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AAIA

Air Accident Investigation Authority

Runway Incursion (RI-VAP)

Investigation Report

Incident

Bombardier Global 5000, P4-AVA and Boeing 737-81B, B-1918

Hong Kong International Airport

Hong Kong

13 November 2018

02-2023

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 this event as a serious incident in accordance with the provisions in Cap. 448B. After examining all collected evidence and the subsequent analysis with the help of the Runway Incursion Severity Classification (RISC) Calculator of the International Civil Aviation Organization (ICAO), the event was reclassified as an incident before the Investigation Report was finalised.

This Incident Investigation Report contains information of an occurrence involving a Boeing B737-81B (registration B-1918) operated by China Southern Airlines and a Bombardier Global 5000 (registration P4-AVA) operated by MS Aviation GmbH, which occurred at Hong Kong International Airport (VHHH) on 13 November 2018.

The Civil Aviation Department of Hong Kong, the aircraft operators, i.e. China Southern Airlines and MS Aviation GmbH, and the following investigation authorities provided assistance to the investigation: -

(i) Civil Aviation Administration of China, representing the State of Registry and the Operator of the B737-81B aircraft;
(ii) National Transportation Safety Board of USA, representing the State of Design and Manufacture of the B737-81B aircraft;
(iii) Aruba Aviation Safety Board, representing the State of Registry of the Bombardier Global 5000 aircraft;
(iv) Federal Safety Investigation Authority of Austria, representing the State of the Operator of the Bombardier Global 5000 aircraft; and
(v) Transportation Safety Board of Canada, representing the State of Design and Manufacture of the Bombardier Global 5000 aircraft.

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

February 2023

Synopsis

At 19:47 on 13 November 2018, there was an occurrence at Hong Kong International Airport (VHHH) in which a China Southern Airlines Boeing 737-81B landed on Runway 07L (RWY 07L) while a preceding Bombardier Global 5000 had not yet vacated the runway after landing. (Hereafter the two aircraft are referred to by their type designators as B738 and GL5T respectively.) The B738 aircraft was a scheduled passenger flight carrying 171 passengers and 8 crew members. The GL5T was a business jet on a ferry flight carrying two crew members. The occurrence was classified as Runway Incursion according to the definition of the International Civil Aviation Organization (ICAO).

After the GL5T completed its landing roll, it continued taxiing on the runway for Rapid Exit Taxiway (RET) A7. When the succeeding B738 was approaching the runway, the air traffic controller cleared it to land while the GL5T was still on the runway. When the B738 landed, the distance between the two aircraft was 1,470 metres. This distance was reduced to slightly more than 1,000 metres by the time the GL5T vacated the runway via RET A7. There was no damage to either aircraft and no injury to any person. Both aircraft taxied to their respective parking gates without further incident.

The investigation identified that the Runway Incursion was caused by the air traffic controller clearing an arriving aircraft to land when he inadvertently misperceived that the runway was clear whereas the preceding landing had not yet vacated the runway. A contributing factor was that the preceding aircraft took an unusually long time to vacate the runway after landing by as much as 70% more than the average Runway Occupancy Time of Arrivals at VHHH, thus contributed to the development of a tight catch-up situation.

The investigation team has made one safety recommendation.

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1 FACTUAL INFORMATION

1.1 History of the Flight

(1) On 13 November 2018, a Bombardier Global 5000 (hereafter the GL5T) was on approach to RWY 07L[1] at VHHH, followed by a China Southern Boeing 737-81B (hereafter the B738). The GL5T (registration P4-AVA), was a ferry flight from Clark International Airport (RPLC) in the Philippines and the B738 (registration B-1918, flight number CSN6045), was a scheduled passenger flight from Yiwu Airport (ZSYW) in China.

(2) At 19:43:20 the GL5T established radio contact on frequency 118.2 MHz with the Air Movements North (AMN) control position (call sign "Tower North") in the Aerodrome Control Tower (the Tower). AMN is responsible for providing Air Traffic Control (ATC) service for the North Runway (RWY 07L/25R). The air traffic controller on duty at AMN (the controller) had taken over the control position at 19:30 after returning from a break for 90 minutes.

(3) As recorded on the Cockpit Voice Recorder (CVR) of the GL5T, the pilots discussed during the approach on which runway exit to use after landing. They agreed on taking Rapid Exit Taxiway (RET) A7. [See Figure 1.]

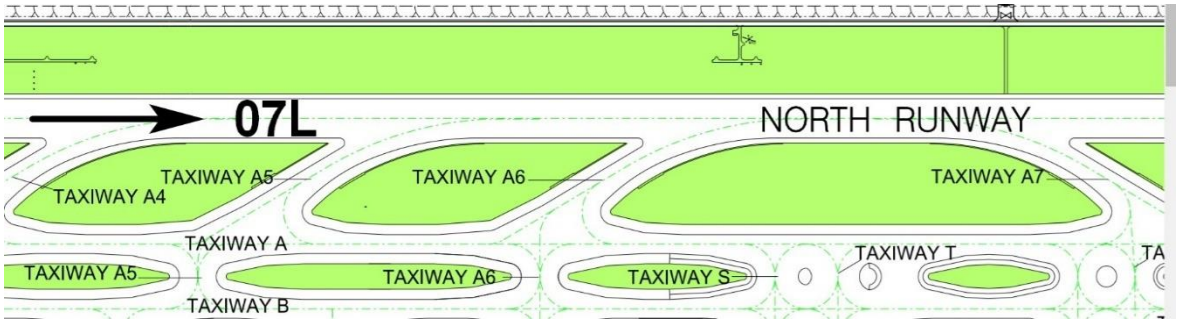

Figure 1: RWY 07L and RETs A5, A6 and A7

(4) At 19:44:32, the controller cleared the GL5T to land. At that time, the GL5T was about two Nautical Miles (NM) from the runway with a ground speed of about 120 knots (kts) as shown on the Situation Display (SIT) [see 1.10.1.5], a speed which the controller considered a bit slower than the more common 140 kts from his observation of the general performance of other aircraft on approach passing that range. This

1 Under the Three-runway system (3RS) Project, a new runway to the north of and parallel to the original dual runways was being constructed at VHHH at the time of the incident. The original North Runway (RWY 07L/25R) was re-designated as the Centre Runway (RWY 07C/25C) on 2 December 2021, to prepare for the commissioning of the new North Runway in 2022, which would be designated as the new RWY 07L/25R. The incident occurred on 13 November 2018; hence the designation of RWY 07L/25R in this Investigation Report refers to that of the original North Runway prior to its re-designation on 2 December 2021.

observation, however, did not surprise the controller, with his expectation of the performance of a business jet aircraft. In anticipation of a catch-up situation, the controller instructed the GL5T to expedite vacating the runway after landing. The controller issued this instruction together with the landing clearance, which was acknowledged by the GL5T.

(5) At 19:45:24, the B738 made its first radio contact with "Tower North", and was advised by the controller to continue approach and expect a late landing clearance.

(6) At 19:46:10, the GL5T touched down RWY 07L with an Indicated Air Speed (IAS) of 99 kts. The B738 was then 3.2 NM from the runway.

(7) Three seconds after landing, the Pilot Flying (PF) of the GL5T activated the thrust reversers and brakes.

(8) After the controller visually observed the GL5T touching down and beginning its landing roll, he checked on the SIT for an updated information about the B738, including its distance from the runway, speed and altitude.

(9) At 19:46:30, the GL5T had slowed down to taxi speed just before RET A6, which was designed for use by aircraft landing RWY 25R rather than RWY 07L. According to the Digital Flight Data Recorder (DFDR) of the GL5T, its taxi speed had reduced to 9 kts at this juncture.

(10) When the controller visually observed the GL5T again after checking on the SIT, he saw the aircraft moving slowly near RET A6. At 19:46:33, the controller asked the pilots of the GL5T if they were taking RET A5. However, the aircraft had already passed A5 by more than 400 metres and the pilots did not reply. Similar to RET A6, RET A5 was designed for use by aircraft landing RWY 25R rather than RWY 07L.

