

Impact of Environmental Factors on Aviation Safety

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Abstract

Air Transport is continuously growing to satisfy the needs of modern civilization. It is very important to reduce the rate of accident by setting new ambitious safety targets, by improving the knowledge of cause of accidents and better understanding of effects of new technologies and procedures (Graaff, 2000). There are various important significant factors that have greater impact on aviation safety. This paper explains the impact of environmental factors on aviation safety. Environmental factors induce rough flight, causes severe discomfort, even injury to the passengers, influence the reputation and economy of the country. These factors create difficulty for pilot's to take decision. These factors increase the probability of other factors to come into play and increase the probability of accident to occur which leads to occurrence of a severe flight failure. Factors such as volcanic ash and earthquake can destroy airport, aircraft facilities and aviation.

Keywords: Safety; accident; Environmental factors.

1. Introduction

Aviation is a critical part of our national economy, providing for the movement of people and goods throughout the world and enabling our economic growth (Waitz et.al, 2004). The volume of air transportation is increasing rapidly; the safety of aviation becomes an important problem over many countries. Accident of an aircraft leads to human injury or even loss of human life, it also influence the reputation and the economy of air transportation industry of the country (McFadden and Hosmane, 2001). Aircraft operate in such environment which contributes to aviation unsafety. Environmental factors are major cause of aviation accident and incident. To reduce the

rate of accident researchers are addressing problem from various perspectives including improving meteorological forecasting techniques, collecting additional weather data automatically via on-board sensors and flight modems, and improving weather data dissemination (often available only in the textual format) and visualization techniques (Spirkovska and Lodha, 2002). Environmental factors considered as all factors related to weather, factors related to atmospheric conditions, factors related to geographical and metrological conditions, factors related to the natural calamities, factors related to the altitude and other factors such as laser light, cosmic radiation etc.all these factors deterioratethe performance of an aircraft and responsible for accident or incident to takes place.To fly in this challenging environment pilot requires a great deal of concentration, experience and information.It is very important to identify and clarify the circumstances and the causes of aircraft accident which occur due to environmental factors that will help to avoid such types of similar accident to occur in future.The paper is organized in the following way; first a brief introduction is given, second all the environmental factors responsible for flight failure are addressed and their impact on aviation safety is explained at last conclusion is given.

2. Effect of Environmental Factors on Aviation Safety

2.1 Effect of weather on aircraft flight

Weather is one of the major cause and explicit factor of aviation accidents and incidents.Aviation is highly weather dependent.Weather factor contribute to accident to occur and enhance the probability and effects of other factors such as heavy weather and poor visibility may increase the possibility of pilot errors and collision with terrain or with other aircraft. Weather-induced rough flights, capable of causing serious discomfort and even injury are a matter of common experience by many passengers (Mahapatra and Zrnic, 1991). In unsuitable weather conditions it is very difficult for a pilot to take decision. Weather phenomenon may also increase the delay of flight.

2.2 Effect of atmospheric conditions on aircraft flight

There are various significant atmospheric factors that have serious air disasters as well as frequent flight schedule disruptions. The major atmospheric hazards are thunderstorms, lightning, hail, icing, wind shear, heavy precipitation, heavy rain, low cloud etc. The cause of large number of accident and incident is thunderstorm. Thunderstorms are dynamic phenomena with well-defined life cycles that are initiated in environments where a deep unstable atmospheric layer exists from the ground upward (Battan, 1961;Magono, 1980). Hail is more hazardous for aircraft engines and structures because it is solid nature and high water content and in extreme case it cause engine to flame out (Guégan et.al, 2011).Kulesa stated that icing is very dangerous during flight because structural icing on wings and control surfaces increases aircraft weight, degrades lift, generates false instrument readings, and compromises control of the aircraft. The presence of ice and snow on the runway reduces the available tire-pavement friction needed for retardation and directional control of aircraft (Pasteet.al,

2012). Rain causes visibility problems and one of the major problems of heavy rain is the combustion of aircraft engines. Wind shear defined as spatial as well as temporal rates of variation of wind speed and/or direction. Wind shear causes rough flights, problem in controlling the aircraft sometimes irrecoverable loss of control lead to an accident.

