



**NOTICE OF PROPOSED AMENDMENT (NPA) No 2011-17**

**DRAFT DECISION OF THE EXECUTIVE DIRECTOR OF THE EUROPEAN AVIATION SAFETY AGENCY**

**amending Decision No 2003/14/RM of the Executive Director of the European Aviation Safety Agency of 14 November 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for normal, utility, aerobatic and commuter category aeroplanes (« CS-23 »)**

**and**

**amending Decision No 2003/02/RM of the Executive Director of the European Aviation Safety Agency of 17 October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for large aeroplanes (« CS-25 »)**

**and**

**amending Decision No 2003/15/RM of the Executive Director of the European Aviation Safety Agency of 14 November 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for small rotorcraft (« CS-27 »)**

**and**

**amending Decision No 2003/16/RM of the Executive Director of the European Aviation Safety Agency of 14 November 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for large rotorcraft (« CS-29 »)**

**and**

**amending Decision No 2003/09/RM of the Executive Director of the European Aviation Safety Agency of 24 October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for engines (« CS-E »)**

**and**

**amending Decision No 2003/07/RM of the Executive Director of the European Aviation Safety Agency of 24 October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for propellers (« CS-P »)**

**and**

**amending Decision No 2003/05/RM of the Executive Director of the European Aviation Safety Agency of 17 October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for auxiliary power units (« CS-APU »)**

**'Volcanic Ash'**

## EXECUTIVE SUMMARY

1. The eruption of the Eyafjallajokull volcano in Iceland in April 2010 severely affected air traffic in Europe and globally. As a response to this event, ICAO created the International Volcanic Ash Task Force (IVATF) in July 2010 in order to assess the global aviation needs in relation to volcanic events.
2. One of the sub-groups of the IVATF (AIR04) has developed a proposal to States for a globally applicable process to facilitate operations into, or avoidance of, areas known or forecast to contain volcanic clouds. The approach is based on a safety risk assessment that must be performed by the operator and accepted by the State of the Operator.
3. The Agency supports the approach adopted within the AIR04 proposal and this NPA intends to aid its application by mandating the supply of relevant information from manufacturers to support operators in developing their safety risk assessment.

## TABLE OF CONTENTS

<b>A.</b>	<b>EXPLANATORY NOTE</b> .....	<b>4</b>
	I. GENERAL .....	4
	II. CONSULTATION .....	5
	III. COMMENT RESPONSE DOCUMENT .....	5
	IV. CONTENT OF THE DRAFT DECISION .....	5
	V. REGULATORY IMPACT ASSESSMENT .....	7
<b>B.</b>	<b>DRAFT DECISIONS</b> .....	<b>12</b>
	I. DRAFT DECISION CS-23 .....	12
	II. DRAFT DECISION CS-25 .....	13
	III. DRAFT DECISION CS-27 .....	15
	IV. DRAFT DECISION CS-29 .....	17
	V. DRAFT DECISION CS-E .....	18
	VI. DRAFT DECISION CS-P .....	19
	VII. DRAFT DECISION CS-APU .....	20

## A. Explanatory Note

### I. General

1. The purpose of this Notice of Proposed Amendment (NPA) is to envisage amending Decision 2003/14/RM of the Executive Director of 14 November 2003<sup>1</sup>, Decision 2003/02/RM of the Executive Director of 17 October 2003<sup>2</sup>, Decision 2003/15/RM of the Executive Director of 14 November 2003<sup>3</sup>, Decision 2003/16/RM of the Executive Director of 14 November 2003<sup>4</sup>, Decision 2003/09/RM of the Executive Director of 24 October 2003<sup>5</sup>, Decision 2003/07/RM of the Executive Director of 24 October 2003<sup>6</sup>, Decision 2003/05/RM of the Executive Director of 17 October 2003<sup>7</sup>.
2. The European Aviation Safety Agency (hereinafter referred to as the 'Agency') is directly involved in the rule-shaping process. It assists the Commission in its executive tasks by preparing draft regulations, and amendments thereof, for the implementation of the Basic Regulation<sup>8</sup> which are adopted as 'Opinions' (Article 19(1)). It also adopts Certification Specifications, including Airworthiness Codes and Acceptable Means of Compliance and Guidance Material to be used in the certification process (Article 19(2)).
3. When developing rules, the Agency is bound to follow a structured process as required by Article 52(1) of the Basic Regulation. Such process has been adopted by the Agency's Management Board and is referred to as 'The Rulemaking Procedure'<sup>9</sup>.

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<sup>1</sup> Decision No 2003/14/RM of the Executive Director of the Agency of 14 November 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for normal, utility, aerobatic and commuter category aeroplanes (« CS-23 »). Decision as last amended by Decision 2010/008/R of the Executive Director of the Agency of 28 September 2010.

<sup>2</sup> Decision No 2003/02/RM of the Executive Director of the Agency of 17 October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for large aeroplanes (« CS-25 »). Decision as last amended by Decision 2011/004/R of the Executive Director of the Agency of 27 June 2011.

<sup>3</sup> Decision No 2003/15/RM of the Executive Director of the Agency of 14 November 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for small rotorcraft (« CS-27 »). Decision as last amended by Decision 2008/09/R of the Executive Director of the Agency of 10 November 2008.

