Designing a Water Rescue Plan for Airports

Abstract

An airport water rescue plan is an integral and essential component in an emergency plan for airports located in close proximity to water bodies. Unlike tactical plans that attend to an aircraft accident on terra firma within the aerodrome, an aircraft mishap at sea often involves a greater degree of complexity and brings with it unique challenges and difficulties.

This paper aims to draw reference from existing international standards, recommendations and guidelines in developing a set of principal considerations in the development of a water rescue plan for airports. These considerations are deliberately developed to provide airport operators with the flexibility to adjust and tweak their plans to better suit their operating environment.

Airport Emergency Services

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About the Author

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INTRODUCTION

All pictures speak a thousand words. However, not many can boast of being able to tell a story on their own. Just like the 'Tank Man' who was photographed stopping the advance of a column of tanks during the 1989 Tiananmen Incident, and the soldiers planting the American flag on the Japanese island of Iwo Jima during World War II on 1945, the image below is certainly an enduring one which will be firmly imprinted on the minds of many for years to come. Hailed as the 'Miracle on Hudson' by major news broadcasters, emergency agencies, pilots and even politicians alike, all 155 persons onboard the US Airways Airbus A320 were pulled to safety as the plane ditched in the frigid Hudson river on 15 January 2009.

Figure 1: Passengers waiting for rescue on the wings of US Airways Flight 1549
Source: Reuters

THE HUDSON MIRACLE

It is not difficult to understand why the accident was considered a miracle, and no surprise when the pilot of the aircraft, Captain Chesley Sullenberger, received universal tributes after successfully manoeuvring his crowded jetliner over New York City and into the Hudson river with an impact that was described as '*not a whole lot more than a rear-end collision*'.[1]

History has proven that aircraft accidents at sea rarely end with such fortunate outcomes. The Hudson crash took place almost exactly 27 years after an Air Florida plane crashed into the Potomac River and sank shortly after taking off from Washington National Airport, US. Seventy-four out of a total of 79 passengers onboard perished together with four fatalities on the ground.

In the past few years, several unfortunate accidents bore testament to the low survivability rates of aircrashes into water bodies. On 25 January 2010, an Ethiopian Airlines Boeing 737 plane crashed into the Mediterranean Sea in stormy weather, two miles west of Lebanon. None of the 90 persons onboard survived. On 30 June 2009, a Yemenia Airway Airbus A310 crashed into the Indian Ocean, 10 miles off the coast of the Comoros island while attempting a second approach to land. Out of the 153 persons onboard, only a 14-year-old girl survived. Just four weeks earlier on 1 June 2009, an Air France Airbus A330 jetliner went down over the Atlantic Ocean en route to Charles de Gaulle. All 228 persons onboard perished.

Figure 2: Salvage operations of Air France Flight 447
Source: Associated Press

The accidents listed above all occurred in very different circumstances which had no doubt affected the outcomes to varying degrees. Therefore, it would also not be fair to assume that the tragic endings of these accidents were caused by an absence of certain factors which contributed to the 'Miracle on Hudson'.

[1] Personal account from a passenger on board US Airways Flight 1549

What factors could the 'Miracle on Hudson' be attributed to? Was it the heroic actions of Captain Sullenberger? Was it divine intervention, or was it sheer luck? One thing we can be sure of is that the outcome would have been drastically different if an effective water rescue plan had not been put in place.

INTERNATIONAL REQUIREMENTS AND GUIDELINES

Annex 14 (Aerodromes) to the Convention on International Civil Aviation states that:

> "*[t]he (aerodrome emergency) plan shall include the ready availability of and coordination with appropriate specialist rescue services to be able to respond to emergencies where an aerodrome is located close to water and/or swampy areas and where a significant portion of approach or departure operations takes place over these areas.*"

Similarly, the Federal Aviation Administration (FAA), US, mandates that:

> *"[e]ach (aerodrome) certificate holder shall develop and maintain an airport emergency plan designed to minimise the possibility and extent of personal injury and property damage on the airport in an emergency."*

The FAA Code of Federal Regulations Part 139.325 also states that the aerodrome emergency plan must include procedures and guidance for prompt response to "*water rescue situations.*"

Both ICAO and FAA have published comprehensive guidance materials to aid aerodrome operators in the promulgation of water rescue plans. These can be found in the ICAO Airport Services Manual Part 1 (Rescue and Fire-fighting) and Part 7 (Airport Emergency Planning), as well as the FAA Advisory Circular (AC) No: 150/5210-13B.

