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FROM RESPONSE TO RECOVERY: A COLLABORATIVE APPROACH TO AERODROME EMERGENCY MANAGEMENT

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SUMMARY

This paper presents the operational experiences and insights gained from the emergency response and aircraft recovery following a Boeing 747-400 Freighter runway excursion at Hong Kong International Airport. Despite severe weather and complex marine conditions, the successful rescue and rapid aircraft recovery within seven days underscores the comprehensiveness and practicality of emergency procedures, reflecting a pragmatic strategy delivered through Rescue and Fire Fighting Service tactical execution, close collaboration with the regulator, and regular large-scale exercises. Furthermore, the incident demonstrates how centralising command via the Airport Emergency Centre and pre-positioning aircraft recovery assets maximised operational efficiency. The event also highlights how maintaining close partnership with government agencies and stakeholders effectively removes administrative and procedural bottlenecks during aviation emergencies.

1. INTRODUCTION

1.1 In the early morning of 20 October 2025, a Boeing 747-400 Freighter landed on the North Runway at the Hong Kong International Airport (HKIA) and veered off the runway near the midpoint. The aircraft collided with a stationary security ground vehicle at an observation point, breached the airport perimeter and came to a stop on the adjacent seashore. The collision resulted in the loss of two airport security personnel and damaged a section of the perimeter fence and some airport facilities.

1.2 Upon activation of the Crash Alarm by the Air Traffic Control (ATC) of the Civil Aviation Department of Hong Kong (HKCAD), the Hong Kong Fire Services Department (HKFSD), Airport Authority Hong Kong (AAHK) and Hong Kong Police Force (HKPF) were immediately alerted. Subsequently, the Hong Kong Marine Department (MARDEP) and Air Accident Investigation Authority (AAIA) were also notified. HKFSD immediately initiated an eight-hour search and rescue operation involving 280 personnel and over 80 fire appliances, vessels and ambulances. Despite poor visibility and challenging diving conditions, HKFSD successfully rescued all four crew members, recovered the two deceased airport security personnel, and confirmed all individuals were accounted for before concluding the search and rescue operation.

1.3 While facilitating the on-site responses, AAHK coordinated with ATC to swiftly re-open the other two runways, which were on standby or undergoing maintenance during the subject

overnight and early morning period. The South and Centre Runways could provide live operations in approximately 20 minutes and 1.5 hours, respectively, minimising disruptions to morning traffic.

1.4 As regards the North Runway, following initial investigation and evidence collection by AAIA and the HKPF, AAHK conducted overnight repairs to restore the perimeter fence to secure the airport area. Concurrently, AAHK established an Aircraft Recovery Committee in accordance with its Emergency Procedures Manual (EPM). Through close partnership with government agencies, AAHK was able to expeditiously engage the Guangzhou Salvage Bureau, under the Rescue and Salvage Bureau of the Ministry of Transport of the People's Republic of China (CRS), to undertake the aircraft salvage operation.

1.5 AAHK restored the North Runway by late afternoon on 21 October 2025, placing it on standby to facilitate wreckage removal. Supported by the Guangzhou Salvage Bureau and facilitated by HKCAD, HKFSD, MARDEP and other Aircraft Recovery Committee stakeholders, the aircraft wreckage was successfully removed within seven days, allowing HKIA to resume normal operations in the evening of 27 October 2025.

2. DISCUSSION

2.1 The successful response and rapid aerodrome recovery underscore that effective aerodrome emergency management depends on both operational execution at the scene and robust strategic planning. This outcome is founded upon a comprehensive strategic approach comprising a well-established Rescue and Fire Fighting Service (RFFS), documented emergency procedures, recurrent exercising, clearly defined command and control, pre-positioned recovery capabilities, as well as inter-agency and cross-jurisdictional coordination. The experience at HKIA demonstrate how prepared measures enable an orderly transition from emergency response to aircraft recovery, and the full restoration of normal aerodrome operations.

