Aircraft Accident Report No: 1/2016

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Report on the accident to AS332 L2 Super Puma helicopter, G-WNSB on approach to Sumburgh Airport on 23 August 2013

Registered Owner and Operator	CHC Scotia Ltd
Aircraft Type	Eurocopter AS332 L2 Super Puma helicopter
Nationality	British
Registration	G-WNSB
Place of Accident	Approximately 1.7 nm west of Sumburgh Airport, Shetland Islands
Date and Time	23 August 2013, at 1717 hrs (Times in this report are UTC unless stated otherwise)

Introduction

The accident was reported by the helicopter operator at approximately 1756 hrs on the day of the accident.

In exercise of his powers, the Chief Inspector of Air Accidents ordered an investigation into the accident be carried out in accordance with the Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 1996. The sole objective of the investigation of an accident or incident under these Regulations is the prevention of accidents and incidents. It shall not be the purpose of such an investigation to apportion blame or liability.

The AAIB despatched teams of investigators and support staff to Aberdeen and the Shetland Islands early the following morning, to commence the investigation.

In accordance with the provisions of ICAO Annex 13, France (the State of aircraft design and manufacture) appointed an Accredited Representative from the BEA[1], assisted by Advisers from the helicopter and engine manufacturers. Advisers from the European Aviation Safety Agency (EASA) and the UK Civil Aviation Authority (CAA) also participated in the investigation.

Footnote

[1] Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile (the French equivalent of the AAIB).

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Summary

At 1717 hrs UTC on 23 August 2013, an AS332 L2 Super Puma helicopter with sixteen passengers and two crew on board crashed in the sea during the approach to land at Sumburgh Airport. Four of the passengers did not survive.

The purpose of the flight was to transport the passengers, who were employees of the UK offshore oil and gas industry, to Aberdeen. On the accident flight, the helicopter had departed the Borgsten Dolphin semi-submersible drilling platform in the North Sea, to route to Sumburgh Airport for a refuelling stop. It then planned to continue to Aberdeen Airport.

The commander was the Pilot Flying (PF) on the accident sector. The weather conditions were such that the final approach to Runway 09 at Sumburgh Airport was flown in cloud, requiring the approach to be made by sole reference to the helicopter's instruments, in accordance with the Standard Operating Procedure (SOP) set out in the operator's Operating Manual (OM). The approach was flown with the autopilot in 3-axes with Vertical Speed (V/S) mode, which required the commander to operate the collective pitch control manually to control the helicopter's airspeed. The co-pilot was responsible for monitoring the helicopter's vertical flightpath against the published approach vertical profile and for seeking the external visual references necessary to continue with the approach and landing. The procedures permitted the helicopter to descend to a height of 300 ft, the Minimum Descent Altitude (MDA) for the approach, at which point a level-off was required if visual references had not yet been acquired.

Although the approach vertical profile was maintained initially, insufficient collective pitch control input was applied by the commander to maintain the approach profile and the target approach airspeed of 80 kt. This resulted in insufficient engine power being provided and the helicopter's airspeed reduced continuously during the final approach. Control of the flightpath was lost and the helicopter continued to descend below the MDA. During the latter stages of the approach the helicopter's airspeed had decreased below 35 kt and a high rate of descent had developed.

The decreasing airspeed went unnoticed by the pilots until a very late stage, when the helicopter was in a critically low energy state. The commander's attempt to recover the situation was unsuccessful and the helicopter struck the surface of the sea approximately 1.7[2] nm west of Sumburgh Airport. It rapidly filled with water and rolled inverted, but was kept afloat by the flotation bags which had deployed.

Search and Rescue (SAR) assets were dispatched to assist and the survivors were rescued by the Sumburgh-based SAR helicopters that attended the scene.

Footnote

[2] AAIB Special Bulletin S7/2013 detailed that the helicopter struck the surface of the sea approximately 1.5 nm west of Sumburgh Airport. This position has been further refined.

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The investigation identified the following causal factors in the accident:

- The helicopter's flight instruments were not monitored effectively during the latter stages of the non-precision instrument approach. This allowed the helicopter to enter a critically low energy state, from which recovery was not possible.

- Visual references had not been acquired by the Minimum Descent Altitude (MDA) and no effective action was taken to level the helicopter, as required by the operator's procedure for an instrument approach.

The following contributory factors were identified:

- The operator's SOP for this type of approach was not clearly defined and the pilots had not developed a shared, unambiguous understanding of how the approach was to be flown.

- The operator's SOPs at the time did not optimise the use of the helicopter's automated systems during a Non-Precision Approach.

