AAIB
Air Accidents Investigation Branch

AAIB Bulletin 11/2023

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(ALL TIMES IN THIS BULLETIN ARE UTC)

Summaries of Aircraft Accident Reports

This section contains summaries of Aircraft Accident ('Formal') Reports published since the last AAIB monthly bulletin.

The complete reports can be downloaded from the AAIB website (www.aaib.gov.uk).

Aircraft Accident Report No: 2/2023

This report was published on 2 November 2023 and is available in full on the AAIB Website www.aaib.gov.uk

Report on the accident to Sikorsky S-92A, G-MCGY at Derriford Hospital, Plymouth, Devon on 4 March 2022

Registered Owner and Operator:	Bristow Helicopters Ltd
Aircraft Type:	Sikorsky S-92A
Nationality:	British
Registration:	G-MCGY
Place of Accident:	Derriford Hospital, Plymouth, Devon
Date and Time:	4 March 2022 at 1055 hrs All times in this report are UTC

Introduction

The Air Accidents Investigation Branch (AAIB) were notified of this accident on 4 March 2022, the day that it occurred. In exercise of his powers, the Chief Inspector of Air Accidents ordered an investigation to be carried out in accordance with the provisions of retained Regulation (EU) 996/2010 (as amended) and the UK Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 2018.

The sole objective of the investigation of an accident or serious incident under these regulations is the prevention of accidents and serious incidents. It shall not be the purpose of such an investigation to apportion blame or liability.

In accordance with established international arrangements, the National Transportation Safety Board (NTSB) in the USA, representing the State of Design and Manufacture of the helicopter, appointed an Accredited Representative to the investigation. The helicopter operator, the hospital Helicopter Landing Site (HLS[1]) Site Keeper[2], and the UK Civil Aviation Authority (CAA) also assisted with the investigation.

Summary

The helicopter, G-MCGY, was engaged on a Search and Rescue mission to extract a casualty near Tintagel, Cornwall and fly them to hospital for emergency treatment. The helicopter flew to Derriford Hospital (DH), Plymouth which has a Helicopter Landing Site (HLS) located in a secured area within one of its public car parks. During the approach

Footnote

1 Hospital Helicopter Landing Sites are also referred to as HHLS in some documents.
2 The HLS Site Keeper is the owner of the HLS, as identified in CAA publication CAP 768, 'Safeguarding Aerodromes'.

and landing, several members of the public in the car park were subjected to high levels of downwash from the landing helicopter. One person suffered fatal injuries, and another was seriously injured.

The investigation identified the following causal factors:

1. The persons that suffered fatal and serious injuries were blown over by high levels of downwash from a landing helicopter when in publicly accessible locations near the DH HLS.

2. Whilst helicopters were landing or taking off, uninvolved persons were not prevented from being present in the area around the DH HLS that was subject to high levels of downwash.

The investigation identified the following contributory factors:

1. The HLS at DH was designed and built to comply with the guidance available at that time, but that guidance did not adequately address the issue of helicopter downwash.

2. The hazard of helicopter downwash in the car parks adjacent to the HLS was not identified, and the risk of possible injury to uninvolved persons was not properly assessed.

3. A number of helicopter downwash complaints and incidents at DH were recorded and investigated. Action was taken in each case to address the causes identified, but the investigations did not identify the need to manage the downwash hazard in Car Park B, so the actions taken were not effective in preventing future occurrences.

4. Prior to this accident, nobody at DH that the AAIB spoke to was aware of the existence of Civil Aviation Publication (CAP) 1264, which includes additional guidance on downwash and was published after the HLS at DH was constructed. The document was not retrospectively applicable to existing HLS.

5. The operator of G-MCGY was not fully aware of the DH HLS Response Team staff's roles, responsibilities, and standard operating procedures.

6. The commander of G-MCGY believed that the car park surrounding the DH HLS would be secured by the hospital's HLS Response Team staff, but the copilot believed these staff were only responsible for securing the HLS.

7. The DH staff responsible for the management of the HLS only considered the risk of downwash causing harm to members of the public within the boundary of the HLS and all the mitigations focused on limiting access to this space.

8. The DH staff responsible for the management of the HLS had insufficient knowledge about helicopter operations to safely manage the downwash risk around the site.

9. The HLS safety management processes at DH did not result in effective interventions to address the downwash hazard to people immediately outside the HLS.

10. HLS safety management processes at DH did not identify that the mitigations for the downwash hazard were not working well enough to provide adequate control of the risk from downwash.

11. Communication between helicopter operators and DH was ineffective in ensuring that all the risks at the DH HLS were identified and appropriately managed.

12. Safety at hospital HLS throughout the UK requires effective information sharing and collaboration between HLS Site Keepers and helicopter operators but, at the time of the accident, there was no convenient mechanism for information sharing between them.

Following this accident, Safety Action was taken by the helicopter operator, Derriford Hospital and NHS England Estates to control and mitigate the risk. The specific action taken is detailed in paragraph 4.2.1 of this report. Additional action by Derriford Hospital and NHS England Estates to improve safety, as described in paragraph 4.2.2 of this report, is either planned or in progress.

Helicopters used for Search and Rescue and Helicopter Emergency Medical Services (HEMS) perform a vital role in the UK and, although the operators of these are regulated by the UK Civil Aviation Authority, the many helicopter landing sites provided by hospitals are not. It is essential that the risks associated with helicopter operations into areas accessible by members of the public are fully understood by the HLS Site Keepers, and that effective communication between all the stakeholders involved is established and maintained. Therefore, nine Safety Recommendations have been made to address these issues, and these are listed in paragraph 4.1 of this report.

Findings

The accident flight

1. The crew were properly licensed and qualified to conduct the flight and were well rested. They all had extensive experience of flying SAR missions in both RN and civilian operations.

2. The operator had procedures and training in place to help crews to mitigate the effects of downwash.

3. The crew were aware of possible downwash issues during the task to pick up the casualty and during the approach to Derriford Hospital.

4. Whilst the crew had two potential hospitals with similar flight times to transport the casualty to the Emergency Department, they chose Derriford because it would be the most expeditious for their hypothermic casualty.

5. To benefit from a small headwind component, the crew elected to make the approach on the DH designated westerly flight path for the approach.

6. The helicopter's landing weight was 23,080 lb/10,468 kg, which was within the weight limit for the HLS.

7. The co-pilot was the PF for the landing as he had the better field of view to perform the approach and landing onto the HLS.

8. The crew conducted a dynamic risk assessment while inbound to Derriford, as required by the operator's Operations Manual.

9. The crew were aware that the helicopter's downwash would be blown over the car park.

10. The crew had briefed to conduct a go-around should they see anything that they considered could be affected by the helicopter's downwash.

11. Shortly before landing, the winchman informed the crew that the casualty needed urgent medical attention.

12. At about 200 ft agl, the winch operator saw a person in the undershoot in the car park and advised the co-pilot. The co-pilot, who could also see them, did not consider their presence to be an issue.

13. The co-pilot believed he saw two people (one who he noted had long hair) to the left of the HLS wall, by the southwestern corner, and a man entering his car in the undershoot who he assessed would not be affected.

14. CCTV evidence shows that a person with long hair was on her own at the south-west corner of the HLS and was the one who was later observed by the co-pilot running to the south-eastern corner of the HLS to assist the injured persons.

