

Serious Incident

Aircraft Type and Registration:	Airbus A319-131, G-EUPS	
No & Type of Engines:	2 International Aero Engine V2522-A5 turbofan engines	
Year of Manufacture:	2000 (Serial no: 1338)	
Date & Time (UTC):	30 October 2025 at 1918 hrs	
Location:	In the climb after takeoff from Edinburgh Airport	
Type of Flight:	Commercial Air Transport	
Persons on Board:	Crew - 6	Passengers - 132
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Air Data Inertial Reference Unit temporary shock loading	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	47 years	
Commander's Flying Experience:	12,127 hours (of which 6,623 were on type) Last 90 days - 161 hours Last 28 days - 53 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and subsequent AAIB enquiries	

Synopsis

Shortly after takeoff from Edinburgh Airport, the Autopilot (AP) and Autothrust (A/THR) systems disconnected during the climb, followed by a loss of positional information from the Global Positioning Inertial Reference System (GPIRS). The flight crew initially declared a PAN and the flight continued to London Heathrow Airport using radar vectors. The flight crew were able to re-engage the AP and A/THR systems, but they disconnected again during the approach and a further rudder travel limiter system error immediately prior to landing necessitated a go-around. The aircraft subsequently landed safely.

The AP and A/THR disconnects and the loss of the GPIRS and rudder travel limiter systems were caused by severe drift of the aircraft's Inertial Reference System (IRS) due to vertical shock loads encountered during the takeoff roll at Edinburgh. The exact source of the shock loading was not determined but two larger sound impulses from the nose landing gear were captured by the Cockpit Voice Recorder (CVR). No damage or irregularity was found with the Air Data Inertial Reference Units (ADIRU) or the Nose Landing Gear (NLG).

Sensitivity of the ADIRUs to shock loading outside of their certification requirements is a known issue to the aircraft manufacturer. The runway at Edinburgh has since been fully resurfaced.

History of the flight

The aircraft was on a scheduled flight from Edinburgh Airport to London Heathrow Airport. Immediately prior to V_R during the takeoff roll on Runway 06 at Edinburgh, the Commander (PM) and co-pilot (PF) heard a “bang” from the nosewheel. About nine minutes after takeoff, and as the aircraft was climbing through FL220, the crew observed a GPS PRIMARY annunciation on the left Navigation Display (ND), followed shortly afterwards by a status message CAT 3 SINGLE ONLY, with CAT 3 DUAL listed as inoperative.

The crew checked the Multipurpose Control and Display Unit (MCDU)¹ position monitor page, where the Inertial Reference System (IRS) IRS 2 deviation value² displayed dashes, instead of a number. IRS 1 and IRS 3 both displayed a deviation value of 5.0 nm, increasing by approximately 0.1 per second, reaching a value of 28.0 nm. AP2, which was engaged after takeoff, then disengaged, so the PF engaged AP1 but this also disengaged after a few seconds, along with the A/THR system. There were no ECAM alerts, or any fault lights on the overhead panel.

The flight crew declared a PAN with ATC and levelled off the aircraft at FL320. They requested a radar heading and ATC informed that the flight was now non-RVSM³. Scottish Control requested the flight crew to squawk 7700 (later cancelled upon transfer to London Control) and to descend to FL290.

The System Display (SD) STATUS page displayed AP 1+2, A/THR and CAT 2⁴ as inoperative systems. The crew attempted to troubleshoot using the Flight Crew Operating Manual (FCOM) and Quick Reference Handbook (QRH), but none of the checklists exactly matched the information presented. The ‘NAV FM/GPS POS DISAGREE’ QRH checklist was consulted and the parameter for estimated accuracy was below the required accuracy, while the Flight Management Guidance Computer (FMGC) positions matched the GPIRS position. The flight crew attempted to confirm the aircraft’s position using a GPS waypoint, but ATC informed them that it was incorrect. They were able to confirm the aircraft’s position using VOR but there was a 5 nm discrepancy between the positions shown on the left and right NDs. The flight crew changed the ND to ROSE VOR and continued the flight to Heathrow on radar vectors.

