

Chief Inspector of Accidents
Accident Investigation Division
Civil Aviation Department
46th Floor
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Hong Kong

Accident Bulletin 2/2012
(An update to Accident Bulletin 3/2011)

Aircraft type:	Aerospatiale SA 315B LAMA helicopter
Registration:	B-HJV
Year of manufacture:	1972
Number and type of engines:	One Turbomeca Artouste IIIB turboshaft engine
Date and time of accident:	3 January 2011 at around 0556 hrs UTC (1356 local time) Note : Hong Kong local time is UTC time + 8 hours
Place of accident:	Kau Lung Hang Lo Wai, Fanling, New Territories, Hong Kong
Nature of Accident:	<p>The helicopter was conducting an underslung load operation on the hillside of Kau Lung Hang Lo Wai, Fanling. When the helicopter was setting down a load onto a work site located near an overhead high voltage electricity line pole, a sudden flash of fire occurred adjacent to the power cables below the helicopter. The generated sparks and smoke cascaded onto the ground, causing injuries to two ground workers.</p> <p>After the accident, the helicopter climbed out of the site and returned to its base in Sek Kong. The underslung assembly and several items of the aircraft equipment were found to have been damaged.</p>
Type of flight:	Aerial Work (Underslung Load Operation)
Persons on board:	Crew : 1 Passengers : Nil
Fatalities:	Nil
Serious Injuries:	Crew : Nil Passengers : Nil Others : 1
Commander's licence:	Hong Kong Airline Transport Pilot's Licence (Helicopters)
Commander's experience:	8,766 hours (of which 4,023.8 hrs were on type)
Source of information:	Inspector's Investigation

**Update on Investigation of Helicopter Accident involving
the Aerospatiale SA 315B LAMA (Registration Mark B-HJV)
Underslung Load Operation on 3 January 2011**

1. In accordance with the Hong Kong Civil Aviation (Investigation of Accidents) Regulations (Laws of Hong Kong, Chapter 448 subsidiary legislation B), the Civil Aviation Department (“CAD”) is conducting an Inspector’s Investigation into the circumstances and causes of the above accident involving an Aerospatiale SA315B LAMA helicopter (registration mark B-HJV) operated by Heliservices (Hong Kong) Limited (“Heliservices”) in Kau Lung Hang Lo Wai, Fanling on 3 January 2011. The investigation team issued an Accident Bulletin 3/2011 on 1 February 2011 to provide some initial information relating to the accident. This Accident Bulletin provides a further update of the latest information available as the investigation progresses.
2. Subsequent to the last issue of the Accident Bulletin 3/2011, the investigation team has conducted more in-depth investigation and analysis into all relevant information relating to the accident. It included inter alia, further tests and examination on the underslung assembly and various items of the aircraft equipment to determine the circumstances and causes of the accident. To provide the team with specialist advice in the field of electrical engineering, the investigation team has also engaged the PolyU Technology and Consultancy Company Limited (“PolyU”), a company with a wide level of expertise and experience in the area of high voltage electricity supply and transmission in Hong Kong, to assist the team in the investigation. To date, the following findings were established.

Findings

3. The lower 11 metres of the 100-foot (30.5 metres) longline’s protective nylon jacket was found to have been crisped and fragmented with a large portion of the shrouded electrical cable missing (see Figure 1). The remote-controlled hook which was connected to the bottom end of the longline was charred, showing clear burn marks and signs of flashover (see Figure 2). The length of this damaged section of the longline was consistent with the height of the overhead lines at Pole 9 of the “Fanling – Ting Kok Road No. 1 132 Kilovolts Overhead Line Circuit (“FNL-TKR No. 1 Circuit”)” (See Figure 3).
4. Besides the longline, several items of the aircraft equipment on board the helicopter were found to have been damaged. These included the Automatic Direction Finder

(ADF) navigation equipment, the aircraft transponder and radio equipment, as well as the circuit breaker and toggle switch of the remote-controlled hook located inside the cockpit and connected to the helicopter electrical system. These items were removed from the helicopter for tests and further investigation after the accident.

