Aerospatiale SA365N Dauphin, G-PDGN

AAIB Bulletin No: 8/2003	**Ref: EW/C2002/01/05**	**Category: 2.2**
INCIDENT		
Aircraft Type and Registration:	Aerospatiale SA365N Dauphin, G-PDGN	
No & Type of Engines:	2 Turbomeca Arriel 1C turboshaft engines	
Year of Manufacture:	1984	
Date & Time (UTC):	21 January 2002 at 0825 hrs	
Location:	Kyle of Lochalsh, Scotland	
Type of Flight:	Public Transport	
Persons on Board:	Crew - 1	Passengers - 5
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Minor to vertical stabiliser	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	43 years	
Commander's Flying Experience:	8,220 hours (of which 800 were on type)	
	Last 90 days - 93 hours	
	Last 28 days - 15 hours	
Information Source:	AAIB Field Investigation	

History of the flight

The flight was planned to depart at 0815 hrs from a heliport located at Kyle of Lochalsh, operating under Visual Flight Rules (VFR). The weather conditions were assessed by the commander before departure as surface wind easterly at 10 kt, cloud base above 600 feet, visibility 5 km with heavy rain. The local time of sunrise was at 0834 hrs. The route was to the north and, because of low cloud over the land, it was planned to cross over the Skye Bridge and to continue over water along the Inner Sound towards the destination on Rona Island, a distance of about 20 nm. The flight was part of a regular contract to take personnel to various locations in the area; thus both the commander and the passengers frequently flew on the route.

The passengers walked out to the helicopter at about 0815 hrs. It was raining hard and consequently their clothing was wet by the time they boarded. The commander and one of the passengers were wearing survival suits, the remainder of the passengers were dressed in normal clothing. When boarding was complete the commander started the engines, keeping his door open in an attempt to prevent an accumulation of condensation. After engine start he selected the demist system on and closed the door.

The helicopter took off at 0820 hrs towards the south and, after it had departed, the lights at the heliport were turned off. After takeoff the commander carried out a turn to the right and climbed to 300 feet amsl, heading towards the Skye Bridge. Finding that the weather conditions and continuing

accumulation of condensation on the windscreen were such that he could not continue the planned flight under Visual Flight Rules, he decided to return to the departure point. He informed the passengers of his intention and believed that he may also have radioed to the base at this time. He commenced a turn to the right and carried out the landing checks, but he had difficulty in locating the landing site. The condensation on the inside of the windshield was restricting his forward visibility. He was able to see the lights on the shore and to identify the locality of the heliport but could not see precisely where it was. He opened his side window to help improve the visibility and attempted to clear the forward windscreen using a towel. He did this by leaving the collective pitch control lever unguarded for a time, moving his left hand to the cyclic and using his right hand to wipe the screen. Looking again out of the side window he suddenly saw the sea surface some 10 feet below and, with both hands now back on the controls, initiated a full power climb. He was however unable to arrest the descent in time to prevent the helicopter from momentarily contacting the water.

The impact was described as a thud or jolt by those in the cabin. The helicopter lifted off again into a climb. When level at about 100 feet the commander radioed the base, the lights were switched on for him and he located the heliport. He flew to the landing area, where the ground crew visually inspected the undercarriage before he carried out a normal landing.

Operating procedures

Company operations on this contract were all planned to be carried out under day Visual Flight Rules (day VFR). It was not the intention of the company that pilots should be required to operate either at night or under Instrument Flight Rules (IFR).

The helicopter was equipped with an Automatic Voice Alert Device (AVAD) which would give a voice alert "ONE HUNDRED FEET" through the intercom system whenever the Radar Altimeter (RA) showed a descent through 100 feet; this height is preset and not adjustable by the pilot. There was also a RA bug which could be set by the pilot to a height which, when descended through, would give a "CHECK HEIGHT" audio alert together with a visual alert. For overwater flights there is a mandatory equipment requirement for an RA to be carried which has both visual and aural warning systems but the operating procedure remains the responsibility of the operator. The commander did not recall hearing any AVAD or RA alert and could not recall the position at which the RA bug was set.

