

SERIOUS INCIDENT

Aircraft Type and Registration:	AS-350, D-HKMB	
No & Type of Engines:	1 Arriel 2D turbine engine	
Year of Manufacture:	2013	
Date & Time (UTC):	17 September 2022 at 1045 hrs	
Location:	Auchmacoy, Aberdeenshire	
Type of Flight:	Specialised operations	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	None	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	73 years	
Commander's Flying Experience:	23,700 hours (of which 20,000 were on type) Last 90 days - 32 hours Last 28 days - 20 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

The helicopter was conducting a survey operation which required flight on closely-spaced parallel tracks at low height. During the turn between two tracks it descended, and the underslung sensor array struck an electricity supply pylon. The impact severed the electricity supply cables causing a loss of power to approximately 1,682 properties. The pilot was unaware of the event and continued his planned sortie.

Following this event, the CAA stipulated enhanced risk mitigation measures for such operations.

History of the flight

The helicopter was operating from a field location near Auchmahoy in Aberdeenshire. It departed from the field location at 1002 hrs and commenced its survey operation using an underslung antenna. This required flying closely-spaced parallel tracks at low height to allow the survey antenna to operate effectively. An overview of the intended survey area and the incident flight is at Figure 1.

The planned height of the antenna above ground was 35 to 45 m and the antennae was suspended 50 m below the helicopter. Therefore, the helicopter would be operating approximately 280 to 300 ft agl. The planned speed for the survey was 35 to 45 kt.

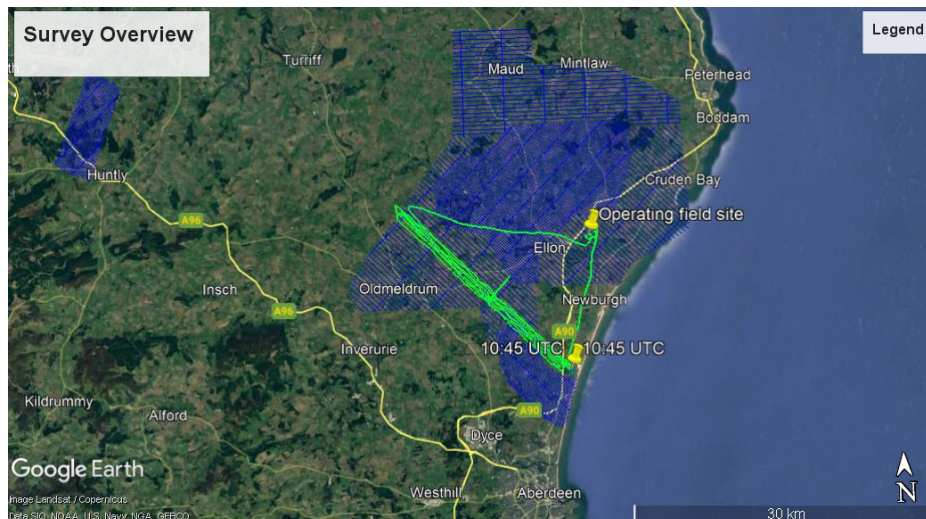


Figure1

Survey Overview

Blue Grid - Planned survey area, Green line - Incident flight

At 1045 hrs the pilot was manoeuvring the helicopter from one planned survey track to the next. To ensure he stayed clear of buildings he had reduced speed to minimise the turning radius. As the speed reduced, the power required to maintain level flight would have increased as translational lift reduced. During the manoeuvre the helicopter lost height and the underslung antenna array struck a 8 m (26 ft) tall electricity supply pylon north of Balmedie (Figures 1 and 2). The collision severed the power cables and interrupted the power supply to 1,682 properties. An expanded view of the incident area is at Figure 2. The pilot stated that he was unaware that the antenna had struck the pylon, so continued the sortie as planned, and was only made aware of the event after landing at the operating field location.

