



## Summary Report

A summary investigation, in accordance with article 45 of the Ordinance on the Safety Investigation of Transport Incidents of 17 December 2014 (OSITI), status as of 1 February 2015 (SR 742.161) was carried out regarding the following serious incident. This report was established to ensure that lessons can be learned from the incident in question.

<b>Aircraft</b>	Airbus A320-232	G-EUUW		
<b>Operator</b>	British Airways PLC, Waterside (HCA3), PO BOX 365 Harmondsworth, West Drayton, UB7 0GB			
<b>Owner</b>	British Airways PLC, Waterside (HCA3), PO BOX 365 Harmondsworth, West Drayton, UB7 0GB			
<b>Commander</b>	British citizen, born 1977			
<b>Licence</b>	Airline Transport Pilot Licence Aeroplane (ATPL(A)) according to the International Civil Aviation Organization (ICAO), issued by the United Kingdom Civil Aviation Authority.			
<b>Flight hours</b>	<b>total</b>	8152 h	<b>during the last 90 days</b>	188 h
	<b>on the incident type</b>	7265 h	<b>during the last 90 days</b>	188 h
<b>First officer</b>	British citizen, born 1988			
<b>Licence</b>	ATPL(A) according to ICAO, issued by the United Kingdom Civil Aviation Authority.			
<b>Flight hours</b>	<b>total</b>	2923 h	<b>during the last 90 days</b>	216 h
	<b>on the incident type</b>	1782 h	<b>during the last 90 days</b>	216 h
<b>Location</b>	20 NM northwest of Geneva Airport (LSGG)			
<b>Coordinates</b>	N 46.522385 / E 5.86268	<b>Altitude</b>	Flight Level (FL) 174	
<b>Date and time</b>	30 December 2017, 11:27:45 UTC <sup>1</sup> (LT <sup>2</sup> = UTC + 1 h)			
<b>Type of operation</b>	Scheduled			
<b>Flight rules</b>	Instrument Flight Rules (IFR)			
<b>Point of departure</b>	London Heathrow (EGLL), United Kingdom			
<b>Point of destination</b>	Geneva (LSGG), Switzerland			
<b>Flight phase</b>	Descent			
<b>Type of incident</b>	Failure of more than one system in a redundancy system mandatory for flight guidance and navigation			
<b>Injuries to persons</b>	<b>Crew</b>	<b>Passengers</b>	<b>Third persons</b>	
	Minor	0	0	0
	None	7	141	-
<b>Damage to aircraft</b>	Not damaged			
<b>Other damage</b>	None			

<sup>1</sup> UTC: *universal time coordinated*

<sup>2</sup> LT: *local time*

## Factual information

### General

The Digital Flight Data Recorder (DFDR) was removed after the flight. The data could be read and was available to the investigation. The Cockpit Voice Recorder (CVR) was left on the aircraft and the respective recording was not available to the investigation.

The following additional sources were available to the investigation:

- The operator's incident report;
- The Air Traffic Control (ATC) report, radio communication and respective radar plot;
- The aircraft manufacturer report, titled „Loss of Yaw Damper System“;
- The data from the quick access recorder (QAR);
- The failure messages on the post flight report (PFR).

### History of the flight

On 30 December 2017, the Airbus aircraft A320-232, registered as G-EUUW and operated by British Airways (BA), was under flight number BA728 and call sign „Speedbird 728“ on a scheduled flight from London Heathrow (EGLL) to Geneva (LSGG) airport. 2 pilots, 5 cabin crew members and 141 passengers were on board.

The aircraft started its descent from cruising Flight Level (FL) 290 towards FL 230 at 11:14:50 UTC. At that time the aircraft was about 50 NM west of Dijon. At 11:17:58 UTC the aircraft levelled off at FL 230 with an indicated airspeed of 300 kt. Two minutes later the flight crew selected a speed of 240 kt. At 11:22:25 UTC the flight crew continued further with their descent. According to the operator's report, the aircraft encountered icing conditions and a build-up of moderate icing was noticed by the flight crew while descending through FL 200. According to the recorded data, both engine and wing anti icing were switched on when leaving FL 230 with a selected airspeed of 230 kt.