15. Three people in Car Park B were blown over by rotor downwash from the landing helicopter.

16. It is unlikely that the flight crew saw the people who were blown over.

17. If a late go-around had been performed, the greater downwash would have increased the risk of incurring damage or injury over a larger area around the HLS.

18. The downwash from the landing S92 affected most of Car Park B to varying degrees with several objects observed to have been affected.

19. Paramedics from an ambulance waiting in Car Park B were alerted by a member of the public and tended to those who had been injured without delay.

20. One pedestrian, who was in Car Park B, was blown over and subsequently died of her injuries; the relative accompanying her was also blown over and suffered minor injuries.

21. Another pedestrian, also in Car Park B, was blown over and suffered serious injuries.

22. Safety signs for pedestrians were provided that were well maintained, legible and repeated throughout Car Park B. However, they were ineffective in changing pedestrian behaviour during helicopter takeoffs and landings.

23. The relative of the fatally injured person was aware of the signs on the wall of the HLS but felt they did not reflect the level of danger they warned against.

24. The seriously injured pedestrian did not notice the warning signs.

25. The behaviour of the injured people on the day of the accident was typical of people within that environment and situation.

DH HLS site findings

26. The DH HLS had been operating for seven years and records indicated there had been over 2,500 landings, of which around 140 were SAR type helicopters.

27. The DH HLS was built in accordance with the guidance material available at the time.

28. The advice provided in the guidance at the time was inconsistent between the different types of HLS and could lead to an interpretation that downwash was not a factor for an HLS on a mound, such as the DH HLS.

29. The DH HLS is intentionally situated close to the ED so that casualties can be transferred quickly. This is a busy area for pedestrian and vehicular movements.

30. An independent helicopter adviser was used during the feasibility stage of the helipad design.

31. The feasibility report recommendations were consistent with HBN 15-03, ICAO Annex 14 version 3 and ICAO heliports manual version 3.

32. The feasibility report considered the effects of downwash but downplayed the potential effects and concluded that most of the downwash would be confined to the DH HLS surface.

33. Involvement of the helicopter adviser by the designers was informal.

34. The hospital Trust believed the downwash hazard was adequately controlled by the design of the DH HLS.

35. The feasibility report made recommendations about managing the DH HLS site and downwash hazard that were over and above the available guidance at the time.

36. The hospital Trust did not implement the recommendation in the feasibility report to manage the public areas outside the DH HLS.

37. The hospital Trust's '*Standard Operating Procedure'* and the '*On-site Operational Procedure and Response to an Emergency Incident'* for the HLS did not include any operational procedures for managing the areas outside the HLS boundary.

38. The hospital Trust was not aware of the additional guidance published in CAP 1264 until after this accident.

39. DH issued the document *Helicopter Operations Using the Hospital Landing Site, Derriford Hospital, Plymouth* (which included the designated flight paths) to numerous helicopter operators including that of G-MCGY.

40. The operator of G-MCGY interpreted the designated flight paths as advisory.

41. One helicopter operator was sent, but could not locate, a copy of this document containing the designated flight paths; this was thought to be due to a change of personnel and may have been missed during the handover.

42. This other operator developed their own flight path which was outside one of the designated flight paths, and this was not communicated to DH.

43. In 2023, another helicopter operator advised DH that they had developed a new flight path outside of those that DH had previously published, and this has been acknowledged by DH.

44. DH was unaware of the significance that helicopter operators using the DH HLS considered the designated flight paths to be advisory only.

45. The operator of G-MCGY used the No 1 AIDU's, *Helicopter Landing Sites - Hospitals United Kingdom* as an HLS directory, and internal document *Compatibility of UK Hospital Sites with UKSAR Aircraft Types* which lists what HLS are approved, and not approved, for its helicopters to operate into.

46. The No 1 AIDU entry for DH states, '*Best approach heading 090*', but there is no reference to the south-westerly designated flight path. The entry for DH also contained other discrepancies including the layout.

47. About a month after the HLS opened, a third party, on behalf of the operator of G-MCGY, conducted an aerial survey to establish the obstacle environment around the DH HLS for performance considerations for helicopter operations.

48. The operator of G-MCGY did not carry out a specific risk assessment of the HLS at DH after a site visit in July 2015.

49. The operator of G-MCGY was sent a copy of the *On-site Operational Procedure and Response to an Emergency Incident* but their headquarters could not locate it. The operator's Newquay base did not have a copy of it and neither did any other operators that used the HLS at DH.

50. None of the helicopter operators that used the HLS at DH had a copy of the hospital Trust's '*Standard Operating Procedure'* for the HLS Response Team staff at DH.

51. The helicopter operator of G-MCGY did not have a copy of any of the standard operating procedures used by HLS Response Teams at any other hospital HLS within the operating area of its Newquay base.

52. The helicopter operator and the commander believed that the hospital's HLS Response Team staff were responsible for ensuring the HLS and its surrounding areas were secured before an arrival. The co-pilot believed that these staff only opened the gates for ED staff and helicopter crews to access the HLS.

53. Although, prior to the helicopter's arrival, the hospital's HLS Response Team had secured the HLS, they did not secure the surrounding areas, nor were they required to do so.

54. On the day of the accident, the HLS Response Team followed the standard operating procedure as specified except for wearing the correct PPE.

55. Security personnel at the hospital were not always able to fulfil the duties specified in the standard operating procedure prior to the arrival of a helicopter because, at times, they may be dealing with other incidents at DH.

DH HLS safety management findings

56. The Trust's risk management policy was consistent with the Health and Safety Regulations and HSE guidance.

57. There were no competency requirements for personnel responsible for managing the DH HLS.

58. DH's HLS management team had insufficient knowledge of helicopter operations to make effective risk assessments for uninvolved persons being exposed to hazards associated with the HLS.

59. The DH HLS risk assessor had not received sufficient training in risk assessment and risk management.

60. A lack of mutual understanding resulted in ineffective communications between the HLS Site Keeper and the helicopter operators who used the HLS.

61. A number of helicopter downwash complaints and incidents at DH were recorded and investigated. The hospital Trust were aware of two previous downwash related events that had resulted in minor injury. Although action was taken on each occasion to prevent a reoccurrence, this did not result in changes being made to the management of Car Park B during helicopter takeoffs and landings.

62. Although reviews of the risk assessments for the HLS and Car Park B were conducted, the reviews did not identify that the downwash hazard in Car Park B was not adequately controlled.

63. The pedestrians that were injured were within 50 m of the centre of the HLS, and in the area that should be designated as a downwash zone for heavy helicopters for HLS built after 2016 (in line with CAP 1264). HBN15-03, which was in place in 2015, did not require a 50 m downwash zone for any type of HLS.

64. Even for smaller HEMS helicopters, downwash in Car Park B can be sufficient to blow people over.

65. The oversight and assurance activity by the DH management did not detect that the people and processes in place were inadequate to identify and mitigate the risks associated with the DH HLS.

General HLS findings

66. Hospital HLS in the UK are unlicensed. Local planning permission is required but there are no aviation regulatory requirements controlling their construction or operation.

67. There is limited aviation competence, resource and centralised support within the NHS for managing hospital HLS.

68. There were no competency requirements for personnel responsible for managing hospital HLS in any guidance documents in place at the time of the accident.

69. Hospital HLS managers would benefit from enhanced guidance on how to risk assess their sites and the range of potential mitigations that might be used to reduce the risk of uninvolved persons being exposed to hazards associated with the HLS.