2.3 Effect of Meteorological and Geographical factors on aircraft flight

It is very difficult and costly for an aircraft to operate on plateaus which have low pressure, complex climate and rough topography (Shanhua and Xueqing, 2007). Weather change in mountains is very quickly. Flight conditions in mountains will be better in the morning and in afternoon more cloud can build-up and stronger winds. It is very important for pilot to understand the major airflow patterns while flying at mountainous areas. During pre-flight planning charts should be carefully read by the pilot's to know the steepness of glaciers and mountainsides. The accident of aircraft also involve due to collision with terrain i.e. hills or mountains. For the prevention of CFIT (controlled flight into terrain) accidents crew position awareness and monitoring of navigational systems are very essential.

2.4 Effect of natural calamities on aircraft flight

Natural disasters have bad impact on aircraft flights and airport infrastructure. Volcanic eruptions and earthquake are natural calamities that affect the airplanes. Earthquakes are the most destructive disasters for airports, aviation facilities. They can cause more injuries to people and damage to the structures (Smith, 2011). Volcano injects large amounts of very small rock fragments known as volcanic ash. Volcanic ash is an aviation safety hazard. Volcanic ash is composed of a mixture of sharp, angular fragments of rapidly quenched volcanic glass, as well as mineral and rock fragments that range in size from fine powder to fragments up to an eighth of an inch in diameter (Casadevall, 1993). The ash is very hard and small in size it can scratch and damage airplane body parts (cockpit and forward cabin windows, landing light covers, leading edges of wings and tail rudder, engine cowlings, and the radar nose cone), engine parts and injection of ash cause serious deterioration of engine performance or even engine failure at a very extreme conditions It can also damage aircraft electronic system.

2.5 Effect of Altitude on aircraft flight

The aerodynamic performance is correlated with the altitude. The air density increases at lower altitude, decrease in altitude increases the aircraft performance and air density decreases at higher altitude, increase in altitude decrease the aircraft performance, hence density of air and altitude have profound effect on engine and aircraft performance. Aircraft require long runways to take off at higher elevation airports because the rate of climb of aircraft is lesser than its approach and true air speed is higher than the indicated air speed as a result landing roll will be longer. As aircraft move towards the higher altitude temperature as well as air density decreases.

Atmospheric temperature also affects the aircraft performance. Aircraft will require long runway to take off, poor rate of climb and faster approach when temperature of atmosphere is very high as a result landing roll will be longer. When high temperature and high elevation combines a situation arises that aerodynamically reduces the performance of the airplane. Sometimes humidity also became a factor that deteriorates the performance of aircraft. Humidity refers to the maximum amount of water content in the atmosphere. When humidity is higher water content in atmosphere will more that will affect the engine power which leads to loss of aircraft performance. Hence, all these factors decrease the efficiency of the aircraft.

3. Conclusion

Environmental factors have greater impact on aviation safety. Because of these factors several flights failure happened in the past. Weather has a greater impact on aviation safety. Factors related to weather enhance the probability of occurrence of other factors to come into play such as mechanical failure problem, pilot error etc. arises due to poor weather conditions and increment in the probability of severe accident and incident. Factors related to atmospheric conditions have greater negative impact to influence the performance of flight. Factors related to meteorological and geographical are also dangerous for aircraft flight performance, to reduce their effect awareness of pilot should be enhanced. Factors related to natural calamities (volcanic ash, earthquake) destroy airport, aircraft facilities and aviation. Temperature and air density are related to altitude and the performance of aircraft is greatly associated with change in altitude. It is very necessary for all over the countries to reduce the rate of flight failure because it cause severe injuries to passengers, cargos and at a very severe accident they even loss their life and failure or damage of aircraft components as well. The cost of aircraft accident is also very high. To reduce the overall rate of aircraft accidents, those accidents which occur due to environmental factors should be minimized. New and advanced technical and operational options will be developed to reduce the environmental factor impacts on aviation safety.

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