<sup>4</sup> Decision No 2003/16/RM of the Executive Director of the Agency of 14 November 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for large rotorcraft (« CS-29 »). Decision as last amended by Decision 2008/10/R of the Executive Director of the Agency of 10 November 2008.

<sup>5</sup> Decision No 2003/09/RM of the Executive Director of the Agency of 24. October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for engines (« CS-E »). Decision as last amended by Decision 2010/015/R of the Executive Director of the Agency of 16 December 2010.

<sup>6</sup> Decision No 2003/07/RM of the Executive Director of the Agency of 24 October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for propellers (« CS-P »). Decision as last amended by Decision 2006/09/R of the Executive Director of the Agency of 16 November 2006.

<sup>7</sup> Decision No 2003/05/RM of the Executive Director of the Agency of 17 October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for auxiliary power units (« CS-APU »).

<sup>8</sup> Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC (OJ L 79, 19.03.2008, p. 1). Regulation as last amended by Regulation 1108/2009 of the European Parliament and of the Council of 21 October 2009 (OJ L 309, 24.11.2009, p. 51).

<sup>9</sup> Management Board decision concerning the procedure to be applied by the Agency for the issuing of opinions, certification specifications and guidance material (Rulemaking Procedure), EASA MB 08-2007, 13.6.2007.

4. This rulemaking activity is included in the Agency's Rulemaking Programme for 2011. It implements the rulemaking task RMT.0364 (MDM.089).
5. The text of this NPA has been developed by the Agency. It is submitted for consultation of all interested parties in accordance with Article 52 of the Basic Regulation and Articles 5(3) and 6 of the Rulemaking Procedure.
6. The proposed rule has taken into account the development of European Union and International law (ICAO), and the harmonisation with the rules of other authorities of the European Union's main partners as set out in the objectives of Article 2 of the Basic Regulation.

## II. Consultation

7. To achieve optimal consultation, the Agency is publishing the draft Decision of the Executive Director on its Internet site. Comments should be provided within 3 months in accordance with Article 6(4) of the Rulemaking Procedure. Comments on this proposal should be submitted by one of the following methods:

**CRT:** Send your comments using the Comment-Response Tool (CRT) available at <http://hub.easa.europa.eu/crt/>.

**E-mail:** Comments can be sent by e-mail only in case the use of CRT is prevented by technical problems. The(se) problem(s) should be reported to the [CRT webmaster](mailto:CRT_webmaster@easa.europa.eu) and comments should be sent by e-mail to [NPA@easa.europa.eu](mailto:NPA@easa.europa.eu).

**Correspondence:** If you do not have access to the Internet or e-mail, you can send your comments by mail to:

Process Support  
Rulemaking Directorate  
EASA  
Postfach 10 12 53  
50452 Cologne  
Germany

Comments should be submitted by 23 December 2011. If received after this deadline, they might not be taken into account.

## III. Comment response document

8. All comments received in time will be responded to and incorporated in a comment response document (CRD). The CRD will be available on the Agency's website and in the Comment-Response Tool (CRT).

## IV. Content of the draft Decision

### **Background**

9. A new approach has been proposed by the ICAO International Volcanic Ash Task Force (IVATF) to manage flight operations with known or forecast volcanic cloud contamination of the airspace. Under this approach, the operator is accountable for assessing the risks to flight operations and for determining and implementing appropriate procedures and mitigating measures. Central to this approach is the development of a safety risk assessment (SRA) that is acceptable to the NAA of the State of the Operator. In order to successfully produce such a SRA, it is essential that the operator is provided with, or has access to, specific technical data and information regarding the susceptibility of the aircraft they operate to volcanic cloud related effects and any precautions that need to be taken into account.
10. Experience to date has shown that most manufacturers are supportive of operators and readily provide such information.

**Objectives**

11. To propose a new obligation on manufacturers to identify any susceptibility of aircraft features to the effects of volcanic cloud contamination and to ensure that information necessary for safe operation is provided to operators.
12. This NPA builds on and supports the work of the IVATF by proposing changes to EASA airworthiness codes (CS-23, CS-25, CS-27, CS-29, CS-E, CS-P and CS-APU). It creates a new obligation on type-certificate, restricted type-certificate, supplemental type-certificate holders, and holders of an ETSO authorisation for APU, to investigate and understand the hazards associated with exposure to the harmful effects of volcanic clouds. Such investigations may be based on a combination of experience, studies, analysis, and/or testing of parts, sub-assemblies or products (i.e. engines or propellers). Information that can be readily used by operators in preparing their SRAs, including recommendations regarding the actual levels of ash tolerance and any operational precautions that need to be taken, will then have to be prepared and distributed.

**The envisaged changes are:**

i)	To Decision 2003/14/RM (CS-23):	Amendment to New New	CS 23.1501 CS 23.1593 AMC 23.1593
ii)	To Decision 2003/02/RM (CS-25):	Amendment to New New	CS 25.1501 CS 25.1593 AMC 25.1593
iii)	To Decision 2003/15/RM (CS-27):	Amendment to New New	CS 27.1501 CS 27.1593 AMC 27.1593
iv)	To Decision 2003/16/RM (CS-29):	Amendment to New New	CS 29.1501 CS 29.1593 AMC 29.1593
v)	To Decision 2003/09/RM (CS-E):	New New	CS-E 1050 AMC E 1050
vi)	To Decision 2003/07/RM (CS-P):	New New	CS-P 80 AMC P 80
vii)	To Decision 2003/05/RM (CS-APU):	New New	CS-APU 550 AMC APU 550

## V. Regulatory Impact Assessment

### 0. Process and consultation

The impact assessment has been developed by the Agency. It draws on information developed by and for the ICAO IVATF.