During the descent, the STATUS page returned to normal and AP and A/THR became available, so the flight crew re-engaged AP2 and the A/THR. They briefed the intent to use available automation for as long as possible but planned to disengage the AP and A/THR when on the final approach, to avoid a workload increase if they disengaged again. They also briefed a go-around procedure.

Footnote

- ¹ The MCDU is the keyboard and screen used by the flight crew to interact with the flight management and guidance system.
 - ² The values show the difference in nautical miles of each IRS position from that computed by the flight management systems.
 - ³ RVSM (Reduced Vertical Separation Minima) allows aircraft to operate with reduced vertical separation. Among other requirements, the rules require a functional autopilot capable of holding altitude.
 - ⁴ Indicating a degraded landing category due to loss of AP and A/THR systems.
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When the aircraft reached 4,200 ft and was cleared to intercept the localiser, the AP and A/THR once again disengaged, so the flight crew continued the approach manually. At approximately 1,500 ft amsl an AUTO FLT RUD TRV LIM 1⁵ ECAM alert triggered. The flight crew were unable to complete the required ECAM actions by 1,000 ft and initiated a go-around as briefed. After levelling off, the ECAM alert self-cleared and the aircraft landed after a second uneventful approach. After landing, whilst parking on stand, a NAV IR 1 FAULT ECAM alert triggered, followed by a NAV IR 1 + 3 FAULT alert after parking.

Recorded information

Introduction

The aircraft's FDR and CVR were removed from the aircraft shortly after landing at Heathrow and subsequently replayed by the AAIB. The entire incident flight was available, with the CVR recording commencing as the flight crew prepared the aircraft for the flight to Heathrow.

Takeoff roll

The taxi out to the runway and initial takeoff roll appeared normal. As the aircraft accelerated along the runway, rhythmic sound pulses were recorded on the CVR cockpit area microphone (CAM), which were consistent with one of the NLG tyres contacting the runway centreline lights. As the aircraft reached a ground speed of about 118 kt (an airspeed of 128 KCAS), the amplitude of one of the sound impulses increased (Figure 1 and Figure 2 - Point A). This coincided with the aircraft's NLG squat switch (recorded at an update rate of four samples per second) starting to oscillate quickly back and forth between its GROUND and AIR indication. One second later (Figure 1 and Figure 2 - Point B), there was a further short duration sound impulse, which was of sufficient intensity to be captured by the CAM and the pilot's headset hot-microphones⁶. Less than one second after this, the aircraft's airspeed reached V_R and the PF applied aft stick, rotating the aircraft into the climb.

The recorded data from the FDR system's tri-axial accelerometer appeared normal during the takeoff. However, the triaxial accelerometer is installed near the aircraft's CG and accordingly accelerations occurring near the forward fuselage, such as those due to nosewheel contact with surface irregularities or centre line lights, may not be apparent.

Footnote

⁵ This alert is triggered when one rudder travel limitation actuator has failed.

⁶ Sounds from the headset microphones are recorded permanently by the CVR system, irrespective of audio settings such as use of the interphone or radios.