The aircraft was descending through FL 190 when the flight crew called Geneva's Air Traffic Control Officer (ATCO) at 11:26:37 UTC on the approach frequency 136.25 MHz, telling him they were descending to FL 160 in a right turn towards the waypoint SOVAD (cf. annex 1). The ATCO confirmed radar contact and cleared the flight to FL 130 with the information that the flight crew could expect radar vectoring to runway 23. Immediately afterwards, the flight crew – according to the operator's report – reported severe vibrations and noise when passing FL 180, followed by multiple system failures.

The flight data show that at 11:27:45 UTC, crossing FL 174 with an airspeed of 229 kt, the active Autopilot (AP) 2, Autothrust (A/THR) and both Flight Directors (FD) disengaged, and the fly-by-wire flight control system reverted to alternate law. The AP disconnection master warning was triggered, and the AUTO FLT YAW DAMPER SYS amber caution was displayed on the ECAM<sup>3</sup>.

At the same time the flight crew called the ATCO and asked for a „*more quickly descent*“. The ATCO did not understand since the request was drowned out by a „cavalry charge“<sup>4</sup> aural warning. The flight crew had to repeat the request, thereupon the ATCO cleared the flight to FL 100. The aircraft then descended with a maximum rate of descent of 3300 ft/min at FL 160.

At 11:28:29 UTC the ATCO advised the flight crew to turn left on heading (HDG) 125 in order to position the aircraft for a left hand downwind. The flight crew acknowledged the instruction

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<sup>3</sup> ECAM: The Electronic Centralized Aircraft Monitoring presents data on the Engine/Warning Display (EWD and System Display (SD). It triggers alerts detected by the aircraft sensors and provides the flight crew with electronic procedures, limitations, information on inoperative systems and various aircraft status information, the underlined part in the title refers to the main system affected, e.g. AUTO FLT.

<sup>4</sup> The cavalry charge is an aural warning that sounds if the AP is manually or automatically disengaged.

and turned left. One minute later the flight crew called the ATCO and informed him that they had some flight control problems and that they requested radar vectors but did not want to start the approach yet. The aircraft was descending through FL 145 with a decreasing speed of 272 kt. The flight crew had in the meantime selected an airspeed of 270 kt. The ATCO acknowledged this message and asked whether they would like to join the holding over the radio beacon SPR, but the flight crew requested further radar vectors. The ATCO continued radar vectoring and told them to report ready for approach.

After further deliberations the flight crew informed the ATCO at 11:33:59 UTC that they were still not ready for the approach and requested to stay under radar vectoring and to maintain FL 110. Thereupon the ATCO advised the flight crew to turn left on HDG 250.

It can be assumed that in the meantime the flight crew had started the checklist related to the ECAM message (cf. annex 4) because the Flight Augmentation Computer 1 (FAC 1) was successfully reset at 11:35:35 UTC. Following the successful reset, normal law was recovered, and the flight crew regained A/THR and Flight Director 1 (FD1) but neither AP 1 nor AP 2 were available. In addition, the ECAM E/WD AUTO FLT YAW DAMPER SYS amber caution was replaced by the AUTO FLT YAW DAMP 2 amber caution (cf. annex 2).

After a frequency change to GVA final, the crew sent the following urgency call at 11:36:03 UTC: „Speedbird 728 Pan-Pan Pan-Pan we are just turning onto a heading of 250 degrees, maintaining flight level 110, standby for our intentions”. Three minutes later the flight crew advised that they were now able to join a holding pattern. Subsequently, the ATC cleared BA728 to hold over SOVAD (cf. annex 1). Attempts to re-engage AP1 were recorded at 11:36:28 and 11:37:09 UTC.

At 11:39:27 UTC the ATCO enquired about the reason for the urgency message. The flight crew answered with „flight control system failures”. The aircraft entered the SOVAD holding pattern at 11:41:52 UTC with an airspeed of 250 kt. The ATCO asked the flight crew to relay the number of souls on board and whether they had any dangerous goods on board.

At 11:46:01 UTC the flight crew informed the ATCO that they had lost their autopilots and requested to stay in the holding for another 10 minutes before commencing an approach. They then confirmed that no dangerous goods were on board.