(11) A few seconds later, at 19:46:49, the controller inadvertently instructed the GL5T to vacate the runway via RET A5, whereas his intention was, in fact, to instruct the aircraft to vacate via RET A7. The GL5T reported with the advice of *"approaching A7 now"*. The controller instructed the GL5T to keep the speed up and vacate the runway via RET A7.

(12) At 19:47:12, the B738 was cleared to land by the controller when the aircraft was about to cross the beginning of RWY 07L. However, at that moment the GL5T was still taxiing on the runway more than 200 metres from RET A7, as shown in the screenshot of the controller's Advanced Surface Movement Guidance & Control System (A-SMGCS) Display in Figure 2.

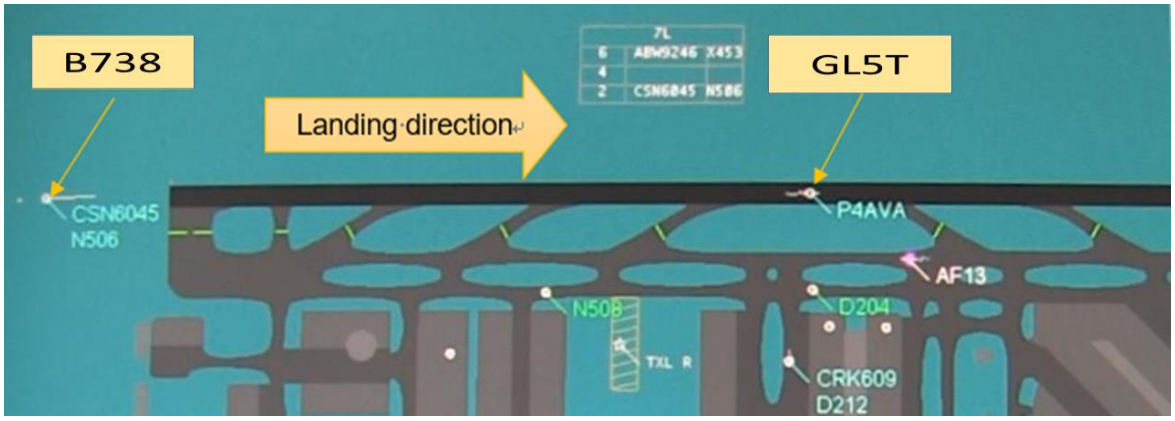

Figure 2: Screenshot of Controller's A-SMGCS Display when the B738 was cleared to land

(13) The B738 landed at 19:47:26 with the GL5T approaching RET A7. The screenshot of the controller's A-SMGCS display shows the moment when the B738 touched down on the runway while the GL5T was approaching the runway exit. The distance between the two aircraft at this moment was 1,470 metres. [See Figure 3.]

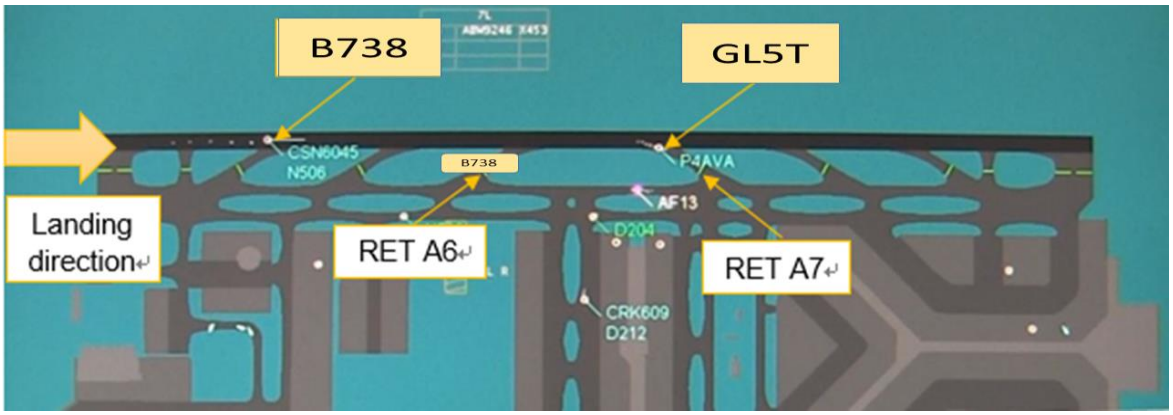

Figure 3: Screenshot of Controller's A-SMGCS Display when the B738 touched down

(14) At 19:47:35, the GL5T entered RET A7 to vacate the runway. The distance between the two aircraft was just in excess of 1,000 metres. The screenshot in Figure 4 shows the positions of the GL5T and the B738 at that moment.

Figure 4: Positions of the GL5T and the B738 at 19:47:35

(15) The incident was classified as Runway Incursion according to the definition of the International Civil Aviation Organization (ICAO)[2].

1.2 Injuries to Persons

There was no injury to any person on board either aircraft or to any third party.

Injuries to Persons						
Persons on board:	Crew	2	Passengers	0	Others	0
Injuries	Crew	0	Passengers	0		

Table 1: Persons on Board the GL5T

Injuries to Persons						
Persons on board:	Crew	8	Passengers	171	Others	0
Injuries	Crew	0	Passengers	0		

Table 2: Persons on Board the B738

1.3 Damage to Aircraft

There was no damage to either aircraft.

2 ICAO Doc 4444: Procedures for Air Navigation Services - Air Traffic Management (PANS – ATM) defines Runway Incursion as “any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft”.

1.4 Other Damage

There was no other damage to property or the environment.

1.5 Personnel Information

1.5.1 Flight Crew

The flight crews of both aircraft held valid licences and medical certificates.

1.5.1.1 Flight Crew of the GL5T

Both pilots were captain rated. The co-pilot was the Pilot Flying (PF)[3]. The other pilot was the Pilot Monitoring (PM), who was responsible for communication with ATC. Both the PM and the PF reported that they were well rested prior to the flight.

1.5.1.2 Flight Crew of the B738

Both pilots were captain rated and the PM was a training pilot. The PM was responsible for communication with ATC while the other pilot was the PF. The pilots followed a 4-day cycle. They had been flying together on Day 1 and Day 2 and this was their first flight on Day 3. Both the PM and the PF reported that they were well rested prior to the flight.

1.5.2 Air Traffic Controller

(1) The controller held a valid ATC licence with the appropriate rating and medical certificate.

(2) The controller's last day off was on 11 November 2018. After a rest period of 23.5 hours on completion of the previous shift, he commenced duties in the Tower at 14:30 on the day of the incident. He took over the AMN position at 19:30 after a 90-minute break.

3 The Pilot Flying (PF) takes direct responsibility for flying the aircraft for the complete flight or for particular parts of it such as the Descent/Approach and Landing. The Pilot Monitoring (PM) or alternatively Pilot Not Flying (PNF) monitors the flight management and aircraft control actions of the PF and carries out support duties such as communications and check-list reading.

1.6 Aircraft Information

1.6.1 The GL5T

The GL5T business jet, serial number 9334, was registered to MS Aviation GmbH[4] in 2018. The aircraft had a private category Certificate of Airworthiness valid until 27 July 2019.

1.6.2 The B738

The Boeing 737-800 (737-81B) aircraft, serial number 38915, was delivered to China Southern Airlines in 2014. The aircraft had valid Certificate of Registration and Certificate of Airworthiness.

1.6.3 Maintenance History

Not relevant to this incident.

1.7 Meteorological Factors

The aerodrome weather report for VHHH at 19:30 indicated that the wind was from 100 degrees at 10 kts, visibility 10 km, cloud coverage 1-2 oktas at 2,500 feet, temperature 25 ºC, dew point 20 ºC and the runway surface was dry. The incident occurred at night.

1.8 Navigation Aids

There were no reports of abnormal operation of any ground-based navigation aids or aerodrome visual ground aids including ground markings, movement area guidance signs, taxiway lights, stop-bar lights and runway lights.