Operational Preparedness and Strategic Response by HKFSD

2.2 To provide full coverage for HKIA's three runways and associated manoeuvring areas, as well as adjacent sea zones, the RFFS provided by HKFSD is deployed across four Airport Fire Stations and two Sea Rescue Berths (See Figure 1). Airport Fire Stations are strategically situated to ensure that first-responding vehicles can reach any point of the runways within two minutes without crossing an active runway. Command boats and speedboats at the East and West Sea Rescue Berths provide sea rescue coverage within a five-kilometre radius of HKIA, with pre-established procedures ensuring the seamless mobilisation of land and sea reinforcements from fire stations outside the HKIA.

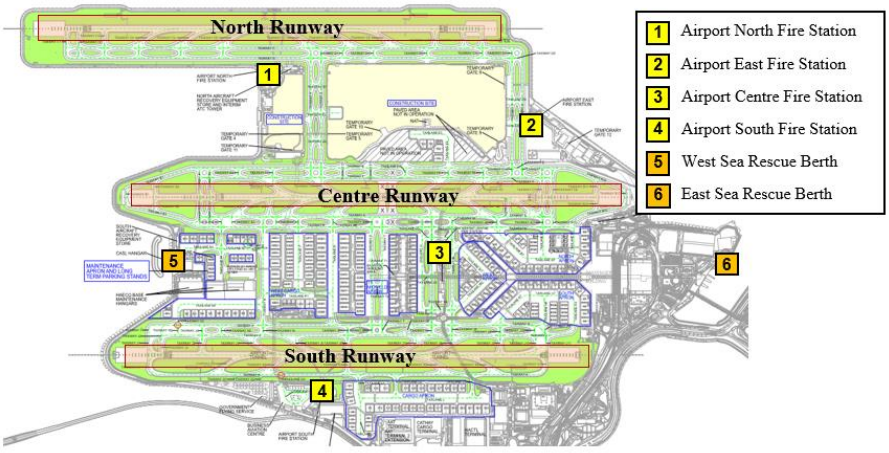

Figure 1 – The locations of Airport Fire Stations and Sea Rescue Berths at HKIA

2.3 HKFSD implements a robust Incident Command System (ICS) to ensure effective coordination across specialised sectors during complex, multi-environment aircraft incidents, maximising rescue efficiency and accelerating patient care. For this accident, the response was structured into four tactical sectors which provided the following operational benefits:

(a) *"Operations 1"*: Land Search and Rescue Operations at the aircraft and seashore – Coordinated all land-based activities around the impact area and shoreline. Responsibilities included scene safety, access control, initial hazard assessments, and identifying victim and debris locations. The sector managed systematic shoreline searches, supported victim movement and evidence collection, and updated the Ambulance Incident Officer to facilitate medical staging.

(b) *"Operations 2"*: Search and Rescue Operations on the sea surface – Conducted surface search and rescue operations by executing search patterns based on available intelligence. This sector identified wreckage locations, supported diver deployment by securing the operational area, managed vessel movements and debris hazards, and relayed real-time coordinates to underwater and land sectors.

(c) *"Operations 3"*: Diving Search and Rescue Operations underwater – Executed underwater search operations through structured dive planning and strict safety management. This sector assessed risks (visibility, currents, entanglement), ran methodical search patterns over the debris field, navigated wreckage hazards, verified victim locations, and provided critical findings to surface and command teams.

(d) *"Ambulance Incident Officer"*: Ambulance Services – Coordinated all medical response functions within the ICS. Responsibilities included organising triage and first aid, managing ambulance readiness, coordinating patient handovers from recovery points to staging areas, tracking hospital availability, maintaining casualty documentation, and ensuring continuity of care.

2.4 The rescue operation took place in nighttime under a "Strong Monsoon Signal"[1] , requiring HKFSD divers to contend with near-zero visibility, powerful sea currents, and shifting wreckage. The complexity was compounded by a hazardous debris field of disintegrated aircraft components—including engines and landing gear—scattered across the seabed. Furthermore, the missing airport security vehicle was severely damaged, unrecognisable, and buried beneath aircraft fragments, presenting severe entanglement risks to frontline personnel.