At 11:51:16 UTC the flight crew reported „ready for approach”. The ATCO provided radar vectors to the instrument landing system (ILS) runway 23 and, approximately one minute later, cleared the flight to descend to 7000 ft on QNH<sup>5</sup> 1015. He then requested once more from the flight crew the number of souls on board and the latter answered with 148.

When receiving the approach clearance to runway 23 at 11:54:54 UTC, the aircraft was passing an altitude of 8800 ft with a speed of 207 kt. At 11:56:19 UTC the flight crew reported „established on runway 23” and, after having changed to the tower frequency, received the landing clearance at 12:03:07 UTC.

After an ILS approach flown manually, the aircraft touched down at 12:05:43 UTC. The aircraft taxied under own power to the given parking stand and the passengers disembarked normally.

### Meteorological information

South of an intense low-pressure system over Iceland, a wide area of westerly wind was blowing from the East Atlantic to the center of Europe. During descent, the aircraft flew through the clouds of a warm front that extended from the Jura to the Netherlands.

In the period from 11:50 UTC up to the time of the landing, the following Aerodrome Meteorological Report (METAR) was valid for Geneva Airport:

„LSGG 301150Z VRB02KT 9999 -RA FEW005 BKN030 OVC060 07/06 Q1015 NOSIG=”

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<sup>5</sup> QNH: pressure reduced to sea level based on the values of ICAO standard atmosphere

In plain language, this means:

Wind	variable 2 knots
Meteorological visibility	10 km or more
Weather	light rain
Clouds	1-2/8 clouds at 500 ft, 5-7/8 clouds at 3000 ft, 8/8 clouds at 6000 ft above ground.
Temperature, dewpoint	7 °C / 6 °C
Atmospheric pressure (QNH)	1015 hPa, pressure reduced to sea level, calculated using the values of the ICAO standard atmosphere.
Landing weather forecast	No significant change expected

### Information about the yaw damper system

In the following description, only the items that are relevant to the serious incident are described. The description is based on the Flight Crew Operating Manual (FCOM) published by the aircraft manufacturer.

The aircraft has two Flight Augmentation Computers (FAC) that perform four main functions, one of them is the yaw function. Yaw damping stabilizes the aircraft in yaw and ensures turn coordination. If the Autopilot (AP) is engaged after takeoff and during a go around, the system assists the pilot with lateral control of the aircraft after an engine failure.

Each FAC interacts with the Elevator Aileron Computers (ELAC) when the AP is disengaged, or with the Flight Management Guidance System (FMGS) when at least one AP is engaged. If both FACs are functioning normally, FAC 1 controls the yaw damper, turn coordination, rudder trim and rudder travel limit and FAC 2 is in standby mode. If a failure is detected on any channel of FAC 1, FAC 2 takes over the corresponding channel.

Since yaw rate and lateral acceleration inputs are required for the yaw damper functions, the Inertial Reference System (IR), as part of the ADIRS<sup>6</sup>, provide crucial information to the FAC computers for flight envelope and speed computations.

Some IR parameters are therefore monitored by the FAC and others by the Flight Management and Guidance Computer (FMGC). The computers acquire parameters from the 3 IRs. When a parameter provided by an IR is different to a voted value among all 3 IRs, the corresponding IR is rejected by the monitoring system. This also occurs when an IR parameter value differs from the same parameter originating from the other two sources. Finally, if IR own side and IR 3, that are monitored by the Sign Status Matrix (SSM) have an invalid SSM status, the corresponding IR is also rejected by the monitoring system.

If either FAC 1 or FAC 2 rejects only one IR, there are no consequences regarding the functionality of the AP, A/THR and FD systems.

When two IRs are rejected by either FAC 1 or FAC 2 (IR own side or IR 3 available), A/THR and both FD are not affected but both APs are no longer available. Indeed both APs are available only if each FAC has 2 IRS valid and consistent. The FCOM however, does not mention the fact that both APs are lost in case of a single failure of the yaw damper system (YAW DAMPER 1(2)).