### 1. Issue analysis and risk assessment

#### 1.1 What is the issue?

Volcanic clouds are a recognised hazard to aviation. They consist mainly of volcanic ash (the prime hazard to aviation safety) as well as other undesirable constituents that can adversely impact the continued airworthiness of aircraft. Several severe incidents took place in the eighties and nineties at various locations throughout the world that resulted in temporary multiple engine failures to commercial airliners. The common denominator in these incidents was the lack of awareness by the pilots that they were flying through volcanic ash contaminated areas. As a consequence of these incidents ICAO put in place contingency measures to mitigate the effects of volcanic ash on aviation, which have been adopted globally<sup>10</sup>. These measures rely primarily on the monitoring, detection and dissemination of volcanic ash information to ensure that pilots remain clear of visible ash clouds.

With the eruption of the Eyjafjallajokull volcano in Iceland in April 2010 the aviation community was confronted with an unexpected and unprecedented disruption of the aviation transport system in Europe. The characteristics of the Eyjafjallajokull eruption, its proximity to Europe and weather patterns at the time, all led to the ash cloud persisting over large areas of Europe. Application by States of the ICAO procedures led to widespread and prolonged closure of airspace leading to significant social impacts and economic consequences for air transport industry. This highlighted the ineffectiveness of existing procedures in providing a balanced approach between safety and enabling continued flight operations.

This eruption of the Eyjafjallajokull volcano is by no means unique, and the eruption of the Grimsvotn volcano in May 2011 also impacted aviation in Europe, although not to the same extent. Furthermore, the eruption of the Chilean volcano Puyehue-Cordon Caulle in June 2011, disrupted air transport in the southern hemisphere and highlighted that this is not just a European issue but can impact aviation globally.

In order to be better prepared for such a difficult situation, the European Council of Transport Ministers has called for action.

The international community has responded by the setting up of the ICAO International Volcanic Ash Task Force (IVATF) in May 2010. As part of this endeavour, a new approach has been proposed to ICAO that will allow flight operations in areas of known or forecast low concentrations of volcanic ash. The approach centres on a SRA produced by an operator, together with a methodology for use by that operator's state in evaluating the robustness of the process and the competence of the operator in using the process. The operator is accountable for assessing the risk of operations and should take into account information from manufacturers in establishing any airworthiness effects on the aircraft they operate, the nature of these effects, the level of exposure that can be tolerated, and any related pre-flight, in-flight and post-flight precautions to be observed by the operator.

This NPA proposes changes to Agency Certification Specifications (CSs) to support operators in developing their SRAs. It mandates manufacturers to supply information on the susceptibility of new or modified products or parts & appliances to volcanic cloud contamination (i.e. volcanic ash plus any other volcanic cloud constituents) and to identify any limitations or precautions

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<sup>10</sup> ICAO Manual on Volcanic Ash, Radioactive Materials and Toxic Chemical Clouds (ICAO Doc 9691), Second Edition - 2007.

that must be observed by the operator to ensure the airworthiness and continued airworthiness of an aircraft.

### **1.2 Who is affected?**

This NPA is specifically addressed to type-certificate holders, restricted type-certificate holders, supplemental type-certificate holders and ETSO authorisation holders who are engaged in the manufacture, change or repair to any of the following:

- Turbine engine aircraft;
- Turbine engines;
- Variable pitch propellers;
- Essential (Category 1) Auxilliary power units (APU).

This NPA will also be of direct interest to all Commercial Air Transport operators of turbine engine aircraft and indirectly to other turbine engine aircraft operators.

### **1.3 What are the risks (probability and severity)?**

Volcanic clouds, and in particular exposure to high concentrations of volcanic ash and/or for prolonged periods of time, can have severe consequences on the operation of aircraft and in the extreme may preclude the ability to continue safe flight and landing.

The adoption of a new approach based on an accepted operator's SRA, will enable flight operations into, or avoiding, areas of known or forecast volcanic ash. As part of the SRA, operators will establish a level of volcanic cloud contamination deemed tolerable from an airworthiness standpoint based on manufacturers' supplied information. If the operator is not in possession of suitable information from manufacturers, then it is expected that the operator will constrain its risk assessment and assume that the aircraft/engine/propeller/APU has minimal tolerance to volcanic cloud exposure. Operations conducted in accordance with the accepted operator's SRA should therefore not create an immediate safety concern. The long-term effects of volcanic cloud contamination on continuing airworthiness will be kept under constant review by manufacturers in accordance with their obligations under Part-21. The severity of the safety risk from encounters with volcanic clouds due to the lack of available manufacturer's data in the preparation of an operator's SRA can therefore be accepted as **Minor**.

The probability of operating in volcanic cloud areas is deemed to be **Occasional** - likely to occur sometimes (has occurred infrequently). Failure conditions are anticipated to occur one or more times during the entire operational life to many different aircraft types within a category.



