NATIONAL TRANSPORTATION SAFETY BOARD
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EMERGENCY AND DISASTER PLANS AND ASSOCIATED PROBLEMS

CONCERNING MAJOR AIRCRAFT ACCIDENTS

BY

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PREFACE

The specter of a possible domestic air carrier jumbo-jet crash cannot be dismissed, despite the excellent safety record wide-bodied types of airplanes have enjoyed since they began service. The risk of disasters will increase as more and more of the newer wide-bodied jets are pressed into service.

Although the mission of accident prevention has been somewhat successful thus far, it is only prudent to be prepared for a change in the pattern. The unprecedented number of people that could be involved in one wide-bodied jet crash - roughly double that of the largest conventional jet - makes it imperative to update air disaster planning, especially for airport crashes.

In such updated planning, the point of central importance is that the airport facilities must be linked to other facilities on a mass basis; only in this way can potential victims of a single wide-bodied airliner be adequately accommodated. Hospital facilities on this scale can only be found in the combined resources of the communities surrounding the airport.

The airport itself is not the only site of possible catastrophe during the approach to touchdown. Each runway at a major facility is literally the terminus of an "air corridor" which extends outward some 20 miles and usually overlies towns and cities. Coping with the problems generated by an impacting aircraft in urban areas is a major challenge, and few fire companies or emergency organizations are equipped for the job.

Significantly, the professional expertise of the airport emergency services for rescue, fire control, and plane removal are essentially unavailable to the volunteer rescue and fire companies in these communities. The jurisdiction of most airports for providing emergency services is frequently limited to the fenced areas surrounding the runways, and few cooperative plans between governmental agencies exist for catastrophic emergencies in the air corridor. For these reasons, some of the problems associated with major accidents will be discussed, and possible solutions outlined.

INTRODUCTION

This discussion advances the view that the entry of the jumbo, or wide-bodied, jet into commercial air transport operations has posed potential emergencies of a magnitude requiring comprehensive planning that will link effectively the airport facilities with coordinated support from the resources of the surrounding communities.

Besides carrying far more passengers than the conventional jets, the wide-bodied aircraft are expected to have a higher percentage of survivors of crashes. This is because of recent advances in the crashworthiness aspects of aircraft structures and interior furnishings, plus the fact that the larger bodies of the jumbo-jets are expected to absorb more of the crash forces than smaller airplanes; but offsetting this plus factor is the enormous increase in fuel capacity of the jumbos, and the added potential for catastrophic fires.

The outlook for the next few years is for a transport fleet in which wide-bodied transports will be a rapidly growing component. At the same time that more and more airliners will be wide-bodied jets, travel by air carrier aircraft will be growing. Domestic air carrier traffic is expected to reflect an average growth rate of 5.3 percent for the period 1976-1985.[1/]

The major commercial air transportation is oriented toward the nation's large urban centers. It was in response to urban orientation and expected increase in air transportation that the jumbo-jet came into being. Indeed, the McDonnell-Douglas DC-10 and the Lockheed L-1011

1/ CAB Economic Evaluation - Airline Equipment Needs and Financing Through 1985.

are often referred to as 'airbuses.' The wide-bodied jets, in other words, are mass transportation vehicles of the air. Like the conventional jets, however, the jumbo-jets make a good deal of noise, and, in most instances, they must have a long runway for landing and taking off. For these reasons, most airports into and out of which the wide-bodied aircraft operate are at locations remote from such urban facilities as hospitals, and other emergency oriented facilities.

Since there has been an increase in the load carrying capacity of aircraft such as the B-747, it is only reasonable to assume that the planning for the worst possible situations should be undertaken to prepare for a catastrophe such as the following:

Total occupants: (crew and passengers)	500
Fatalities: (impact)	125
Fatalities: (post-fire)	125
Injured: (requiring hospitalization)	125
Uninjured: (requiring guidance)	125

The care of 125 seriously injured survivors would probably exceed the hospitalization facilities of all but the largest cities. Although medical care of survivors is not a direct National Transportation Safety Board responsibility, it is appropriate that the Safety Board has taken a positive role in acting as a catalyst to alert all emergency oriented organizations to the implications of a major air disaster.

DISCUSSION

AIRCRAFT ACCIDENTS:

Every major accident in airline operation differs in time, location, and severity. With this assumption as a basic premise, we must understand that an accident manual cannot cover all situations or contingencies; consequently, the successful handling of a given accident will depend on the judgement, initiative, and prudence of those concerned, particularly during the first few hours.