If a FAC 1(2) rejects IR own side and IR 3, the respective yaw damper is lost as well. As a result, the ECAM caution AUTO FLT YAW DAMPER 1(2) will be displayed. In such a case, the pilot can try to reset the affected FAC by means of a pushbutton on the flight control overhead panel. It is important to note that the information displayed on the status page is incomplete in case of loss yaw damper due to IRs rejections because it only shows CAT 3 Dual and

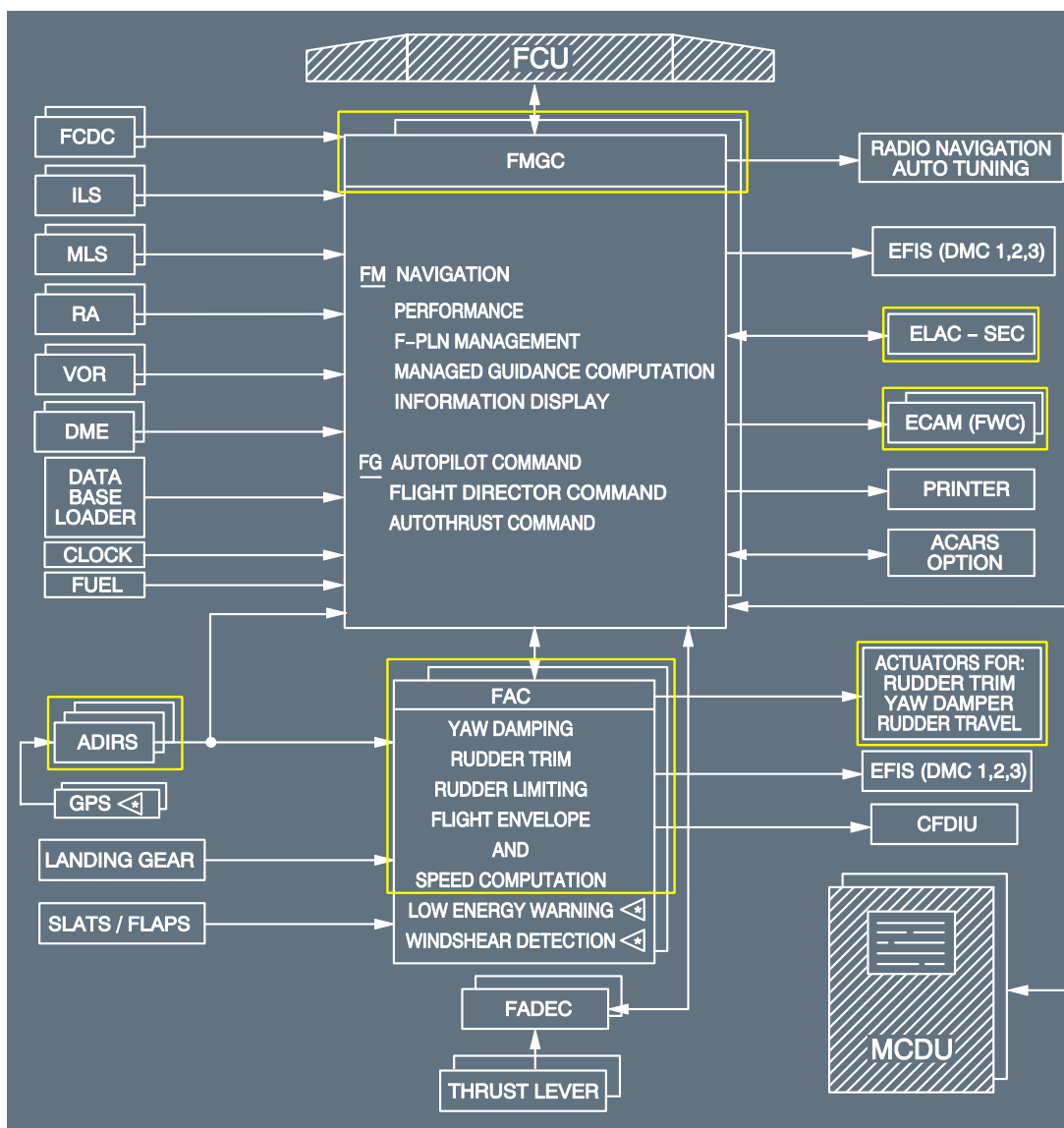
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<sup>6</sup> ADIRS: Air Data and Inertial Reference System

yaw damper 1(2) as inoperative and displays the incorrect information that the approach capability is CAT 3 SINGLE ONLY<sup>7</sup>, since it is not possible to perform such an approach without an AP (cf. annex 2). In addition it has to be mentioned that other failure cases can also lead to a yaw damper fault such as an actuator failure but nevertheless the AP would remain available.

