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AAIA

Air Accident Investigation Authority



Crew Incapacitation

Investigation Report

Incident

Boeing 777-367

B-HNP

Enroute from Sapporo to Hong Kong

26 January 2019

07-2023

AAIA Investigations

Pursuant to Annex 13 to the Convention on International Civil Aviation and the Hong Kong Civil Aviation (Investigation of Accidents) Regulations (Cap. 448B), the sole objective of the investigation and the Investigation Report is the prevention of accidents and incidents. It is not the purpose of the investigation to apportion blame or liability.

The Chief Inspector ordered an inspector's investigation into the event as a serious incident in accordance with the provisions in Cap. 448B.

Based on all collected evidence and the subsequent analysis, the event has been reclassified as an incident in accordance with the latest ICAO guidance on occurrence classification.

This incident investigation report contains information of an occurrence involving a Boeing 777-367 passenger aircraft, registration B-HNP, operated by Cathay Pacific Airways Limited, which occurred on 26 January 2019.

The National Transportation Safety Board (NTSB) of the United States, being the investigation authority representing the State of Design and the State of Manufacture, the Civil Aviation Department (CAD), and the operator provided assistance to the investigation.

Unless otherwise indicated, recommendations in this report are addressed to the regulatory authorities of the State or Administration having responsibility for the matters with which the recommendation is concerned. It is for those authorities to decide what action is taken.

This Investigation Report supersedes all previous Preliminary Report and Interim Statements concerning this incident investigation.

All times in this Investigation Report are in Hong Kong Local Times unless otherwise stated.

Hong Kong Local Time is Coordinated Universal Time (UTC) + 8 hours.

Chief Accident and Safety Investigator
Air Accident Investigation Authority
Transport and Logistics Bureau
Hong Kong
May 2023

Aircraft Type and Registration	Boeing 777-367,B-HNP
No & Type of Engines	2 Rolls-Royce Trent 884B-17 turbofan engines
Year of Manufacture	2005 (Serial no 34243)
Date & Time	26 January 2019 at 2200 hrs
Location	Latitude : 23°23'34.1333" Longitude : 119°17'17.5123"
Type of Flight	Commercial Air Transport (Passenger)
Persons on Board	Crew – 16 Passengers – 358
Injuries	Crew – None Passengers - None
Commander's Licence	Airline Transport Pilot's Licence
Commander's Age	62 years
Commander's Flying Experience	22,896 hours (of which 4,758 were on type) Last 90 days - 184 hours Last 7 days - 8:49 hours Last 24 hours – 8:49 hours
Commander's Medical Certificate	Valid till 31 March 2019
First Officer's Licence	Airline Transport Pilot's Licence
First Officer's Age	34 years
First Officer's Flying Experience	8,223 hours (of which 7,831 were on type) Last 90 days - 269 hours Last 7 days - 18 hours Last 24 hours – 8:49 hours
First Officer's Medical Certificate	Valid till 31 July 2019

Synopsis

On 26 January 2019, a Cathay Pacific Airways Boeing 777-367 aircraft, registration B-HNP, was operating from New Chitose Airport (RJCC), Japan, to Hong Kong International Airport (VHHH), Hong Kong on a scheduled passenger flight with flight number CPA 583.

The Pilot in Command experienced a loss of focus in both eyes shortly before entering Hong Kong Flight Information Region (FIR). Subsequently, a PAN-PAN was declared to the Hong Kong Air Traffic Control. Single pilot operation was carried out by the First Officer for approach and landing. The aircraft landed safely at 2255 hrs and taxied to bay W69 without further incident. On arrival, the CN was able to walk and was taken to a hospital for medical supervision. There was no damage to the aircraft and no injury to persons.

In view of the analysis on the operation of this flight and the operator's Standard Operating Procedures for and training in crew incapacitation, no safety recommendation is proposed.