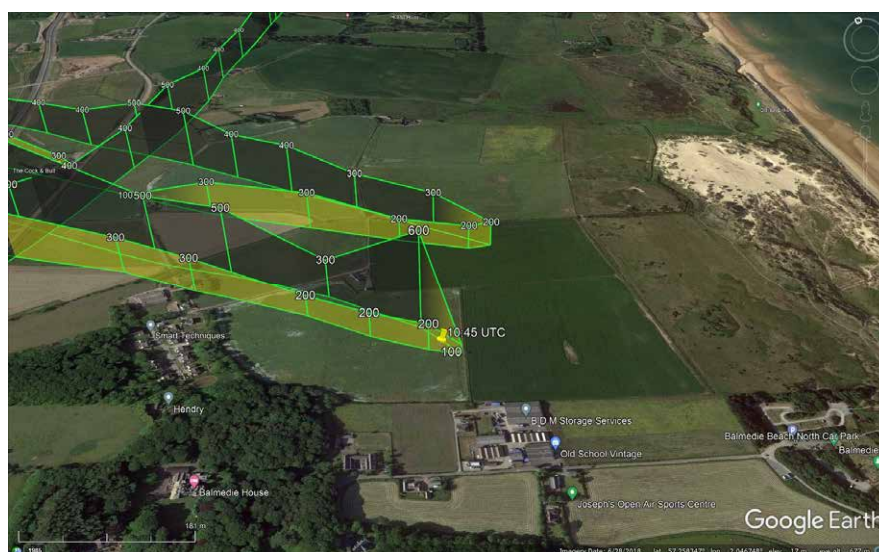


Figure 2

Flight path, with incident at 1045 hrs, showing barometric altitudes

Underslung antenna array information

To conduct the geophysical survey the helicopter carried an underslung antenna array (Figure 3). The whole system including its internal generator weighs 780 kg. To avoid the structure of the helicopter affecting the measurements taken by the system the antenna is carried 50 m below the aircraft. The antenna frame is 28 m long, 16.5 m wide, and covers an area of 340 m². The operator had no specific flight test data related to the load but stated that the Rotorcraft Flight Manual limited the speed to 80 kt for underslung loads but gave no limit for angle of bank.

The antenna transmits an electromagnetic signal which is reflected from the ground. The reflected signal is used to indicate the conductivity of the different layers of the ground and forms the basis for a geological interpretation of what is contained in the layers. The incident occurred during the first scheduled survey using the system in the UK, although the system has been operated globally for 17 years and has covered 1.3 million km of survey lines.



Figure 3

Antenna suspended from an AS350

Organisational information

To facilitate the operation of the survey antenna at the required heights the operator made an application to the CAA for a permission against the terms of SERA 5005. This rule requires aircraft to approach no closer than 500 ft to any vehicle, vessel, person or structure. The application made a request to operate the underslung load at 80 ft agl and the helicopter at 100 to 200 ft agl. It stated that built up areas would not be overflown, and all cities,

villages or single houses would be circumnavigated. The application form required the submission of a detailed risk assessment for the proposed activity and, in response, the operator submitted its Standard Operating Procedure (SOP) for operating with the antenna system.

The SOP analyses risk based on the interaction between the likelihood and severity of a hazardous event. Specific events in a risk register are analysed to give a risk rating. If the risk is in either the medium or high category, then additional control measures are required to reduce the risk to an acceptable level.

The risk analysis placed contact with obstacles in the high-risk category and therefore specific measures were required to alleviate the risk. The operator's mitigating measures were:

1. Flight experience
2. Experience with helicopter type/with kind of operations
3. Procedure (SOP)
4. Flight preparation
5. Suitable landing and takeoff sites
6. Preparation of landing site, ground communication (if possible)
7. Weather limits
8. Emergency response plan

With these mitigations in place, the risk register recorded the risk category as low. The mitigations used were generic and made no reference to the identification of obstacle hazards in the survey area, for example through the use of maps with powerline overlays (aviation charts generally only show known obstacles above 300 ft).