Resetting a FAC is mentioned in the FCOM as follows: „The pilot can disengage or reset each FAC (in case of failure) by means of a pushbutton on the flight control overhead panel” (FCOM page DSC-22\_40-10 P 1/2). Furthermore, the reset procedure is also published in the resetting table of the Quick Reference Handbook (QRH) in case of an AUTO FLT YAW DAMPER 1(2) FAULT (cf. annex 3).

If both FAC reject 2 IR (IR own side and IR 3) or even all 3 IR as was the case during this serious incident, the yaw damper function is lost, the flight control system reverts to alternate law, the flight envelope protections are lost and the ECAM caution AUTO FLT YAW DAMPER SYS is displayed. The AP, A/THR and FD functions are therefore no longer available with both FMGC. To deal with this ECAM caution, the respective procedure, also published in the FCOM, has to be executed (cf. annex 4).



**Figure 1:** System interface diagram (Copy from FCOM DSC-22\_10-20 P 2/2). The above-mentioned components are framed in yellow.

<sup>7</sup> Automated landing capability without redundancy (fail passive) requiring a Decision Height (DH) not lower than 50 ft and a Runway Visual Range (RVR) not less than 200 m or visibility not less than 800 m.

## Analysis

### Technical aspects

The DFDR data and the failure messages of the Post Flight Report (PFR) show that the yaw damper function was lost in both FAC at 11:27:45 UTC, resulting in the disengagement of the autopilot active at the time of the failure (AP 2), Autothrust (A/THR) and both Flight Directors (FD) and the reversion of the flight controls system to alternate law. The master caution was triggered, and the AUTO FLT YAW DAMPER SYS message was displayed on the ECAM.

The loss of the yaw damper function can occur when the FAC rejects its own IR and IR 3 (cf. chapter „Information about the yaw damper system“). The QAR data show that none of the 3 IR registered any faults. Additionally, the manufacturer analysed the BITE<sup>8</sup> data from the FACs and confirmed that each FAC rejected all 3 IR. Furthermore, no other rejections were recorded previously, indicating that the IR rejections occurred simultaneously and not sequentially.

As outlined above, the FAC can reject an IR due to yaw rate or lateral body accelerations. The DFDR data do not show any significant yaw rate change but it shows a significant lateral body acceleration at the time the rejections occurred. Since the parameters are sampled only once per second, the frequency and the maximum acceleration cannot be deducted. However, it can be assumed that the IRs were rejected due to these lateral body accelerations.

According to the checklist (cf. annex 4), FAC 1 and FAC 2 should be reset by pushing the respective push button „off then on“. The reset unlatches the faults and resets the monitoring function, thus recovering the yaw damper function, FD and A/THR related to the respective FAC, provided the fault does not exist anymore. This happened, when the flight crew successfully cycled the FAC 1 push button. It also means, that at least 2 IR were valid again.

After the successful reset of FAC 1, the status of the auto flight system was now similar to a rejection in FAC 2 of IR 2 and 3, or of all 3 IRs and therefore the ECAM display changed to AUTO FLIGHT YAW DAMPER 2. Even if this new ECAM display does not explicitly require a FAC reset, based on the actual situation, a reset of FAC 2 would have been the next logical step.

Based on the analysed BITE data from both FACs, a reset of FAC 2 would have been in all probability successful. Although the operator's report states that the flight crew did attempt the reset without success, there is no evidence of FAC 2 having been reset. Cycling a FAC push button generates a push button switch message in the PFR; this was the case for FAC 1 but not for FAC 2.

### Operational aspects

According to the operator's report, the flight crew encountered moderated icing conditions when descending through FL 200. They switched on the engine and wing anti-ice systems when leaving FL 230 and selected a lower airspeed. It can be assumed that this was done as a precautionary measure in order to fly at the appropriate speed when entering the expected turbulence zone. This was adapted to the situation and a safety-conscious decision.