1. FACTUAL INFORMATION

1.1. History of the Flight

- (1) On 26 January 2019, a Cathay Pacific Airways Boeing 777-367 aircraft, registration B-HNP, was operating from New Chitose Airport (RJCC), Japan, to Hong Kong International Airport (VHHH), Hong Kong on a scheduled passenger flight with flight number CPA 583.
- (2) At approximately 2200 hrs, while the aircraft was enroute in the Taipei Flight Information Region (FIR) at flight level (FL) 370, the Captain (CN) experienced a sudden loss of visual acuity. He acted as Pilot Monitoring (PM) and the First Officer (FO) was acting as Pilot Flying (PF) when it occurred. At this moment, the autopilot system was engaged in accordance with the operator's Standard Operating Procedures (SOP).
- (3) The CN's situation continued to deteriorate over time. He advised the FO of his loss of visual acuity and his command decision to declare Pilot Incapacitation. He briefed the FO and Inflight Service Manager (ISM) that he was relinquishing control to the FO, and they conducted the Non-Normal Checklist (NNC) for an Incapacitated Pilot with the FO assuming control of the aircraft.
- (4) The CN instructed the FO to contact the operator's Integrated Operations Centre (IOC) to advise of the incapacitation occurrence and the single pilot operation. He also advised the ISM to alert the operator's Aviation Medical Office (AMO)¹ for immediate medical attention advice and arrangement of an ambulance, and to send in a senior cabin crew member to assist in the cockpit.
- (5) The ISM assigned a Senior Purser (SP), who later took an observer seat in the cockpit, to assist the FO with cockpit to cabin coordination and checklist reading, if required, for the descent, approach and landing in Hong Kong in accordance with the SOP.
- (6) The CN remained conscious and in communication with the FO and the SP during the occurrence. He remained in the left hand seat in the full back position and strapped himself to prevent any possible interruption with the operation of the aircraft.
- (7) Following advice from the AMO, the CN's condition improved.

¹ When a medical situation arises during a flight, crewmembers have ready access to an emergency department doctor for advice and assistance.

- (8) As the flight entered the Hong Kong FIR the FO made a PAN-PAN² call to the Hong Kong Air Navigation Service Provider (ANSP)³ requesting a priority approach.
- (9) The FO completed the approach and the aircraft landed safely at 2255 hrs and taxied to bay W69 without further incident.
- (10) On arrival, the CN was able to walk and was taken to a hospital for medical supervision.
- (11) The aircraft was undamaged, and no one was injured in this occurrence.

1.2. Injuries to Persons

Nil.

1.3. Damage – Aircraft

Nil.

1.4. Personnel Information

Both the CN and the FO held a valid Airline Transport Pilot's Licence (ATPL).

1.5. Aircraft Information

- (1) The Boeing 777-300 is a long range, twin aisle, twin-engine jet manufactured by Boeing Commercial Airplanes. It has a two-crew cockpit and is powered by two Rolls-Royce Trent 884 engines.
- (2) The aircraft was operated by Cathay Pacific Airways and had a valid Certificate of Airworthiness (C of A) in Transport Passenger category and a valid Certificate of Registration (C of R).
- (3) The aircraft was equipped with VHF radio communication systems. All VHF radios were serviceable. All communications between Hong Kong ATC and the crew were recorded by Voice Recording System in the ATC System.

² A PAN-PAN call is the ICAO standard phraseology used as a preface to a radio transmission to indicate a state of urgency requiring priority, but for the time being, it does not pose an immediate danger to life or to the aircraft itself.

³ The Air Traffic Management Division of the Civil Aviation Department (CAD) is the ANSP in Hong Kong responsible for the provision of air traffic service (ATS) to aircraft operating within the Hong Kong FIR, which include the alerting service regarding aircraft in need of search and rescue, and the coordination of search and rescue mission.

- (4) The aircraft's autopilot flight director system (AFDS) can automatically control the aircraft attitude through takeoff (flight director only), climb, cruise, descent, approach, go-around, and autoland. It also supplies indications so the flight crew can manually control the aircraft flight trajectory.
- (5) There was no deferred defect or defect log entries on the autopilot system, the VHF system, and the SATCOM⁴ system before the flight.
- (6) Normal and non-normal⁵ electronic checklists (ECL) for aircraft operation can be shown on any multifunction display (MFD) of the Primary Display System. The flight crew completes the electronic checklist item by item on a READ and DO basis.
- (7) Pushing the CHKL switch on the display select panel (DSP) will show a checklist on the selected MFD.