- The decision to fly a 3-axes with V/S mode, decelerating approach in marginal weather conditions did not make optimum use of the helicopter's automated systems and required closer monitoring of the instruments by the crew.

- Despite the poorer than forecast weather conditions at Sumburgh Airport, the commander had not altered his expectation of being able to land from a Non-Precision Approach.

AAIB Special Bulletins S6/2013 and S7/2013, published on 5 September 2013 and 18 October 2013 respectively, provided initial information on the circumstances of the accident. Special Bulletin S1/2014, published on 23 January 2014, highlighted a safety concern relating to pre-flight safety briefings given to passengers, on the functionality of emergency equipment provided to them for UK North Sea offshore helicopter flights.

The AAIB investigation found similarities between this accident and previous accidents resulting from ineffective monitoring of the flight instruments by the flight crew.

Following this accident, the operator of G-WNSB and the Civil Aviation Authority (CAA) took safety actions intended to prevent similar accidents in future and to increase the level of safety of UK offshore helicopter operations in the North Sea.

During the investigation a number of additional safety concerns were identified. In addition to the Safety Recommendations issued in the aforementioned Special Bulletins, this final report contains further Safety Recommendations concerned with the certification of rotorcraft, Helicopter Flight Data Monitoring and offshore helicopter survivability.

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Findings

Operational aspects

1. The pilots were properly licensed, qualified and sufficiently rested to conduct the flight.

2. Both pilots had flown into Sumburgh Airport previously and they were familiar with the method of flying a Localiser DME approach.

3. The flight crew had obtained a meteorological forecast for Sumburgh which indicated that the weather conditions would be better than they actually were. Whilst en route to Sumburgh the crew received up to date meteorological reports which indicated that conditions had deteriorated.

4. The flight crew did not obtain up to date weather reports for alternate airports during the final flight sector and did not have a well rehearsed plan for a diversion.

5. The weather conditions at Scatsta, the nominated alternate airport, would probably have precluded making a successful approach, but the flight crew were not aware of this.

6. The company Standard Operating Procedures allowed a variety of Non-Precision Approach methods to be employed; the crew conducted a Localiser DME approach to Runway 09 at Sumburgh Airport using a continuous descent approach technique with a reducing airspeed.

7. The approach was planned and flown by the commander who had engaged the autopilot in 3-axes with V/S mode.

8. The company stabilised approach criteria were met at 1,000 ft amsl. Below 1,000 ft amsl, the flight path deviated from the published vertical profile and the airspeed reduced below the IFR operating limit of 70 kt for 3-axes flight.

9. There was no evidence in the historic FDM data reviewed that the commander had ever continued with an approach to land in weather conditions below minima; his previous 29 approaches to Sumburgh Airport had all transitioned to manual flight at altitudes above 500 ft aal. No FDM events were found that indicated that the commander had flown at low airspeed during an approach.

10. The commander maintained an expectation that he would be able to see the runway at, or before, MDA and the helicopter would land at Sumburgh.

11. In the latter stages of the approach there was a period of some 30 seconds when the flight instruments were not adequately monitored and the helicopter's airspeed continued to reduce unchecked below 80 kt.

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12. The Automatic Flight Control System control of the flight path was compromised before the helicopter reached the Minimum Descent Altitude due to the helicopter's low energy state.

13. The 'CHECK HEIGHT' audio alert sounded at the Minimum Descent Altitude (MDA) of 300 ft.

14. The descent continued below the MDA without the required visual references having been acquired.

15. The commander attempted recovery action and ultimately applied maximum collective pitch, but evidence suggests that the helicopter had probably entered Vortex Ring State and the situation was unrecoverable in the remaining height available.

Flight Data Monitoring (FDM)

16. The FDM event rate per flight for the commander was below the operator's AS332 L2 fleet average.

17. Analysis of FDM data showed that flight crew on the operator's AS332 L2 fleet adopted different methods of conducting the Sumburgh Airport Runway 09 Non-Precision Approach. There were variations in vertical descent paths, airspeeds and autopilot upper mode setting in 3-axes and 4-axes.

18. FDM data showed that on the operator's AS332 L2 fleet in the previous two years, the ratio of 3-axes to 4-axes approaches was about four to one.

Engineering aspects

19. No evidence was found of a causal or contributory fault with the helicopter either before or during the accident flight.

20. No evidence was found that would indicate the helicopter had not been maintained or certified in accordance with current regulations.

21. The collective pitch trim system problem identified by the crew during the flight was considered to have had no bearing on the final stages of the flight.