In order to fulfill their role, the Safety Board investigation team must arrive at the scene of the accident with a minimum of delay, and be prepared to execute an orderly investigation which is well coordinated with local authorities. To minimize the possibility of on-scene conflict, the local authorities must be made aware of the Safety Board's statutory function and responsibilities.

The National Transportation Safety Board is a Federal agency created in 1967, and headed by five Members appointed by the President and confirmed by the Senate. The primary function of the Safety Board is to promote safety in transportation.

In civil aviation this means determining the cause of all accidents -- and recommending corrective actions whenever possible.

The Safety Board's headquarters office is in Washington, D.C., with 12 small field offices located throughout the country. The investigation of general aviation accidents is usually conducted by one or two technical personnel from the field office nearest to the

accident scene. For major air carrier disasters, the Safety Board maintains a 10-man Go-Team of aviation technicians in Washington -- on weekly rotational duty -- which flies immediately to the crash site of any fatal air carrier accident.

Prior to the arrival of a Safety Board team of investigators, the wreckage scene is temporarily guarded by local police authorities. However, once on the scene, the Safety Board assumes complete charge of the investigation -- access to the wreckage area is controlled by the Safety Board and identification credentials are issued from the Safety Board command post near the accident to all technical investigative personnel and visiting news media representatives. Even the wreckage becomes the property of the Safety Board until it is released back to the air carrier or the carrier's insurance company.

Also, in such cases, when the on-scene investigation is completed, the Safety Board convenes a public hearing in which all the evidence is presented as sworn testimony. Thereafter, a Safety Board report on the probable cause, including any possible corrective actions, is made public.

The Safety Board has no liability interests; it does not permit legal or insurance personnel to participate in its investigations -- or its hearings -- although it invites technical assistance from parties involved in the accident, such as the airline, the engine and airframe manufacturer, the Federal Aviation Administration, the Air Line Pilots Association, and others. Basically, the Safety Board

investigates to find the cause of the accident, and to initiate, on the basis of its findings, specific recommendations to prevent future accidents.

In the event of a major accident, two basic functions are set in motion. First, the initial field activity is generated. It consists essentially of notification, enlisting aid for preservation of life, securing the accident scene, and maintaining crowd control. Simultaneously, emergency centers, message centers, housing, and local transportation are established. Second, the accident team and investigative equipment are dispatched to the scene. Upon arrival, the accident investigation team supplants local field control and establishes functions of security, identification, communication, and investigation. As in all emergency teams or forces, a local team list with specific individuals and their alternates should be maintained. These individuals must be prepared to proceed to an accident scene immediately.

When an accident occurs, there is one thing that we can be positive about, that is the newsworthy aspects as far as the public is concerned. An announcement on the radio or television that an aircraft has crashed, or is in trouble similar to the B-747 takeoff accident at San Francisco International and subsequent lengthy period of circling before landing, may result in large numbers of people going, or trying to go, to the scene to witness the occurrence. In the past, this has resulted in traffic jams that deny passage of emergency vehicles, produced a heavier workload for police officers,

and endangered the general public. This type situation should always be kept in mind during any preparations or planning for emergency situations.

When an accident occurs, the most critical problem in disaster plan implementation is the handling of passengers and the alleviation of confusion. A catastrophic accident involving a jumbo-jet, with a passenger carrying capacity of 500, suggests an occurrence approaching--in potential, a natural disaster. The worst possible condition, in terms of required resources to cope with it, would be an accident involving a jumbo-jet in which half of the passengers survived with varying degrees of injury, and the other half perished due to impact forces or fire. Depending upon where such an accident occurred, the resources of a community, or even a large section of a State, could be overtaxed.

To execute a well-defined plan which includes crowd control, fire and rescue operations, on-scene medical aid and evacuation, wreckage investigation, and subsequent wreckage handling requires immediate action. Such an overall plan would require precise coordination and cooperation among all participating organizations. The Safety Board, as the most directly involved Federal agency, is prepared to execute its accident investigation functions in harmony with other civil authorities.

Since the action to be taken by the National Transportation Safety Board and civil authorities, as required to cope with an

aircraft accident, is essentially the same regardless of locale--the task is to handle these problems as efficiently as possible.

The accident investigator is concerned with determining the cause of an occurrence, and using this information to prevent similar accidents. The size of a jumbo-jet will create many problems during an investigation. When we consider the fact that a B-747 is twice the size of a B-707, with twice the area of wing and horizontal tail, and three times the area of the vertical tail, it is apparent that moving and handling the wreckage will become a monumental undertaking. Lifting equipment will of necessity be larger and more bulky than any used in the past.