The helicopter was equipped with floats, which could be deployed by the pilot prior to a controlled ditching. With floats deployed the helicopter would be expected to remain afloat for at least five minutes. It was also equipped with lifejackets and a liferaft. The passengers were regular travellers on the route, but most of them did not customarily wear survival suits. At the time of the incident, individual, made to measure survival suits were not available and those provided were disliked by the passengers because of their lack of cleanliness and poor fit. The employer of the personnel involved has, since this incident, supplied individual survival suits for all regular passengers. The same employer also requires all personnel to wear survival suits while in transit on another contract, which involves longer over water transit times.

The operator's aircraft overdue procedures were published in their Operations Manual. The published procedures were for a departing helicopter to make a radio call to base after departure at the time of changing to an en-route frequency. Should this call not be received as expected, then initial overdue action would be taken after 15 minutes. For flights associated with this contract there was not a formal notification of the helicopter's safe arrival at destination, but the operations officer at the Kyle base would usually monitor the landing clearances given to the pilot at the various locations on the daily schedule, by keeping a listening watch on the appropriate radio frequency.

Sea survival

Survival times for immersion in the prevailing sea temperatures (+7°C to +9°C), without a survival suit, would usually be less than one hour, but could also be adversely affected by the shock of the sudden cold immersion. (Reference JAR-OPS 3 Subpart K, IEM OPS 3.827) The ability to hold

one's breath can be severely curtailed by this shock, perhaps to just a few seconds, thus reducing the chances of successful escape from a submerged aircraft.

Examination of the aircraft

The physical damage to the aircraft was limited to the right hand vertical fin, with the portion that protruded below the horizontal stabiliser having broken off as a result of contacting the water.

The operator found no defect in the heating and demisting system, apart from a small crack in one of the windscreen diffusers. However, this was not considered to have affected the pattern of airflow.

Dual controls were not fitted to the aircraft. The operator carried out a post-incident check on the friction/balance of the collective lever. The lever was found to be balanced with a bias towards the dual controls fitted condition and has since been adjusted to be balanced in the single controls condition.

The company stated that following the incident the Automatic Voice Alerting Device (AVAD) system was tested and found to operate correctly. They also observed that, although at the time there was no set procedure for setting it, the RA bug was found to be set at 100 feet.

Description of heating and demisting system

Each engine supplies hot air from the high pressure stage of the compressor which passes through a manually controlled cock before exhausting via nozzles into ducts located beneath the floor on either side of the cabin. Ambient air is entrained into the ducts by the action of the nozzles and becomes mixed with the hot air. The mixed air then flows forwards to the cabin heating outlets, the lower side transparent panel demisting diffusers and finally to a further set of demisting diffusers for the bottom of the windscreen. The outlets on the left and right sides of the cabin are opened and closed by means of levers mounted respectively on the left and right sides of the cockpit floor. The Flight Manual advises that when the ambient temperature falls below -20° C, demisting can be improved by closing the cabin heating outlets.

The bleed cock, which is operated by a handle located aft of the engine controls on the cockpit ceiling, is normally closed for engine start, takeoff and landing. The system is operated 'as required' during cruise.

The aircraft can be supplied by the manufacturer with either glass or Perspex windscreens. However, consideration of the birdstrike hazard has resulted in the UK Civil Aviation Authority (CAA) requiring all AS365N aircraft operating in the UK to be equipped with glass windscreens. (Perspex windscreens are still permitted on the earlier SA365C model however). Each glass windscreen is supplied with a built-in electrical heating element, although this system remains inactive unless a dedicated alternator and the associated wiring are also fitted to the aircraft. This work is normally carried out by the manufacturer or appointed agent, as opposed to being the subject of a modification embodied by an operator. Operational heating elements are not mandatory and the system had not been fitted to G-PDGN. The operator commented that, when the aircraft was flown in conditions such as prevailed on the day of the incident, the presence of the elements in the glass windscreen degraded the visibility relative to that which would have been available through the alternative Perspex screen.

Other incidents

The CAA Mandatory Occurrence Report (MOR) database contained one other similar incident involving an AS365. This occurred during North Sea operations in 1996, with '*approach/landing difficulties in heavy rain due ineffective wipers and heavy misting inside cockpit. Go around necessary at one rig*'. Also in 1996, a similar event occurred to an AS332 Super Puma, again during the approach/landing phase. Although these reports contained little detail, it is thought that the fact that they both occurred at the end of their flights reflected the engine bleeds being switched off prior to landing, in accordance with normal operating procedures.

