International Civil Aviation Organization





WORKING PAPER

INTERNATIONAL VOLCANIC ASH TASK FORCE (IVATF)

FIRST MEETING

Montréal, 27 to 30 July 2010

Agenda Item 5: Development of ash concentration thresholds (AIR sub-group)

- **5.1:** Development of acceptable level(s) of ash concentration for safe aircraft operations in airspace contaminated by volcanic ash
- 5.2: Establishment of regulatory provisions

ASH CONCENTRATION THRESHOLDS: BACKGROUND AND FUTURE ACTION

(Presented by the Secretariat)

SUMMARY

This working paper provides an overview related to the efforts made to establish the threshold that constitutes an acceptable level of volcanic ash (VA) concentration for safe aircraft operations in contaminated airspace. It also suggests future action to accelerate research and development work in this key area.

1. **INTRODUCTION**

1.1 The purpose of this working paper is two-fold:

- a) to provide an overview of the efforts over the past 20 years to establish an acceptable level of ash concentration for safe aircraft operations in airspace contaminated by volcanic ash (VA); and
- b) to suggest future action to be led by the airworthiness (AIR) sub-group to accelerate developments that would lead to the establishment of a threshold for acceptable level of VA for safe aircraft operations.

2. DEVELOPMENT OF ACCEPTABLE LEVEL(S) OF ASH CONCENTRATION FOR SAFE AIRCRAFT OPERATIONS IN AIRSPACE CONTAMINATED BY VOLCANIC ASH

2.1 The Task Force (TF) will appreciate that since the establishment of the International Airways Volcano Watch (IAVW) by ICAO in 1987, one of the main challenges that has impacted the effectiveness of the IAVW has been the lack of a definition of acceptable levels of volcanic ash concentration for safe aircraft operations in contaminated airspace. Such a threshold would be necessary in order to increase safety, optimize re-routings of aircraft and to minimize aircraft exposure to non-visible ash which would reduce long term maintenance.

2.2 As early as at the First Symposium on Volcanic Ash and Aviation Safety, (held in Seattle, Washington, United States, 1991), the importance of the issue was recognized: "The ash particle size distribution and concentration in volcanic eruption clouds should be documented [...]. In addition engine and (or) combustor tests should be sponsored [....] to establish threshold values for "safe" levels of ash concentration and the "safe" range of combustor temperature (*Proceedings of the Symposium* refers).

2.3 The TF will note that, over the years the efforts by appropriate ICAO bodies continued to establish such an ash concentration level; however, little progress was made. During the First Meeting of the International Airways Volcano Watch Operations Group (IAVWOPSG/1) in 2003 it was recognised that there were still uncertainties regarding the delineation of acceptable concentrations compared to concentrations known to impact on aircraft operations in terms of safety and maintenance; in the absence of such a threshold, the volcanic ash advisories centres (VAACs) continued to be tasked (Annex 3 — *Meteorological Service for International Air Navigation*, 3.5 refers) to:

- a) monitor relevant geostationary and polar-orbiting satellite data to detect the existence and extent of volcanic ash in the atmosphere in the area concerned;
- b) activate the volcanic ash numerical trajectory/dispersion model in order to forecast the movement of any ash "cloud" which has been detected or reported; and
- c) issue advisory information regarding the extent and forecast movement of the volcanic ash "cloud".

2.4 The above provisions are still applicable. The group will note that, in absence of agreed values of ash concentration which constitute a hazard to jet aircraft engines, Paragraph 3.5 refers to any ash cloud, irrespective of its concentration; the lack of information related to the ash concentration in volcanic ash advisories means that *de facto* any volcanic ash cloud is to be avoided.

2.5 In view of the importance of this issue and lack of progress made so far, the IAVWOPSG/4 Meeting (2008) re-considered the issue and formulated Conclusion 4/24 calling for

- a) the World Meteorological Organization (WMO) to further explore how to measure the concentration of volcanic ash from a scientific viewpoint; and
- b) the International Air Transport Association (IATA) and International Federation of Air Line Pilots' Associations (IFALPA) to explore the issues related to "safe'

concentration of volcanic ash from an industry viewpoint, including the possibility to invite the manufacturers to IAVWOPSG meetings.