70. Updated HLS design guidance was published by the CAA as CAP 1264 after the Derriford HLS was completed. CAP 1264 specifies a larger safety zone of up to 65 m for heavy helicopters like the S92.

71. CAP 1264 is not retrospectively applicable to existing HLS.

72. CAP 738 contains useful guidance on downwash zones but this is not included in CAP 1264.

73. In the absence of a centralised database, there is no convenient mechanism for HLS Site Keepers to promulgate site information to all the helicopter operators that might use it.

74. It would be beneficial to the industry to have access to a centralised database that can by updated rapidly in an operational environment by HLS Site Keepers and helicopter operators.

75. CAP 1864, Onshore Helicopter Review Report, published in 2019, issued Action 23, which was to work towards a '*unified*' hospital HLS database. The OnSLG was established with one of its tasks being to work on this.

76. The progress of relevant national safety initiatives has been slow with a lack of State-level leadership to support and coordinate the efforts of the parties involved.

Safety Recommendations and Action

Safety Recommendations

The following Safety Recommendations have been made:

Safety Recommendation 2023-028

It is recommended that the UK Civil Aviation Authority includes the appropriate downwash guidance relevant to hospital helicopter landing sites in one published document.

Safety Recommendation 2023-029

It is recommended that the UK Civil Aviation Authority, in conjunction with the Onshore Safety Leadership Group and the relevant NHS organisations in the UK, develop and promulgate enhanced risk management guidance for hospital helicopter landing sites, and provide information on the range and use of potential mitigations for the protection of uninvolved persons from helicopter downwash.

Safety Recommendation 2023-030

It is recommended that NHS England Estates, in conjunction with the Onshore Safety Leadership Group and the UK Civil Aviation Authority, develop competency requirements, and introduce training, for all hospital helicopter landing site managers that includes, as a minimum, a basic introduction to helicopter operations and safety management practices appropriate for such facilities.

NHS England Estates should seek participation from the healthcare organisations in Scotland, Wales, and Northern Ireland to develop these competency requirements.

Safety Recommendation 2023-031

It is recommended that NHS England Estates review all existing hospital helicopter landing sites for which it has responsibility against the latest guidance and instigate appropriate actions to minimise the risk of injury from downwash to uninvolved persons.

Safety Recommendation 2023-032

It is recommended that NHS Wales Health Boards and Trusts review all existing hospital helicopter landing sites for which they have responsibility against the latest guidance and instigate appropriate actions to minimise the risk of injury from downwash to uninvolved persons.

Safety Recommendation 2023-033

It is recommended that NHS Scotland Assure review all existing hospital helicopter landing sites for which it has responsibility against the latest guidance and instigate appropriate actions to minimise the risk of injury from downwash to uninvolved persons.

Safety Recommendation 2023-034

It is recommended that the Northern Ireland Health and Social Care Trusts review all existing hospital helicopter landing sites for which they have responsibility against the latest guidance and instigate appropriate actions to minimise the risk of injury from downwash to uninvolved persons.

Safety Recommendation 2023-035

It is recommended that the Onshore Safety Leadership Group (OnSLG), in conjunction with the UK Department for Transport, facilitate and support the development and introduction of a dedicated national hospital helicopter landing sites (HLS) database that can be updated in an operational environment by helicopter operators and hospital HLS Site Keepers.

In addition to helicopter operators and other stakeholders, the OnSLG should seek participation from the healthcare organisations in England, Scotland, Wales, and Northern Ireland.

Safety Recommendation 2023-036

It is recommended that the UK Department for Transport, in conjunction with the Onshore Safety Leadership Group, establish and lead a national initiative to improve the protection of uninvolved persons from helicopter operations at hospital helicopter landing sites (HLS).

This initiative should have sufficient authority, representation, resources, and expertise to ensure that coordination between the various risk owners and stakeholders is effective.

The various stakeholder roles and responsibilities (in particular those of HLS Site Keepers and helicopter operators) should be clear to all those involved, and the planning, design, and ongoing risk management of hospital HLS should be considered appropriately.

Safety Actions

Action taken

As a result of this accident, Safety Action was taken by various organisations as set out below.

Action taken by the operator of G-MCGY

The approval for its S92 and AW189 helicopters to operate into the HLS at DH was removed from its FSI until further notice.

Since the accident, more frequent reviews of the FSI are being conducted and additional information has been added for each site as to whether it has facilities for it to be secured and by whom, ie coastguard rescue team, police and/or hospital staff.

Action taken by the DH HLS Site Keeper

No helicopters >5,000 kg MTOW were permitted to land on the HLS at DH until further notice. A Notice To Airmen was issued to publicise.

Car Park B was closed to all vehicles other than ambulances until further notice.

All pedestrian movements in Car Park B would be controlled during all future helicopter landings and takeoffs.

All pedestrian movements on the public highway pavement along Derriford Road would be controlled as far as reasonably practical during helicopter operations, but DH has no legal authority to prevent pedestrian movements on the public highway.

The risk assessment for Car Park B was amended to include an assessment of the risk to pedestrians from helicopter downwash.

Additional visual and audible signs around the landing pad on the main pedestrians' routes around the location have been installed.

Yellow hatched floor markings have been installed outside each of the gated entrances to the pad, warning pedestrians not to stand in that location to view helicopters landing or taking off.

Audible message points around the external walls of the landing pad, activated by the security team once they reach the pad, have been installed. The audible message will warn pedestrians of helicopter movements, the risks of downwash and asking them to move to a different location quickly.

Action taken by the QEH HLS Site Keeper

As a result of the incident involving G-RESU, the hospital has established a monthly road sweeping programme.

Action taken by NHS England Estates

They have hosted online events for stakeholders at NHS hospitals to draw attention to the guidance in CAP 1264 on the safe and compliant design and management of HLS sites amongst the industry and local planning authorities.

Action taken by the HSE

On 10 May 2023, the HSE wrote to all NHS Trust and Board Chief Executives with a '*reminder of legal health and safety duty and how it should be discharged to effectively manage risk associated with hospital helipad use.*

Action planned or in progress

As a result of this accident, the following Safety Action is planned or in progress.

Action planned or in progress by the DH HLS Site Keeper

- Designs to secure and control access to Car Park B have been finalised and works are currently being tendered.
- The procedures for the security staff were reviewed with additional responsibilities added. These procedures were issued to security staff and are being trialled in conjunction with advice from an aviation consultant appointed by DH. They had not been approved for wider circulation at the time of publication of this report.

Action planned or in progress by NHS England Estates

- They have instigated a national data collection with all NHS hospital Chief Executives in England to seek assurance on levels of compliance with the standards in CAP 1264 and to identify any staff training requirements. The results of this had not been made available at the time of publication of this report, but they are intended to inform NHS England Estates of any additional next steps that may be required.
- NHS England Estates, working with the CAA, is considering introducing a package to develop training in ground operations and oversight of hospital HLS facilities. The objective is to roll out such a training programme to the Accountable Managers of all the hospital HLS in England, Wales, and Scotland.
- They are working with other hospital HLS towards a common database for all operators.

AAIB Correspondence Reports

These are reports on accidents and incidents which were not subject to a Field Investigation.

They are wholly, or largely, based on information provided by the aircraft commander in an Aircraft Accident Report Form (AARF) and in some cases additional information from other sources.

The accuracy of the information provided cannot be assured.