Evacuation and survivability

22. The impact with the water was survivable.

23. One passenger died in the liferaft from a chronic heart condition which was likely to have been exacerbated by the stress of the evacuation.

24. One passenger managed to escape from the helicopter cabin but drowned prior to, or immediately after, reaching the surface of the water. There was insufficient evidence to determine why this had occurred.

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25. One passenger was incapacitated by a head injury during or immediately following the impact with the water and most likely drowned without regaining consciousness.

26. One passenger died as a result of being unable to successfully escape from the cabin. [Note: this finding was amended on 13 August 2020 when an addendum was issued.]

27. The pilots were unable to jettison their doors using the emergency lever and had to revert to the normal door opening mechanism to exit from the cockpit.

28. The EBS hybrid rebreathers, worn by the passengers, functioned correctly but were not used by the majority of the passengers, either because they were unaware of the air supply that was available within them, or because they were unable to locate or deploy the mouthpiece.

29. Those passengers who escaped from the cabin used the windows as exits. A number of window panes were displaced during the initial impact; others were removed by the passengers.

30. The majority of passengers who removed window panes reported that this was not easy and was significantly harder than they experienced during training.

31. Water ingress into some passenger survival suits was most likely the result of poorly fitting neck or wrist seals, or access zips not being fully closed.

32. Both liferafts were successfully deployed by the co-pilot using deployment handles fitted to the underside of the helicopter fuselage. He was only aware of the additional handles as a result of an informal conversation with a pilot who had instructed in the Norwegian sector.

33. The handles used were non-standard for UK helicopters and had been fitted when the helicopter was operated on the Norwegian register.

34. The Flight Manual supplement describing the additional liferaft deployment handles had not been updated to reflect the helicopter's change of registration.

35. The co-pilot was unable to manoeuvre the second liferaft to recover passengers from the water due to the sea current.

Search and Rescue (SAR)

36. ATC contacted the Sumburgh RFFS approximately six minutes after the helicopter's final radio transmissions acknowledging the clearance to land; transmissions from the helicopter's ELT received during this period were not recognised at first by the Sumburgh tower controller.

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37. Within one minute of notification, the airport fire vehicles and rescue boat reported manned.

38. There was a short delay in the coastguard being notified by the designated police control centre; however, this did not affect the outcome of the rescue.

39. There was a significant delay to the launch of the airport Fast Rescue Craft because of the tide state and location of the slipway; this did not affect the outcome of the rescue.

40. The survivors were all recovered by winch to SAR helicopters and flown to a casualty reception centre at Sumburgh Airport.

Safety Recommendations and actions

Safety Recommendations made previously in Special Bulletin S7/2013 published on 18 October 2013:

Safety Recommendation 2013-021

It is recommended that the operator of Sumburgh Airport, Highlands & Islands Airports Limited, provides a water rescue capability, suitable for all tidal conditions, for the area of sea to the west of Sumburgh, appropriate to the hazard and risk, for times when the weather conditions and sea state are conducive to such rescue operations.

Safety Recommendation 2013-022

It is recommended that the Civil Aviation Authority review the risks associated with the current water rescue provision for the area of sea to the west of Sumburgh Airport and take appropriate action.

The following new Safety Recommendations are made in this report:

Safety Recommendation 2016-001

It is recommended that the European Aviation Safety Agency introduces a requirement for instrument rated pilots to receive initial and recurrent training in instrument scan techniques specific to the type of aircraft being operated.

Safety Recommendation 2016-002

It is recommended that the European Aviation Safety Agency reviews the existing research into pilot instrument scan techniques, particularly with respect to glass cockpit displays, with a view to addressing shortcomings identified in current instrument scan training methods.

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Safety Recommendation 2016-003

It is recommended that the Civil Aviation Authority reviews the methods used by UK North Sea helicopter operators for confirming compliance with their Standard Operating Procedures (SOPs), to ensure they are effective.

Safety Recommendation 2016-004

It is recommended that the Civil Aviation Authority reviews the Standard Operating Procedures of helicopter operators supporting the UK offshore oil and gas industry, to ensure their procedures for conducting Non-Precision Approaches are sufficiently defined.

Safety Recommendation 2016-005

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for Large Rotorcraft (CS 29) to align them with the Certification Specifications and Acceptable Means of Compliance for Large Aeroplanes (CS 25), with regard to the provision of operational information in Flight Manuals.

Safety Recommendation 2016-006

It is recommended that the European Aviation Safety Agency requires manufacturers of Large Rotorcraft to develop Flight Crew Operating Manuals for public transport types already in service.