The DFDR data show that the flight crew made a FAC 1 reset at 11:35:35 UTC, 8 minutes after the master caution was displayed. It can be assumed that this reset was performed according to the first action point of the respective ECAM checklist (cf. annex 4). In the absence of the CVR recording it remains unclear as to why the flight crew delayed the application of the first action of the checklist.

The reset of FAC 1 was successful and, as a next step, a reset of FAC 2 should have been performed. However, it must be noted that after the successful reset of FAC 1 the ECAM display changed to AUTO FLT YAW DAMPER 2 and a reset of FAC 2 is not explicitly required

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<sup>8</sup> BITE: Built-in test equipment primarily refers to passive fault management and diagnosis equipment built into airborne systems to support maintenance processes.

anymore (cf. annex 3). Although the operator's report states that the flight crew did reset FAC 2 without success, there is no indication in the analysed data that a reset of FAC 2 was executed.

Without a reset of FAC 2 neither AP 1 nor AP 2 could be re-engaged. The flight crew attempted to re-engage the AP 1 twice, once at 11:36:28 UTC and again at 11:37:07 UTC. Pilots are generally not aware that the FMGC needs authorization from both FACs to recover the AP and that the status page is inaccurate in suggesting that the AP of the non-affected side is available. The re-engagement of A/THR at 11:36:40 UTC was meaningful and helped the flight crew to reduce their workload.

After having sent an urgency message and according to the operator's report, the flight crew opted to join a holding pattern in all likelihood to analyse the situation following the operator's guidelines using the acronym DODAR<sup>9</sup>, because the status page did not reflect the actual status of the aircraft. This was an appropriate decision but did not result in the recovery of the autopilots as detailed above and the approach had to be flown without any of the autopilots engaged.

## Conclusions

As flight BA728 was passing through a turbulent layer in icing conditions during descent to Geneva Airport, both FACs of the Airbus A320 simultaneously rejected all 3 IRs due to a significant lateral body acceleration, leading to the loss of the yaw damper function. As a consequence, the active Autopilot, Autothrust (A/THR) and both Flight Directors (FD) disengaged, and the flight controls reverted to alternate law.

The flight crew successfully reset FAC 1 which led to the recovery of one yaw damper, normal law, A/THR and FD 1. Since the FAC 2 was not reset, the landing capability of the aircraft remained limited to CAT 1<sup>(10)</sup> without AP and the subsequent ILS approach was flown manually with the A/THR engaged. There is no evidence showing that the resetting of FAC 2 would not have been successful. Such a reset would have enabled the flight crew to re-engage AP 1 and/or 2 and hence would have offered the option of an automatic landing, as required in low visibility conditions, for example.

However, the investigation also showed that it is generally not known by the pilots and not mentioned in the FCOM that in all cases the FMGC needs at least 2 IRs valid and consistent in each of the FACs to enable the re-engagement of one or both Autopilots. This means that if there is an AUTO FLT YAW DAMPER 1(2) fault due to 2 IRs rejections in one or both FACs, the APs are not available unless both FACs are reset. This is inconsistent with the status page that suggests the AP availability on the non-affected side (cf. annex 2).

In a statement, dated 11 October 2019, the manufacturer confirmed that it is planning improvements to the system messages on the status page or increased AP availability in case of IRS rejection in the FAC. In the meantime, Airbus has stated that they have updated the QRH system reset table to require a reset of the FAC when AP is inoperative following an AUTO FLT YAW DAMPER 1(2) fault.

For this reason, the STSB decided not to make a safety recommendation and concludes in regard to Article 45 of the Ordinance on the Safety Investigation of Transport Incidents (OSITI) hereby the investigation with the present summary report.