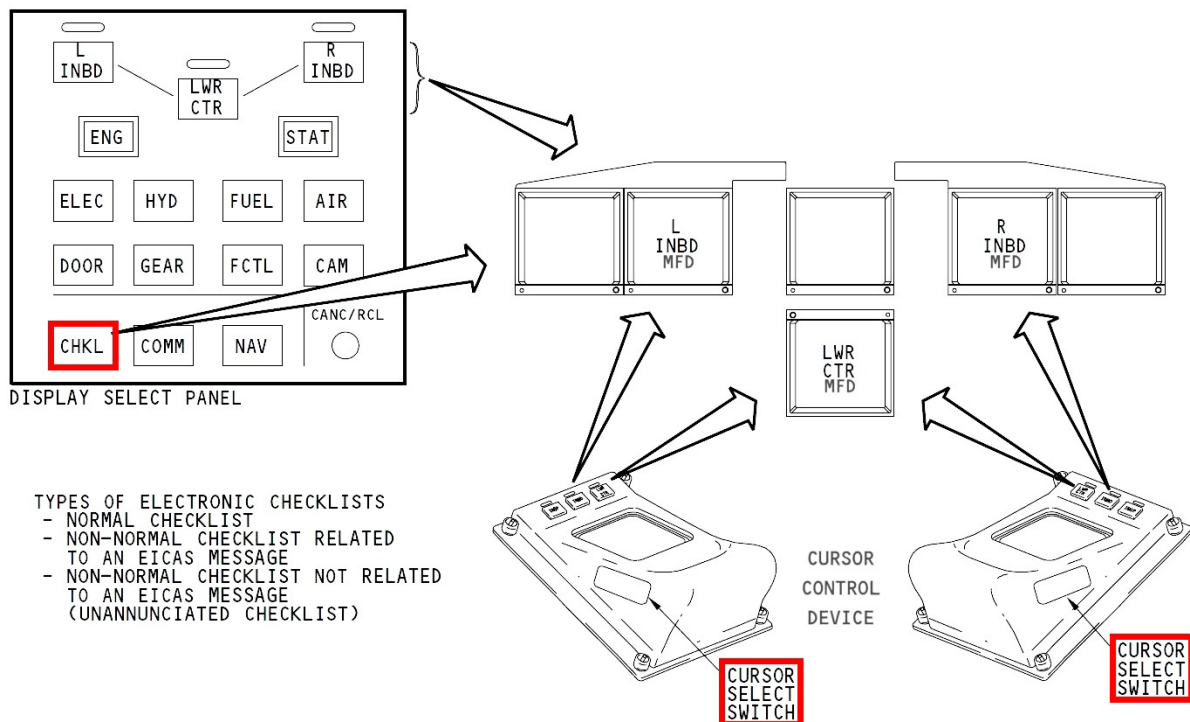


Figure 1: Primary Display System - Electronic Checklist

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⁴ Satellite communications (SATCOM) is the airborne radio telephone communication via a satellite.

⁵ Normal checklists are used for routine tasks such as preparing for landing. Non-normal checklists advise corrective actions for circumstances such as pilot incapacitation.

- (8) The checklist function monitors the position of switches, controls and other data in the flight deck. There are two types of checklist items: closed loop items and open loop items.
- (9) Closed loop items are monitored by the checklist function. They automatically show complete when the Boolean state of the applicable line item goes true.
- (10) Open loop items are not monitored by the checklist function. The flight crew have to use the cursor select switch on the cursor control device (CCD) to set open loop items complete.
- (11) Normal checklists are organized by phase of flight. The flight crew uses them to verify that important procedural steps have been performed.

1.6. Meteorological Factors

There was no significant weather enroute and at Hong Kong International Airport when the CN lost his visual acuity. The weather conditions are not considered a factor in this incident.

1.7. Medical and Pathological Information

- (1) The CN's last medical check was on 12 September 2018 and he was assessed fit with the requirement to use corrective lenses.
- (2) Both the CN and the FO were compliant with the medical requirements to hold an ATPL.
- (3) The CN experienced a loss of focus in both eyes and the situation continued to deteriorate and a flashing multi coloured storm was visible in both eyes. He had no medical history regarding this symptom. The result of his medical diagnosis after the incident was not available to the investigation team.
- (4) After taking oxygen and medicine as advised by MedLink of the AMO, the CN's condition was improved. The duration of this episode was approximately 30 minutes. After which the CN's normal sight returned.
- (5) The CN was on a jumpseat doing check duties for 12.72 hours on 22 January 2019. He was off duty for two days and on ground duty on 25 January 2019. He had a rest period of 58.95 hours in between. Before he reported duty for flight CPA582 (VHHH to RJCC), he had another rest period of 18.42 hours.
- (6) After the event the CN was temporarily removed from duties until he could obtain medical clearance to resume flying.

