

Planning for an airport disaster

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Introduction

AS MOST MAJOR AIRPORTS are located at some distance away from urban hospitals, emergencies occurring at airports can cause considerable difficulties in obtaining timely and adequate attention. Besides coping with major air disaster, the airport itself is a city on its own right with a mixed population, consisting of passengers, relatives visiting passengers and the airport authority staff. This multitude has increased over the years at most international airports and so it will be with the Subang International Airport. Table I shows these figures for some of the major airports, Mohler *et al.* (1971).

Thus from the above aspect alone there should be an adequate medical organisation available at all international airports. Unfortunately, this is not so at all major airports. It is only at some such international airports that highly well-organised services are available for twenty-four hours. These are the Charles de Gaulle and Orly Airports in France, the John F. Kennedy at New York, the Logan at Boston and the Heathrow in the United Kingdom.

The average passenger finds himself or herself in unusual and strange surroundings. The airlines cater only for problems arising in their ticketed passengers, but what of all the other non-passenger problems? Thus, the need for an adequate medical facility. If such a medical facility exists and perhaps clinics with nursing and medical staff for the case of airport personnel, then the ideal situation exists for the case of common daily airport casualties. The usefulness of this nucleus has more far reaching effects in the event of a major airport disaster. For

indeed, the staff are on the spot, so to speak, and could form the initial nucleus of medical personnel in the event of a disaster. The first urgent reinforcement in the initiation of the plan to be outlined will be from the fire-brigade staff on duty at the airport.

Airport Disaster Organisation

The main objective of an airport disaster organisation is to enable the most seriously injured passengers to survive, while at the same time it will provide adequate and efficient conditions for all other categories of casualties. It is therefore imperative that the staff working at the site of an accident should have adequate assistance promptly. Casualty sorting and first aid must be top priorities. It is necessary for one hospital to be associated with each major international airport. However, in major disasters it might be necessary to evacuate casualties to more than one hospital. The tendency in the world today, in modern airports, is to have nearby, not merely a medical department catering for the needs of the airport, but an emergency hospital, such as exists near the Charles de Gaulle Airport. These hospitals are situated in relation to motorways as well as the airports. They then serve a dual purpose. The University Hospital, though some distance from the Subang International Airport, is in a similar unique position. The system controlling the management of airport disaster should be under a single central authority.

Features Peculiar To An Aircraft Accident At A Major Airport

1. The possibility that there will be a large and instantaneous number of casualties.

Table I
 Airport passenger, non-passenger (Spectators, well-wishers and greeters), and on-site employee numbers for the year 1948 and
 estimated for the year 1973, figures in parentheses are less firm than other figures.

FOR MAJOR AIRPORTS

AIRPORT	1968 Passenger Population	1973 Passenger Population	1968 Nonpassenger Population	1973 Nonpassenger Population	1968 Full Time Employees	1973 Full Time Employees
1. Boston (Logan)	8,000,000	13,000,000	6,000,000	9,000,000	8,000	11,000
2. New York (JFK)	20,000,000	30,000,000	30,000,000	45,000,000	41,000	55,000
3. Pittsburgh (Greater Pittsburgh)	5,500,000	11,000,000	(6,000,000)	12,000,000	3,000	12,900
4. Chicago (O'Here)	30,000,000	(40,000,000)	45,000,000	(55,000,000)	18,000	(20,000)
5. Los Angeles International	21,000,000	56,000,000	1,500,000	1,000,000	26,000	(35,000)
6. San Francisco International	14,000,000	22,500,000	30,000,000	45,000,000	28,000	50,000
7. London (Heathrow)	14,000,000	28,000,000	19,000,000	38,000,000	45,000	60,000
8. Paris Only	7,000,000	14,000,000	4,000,000	4,000,000	19,000	25,500
9. Rome (Leonardo Da Vinci)	6,000,000	12,000,000	7,000,000	15,000,000	10,800	22,000

2. The fact that these casualties may be suffering not only from major injuries to the body but may also have in addition burns and the consequence of suffocation.
3. This situation is one that would lead to panic by the catastrophic nature of its origin and suddenness.
4. The wreckage will never be in one single place. It would be scattered and probably very much so, depending on the nature of the impact at the time of the crash.
5. To all these difficulties, one will have to consider those arising from adverse weather conditions such as heavy rain and thunderstorms at the time of impact.