Bern, 20 August 2020

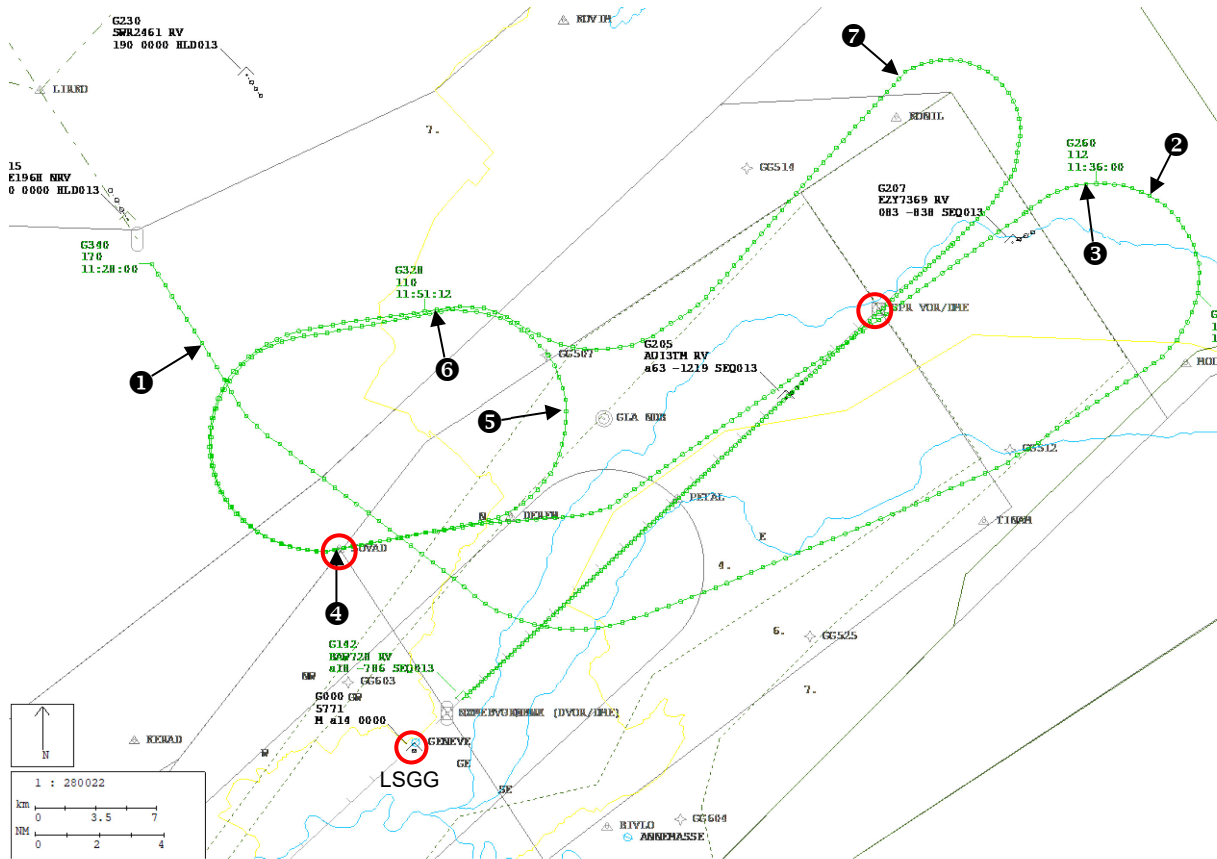
Swiss Transportation Safety Investigation Board

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<sup>9</sup> DODAR is a well-known acronym used during a problem-solving and decision-making process, widely used by airline companies. It stands for **D**iagnostics, **O**ptions, **D**ecide, **A**ct or **A**ssign and **R**eview.

<sup>10</sup>The lowest possible weather minima in case of category (CAT) 1 landing capability requires a Decision Height (DH) of not lower than 60 m (200 ft) and a Runway Visual Range (RVR) of not less than 550 m or visibility not less than 800 m.

Annex 1: Flight path of G-EUW during the last 38 minutes of the flight



Pos	Time UTC	Altitude	airspeed	Event
1	11:28:29	FL 145	281 kt	The ATCO instructs the flight crew to turn left for positioning on left hand downwind
2	11:35:35	FL 110	258 kt	The flight crew resets the FAC 1 successfully
3	11:36:03	FL 110	260 kt	The flight crew sends an urgency message (PAN-PAN)
4	11:41:52	FL 110	250 kt	Speedbird 728 enters the SOVAD holding pattern
5	11:46:01	FL 110	251 kt	The flight crew informs the ATCO that they have lost AP capability and request to stay in the holding pattern for another 10 minutes
6	11:51:16	FL 110	250 kt	The flight crew reports its readiness for the approach
7	11:54:54	8800 ft	207 kt	The ATCO grants approach clearance




