



## **Volcanic Ash –Aircraft Encounter Damages: in Volcanological Point of View**

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The jet era or age began at 1930 and 40's in aviation sector, with the production of first jet engine for the aircrafts. Since 1950's, the commercial aviation with regular flights were established. Civil aviation and air-transport drastically increased due to intensive demand, and declared at least 10 fold since 1970 by IATA report. Parallely to technological and economical developpement, the commercial jets became more comfortable, secure and rapid, bringing the world smaller, the countries closer. On the other hand, according to Global Volcanism Program Catalogues of Smithsonian Institute, about 1,500 volcanoes have erupted in the Holocene, 550 of them have had historical eruptions and considered as active. Besides an average of 55-60 volcanoes erupt each year, and about 8-10 of these eruptions produce ash clouds that reach aircraft flight altitudes (Salinas and Watt, 2004). Volcanic ash can be expected to be in air routes at altitudes greater than 9 km (30,000 ft) for roughly 20 days per year worldwide (Miller & Casadeval, 2000). A precious compilation of incidents due to encounters of aircrafts with volcanic ash clouds covering the years between 1953 and 2009 was used in this work (Guffanti et al., 2010-USGS Report) with an additional information on Eyfjallajökull-2010 eruption. According to this compilation, 129 incidents happened within the concerned time interval. The damages, in general, fall in second and third class of Severity index, indicating the damages are limited on airframe of the planes, or some abrasions in jet engine, windblast etc.. We focused on fourth class of severity index involving the damages on jet engine of aircraft (engine fail) due to ingestion of volcanic ash and investigate eruption style and caused damage relationships. During the eruptive sequences of Mts Saint Helen (USA), Galunggung (Indonesia, 2 incidents), Redoubt (USA), Pinatubo (Philippines), Unzen (Japan), Manam (Papua New Guinea), Soufriere Hills (Lesser Antilles), Chaiten (Chilie), Eyfjallajökull (Iceland). The common point of all those eruptions is that all eruption clouds had the external water input. This input was as phreatomagmatic style eruption, ice plugged-vent clearing-vulcanian, heavy rain fall on eruption cloud or on eruptive vent, typhoon, ice grain in eruptive cloud, etc. We will show water input, case by case, to those eruptions belonging to severity index 4. Besides, we will also present other damages created by volcanic ash-aircraft encounters basing on their eruption styles as a result of advanced statistical methods.  
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