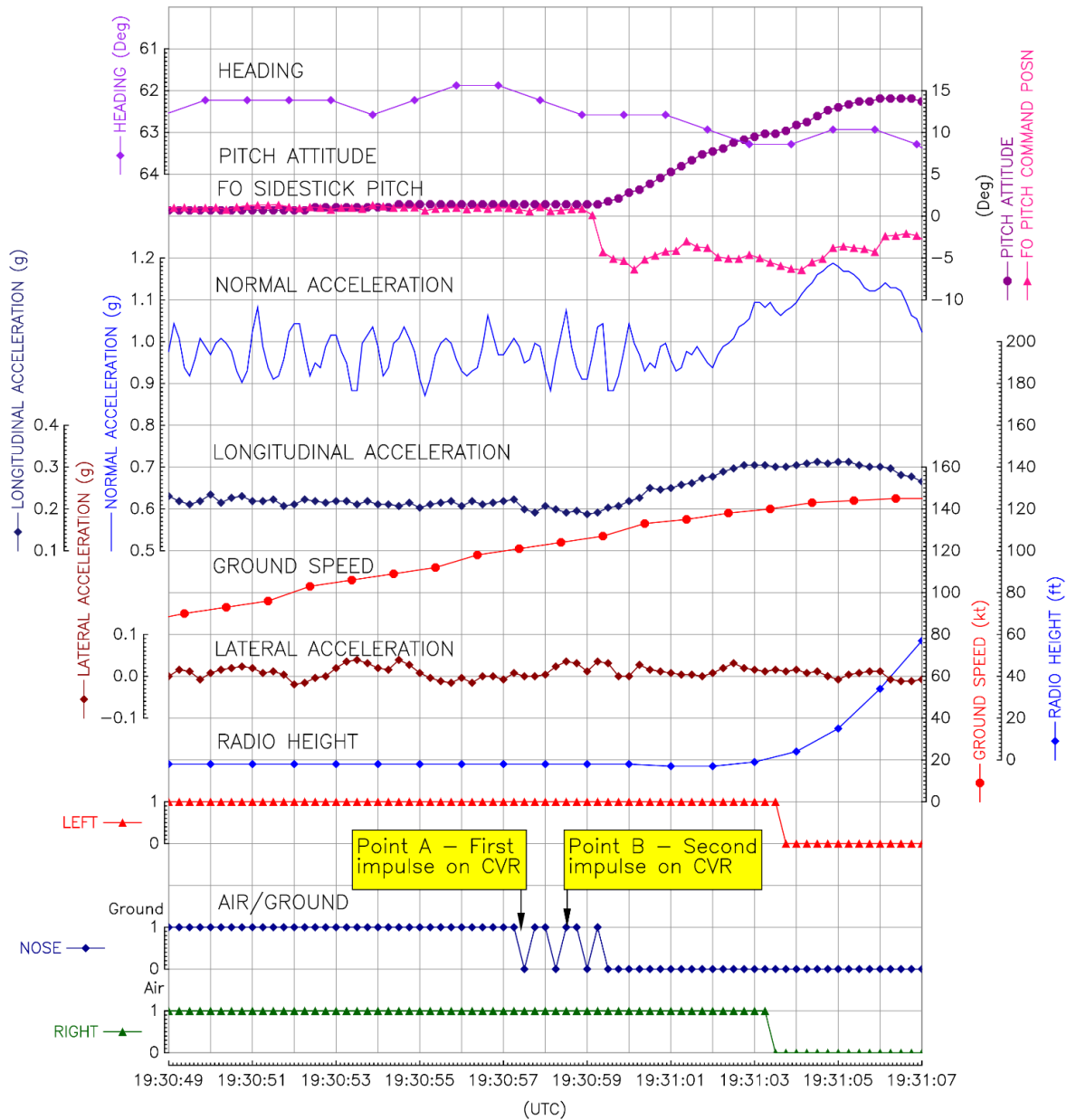
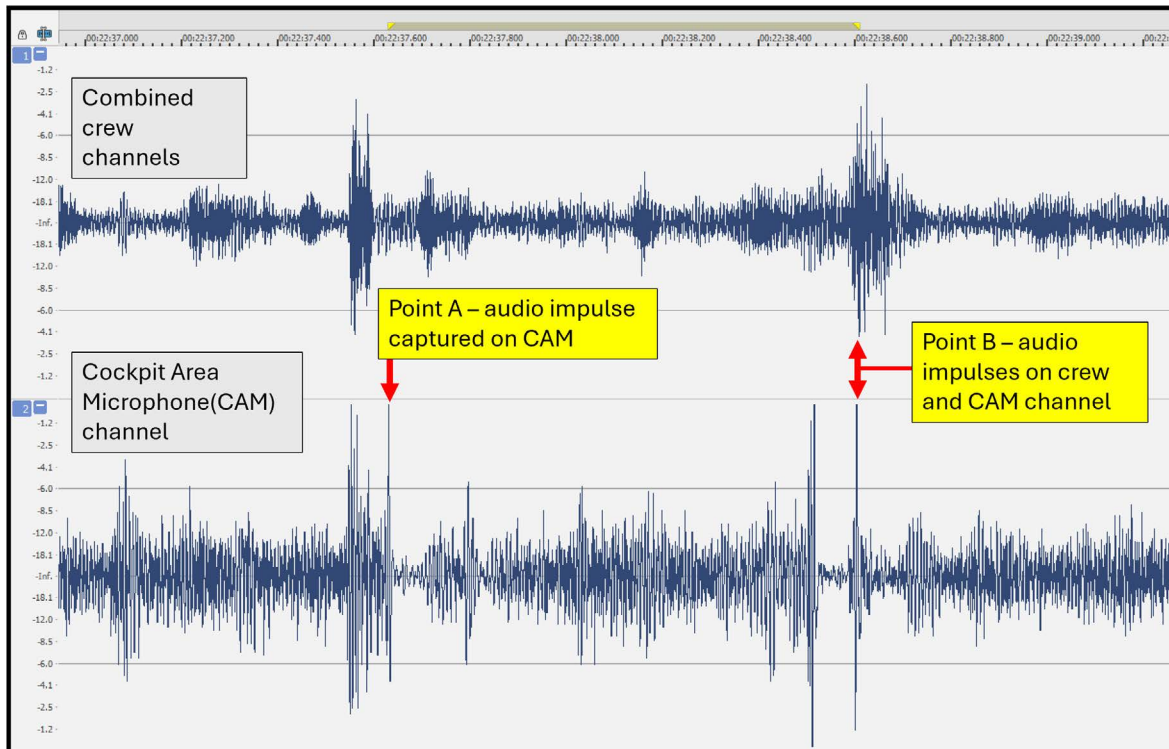


