

Abstract of

A Study on the Prevention of Aircraft Encounter with Volcanic Ash in Proximity Area between Airways and Active Volcano

Saburo ONODERA

In this study aircraft volcanic ash encounter problems are discussed.

Firstly, a DC-10 aircraft encounter case with volcanic ash of Unzen Volcano, Japan, on 27 June 1991 was reviewed. This case was listed in the appendix to the “Manual on Volcanic Ash, Radioactive material, and Toxic Chemical Clouds” first issued in 2001 by ICAO (International Civil Aviation organization). Due to the 10 years that have elapsed since the date of the encounter, it was not possible for the author to access more concrete aeronautical data than what had been shown in the table in the ICAO document. Instead, the author collected volcanological and meteorological data, and found that such large scale volcanic surface activities as lifting volcanic ash up to 37000ft (11300m) had not taken place on the day. DC-10 aircraft performance data, along with available environmental data, were all inconsistent with an encounter at high altitude, FL370. None of the reported items at the encounter aircraft was an exclusive one to a volcanic ash encounter, but all of them were common to “high altitude ice crystal icing” in the vicinity of cumulonimbus clouds, which was just starting to be reported from the 1990s (Mason, 2007). The atmospheric conditions on 27 June 1991 in western Japan were suitable for spawning cumulonimbus clouds that would have been favourable for the occurrence of this phenomenon. Although lacking sufficient direct aeronautical data and aircraft data, the most probable cause of engine failure is thought to be “Ice Crystal Icing” at high altitude. It is not thought to be a volcanic ash encounter.

Secondly, the B747 and B737 volcanic ash encounter cases on 18 Aug. 2000 at

Miyakejima Volcano, Japan, were reviewed. The cases were researched by scrutinising a newly found in-house document of ATC (Air Traffic Control), in addition to the basic data from the past. The results on the encounters were as follows. A minor error in the upper wind forecast had a significant impact on the volcanic ash avoidance plan by ATC, which also had to deal with the restricted conditions of a prohibited area at the time due to military airspace. Volcanic ash encounters took place for the last two aircraft in a chain of 7 inbound aircraft on the same radar vectoring course bound for Narita Airport. ATC did not have concrete information on the whole shape of the area of volcanic ash contamination, which made proper decision making difficult for them. The explosive volcanic eruption on this day was sudden to everybody, including volcanologists at the field site. Nobody in the airline industry could take special countermeasures in advance against the sudden eruption in this evening.

Embedded documents, which were created by pilots, Met Office and flight operations staff at the time of the eruption on December 1989, at Redoubt Volcano, Alaska, were researched. These documents provided lessons learned from the perspective of mitigation of volcanic ash hazards, e.g., making the best use of skills or knowledge of respective persons for prevention of volcanic ash encounter. Photographs of a volcanic eruption column in the growing stage taken by a pilot during flight and sketches of the airborne weather radar screen recorded by the same pilot provided valuable resources for the prevention of volcanic ash encounter in future eruptions.

Common factors which were observed at the 1986 Izu-Oshima Volcano eruption, the 1991 Pinatubo Volcano eruption, and the 2000 Miyakejima Volcano eruption that had previously not been reviewed were extracted. The countermeasures against the above issues should be considered in order to prevent the reoccurrence of volcanic ash encounters in a similar area and in the proximity between volcano and airways.

Finally, the weaknesses in this country regarding the prevention of volcanic ash encounter are discussed. The field of technology and research is thought to be excellent, however, the application of these fields for aviation purposes, especially for mitigation of volcanic

ash hazards, seems to be insufficient. Drills are not frequent for aircraft volcanic ash encounter. A new comprehensive approach should be applied to the proximity area between the active volcano and airways in order to prevent the reoccurrence of encounters with similar patterns and conditions.