Airports differ and will naturally operate under vastly dissimilar environments and conditions. The objective is to create conditions in which survival is possible in the event of an accident, and from which the mission can succeed. It is therefore crucial for crisis managers to adapt these guidelines into a feasible, relevant and effective plan not just for the aerodrome operator, but for other mutual aid agencies who have a part to play in the successful mitigation of any air disaster.

PRINCIPAL CONSIDERATION 1 – UNIQUE CONDITIONS DURING AN AIRCRASH INTO WATER

Any water rescue plan must take into account the unique and harsh circumstances survivors are subjected to during an aircraft accident in water. The success of the rescue mission will therefore be greatly influenced by the plan's ability to address these concerns. Some of the key considerations in the rescue mission are as follows:

Water Temperature

Survivors of an aircrash into water will not only be unprepared for the sudden exposure to low water temperatures, they will also experience increased body-cooling rates due to the evaporating fuel that could be seeping out from the aircraft wreckage. Survivors are also vulnerable to hypothermia which may set in when the core body temperature drops below the temperature required for normal metabolism and bodily functions at 35°C.

The water rescue plan must also take into consideration the temperature of the waters surrounding the aerodrome. During the Hudson river crash, most passengers had to wade in knee-high waters after evacuating from the aircraft, with some reports of passengers shivering in chest-high waters of 2°C. In the waters surrounding Singapore and neighbouring countries, water temperatures are typically more forgiving at 27°C to 29°C. Even so, survivors will be susceptible to hypothermia setting in after prolonged exposure.

Duration of Exposure

When a person suddenly comes into contact with extremely cold water, they experience a cold shock response. This phenomenon is similar to jumping into a freezing swimming pool on a hot summer day. Immediately, the person will hyperventilate and take uncontrollable, deep and fast breaths for the next one to three minutes. If a person goes underwater in this state, he/she could swallow water and drown. However, once the cold shock response subsides, the person should be out of the danger zone temporarily.

An average person will be able to survive in 5°C waters for a period of 10 to 20 minutes before the muscles become weak from the effort of staying afloat. The person will then lose coordination and strength as blood moves away from the extremities towards the core of the body to protect the heart.

The need to reduce the risk of hypothermia in survivors translates that the water rescue plan must place great emphasis on the quick response time to the scene of the accident. Of equal significance is to prevent survivors from experiencing hypothermia while in transit to medical facilities. Thus, rescue vessels must also be equipped with blankets, as well as other forms of body warmers.

Other Water Conditions

Survivors may encounter hazards which will diminish their chances of survival. Depending on the characteristics of the water, aircrashes into water bodies are mostly high-impact events which will result in the break-up of the fuselage. Spilt fuel could possibly be ignited, leading to a post-impact fire. Even if ignition sources were suppressed by the waters, the inhalation and ingestion of fuel vapours would definitely pose severe health risks to the survivors.

On the other hand, sharp-edged debris from the wreckage may inflict severe injuries to passengers, further hampering their survivability rates. Flotation devices may also be rendered ineffective by the jagged debris.

In open waters, rough currents and waves may overpower survivors without life vests; the risk of drowning is likely to occur. On the other hand, life vests would not be useful in swampy areas as survivors may succumb to the 'quicksand effect' of the treacherous terrain. The dangers posed by various marine life in such environments are also a genuine concern to both survivors and rescue personnel.

PRINCIPAL CONSIDERATION 2 – CLEAR LINES OF RESPONSIBILITIES

ICAO Airport Services Manual Part 1, Chapter 13 states that:

> *"[i]n producing its detailed plan, the airport authority should have regard to the services and facilities already provided by the search and rescue organisation in accordance with ICAO Annex 12 (Search and Rescue), to ensure that the separate responsibilities for an aircraft accident in the vicinity of the airport are clearly delineated."*

FAA AC No: 150/5210-13B also states that:

> "*[b]ecause of jurisdictional or logistical reasons, an airport operator may need to develop a water rescue plan that consists of a written mutual aid agreement identifying an entity other than the airport to act as the primary response agency.*"

Clear lines of responsibilities and good operational leadership are vital for a successful rescue mission of an aircraft accident at sea. Unlike on land where the operational area is smaller and easily contained, an aircrash at sea could stretch the operational area many hundred nautical miles, with various resources spread thinly beyond the on-scene commander's line of sight.