Figure 1
Relative timing of CVR sounds during takeoff roll

**Figure 2**

High amplitude sounds recorded on the CVR during takeoff

NLG air/ground indication

When uncompressed, the NLG shock absorber can extend to 44.9 cm (Figure 3 - dimension H). If the shock absorber extension is less than 44.1 cm, a proximity sensor indicates that the NLG is on the ground, and when the shock absorber extension is beyond 44.46 cm, the NLG is in the air position. Between 44.1 and 44.46 cm, the shock absorber is referred to as being within a transition zone, whereby it is possible that the indication could be either air or ground.

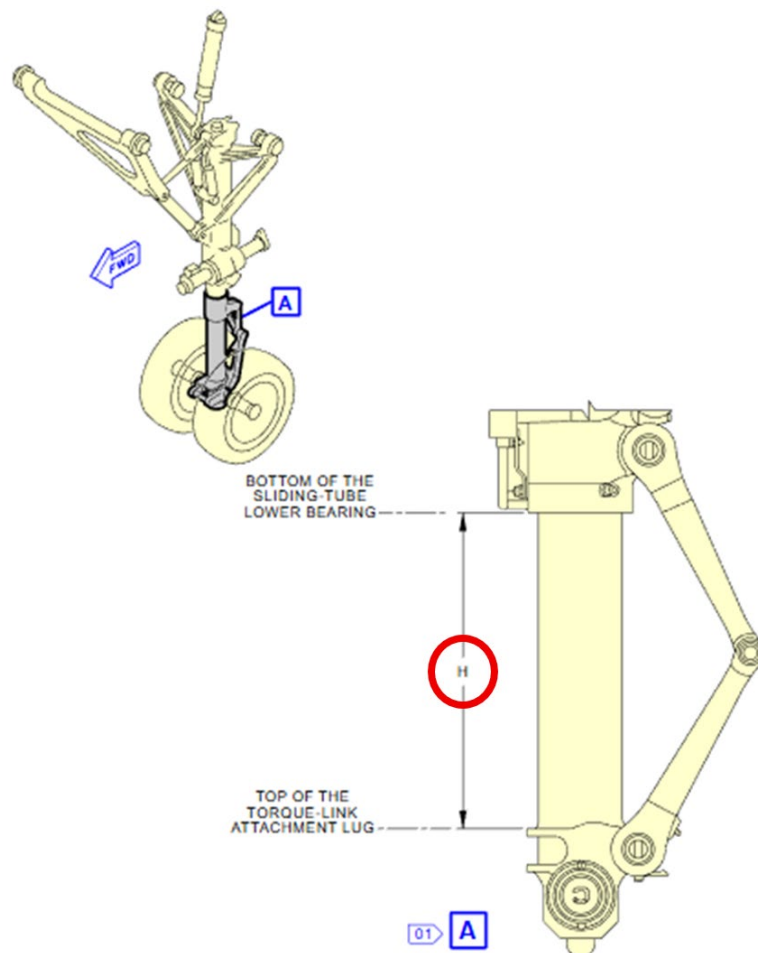


Figure 3
NLG shock absorber

Approximate runway position of sound impulse

Figure 4 shows the approximate area of the runway where the second sound impulse was recorded by the CVR.