**Table 1: Risk index matrix**

Probability of occurrence		Severity of occurrence				
		Negligible	Minor	Major	Hazardous	Catastrophic
		1	2	3	5	8
<b>Extremely improbable</b>	1					
<b>Improbable</b>	2					
<b>Remote</b>	3					
<b>Occasional</b>	4		8			
<b>Frequent</b>	5					

## 2. Objectives

The overall objectives of the Agency are defined in Article 2 of Regulation (EC) No 216/2008 (the 'Basic Regulation'). This proposal will contribute to the overall objectives by ensuring that a high uniform level of civil aviation safety in Europe is maintained that is both safe and cost-effective.

The specific objective is to mitigate the risks to aircraft from operating in areas contaminated by volcanic clouds. For this purpose, it is proposed that manufacturers support operators by providing all relevant airworthiness information for use in developing their SRAs. In order to successfully produce such SRAs, it is essential that operators are provided or have access to reliable technical data and information regarding the susceptibility of the aircraft they operate to volcanic cloud related airworthiness effects, the nature of these effects and the related pre-flight, in-flight and post-flight precautions to be observed.

## 3. Options identified

**Table 2: Selected policy options**

Option No	Description
0	Baseline option (No change to CSs – Reliance on voluntary information supplied by manufacturers)
1	Amend CSs to require new or changed products, parts & appliances, to be assessed for their susceptibility to volcanic cloud effects, and to provide information to operators
2	As 1 but extended to cover all in-service aircraft

3	As 1 but limited to "volcanic ash" only
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## 4. Analysis of impacts

### 4.1 Safety impact

The move towards a SRA approach will have no impact on safety. Aircraft (including engines) have been shown to tolerate moderate levels of volcanic ash concentrations and any long-term effects (e.g. increased corrosion, erosion, wear, loss of performance) would become evident long before it became a safety of flight concern. Operators will be required to have an accepted SRA and related procedures that enables controlled access to affected areas with the full knowledge of all available and forecast volcanic cloud information.

Option 0: Operators will be reliant on the good will of manufacturers to provide information for inclusion in their SRA, or to generate the necessary information independently. Without access to this information, operators may need to restrict operations to mitigate any safety risks.

Option 1: Operators' SRA will be supported by technical information from individual manufacturers, ensuring that any procedures and operational limitations are both relevant and appropriate for the specific aircraft type operated and will maintain an adequate safety margin.

Option 2: As the majority of operators have already completed and implemented a SRA that has been accepted by the State of the Operator, retroactive application is not expected to bring any additional safety benefit.

Option 3: Volcanic clouds contain a number of constituents that can be hazardous to aircraft. Volcanic ash is the primary hazard, as it can cause multiple engine failures, as well as adversely affecting systems, structures and cabin air quality. However, other threats such as SO<sub>2</sub> gas can have longer-term effects, and for which operators should be informed.

### 4.2 Environmental impact

None identified.

### 4.3 Social impact

The SRA approach will negate the need to close airspace during a volcanic cloud event enabling operators to continue flying within the bounds of their accepted SRA. The new approach will therefore have a positive benefit by reducing the impact on the travelling public and allow social and business needs to be better met.

Option 0: This option may not allow the full benefit of the SRA approach to be realised if the lack of information from manufacturers limits the scope of the SRA. Without valid technical information supplied by manufacturers, operators will be required to constrain their SRA by assuming minimal tolerance to volcanic cloud exposure.

Option 1: Only through incorporating manufacturer's information can the operator's SRA provide the greatest scope and least impact on flight operations and the travelling public.

Option 2&3: As Option 1.

### 4.4 Economic impact

The economic impact to airlines due to the closure of European airspace following eruption of the Eyjafjallajokull volcano in May 2010 has been estimated at \$1.8 billion of revenue loss, with some 10 million passengers and 100,000 flights being affected during the six-day period<sup>11</sup>. The new approach is expected to greatly reduce this impact.

<sup>11</sup> Data from IATA (Fact Sheet – Volcanic Ash).

Option 0: The new approach is reliant on acceptance of the operator's SRA prior to operations in affected airspace. Comments received on A-NPA 2011-06 indicate that some manufacturers have been unable or unwilling to provide the necessary information to support operators. This will impact on the operator's SRA, either leading to increased costs for the operator if the relevant information has to be established independently, or may lead to significant loss of revenue if flight operations have to be suspended. Suspension of flight operations may also impact manufacturers' revenue if support services are provided on a "by-the-hour" basis.

Option 1: Establishing the effects of volcanic cloud contamination on aircraft/engines/propellers and APUs will require additional work to be performed by the manufacturer. This additional work is deemed to be small in relation to what is required for certification of a new/changed product or APU.

Option 2: In addition to Option 1, most manufacturers have voluntarily assessed their existing products for the effects of volcanic cloud contamination. No significant increase in costs is therefore expected, with the possible exception of those small number of manufacturers who have not voluntarily supplied information, where there may be an adverse effect.

Option 3: As Option 1. No additional significant impact identified.

#### **4.5 Proportionality issues**

None identified.

#### **4.6 Impact on regulatory coordination and harmonisation**

The proposed rule text is not harmonised with the FAA or TCCA.