1.9 Communications

Both aircraft were equipped with Very High Frequency (VHF) radio communication systems. All VHF radios were serviceable. Radio communication between Hong Kong ATC and the crews was recorded by the Digital Recording System (DRS)[5], which supported Hong Kong ATC in the provision of air navigation services. There was no interruption to communication between the controller and the aircraft.

4 GmbH is a German abbreviation which means “company with limited liability”.

5 Digital Recording System is an ATC system that provides recording, playback and real time monitoring functions for radio transmissions, intercom and audio reception at controller workstations from the headset microphone and the surrounding area.

1.10 Aerodrome Information

1.10.1 Aerodrome Control Tower Equipment

1.10.1.1 A-SMGCS

A-SMGCS is an airport traffic management tool using a combination of Surface Movement Radar data and a network of sensors installed at VHHH to establish the positions and identities of aircraft and vehicles on and around the airport surface including runways and manoeuvring areas. The positions and identities of aircraft and vehicles are continuously tracked and displayed at A-SMGCS workstations provided in the Control Tower for reference of air traffic controllers.

1.10.1.2 Safety Logic Functions of A-SMGCS

Safety Logic functions in the A-SMGCS help prevent potential collisions on the airport surface. Based on target surveillance and prediction data, the A-SMGCS monitors (i) single tracks on or approaching closed runways, (ii) tracks that are too close together, and (iii) tracks predicted to be too close together. When the system detects tracks under any of these conditions, it generates a visual and audible alert to notify air traffic controllers of the situation. According to the A-SMGCS supplier, since tracks of the two targets concerned did not meet pre-defined criteria for triggering an alert, A-SMGCS did not show any visual or audible alert in this incident.

1.10.1.3 Surface Movement Radar (SMR)

The SMR is a short-range radar for the monitoring of all movements on the manoeuvring areas at VHHH. The SMR signal is normally integrated into the A-SMGCS and displayed on A-SMGCS workstations.

1.10.1.4 Use of A-SMGCS and SMR

(1) As stipulated in Part 3 of the Manual of Air Traffic Control (MATC), prior to providing guidance or instructions to aircraft based on information derived from the A-SMGCS or SMR, air traffic controllers are required to establish positive aircraft identification by one of the following methods:

(i) correlate the position of an aircraft as visually observed to that indicated on the A-SMGCS or SMR display;

(ii) ensure the automatic association by A-SMGCS or SMR of a label to an arriving aircraft; or

(iii) correlate the exact position of an aircraft as reported by pilot's radio transmission to that indicated on the A-SMGCS or SMR display.

(2) Furthermore, whilst the A-SMGCS and SMR may be used, among other things, to confirm that arriving aircraft have vacated the runway, it is stated in a Note in MATC, Part 3, paragraph 5.1(iii) that the A-SMGCS or SMR alone should not be used to determine if an arriving aircraft has vacated the runway.

1.10.1.5 Situation Display (SIT)

The Situation Display (SIT) is part of the Air Traffic Management System (ATMS) in use by the Civil Aviation Department (CAD). The SIT provides a function to measure the spacing between two consecutive aircraft, which is an optional tool for the reference of aerodrome controllers. The SIT is an aid to provide additional information to aerodrome controllers but not for radar vectoring or other forms of radar control, as stated in MATC Part 3, Chapter 2. Information derived from the SIT may be used by aerodrome controllers to determine the distance from touchdown and spacing between arriving aircraft in order to achieve the maximum runway utilisation.

1.11 Flight Recorders

Cockpit Voice Recorders (CVR) with recording duration of two hours, and Digital Flight Data Recorders (DFDR) with recording duration of 25 hours were installed on both aircraft. The DFDR and CVR data were analysed.

1.12 Wreckage and Impact

Not applicable.

1.13 Medical/Pathological Information

No medical or pathological investigations were conducted.

1.14 Smoke, Fire and Fumes

Not applicable.

1.15 Survival Aspects

Not applicable.

1.16 Tests and Research

The investigation team conducted on-site assessments of visual observation of the runway from the cockpit and from the Tower.

1.17 Organisation, Management, System Safety

1.17.1 MS Aviation GmbH

MS Aviation is an Austrian air operator providing business aviation asset management, charter flight management and airworthiness maintenance.

1.17.2 China Southern Airlines

China Southern Airlines is one of the major air operators in China with its home base at Guangzhou Baiyun International Airport, China. It serves an extensive international and domestic network with a fleet of more than 860 passenger and cargo aircraft, including Boeing B737s.

1.18 Additional Information

1.18.1 Aeronautical Information Publication Hong Kong (AIPHK)

Regarding runway utilisation for arrivals at VHHH, it is promulgated in AIPHK, Part 3 - Aerodrome, Section AD 1, Sub-section AD 1.1, paragraph 10.2, that: -

> *(1) Pilots should vacate the runway as quickly as practicable to enable ATC to apply minimum spacing on final approach thereby maximising runway utilisation and minimising the occurrence of missed approaches.*
>
> *(2) To facilitate minimum runway occupancy time, each runway has multiple RETs that comply with ICAO design specifications. Pilots should vacate via the first available RET commensurate with operational conditions, or as instructed by ATC.*

1.18.2 Rapid Exit Taxiways (RET)

(1) RETs are provided at VHHH to reduce Runway Occupancy Time for Arrivals (ROTA). The intersection angle of the RETs with the runway is 30°, which is the preferred angle (within the range of 25° to 45°) according to ICAO Recommendation in Chapter 3 of Annex 14 Volume I: Aerodrome Design and Operations. The shallow intersection angle enables arrivals to vacate the runway at speeds up to 50 kts (93 km/hour) under wet conditions.

(2) ROTA studies conducted jointly by the CAD and Airport Authority Hong Kong (AAHK) showed an average ROTA of approximately 50 seconds

for most aircraft.

1.18.3 Visual Surveillance by Aerodrome Controllers

According to ICAO Doc 4444: Procedures for Air Navigation Services - Air Traffic Management (PANS-ATM), Chapter 7: -

> *"Aerodrome controllers shall maintain a continuous watch on all flight operations on and in the vicinity of an aerodrome as well as vehicles and personnel on the manoeuvring area. Watch shall be maintained by visual observation, augmented when available by an ATS surveillance system*;
>
> *Visual observation shall be achieved through direct out-of-the-window observation, or through indirect observation utilizing a visual surveillance system which is specifically approved for the purpose by the appropriate ATS authority"*.

1.18.4 Landing Clearance

According to MATC Part 3, landing aircraft will not normally be permitted to cross the beginning of the runway on final approach until the preceding landing is clear of the runway.

1.19 Useful or Effective Investigation Techniques

Not applicable.

2 Safety Analysis

The Safety Analysis provides a detailed discussion of the safety factors identified during the investigation, providing the evidence required to establish the findings, causes, contributing factors and the safety recommendations.

2.1 Introduction

After evaluation of evidence available and collected, the investigation team considered that aircraft maintenance, meteorological conditions, aids to navigation and aerodrome surface marking, lighting, signage and visual aids were not relevant to this incident. All communication equipment in the Tower was serviceable and there were no reports of defective radio communication system on either aircraft. There was no interruption to communication between the controller and the two aircraft involved in the incident. The investigation focused on analysing issues related to flight operations, ATC operations and human factors.

2.2 Flight Operations

2.2.1 The GL5T Flight Crew

(1) Both pilots of the GL5T held valid licences and medical certificates.

(2) During the investigation interview, both pilots reported that they were well rested prior to the flight. They also advised that they had landed at VHHH before (six to seven times for PF and twice for PM) and were aware of the location of RET A7.

(3) The DFDR indicated that the aircraft touched down at a speed of 99 kts at about 19:46:10. Three seconds after touchdown, the crew activated both thrust reversers and brakes.

(4) The aircraft completed its landing roll and slowed to taxiing speed of around 10 kts before passing RET A6, with RET A7 more than 400 metres ahead, a distance which took 40 seconds of taxiing time by the GL5T.

