The Protection of Aircraft by orbital Surveillance of Volcanoes: A Review

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Over the last ten years or so there has been increasingly heightened attention and anxiety directed toward the hazard presented to turbine-engined transport aircraft from the en-route penetration of airborne clouds of volcanic ash, "l'he nature of the hazard has been demonstrated to be primarily from (1) ingestion of silicate particulate into the combustion and cooling chambers of operating engines in-flight, and (2) the impact abrasion of windscreen surfaces so as to drastically reduce transparency, The ingestion of volcanic ash generally results in a range of internal damage modes, including abrasion, overheat i ng, and interference with the f uel injection and combustion processes, all of which represent extreme danger to the aircraft flight regime. The prompt loss of pilots' forward visibility after entering a volcanic ash cloud presents an additional extreme hazard, later on final approach to landing. Over the last 15 years, three B747 type aircraft have experienced all-engine, flameouts due to volcanic ash ingestion, and major tragedies have narrowly been averted due to surpassing, piloting skill and luck.

Given this extreme. hazard, a high degree of interest has focused on schemes to detect and track volcanic ash clouds at the operating altitudes of aircraft. international civil aviation groups have set a goal of providing an in-cockpit warning to en-route aircraft of a potential volcanic ash threat within 30 minutes after an eruption. While various ground and airborne in-situ monitoring approaches, and satellite monitoring from low-earth orbit, may potentially provide occasional detection and notification of an eruption within the desired 30 minute window, only continuous observation of volcanoes from geostationary or quasi-geostationary earth orbits can potentially provide *assured detection, notification, and tracking* of volcanic plumes within the required 30 minutes. Approaches to providing such continuous coverage hemispherically and globally will be reviewed, and current instrument and mission design studies underway at JPL will be discussed. (Work presented here was carried out under contract to NASA at the Jet Propulsion l laboratory.)

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