1.8. Organisation, Management, System Safety

1.8.1. Operations Procedures for Pilot Incapacitation

1.8.1.1. Procedures for Flight Crew

The procedures, policy, and guidance for flight crew regarding pilot incapacitation are described in the Boeing Flight Crew Training Manual (FCTM), the NNC, and the operator's Operations Manual Part A (OM Part A). The relevant contents are as follows.

1.8.1.1.1. Boeing 777 Flight Crew Training Manual

The FCTM provides general information on crew action upon confirming pilot incapacitation:

“If a pilot is confirmed to be incapacitated, the other pilot should take over the controls and check the position of essential controls and switches.

- *after ensuring the airplane is under control, engage the autopilot to reduce workload • declare an emergency*
- *use the cabin crew (if available). When practical, try to restrain the incapacitated pilot and slide the seat to the full-aft position. The shoulder harness lock may be used to restrain the incapacitated pilot*
- *flight deck duties should be organized to prepare for landing*
- *consider using help from other pilots or crewmembers aboard the airplane.”*

1.8.1.1.2. Non-Normal Checklist

The NNC procedures for pilot incapacitation are as below.

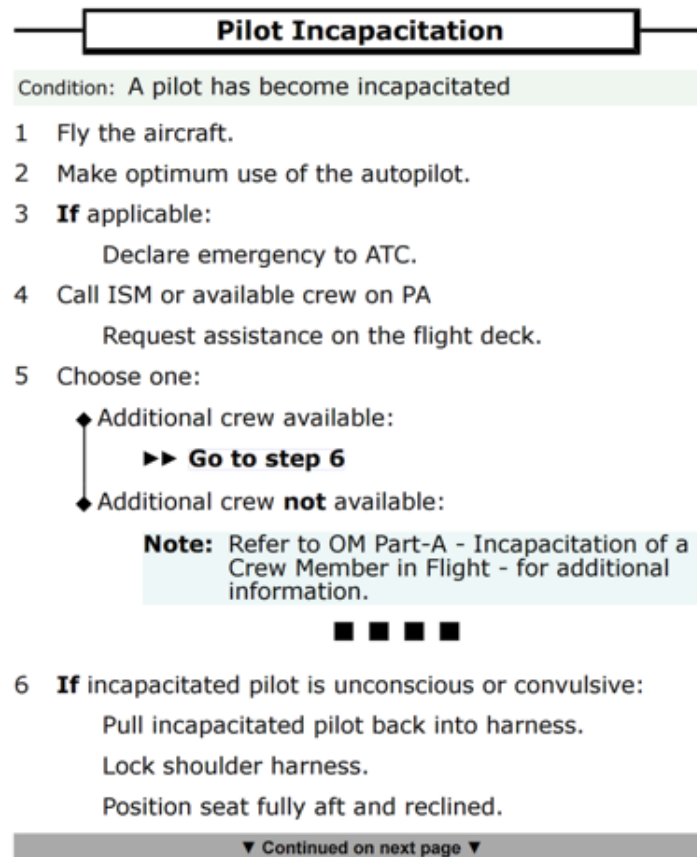


Figure 2: Non-Normal Checklist Procedure for Pilot Incapacitation

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1.8.1.1.3. Operations Manual Part A

The relevant information is extracted as follows.

- (1) If the Commander/Pilot in Charge (PIC) becomes incapacitated, the FO will assume the command of the aircraft.
- (2) In the event of injury or illness occurring to any crew member in flight, the crew should assess whether to land at the nearest suitable airport where adequate medical facilities are available.
- (3) The crew shall seek advice from the AMO, Senior Medical Officer (SMO) or Duty Medical Officer (DMO) via SATCOM or if unavailable via ACARS⁶

⁶ Aircraft Communication Addressing and Reporting System (ACARS) is a digital data link system for the transmission of messages between aircraft and ground stations.

requesting an urgent response. If direct contact with the SMO/DMO is not available, the crew should seek advice from MedLink.