(5) As RET A6 was designed for landing on RWY 25R, no lead off lights could be seen by the pilots at the location of the GL5T taxiing in the opposite (RWY 07) direction. [See Photo 1 below.]

Photo 1: Cockpit View When Approaching RET A6 on Landing Roll

(6) As an aircraft approaches RET A7, the lead off lights guiding the aircraft to vacate the runway can be seen in alternating green and yellow. [See Photo 2 below.]

Photo 2: Lead off Lights Guiding Aircraft to RET A7

(7) The external view from the cockpit is affected by the height of the cockpit above ground, which depends on aircraft size. At a lower eye level above ground, pilots of smaller aircraft have a shorter forward distance of visual surveillance of the runway surface from the cockpit. It would take a relatively longer time for the GL5T to come into visual range of the RET A7 lead off lights compared with the pilot's view from a larger aircraft.

(8) An ATC instruction to *"vacate A5"* was received by the pilots as the aircraft was accelerating towards RET A7. This instruction did not add to the time the GL5T spent on the runway as at that moment it had already taxied past RET A5.

(9) As a result of the long taxi distance at a slow speed, the GL5T occupied the runway for a total of 85 seconds, which was longer than the average ROTA of 50 seconds by 70%. This is not aligned with the AIPHK, which stipulated that pilots should vacate the runway as quickly as practicable to enable ATC to apply minimum spacing on final approach thereby maximising runway utilisation and minimising the occurrence of missed approaches.

2.2.2 The B738 Flight Crew

(1) Both pilots of the B738 held valid licences and medical certificates. During the investigation interview, the pilots advised that they had followed the normal duty roster prior to the incident. Both pilots had previous experience of landing at VHHH.

(2) The pilots of the B738 were aware of the preceding aircraft and had been advised to expect a late landing clearance by the controller. The controller issued a landing clearance when the B738 was close to the beginning of the runway.

(3) Whilst on final approach both pilots of the B738 saw the lights of the GL5T ahead. Before touching down, they conducted a quick scan of the touchdown zone of the runway and then concentrated on navigating the aircraft. During this quick scan, no abnormal lights were observed.

(4) For visual surveillance, a larger size of an object and a higher level of ambient illumination will make it easier for the object to be detected visually. The size of the GL5T and the time of the incident at night contributed to the failure of the B738 pilots to visually detect the GL5T while they were preparing for landing. The nose-up attitude of the aircraft when it was close to the runway surface in the final stage of landing also imposed a limitation to the forward external view of the pilots from the cockpit.

(5) Without noticing any visual clue indicating the runway was still occupied, the pilots of the B738 believed that the GL5T had already vacated the runway when the controller issued the landing clearance.

(6) An ATC clearance to land does not relieve pilots of their responsibility to go around if required. Both pilots of the B738 were ready and prepared for a go-around in case it was necessary to do so, as ATC had advised them to expect a late landing clearance. The pilots advised the investigation team that even after receiving the landing clearance, they would still be prepared for a go-around if they considered it unsafe to land. In this case, since the pilots did not notice abnormal lights on the runway, they believed that the runway was clear for their landing.

2.3 ATC Operations

(1) The controller held a valid ATC licence with the appropriate rating and medical certificate.

(2) According to the controller, traffic volume on the day of the incident was moderate and normal, being *"not too relaxed or too busy"* as he recalled during the investigation interview. The Aerodrome Control Supervisor (ASU) on duty during the time of the incident also considered that the traffic volume was normal. This incident occurred 17 minutes after the controller returned from a 90-minute break to take over the AMN control position. The controller did not suggest fatigue was a factor when he subsequently reviewed the incident with the ASU or during the interview with the investigating team.

(3) When the GL5T landed, the B738 was 3.2 NM from the runway. This was not unusual with the traffic movement rate at VHHH. The controller was aware of the situation and the need for it to be managed. When clearing the GL5T to land, he instructed it to expedite vacating the runway after landing. He also advised the B738, while the aircraft was on final approach, to expect a late landing clearance.

(4) After the GL5T landed, the controller instructed it to vacate the runway via RET A5, which was already more than 400 metres behind the GL5T. During the interview, the controller explained that he had inadvertently instructed the GL5T to vacate via A5 whereas his intention was actually A7. The incorrect instruction, however, did not have any impact on the incident as the GL5T had already passed A5 and was accelerating on the runway towards RET A7.

(5) During the interview, the controller also recalled that when he gave the landing clearance to the B738, his visual observation showed that the GL5T had reached the entry of A7 with its nose turning onto A7 and its speed was increasing. Yet, the GL5T was still taxiing on the runway at that moment.

(6) When the controller subsequently noticed that the GL5T had in fact not yet vacated the runway, he considered it too late to instruct the B738 to go around as it had already landed on the runway.

2.3.1 Aerodrome Control Tower Operations during Daytime versus Night-time

(1) The views of the North Runway at the AMN control position during daytime and night-time are shown in Photo 3 and Photo 4 respectively.

Photo 3: View of North Runway at AMN Position during Daytime

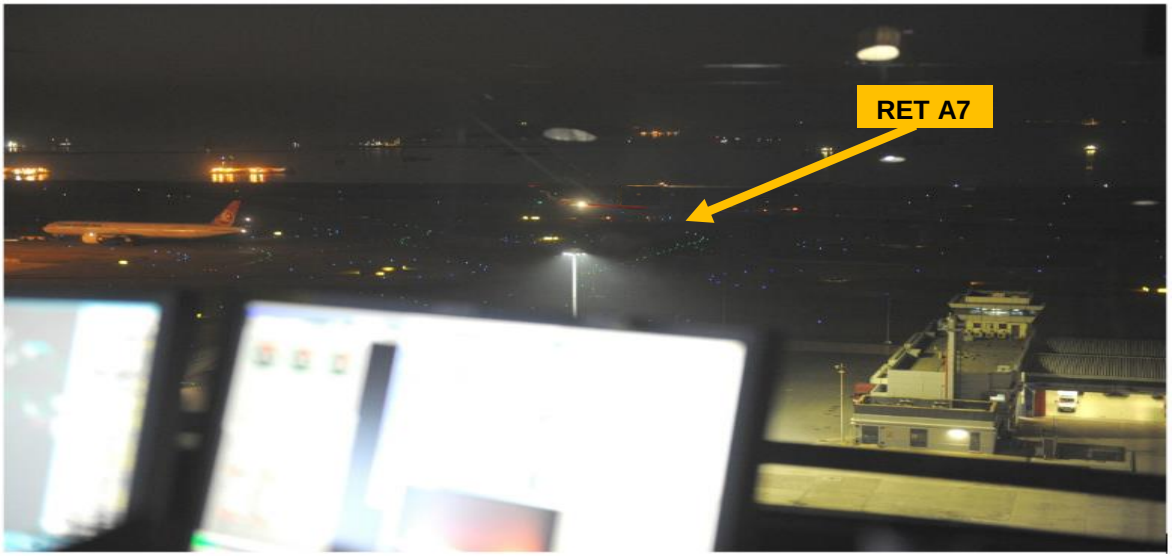

Photo 4: View of North Runway at AMN Position during Night-time

(2) Due to the relatively lower level of depth perception and visual reference during night-time as compared with daytime, it can be challenging for Tower controllers to readily determine the relative motion of an aircraft by solely relying on visual observation. Photos 5 and 6 show an exemplar aircraft in the process of vacating RWY 07L via RET A7 during daytime and night-time respectively. Tower equipment such as A-SMGCS can help Tower controllers in making such assessments.