Several years ago, a committee of Safety Board personnel was assigned the task of establishing contact with various civil authorities within the Washington, D.C., metropolitan area for the purpose of reviewing disaster programs. The review was organized into three phases: first, to determine the general organization of the community with respect to disaster planning; second, to help the local metropolitan authorities determine the adequacies of existing plans and facilities to cope with a catastrophic accident involving a jumbo-jet aircraft; and third, to promulgate the Safety Board's role in the face of an aviation accident disaster. The subsequent discussions with local authorities were so well received and, since the problems arising in the face of disaster are not unique to the local area, the committee expanded the project in an effort to determine the state of preparedness of other communities throughout the country. Although it

was impossible to contact all cognizant civil authorities, several major air terminal areas were reviewed. Since much help can be expected from the air carriers and aircraft manufacturers, these organizations were also contacted.

The survey indicated that all of the major airports have disaster plans to effect the handling of aircraft accidents. Most of these are sufficiently complete to cope with a jumbo-jet catastrophe, and others are in process of being updated to include this capability. In addition, all major air carriers and the airframe manufacturers have accident plans. Some of these are well detailed to the point of having preassigned personnel.

The investigative actions of NTSB personnel are well defined. However, it was found that actions required by a community during a major aircraft accident were not as clearly indicated. In an effort to aid authorities responsible for planning action to combat the problems associated with disasters, the Safety Board prepared a brochure "Civil Aircraft Accident Investigation Guidelines." This brochure has had wide distribution as a guide, and a basis to work from, during preparations of plans to cope with an accident.

Two aircraft accidents, in particular, bring to mind the difficult tasks confronting a community in the areas of fire fighting, occupant rescue, crowd control, and wreckage recovery.

The first example is most interesting in that it involved problems of recovery operations in a remote area. This tragedy took the lives of 104 passengers and seven crewmembers. The crash

occurred at the apex of a 2,400-foot steep ridge, and consequently the wreckage was strewn over an area of approximately 1,200 feet. Special equipment, including helicopters, slings, and nets, was necessary to recover the wreckage.

Three important lessons can be gained from an analysis of this recovery operation: the need for a clear disaster plan, available volunteer force, and communications equipment are all elements which are needed for a successful recovery operation.

At 12:08 p.m., the jet airliner reported inbound for a landing. Following this message, nothing except bleak silence was heard on the communications network. Six minutes later the tower queried air traffic control as to the location of the aircraft. Other than the query, the air traffic control did not know the location. Silence greeted repeated queries by the towermen as they sought to contact the missing aircraft.

The dispatcher at the public safety headquarters immediately invoked the department's aircraft disaster plan. All department officials were notified: the disaster office, the National Guard, the police department, the volunteer fire department, the U.S. Forest Service, the district attorney's office, the local hospital, and the medical community were alerted. All State Troopers in that area were put on call pending the result of the search for the missing aircraft. Three private helicopters and one Coast Guard helicopter were engaged to participate in the search.

The helicopter crews made a positive sighting of the wreckage 18.5 miles from the airport at 4:45 p.m. A State Police Sergeant was with the first men to arrive at the scene. He determined that none of the passengers was alive and advised the headquarters that the accident would be a recovery rather than a rescue. The slopes of the mountain in the area of the wreckage were too precipitous to land recovery helicopters, and the men had to use slings and nets for hoisting bodies, personal effects, and equipment from the aircraft.

Prior to the location of the wreckage, the State Troopers had called in an emergency medical technician, a trained and equipped disaster team, and equipment from the training academy. After the wreckage was sighted, additional troopers were flown to the area from their division headquarters and from other locations throughout the State. The Coast Guard assigned one of its cutters to the operation. The State disaster office contributed its services in coordinating activities throughout the State.

Four State Troopers and one member of the police department were placed on top of the ridge to guard the crash site. The need for tents and foul weather gear gave rise to calling local sporting goods stores to obtain various types of equipment. In one instance, an owner gave the police the key to his store and told them to take what they needed and mark the items down as they went along.

Winds of 50 knots swept the ridge, and rain and snow squalls made the night uncomfortable. Ponchos that had been hurriedly obtained

from the Army were ineffective in the high winds and closer fitting rain pants and jackets were eventually obtained to replace them. Team leaders found that 2 days on the ridge was about all a man could take without getting a hot meal and a change of clothes to dry out. The difficulty of camping on the ridge made it necessary to establish a base camp in a more suitable location.

Since a large number of bears had been seen in the vicinity of the wreckage, a number of men wore sidearms and carried high-powered rifles. In one instance, a helicopter was used to scare a bear out of the area.