If the SRA approach is adopted by ICAO, then it could be expected that other authorities may adopt this approach. Furthermore, and irrespective of the direction ICAO takes, an operator is responsible for identifying all hazards associated with their operations as part of their existing SMS. The proposals outlined in this NPA for the supply of additional hazard information are therefore aligned with existing rules and will facilitate operators in meeting their obligations.

### **5. Conclusion and preferred option**

The Agency prefers Option 1: Amend CSs to require new or changed products, parts & appliances, to be assessed for their susceptibility to volcanic cloud effects, and to provide information to operators.

The proposed option will ensure that operators' SRA can be completed using appropriate technical information to be provided by the manufacturers. This will minimise any disruption in flight operations due to volcanic cloud contamination and thereby minimise the costs to industry and inconvenience to the travelling public. The economic burden for the industry will be limited as it is only applicable to new or changed products, parts and appliances.

## B. Draft Decisions

The text of the amendment is arranged to show deleted text, new text or new paragraph as shown below:

1. deleted text is shown with a strike through: ~~deleted~~
2. new text is highlighted with grey shading: **new**
3. ...

... indicates that remaining text is unchanged in front of or following the reflected amendment.

## I. Draft Decision CS-23

### Book 1

#### SUBPART G OPERATING LIMITATIONS AND INFORMATION

##### GENERAL

#### CS 23.1501 General

(a) Each operating limitation specified in CS 23.1505 to 23.1527 and other limitations and information necessary for safe operation must be established.

(b) The operating limitations and other information necessary for safe operation must be made available to the crew members as prescribed in CS 23.1541 to ~~23.1589~~ **CS 23.1593**.

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#### **CS 23.1593 Volcanic cloud contamination**

(See AMC 23.1593)

For turbine engine powered aeroplanes, the susceptibility of aeroplane features to the effects of volcanic cloud contamination must be established.

### Book 2

#### SUBPART G OPERATING LIMITATIONS AND INFORMATION

#### **AMC 23.1593 Volcanic cloud contamination**

Acceptable means of establishing the susceptibility of aeroplane features to the effects of volcanic clouds should include a combination of experience, studies, analysis, and/or testing of parts or sub-assemblies.

Information necessary for safe operation should be contained in the unapproved part of the flight manual. This information may be used to assist operators in producing operational data and instructions for their flight crews when operating in, or avoiding, airspace contaminated with volcanic clouds. The information should be readily usable by operators in preparing their safety risk assessments, and should include recommendations regarding the actual levels of ash concentrations levels and the time period that can be tolerated, together with any operational precautions that need to be taken by the operator.

A volcanic cloud comprises volcanic ash together with gases and other chemicals. Although the primary hazard is volcanic ash, other elements of the volcanic cloud may also be undesirable to operate through, and their effect on airworthiness should be assessed.

In determining the susceptibility of aeroplane features to the effects of volcanic clouds and the necessary information to operators, the following points should be considered:

- (1) Identify the features of the aeroplane that are susceptible to airworthiness effects from volcanic clouds. These may include, but are not limited to the following:
  - a. The malfunction or failure of one or more engines, leading not only to reduction or complete loss of thrust but also to failures of electrical, pneumatic and hydraulic systems;
  - b. Blockage of pitot and static sensors, resulting in unreliable airspeed indications and erroneous warnings;
  - c. Windscreen abrasion, resulting in windscreens being rendered partially or completely opaque;
  - d. Fuel contamination;
  - e. Volcanic ash and/or toxic chemical contamination of cabin air-conditioning packs, possibly leading to loss of cabin pressurisation or noxious fumes in the cabin;
  - f. Erosion of external and internal aeroplane components;
  - g. Volcanic cloud static discharge, leading to prolonged loss of communications; and
  - h. Reduced electronic cooling efficiency, leading to a wide range of aeroplane system failures.
- (2) The nature and severity of effects.
- (3) The effect of volcanic ash on operations to/from contaminated aerodromes. In particular, deposits of volcanic ash on a runway can lead to degraded braking performance, most significantly if the ash is wet.
- (4) The related pre-flight, in-flight and post-flight precautions to be observed by the operator including any necessary amendments to Aircraft Operating Manuals, Aircraft Maintenance Manuals, Master Minimum Equipment List/Despatch Deviation, or equivalents required to support the operator.
- (5) The recommended continuing airworthiness inspections associated with operations in volcanic cloud contaminated airspace and to/from volcanic ash contaminated aerodromes; this may take the form of Instructions for Continuing Airworthiness or other advice.

## II. Draft Decision CS-25

### Book 1

### SUBPART G OPERATING LIMITATIONS AND INFORMATION

#### GENERAL

#### CS 25.1501 General

(a) Each operating limitation specified in CS 25.1503 to 25.1533 and other limitations and information necessary for safe operation must be established.

(b) The operating limitations and other information necessary for safe operation must be made available to the crew members as prescribed in CS 25.1541 to ~~23.1587~~CS 25.1593.

~~(c) Supplementary information must be made available to the operator of each aeroplane as prescribed in CS 25.1591.~~

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### **CS 25.1593 Volcanic cloud Contamination**

(See AMC 25.1593)

The susceptibility of aeroplane features to the effects of volcanic cloud contamination must be established.