Recommendation 2016-007

It is recommended that the Civil Aviation Authority expedites the requirement for companies operating helicopters in support of the UK offshore oil and gas industry to establish a Helicopter Flight Data Monitoring (HFDM) programme.

Safety Recommendation 2016-008

It is recommended that the European Aviation Safety Agency considers establishing a European Operators Flight Data Monitoring forum for helicopter operators to promote and support the development of Helicopter Flight Data Monitoring programmes.

Safety Recommendation 2016-009

It is recommended that the European Aviation Safety Agency collaborates with National Aviation Authorities and helicopter operators to develop and publish guidance material on detection logic for Helicopter Flight Data Monitoring programmes.

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Safety Recommendation 2016-010

It is recommended that the Civil Aviation Authority, in co-operation with UK offshore helicopter operators, initiates a review of existing Helicopter Flight Data Monitoring programmes to ensure that operating procedures applicable to approaches are compared with those actually achieved during everyday line flights.

Safety Recommendation 2016-011

It is recommended that the Civil Aviation Authority expedites the publication of the Helicopter Safety Research Management Committee report into improving warning envelopes and alerts.

Safety Recommendation 2016-012

It is recommended that the Civil Aviation Authority supports the ongoing development of Helicopter Terrain Awareness Warning Systems, following the publication of the Helicopter Safety Research Management Committee report into improving warning envelopes and alerts.

Safety Recommendation 2016-013

It is recommended that the European Aviation Safety Agency requires the installation of Helicopter Terrain Awareness Warning Systems to all helicopters, used in offshore Commercial Air Transport operations, with a Maximum Certificated Take-off Mass (MCTOM) of more than 3,175 kg, or a Maximum Operational Passenger Seating Configuration (MOPSC) of more than nine, manufactured before 31 December 2018.

Safety Recommendation 2016-014

It is recommended that the European Aviation Safety Agency introduces a requirement for the installation of cockpit image recorders, in aircraft required to be equipped with Flight Data and Cockpit Voice Recorders, to capture flight crew actions within the cockpit environment.

Safety Recommendation 2016-015

It is recommended that the European Aviation Safety Agency introduces a requirement to install image recorders, capable of monitoring the cabin environment, in aircraft required to be equipped with Flight Data Recorder and Cockpit Voice Recorders.

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Safety Recommendation 2016-016

It is recommended that the European Aviation Safety Agency instigates a research programme to provide realistic data to better support regulations relating to evacuation and survivability of occupants in commercial helicopters operating offshore. This programme should better quantify the characteristics of helicopter underwater evacuation and include conditions representative of actual offshore operations and passenger demographics.

Safety Recommendation 2016-017

It is recommended that, where technically feasible, the regulatory changes introduced by the European Aviation Safety Agency Rulemaking Task RMT.120 are applied retrospectively by the EASA to helicopters currently used in offshore operations.

Safety Recommendation 2016-018

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for rotorcraft (CS 27 and 29) to require the installation of systems for the automatic arming and activation of flotation equipment. The amended requirements should also be applied retrospectively to helicopters currently used in offshore operations.

Safety Recommendation 2016-019

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for Large Rotorcraft (CS 29), certified for offshore operation, to require the provision of a side-floating capability for a helicopter in the event of impact with water or capsize after ditching. This should also be applied retrospectively to helicopters currently used in offshore operations.

Safety Recommendation 2016-020

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for Large Rotorcraft (CS 29), certified for offshore operation, to ensure that any approved cabin seating layouts are designed such that, in an emergency (assuming all the exits are available), each exit need only be used by a maximum of two passengers seated directly adjacent to it.

Safety Recommendation 2016-021

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for Large Rotorcraft (CS 29), certified for commercial offshore operations, to include minimum size limitations for all removable exits, to allow for the successful egress of a 95th percentile-sized offshore worker wearing the maximum recommended level of survival clothing and equipment.

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Safety Recommendation 2016-022

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for Large Rotorcraft (CS 29), certified for use in commercial offshore operations, to require a common standard for emergency exit opening mechanisms, such that that the exit may be removed readily using one hand and in a continuous movement.

Safety Recommendation 2016-023

It is recommended that the European Aviation Safety Agency amends the operational requirements for commercial offshore helicopters to require the provision of compressed air emergency breathing systems for all passengers and crew.

Safety Recommendation 2016-024

It is recommended that the European Aviation Safety Agency (EASA) amends the operational requirements for commercial offshore helicopter operations, to require operators to demonstrate that all passengers and crew travelling offshore on their helicopters have undertaken helicopter underwater escape training at an approved training facility, to a minimum standard defined by the EASA.