Photo 5: Exemplar Aircraft Vacating RWY 07L via RET A7 during Daytime

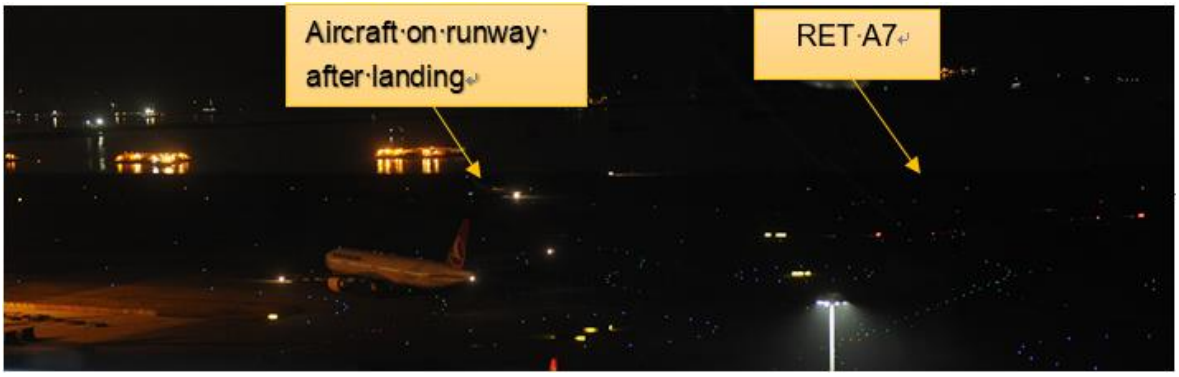

Photo 6: Exemplar Aircraft Vacating RWY 07L via RET A7 during Night-time

2.3.2 Handling of a Tight Situation

(1) The controller obtained his Aerodrome Control Rating two months before the date of the incident. He advised the investigating team that the training he received included handling of similar situations with a relatively slower business jet ahead and a larger aircraft catching up from behind. As a part of their ATC training, Tower trainees learn to make visual observations and use A-SMGCS as a supplement to determine aircraft positions.

(2) Under normal circumstances, an aircraft landing RWY 07L vacates the runway via a suitable RET and occupies the runway for an average of 50 seconds. In this case the slow taxiing speed of the GL5T after landing, resulting in its occupying the runway for a total of 85 seconds (70% longer

than the average figure) was abnormal and could have affected the controller's judgment.

(3) During a post incident discussion with the ASU and in the interview with the investigation team, the controller did not indicate that stress was a factor. However, in referring to the wrong runway exit twice when communicating with the GL5T, the controller might be subconsciously subject to a certain level of stress due to the evolving situation.

(4) Based on the controller's anticipation, as deduced from the instruction to the GL5T to expedite vacating the runway after landing, and the advice to the B738 to expect a late landing clearance, it would be reasonable to consider that the controller was suitably prepared for managing the situation. However, the misperception that the runway was clear (whilst it was not) affected the correctness of the controller's situational awareness. As a result, although his plan for managing the traffic situation on hand was adequate, the outcome did not turn out as intended.

2.4 Human Factors

2.4.1 Visual Surveillance

(1) Chapter 2 of the ICAO Doc 9870: Manual on the Prevention of Runway Incursions describes contributory factors to runway incursion occurrences. ATC related factors are listed in Section 2.4 of Chapter 2, including the *"misidentification of an aircraft or its location"*. One of the recommendations for the prevention of runway incursions in Chapter 4 of the Manual suggests that: -

> *"Controllers should be "head-up" for a continuous watch on aerodrome operations".*

This recommendation is in line with the provision in 7.1.1.2, Chapter 7, ICAO Doc 4444: Procedures for Air Navigation Services - Air Traffic Management (PANS-ATM), which states that: -

> *"Aerodrome controllers shall maintain a continuous watch on all flight operations on and in the vicinity of an aerodrome as well as vehicles and personnel on the manoeuvring area. Watch shall be maintained by visual observation, augmented when available by an ATS surveillance system".*

(2) EUROCONTROL[6] recommends, in the European Action Plan for the Prevention of Runway Incursions (EAPPRI), that: -

6 EUROCONTROL: European Organization for the Safety of Air Navigation is a pan-European, civil-military organization dedicated to supporting European aviation. [www.eurocontrol.int.]

"Air traffic controllers shall perform a visual scan of the entire runway and approach area in both directions before issuing a clearance to enter the runway or landing. This should primarily be by direct visual means, backed up by surveillance equipment in poor visibility situations".

(3) Appendix E to EAPPRI contains EUROCONTROL's best practices for ATS Providers and controllers, which states under "visual scanning techniques" that: -

"In more than half of the analyzed Sudden High Energy Runway Conflict (SHERC) events in the EUROCONTROL Operational Safety Study, ATC did not visually detect the potential conflict prior to the runway incursion: the best practice of a proper and systematic visual scan of the entire runway and approach area, in both directions, can be one of the most effective safety barriers to stop an event.

(4) On visual scanning techniques, EUROCONTROL considers that: -

(i) Anyone can "look", but scanning is more than just looking. It is the skill of seeing by looking in a methodical way.

(ii) Glancing out without stopping to focus on anything is of limited value.

(iii) Scanning is not limited to the external (outside of the Tower) view but must also incorporate a structured search inside the Tower at supporting systems such as weather and surveillance systems, EFS, etc.

(iv) A structured, methodical scanning technique will help controllers integrate visual search inside the Tower with the need to maintain direct out-of-the-window observation thus achieving a 'continuous watch' of aerodrome operations.

(5) In maintaining visual surveillance, attention has to be paid to cognitive limitations.

2.4.2 Visual Perception Error

(1) In an article on Inadvertent Errors published by Flight Safety Foundation[7] on 6 October 2016, Dale Wilson pointed out that: -

7 Flight Safety Foundation is an international non-profit organization whose sole purpose is to provide impartial, independent, expert safety guidance and resources for the aviation and aerospace industry. [https://flightsafety.org]

> *"Cognitive limitations in human perception, attention, memory and decision making play a role in many aviation accidents"*.

Perception errors include those due to visual perception, auditory perception and memory failures as well as attention errors and decision errors.

(2) Although the controller was maintaining visual surveillance of RWY 07L, he inadvertently misperceived that the runway was clear and issued a landing clearance to the B738. During the interview with the investigation team, the controller recalled the situation as follows: -

> *"I looked at the runway directly and did not use the A-SMGCS when I gave landing clearance to the CSN* [i.e. the B738]*. It was because I would like to make a decision by having the two aircraft in sight. When I gave 'clear to land' to the CSN* [the B738]*, I saw that P4-AVA* [the GL5T] *was turning from the runway into* [sic] *the RET A7 and right at the intercept between the runway and A7. It was accelerating at that moment".*

(3) The controller's recollection quoted above indicated that he believed that at the time of the incident he was aware of the position and progress of the GL5T as derived from his direct visual observation before he cleared the B738 to land. If the controller had any doubt, according to procedures, normal practices and ATC training, he should and could easily have counterchecked his visual observation with the information on the A-SMGCS display.

(4) On noticing that the GL5T had in fact not vacated the runway when the B738 landed, the controller did not instruct the B738 to go around as he considered it too late to do so under the circumstance with the B738 already landed. Such concern was not without reason, as it is stated in Chapter 7 of ICAO Doc 4444: Procedures for Air Navigation Services - Air Traffic Management (PANS-ATM) that : -

> *"a go-around executed after touchdown may expose the aeroplane to the risk of overrunning the runway. Moreover, a low altitude missed approach may expose the aeroplane to the risk of a tail strike".*

2.5 Risk Assessment and Severity Classification

(1) Chapter 6 of ICAO Doc 9870: Manual on the Prevention of Runway Incursions contains guidance on the Classification of the Severity of Runway Incursions. For the purpose of global harmonisation and effective data sharing, a Severity Classification Scheme from A to E is stipulated in the Manual as follows: -

A: A serious incident in which a collision is narrowly avoided.

B: An incident in which separation decreases and there is significant potential for collision, which may result in a time-critical corrective/evasive response to avoid a collision.

C: An incident characterised by ample time and/or distance to avoid a collision.

D: An incident that meets the definition of runway incursion such as the incorrect presence of a single vehicle, person or aircraft on the protected area of a surface designated for the landing and take-off of aircraft but with no immediate safety consequences.

E: Insufficient information or inconclusive or conflicting evidence precludes a severity assessment.