The Air France Flight 447 crash on 1 June 2009 illustrated the enormity and complexity of search and rescue operations for an aircrash at sea. The first two bodies were only recovered on 6 June, five days after the crash. After three weeks of search operations, 51 bodies out of the 228 persons onboard were recovered. On 6 May 2010, the location of the flight's black box was pinpointed to within a three to five square kilometres radius on the ocean floor. To-date, both the cockpit voice recorder and flight data recorder have not been recovered.

In Singapore, the Rescue Coordination Centre (RCC) is the incident manager responsible for the command, control and communications for any aircraft accident at sea beyond the turn-out area of the Airport Emergency Service (AES). Within AES' turn-out area, the airport operator, Changi Airport Group, will assume the role of incident manager, with the RCC playing a vital role as well. In either scenario, the incident manager would be well supported by mutual aid agencies such as the Republic of Singapore Navy, Republic of Singapore Air Force, Police Coast Guard and the Maritime Port Authority of Singapore out at sea.

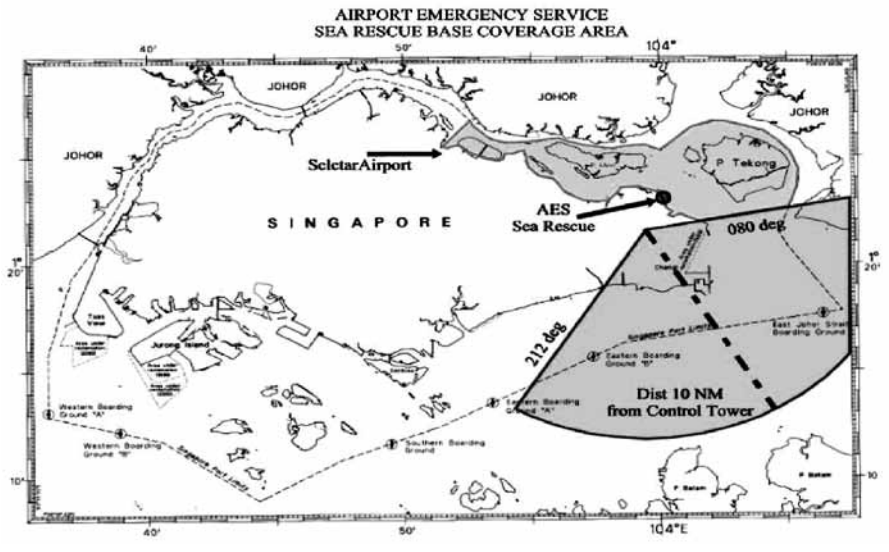

Figure 3: Turn-out area of Airport Emergency Service, Changi Airport Group

PRINCIPAL CONSIDERATION 3 – PERSONNEL AND TRAINING

At airports that are planning to or already providing water rescue services, the rescue personnel are generally selected from amongst trained aircraft rescue and fire-fighting officers. This is the case for many international airports such as Singapore's Changi Airport, Denmark's Copenhagen Airport, Boston's Logan International Airport and Hong Kong's Chek Lap Kok Airport.

Personnel deployed at specialised sea rescue units must possess fundamental skills such as fire-fighting, first aid, safety awareness, victim and hazard recognition and the proper use of personal protective equipment. In addition, they must also be equipped with a whole new array of competencies and knowledge, to ensure effective performance at their job and to safeguard their own well-being in an actual operation. The diverse repertoire of skills include vessels handling, water rescue techniques, victim handling procedures, deep-sea diving and navigation rules.

Airport operators or providers of sea rescue services decide on the scope and depth of training to be undertaken by sea rescue personnel. In an ideal situation, it would be best to have personnel who are trained in all aspects of sea rescue operations. However, as airports around the world seek to increase their productivity and drive cost efficiency, it becomes increasingly untenable for sea rescue services to enforce "wholesale training".

How then can sea rescue services ensure cost effectiveness of training without compromising operational effectiveness and excellence?

Once the water rescue plan has clear lines of responsibilities in place for the various agencies, it is then not difficult to review, analyse and streamline training requirements for an airport's sea rescue services. For example, if a country's Navy or Coast Guard has the necessary deep-sea diving capabilities, it may then not be essential for the airport's sea rescue services to replicate this skill. Instead, more resources can be invested into rescue swimming and surface rescue training components.

However, decisions such as this must also be based on "time and space" considerations. If the response time of a particular agency is assessed to be faster than the sea rescue unit, it may be necessary for that agency to further improve on its surface rescue and rescue swimming capabilities as these skills are vital for saving lives in the immediate aftermath of an aircrash at sea.