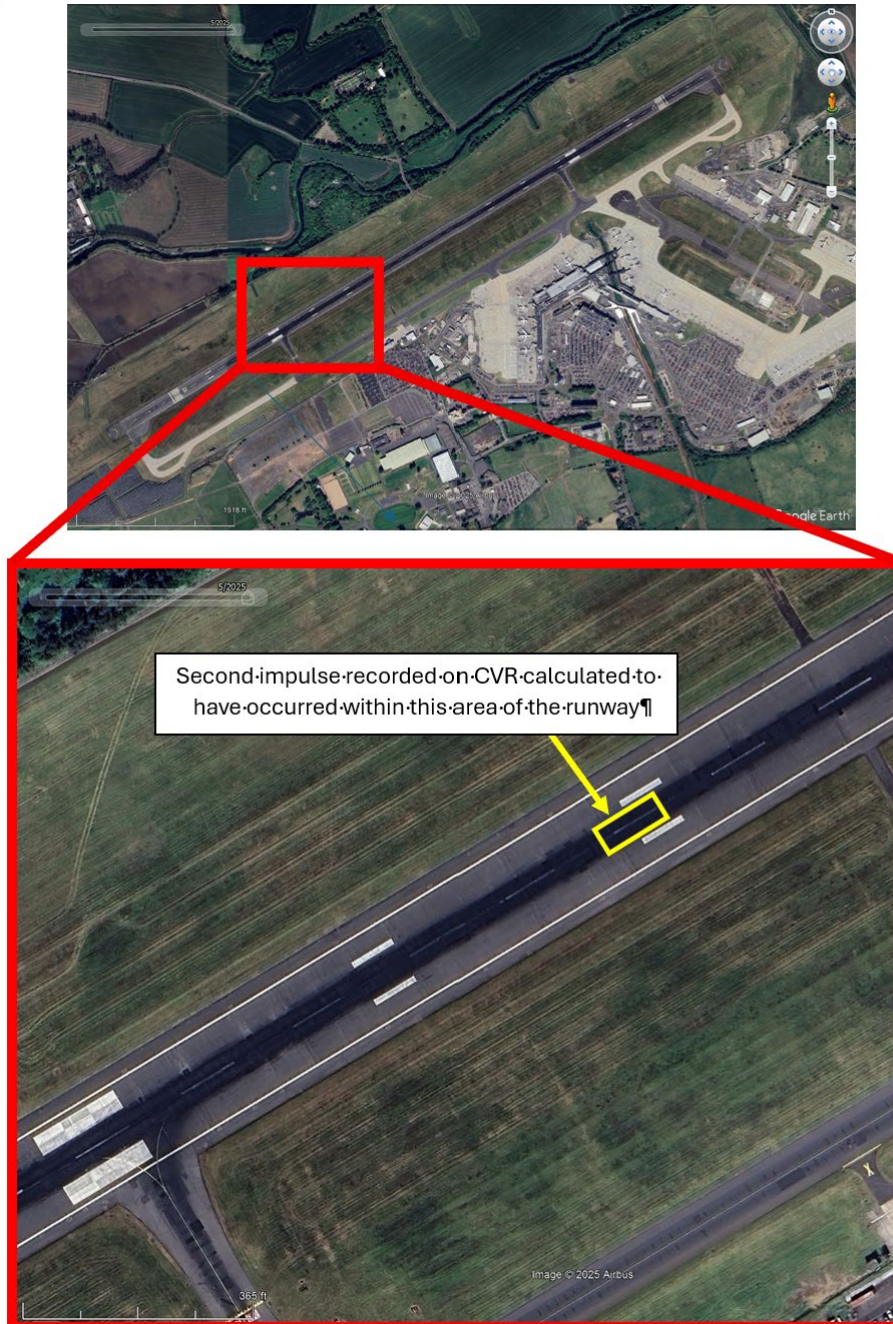


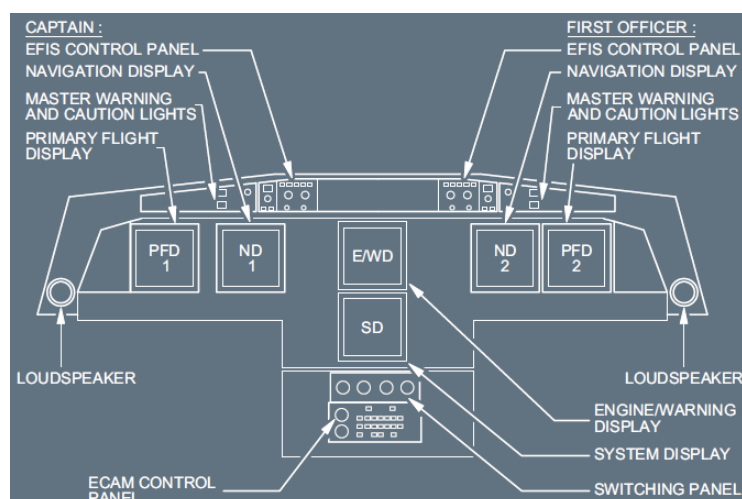
Figure 4

Approximate area of runway when second CVR sound impulse occurred

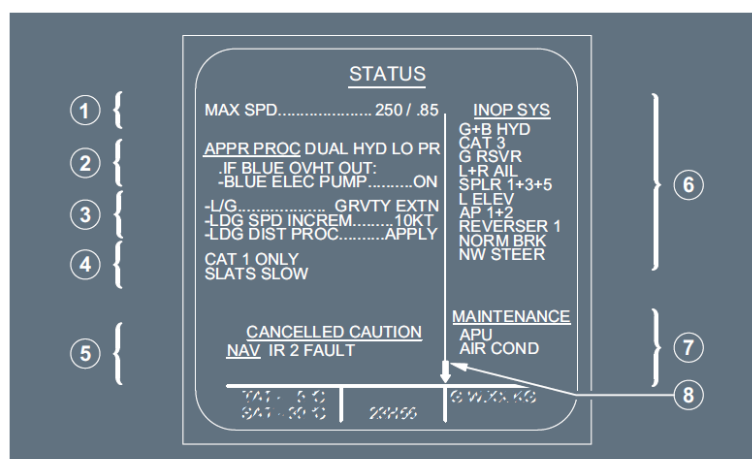
Aircraft information

Flight deck panel arrangement

Figure 5 shows the arrangement and naming of A319 flight deck panels, and Figure 6 shows an example of information shown on the Status Display (SD) panel. The STATUS page displays an operational summary of the state of the aircraft.

**Figure 5**

Flight deck panel arrangement (from FCOM)



- (1) Limitations (speed, flight level): Blue
- (2) Approach procedures: White (Red) (Amber)
- (3) Procedures (corrections to apply for landing): Blue
- (4) Information: Green
- (5) Cancelled caution: White
- (6) Inoperative system: Amber
- (7) Maintenance status: White
- (8) The arrow appears if the data on the STATUS page overflows the left or right area of the page.
The flight crew can press the CLR pb, in order to scroll the display to view the overflow.