Thus it is only a very careful and rational study that would be able to evolve as near foolproof a plan as possible. Deciding how many casualties there would be on the basis of the critical medical aircraft, the 747B is the ideal to base the plan on. On this basis, it is easy to handle problems involving smaller categories of aircraft. Following an air disaster, the casualties are generally divided into three major categories:-

1. The very extremely urgent cases which need immediate resuscitation.
2. The seriously injured passengers who do not require resuscitation.
3. Those fortunate passengers with minor injuries.

There are no definite statistics to indicate the percentages of passengers in each category in the event of air disaster. However, taking into consideration other catastrophies that have occurred throughout the world, such as earthquakes, train derailments, etc., arbitrarily it is advisable to place the surviving passengers as follows:

- Category 1 — ten percent
- Category 2 — twenty percent
- Category 3 — seventy percent

The most important thing to be appreciated is the necessity to treat these categories of patients in an unprepared and difficult situation. Without such realisation, it is impossible to provide an adequate number of staff for medical resuscitation and nursing as is deemed necessary. Hence, without such vital planning, it is not possible to offer the best possible patient care in these most adverse conditions.

The Organisation

In trying to establish an organisation to care for these patients, one has to be realistic and not try to attain the impossibility of perfection. Two policies are available for consideration.

One This policy concentrates on evacuation of the injured as and when they are discovered. It has the advantage that it does not require specialist staff, but only stretcher bearers and ambulances. It also shows an apparent efficiency in that it caters well for the public opinion because the patients are being rapidly carried from the disaster site. This plan is transferring responsibility to others and the organisation is not without disadvantages. Many will die, who otherwise might have been saved by resuscitation. Besides, still others would suffer deterioration in their general condition and even end up by suffering external haemorrhage, suffocation, or both, by the time they arrive at hospital. These problems may have been prevented and tragedy avoided if rapid and efficient management was available at the scene of the disaster. This policy is therefore unacceptable. However, should this policy be accepted, due to one reason or another, it is advisable to distribute the patients to more than one hospital as otherwise one hospital will be ill prepared to cope with such a multitude of patients in a matter of a few minutes.

Two The ideal alternative policy would be when the injured are not evacuated by anyone, anywhere or anyhow. This scheme also has its drawbacks because of the elaborate organisation needed, but it is by far the most efficient. It makes sure that the most seriously injured are given the chance to survive while others are given the maximum moral and material comfort. Thus the following series of action are necessary to ensure the final goal:

1. The casualties have to be collected.
2. There should be adequate sorting out of all the casualties.
3. First aid and evacuation direction should be clear and precise.
4. Evacuation should be adequately organised.

The whole operation should be directed by a single authority. A medical co-ordinator should be the officer in sole charge of the disaster operation. He should be the first to arrive on the scene in the event of an unfortunate incident, to co-ordinate the work. Continuous efforts are needed to improve existing facilities or those that are likely to be organised.

The number of casualties to be catered for in the event of an air disaster will naturally depend on the type of aircraft involved. Today, in most international airports, the Boeing 747B is considered the standard critical aircraft. A crash of such an aircraft would cause the greatest number of problems.

Collection and Sorting

This takes place in two stages. The first people to move on to the scene of accident will be the firemen who will extinguish any fires and open up a passage through which the passengers could be cleared from the wreckage in less than three minutes, if possible. Ancillary medical staff on the spot should not approach the wreckage until the fire is extinguished and when this is done, the whole wreckage area is cordoned off as a casualty clearing area and the casualties assembled here. The first medical staff for this purpose will be those of the airport authority. Figure 1 shows the first phase of the operation.