- (4) If crew incapacitation leads to the number of effective crew members (flight and cabin Crew) falling below the minimum specified in the Operations Manual, an emergency shall be declared to ATC.
- (5) In the case of pilot incapacitation on an Extended Diversion Time Operations (EDTO) sector, the senior pilot in charge should, when deciding whether to continue the flight or land enroute, take into account the following factors:
 - (a) the seriousness of the illness or injury;
 - (b) the reduction in flight time;
 - (c) weather and approach aids at the destination and suitable enroute alternate airports;
 - (d) familiarity with suitable enroute alternate airports; and
 - (e) the extra workload involved in diverting single-handedly, even with assistance from other Crew members (e.g. Cabin Crew or positioning Flight Crew).
- (6) Once a flight crew member has become incapacitated, under no circumstances should that person resume duties until cleared by the SMO/DMO.
- (7) In case of incapacitation of the Commander/PIC, the pilot assuming command is to operate from their normal control seat if possible. Aircraft docking may only be accomplished by a pilot seated in their normal operating seat either using a guidance system calibrated for that seat or a ground marshaller. The aircraft shall be towed onto the bay if this is not possible.

1.8.1.1.4. Procedures for Cabin Crew

The relevant procedures of pilot incapacitation include the following steps.

- (1) Pull pilot back into seat.
- (2) Restrain pilot using shoulder harness.
- (3) Lock shoulder harness.
- (4) Position seat fully aft.
- (5) Recline seat back fully.
- (6) Fit the oxygen mask (100% setting and emergency setting) or use resuscitation equipment.
- (7) Remove pilot, unless he is convulsive.
- (8) Carry out cockpit duties as instructed, including reading the checklists of descent, approach, and landing if required to do so by the pilot flying.

1.8.2. Crew Training and Checking for Pilot Incapacitation

1.8.2.1. Training and Checking for Flight Crew

- (1) When a flight simulator is used for proficiency training and checking, the opportunity is taken to use Line-Oriented Flight Training (LOFT)⁷ with emphasis on Crew Resource Management (CRM) where possible.
- (2) LOFT is utilised in the recurrent training programme and the flight crew has to complete elements of CRM training.
- (3) Pilot incapacitation is an annual item in the proficiency checks the flight crew are subject to.

1.8.2.2. Training for Cabin Crew

- (1) The operator's cabin crew training is conducted in the cabin-training centre, with an emphasis on a competency-based approach to performance assessment.

⁷ LOFT is the training in a simulator with a complete crew using representative flight segments which contain normal, abnormal, and emergency procedures that may be expected in line operations.

- (2) The cockpit trainer is a fixed base dual type (Airbus/Boeing) mock up with representative seats and harness for the respective types. The mock up does not have electronic checklists presented in the pilot's displays.
- (3) Senior cabin crew members are trained to perform checklist reading using paper Quick Reference Handbook (QRH) stowed in the cockpit.
- (4) The pilot position for the incapacitation exercise is assumed by one of the trainees.
- (5) Senior cabin crew members are arranged to participate in flight simulator LOFT exercises.

1.9. Additional Information

1.9.1. Pilot Incapacitation

- (1) According to ICAO Doc 8984⁸, inflight "incapacitation" means any reduction in medical fitness to a degree or of a nature that is likely to jeopardize flight safety. The document divides incapacitations into two operational classifications: "obvious" and "subtle".
- (2) *"Obvious incapacitations are those immediately apparent to the other crew members. The time course of onset can be "sudden" or "insidious" and complete loss of function can occur."*
- (3) *"Subtle incapacitations are frequently partial in nature and can be insidious because the affected pilot may look well and continue to operate but at a less than optimum level of performance. The pilot may not be aware of the problem or capable of rationally evaluating it. Subtle incapacitations can create significant operational problems."*

1.9.2. Crew Resource Management (CRM)

- (1) Crew Resource Management (CRM) is the effective utilisation of the vast array of resources available to flight crew to assure a safe and efficient operation, reducing and managing error, avoiding stress and increasing efficiency. The resources may include other flight crew members, cabin crew, procedures, machine interface in the aircraft, ATC, support from airline maintenance and operations centres, etc.
- (2) CRM is considered essential training of the cognitive and social skills needed to support technical knowledge and skills training in order to optimise safe and efficient aircraft operation for crew members.