CAA Permission

The CAA granted a Permission for the operation to be conducted as follows:

- a) no flight pursuant to this Permission shall take place over a congested area, along a motorway, major arterial road or railway;*
- b) no helicopter shall fly pursuant to this Permission closer than 60 metres (200 feet) to any person, vessel, vehicle or structure;*
- c) no flight shall be made pursuant to this Permission at night;*
- d) no flight shall be made under any structure or wires;*
- e) flight pursuant to this Permission shall be flown only within the areas outlined in the .kmz file "Q1597_GBR_Aberdeenshire_NewExco" and in accordance with the procedures, conditions and limitations specified in the company document "AIR-OPS-SOP 004-Skytem-Stand 9- 211009", supplied to the CAA with the email "Airborne Survey flights permission low level" dated 26 April 2022;*

- f) *before any flight is made pursuant to this Permission, the operator shall inform the local police authority, and if possible, the Local Authority of each intended flight;*
- g) *the operator shall record the time at which the helicopter takes off and the time at which it lands in relation to any flight made pursuant to this Permission together with details of the location by map grid reference of the area or areas over which such flights were undertaken;*
- h) *any record required to be made pursuant to this Permission shall be retained by the operator for 12 months and shall, within a reasonable time of being demanded by an authorised person, be produced by the operator to that authorised person;*
- i) *before any flight is made pursuant to this Permission, the Operator shall take NOTAM action as appropriate to the route and location.'*

The operator complied with the requirements at f) and i), to file NOTAMS and inform the local authorities of the survey activity. Following the incident, the CAA withdrew the Permission to operate to 200 ft from vehicle, vessel, person or structure.

Aircraft performance

The SOP for the operation with the underslung antenna array recognised that significant portions of such flights would be carried out within the avoidance zone of the Height/Velocity diagram¹. The Height/Velocity diagram for the AS350 is at Figure 4 and the avoidance zone is shown by a 'Z'. Within the avoidance zone if an engine failure occurs a safe landing is unlikely. This risk is also addressed in the risk register and classified in the high category. The suggested mitigations are good maintenance, using trained, experienced pilots and avoiding built up areas, houses and roads. If an engine failure occurs within the Height/Velocity diagram avoidance zone, the aircraft has insufficient performance to affect a safe landing. A twin engine helicopter would have much reduced exposure to the risk of engine failure but would carry a much greater commercial cost.

Analysis

The underslung antenna struck an electricity pylon as the helicopter manoeuvred between survey lines. The pilot had reduced speed to minimise the turn radius to keep the antenna clear of buildings. However, it is likely as the speed reduced and the power demand consequently increased the pilot did not accurately control the height of the aircraft and allowed the descent. The antenna was therefore below its intended survey height and struck a pylon that was 8 m tall, severing the power cables. Unaware of the collision the pilot continued his planned survey.

Footnote

¹ The Height-Velocity diagram is a performance chart that shows combinations of height and forward speed (including hover) from which, after an engine failure, a safe landing cannot be made.