Figure 6

SD panel example display (from FCOM)

Air Data and Inertial Reference System (ADIRS)

The ADIRS comprises three identical ADIRUs which supply data parameters for central aircraft control systems. The ADIRU units fitted to G-EUPS are manufactured by Northrop Grumman Company (NGC) and are within the part number (PN) series PN 465020-030x-0316/318.

The units are fitted to an avionics rack located immediately aft and above the NLG bay. Each ADIRU is divided into Air Data Reference (ADR) and Inertial Reference (IR) sections that can work independently of each other. The data parameters provided by each section are:

- **ADR:** Barometric altitude, airspeed, Mach, angle of attack, temperature and overspeed warnings.
- **IR:** Attitude, flight path vector, track, heading, accelerations, angular rates, ground speed and aircraft position.

Data from the ADIRUs is supplied to the FMGC and the Flight Augmentation Computer (FAC) for further processing and subsequent use by the Flight Management (FM) and Flight Guidance (FG) systems. The FM uses ADIRU data to control navigation, and the FG uses ADIRU data to control AP, flight director, and A/THR. Data from the FAC is used to control the rudder, rudder trim and yaw damper functions.

The ADIRS control panel located on the overhead panel allows for selection of modes (NAV, ATT, OFF) and indications of failures. System messages and warnings are displayed on the SD panel, and system status can be found via the MCDU system information pages.

IRS Faults

The FMGC and FAC compare and monitor the output from all three IRs to identify any discrepancies. If the parameter from one IR exceeds the allowable error threshold, it is disregarded. The rudder travel limiter system becomes unavailable when only one IR remains valid, or when all three IRs are rejected.

Aircraft examination

The operator's maintenance team conducted troubleshooting activities following the flight. The post-flight report contained the following fault messages:

- ADIRU 1/2/3 DISAGREE.
- ADIRU 1+2+3 (1FP1+2FP2+3FP3)/BSCU(10GG).
- FAC1/RTL ACTR 4CC.

Aircraft manufacturer maintenance action Troubleshooting Manual (TSM) 32-42-00-810-963-A '*Loss of the ADIRU Buses that Supply the BSCU*'⁷ was actioned to address the fault messages, including a BITE⁸ test of IR1, IR2 and IR3. This was completed, with no fault found.

Footnote

⁷ BSCU refers to the aircraft's Braking and Steering Control Unit.

⁸ BITE (Built-in Test Equipment) facilitates interrogation of aircraft system integrity.

The NLG was inspected using the following procedures which were completed satisfactorily, with no findings:

- TSM 32-20-00-810-802-A '*Vibrations Felt on the NLG during Take-Off and Lift-Off Phases*'.
- General Visual Inspection of NLG in accordance with Aircraft Maintenance Manual (AMM) 32-21-00-200-002-A.
- NLG Shock Absorber Charge Pressure Check IAW AMM 12-14-32-614-004-A.

The instructions in aircraft manufacturer Technical Follow-Up Notice '*In-flight severe IR drift with ADIRU NGC PN 465020-030x-0316/318 inducing possible loss of AP/FD and ATHR*' were followed.

Aircraft performance

Each FMGC computes its own landing category⁹: CAT1, CAT2, CAT3 single, and CAT3 DUAL, and displays the corresponding landing category on the FMAs. Each category depends upon the availability of aircraft systems and functions, for example the number of AP systems available and A/THR system. When the landing capability downgrades, a triple click aural warning is activated.

Aerodrome information

The runway was inspected the same day by the Edinburgh airport operations team in the area where it was calculated the aircraft experienced the shock load. Details of the surface condition and previous repairs were provided to the investigation. The runway surface had multiple repair patches along its length, with several on or near the centreline, in the area just before where the aircraft was calculated to have rotated. One repair patch was identified by the operations team to have developed an abnormal surface condition in comparison with its previous inspection and was subsequently replaced. However, its location was offset from the centreline and it is unlikely the nosewheels travelled over the degraded area. Planned resurfacing of the entire runway commenced in November 2025 and was completed during April 2026.