## **Book 2**

### **SUBPART G OPERATING LIMITATIONS AND INFORMATION**

#### **AMC 25.1593 Volcanic cloud contamination**

Acceptable means of establishing the susceptibility of aeroplane features to the effects of volcanic clouds should include a combination of experience, studies, analysis, and/or testing of parts or sub-assemblies.

Information necessary for safe operation should be contained in the unapproved part of the flight manual. This information may be used to assist operators in producing operational data and instructions for their flight crews when operating in, or avoiding, airspace contaminated with volcanic clouds. The information should be readily usable by operators in preparing their safety risk assessments, and should include recommendations regarding the actual levels of ash concentrations levels and the time period that can be tolerated, together with any operational precautions that need to be taken by the operator.

A volcanic cloud comprises volcanic ash together with gases and other chemicals. Although the primary hazard is volcanic ash, other elements of the volcanic cloud may also be undesirable to operate through, and their effect on airworthiness should be assessed.

In determining the susceptibility of aeroplane features to the effects of volcanic clouds and the necessary information to operators, the following points should be considered:

- (1) Identify the features of the aeroplane that are susceptible to airworthiness effects from volcanic clouds. These may include, but are not limited to the following:
  - a. The malfunction or failure of one or more engines, leading not only to reduction or complete loss of thrust but also to failures of electrical, pneumatic and hydraulic systems;
  - b. Blockage of pitot and static sensors, resulting in unreliable airspeed indications and erroneous warnings;
  - c. Windscreen abrasion, resulting in windscreens being rendered partially or completely opaque;
  - d. Fuel contamination;
  - e. Volcanic ash and/or toxic chemical contamination of cabin air-conditioning packs, possibly leading to loss of cabin pressurisation or noxious fumes in the cabin;
  - f. Erosion of external and internal aeroplane components;

- g. Volcanic cloud static discharge, leading to prolonged loss of communications; and
  - h. Reduced electronic cooling efficiency, leading to a wide range of aeroplane system failures.
- (2) The nature and severity of effects.
  - (3) The effect of volcanic ash on operations to/from contaminated aerodromes. In particular, deposits of volcanic ash on a runway can lead to degraded braking performance, most significantly if the ash is wet.
  - (4) The related pre-flight, in-flight and post-flight precautions to be observed by the operator including any necessary amendments to Aircraft Operating Manuals, Aircraft Maintenance Manuals, Master Minimum Equipment List/Despatch Deviation, or equivalents required to support the operator.
  - (5) The recommended continuing airworthiness inspections associated with operations in volcanic cloud contaminated airspace and to/from volcanic ash contaminated aerodromes; this may take the form of Instructions for Continuing Airworthiness or other advice.

### III. Draft Decision CS-27

#### Book 1

#### SUBPART G OPERATING LIMITATIONS AND INFORMATION

#### GENERAL

#### CS 27.1501 General

(a) Each operating limitation specified in CS 27.1503 to 27.1525 and other limitations and information necessary for safe operation must be established.

(b) The operating limitations and other information necessary for safe operation must be made available to the crew members as prescribed in CS 27.1541 to ~~27.1589~~CS 27.1593.

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#### CS 27.1593 Volcanic Cloud Contamination

(See AMC 27.1593)

For turbine engine powered rotorcraft, the susceptibility of rotorcraft features to the effects of volcanic cloud contamination must be established.

#### Book 2

#### SUBPART G OPERATING LIMITATIONS AND INFORMATION

#### AMC 27.1593 Volcanic cloud contamination

Acceptable means of establishing the susceptibility of rotorcraft features to the effects of volcanic clouds should include a combination of experience, studies, analysis, and/or testing of parts or sub-assemblies.

Information necessary for safe operation should be contained in the unapproved part of the flight manual. This information may be used to assist operators in producing

operational data and instructions for their flight crews when operating in, or avoiding, airspace contaminated with volcanic clouds. The information should be readily usable by operators in preparing their safety risk assessments, and should include recommendations regarding the actual levels of ash concentrations levels and the time period that can be tolerated, together with any operational precautions that need to be taken by the operator.

A volcanic cloud comprises volcanic ash together with gases and other chemicals. Although the primary hazard is volcanic ash, other elements of the volcanic cloud may also be undesirable to operate through, and their effect on airworthiness should be assessed.

In determining the susceptibility of rotorcraft features to the effects of volcanic clouds and the necessary information to operators, the following points should be considered:

- (1) Identify the features of the rotorcraft that are susceptible to airworthiness effects from volcanic clouds. These may include, but are not limited to the following:
  - a. The malfunction or failure of one or more engines, leading not only to reduction or complete loss of thrust but also to failures of electrical, pneumatic and hydraulic systems;
  - b. Blockage of pitot and static sensors, resulting in unreliable airspeed indications and erroneous warnings;
  - c. Windscreen abrasion, resulting in windscreens being rendered partially or completely opaque;
  - d. Fuel contamination;
  - e. Volcanic ash and/or toxic chemical contamination of cabin air-conditioning packs, possibly leading to loss of cabin pressurisation or noxious fumes in the cabin;
  - f. Erosion of external and internal rotorcraft components;
  - g. Volcanic cloud static discharge, leading to prolonged loss of communications; and
  - h. Reduced electronic cooling efficiency, leading to a wide range of rotorcraft system failures.
- (2) The nature and severity of effects.
- (3) The effect of volcanic ash on operations to/from contaminated aerodromes.
- (4) The related pre-flight, in-flight and post-flight precautions to be observed by the operator including any necessary amendments to Aircraft Operating Manuals, Aircraft Maintenance Manuals, Master Minimum Equipment List/Despatch Deviation, or equivalents required to support the operator.
- (5) The recommended continuing airworthiness inspections associated with operations in volcanic cloud contaminated airspace and to/from volcanic ash contaminated aerodromes; this may take the form of Instructions for Continuing Airworthiness or other advice.