⁸ Third Edition - 2012

1.9.3. Line-Oriented Flight Training

- (1) LOFT is a practical application of CRM concepts. It is carried out in a flight simulator as part of initial or recurrent flight crew training. It involves simulated scenarios of routine daily airline operations with reasonable and realistic difficulties and emergencies introduced to provide training and evaluation of proper flight deck management techniques.
- (2) The abnormalities, which will be encountered, are generally not pre-briefed.
- (3) Special emphasis is laid on situations which involve communications, management and leadership.
- (4) LOFT is not used as a method of checking the performance of individuals. Instead, it is a validation of training programmes and verification of operational procedures.

1.9.4. Event Classification

- (1) According to Attachment C of ICAO Annex 13 *Aircraft Accident and Incident Investigation* in the Eleventh Edition at the time of the occurrence, flight crew incapacitation in flight is a typical example of serious incident. In the Twelfth Edition published in July 2020, this example was expanded as follows:

“Flight crew incapacitation in flight:

- a) for single pilot operations (including remote pilot); or*
- b) for multi-pilot operations for which flight safety was compromised because of a significant increase in workload for the remaining crew.”*

- (2) In addition, the revised Attachment C introduced an event risk-based analysis which can be performed as follows:

- “a) consider whether there is a credible scenario by which this incident could have escalated to an accident; and*
- b) assess the remaining defences between the incident and the potential accident as:*
 - effective, if several defences remained and needed to coincidentally fail; or*

- *limited, if few or no defences remained, or when the accident was only avoided due to providence.”*

- (3) Based on the new guidance, risk assessment on occurrence can be performed in a systematic, robust, and intellectually cohesive manner to determine whether it should be classified as a serious incident.

2. Safety Analysis

2.1. Flight Operations

- (1) The CN experienced a loss of focus in both eyes and declared his obvious incapacitation shortly thereafter. He enacted the NNC procedures, and advised the FO to take over the aircraft, communicate with the IOC and make a PAN-PAN call to ATC to indicate a state of urgency requiring a priority approach. Therefore, the FO, with the assistance from the cabin crew and ATC, had an early opportunity to maintain control of the aircraft, take care of the CN, and re-organise the flight deck work and land the aircraft.
- (2) When the CN declared incapacitated, the FO was the PF and the autopilot system was kept engaged. There was no immediate threat to the control of the aircraft. Optimal use of the autopilot is mandated by airlines as SOPs and it is also one of the steps in the NNC of Pilot Incapacitation. The autopilot system could also autoland the aircraft if required.
- (3) The FO did not opt to divert to Taipei because it was the CN's last command before he declared he was incapacitated. When the CN declared pilot incapacitation, the aircraft was about 147 nautical miles from Taipei and 304 nautical miles from Hong Kong. Taking into consideration of the flight phase, routes (U-turn to Taipei versus enroute to Hong Kong), time taken for negotiating a re-clearance with Taipei ATC, aircraft conditions, meteorological conditions, the CN's medical situation, etc., the FO's assessment of the contingency options and the decision to continue to home base is considered appropriate.
- (4) According to the FO, the SP read out ACARS messages from the IOC to the CN, and acknowledged each of the FO's messages and relayed them to the cabin. The SP alleviated the workload of the FO on communication.
- (5) The FO used the electronic checklists as per the SOP with the Senior Purser available to read out the paper checklist if required, as he considered that the electronic checklists were obvious enough for him to follow. Since the normal ECLs are automatically displayed in the proper

sequence for each phase of flight, it is highly unlikely for a pilot to skip a checklist. Open loop checklist items require pilots to acknowledge each step in a sequence. Closed loop checklist items are tied via sensors to certain aircraft functions and states. They will not allow a pilot to bypass a step until it is addressed. By having checklists available at the touch of a button, crewmembers, when faced with unexpected situations, have the proper checklists for emergency procedures available.

