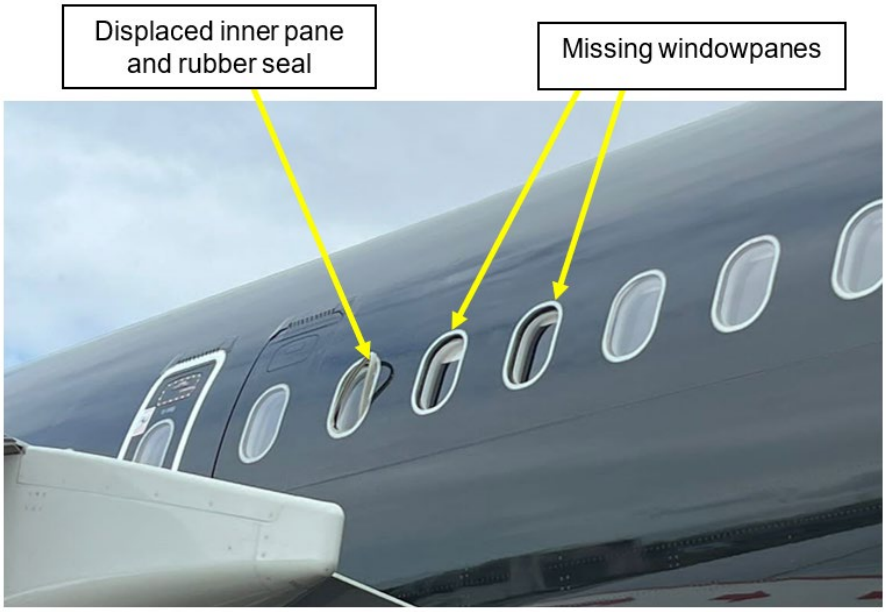

Figure 4

Displaced and missing windowpanes on the left side of the aircraft

A fourth window protruded from the left side of the fuselage (Figure 5). The four affected windows were adjacent to each other, just aft of the left overwing exit.

Figure 5

Protruding window on the left side of the aircraft

Removal of the cabin lining inside the passenger cabin revealed that the window retainers were in good condition and correctly installed. The foam ring material on the back of the cabin liners was found to be melted in the areas adjacent to the windows that were damaged or missing (Figure 6).

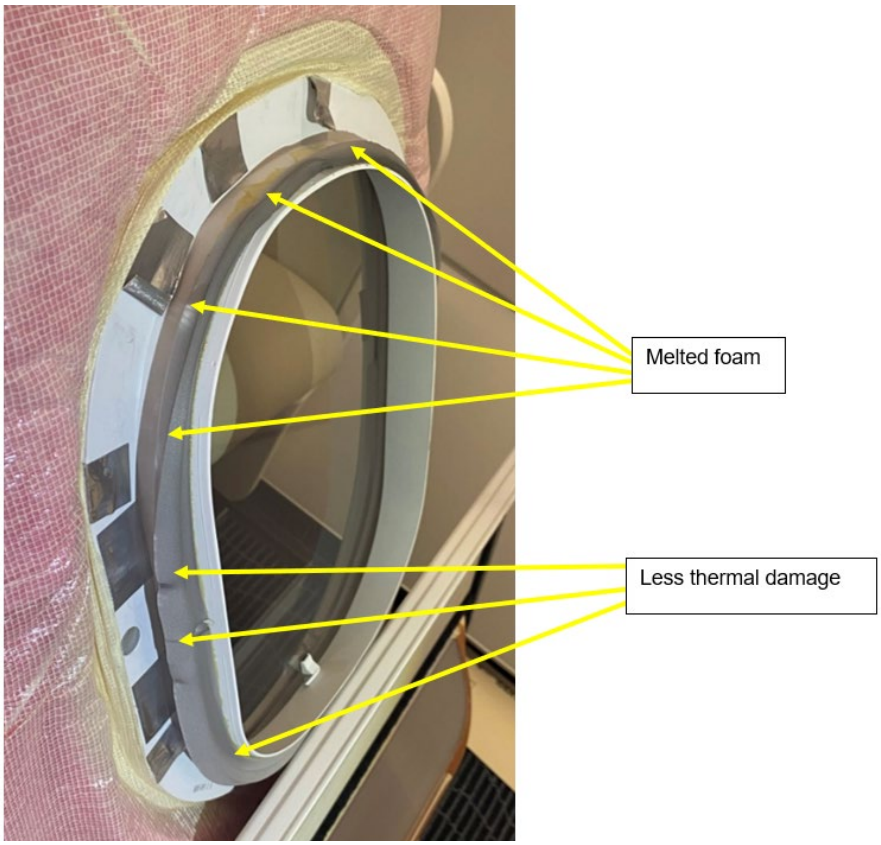

Figure 6

Foam ring material affected by elevated temperatures

Visual examination of the damaged windowpanes revealed that they were deformed and shrunk (Figure 7). The deformed panes no longer formed an effective interface with the rubber seals.