**IV. Draft Decision CS-29****Book 1****SUBPART G OPERATING LIMITATIONS AND INFORMATION****GENERAL****CS 29.1501 General**

(a) Each operating limitation specified in CS 29.1503 to 29.1525 and other limitations and information necessary for safe operation must be established.

(b) The operating limitations and other information necessary for safe operation must be made available to the crew members as prescribed in CS 29.1541 to ~~29.1589~~ CS 29.1593.

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**CS 29.1593 Volcanic Cloud contamination**

(See AMC 29.1593)

For turbine engine powered rotorcraft, the susceptibility of rotorcraft features to the effects of volcanic cloud contamination must be established.

**Book 2****SUBPART G OPERATING LIMITATIONS AND INFORMATION****AMC 29.1593 Volcanic cloud contamination**

Acceptable means of establishing the susceptibility of rotorcraft features to the effects of volcanic clouds should include a combination of experience, studies, analysis, and/or testing of parts or sub-assemblies.

Information necessary for safe operation should be contained in the unapproved part of the flight manual. This information may be used to assist operators in producing operational data and instructions for their flight crews when operating in, or avoiding, airspace contaminated with volcanic clouds. The information should be readily usable by operators in preparing their safety risk assessments, and should include recommendations regarding the actual levels of ash concentrations levels and the time period that can be tolerated, together with any operational precautions that need to be taken by the operator.

A volcanic cloud comprises volcanic ash together with gases and other chemicals. Although the primary hazard is volcanic ash, other elements of the volcanic cloud may also be undesirable to operate through, and their effect on airworthiness should be assessed.

In determining the susceptibility of rotorcraft features to the effects of volcanic clouds and the necessary information to operators, the following points should be considered:

- (1) Identify the features of the rotorcraft that are susceptible to airworthiness effects from volcanic clouds. These may include, but are not limited to the following:
  - a. The malfunction or failure of one or more engines, leading not only to reduction or complete loss of thrust but also to failures of electrical, pneumatic and hydraulic systems;
  - b. Blockage of pitot and static sensors, resulting in unreliable airspeed indications and erroneous warnings;

- c. Windscreen abrasion, resulting in windscreens being rendered partially or completely opaque;
  - d. Fuel contamination;
  - e. Volcanic ash and/or toxic chemical contamination of cabin air-conditioning packs, possibly leading to loss of cabin pressurisation or noxious fumes in the cabin;
  - f. Erosion of external and internal rotorcraft components;
  - g. Volcanic cloud static discharge, leading to prolonged loss of communications; and
  - h. Reduced electronic cooling efficiency, leading to a wide range of rotorcraft system failures.
- (2) The nature and severity of effects.
  - (3) The effect of volcanic ash on operations to/from contaminated aerodromes.
  - (4) The related pre-flight, in-flight and post-flight precautions to be observed by the operator including any necessary amendments to Aircraft Operating Manuals, Aircraft Maintenance Manuals, Master Minimum Equipment List/Despatch Deviation, or equivalents required to support the operator.
  - (5) The recommended continuing airworthiness inspections associated with operations in volcanic cloud contaminated airspace and to/from volcanic ash contaminated aerodromes; this may take the form of Instructions for Continuing Airworthiness or other advice.

## V. Draft Decision CS-E

### Book 1

#### SUBPART F TURBINE ENGINES - ENVIRONMENTAL AND OPERATIONAL DESIGN REQUIREMENTS

##### CS-E 1050 Volcanic Cloud Contamination

(See AMC E.1050)

(a) The susceptibility of turbine engine features to the effects of volcanic clouds must be established.

(b) Information necessary for safe operation must be provided in the relevant documentation.

### Book 2

#### SUBPART F TURBINE ENGINES - ENVIRONMENTAL AND OPERATIONAL DESIGN

##### AMC E 1050 Volcanic Cloud Contamination

Acceptable means of establishing the susceptibility of engine features to the effects of volcanic clouds should include a combination of experience, studies, analysis, and/or testing of parts, sub-assemblies or engines.

Information necessary for safe operation should be contained in the relevant documentation. This information may be used to assist operators in producing operational data and instructions for their flight crews when operating in, or avoiding, airspace contaminated with volcanic clouds. The information should be readily usable by operators in preparing their safety risk assessments, and should include recommendations

regarding the actual levels of ash concentrations levels and the time period that can be tolerated, together with any operational precautions that need to be taken by the operator.

A volcanic cloud comprises volcanic ash together with gases and other chemicals. Although the primary hazard is volcanic ash, other elements of the volcanic cloud may also be undesirable to operate through, and their effect on airworthiness should be assessed.