**Annex 2:** FCOM abnormal checklist in case of AUTO FLIGHT YAW DAMPER 1(2)

<b>AUTO FLT YAW DAMPER 1(2)</b>	
Applicable to: ALL	
<b>ANNUNCIATIONS</b>	
<p>Triggering Conditions:</p> <p>This alert triggers when one yaw damper actuator is failed.</p>	
Applicable to: ALL except MSN 2389	
Crew awareness.	
Applicable to: ALL	
<p style="color: green;">CAT 3 SINGLE ONLY</p>	<p style="text-align: center;">STATUS</p> <div style="border-left: 1px solid black; padding-left: 10px;"> <p style="color: orange; text-align: center;"><b>INOP SYS</b></p> <p style="color: orange; text-align: center;">CAT 3 DUAL YAW DAMPER 1(2)</p> </div>



**Figure 2:** Copy from FCOM (PRO-ABN-AUTO\_FLT P 29/34)

**Annex 3:** QRH procedure in case of AUTO FLIGHT YAW DAMPER 1(2) FAULT

 <b>ABNORMAL AND EMERGENCY PROCEDURES</b> [RESET] SYSTEM RESET		<b>02.8</b>
BRITISH AIRWAYS <b>A318/A319/A320/A321</b> QUICK REFERENCE HANDBOOK		07-Jun-17
ECAM System	System malfunction or ECAM Alert (Affected System)	Reset Procedure
AUTO FLT	<p style="color: orange;"><b>AUTO FLT YAW DAMPER 1(2) FAULT</b></p> <p>(FAC 1(2))</p>	<p><b>On ground, or in flight:</b></p> <p>In order to perform a reset, use the associated FAC pushbutton:</p> <ul style="list-style-type: none"> <li>- Set FAC 1(2) pb to OFF</li> <li>- Wait 3 s</li> <li>- Set FAC 1(2) pb to ON.</li> </ul>

**Figure 3:** Copy from QRH (system reset table, ECAM system AUTO FLT, ABN-02-09)

**Annex 4:** FCOM abnormal checklist in case of AUTO FLT YAW DAMPER SYS

<b>AUTO FLT YAW DAMPER SYS</b>	
Applicable to: ALL	
<b>ANNUNCIATIONS</b>	
<p><u>Triggering Conditions:</u></p> <p>This alert triggers when the yaw damper system is failed.</p>	
Applicable to: A319, A320 and A321	
<p>Loss of yaw dampers 1 + 2.</p> <p>FAC 1.....OFF THEN ON</p> <p>FAC 2.....OFF THEN ON</p> <p>● <b>If fault remains:</b></p>	
<b>ASSOCIATED PROCEDURES</b>	
<p><b>F/CTL ALTN LAW</b> (PROT LOST)</p> <p><i>F/CTL normal laws are lost. All protections, except maneuver protections, are lost.</i></p> <p>MAX SPEED.....320 KT</p>	
Applicable to: MSN 1014-3926, 4185-4975	
<p>MAX SPEED ..... 320 KT <i>Speed is limited, due to the loss of high-speed protections.</i></p> <p><b>APPR PROC</b></p> <p>FOR LDG .....USE FLAP 3 <i>This line is replaced by "FOR LDG : USE FLAP 3" when CONF 3 is selected, as a reminder.</i></p> <p>GPWS LDG FLAP 3 .....ON <i>Will be displayed, when flaps in CONF 3.</i></p> <p>APPR SPD .....VREF + 10 KT</p> <p>LDG DIST PROC ..... APPLY</p> <p><b>ALTN LAW : PROT LOST</b> <b>WHEN L/G DN : DIRECT LAW</b> <i>At landing gear extension, control reverts to direct law in pitch,as well as in roll</i> <i>Refer to PRO-ABN-F_CTL F/CTL DIRECT LAW.</i></p>	<p style="text-align: center;">STATUS</p> <p style="text-align: center;"><b>INOP SYS</b></p> <p>F/CTL PROT YAW DAMPER AP 1 + 2 CAT 2 STEEP APPR  GLS AUTOLAND </p>

**Figure 4:** Copy from FCOM (PRO-ABN-AUTO\_FLT P 30/34; 31/34, 32/34)