(2) To assist States in assessing the severity of runway incursion events, ICAO has made available a Runway Incursion Severity Classification (RISC) Calculator, which is a computer program that classifies the outcome of runway incursions. RISC classifies the outcome of runway incursions into one of three severity classifications: “A”, “B” or “C”.

(3) When the B738 landed it was 1,470 metres behind the GL5T. This distance was reduced to slightly more than 1,000 metres by the time the GL5T vacated the runway.

(4) By means of the RISC Calculator, the investigation team obtained Severity Classification “C” for this occurrence, i.e. there was ample time and/or distance to avoid a collision. The initial classification of this occurrence as Serious Incident in the Preliminary Report is therefore revised as Incident according to the ICAO Doc 9870 Severity Classification Scheme quoted in 2.5(1) above.

3 Conclusions

From the evidence available, the following findings are made with respect to the occurrence. These findings should not be read as apportion blame or liability to any particular organization or individual.

3.1 Findings

(1) Both aircraft had valid Certificates of Registration and Certificates of Airworthiness. [1.6.1 and 1.6.2]

(2) Aircraft maintenance was not relevant to this incident. [2.1]

(3) Meteorological conditions were not relevant to this incident. [2.1]

(4) Aids to navigation and aerodrome surface markings, lighting, signage and visual aids were not relevant to the incident. [2.1]

(5) All communication equipment in the Tower was serviceable and there were no reports of defective radio communication system on either aircraft. There was no interruption to communication between the controller and the two aircraft involved in the incident. [2.1]

(6) The pilots of both aircraft held valid licences and medical certificates. [2.2.1(1) and 2.2.2(1)]

(7) There was no evidence to suggest that the pilots' performance was affected by fatigue. [2.2.1(2) and 2.2.2(1)]

(8) The controller issued a taxi instruction ("vacate A5") to the GL5T while the aircraft had already passed RET A5 on its way to RET A7. [2.2.1(8)]

(9) The incorrect taxi instruction given by the controller to the GL5T had no impact as the aircraft continued to proceed to A7. [2.2.1(8) and 2.3(4)]

(10) The GL5T occupied the runway for a total of 85 seconds, which was longer than the average ROTA of 50 seconds by 70%. This is not aligned with the AIPHK, which stipulated that pilots should vacate the runway as quickly as practicable to enable ATC to apply minimum spacing on final approach thereby maximising runway utilisation and minimising the occurrence of missed approaches. [2.2.1(9)]

(11) The pilots of the B738 were aware of the tight situation and cross-checked the distance behind the GL5T during the approach. [2.2.2.(2) and 2.2.2(3)]

(12) Without noticing any visual clue indicating the runway was still occupied, the pilots of the B738 believed that the runway was clear when the controller issued the landing clearance. [2.2.2(5)]

(13) The pilots of the B738 were prepared to go around if required as they had been advised by the controller to expect a late landing clearance. [2.2.2(6)]

(14) The pilots of the B738 landed and did not go around because prior to landing they did not notice abnormal lights on the runway and believed that the runway was clear. [2.2.2(6)]

(15) The controller held a valid ATC licence with the appropriate rating and medical certificate. [2.3(1)]

(16) There was no evidence to suggest that the controller's performance was affected by fatigue. [2.3(2)]

(17) The instructions given by the controller to the two aircraft respectively on first contact indicated he was aware of the tight catch-up situation. The GL5T was instructed to expedite vacating the runway after landing and the B738 was advised to expect a late landing clearance. [2.3(3)]

(18) The controller was visually observing the North Runway from the Tower in order to maintain visual surveillance on both aircraft involved in this incident. When the controller inadvertently misperceived that the GL5T was entering RET A7, he cleared the B738 to land. [2.4.2(2) and 2.4.2(3)]

(19) When the controller subsequently realised that the runway was not clear for landing, he assessed that it was too late to instruct the B738 to go around, as it had already touched down on the runway. [2.4.2(4)]

(20) When the B738 landed it was 1,470 metres behind the GL5T. This distance was reduced to slightly more than 1,000 metres by the time the GL5T vacated the runway. [2.5(3)]

(21) By means of the ICAO Runway Incursion Severity Classification (RISC) Calculator, Severity Classification C was derived for this incident, i.e. there was ample time and distance to avoid a collision. [2.5(4)]

3.2 Causes

The controller cleared an arriving aircraft to land when he inadvertently misperceived that the runway was clear whereas the preceding landing had not yet vacated the runway. [3.1(18)]

3.3 Contributing Factors

The preceding aircraft took an unusually long time to vacate the runway after landing by as much as 70% more than the average Runway Occupancy Time of Arrivals at VHHH, thus contributed to the development of a tight catch-up situation. [3.1(10)]

4 Safety Actions Already Implemented

Whether or not AAIA identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. AAIA has been advised of the following proactive safety action in response to this occurrence.

4.1 Safety Actions Already Implemented by CAD after the Incident

(1) Shortly after this incident, CAD conducted a meeting with Hong Kong Business Aviation Centre (BAC), requesting all flight operators to be reminded to minimise ROTA after landing.

(2) On 4 December 2018, CAD additionally issued an Aeronautical Information Circular (AIC 26/18) stipulating the need for all arriving traffic and General Aviation/Business Aviation (GA/BA) traffic to vacate the runway as soon as practicable.

(3) The controller was given a Tower simulator session and a briefing by his Supervisor on how to handle similar scenarios better in future.

5 Safety Recommendations

Safety actions in Section 4.1, which had been implemented by CAD after the incident, are considered appropriate.

5.1 Safety Recommendation 01-2023

It is recommended that the operator should remind its pilots that after landing at Hong Kong International Airport they should, as stipulated in AIP Hong Kong, vacate the runway as quickly as practicable to enable ATC to apply minimum spacing on final approach thereby maximising runway utilisation and minimising the occurrence of missed approaches.

Safety Recommendation Owner: MS Aviation GmbH

6 General Details

6.1 Occurrence Details

Date and time:	13 November 2018, 19:47 (local time)	
Occurrence category:	Incident	
Primary occurrence type:	Runway Incursion (RI)	
Location:	Runway 07L, Hong Kong International Airport, Hong Kong	
	Latitude: 22°18’41.14”N	Longitude: 113°53’58.32”E

6.2 Pilot and ATC Personnel Information

6.2.1 P4-AVA (the GL5T)

6.2.1.1 Pilot Flying

Licence:	AUSTRIA Airline Transport Pilot
Aircraft ratings:	BD700, Instrument, Multi Engine Captain. Certificate of Validation issued by Aruba valid till 10 August 2019 with a current medical certificate
Medical certificate:	See above
Flying Experience:	
Total all types:	8 900+ hours
Total on type (Bombardier Global 5000)	1 500+ hours

6.2.1.2 Pilot Monitoring

Licence:	FRANCE Airline Transport Pilot
Aircraft ratings:	BD700, Instrument, Multi Engine Captain. Certificate of Validation issued by Aruba valid till 10 August, 2019 with a current medical certificate
Medical certificate:	See above
Flying Experience:	
Total all types	8 006+ hours
Total on type (Bombardier Global 5000)	753+ hours

6.2.2 CSN6045 (the B738)

6.2.2.1 Pilot Flying

Licence:	PRC ATPL
Aircraft ratings:	B737-800, Captain. Holder of a valid licence with a current medical certificate
Medical certificate:	See above
Flying experience:	
Total all types:	1 286 hours
Total on type (B737-800) :	1 036 hours
Total in the last 90 days	232 hours
Total in the last 30 days	86 hours
Total in the last 7 days	28 hours
Total in the last 24 hours	4 hours

6.2.2.2 Pilot Monitoring

Licence	PRC ATPL
Aircraft ratings	B737-800, Captain. Holder of a valid licence with a current medical certificate
Medical certificate	See above
Flying experience	
Total all types:	14 277 hours
Total on type (B737-800) :	14 027 hours
Total in the last 90 days	246 hours
Total in the last 30 days	101 hours
Total in the last 7 days	30 hours
Total in the last 24 hours	4 hours