In determining the susceptibility of turbine engine features to the effects of volcanic clouds and the necessary information to operators to allow safe engine operation, the following points should be considered:

- (1) Identify the features of the turbine engine that are susceptible to airworthiness effects from volcanic clouds. These may include, but are not limited to the following:
  - a. Erosion of compressor blades and other internal parts;
  - b. Glassy deposits on hot section parts, which can result in loss of surge margins, engine stall, flame out, and inability to restart engines;
  - c. Clogging of turbine blade cooling channels;
  - d. Corrosion of metallic parts;
  - e. Oil circuit contamination; and
  - f. Electrical, hydraulic and pneumatic systems.
- (2) The nature and severity of effects.
- (3) The related pre-flight, in-flight and post-flight precautions to be observed by the operator including any necessary amendments to Engine Manuals, Despatch Deviation, or equivalents, required to support the operator.
- (4) The recommended continuing airworthiness inspections associated with operations in volcanic cloud contaminated airspace; this may take the form of Instructions for Continuing Airworthiness or other advice.

## VI. Draft Decision CS-P

### Book 1

#### SUBPART A GENERAL

#### CS-P 80 Volcanic Cloud Contamination

(See AMC P.80)

For variable pitch propellers:

- (a) The susceptibility of features of the propeller system to the effects of volcanic clouds must be established.
- (b) Information necessary for safe operation must be provided in the relevant documentation.

**Book 2****SUBPART A GENERAL****AMC P 80 Volcanic Cloud Contamination**

Acceptable means of establishing the susceptibility of propeller features to the effects of volcanic clouds should include a combination of experience, studies, analysis, and/or testing of parts, sub-assemblies or propellers.

Information necessary for safe operation should be contained in the relevant documentation. This information may be used to assist operators in producing operational data and instructions for their flight crews when operating in, or avoiding, airspace contaminated with volcanic clouds. The information should be readily usable by operators in preparing their safety risk assessments, and should include recommendations regarding the actual levels of ash concentrations levels and the time period that can be tolerated, together with any operational precautions that need to be taken by the operator.

A volcanic cloud comprises volcanic ash together with gases and other chemicals. Although the primary hazard is volcanic ash, other elements of the volcanic cloud may also be undesirable to operate through, and their effect on airworthiness should be assessed.

In determining the susceptibility of variable pitch propeller features to the effects of volcanic clouds and the necessary information to operators to allow safe propeller operation, the following points should be considered:

- (1) The features of the propeller system that are susceptible to airworthiness effects from volcanic clouds. These may include, but are not limited to the following:
  - a. Erosion of propeller blades and other propeller system components;
  - b. Corrosion of metallic parts;
  - c. Oil circuit contamination; and
  - d. Electrical, hydraulic and pneumatic systems;
- (2) The nature and severity of effects.
- (3) The related pre-flight, in-flight and post-flight precautions to be observed by the operator including any necessary amendments to Propeller Manuals, Dispatch Deviation, or equivalents required to support the operator.
- (4) The recommended continuing airworthiness inspections associated with operations in volcanic cloud contaminated airspace; this may take the form of Instructions for Continuing Airworthiness or other advice.

**VII. DRAFT DECISION CS-APU****Book 1****SUBPART D CATEGORY 1 APUs. ADDITIONAL SPECIFICATIONS****CS-APU 550 Volcanic Cloud Contamination**

(See AMC APU.550)

- (a) The susceptibility of features of the APU to the effects of volcanic clouds must be established.
- (b) Information necessary for safe operation must be provided in the relevant documentation.

**Book 2****SUBPART D CATEGORY 1 APUs. ADDITIONAL SPECIFICATIONS****AMC APU 550 Volcanic Cloud Contamination**

Acceptable means of establishing the susceptibility of APU features to the effects of volcanic clouds should include a combination of experience, studies, analysis, and/or testing of parts, sub-assemblies or APUs.

Information necessary for safe operation should be contained in the relevant documentation. This information may be used to assist operators in producing operational data and instructions for their flight crews when operating in, or avoiding, airspace contaminated with volcanic clouds. The information should be readily usable by operators in preparing their safety risk assessments, and should include recommendations regarding the actual levels of ash concentrations levels and the time period that can be tolerated, together with any operational precautions that need to be taken by the operator.

A volcanic cloud comprises volcanic ash together with gases and other chemicals. Although the primary hazard is volcanic ash, other elements of the volcanic cloud may also be undesirable to operate through, and their effect on airworthiness should be assessed.

In determining the susceptibility of Category 1 APU features to the effects of volcanic clouds and the necessary information to operators to allow safe APU operation, the following points should be considered:

- (1) The features of the APU that are susceptible to airworthiness effects from volcanic clouds. These may include, but are not limited to the following:
  - a. Erosion of compressor blades and other internal parts;
  - b. Glassy deposits on hot section parts, which can result in loss of surge margins, APU stall, flame out, and inability to restart APUs;
  - c. Clogging of turbine blade cooling channels;
  - d. Corrosion of metallic parts;
  - e. Oil circuit contamination; and
  - f. Electrical, hydraulic and pneumatic systems.
- (2) The nature and severity of effects.
- (3) The related pre-flight, in-flight and post-flight precautions to be observed by the operator including any necessary amendments to APU Manuals, Despatch Deviation, or equivalents required to support the operator.
- (4) The recommended continuing airworthiness inspections associated with operations in volcanic cloud contaminated airspace; this may take the form of Instructions for Continuing Airworthiness or other advice.