During the initial phase, the important step of sorting takes place in two stages. The initial stage is characterised by the following:

1. It takes place at the casualty collecting area.
2. It is rapid and it is carried out by non-medical staff.
3. It is functional and not lesional, for one endeavours to answer basic questions such as "Is there haemorrhage, suffocation or shock, or all?" Thus it follows that after sorting out, first aid is immediately assured for those casualties who need to overcome haemorrhage and suffocation.
4. Labelling of casualties is done at this stage of the operation, using red, yellow and green labels. A red label indicates extremely urgent patients who should not be moved without proper resuscitation before transport. A yellow label indicates the seriously injured patients who could be directly evacuated without risk and without resuscitation. A green label indicates the minor injuries who could wait until the more serious casualties have been attended to.

The second stage of the operation starts when staff and equipment reinforcements arrive on the scene. These reinforcements consisting of medical and nursing staff should come from the nearest hospital working in conjunction with the airport authority. For Subang airport, it will be the University Hospital in the first instance. With the arrival of staff reinforcements, the next step of casualty collection and sorting according to lesions, is carried out.

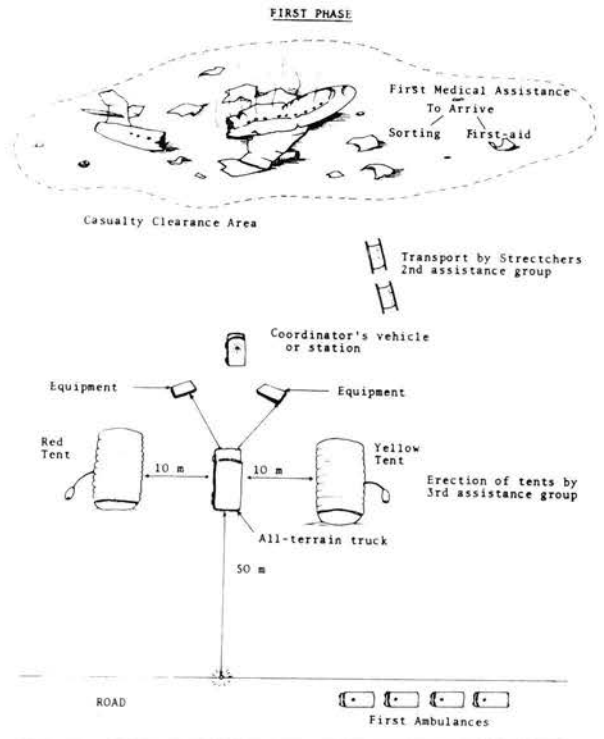


Figure 1 – Sketch of possible arrangement for Phase I of handling an air disaster.

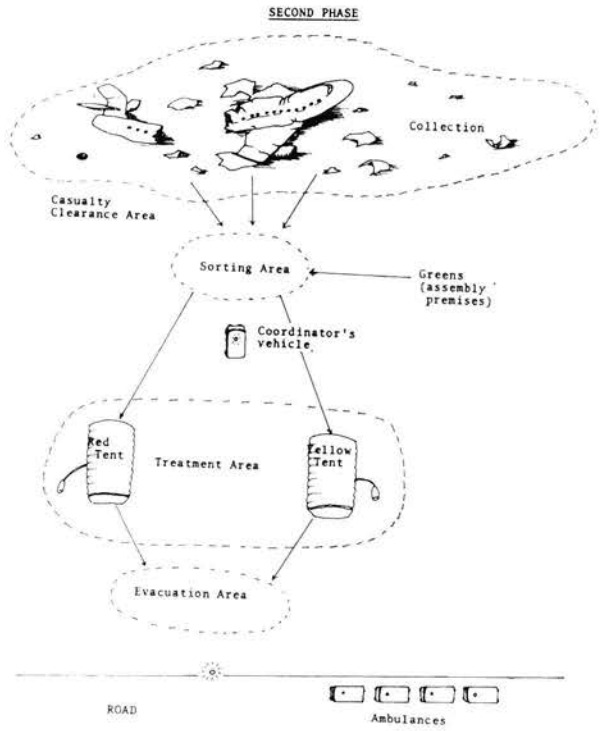


Figure 2 – Sketch of arrangement for Phase II of an airport disaster organisation.