SERIOUS INCIDENT

Aircraft Type and Registration:	DHC-6 Series 310 (Twin Otter), G-CBML
No & Type of Engines:	2 Pratt & Whitney Canada PT6A-27 turboprop engines
Year of Manufacture:	1980 (Serial no: 695)
Date & Time (UTC):	13 March 2023 at 1535 hrs
Location:	St Mary's Airport, Isles of Scilly
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 2 Passengers - 15
Injuries:	Crew - None Passengers - None
Nature of Damage:	None
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	63 years
Commander's Flying Experience:	9,700 hours (of which 5,000 were on type) Last 90 days - 67 hours Last 28 days - 21 hours
Information Source:	Aircraft Accident Report Form submitted by the commander and further enquiries conducted by the AAIB

Synopsis

Whilst landing in gusty crosswind conditions the commander was unable to keep the aircraft on the paved surface so elected to go around. The aircraft travelled approximately 12 m across adjacent grass before getting airborne again. No damage was caused to the aircraft.

History of the flight

The Twin Otter was undertaking a scheduled flight from Land's End Airport to St Mary's Airport in the Isles of Scilly. Several flights had been cancelled earlier in the day due to the strong winds at St Mary's. By the early afternoon reports indicated the wind had reduced slightly with the 1450 hrs METAR giving the surface wind from 220° at 22 kt. As this was now within the aircraft limits the commander decided it was safe to undertake the flight. The aircraft departed Land's End Airport at 1510 hrs.

The commander made a visual approach to Runway 27 at St Mary's, electing to land with full flap. When the aircraft was cleared to land, ATC reported the surface wind as "210° at 19 kt, maximum 27 kt". As the aircraft approached the runway ATC gave an instant wind check of "210° at 20 kt". The aircraft touching down at 1534 hrs.

The commander reported that the initial touchdown was smooth but slightly further down the runway than ideal due to the aircraft floating slightly. Once all three wheels were on the

ground, he was about to select reverse when the right wing started to lift. He recalled that he reduced the in-to-wind aileron to lower the right wing but the left wing then "rose quite violently and the aircraft started to veer to the left, weathercocking into wind, now only on the nose and right main wheels". The commander reported that he was unable to lower the left wing or stop the aircraft drifting to the left. As the aircraft approached the edge of the runway he decided to go around and applied full power. The co-pilot selected Flap 10.

The co-pilot's recollection was that the approach was stable and the initial touchdown was normal but the aircraft then started to "wheelbarrow on two wheels and pull to the left". At this time he had the sense that the right wing was lifting. He recalled checking the control column and seeing the ailerons were around the neutral position. As the aircraft left the paved surface he recalled the commander calling "going around" and applying full power, and he instinctively selected Flap 10.

The aircraft travelled across the grass to the left of the runway before becoming airborne. Once airborne it accelerated in ground effect as the flaps retracted and was then able to climb away. Once level the flight crew discussed returning to the mainland but decided to make a second approach. The second visual approach was uneventful, and the aircraft landed without further incident at 1539 hrs.

Inspection after landing revealed no damage to the aircraft. Tyre marks were found leaving the runway just past the runway intersection and extending approximately 12 m onto the grass (Figure 1).

It was stated in the commander's and ATC report that two local pilots witnessed the incident and reported that at the time of landing there were two significant gusts of wind punctuated by a short lull.

Aerodrome information

St Mary's Airport has two runways, 14/32 and 09/27, as shown in Figure 2. Runway 27 is 522 m long and 18 m wide and has a declared LDA of 501 m. The AIP[1] contains the following warning:

> *'Pilots should exercise extreme caution when landing and taking-off at this aerodrome, which is markedly hump-backed. The gradients increase to as much as 1 in 13 at the runway ends.*
>
> *Turbulence and/or windshear may affect the final half mile of approaches to all runways and may be increased by valley effect and/or structures when using Runways 09, 14 or 27.'*

Footnote

[1] AIP – Aeronautical Information Publication, available at https://nats-uk.ead-it.com/cms-nats/opencms/ en/Publications/AIP/ [accessed 3 June 2023].

Figure 1

Tyre marks found on Runway 27 leaving the runway to the left

Figure 2

Aerial view of St Mary's Airport showing where the aircraft departed the runway (for orientation the yellow markings seen in Figure 1 can be seen in this view to the right of the point the aircraft left the paved surface)

Aircraft performance

The company crosswind limit for the Twin Otter is 27 kt on a dry or wet runway. The company's operations manual specifies lower limits for commanders with less than 150 hours P1 on type, for co-pilots and for night landing at St Mary's.

The manual states '*if a significant cross wind is unavoidable consideration to using flap 20 for landing should be made if the runway is of suitable length'.* The manual requires full flap to be used for landing on Runway 27 at St Mary's if the headwind component is less than 12 kt.

Meteorology

The METAR issued at 1520 hrs gave a surface wind from 220° at 22 kt, visibility 8 km, cloud few at 1,400 ft, temperature 12°C, dewpoint 9°C and a sea level pressure of 987 hPa. The runway conditions were wet/wet/wet (condition code 5/5/5).

The full requirements for meteorological observations at aerodromes are specified in CAP 746[2]. Reported surface wind direction and speed is the average taken over a ten minute period immediately preceding the time of the observation. A gust is only reported if, within that period, the wind exceeds the mean wind speed by 10 kt or more. The wind direction is referenced to True North. When ATC reports the wind to aircraft for takeoff and landing, the direction is expressed in degrees Magnetic and the reading is averaged over the previous two minutes. Gusts are still reported if the wind exceeds the mean wind speed by 10 kt or more in the last 10 minutes. Variations in wind direction is reported when the total variation in direction over the previous ten-minute period is 60° or more.

Flight crew

The commander had a total of 9,700 hours flying experience including 5,000 hours on the Twin Otter. He was a training captain for the operator and held Class Rating Instructor and Examiner (CRI/CRE) ratings.

The co-pilot had a total of 1,300 hours including 1,000 hours on the Twin Otter.

Organisational information

The operator had identified the risk of a runway excursion at St Mary's due to the narrow and short runway within their Safety Management System. It had put the following mitigations in place to manage the risk:

- '*SOPs contain specific weather limits for St Mary's for pilots of limited experience.*

Footnote

[2] CAP746 – *'Requirements for meteorological observations at aerodromes'* available at https://www.caa.co.uk/ [accessed 3 June 2023].

- *SOPs state pilots in command have to be checked out with a base trainer before taking off or landing at St Mary's.*
- *ATC report mean and max wind on R/T to better estimate max cross-wind.*
- *SOPs state approach must be stabilised to continue to land.*
- *Maximum reduced cross wind at night introduced.*
- *No pilot can land or depart St Mary's without prior circuit training by a CRE/ CRI.*'

The operator stated that prior to this occurrence these mitigations had been effective.

Following the operator's review of this incident, it intends to display a live wind plot in the Land's End crew room, provided by the Met Office, which shows the surface wind direction and strength for St Mary's for the last 30 minutes. It is intended that this will give flight crew a better understanding of the frequency of wind gusts before they depart. It will also display a live web cam from St Marys to give a view of the weather conditions.

The chief pilot is also considering if the 12 kt headwind requirement for using Flap 20 may be reduced for aircraft below maximum landing weight. It is intended that this may allow greater use of Flap 20 in crosswind conditions. This would not have helped in this incident as the aircraft was close to the maximum landing weight.