6.2.3 ATC Personnel (the controller)

Licence:	Hong Kong Air Traffic Controller Licence
Ratings:	Aerodrome Control
Date of first issue of rating:	7 September 2018
Medical certificate:	Class 3 issued on 22 June 2015
Limitation	Corrective lenses are required
ICAO Language Proficiency	Level 4 valid until 17 December 2020

6.3 Aircraft Details

6.3.1 P4-AVA (the GL5T)

Manufacturer and model:	Bombardier BD-700-1A11 Global 5000
Registration:	Aruba, P4-AVA
State of Operator:	Austria
State of Manufacture:	Canada
Aircraft Serial number:	9334

Flight Number	Not applicable
Year of Manufacture	2009
Engines	Two Rolls Royce BR700-710A2-20 turbo-fan engines
Operator:	MS Aviation GmbH
Type of Operation:	Commercial Air Transport (Passenger)
Certificate of Airworthiness	Transport Category (Private) Issued on 10 August 2018 and valid till 27 July 2019
Departure:	Clark International Airport, The Philippines
Destination:	Hong Kong International Airport, Hong Kong

6.3.2 CSN6045 (the B738)

Manufacturer and model:	Boeing 737-800
Registration:	PRC, B-1918
State of Operator:	China
State of Manufacture:	USA
Aircraft Serial number:	38915
Flight Number	CSN6045
Year of Manufacture	2014
Engines	Two CFM56-7B26E turbo-fan engines
Operator:	China Southern Airlines
Type of Operation:	Commercial Air Transport (Passengers)
Certificate of Airworthiness	Transport Category (Passengers) Issued on 27 March 2014 and valid
Last A check	Completed on 31 October, 2018 and still valid
Departure:	Yiwu Airport, PRC
Destination:	Hong Kong International Airport, Hong Kong

6.4 Aerodrome Information

6.4.1 Hong Kong International Airport

Aerodrome Code	VHHH
Airport Name	Hong Kong International Airport
Airport Address	Chek Lap Kok, Lantau Island
Airport Authority	Airport Authority Hong Kong
Air Navigation Services	Approach Control, Aerodrome Control, Ground Movement Control, Zone Control, Flight Information Service, Clearance Delivery Control, Automatic Terminal Information Service
Type of Traffic Permitted	IFR/VFR
Coordinates	22° 18’ 32” N, 113° 54’ 53” E
Elevation	28 ft
Runway Length	3,800 m
Runway Width	60 m
Stopway	Nil
Runway End Safety Area	240 m x 150 m
Azimuth	07L / 25R, 07R/ 25L
Category for Rescue and Fire Fighting Services	CAT 10

7 Abbreviations

AAHK	Airport Authority Hong Kong
AAIA	Air Accident Investigation Authority
AIC	Aeronautical Information Circular
AIPHK	Aeronautical Information Publication Hong Kong
AMN	Air Movements North Controller
AOC	Air Operator's Certificate
A-SMGCS	Advanced Surface Movement Guidance and Control System
ASU	Aerodrome Control Supervisor
ATC	Air Traffic Control
ATS	Air Traffic Service
B737-81	Boeing 737-81
BA	Business Aviation
BAC	Hong Kong Business Aviation Centre
CAD	Hong Kong Civil Aviation Department
CAT	Category
CSN	China Southern Airlines
CVR	Cockpit Voice Recorder
DFDR	Digital Flight Data Recorder
DRS	Digital Recording System
EAPPRI	European Action Plan for the Prevention of Runway Incursions
EUROCONTROL	European Organization for the Safety of Air Navigation is a pan-European
GA	General Aviation
IAS	Indicated Air Speed
ICAO	International Civil Aviation Organization

IFR	Instrument Flight Rules
MATC	Manual of Air Traffic Control
MEL	Minimum Equipment List
MHz	Mega Hertz
NM	Nautical Miles
ºC	Degrees Celsius
PF	Pilot Flying
PM	Pilot Monitoring
R/T	Radio Telephone
RET	Rapid Exit Taxiway
ROTA	Runway Occupancy Time for Arrivals
RPLC	ICAO code of Clark International Airport, The Philippines
RWY	Runway
SIT	Situation Display
SMR	Surface Movement Radar
TWY	Taxiway
UTC	Coordinated Universal Time
VFR	Visual Flight Rules
VHF	Very High Frequency
VHHH	ICAO code of Hong Kong International Airport, China
ZSYW	ICAO code of Yiwu Airport, China

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9.1 Aerodrome Layout

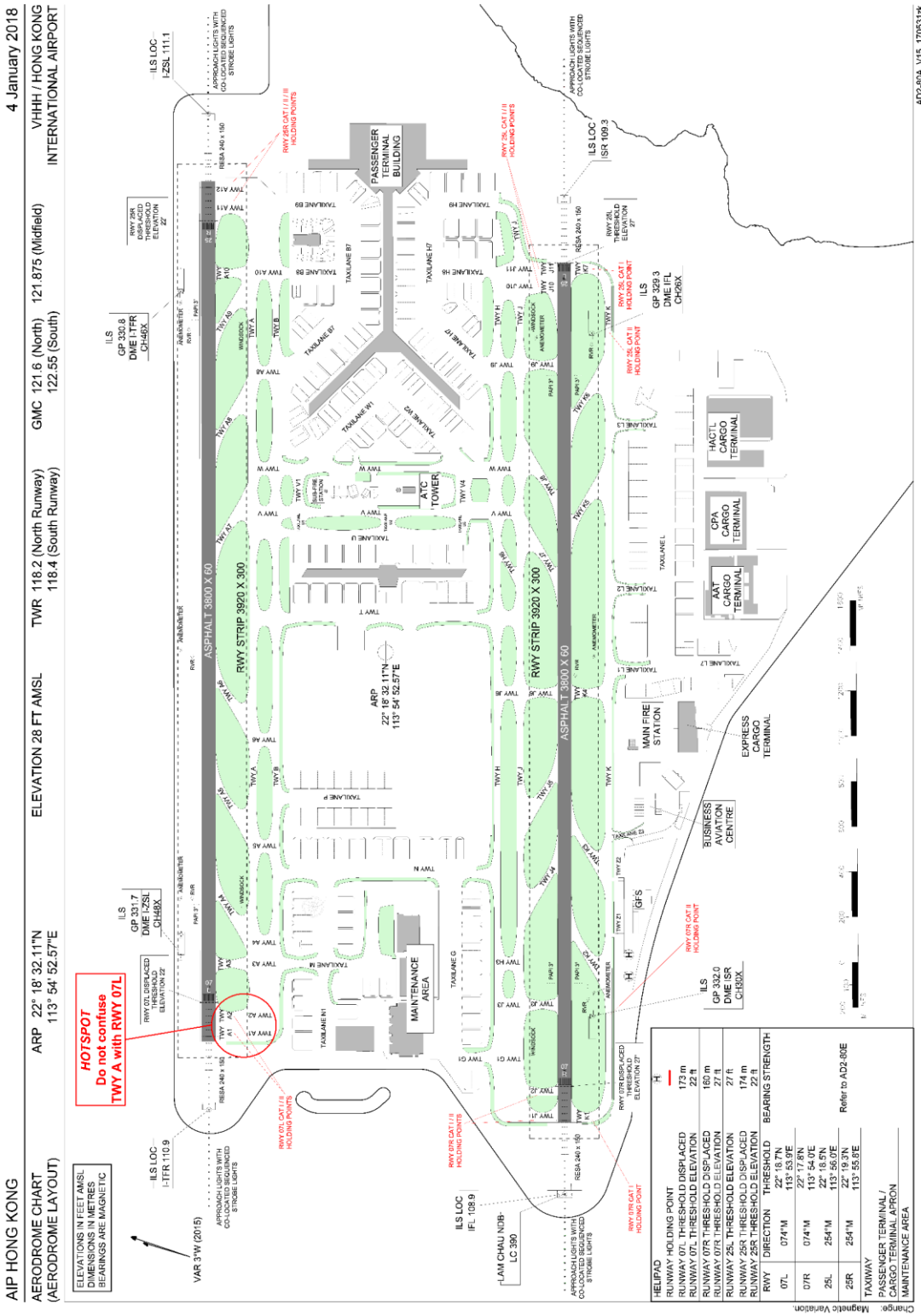

Figure 5: Hong Kong International Airport Aerodrome Layout

9.2 Transcript of ATC Radio Communication

The transcript of ATC radio communication between P4-AVA (GL5T) / CSN6045 (B738) and Hong Kong (HK) Tower North is listed below.