The State Troopers coordinated initially all activities at the crash site. They organized recovery teams, named team leaders, and equipped them with portable radios. In some areas the slopes were so steep that mountain climbers were called in to string ropes to enable recovery and investigative teams to have access to all parts of the zones blocked off by the crews. The team leaders were told to impress upon their crews that nothing should be moved until authorized.

In the meantime, fixed-wing aircraft were employed to carry supplies to the base camp for relay to the crash site. A supply depot was set up and administered for this purpose by the fire department at the airport.

Two National Guard cooks were dispatched to provide hot meals at the base camp, and relays of men were sent to the mountain camp to relieve those men who were on the ridge for more than 48 hours.

In a couple of instances, the helicopter could not reach the camp because of weather for more than a day.

Security was maintained from the beginning to protect the accident site and the bodies of the crash victims from marauding wild animals.

In summary, many aspects of this accident were different when compared to air accidents in more populated areas. Besides the problem of locating the crash site, the teams overcame numerous other difficulties. These included: transporting recovery parties where there was no road, over 15 miles of water and 5 miles of rugged mountains to traverse before reaching the site; establishing base camps for recovery teams; supplying the men working at the crash site in precipitous terrain; locating and recovering bodies from sheer cliffs and canyons, and transporting the victims from the accident area.

The need for a disaster plan is readily evident. By using a plan which had been previously drawn up, the department of public safety conducted the search and recovery operation with a minimum of confusion.

Communications are of paramount importance. Radio contact should be readily available between headquarters, search personnel, and rescue and recovery crews at the scene. Portable communication equipment is an absolute necessity.

Camping equipment and supplies should be stored in a strategic location and be available immediately to support at least a 5-man team.

A list of business establishments and their owner's telephone numbers, both at home and at work, should be maintained for use in obtaining additional supplies during emergencies.

Primary consideration should be given to establishing and improving liaison between the Department of Public Safety and other units likely to participate in disaster operations. These include military and disaster units, local police and fire departments, hospitals, search and rescue organizations, fingerprint experts, dentists and doctors, coroners and morticians, and the district attorney's office.

Assignments of duty is an important factor in a disaster situation. There will always be personnel on leave, ill, in transit, and various other reasons for being unavailable. The assignment of "back-up" men becomes all important.

The second example is interesting in that the accident occurred near an airport. This accident turned out to be the worst aircraft crash in the State's history.

The aircraft had been making an approach to the airport during low visibility conditions. About the time of the crash, the visibility at the airport control tower was reported to be 1 3/4 miles, with partial sky obscuration. Observers on the beach nearby stated that a thick fog hung over the water. They could see only 50 to 60 feet vertically; horizontal visibility was estimated at 200 feet. The flight was approaching the airport over the water from the south in what appeared to be a normal pattern.

The control tower had cleared the flight to land. Shortly after his radio contact, one of the men in the tower noticed a flash of light to the south near the beach. The tower operator tried to contact the aircraft by radio. When he could not establish contact with the aircraft, he notified the fire department by means of a direct telephone line to the dispatcher. He reported an aircraft crash at the end of the runway near the water.

The city fire fighting apparatus stationed near the field responded to the airport property through an emergency gate. However, as they approached the end of the runway they noticed a column of black smoke about one mile south. The officer in charge radioed the dispatcher indicating the location of the crash and requested authority to enter the town area. The authority was granted and the apparatus promptly responded to the scene.

The first piece of fire apparatus, arriving approximately three minutes after notification, came from the nearby town. About 50 feet inland the fire fighter found three 2½-story wood-frame summer residences and about 220 feet farther inland a 100-foot-long wood-frame beach house, all beginning to burn. They had no information as to the size or type of aircraft that had crashed, or its location. Where they stopped, the burning beach blocked their view of the wreckage. As additional apparatus was responding to the other side of the fire area, the first company attacked immediately the fire before them.

One piece of apparatus responding from the town headquarters station, 2.5 miles from the crash site, arrived approximately five

minutes after notification. The aircraft was then smoking heavily, but no significant amount of fire was showing. While the fire fighters were knocking down some fencing around tennis courts near the crash so that they could reach the wreckage, a minor explosion occurred. Before they could set up hand lines, another explosion severely shook the wreckage. Fire was then visible throughout the major portion of the wreckage. The fire fighters covered the wreckage with foam and applied water spray to cool the hot spots and the surrounding smaller fires. The fire in the wreckage was relatively easy to extinguish and was quickly put out. However, additional time was required to cool the debris. Twenty-eight of the 31 persons on board died as a result of the crash and fire.