Analysis

As the aircraft approached Runway 27, ATC reports suggest there was a headwind component of approximately 10 - 15 kt and a crosswind component from the left of approximately 16 – 23 kt.

It is likely that as the aircraft touched down it experienced a lull in the wind which meant the commander had too much in-to-wind aileron at that moment. However, as he reduced the aileron, the wind increased, such that he then had insufficient aileron to keep the wings level. As the airspeed decreased and the flight controls became less effective the commander was unable to keep the aircraft on the runway.

The co-pilot recalled seeing the ailerons around the neutral position after landing so it is also possible that the commander reduced the in-to-wind aileron too much on landing and this caused the right roll.

The commander's quick actions to initiate a go-around avoided the consequences of any further ground excursion. Landing with Flap 20 may have made it easier to manage the crosswind, but, with possibly only 10 kt of headwind the commander considered full flap was required to ensure the aircraft would stop within the runway distance available.

ATC is only required to report gusts if the wind speed exceeds the average by 10 kt or more in the preceding ten minutes. This can mean that there are significant variations in the wind which are not reported. ATCOs can provide maximum wind or instant wind, as

they did at St Mary's, if they consider this would assist the pilots. This information can also be requested from ATC.

The operator has provided additional live wind information to their pilots in their crew room to give a better indication of the frequency and intensity of gusts over the previous 30 minutes. It is thought this will assist its pilots by giving them more knowledge about the wind conditions they are likely to experience in St Mary's.

Conclusion

It is likely that the combination of the gusting wind and the amount of in-to-wind aileron applied caused the aircraft to roll right and weathercock into wind. This caused the aircraft to veer left and leave the paved surface. The commander's decision to go around prevented a more serious outcome.

SERIOUS INCIDENT

Aircraft Type and Registration:	Pierre Robin R2160, G-BLWY	
No & Type of Engines:	1 Lycoming O-320-D2A piston engine	
Year of Manufacture:	1980 (Serial no: 176)	
Date & Time (UTC):	16 April 2023 at 1530 hrs	
Location:	Deenethorpe Airfield, Northamptonshire	
Type of Flight:	Training	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Transparent panel over the rear area of the cockpit detached. Slight damage to the right flap and wing	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	48 years	
Commander's Flying Experience:	2,685 hours (of which 2,325 were on type) Last 90 days - 115 hours Last 28 days - 50 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries made by the AAIB	

Synopsis

During an aerobatic training flight, a transparent panel over the rear area of the cockpit detached and fell away. The aircraft landed without further incident. The panel detached due to its leading edge dis-bonding from its support frame, allowing the airflow to get under this edge and cause the panel to fail.

History of the flight

The aircraft was on an aerobatic training flight over open countryside. A clearing turn was carried out at 100 kt and about 60° angle of bank when the transparent panel over the rear right-side of the cockpit detached and fell away from the aircraft. The aircraft returned to the airfield without further incident. Both occupants were uninjured, but the aircraft sustained minor damage on the right wing, flap and rear fuselage.

Aircraft examination

There are two (left and right) transparent panels over the rear area of the cockpit which extend from the edge of the fuselage to a central ridge frame (Figure 1).

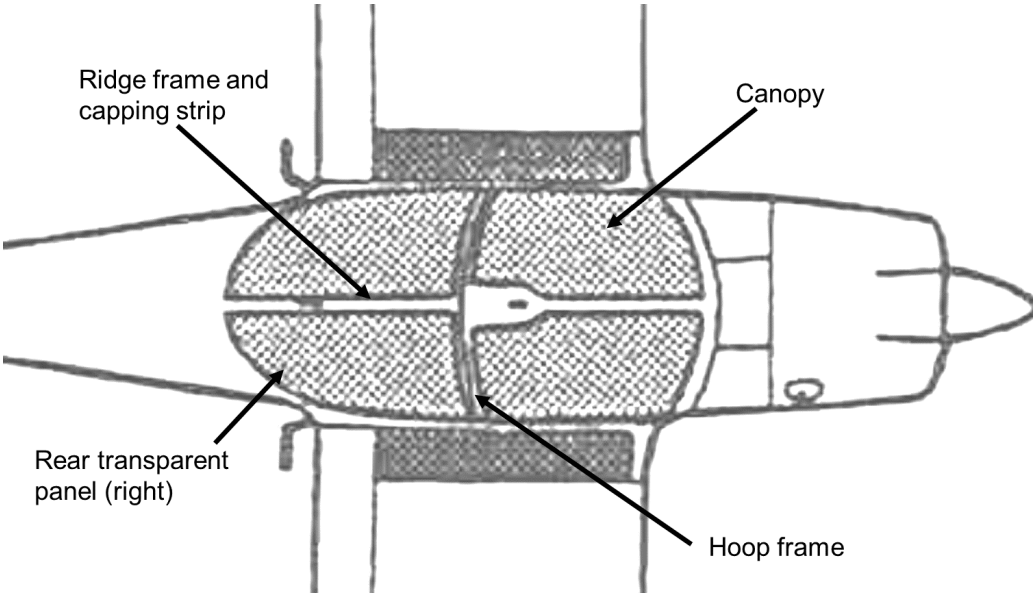

Figure 1

Cockpit transparent panels and associated structure

The panels are bonded to the fuselage structure and supporting framework by a sealing adhesive. In addition, a line of screws along the side and rear edge of the panel secures the panel to the fuselage. A capping strip, held in place by screws, is fitted over the edges of each panel where they attach to the ridge frame.

The panel had broken away leaving jagged edged pieces of the panel attached to the side, rear and ridge frames; the screws and adhesive bond were still in place. The leading edge of the panel, where it attaches to a hoop frame just behind the seats (Figure 2) appears to have dis-bonded completely from the frame. It also appears to have taken parts of the canopy weather seal with it. A narrow bead of the adhesive sealant remained on the hoop frame. Examination of the left transparent panel found the bond along the hoop frame had started to come apart and could be lifted under finger pressure.

Probable cause

Although it is not fully clear what initiated the detachment of the panel, it is likely that the bond on part of the leading edge, were it attaches to the hoop frame, had failed. The upward force on the panel in flight was sufficient to open a gap and allow the airflow to pass between the frame and panel causing it to break.

It is known that polymethyl methacrylate[1] (PMMA) materials such as used in the panel do not tolerate adverse loads which can induce flexing or distortion from their preformed shape. This often results in the material rapidly cracking along rigidly held edges and breaking apart, which in this event can be seen by the remaining jagged panel pieces trapped under the screws.

Footnote

[1] PMMA is more commonly known by trademarks such as Perspex and Plexiglas.

Figure 2

Dis-bonded area and canopy seal on the hoop frame

ACCIDENT

Aircraft Type and Registration:	Pioneer 300, G-OWBA	
No & Type of Engines:	1 Rotax 912ULS piston engine	
Year of Manufacture:	2013 (Serial no: LAA 330-15155)	
Date & Time (UTC):	26 March 2023 at 1620 hrs	
Location:	North Weald Aerodrome, Essex	
Type of Flight:	Training	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Damage to the left wing and left main landing gear retraction mechanism	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	27 years	
Commander's Flying Experience:	2,900 hours (of which 17 were on type) Last 90 days - 81 hours Last 28 days - 20 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

During the landing roll the left main landing gear collapsed because the landing gear was not in the down and locked position. Examination could not positively identify the reason that the gear was not locked down, however it is considered likely that the landing gear had not been set up correctly after a recent part replacement.