Casualties with Red Cards

1. First aid is the most important for these unfortunate individuals. Haemorrhage has to be stopped by means of haemostatic cushions, pressure dressings, etc. Cases in shock have to be attended to by clearing the upper respiratory tract and ensuring a proper and unhampered airway. Splinting of injured limbs have also to be attended to.
2. Resuscitation of these patients should be carried out by doctors with proper equipment on the spot. Figure 3 shows a suitable arrangement for the treatment tents.
3. Evacuation of these patients after such resuscitation gets priority over all other categories.

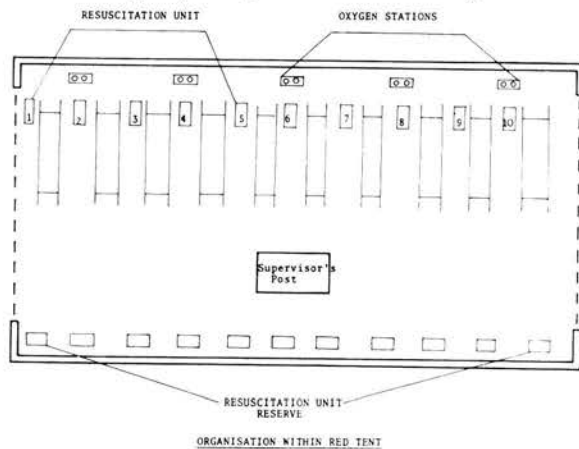


Figure 3 - Shows the general plan for resuscitation in the red tent.

Casualties with Yellow Cards

These can be evacuated in the first ambulances that arrive at the disaster site and thus start an activity that is psychologically important by assuring the public and the casualties that action is on the way for their betterment and restoration to normal. The evacuation and whatever treatment, when permitted, would be determined by the condition of the individuals.

Casualties with Green Cards

These casualties could be collected at a single spot and transported as soon as possible to a suitable area where they could have treatment for their minor injuries. Their evacuation would take effect only after those with red cards and yellow cards have been dealt with. In fact, the management of these third category of casualties could be done at the airport first aid centre. The evacuation of the casualties should be according to a plan to avoid confusion. This should be carried out as outlined below.

Plans for Evacuation

The seriously injured are accompanied by attendants. A complete, updated list of hospitals should be available. In this case, the hospitals will be the University Hospital, the Klang District Hospital and the General Hospital Kuala Lumpur. The means of transportation would be by private ambulances and by air force helicopters.

The disposal of these patients to a single hospital or more than one hospital would naturally depend

Table II.

Figures calculated for various types of aircraft and categories of the injured to be expected when the airport is ready for disasters

Aircraft Types	Capacity	Maximum Number of Possible Injured							
		Over 50% Injured				Over 85% Injured			
		Total	Red	Yellow	Green	Total	Red	Yellow	Green
Stretched DC-9-40) TRIDENT)	115	57	6	12	39	97	9	18	68
BOEING 737	125	62	6	12	44	105	10	20	76
BOEING 727 - 200) Stretched B-707-320)	189	94	9	18	67	160	16	32	112
Stretched DC-8	259	129	13	26	90	220	22	44	154
DC-10	270	135	13	26	96	229	23	46	160
AIRBUS) BOEING 747)	316	158	16	32	110	268	27	54	187
BOEING 747 C	490	245	24	48	173	416	42	84	290

on the number of seriously injured patients. It is always advisable to have more than one hospital alerted for this purpose. In this context, the University Hospital will have to bear the main brunt of the casualties, but the General Hospital at Kuala Lumpur and the District Hospital at Klang have to be alerted as well, to receive the overflow from the University Hospital. In fact, after a certain number of patients have been sent to the University Hospital, some may well be directed to the other two hospitals to ensure that prompt treatment be available to all casualties. Overcrowding all casualties in one hospital would delay the treatment of those who arrive later in the hospital. The control of numbers and direction of their destination will be the responsibility of the medical co-ordinator who will be in charge of the entire organisation. He should be readily available throughout the period of alert. Figure 4 shows the general scheme of the organisation. Complimentary action will be needed in addition to the above.