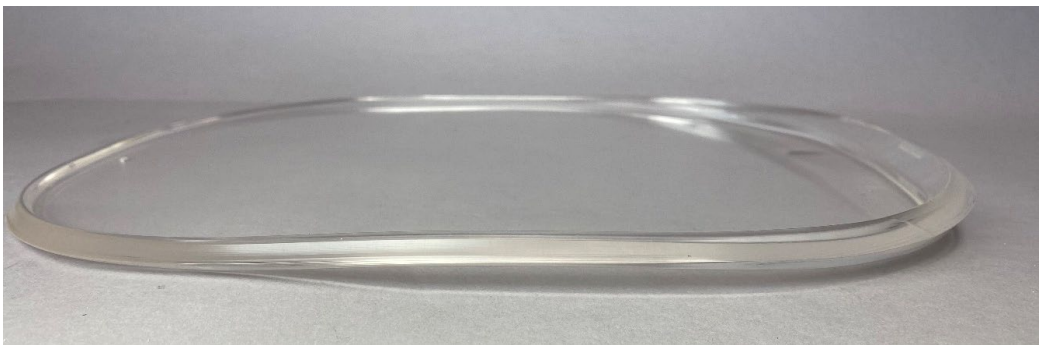

Figure 7

Inner pane showing plastic deformation around the entire perimeter

With the AAIB in attendance, the operator removed several cabin liners from the right side of the passenger cabin. This revealed additional thermal damage and window deformation in the area around the overwing emergency exit, but to a lesser extent than the left side of the aircraft.

Horizontal stabiliser

The underside of the left horizontal stabiliser leading edge panel was punctured. Small pieces of acrylic were found in the stabiliser when the panel was removed.

Cabin windows description

The outer surface of the cabin windows is flush with the outer surface of the fuselage. The windows consist of an inner pane, an outer pane and a seal. The panes are made from stretched acrylic. A vent hole through the inner pane lets cabin pressure into the space between the inner and outer panes.

The cabin windows are attached to the window frames using retainers, eyebolts and nuts (Figure 8).