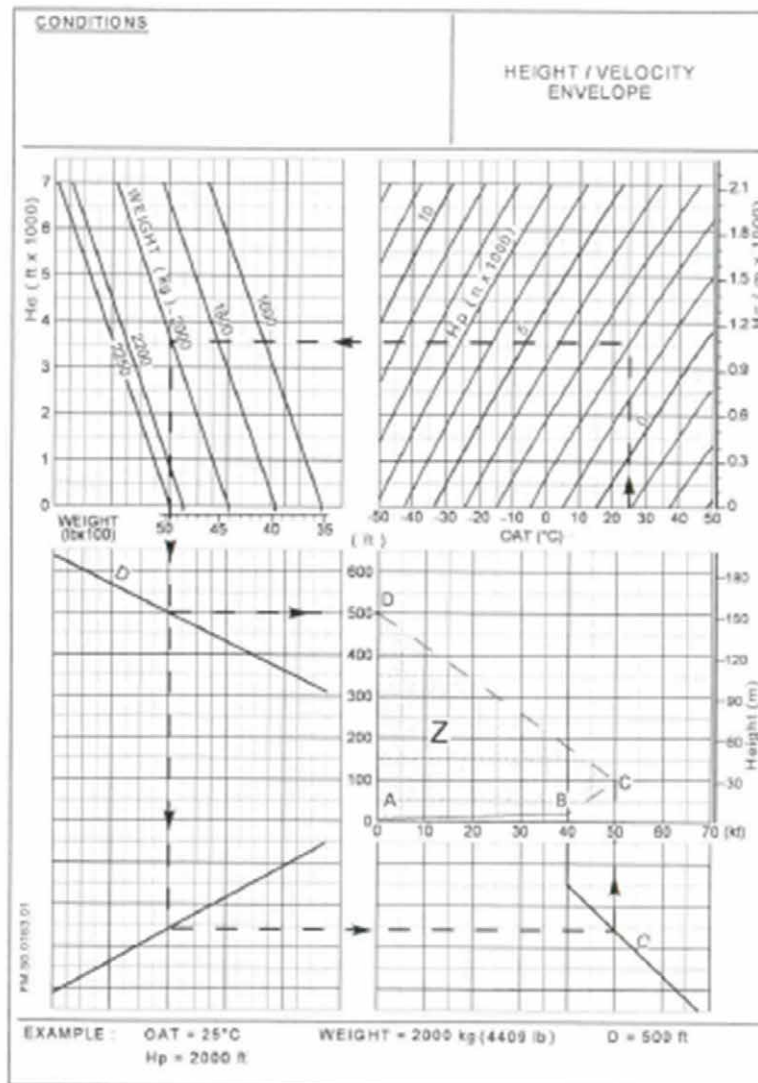


Figure 4

AS350 Height/Velocity diagram

The maps available to the pilot showed only the major power cables and so in his pre-flight preparation he would have been unaware of the presence of the pylon involved in the incident. Avoiding the lower height power cables during the survey relied on the single pilot acquiring such obstructions visually. Given the demanding nature of the intended task, carrying the antenna at only 80 ft agl, the pilot's routine workload was high, which may explain why he did not recognise the presence of the pylons and their proximity to his manoeuvre. The generic mitigations in the operator's risk register, and 'flight preparation' in particular, were ineffective at identifying that a relevant obstacle existed on the route and, thereby, preventing the collision.

At low speed and height the helicopter was operating within the unsafe area of the Height/Velocity diagram. As a result, if the aircraft suffered an engine failure, then a safe landing would be unlikely. As the aircraft would lack the performance to achieve a safe landing the training and experience of the pilot, suggested by the operator as a mitigation would

not be effective. This could be alleviated by using a twin engine aircraft but would incur significantly increased commercial costs.

Conclusion

The pilot was not aware of a height loss during a low speed manoeuvre between planned lines of an aerial survey. As a result of the height loss, the aircraft's underslung load was below its intended height and struck an electricity pylon that had not been identified as a relevant obstacle on the route.

Safety actions

Following the CAA's withdrawal of the Permission to operate below the SERA 5005 limitations, the operator cancelled the remainder of the survey. The CAA issued the operator with an enhanced requirement for mitigations that would be required for any similar operation in future, as follows:

1. The Risk Assessment to be revaluated and have more detail.
2. The 60 m lateral distance from the Load to be included in the SOPs / RAs, matching the more specific 60 m 'bubble' of the new Permission.
3. A 45 m agl minimum height limitation for the load.
4. The use of an observer in the left seat. This crew member would be responsible for lookout, obstruction identification and having mapping with an obstruction overlay.
5. Mapping, ideally digital, with obstruction overlay to be used for both planning and whilst in flight.
6. The pre-flight planning processes should be demonstrated to the CAA before operations commence.
7. The quality and acceptability of the obstruction data and mapping should be demonstrated to the CAA before operations commence.