GENERAL PATTERN OF ORGANISATION

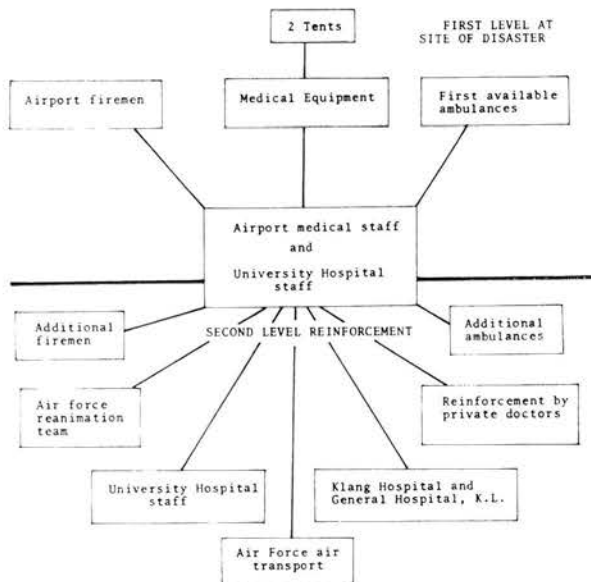


Figure 4 – Shows a summary of the general pattern of organisation in the event of an airport disaster.

The uninjured passengers should be taken to the terminal building of the airport and comforted and cared for until adequate disposal could be arranged. They may be in some degree of shock. The dead would have to be collected at this area

of the airport where they could be identified and later transported by relatives.

In order to ensure efficiency of this system, unexpected and unscheduled exercises involving partial operations and full operations once or twice a year should be held. It is important to see that the soundness of the instructions is appreciated by all staff involved in the running of the emergency organisation. Frequent contact with outside bodies and doctors working outside in such practices would arouse their interest and make their services available in the time of a national crises.

The Operational Procedure in this Organisation

The alert should be triggered off by the tower and there should be direct communication from the tower to the main hospital, namely the University Hospital, that an accident is impending. On receipt of the alert, the emergency programme of the Accident and Emergency Department should be put on standby, ready to move in ambulances with staff to the scene of disaster, should it occur.

At the University Hospital, there should be a large map of the entire airport showing access roads to its various aspects. Should the disaster take place, the tower should give an indication as to the exact location of the wreckage in relation to the map, which ideally should be marked off in squares, so that location of the rendezvous point commonly known in most international airports as the "X" point, could be selected. It may be a good procedure to have pre-selected "X" points for different areas in the map of the airport and its surroundings. One has to remember that crashes of aircraft taking off or coming into Subang are not going to happen on the runway but in the vicinity of the airport itself.

The number of staff for coping with the disaster would naturally depend on the number of casualties. With a small number of casualties – ten or slightly more – the number of staff would be limited. The staff can be divided into four categories:

1. The permanent local staff, namely the airport staff who are on the spot.
2. The medical co-ordinator who will be needed irrespective of the number of casualties. Also included in this phase are the vehicles that come under his authority and radio networks, special phone linkage, loudspeaker system, blinking lights, etc.
3. The regional staff that would have to reinforce local staff would be staff of the University Hospital, whose numbers could be increased

according to the number of casualties. The staff would have to include not only medical personnel but assistants in the form of attendants, stretcher bearers, ambulances and ambulance drivers.

4. Airforce personnel would be needed to stand by for helicopter transportation as and when indicated. In addition to this non-permanent local and regional staff, staff from neighbouring hospitals could also be called in, in the event of a major air disaster. These, of course, will all have to be pre-arranged and be in the telephone communication with the main medical co-ordinator who would summon for additional assistance as needed.