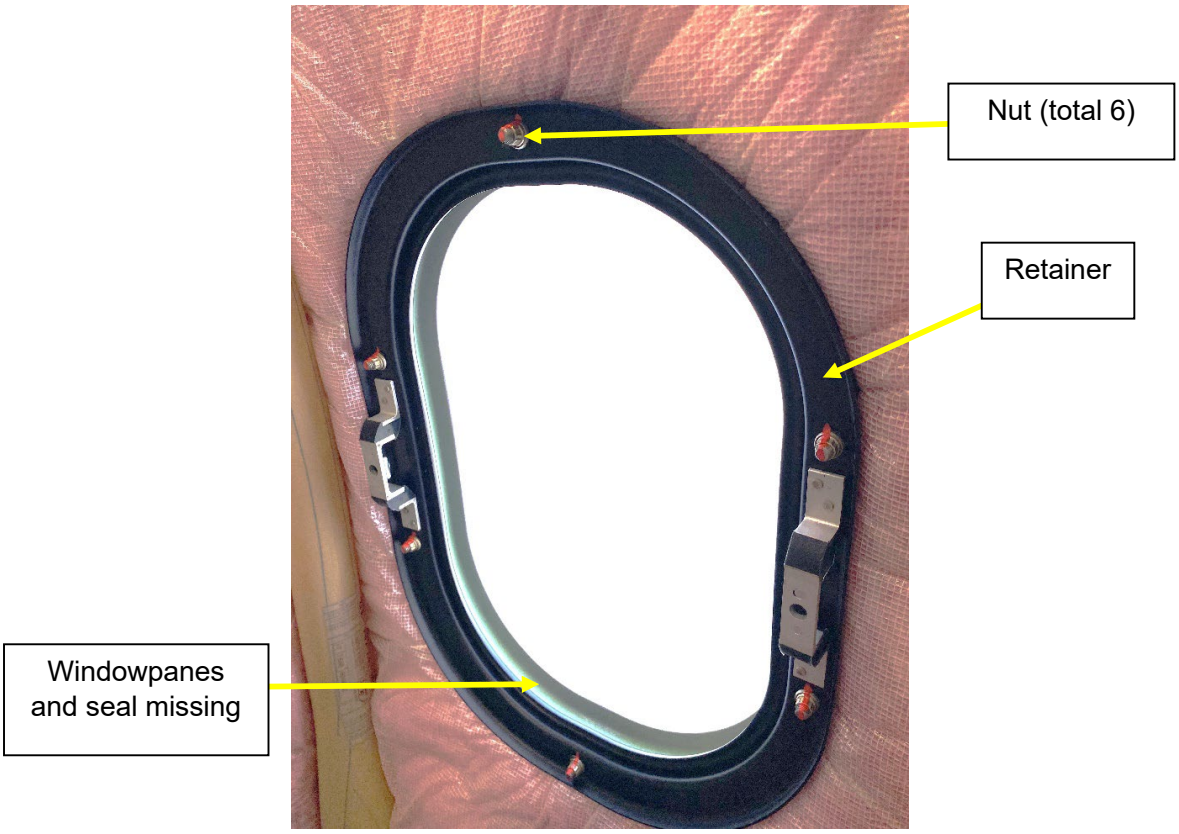

Figure 8

Correct installation of the retainer but the window assembly is missing

External lighting

Photographs of the filming showed that the lights were between approximately 6 and 9 m from the window areas where damage was apparent (Figure 9).

Image for illustration only – not to scale

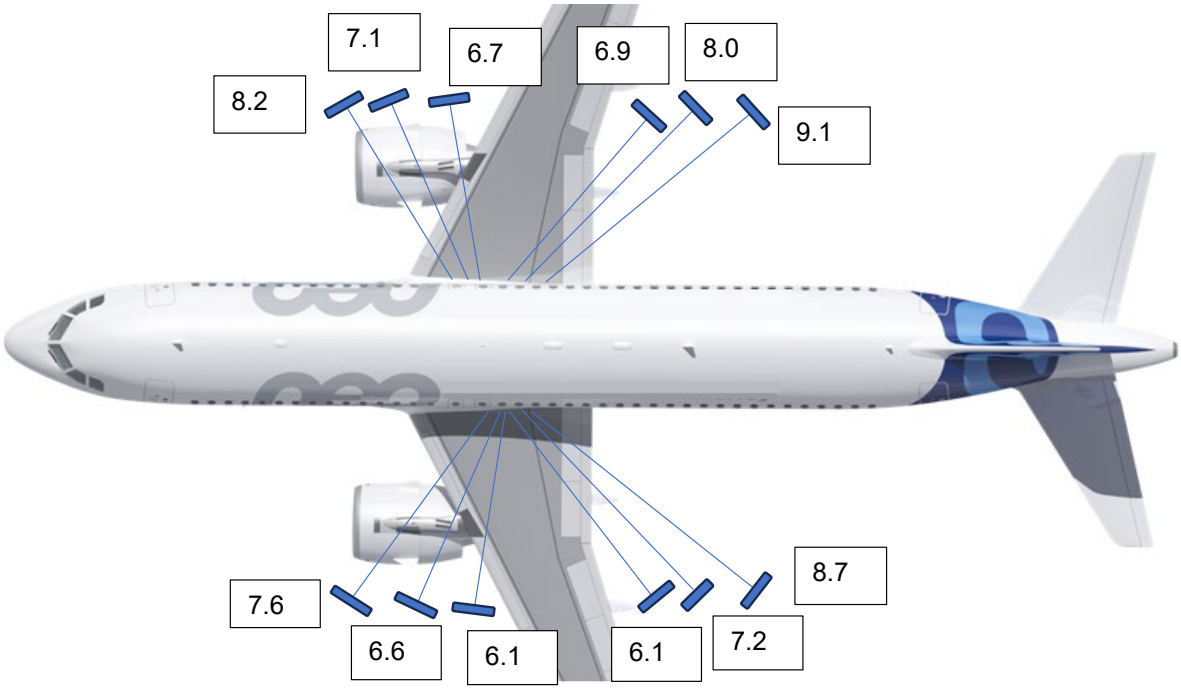

Figure 9

Approximate distance of the flood lights from the fuselage during the filming activity

The aircraft operator identified the flood lights as Maxibrute 12. An online datasheet[4] for these lights included the data at Table 1. The investigation has not yet established the reason for the specified minimum distance from the object to be illuminated.

Parameter	Value
Lighting capacity	12,000 Watts
Minimum distance from object to be illuminated	10 m
Minimum distance from a flammable object	1.5 m
Maximum surface temperature	200°C

Table 1

Data extracted from the flood light datasheet

[4] Maxibrute_12 (filmgear.net) [Last accessed 13 October 2023]

Observations

The windows appear to have sustained thermal damage and distortion because of elevated temperatures while illuminated for approximately four to five and a half hours during filming activity the day before the flight. It is likely that the flood lights were positioned closer than 10 m. Whereas in this case the damage became apparent at around FL100 and the flight was concluded uneventfully, a different level of damage by the same means might have resulted in more serious consequences, especially if window integrity was lost at higher differential pressure.

Further investigation

The AAIB investigation continues with the support of the BEA[5], the aircraft manufacturer, and the aircraft operator to understand how a similar occurrence can be prevented from occurring again.

Published 3 November 2023.

[5] Bureau d'enquêtes et d'analyses pour la sécurité de l'aviation civile, the French aviation safety investigation authority.