2.5 To overcome these critical hazards, the operation successfully leveraged advanced technological measures—combining an Underwater Remotely Operated Vehicle (UROV) with high-resolution sonar and robust communication systems—to eliminate unnecessary personnel risk. This integration provided precise, real-time mapping of the complex debris environment to locate the wreckage and directly informed thorough risk assessments, detailed safety protocols, and tailored navigation plans prior to deployment. Furthermore, these systems enabled seamless coordination and rapid information exchange between dive teams and surface command, ultimately maximising diver safety, operational efficiency, and the success rate of victim recovery in hazardous environments.

Regulatory Compliance and Institutional Manual Frameworks

2.6 One important driver behind HKIA's swift and coordinated response is its strict adherence to international standards embedded in the aerodrome licensing requirements. HKIA maintains its aerodrome license under continuous and stringent regulatory oversight by the HKCAD.

[1] "Strong Monsoon Signal" is issued by the Hong Kong Observatory when winds associated with summer or winter monsoons are blowing in excess of 40 km/h near sea level anywhere in Hong Kong.

This compliance mandates the establishment, updating, and operational enforcement of the EPM, thereby providing clear guidance during a crisis.

2.7 The EPM defines airport emergencies into three core categories: Aircraft-Related Emergencies, Security-Related Emergencies, and General Core Hazards (such as fire, public health crises, and severe weather events). Within this framework, "Aircraft Accident" is one of the 17 specific scenarios for which the roles, responsibilities, and protocols of all responding parties are formulated. By predefining command positions, cross-departmental communication frequencies, and multi-agency jurisdictional boundaries, this structured approach enables activation of emergency response without delay, leading to the swift deployment of rescue and recovery resources.

Robust Exercise Regimes and Proactive Drills

2.8 Operational readiness cannot rely solely on written procedures; it requires recurring and rigorous validation. AAHK enforces a comprehensive training curriculum, planning and executing over 30 full-scale drills and tactical exercises annually to stress-test emergency response and business continuity plans. This comprehensive regime includes the full-scale Aircraft Crash and Rescue Exercise, quarterly Airport Emergency Centre (AEC) support drills, quarterly Integrated Airport Centre (IAC) fallback exercises, biannual Family Reception Centre exercises, and business continuity exercises covering public health, security, airfield, terminal, transportation, and adverse weather preparedness.

2.9 AAHK mandates that its major exercises go beyond standard regulatory licensing requirements to encompass realistic, multi-hazard scenarios. Past full-scale exercises highlighting this proactive preparation include: the 2018 exercise simulating a complex sea rescue disaster; the 2023 exercise evaluating a landing aircraft suffering abnormal runway contact and structural damage leading to a hazardous chemical leak; and the 2024 exercise testing a hull crash after an aborted takeoff. This accumulated familiarity with sea rescue and runway incidents directly contributed to the reflexive responses demonstrated in this accident.

Unified Command Structure and the Airport Emergency Centre

2.10 A common challenge in major crisis management worldwide is the fragmentation of command across responding agencies. HKIA mitigates this risk by defining six overlapping tactical phases in an emergency response and establishing AAHK as the overall coordinator. When an accident occurs, operations are managed through a predefined matrix of responsible lead agencies, unified under a single coordination hub:

(a) Rescue operations are directed by the HKFSD;

(b) Passenger reception is led by the HKPF;

(c) Medical service coordination and off-site hospital routing are managed by the Home Affairs Department;

(d) Family reception and airline logistics are executed by the aircraft operator concerned;

(e) Media management is centralised under AAHK's Corporate Affairs Department; and

(f) All response efforts are coordinated centrally through the AEC managed by the AAHK.

2.11 The AEC, located inside the IAC of the HKIA, serves as the central command and control hub of the aerodrome (See Figure 2). It brings together representatives from more than 20 public and private organisations under one roof to facilitate immediate, face to face coordination while concurrently serving as the communication hub for directing personnel at the accident site. This centralisation removes communication barriers, supports real-time asset tracking, enables immediate data sharing, and facilitates consensus-driven decision-making among over 1,000 on-site response personnel. The rapid reinstatement of the South and Centre Runways, as described in Para. 1.3 above, was a direct result of this unified command facility, where airport operator, air traffic control personnel, and safety teams worked side by side to coordinate safety sweeps and dynamically managed capacity demands.