- (6) ATC prioritised the approach of the flight and instructed them to descend for a high speed approach to Hong Kong. The communication of the flight with the enroute and terminal ATC units was effective and the ATC instructions were precise, simple and direct.
- (7) There was no evidence indicating that the FO had any difficulty in dealing with the situation and continuation of the flight. Adhering to the SOP and making the best use of the assistance and resources from ATC, cabin crew, and aircraft automation reduced the complexity and workload for the FO.
- (8) The aircraft was landed safely and taxied to the arrival gate behind a Follow Me car with no further events. The situation was under control of the FO.
- (9) The flight crew and cabin crew complied with the operational aspects of company procedures, policy, and guidance during the descent, approach, and landing.

2.2. Training

- (1) It should be noted that both pilots are trained and have to pass the proficiency checks to the same standard, one of whom is nominated by the company as a CN and the other as an FO. In addition, incapacitation training is carried out in the company simulator recurrent training package approved by the CAD and cabin crew also attend refresher courses annually and practical refresher every three years.
- (2) According to the statement of the CN, although the workload for the FO increased significantly, the FO executed the NNC literally and it was apparent that the FO's previous training was very useful as his stress level was well controlled.
- (3) Pilot incapacitation is an annual item in the proficiency check. In addition, the operator's LOFT in simulator training, pilot incapacitation may be simulated at any phase of the flight. It is considered that the FO was trained adequately to manage cases of pilot incapacitation.

2.3. AAIA Observations

- (1) Overall the event, from an operational point, was handled utilizing robust SOP assisted with appropriately applied CRM. Aspects of training, both in the operation of the aircraft and in which the CN declared that he was incapacitated and did not interfere in further duties, all combined to produce a successful outcome.
- (2) Checklists, whether paper or electronic, constitute tools that support flight crew airmanship and memory and ensure that all required actions are performed without omission and in an orderly manner. The completion of checklists provides a defence against errors of omission in normal and abnormal circumstances and assist the flight crew in the application of SOP to ensure safe and proper operation of the aircraft.

2.4. Reclassification of the Event

- (1) According to the above analysis, AAIA considers that the flight safety of this event was not compromised because of a significant increase in workload for the remaining crew.
- (2) In addition, the SOP, training of flight crew, ATC, cabin crew, and aircraft automation were defences in place which effectively stopped further escalation of the event into a serious incident or accident.
- (3) Therefore, according to the additional description of “flight crew incapacitation in flight” and the new guidance on event risk-based analysis in the revised Attachment C of ICAO Annex 13, the event was reclassified as Incident.

3. Conclusions

3.1. Findings

- (1) The Captain experienced a sudden loss of visual acuity during cruise at FL 370. He advised the First Officer and declared Pilot Incapacitation in a timely manner. [1.1 (2), 1.1 (3)]
- (2) The crew were licensed and qualified for the flight in accordance with existing regulations and the operator’s requirements. [1.4, 1.7 (2)]
- (3) The aircraft had a valid Certificate of Airworthiness and a valid Certificate of Registration. [1.5 (2)]

- (4) The weather conditions are not considered a factor in this incident. (1.6)
- (5) The Captain had sufficient rest before conducting this flight. [1.7 (5)]
- (6) The operator has procedures, policy, guidance, and training for flight crew and cabin crew regarding pilot incapacitation. (1.8.1, 1.8.2)
- (7) The Captain's incapacitation was obvious and he advised the First Officer in a timely manner. This allowed the First Officer and the cabin crew to take appropriate actions promptly. [2.1 (1)]
- (8) The First Officer made optimal use of the autopilot system to control the aircraft. [2.1 (2)]
- (9) The First Officer's assessment of the contingency options and the decision for a home base return is considered appropriate. [2.1 (3)]
- (10) The Senior Purser alleviated the workload of the FO in communication with the cabin crew. [2.1 (4)]
- (11) The First Officer used the electronic checklists as per the SOP with the Senior Purser available to read out the paper checklist if required. [2.1 (5)]
- (12) The best use of the assistance and resources from ATC, aircraft automation, and cabin crew reduced the complexity and workload for the First Officer. [2.1 (7)]
- (13) The flight crew and cabin crew complied with the operational aspects of company procedures, policy, and guidance during the descent, approach, and landing. [2.1 (9)]

3.2. Cause

The Captain experienced a loss of focus in both eyes and the situation continued to deteriorate.

4. Safety Recommendations

In view of the above analysis on the operation of this flight and the operator's SOP for and training in crew incapacitation, no safety recommendation is proposed.