History of the flight

A student pilot was landing with a slight crosswind from the left. Just before the flare the instructor added right rudder and left aileron before they made a 'smooth and symmetrical' touchdown. The instructor recalled that after approximately 5 seconds the aircraft started to veer to the left. He then noticed that the left wing had contacted the runway. The aircraft departed the runway and struck a runway light. Assessment of the aircraft after the accident identified that the left main landing gear had collapsed.

During the previous flight, when the landing gear was lowered for landing, the right main landing gear green light did not illuminate, indicating that it was not down and locked. The pilot, who was the instructor of the accident flight, flew the aircraft past the tower and received confirmation that the gear was visually down. He then made a successful landing. He discussed the event with the maintainer who advised making an adjustment to the right main gear down microswitch as it was considered likely that, during recent

maintenance in which landing gear actuation system components were replaced, the microswitch position may not have been correctly set.

Aircraft information

The Alpi Pioneer 300 is a small two-seat, low-wing aircraft, of mainly wooden construction. The aircraft is fitted with electrically operated retractable tricycle landing gear (Figure 1).

The nosewheel retracts rearwards and the mainwheels retract outwards into wheel wells on the underside of the wings. An electric motor drives a retraction/extension gearbox which drives jack screws that, when lowering the landing gear, extend the mechanisms. Once at full travel an over-centre mechanism locks the gear in the down position. Microswitches sense that the mechanisms are in the down and locked position and illuminate green lights on the instrument panel indicating their respective landing gear leg's position.

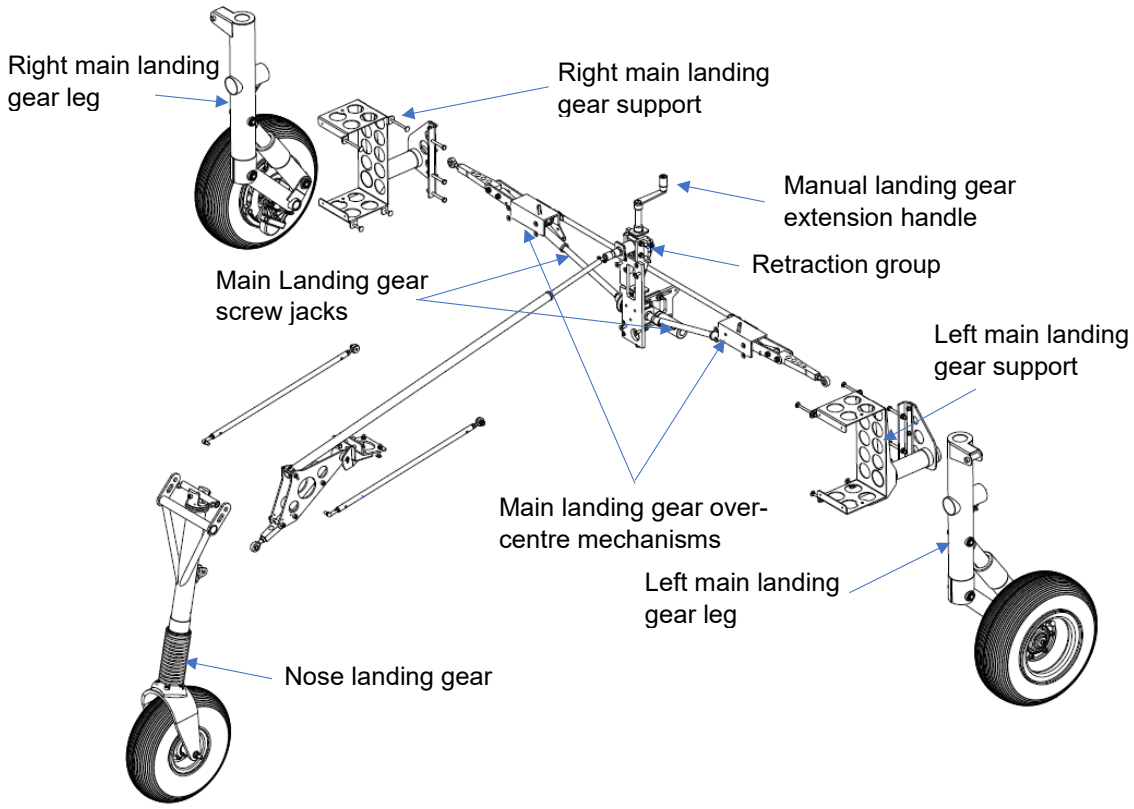

Figure 1

Alpi Pioneer 300 landing gear configuration

In August 2022, approximately three flying hours before the accident, the main landing gear extension/retraction mechanism was replaced due to several components, including the jack screws, gearbox shafts and jack screw universal joints, being distorted and bent. The left over-centre arm assembly was also found to be coming away from the spar box fixing bolts, so was replaced.

Aircraft examination

The left main landing gear threaded bar had buckled, fracturing towards its outboard/ extended end (Figure 2).

Figure 2

Buckled and fractured G-OBWA left main gear jack screw

A scuff mark was identified in the wheel well (Figure 3), which indicated that the tyre had contacted the wheel well wall. Assessment of the wheel identified that the tyre fitted was not specified in the maintenance manual and was 2 inches wider than the specified tyre.

Figure 3

G-OBWA left wheel well (underside of wing) showing scuffing

Analysis

When an outward side load is applied to the landing gear the load path should be through the over-centre mechanism and into the airframe. However, as the jack screw was buckled it indicated that the load path was through the extension/retraction mechanism and that the gear was not locked down during the landing.

With the damage to the components, it was not possible to establish why the mechanism was not locked down; however, it is considered possible that the landing gear had not been correctly set up when the new components had been installed. As the jack screw had failed whilst in the extended position, it is considered unlikely that the issue identified with the incorrect tyre being fitted was linked to the landing gear failure.

The landing gear indication issue that occurred during the flight before the accident may have been related to the landing gear not travelling to the full extent when being lowered, rather than a maladjusted microswitch. A more thorough investigation of the issue may have identified the over-centre mechanism issue and prevented the failure of the screw jack.

This event serves as a reminder for all issues to be fully investigated to understand their root cause. Even if an easy fix may, on the face of it, rectify a fault an underlying issue may remain.

The installation of the incorrect tyre, although unrelated to the landing gear failure, also serves as a reminder to ensure that only components included in the defined parts list should be fitted to an aircraft.

SERIOUS INCIDENT

Aircraft Type and Registration:	Piper PA-28-140, G-AVLG	
No & Type of Engines:	1 Lycoming O-320-E3D piston engine	
Year of Manufacture:	1967 (Serial no: 28-23358)	
Date & Time (UTC):	26 June 2023 at 1050 hrs	
Location:	Near Thruxton Aerodrome, Hampshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	None	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	25 years	
Commander's Flying Experience:	90 hours (of which 37 were on type) Last 90 days - 15 hours Last 28 days - 0 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and enquiries made by the AAIB	

Synopsis

During preparation for a flight from Bournemouth Airport to Thruxton Aerodrome, the pilot noted that '11 US gal' was recorded in the aircraft Technical Log (Tech Log), which would be sufficient fuel for this short flight. However, during the approach to Thruxton the aircraft ran out of fuel, and the pilot conducted a successful forced landing in a field.