Regulation

The operator held an Air Operator's Certificate (AOC) issued by the Civil Aviation Authority (CAA) for the conduct of public transport operations in accordance with CAP 360. The helicopter on this occasion was being operated in accordance with the requirements of Performance Group A Restricted. This is essentially where, in the event of critical power unit failure, climb performance is available to enable the helicopter to safely continue the flight, except when the failure occurs early during the takeoff in which case a forced landing may be required.

Present regulations regarding helicopter flight over water and survival equipment are based on the probability of a helicopter impacting the water, principally as a result of a powerplant failure. A review of UK operated fatal offshore accidents between 1976 and 1992 showed that of eight accidents there was only one for which powerplant failure was cited as a possible cause. The remainder were as a result of other mechanical failures or loss of control/disorientation.

The UK regulation regarding the wearing of survival suits is solely applicable to crew members. The terms in the Air Navigation Order (ANO) are as follows:

> *'A survival suit for each member of the crew is required in the case of a helicopter classified in its certificate of airworthiness as being of performance group A2 which is intended to fly beyond 10 minutes flying time from land or which actually flies beyond 10 minutes flying time from land, on a flight which is either in support of or in connection with the offshore exploitation, or exploration of mineral resources (including gas) or is on a flight under and in accordance with the terms of a police air operator's certificate, when in either case the weather reports or forecasts available to the commander of the aircraft indicate that the sea temperature will be less than plus 10°C during the flight.'*

At present the majority of UK helicopter AOC holders are operating in accordance with CAP 360. There is no UK regulation which requires passengers to wear survival suits although the wearing of such suits has been standard practice in the offshore mineral exploitation industry for a number of years. This is reflected in the present equivalent European standard of regulation for Public Transport Operation of helicopters as specified in JAR-OPS 3 in which the applicable regulation regarding survival suits is as follows:

> 'An operator shall not operate a helicopter on a flight to or from a helideck located in a hostile sea area at a distance from land corresponding to more than 10 minutes flying time at normal cruising speed on a flight in support of or in connection with the offshore exploitation of mineral resources (including gas) unless:
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> (1) When the weather report or forecasts available to the commander indicate that the sea temperature will be less than plus 10°C during the flight, or when the estimated rescue time exceeds the calculated survival time, or the flight is planned to be conducted at night, all persons on board are wearing a survival suit.'

Discussion

The local time of sunrise was at 0834 hrs, which therefore allowed day VFR operations from 0804 hrs, the start of official morning twilight. The flight was thus scheduled to depart 10 minutes after (and took place 15 to 20 minutes after) this time. In spite of this, the prevailing cloud and rain resulted in poor light conditions, evidenced by the commander's difficulty in locating the heliport until the lights were turned back on. Wet weather conditions, condensation on the windscreen and the lack of good external references available over the water would have further reduced the ability of the commander to fly solely by visual reference.

The commander did not hold an instrument rating and had not completed the requirements for conducting VFR flight at night (Night qualification), nor was he required to have done so. The absence of such qualifications meant that he was untrained and unpractised in incorporating the flight instruments into his visual scan and using the information displayed by them to fly the aircraft. Thus,

as the visibility deteriorated, the flight instruments were of limited practical use and he did not have the option to transfer completely to IFR flight.

The inadvertent descent may have occurred as a result of the collective pitch lever being left unguarded with insufficient friction applied and migrating downwards, or alternatively as a result of an unintended forward cyclic input while the commander attempted to clear the windscreen. The descent was not noticed by the commander until a very late stage at which time immediate recovery action was taken. Also, although both the AVAD and RA audio alerts had probably sounded during the descent, it does not appear that either was heard by the commander.