5. At Pole 9, there were three live overhead lines located on the two sides of the supporting pole, namely Phase L1, Phase L2 and Phase L3, with Phase L2 located at the side on which the underslung load operation was conducted (see Figure 4). The event log of China Light and Power Limited (“CLP”) showed that within a short duration of approximately 168 milliseconds between 0556 and 0557 hrs (between 1356 and 1357 local time), there were substantial disturbances in the voltage and current waveforms of Phase L2. This indicated that a short circuit had occurred in Phase L2 of the FNL-TKR No. 1 Circuit. Phases L1 and L3 only showed minor consequential disturbance due to the short circuit in Phase L2, indicating that there was no short circuit in these phases.
6. Expert advice from the PolyU further indicated that if an external object had come sufficiently close to the Phase L2 conductor and an earthed object, a short circuit may occur, causing a flashover. Based on these findings, the investigation team estimated that at the time of the accident, the longline might have come close enough to the Phase L2 conductor to trigger a fault current to flow from the conductor to an earthed object, causing a flashover. Other possible causes including transient surges of electricity in the CLP’s electrical system and lightning strikes were also considered, however on further investigation, these possibilities had been ruled out.
7. To determine how close the longline might have come to the Phase L2 conductor and an earthed object, the investigation team conducted a series of high voltage electrical experiments in the PolyU laboratory to evaluate the possible scenarios. Results of the experiment have revealed that when the bare conductors were separated by a distance of approximately 20 centimetres, the air insulation gap could break down at an applied voltage comparable in magnitude to the FNL-TKR No. 1 circuit voltage, causing a flashover to occur between the electrodes. It follows that if the accident longline, which was shrouded by a protective nylon fabric jacket, had moved to a distance closer than approximately 20 centimetres to the Phase L2 conductor and an earthed object at the time of the accident, the air insulation gap between them could break down and a flashover could occur. This experiment result was repeatable in the laboratory and consistent with those published in the relevant Institute of Electrical and Electronics Engineers (IEEE) Guide.

8. Given the above findings, the investigation team will continue to study all other relevant evidence and information in order to determine the circumstances and possible causes of the accident with a view to avoiding similar accidents in the future.
9. During the course of investigation, the investigation team issued the following Safety Recommendation in March 2011 :

Recommendation 2011-2

It is recommended that when operating in the vicinity of overhead high voltage electricity lines, the use of any underslung cable assemblies by Heliservices on Aerospatiale SA 315B LAMA helicopters, which consists of electrical conducting material, should be suspended until completion of the investigation or a further recommendation is issued.

10. After the accident, Heliservices has suspended the use of the longlines which incorporate a shrouded electrical cable. Heliservices has also suspended all of its underslung operations in the vicinity of overhead high voltage electricity lines.
11. If there are other safety recommendations deemed necessary during the course of the investigation, they will be promulgated immediately.

Issued on 9 March 2012

This Bulletin contains facts relating to the accident as determined up to the time of issue. The information must be regarded as tentative and subject to alteration or correction if additional evidence becomes available.



Figure 1 : The lower 11 metres of the longline's protective nylon jacket was found to have been crisped and fragmented with a large portion of the shrouded electrical cable missing.



Figure 2 : The remote-controlled hook which was connected to the bottom end of the longline was charred, showing clear burn marks and signs of flashover.