It was established that the quantity of fuel recorded in the Tech Log was incorrect and there was insufficient fuel onboard to complete the flight to Thruxton.

History of the flight

The aircraft was being flown from Bournemouth Airport to Thruxton Aerodrome where it would be refuelled before being flown to its base at Middle Wallop Airfield. The pilot joined left base at Thruxton for a landing on Runway 25. He completed his downwind checks and as he turned onto Final, the engine began to run roughly and lost power. The pilot switched to the right fuel tank which appeared to have no effect on the engine power. Realising he would not make the runway threshold, he selected a field just to the right of the extended centre line and carried out an uneventful forced landing. The aircraft was undamaged and the pilot uninjured.

Shortly after landing the pilot established, by running the fuel pump and checking the fuel pressure, that the left fuel tank was empty and that some fuel remained in the right tank.

Circumstances leading to the fuel exhaustion

Fuel on board at the start of the flight

Following its annual inspection at Bournemouth, the pilot was asked to collect the aircraft. At Bournemouth he checked the Tech Log and satisfied himself that the work had been completed and certified. He also noted that the fuel recorded in the log was '11 US gal'. The pilot decided to refuel the aircraft at Thruxton and then continue to Middle Wallop as he considered that the quantity of fuel in the aircraft would be sufficient for the 20-minute flight, with a reserve.

While carrying out the A-Check the pilot was unable to find the fuel tank dipstick in the aircraft. As no other suitable dipstick was available, he checked the fuel levels by looking into each tank through the filler cap. At this point he believed he saw an amount of fuel which he reported "matched my expectations believing I knew how much fuel was on board". He also noted that the fuel gauges were "off the stops" and so assumed there was fuel in the tanks. However, calculations based on this aircraft and the route flown, suggested that rather than 11 US gal, there was only between 5 and 7 US gal of usable fuel in the aircraft fuel tanks at the start of the flight. It is not known what the distribution of fuel was between the two tanks.

Fuel onboard on arrival at Bournemouth

The Tech Log showed that there was 11 US gal of fuel on board the aircraft before it was flown to Bournemouth for the maintenance. However, the Tech Log had not been completed following the flight to Bournemouth and, therefore, there was no record of the amount of fuel remaining in the aircraft when it landed. There was also no record of the amount of fuel used during the engine runs carried out during the maintenance.

Confirmation bias

The aircraft operator had a fuel account at Thruxton as Avgas is not always easily available at Middle Wallop where the aircraft is based. It was, therefore, normal practice to refuel at Thruxton. Refuelling at Bournemouth was not considered as the pilot thought he had enough fuel in the aircraft for the first part of the flight. Moreover, refuelling at Thruxton followed by a very short flight to Middle Wallop, would ensure the aircraft had the maximum amount of fuel onboard for flying the next day.

Comment

The pilot attempted to rectify the loss of engine power by switching to the right fuel tank. When this appeared to have no effect, he took immediate action to conduct a forced landing in a field rather than try to stretch the glide to make the runway. Had he not done so, the outcome may have been different.

On this occasion, the pilot believes that when he looked in the fuel tanks at Bournemouth, he experienced confirmation bias because he was expecting to see fuel present based on what he read in the Tech Log.

The pilot was misled by the entry in the Tech Log, which had not been completed after the last flight, as to the quantity of fuel on board the aircraft. Fuel, and oil, might be consumed during a period of maintenance, and therefore any quantities of fluid entered in the Tech Log prior to the start of the maintenance should be treated with caution.

SERIOUS INCIDENT

Aircraft Type and Registration:	Piper PA-28R-201, G-WAMS	
No & Type of Engines:	1 Lycoming IO-360-C1C6 piston engine	
Year of Manufacture:	2001 (Serial no: 2844050)	
Date & Time (UTC):	10 August 2023 at 1525 hrs	
Location:	Stapleford Aerodrome, Essex	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Right wingtip underside damaged and flap bent	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	23 years	
Commander's Flying Experience:	1,420 hours (of which 50 were on type) Last 90 days - 120 hours Last 28 days - 40 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

During the landing run the main right landing gear collapsed and the aircraft slewed off the runway. The landing gear collapsed because the landing gear selector had been inadvertently knocked towards the GEAR UP position during touchdown.

History of the flight

The aircraft was returning to Stapleford Aerodrome after a cross channel flight. The pilot landed the aircraft and as it slowed to approximately 30 kt, the aircraft tilted to the right. The pilot initially thought the right tyre was flat. However, the wingtip suddenly dropped and contacted the runway, causing the aircraft to slew to the right and off the paved surface.

The pilot made the aircraft safe and vacated the aircraft along with his passenger.

Cause

The pilot had configured the aircraft for landing and confirmed that the landing gear was down and locked. However, during touchdown his passenger, also a qualified pilot occupying the left seat[1], dropped a tablet device into the footwell. The passenger was

Footnote

[1] The aircraft commander in this case was flying the aircraft from the right seat stated that as an instructor, he finds it more comfortable to do so when pleasure flying with a passenger.

concerned the device would interfere with the rudder pedals during the landing, so hastily retrieved it. During its retrieval he inadvertently knocked the landing gear selector out of its guard towards the GEAR UP position. Despite immediately repositioning the selector, the gear had unlocked.

Pilot's comments

To mitigate the risk of a similar occurrence in the future, the pilot will undertake the following actions:

- For general pleasure flights in complex aircraft, his passengers will occupy the right seat.
- Brief passengers to stow and secure loose or unnecessary items prior to critical phases of a flight.
- Brief the passengers to ensure that they inform him if they interact with any of the aircraft controls at any stage of the flight.

AAIB Record-Only Investigations

This section provides details of accidents and incidents which were not subject to a Field or full Correspondence Investigation.

They are wholly, or largely, based on information provided by the aircraft commander at the time of reporting and in some cases additional information from other sources.

The accuracy of the information provided cannot be assured.

Record-only UAS investigations reviewed: August - September 2023

3 Aug 2023 **DJI Mavic 2** Yoxford, Suffolk

The remote pilot was operating with visual line of sight with a colleague as observer when the UA collided with a tree at a height of approximately 5 metres. The UA fell to the ground with damage to the rotors.

9 Aug 2023 **Windracers** Thorney Island, West Sussex
Ultra-UAS, G-WNDA

A trainee remote pilot under instruction was practising touch-and-go's on Runway 29. During one landing the aircraft touched down on its nose wheel and the nose wheel became dislodged from the wheel hub. The aircraft climbed away and during the subsequent landing the aircraft drifted left and the right wingtip made contact with the runway.

12 Aug 2023 **Model Aircraft** Elvington Airfield, North Yorkshire
Mitsubishi A6M Zero

During a forced landing after engine failure, the model aircraft was caught by a gust of wind and it fell to the ground.

17 Aug 2023 **DJI M300** Strathaven, South Lanarkshire

The UAS was carrying out a survey of a castle, which was closed to the public, and had completed two successful flights. Two minutes into the third flight the remote pilot received a 'strong interference detected' warning. The UA subsequently struck the castle.

21 Aug 2023 **DJI Inspire 1** Sennybridge, Powys

Following successful pre-flight checks, the UA took off. However, at a height of about 10 m, it reported a 'battery critical, land immediately' warning and fell to the ground where it suffered substantial damage.

3 Sept 2023 **Model Aircraft** Pontefract, West Yorkshire
Airworld Hawk

The model jet aircraft lost elevator control. It flew into a field, struck the ground and was destroyed.