Safety Recommendation 2016-025

It is recommended that the European Aviation Safety Agency amends the design requirements for helicopters to ensure that where liferafts are required to be fitted, they can be deployed readily from a fuselage floating in any attitude.

Safety Recommendation 2016-026

It is recommended that the European Aviation Safety Agency requires that, for existing helicopters used in offshore operations, a means of deploying each liferaft is available above the waterline, whether the helicopter is floating upright or inverted.

Summary of Safety Actions

CAA Safety actions

The CAA published CAP 1145, Civil Aviation Authority – Safety review of offshore public transport helicopter operations in support of the exploitation of oil and gas. In this document the following actions are of relevance to the G-WNSB accident:

A4 The CAA will work with the helicopter operators via the newly established Helicopter Flight Data Monitoring (FDM) User Group to obtain further objective information on operational issues from the FDM programme.

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A7 With effect from 1 June 2014, the CAA will require helicopter operators to amend their operational procedures to ensure that Emergency Flotation Systems are armed for all over-water departures and arrivals.

A8 With effect from 1 June 2014, the CAA will prohibit the occupation of passenger seats not adjacent to push-out window emergency exits during offshore helicopter operations, except in response to an offshore emergency, unless the consequences of capsize are mitigated by at least one of the following:

a) all passengers on offshore flights wearing Emergency Breathing Systems that meet Category 'A' of the specification detailed in CAP 1034 in order to increase underwater survival time;

b) fitment of the side-floating helicopter scheme in order to remove the time pressure to escape.

A9 With effect from 1 April 2015, the CAA will prohibit helicopter operators from carrying passengers on offshore flights, except in response to an offshore emergency, whose body size, including required safety and survival equipment, is incompatible with push-out window emergency exit size.

A10 With effect from 1 April 2016, the CAA will prohibit helicopter operators from conducting offshore helicopter operations, except in response to an offshore emergency, unless all occupants wear Emergency Breathing Systems that meet Category 'A' of the specification detailed in CAP 1034 in order to increase underwater survival time. This restriction will not apply when the helicopter is equipped with the side-floating helicopter scheme.

In the case of **Action A10** the UK Oil and Gas Industry have introduced a new CAA approved Category A Compressed Air Emergency Breathing System (CAEBS). From **1 September 2014**, all UK passengers travelling by helicopter to and from an offshore installation, who are not seated next to an emergency exit will be required to wear this device. From **1 January 2015, ALL** UK passengers on all UK helicopter flights to and from an offshore installation will be required to wear this device.

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Safety actions by the operator

The operator took action to review and revise its standard operating procedures and promulgated them to its flight crews in July 2014.

Key elements of the changes for the Super Puma fleet were:

All instrument approaches to be flown 4-axes coupled. If 4-axes mode is not available then 3-axes with IAS mode is required.

A specified, pre-briefed, nominated fixed airspeed to be used for onshore approaches below 1,000 aal.

Changes to the stabilised approach definitions and criteria.

When climbing or descending in 3 axis/2 cue[3] without the collective coupled, crews shall couple airspeed, not vertical speed, to the pitch axis.

Safety actions by the manufacturer

In December 2014, in a presentation given at the EASA Rotorcraft Symposium 2014, Airbus Helicopters reported on an initiative that was launched in September 2013, the Airbus Helicopters Safety Partnership. This was an '*initiative bringing together Airbus Helicopters' efforts to implement and improve safety practices and standards in close cooperation with oil and gas operators, authorities and industry stakeholders*'.

In November 2015, the helicopter manufacturer advised the AAIB that:

'*the FCOM 225 for oil and gas operations has been released by AH and AH has committed to release FCOM for all new AH helicopters flying in oil and gas operations. It will be done at least for the H175 and the H160. For the 332L2, a FOBN (Flight Operational Briefing Note) related mainly to the optimized use of the AFCS is planned by AH.*'

Other safety actions

The safety issue highlighted in AAIB Special Bulletin S1/2014, published on 23 January 2014, concerned the content of the pre-flight safety briefing video. UK operators in the North Sea took safety action to amend the pre-flight safety briefing video for passengers to include information on the automatic air supply feature.

In response to Safety Recommendation 2013-021, Highlands & Islands Airports Limited took action to modify the Runway 09 slipway to allow a water rescue capability to be provided in all tidal conditions, subject to weather conditions.

Footnote

[3] According to helicopter type.

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