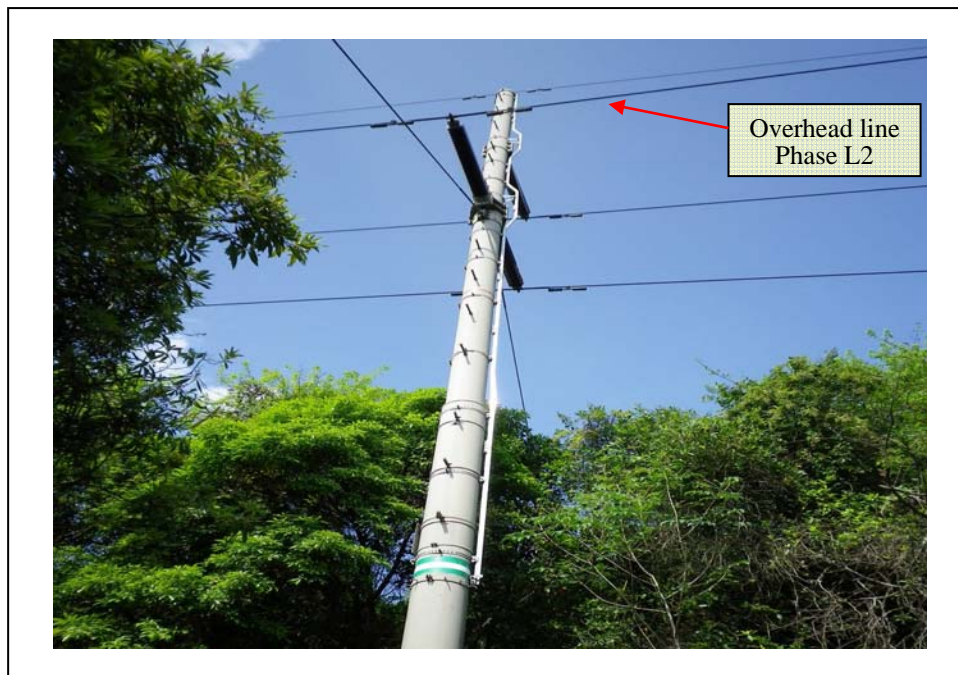


Figure 3 : Pole 9 of the “Fanling – Ting Kok Road No. 1 132 Kilovolts Overhead Line Circuit (“FNL-TKR No. 1 Circuit”)

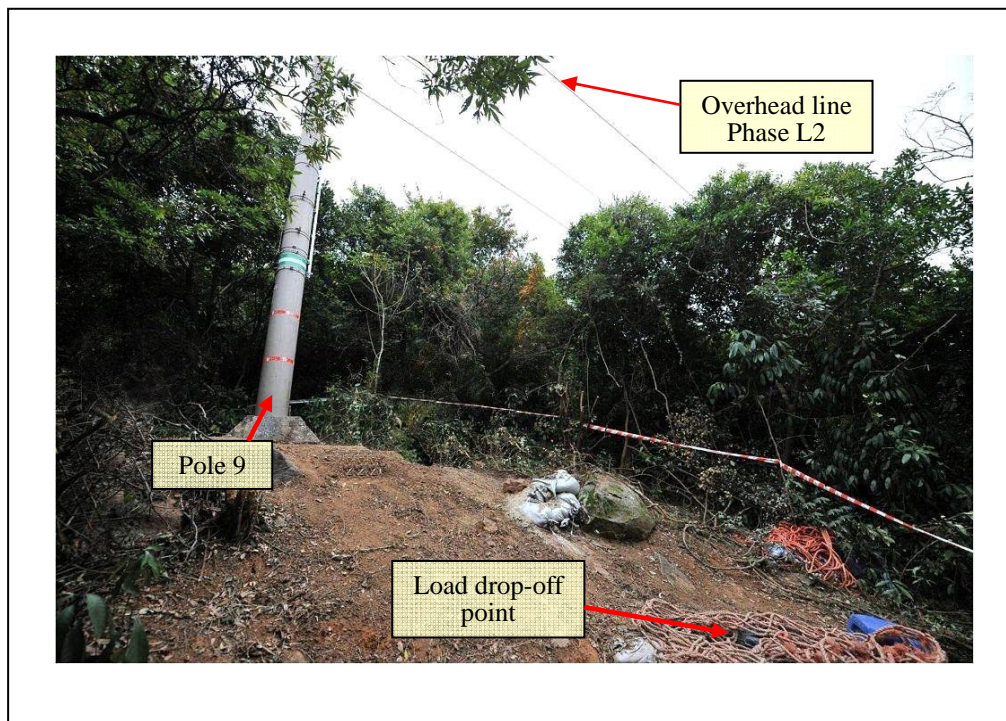


Figure 4 : The relative location of Pole 9 of the “FNL-TKR No. 1 Circuit” and the accident work site