The Equipment Needed

Equipment needed for a disaster should include first aid medical kits, resuscitation equipment, perfusion sets, surgical equipment, inflatable splints, dressing material, special mattresses for fracture patients, stretchers, labels for the three categories of patients and evacuation cards. All this equipment is carried in the co-ordinator's truck and general stores stocked in the Emergency Medical Unit at the airport itself. To this medical equipment should be added ambulances, radio networks and operational equipment.

The local premises, for handling of the casualty should consist of two inflatable tents with proper lighting – the red one being used for resuscitation of the seriously injured patients, and the yellow one for major casualties. These inflatable tents used in European airports can generally be inflated in under two minutes.

The building in the airport itself which deals with the third category of minor casualties, should be divided into a sorting room, a room for minor surgery, and rooms to take the stretchers.

Details of Resuscitation Procedures

The resuscitation procedure itself can be divided into phases:

Phase 1 In the first phase, mainly first aid is given in the casualty collecting area. The co-ordinator should divide his staff into three groups:

1. the first aid staff proper for sorting, first aid, and attaching colour labels.
2. stretcher bearers for evacuating the injured from the casualty area for further treatment.
3. the tent erectors.

Casualties are evacuated immediately. The red casualties are carried to the tent. The green casualties are left to themselves for the time being. The tents are erected at the locations marked by blinking lights of the same colour by the co-ordinator.

Phase 2

By this time reinforcement should arrive at the scene to help the staff that are already on the spot and the collecting tents should be operational. The sorting out of the injured in the casualty area is by now complete and the final sorting out area is set up in front of the tent. This sorting is lesional. The red and yellow casualties should by now be in the tents of their corresponding colours while the green casualties have assembled in the premises where they could be attended to after the serious ones have been dealt with. In the evacuation area, the casualties for transport are assembled and evacuation cards are attached to them.

Phase 3

This phase depends on the circumstances available. In fact it implies an extension of the second phase, and the availability of a sufficient number of doctors and resuscitation staff on the spot; and that a real field hospital is in operation with perfectly established communication and secretarial help.

A factor of importance to be appreciated is that in this age of jet transport, modern construction with reinforced structures, less inflammable material, and wide bodies, provide more possibility of absorption of crash forces with the likely increase in the number of survivors.

Discussion

In this modern era of increased air travel involving millions of passengers, adequate measures should exist for the handling of any unforeseen occurrence such as a plane crash. Even though the number of air disasters are minimal compared to the many million passengers carried by aircraft each year, nevertheless it is obligatory for each international airport to be organised for such an eventuality. To be unprepared is unwise and will cost many loss of lives, some of whom might have been saved. An air disaster is an unexpected and unforeseen occurrence, thrust on a community with the swiftness of a flash of lightning, that it will take the authorities quite unawares. In one fell swoop, the entire locality is transformed into a battlefield on a wartime footing, for such is the dramatic nature of these unfortunate incidents. It is the very nature of their suddenness that calls for extreme thoroughness in the planning and preparation for such an eventuality.

The broad details of a suitable organisation for this has been described, dividing the handling of the situation into three phases. The importance of each has been stressed as an essential for efficiency. In addition to the main phases for the care of the casualties, the ancillary requirements also have been highlighted, to ensure an efficient working of the organisation. It would seem that the most essential criteria for efficiency would firstly to be adequately prepared, and secondly, to have smooth co-operation and co-ordination of the departments and personnel involved. The work has to be carried out with wartime efficiency for many a human life is at stake.

Summary

The increase in the numbers of passengers and commercial aircraft using an international airport

will create major problems in the handling of accidents at airports and in their immediate vicinity. For this purpose, this paper has outlined a scheme for daily emergencies at international airports. This organisation would be the nucleus of medical activity in the event of a major air disaster. The organisation for such a catastrophe and the back-up organisation needs have been outlined as well as the organisation needed for the case of casualties.

Reference

1. Bergot A.T.: Personal Communication, 1971.
2. Mohler Stanley R., *et al.*: (1971) Aeromedical and human factor aspects of airports, *Aerospace Med.* **42.**, 439-448.