(Note: UTC + 8 = Local Time, e.g. 11:47:26 UTC = 19:47:26 Local Time)

TIME (UTC)	STATION	R/T COMMUNICATION
11:43:20	P4-AVA (GL5T)	TOWER PAPA FOUR ALPHA VICTOR ALPHA ESTABLISHED RUNWAY ZERO SEVEN LEFT DISTANCE 6 MILES
11:43:28	HK TOWER NORTH	PAPA FOUR ALPHA VICTOR ALPHA TOWER NORTH GOOD EVENING CONTINUE APPROACH RUNWAY ZERO SEVEN LEFT THE WIND TOUCHDOWN IS ONE ONE ZERO DEGREES ONE TWO KNOTS
11:43:37	P4-AVA (GL5T)	ROGER CONTINUE APPROACH RUNWAY ZERO SEVEN LEFT PAPA FOUR ALPHA VICTOR ALPHA
11:44:32	TOWER NORTH	PAPA VICTOR ALPHA AFTER LANDING PLEASE EXPEDITE VACATING THE RUNWAY THE WIND IS ONE ZERO ZERO DEGREES ONE TWO KNOTS CLEARED TO LAND RUNWAY ZERO SEVEN LEFT
11:44:40	P4-AVA (GL5T)	ROGER CLEARED TO LAND RUNWAY ZERO SEVEN LEFT AND WE TRY TO EXPEDITE TO VACATE THE RUNWAY PAPA FOUR ALPHA VICTOR ALPHA
11:45:24	CSN6045 (B738)	TOWER GOOD EVENING CHINA SOUTHERN SIX ZERO FOUR FIVE ILS RUNWAY ZERO SEVEN LEFT
11:45:29	HK TOWER NORTH	CHINA SOUTHERN SIX ZERO FOUR FIVE TOWER NORTH GOOD EVENING CONTINUE APPROACH

		RUNWAY ZERO SEVEN LEFT TOUCHDOWN WIND IS ONE ONE ZERO DEGREES ONE TWO KNOTS AND EXPECT A LATE LANDING CLEARANCE
11:45:41	CSN6045 (B738)	CHINA SOUTHERN SIX ZERO FOUR FIVE
11:46:33	HK TOWER NORTH	PAPA VICTOR ALPHA AND ERR PLEASE VACATE VIA ERR CONFIRM YOU ARE NOW TAKING ALPHA FIVE
11:46:49	HK TOWER NORTH	VICTOR ALPHA VACATE ALPHA FIVE
11:46:54	P4-AVA (GL5T)	APPROACHING A7 NOW SIR
11:46:58	HK TOWER NORTH	PAPA VICTOR ALPHA KEEP THE SPEED AND EXIT ALPHA SEVEN
11:47:01	P4-AVA (GL5T)	WILCO
11:47:07	HK TOWER NORTH	PAPA VICTOR ALPHA PLEASE EXPEDITE THANK YOU
11:47:09	P4-AVA (GL5T)	EXPEDITING
11:47:12	HK TOWER NORTH	CHINA SOUTHERN SIX ZERO FOUR FIVE CLEARED TO LAND RUNWAY ZERO SEVEN LEFT THE WIND IS ONE ZERO ZERO DEGREES ONE ONE KNOTS
11:47:18	CSN6045 (B738)	CLEARED TO LAND CHINA SOUTHERN SIX ZERO FOUR FIVE

11:47:25	P4-AVA (GL5T)	PAPA FOUR ERR VACATING RUNWAY ZERO SEVEN LEFT PAPA VICTOR ALPHA
11:47:31	HK TOWER NORTH	PAPA FOUR ALPHA VICTOR ALPHA TURN LEFT HOLD SHORT OF WHISKEY
11:47:34	P4-AVA (GL5T)	HOLD SHORT OF WHISKEY TURN RIGHT
11:47:40	HK TOWER NORTH	PAPA FOUR ALPHA VICTOR ALPHA TAXI WHISKEY HOLD SHORT HOTEL PLEASE KEEP THE SPEED
11:47:45	P4-AVA (GL5T)	WHISKEY AND HOLD SHORT OF HOTEL PAPA FOUR ALPHA VICTOR ALPHA
11:48:01	HK TOWER NORTH	CHINA SOUTHERN SIX ZERO FOUR FIVE LAST LEFT TURN ALPHA
11:48:05	CSN6045 (B738)	LEFT TURN ALPHA CHINA SOUTHERN SIX ZERO FOUR FIVE

END

9.3 AIC 26/18

HONG KONG SPECIAL ADMINISTRATIVE REGION
PEOPLE'S REPUBLIC OF CHINA
AERONAUTICAL INFORMATION SERVICE

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GENERAL AVIATION/BUSINESS AVIATION (GA/BA) AIRCRAFT MINIMIZING RUNWAY OCCUPANCY TIME

1. **Introduction**

1.1 It is stipulated in the AIP Hong Kong that pilots of arrival aircraft should vacate the runway as quickly as practicable to enable ATC to apply minimum spacing on final approach thereby maximizing runway utilization and minimizing the occurrence of missed approaches. Achievement of high and sustainable runway capacity at the HKIA relies and requires the collaboration of airline operators as well as GA/BA operators.

1.2 According to the Runway Occupancy Time of Arrivals (ROTA) studies conducted jointly by the CAD and AAHK, the average ROTA of most aircraft is approximately 50 seconds, with the exception of GA/BA twin-engine executive jets where the figure is well above the average. It is also noticed that such unsatisfactory situation was more prominent when Runway 07L was the duty landing runway.

1.3 Recently there has been an increase in the number of cases in which the arriving aircraft following a GA/BA arrival has had to go around as a result of the GA/BA aircraft unable to vacate runway in time. According to CAD's records, there have been 7 such occasions in the last 3 months.

2. What Causes the Poor ROTA Performance of GA/BA Aircraft?

2.1 A MEDIUM category GA/BA twin-engine jet is relatively slow inside 4 nm from touchdown in comparison to other aircraft operating at the HKIA. For Runway 07L, it is not uncommon to observe a GA/BA aircraft braking towards taxi speed abeam Taxiway A6, and then it continues on the runway at relatively slow speed to vacate runway via the first available Rapid Exit Taxiway (RET) A7, which is approximately 450 metres away from Taxiway A6.

2.2 The time taken on the runway between A6 and A7 can be as high as 35 seconds. This is almost equivalent to half a runway slot.

3. Suggested Action By Pilot

3.1 Without compromising the safe operation of aircraft, pilots of GA/BA aircraft should consider minimizing braking to reduce the deceleration rate on the landing roll so as to be able to vacate runway expeditiously via the first available RET (Brake-to-vacate Procedure). The design of RET allows for exit speed of approximately 50 knots for all weather operations. (Note: 50 knots is for dry runway surface; slight adjustment if the runway surface is wet.)

3.2 Pilots should ensure familiarity with HKIA aerodrome layout including the ground lighting system, particularly in respect of the location of the first RET as listed below:

Runway 07L	----	RET A7 (no RETIL - Rapid Exit Taxiway Indicator Lights)
Runway 25R	----	RET A6 (with RETIL)
Runway 07R	----	RET K5 (with RETIL)
Runway 25L	----	RET K3 (with RETIL)

4. Performance Target

4.1 ROTA performance of all aircraft including GA/BA aircraft will continue to be monitored. A 50-second ROTA is the benchmark figure that is required to maximize runway utilization and reduce arrival delays to all aircraft.