Figure 2 – The Airport Emergency Centre of HKIA

Advanced Technical Logistics: Specialised Aircraft Recovery Asset Inventories

2.12 The speed of any aircraft recovery is limited by the immediate availability of specialised engineering equipment. AAHK addresses this by maintaining dedicated Aircraft Recovery Equipment Stores in close proximity to the North and Centre Runways. Rather than relying on external commercial supply chains, which could take days to coordinate and mobilise, AAHK maintains a substantial inventory of ready-to-deploy, proprietary recovery assets. This includes 126 state-of-the-art high-capacity pneumatic recovery airbags for aircraft leveling, 10 heavy-duty hydraulic lifting jacks, specialised de-bogging kits for aircraft stuck in soft soil, and heavy-duty high-tensile lifting slings capable of supporting wide-body aircraft structures.

2.13 To ensure these assets can be deployed immediately during an active crisis, AAHK enforces airport community-wide training requirements. Regular intensive technical training courses are conducted on-site at HKIA in partnership with local line maintenance operators and home-based airlines. In addition, specialised engineering staff undergo regular overseas technical training to maintain proficiency in aircraft salvage and lifting methodologies.

Close Partnership with Government Agencies and Leveraging Regional Cooperation

2.14 While standard airport emergency planning primarily addresses incidents within local airside boundaries, the operational scale and complexity of this accident required capabilities extending beyond standard provisions. Conventional aircraft recovery equipment is not designed for the salvage of a destroyed aircraft in a marine environment, necessitating large-scale maritime salvage expertise. To bridge this operational gap, the HKCAD leveraged the “Tripartite Agreement on Search and Rescue and Salvage of Crashed Aircraft” signed with the CRS and AAIA and facilitated an expedited response by referring the established contact protocols for the Guangzhou Salvage Bureau under CRS, to AAHK. This enabled the direct communication and the subsequent mobilisation of specialised regional resources.

2.15 Following this direct referral, AAHK expeditiously engaged the Guangzhou Salvage Bureau to undertake this aircraft salvage operation on short notice. Supported by relevant government agencies, teams of specialised engineers, professional divers and heavy-lifting vessels from the Chinese Mainland were immediately mobilised and transited directly through Hong Kong waters to HKIA. The ability to quickly secure and deploy this highly specialised technical expertise was instrumental to the swift recovery of HKIA operations. This successful deployment demonstrated that strong partnership with government agencies and the ability to leverage regional cooperation are indispensable elements of aerodrome crisis resilience.

Conclusion

2.16 The handling of the accident at HKIA demonstrates that effective aerodrome emergency management depends on a systematic transition from immediate accident-site response to integrated infrastructure recovery. HKIA's ability to contain the crisis, restore runway operability, and complete a complex marine salvage operation within seven days illustrates that operational resilience relies on a unified system rather than isolated actions. The synchronised deployment of specialised RFFS and strict enforcement of the EPM prove that regulatory compliance ensures clarity when a crisis unfolds. Furthermore, centralising multi-agency command within the AEC and maintaining pre-positioned aircraft recovery assets are critical to mitigating administrative and logistical bottlenecks in case of aircraft emergencies. Finally, the rapid mobilisation of cross-border aircraft salvage expertise underscores that strong partnership with government agencies and the ability to leverage regional cooperation are indispensable elements of aerodrome resilience. As aerodrome environments become increasingly complex and interconnected, this case reinforces the importance of investing in comprehensive preparedness frameworks and professional teams to guarantee business continuity and rapid recovery during high-consequence aviation emergencies.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the aircraft accident response and recovery experience at HKIA; and

b) share experience and best practices in aircraft emergency response management and operational preparedness of aerodrome RFFS.

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