Advanced Preparation for Rescue and Medical Action in an Emergency Landing Disaster in Maltese Waters

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Key Words
Emergency landing disaster;
Medical action; rescue

Air traffic into Malta is heavy for such a small island, especially during the busy summer tourist season. Almost every type of aircraft flies in, including Jumbos with up to 450 passengers. Eversince the airport has been the sole responsibility of the Maltese authorities there have been two minor incidents; one in which a small private plane made a crash landing (minor injuries) and another when a commercial aircraft engine caught fire on take-off. Both incidents were efficiently dealt with. The island is only 10 km in width at the widest point and Luqa airport is only 6-7 km distant, from each coast. The flight path along the main runway passes over the Grand Harbour on the east and over high cliffs on the west. At landing speeds this is approximately 1 minute of flying time, so there is a considerable likelihood that, in the event of a disaster it could be at sea.

All those persons involved in the aircraft industry with whom we consulted have stated that, forewarned of an aircraft fault, they would always prefer to come down on land, rather than on the sea. Making an emergency landing at sea would compound the difficulties in rescuing the passengers, and salvaging the aircraft would be almost impossible. Also, Luqa Airport has emergency equipment immediately available and procedures selected according to the likely extent of the disaster. These are normally designated as "Priorities" numbered 1 to 3 following the practices of the International Civil Aviation Organisation (ICAO). Additional to procedures for a crash on land preparations are in hand for rescue at sea.

This paper deals with one special aspect of such a rescue. In the event of a known fault developing in an aircraft, while emergency services are placed on stand-by at the Airport, so also are teams for a sea rescue.

Should the situation develop into an accident, full air/sea rescue procedures would be set in action. The location of the wreckage is the responsibility of the helicopters and patrol boats of the Coast Guard. Immediately after the accident is known to have occured all services likely to be required are put into action by the Emergency Control Centre, such as: Police, Ambulance Service, Casualty Department at the Hospital, etc. One of these services is the Surface and Underwater Volunteer Rescue Organisation (SURVO).

SURVO consists of a number of teams specially trained in techniques of rescuing persons trapped beneath the water, and from the surface. All are experienced aqua-lung divers, highly skilled in approaching a panicking person and in administering respiratory resuscitation to the drowning.

When alerted, the SURVO volunteers assemble at one of three selected centres around the island; the heliport, the coast guard station and diving centre. Equipment is collected from the designated centre. This includes medical supplies - additional aqualungs, regulators with a full face mask/octupus attachment, in addition to their own personal equipment. One member of each team is a medical officer, a doctor from the local hospital who is also a trained aqualung diver.

The Maltese Islands are in the form of a plateau tilted approximately from east to west. The western coast is almost entirely a cliff 150-200 m high from which access to the sea is almost impossible. The

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east coast has several bays. The three centres are on the east coast from which acess to the sea is easy. The sea is very deep close to the coast at most points around the island. Diving operations are very difficult below 50 m, so effective rescue is limited to this depth.

If a perfect landing occurs on the sea, the plane floats for some little time. All passengers should be able to make their escape from the plane complete with an inflatable life jacket. The SURVO teams should be present to take the passengers from the sea and transport them by inflatable boats to the larger boats on which medical teams are in attendance. They are trained to give respiratory resuscitation on inflatable boats using a tight face mask and an Ambu bag. If need be the SURVO divers are able to attach a pressure regulating valve to their cylinders with an output to a soft bag connected to non-rebreathing system with a Ruben Hesee Valve.

The divers work in pairs as is the normal practice. They approach a person in the water, determine if respiratory resuscitation is necessary and if so start it immediately, while towing him to the inflatable boat. Once safely on board major injuries can be attended to while the victim is transported to the hospital boat or coastal mobile casualty unit. While giving resuscitation in the water life saving principles are used. The approach to the subject must always be made from behind (to prevent the rescuing diver from being grasped by the victim). A firm hold is taken with one hand around the nape of the neck, and the other on the chin. The hand holding the chin is normally used to close the mouth, while a seal is made on the nose, so using a "mouth to nose" technique. The use of a "mouth to mouth" method in rescuing passengers would be preferable but it is very difficult to accomplish in the sea. There remains the problem of those injured and unable to leave the plane. In order to rescue them, the plane would have to be entered risking it sinking at any time. It would be impossible for a fully equipped SURVO team member to reach any of the plane exits from the sea. This problem is still under consideration.

In the more likely situation where the plane hits the water and the fuselage is damaged it will become submerged within a very short time. The probability of anyone contriving to escape is extremely remote.

Should the fuselage come to rest at a workable depth and should a pocket of air be trapped therein, there might be a possibility to save those still alive. In a simplified analysis of the situation, we consider that the fuselage is damaged on the underpart and that it rests with this damaged portion towards the sea bed. The water level will rise inside the aircraft compressing the trapped air until the air pressure balances the pressure of the water. Should the plane end up in relatively shallow water, say, 10 m so that with a larger aircraft the roof would still be exposed; the water would rise half way up the fuselage, so it can be imagined that in deeper water a very small air pocket would remain. Any surviving passengers will be exposed to the same physiological conditions as a diver swimming at the depth of the water/air interface.

For an interface above 9 m no decompression complication exists. As the interface goes below 9 m the decompression consideration rapidly becomes very significant.

When a group of people are trapped in a sealed space two principle factors effect the rate of onset of asphyxia – the partial pressure of carbon dioxide and of oxygen. Many other very complex physical and physiological influences are involved, but to make a discussion reasonably simple only these two effects are being considered.

If the sealed passenger cabin is at approximately atmospheric pressure since it is so regulated during flight and unpolluted air was present, the onset of hypoxia would be concurrent with the increase in carbon dioxide partial pressure. If however the aircraft were submerged, the air trapped inside would be compressed to a higher pressure, and carbon dioxide narcosis would occur before hypoxia. To emphasise this simplified analysis, the same mass of air at a higher pressure (under reduced volume) will give enough oxygen for a longer time, but will produce carbon dioxide narcosis in a shorter time. This difference is further exaggerated if the oxygen carried in the aircraft is released into the cabin. The most likely situation is that the aircraft will break up and be scattered over a large area; any survivors being those who by some miracle have been thrown clear. However in planning a rescue operation it is necessary to be prepared for every eventuality that one can imagine, thereby reducing the number of unforeseen situations which will occur. The presence of even a single living person in a submerged aircraft necessitates that a procedure is worked out to rescue him.

An "octupus rig" is a standard piece of equipment used by a diving instructor. It is an additional mouthpiece attached to the instructor's cylinder. By further adding a full face mask it should be possible for an untrained person to breath while being led from the aircraft. Using this as a basis it is necessary to consider methods of ingress. The plane should be entered below but as close as possible to the air/water interface; this level would first have to be determined. It should be noted, that if a part of the cabin is above sea level, opening this to the atmosphere will cause the level of the water in the plane to rise to sea level. Either a suitable door would have to be forced or an opening cut in the fuselage and the inevitable debris would have to be cleared to make a passage.

All of the foregoing still holds true for an accident during the night or in poor weather conditions, but the survival chances would be correspondingly reduced.

To all the injury and rescue problems expected in a disaster on land are added the complications of drowning, asphyxia, hypothermia, decompression sickness and barotrauma. Therefore every person rescued, even those with no apparent injury must be fully hospitalised from the medical boat or mobile casualty unit.