Previous occurrences

The AAIB investigated a previous similar occurrence on an A319 from the same operator in 2021¹⁰, also at Edinburgh, where an uneven runway patch repair was thought to be causal. The patch was subsequently replaced.

Footnote

⁹ Landing categories specify the parameters within which suitably-approved aircraft can make low visibility landings following a precision approach, in accordance with specified decision heights and runway visual ranges. <https://www.caa.co.uk/commercial-industry/aircraft/operations/types-of-operation/all-weather-operations/> [accessed 5 May 2026].

¹⁰ AAIB Report AAIB-27579 Airbus A319-131 G-DBCF https://assets.publishing.service.gov.uk/media/629f518c8fa8f5039a1bd719/Airbus_A319-131_G-DBCF_07-22.pdf [accessed 9 January 2026].

That investigation discovered there had been five other similar incidents occurring on aircraft fitted with NGC ADIRUs of part number series PN 465020-030x-0316/318. All were determined to have resulted from the ADIRUs suffering vertical shock loads which were outside of the qualification standard requirements.

Safety actions resulting from the previous occurrence investigated by the AAIB, focused on servicing of the NLG, including design and introduction of a Liquid and Nitrogen Charge Equipment (LANCE) servicing tool, and an amendment to the AMM regarding the maintenance check of the NLG shock absorber. At the time of publication, the LANCE tool has not yet completed qualification for operator use but is expected to be in service during 2026. An aircraft manufacturer's Technical Follow-Up notice was also issued¹¹ to inform operators maintenance teams of IR drift issues and how to investigate occurrences. This was followed on G-EUPS, as part of the troubleshooting activity by the operator.

Information from the aircraft manufacturer indicated that there had been seven further similar incidents across the worldwide fleet since 2021.

Analysis

The aircraft suffered a severe IR drift event in flight, which provided erroneous data parameters to the FAC, the FM and FG systems. This caused the AP and A/THR systems to disengage on multiple occasions, a loss of positional information, and unavailability of the rudder travel limiter system. The events were successfully managed by the flight crew, and the aircraft continued to its planned destination.

Post-flight troubleshooting and inspection showed that the NLG extension and condition was found to be satisfactory, and the ADIRUs were serviceable.

The aircraft's NLG ran over several runway centreline lights plus another larger irregularity on the runway surface, immediately prior to rotation. The NLG squat switch fluctuated between the AIR/GROUND positions several times during this period, indicating that vertical loads transferred into the NLG were sufficiently high for the NLG leg to decompress past the 44.1 cm extension required for GROUND indication, and up to, or in excess of, the 44.9 cm extension required for air indication.

Resulting vertical shock loading was transmitted from the NLG into the airframe and avionics rack housing the ADIRUs. It could not be established from the data available whether a single load or a series of loads in quick succession, resulted in a force that was likely outside of the ADIRU's operating qualification standard requirements.

Similar previous occurrences have shown this ADIRU to be sensitive to large vertical acceleration forces; units within the part number series PN 465020-030x-0316/318 have not been fitted to new aircraft since 2015 and the issue is known to the aircraft manufacturer. Since the shock loads encountered are considered to be outside of the certification standards

Footnote

¹¹ 'In-flight severe IR drift with ADIRU NGC PN 465020-030x-0316/318 inducing possible loss of AP/FD and ATHR' issued April 2020.

required of the ADIRU, and the NLG had been serviced in accordance with the AMM, no further manufacturer action has been taken.

The runway surface was inspected, with no singular irregularity appearing capable of causing the shock load. Full runway resurfacing at Edinburgh will minimise the probability of surface irregularities affecting other aircraft.

Conclusion

A shock load was transferred from the nose landing gear to the Air Data Inertial Reference Units, when the aircraft ran over several runway centreline lights and a runway surface irregularity. This resulted in an inertial reference drift causing loss of positional information, autothrust, autopilot and rudder travel limiter systems. Inertial reference drift is a known issue with the model of Air Data Inertial Reference Unit fitted to G-EUPS, when experiencing shock loading outside of its certification requirements. The runway has since been resurfaced.