2.6 The TF will be disappointed to note that no progress had been made by the time of the IAVWOPSG/5 Meeting (Lima, Peru, 15 to 19 April 2010). The IAVWOPSG noted the efforts by IATA to involve the industry (airframe and engine manufacturers); however, these efforts had not been successful, to the disappointment to the group.

2.7 However, at the ensuing 5th International Workshop on Volcanic Ash (Santiago, Chile, 22 to 26 April 2010), the attendance by an industry representative from Airbus was noted with satisfaction; he was tasked to contact its engine manufacturers to find out if they would be in a position to establish the safe particle size and concentration of ash that would be sustainable to aircraft engines. It was agreed that Airbus would report the results of this study to IATA who in turn would keep the IAVWOPSG informed.

2.8 In conclusion, the TF may wish to concur that whilst the issue of the safe level of ash concentration has been part of the IAVW since its establishment, little progress has been made over the last 20 years in resolving the issue.

3. ESTABLISHMENT OF REGULATORY PROVISIONS

3.1 The TF will realize that the very first steps towards resolving the long-standing issue of safe ash concentrations mentioned in 2.7 above were taken by the industry (in particular, the engine manufacturers) at the time when aircraft operations were facing a major disruption in the EUR/NAT Regions: the explosive phase of the Eyjafjallajokull eruption in April 2010 had provoked an unprecedented disruption of air operations, which paralyzed aircraft operations in the western and northern parts of the EUR and eastern parts of the NAT Regions for many days. In order to resume operations and to allow aircraft operations in airspace contaminated by volcanic ash under these exceptional circumstances, the airframe and engine manufacturers, aviation safety regulators, operators, meteorological authorities and research communities in Europe held extensive discussions. Based on the information available, they reached a consensus to permit operations in areas of volcanic ash with densities predicted of up to 2 x 10 -3 g/m³, subject to appropriate precautionary maintenance being applied. Further refinement of this threshold was done as the crisis progressed. They are reflected in the EUR/NAT Contingency Plans endorsed by the European Air Navigation Planning Group (EANPG) and North Atlantic Systems Planning Group (NAT/SPG), respectively.

3.2 The TF may wish to agree that the action taken by the EANPG and NAT/SPG is the very first initiative to establish acceptable ash thresholds. However, it may be agreed that for global application it would be necessary to undertake a thorough assessment study by appropriate experts and organizations to validate the proposed thresholds. The global establishment of such limits, supported by scientific evidence, would allow making a breakthrough in one of the most important outstanding issues since the establishment of the IAVW; if validated, these thresholds would provide important tools to improve the efficiency of contingency planning.

3.3 In the light of the foregoing, the TF may wish to task the AIR Sub-group to work on the establishment of safe ash concentration levels for aircraft operation in airspace contaminated by volcanic ash taking into account the early results contained in the EUR/NAT VA contingency plans. It is understood that this work will require substantial efforts and may not be completed in a short time.

Nevertheless, it may be expected that initial results can be reported in one year's time, i.e. 2011 at the IVATF/2 Meeting. In this regard, the TF is invited to formulated the following "Action Agreed":

Action Agreed 1/... — Threshold for acceptable ash concentration

That, the AIR sub-group be tasked to:

- a) validate and refine, as necessary, the acceptable levels of ash concentration for safe aircraft operation in contaminated airspace developed by the EUR/NAT VATF and contained in the EUR/NAT VA Contingency Plans; and
- b) present a progress report at the IVATF/2 Meeting.

4. **ACTION BY THE IVATE**

- 4.1 The IVATF is invited to:
 - a) note the information in this working paper; and
 - b) endorse the draft "Action agreed" contained therein.

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