5 Sept 2023 **Model Aircraft E-Flite** Telford, Shropshire
Evolution

The model aircraft flew beyond visual line of sight at 100 ft height and 200 ft distance, and was not recovered.

7 Sept 2023 **DJI Inspire 2** Northolt, London

The controller lost link to the UA 20 seconds into the flight. The UA subsequently flew beyond visual line of sight and was not found.

Record-only UAS investigations reviewed: August - September 2023 cont

7 Sept 2023 **DJI Mavic Enterprise 2** Chacewater, Cornwall

Whilst recording footage the UA was manoeuvring at head height along a road with overhead cables. The road dipped downhill and the operator had not realised that the UA had climbed relative to the wires, which it hit and subsequently fell to the ground.

28 Sept 2023 **DJI Air 2S** Bourn Airfield, Cambridgeshire

The UA was being flown 40 m from the remote operator and at a height of 15 m when it suddenly lost lift and dropped to the ground. The cause of the loss of power was not determined.

30 Sept 2023 **Model Aircraft FMS Skytrainer** Near Battlesbridge, Essex

The control link to the model aircraft was lost and the aircraft flew into the ground. It was not recovered.

Miscellaneous

This section contains Addenda, Corrections and a list of the ten most recent Aircraft Accident ('Formal') Reports published by the AAIB.

The complete reports can be downloaded from the AAIB website (www.aaib.gov.uk).

TEN MOST RECENTLY PUBLISHED FORMAL REPORTS ISSUED BY THE AIR ACCIDENTS INVESTIGATION BRANCH

3/2015 Eurocopter (Deutschland) EC135 T2+, G-SPAO
Glasgow City Centre, Scotland
on 29 November 2013.

Published October 2015.

1/2016 AS332 L2 Super Puma, G-WNSB
on approach to Sumburgh Airport
on 23 August 2013.

Published March 2016.

2/2016 Saab 2000, G-LGNO
approximately 7 nm east of Sumburgh Airport, Shetland
on 15 December 2014.

Published September 2016.

1/2017 Hawker Hunter T7, G-BXFI
near Shoreham Airport
on 22 August 2015.

Published March 2017.

1/2018 Sikorsky S-92A, G-WNSR
West Franklin wellhead platform, North Sea
on 28 December 2016.

Published March 2018.

2/2018 Boeing 737-86J, C-FWGH
Belfast International Airport
on 21 July 2017.

Published November 2018.

1/2020 Piper PA-46-310P Malibu, N264DB
22 nm north-north-west of Guernsey
on 21 January 2019.

Published March 2020.

1/2021 Airbus A321-211, G-POWN
London Gatwick Airport
on 26 February 2020.

Published May 2021.

1/2023 Leonardo AW169, G-VSKP
King Power Stadium, Leicester
on 27 October 2018.

Published September 2023.

2/2023 Sikorsky S-92A, G-MCGY
Derriford Hospital, Plymouth, Devon
on 4 March 2022.

Published November 2023.

Unabridged versions of all AAIB Formal Reports, published back to and including 1971, are available in full on the AAIB Website

http://www.aaib.gov.uk

GLOSSARY OF ABBREVIATIONS

aal	above airfield level
ACAS	Airborne Collision Avoidance System
ACARS	Automatic Communications And Reporting System
ADF	Automatic Direction Finding equipment
AFIS(O)	Aerodrome Flight Information Service (Officer)
agl	above ground level
AIC	Aeronautical Information Circular
amsl	above mean sea level
AOM	Aerodrome Operating Minima
APU	Auxiliary Power Unit
ASI	airspeed indicator
ATC(C)(O)	Air Traffic Control (Centre)(Officer)
ATIS	Automatic Terminal Information Service
ATPL	Airline Transport Pilot's Licence
BMAA	British Microlight Aircraft Association
BGA	British Gliding Association
BBAC	British Balloon and Airship Club
BHPA	British Hang Gliding & Paragliding Association
CAA	Civil Aviation Authority
CAVOK	Ceiling And Visibility OK (for VFR flight)
CAS	calibrated airspeed
cc	cubic centimetres
CG	Centre of Gravity
cm	centimetre(s)
CPL	Commercial Pilot's Licence
°C,F,M,T	Celsius, Fahrenheit, magnetic, true
CVR	Cockpit Voice Recorder
DME	Distance Measuring Equipment
EAS	equivalent airspeed
EASA	European Union Aviation Safety Agency
ECAM	Electronic Centralised Aircraft Monitoring
EGPWS	Enhanced GPWS
EGT	Exhaust Gas Temperature
EICAS	Engine Indication and Crew Alerting System
EPR	Engine Pressure Ratio
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
FAA	Federal Aviation Administration (USA)
FDR	Flight Data Recorder
FIR	Flight Information Region
FL	Flight Level
ft	feet
ft/min	feet per minute
g	acceleration due to Earth's gravity
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
hrs	hours (clock time as in 1200 hrs)
HP	high pressure
hPa	hectopascal (equivalent unit to mb)
IAS	indicated airspeed
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IP	Intermediate Pressure
IR	Instrument Rating
ISA	International Standard Atmosphere
kg	kilogram(s)
KCAS	knots calibrated airspeed
KIAS	knots indicated airspeed
KTAS	knots true airspeed
km	kilometre(s)
kt	knot(s)
lb	pound(s)
LP	low pressure
LAA	Light Aircraft Association
LDA	Landing Distance Available
LPC	Licence Proficiency Check
m	metre(s)
mb	millibar(s)
MDA	Minimum Descent Altitude
METAR	a timed aerodrome meteorological report
min	minutes
mm	millimetre(s)
mph	miles per hour
MTWA	Maximum Total Weight Authorised
N	Newtons
N_R	Main rotor rotation speed (rotorcraft)
N_g	Gas generator rotation speed (rotorcraft)
N_1	engine fan or LP compressor speed
NDB	Non-Directional radio Beacon
nm	nautical mile(s)
NOTAM	Notice to Airmen
OAT	Outside Air Temperature
OPC	Operator Proficiency Check
PAPI	Precision Approach Path Indicator
PF	Pilot Flying
PIC	Pilot in Command
PM	Pilot Monitoring
POH	Pilot's Operating Handbook
PPL	Private Pilot's Licence
psi	pounds per square inch
QFE	altimeter pressure setting to indicate height above aerodrome
QNH	altimeter pressure setting to indicate elevation amsl
RA	Resolution Advisory
RFFS	Rescue and Fire Fighting Service
rpm	revolutions per minute
RTF	radiotelephony
RVR	Runway Visual Range
SAR	Search and Rescue
SB	Service Bulletin
SSR	Secondary Surveillance Radar
TA	Traffic Advisory
TAF	Terminal Aerodrome Forecast
TAS	true airspeed
TAWS	Terrain Awareness and Warning System
TCAS	Traffic Collision Avoidance System
TODA	Takeoff Distance Available
UA	Unmanned Aircraft
UAS	Unmanned Aircraft System
USG	US gallons
UTC	Co-ordinated Universal Time (GMT)
V	Volt(s)
V_1	Takeoff decision speed
V_2	Takeoff safety speed
V_R	Rotation speed
V_{REF}	Reference airspeed (approach)
V_{NE}	Never Exceed airspeed
VASI	Visual Approach Slope Indicator
VFR	Visual Flight Rules
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VOR	VHF Omnidirectional radio Range

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