No fire fighting equipment was stationed at this airport. Apparatus from the city fire station located about 200 yards from the field has access through an electrically controlled gate. The city provides a small foam truck and a pumper in that station. Because of the growth of activity at the airport, the city bought a special fire fighting vehicle for use on the field. This unit was to replace the small foam truck and carried facilities for a combined fire attack. The vehicle had been delivered, but at the time of the crash was not in service.

We have been discussing air crashes in remote areas and near airports, but the airport is as critical to the passenger in air transportation as is the aircraft, and cannot be overlooked during any preparation of plans to combat an emergency or disaster. These

preparations should be concerned with the airport population as well as passengers aboard the aircraft. Traditionally, in the United States, air transport aircraft are certificated by the FAA, but the airports were not until recently. The FAA issued FAR 139 which brings the airports under the regulatory sphere of the FAA. The airport terminal has by tradition been a local or private responsibility. Because of the rather distant location of many large airports with respect to urban centers, certain medical emergencies on the airport premises can lead to difficulties in acquiring timely professional attention. The nonpassenger and full-time employees at U.S. airports are increasing steadily. For example, Chicago O'Hare Airport forecasts 40 million passengers per year by 1973 with 55 million nonpassengers. On the other hand, Los Angeles International Airport plans for a marked decrease in nonpassengers as compared to passengers for 1973, the passenger figure being 56 million and the nonpassenger figure being one million.1/ It is interesting to note that the Aviation Daily of February 14, 1978, listed certain airport traffic for November 1977 in which O'Hare listed 3,476,556 for that month. This total is in line with the growth forecast of 1971.

These figures support the view that each airport is a unique facility with respect to its passenger and nonpassenger population. This will be one of the considerations involved in developing airport terminal human factors features and medical services during preparation of emergency plans.

1/ Aerospace Medicine, Volume 42, Number 4, April, 1971

An opinion commonly held is that an aircraft accident leaves very few survivors. However, conditions during an accident on an airport do not lead necessarily to the destruction of the aircraft. For example, during the period 1968-1972, the NTSB accident-incident report shows that air carriers alone experienced a total of 140 accidents on airports. Seventeen of these accidents were classified as fatal. There were 115 fatalities, 174 serious injuries, and 387 minor injuries. The 140 accidents involved a total of 7,682 passengers. This trend has continued. During the period 1973-1976, there were 73 accidents recorded, in which 6 were listed as fatal. There were 225 fatalities, 194 serious injuries, and 328 minor injuries. The 73 accidents involved a total of 5,126 passengers.

Airport accidents may result in large numbers of injured persons, and rational organization for their treatment should be developed. Because an accident may take place within an airport area, and to prepare for the increased complexity of managing the wide-bodied aircraft accident problems, the major airports and airline operators are developing procedures, techniques, and supplemental equipment so that crash rescue and recovery problems do not exceed the capabilities of crash and rescue service.

In view of the possible increased number of injuries, the question of alternative medical assistance is of utmost importance, and should be considered. An alternate method appears to be vital, because the medical help required to meet the needs of the number of persons sustaining serious injury resulting from an accident involving one

or more wide-bodied aircraft, or the stretched versions of large turbo-jets may not be available within reasonable time. In an attempt to resolve this problem, the airport authorities should study the feasibility of bringing portable surgical and first aid units with emergency electrical power source onto the field. An inflatable structure that would house the surgical apparatus necessary to handle serious injuries may be an acceptable method. The transportation of surgeons, physicians, and medical staff to the site may be more feasible, in some instances such as areas of heavy traffic congestion, than moving a number of survivors to the hospitals immediately.

Every airport has the potential to be the site of an air tragedy. Today for a major airport this could result in more than a hundred persons having various degrees of injury and, in some cases, more than two hundred, including persons on the ground. The provision of expeditious first aid and acute emergency medical care is a significant factor in many of these cases with respect to the well-being of survivors, both passenger and nonpassenger. The introduction of wide-bodied jets, which provide for a considerably greater structural absorption of crash forces, may increase the proportion of survivors in accidents on and around airports. Many of these will have varying degrees of injuries and, thus, the airport medical capabilities and emergency planning assume increasing significance. It becomes more apparent that an airport disaster plan must be developed, integrated with all elements of the airport and surrounding community which

will be concerned, and updated annually, or as required by changing circumstances.

It has been a pleasure for me to bring these thoughts and situations to your attention and I hope that they will be beneficial to you in preparing any plan aimed toward alleviating conditions surrounding a disaster. Personnel from the Safety Board are constantly alert for ways to assist in any program to enhance safety. I am sure that these discussions will bring out ideas that will enable us to carry out our mission with increased efficiency and effectiveness.

James T. Childs