Besides individual competencies, emphasis must also be placed on developing the group of individuals into an effective and operationally-ready team. Therefore, the training plan must take into account programmes which enforce and inculcate the values of teamwork and team coordination. It is also vital for the team to be led by chosen leaders who have the authority, decisiveness and operational awareness to make independent and often difficult decisions under unbearable conditions and stress.

PRINCIPAL CONSIDERATION 4 – KEY ASSETS AND EQUIPMENT

Sizing up the vehicular assets of a land fire station is straightforward as international standards set by ICAO and FAA have determined the type, size, number and capabilities of fire trucks required to provide runway fire protection at airports. Terrain within or around the airport vicinity does not pose insurmountable challenges as it is generally flat, obstacle-free and easy to manoeuvre about.

Conversely, international standards by ICAO and FAA for the provision of vessels in sea rescue operations are performance-based rather than prescriptive. The type of rescue vessels and equipment available in the market that could contribute to mission success during an aircraft crash in water bodies has been well documented by ICAO and FAA.

Vehicles and vessels used for the conduct of water rescue operations must also be suitable for the water condition and environment. Collectively, these equipments should have enough capacity to accommodate the maximum number of passengers carried by the largest aircraft serving the airport. The appropriate selection of these assets will require planners to consider weather variations and tide conditions in the local environment.

Again, FAA AC No: 150/5210-13B provides guidance and recommendations on the specific applications of various sea vessels in different operating environments. For instance, fast boats are recommended for airports in close proximity to oceans or large lakes whilst inflatable or air cushion vessels and shallow draft boats or amphibious vehicles are recommended for inland waters and swampy areas respectively.

Figure 4: One of the two hovercrafts under AES' inventory

Figure 5: Catamaran fire command boat of the Hong Kong Fire Services Department (HKFSD)
Source: HKFSD website

It is important to note that the capacity requirement to "*accommodate the maximum number of passengers carried by the largest aircraft serving the airport*"[2] does not imply that the airport operator or sea rescue service provider must single-handedly accommodate all passengers. What it mandates is for the airport operator, who is the party responsible for promulgating the water rescue plan, to ensure that the collective efforts and assets of all mutual aid agencies have adequate capacity to comply with the requirement.

It is common for sea rescue units to augment the capacity of their vessels with inflatable life rafts which can be deployed to pick up survivors during an aircrash at sea. Rescue units should bear in mind that it is not merely a "ferry service". A certain standard of fire-fighting capability would also be useful in the event of a post-crash fire. Other basic provisions that must be carried onboard the rescue vessels are blankets to delay or reverse the onset of hypothermia as well as medical equipment for initial triaging and stabilising of casualties.

Of equal importance is the coordination of the sea rescue plan with air assets such as helicopters for winching operations and expeditious evacuation of casualties with grave injuries to medical facilities. Helicopters are particularly beneficial to rescue operations as it can be used to drop flotation devices such as life rafts, or provide illumination from an elevated vantage point.

PRINCIPAL CONSIDERATION 5 – TESTING OF PLAN

Like every operational plan, a sea rescue plan requires each and every party involved to have an intimate understanding of their own roles and responsibilities, as well as that of their supporting partners. Close

[2] Extracted from FAA AC No: 150/5210-13B

coordination amongst all parties is also a pre-requisite to the mission's success. The only way to glean the effectiveness and identify the gaps of any plan is to put it into practice in a controlled exercise environment.

ICAO mandates the conduct of a full-scale aircraft crash exercise at least once every two years while FAA's requirement is at least once every three years. During a full-scale exercise, it is important to involve all parties to derive maximum benefits.

During the Hudson river crash, the first two vessels that arrived at the ditching four minutes later were private ferries which played a key role in rescuing the passengers from the waters before the arrival of trained personnel from the New York City Fire and Police Departments and the US Coast Guard. It may be worthwhile for airport operators to involve private ferry operators in their full-scale exercises even though these operators are not typically in the loop of the "crisis management channels".

Full-scale exercises also provide useful platforms for the incident manager to assess the synergies amongst all parties, and to evaluate the harmonisation of resources at his disposal. Any changes in the principal considerations previously discussed above can also be validated during these exercises before actual implementation.

CONCLUSION

An effective water rescue plan is a critical element of the aerodrome emergency plan. Recognising the principal considerations would ensure that the plan is operationally effective and relevant to the airport's operating environment. It is every emergency practitioner's wish that the enduring image from the Hudson river crash will trigger the impetus to continually review, adjust and improve on our contingency plans. Indeed, as Confucius once said, "*A man who does not think and plan long ahead will find trouble at his door.*"