There can be little doubt that in this incident the windscreen misting occurred as a result of the saturated air both outside and inside the cabin. However, these conditions cannot be considered to be exceptional for this type of operation. Indeed, the fact that the pilot had provided himself with a towel indicates an expectation that at least a degree of windscreen misting would occur at some stage. In this case the situation may have been exacerbated by the wet clothing of the occupants. The reportedly short period that elapsed between engine start and takeoff suggests that the heating/demisting system, assuming it had been selected ON, had insufficient time to be effective. It is also probable that even if the windscreens had been fitted with a functional electrical demisting element, there would have been a similar lack of time for effective demisting to occur. Nevertheless, the operator has reported that the possibility of fitting such a system to the aircraft is being examined. The operator has also introduced rotors running boarding of passengers to ensure that demisting, where required, is at full efficiency before passengers are boarded. This change in practice does however have the potential to increase the risk to personnel from the running rotors.

This was a routine trip made by both the passengers and the commander, the route of which was usually flown mainly overland. It is probable that this was the reason that the majority of the passengers chose not to wear survival suits, together with the discomfort of wearing them. However, on this occasion as a result of the poor weather conditions, it did become necessary to fly the route over water. Moreover it is under these conditions of restricted visibility and low cloud that the possibility of a pilot becoming disorientated is increased.

The evidence from this and previous incidents shows that there is a significant possibility of a helicopter impacting a water surface as a result of an event other than a powerplant failure. There is further evidence that wearing a survival suit would enhance the probability of escape from a submerged helicopter in water temperatures of less than 10°C, and prolong the time of survival.

In this case, if the helicopter had not managed to fly away successfully after surface contact, it is unlikely that, in the prevailing weather and light conditions, there would have been any onshore witnesses to the event. It is, therefore, also unlikely that there would have been any immediate notification of the accident to the emergency services and search and rescue action would have been delayed until the aircraft was notified as overdue.

Although, on this occasion, the flight was never planned to be more than 10 minutes from land and there was a lifeboat station nearby at Kyle of Lochalsh, the time interval between an accident occurring and search and rescue personnel attending was likely to have been greater than one hour, and therefore greater than the estimated survival time in the prevailing sea temperature.

Safety action

Since this incident both the contractor and the operator have reviewed the operation and a number of changes have been either proposed or implemented. The proposed changes were as follows:

Scheduled departure times were to be reviewed by the contractor with a view to ensuring that reasonable daylight conditions would be available at the departure time. The operator has also considered a change of procedure to require that helipad lights are to be left on until a departing aircraft has either gone to an en-route frequency or arrived at its destination.

The following changes have been implemented by the operator:

The schedule of recurrent training for pilots has been revised to include basic disorientation awareness and to include some flight time for pilots in simulated instrument conditions. A procedure has been introduced for carrying out a self test of the radio altimeter system prior to flight, and for the bug to be set to 200 feet for flights conducted under VFR. Rotors running boarding of passengers is now carried out. The collective pitch lever balance has been altered to reflect the condition without dual controls fitted.

Safety Recommendations

The wearing of survival suits by those engaged on public transport helicopter flights in connection with the offshore mineral exploitation industry has been standard practice for a number of years and this is now reflected in present regulations. Currently, no protection through regulation is afforded to personnel engaged on flights in equivalent conditions if such flights are not directly associated with this particular industry. Neither is there any requirement for survival suits to be worn by those engaged on flights which take place within ten minutes flying time from the coast, despite the sea areas around the UK falling within the area designated as a 'hostile environment' under JAR definitions (all open sea areas north of 45°N). The evidence from this incident is that the proximity of a coastline does not necessarily mean that search and rescue can be effected within the probable survival time of personnel immersed in water. Indeed much of the coast lies in remote areas where search and rescue times are likely to be in excess of one hour.

Whereas there already exists an equipment requirement for flights over water to be fitted with a Radio Altimeter there is at present no corresponding requirement for a procedure for the setting of the height bug.

The following safety recommendations are therefore made:

Safety recommendation 2003-09

It is recommended that the Civil Aviation Authority review the terms of the Air Operator's Certificates issued to those helicopter operators whose operations take place over water where the water temperature may be less than +10°C. A special requirement for the wearing of survival suits by both crew and passengers where the likely rescue time exceeds the estimated survival time should be considered. Particular attention should be paid to those flights where personnel are carried on a regular basis as a part of their work, with a view to standardising requirements whatever the nature of the industry.

Safety Recommendation 2003-73

It is recommended that the Civil Aviation Authority require operators of flights, for which there is an existing equipment requirement for a Radio Altimeter to be fitted, to have, in their operations manuals, a procedure for the setting of the height bug.