

**Seventeenth Meeting of the Cross Polar Trans East Air Traffic Management Providers' Work Group  
(CPWG/17)**

(Samara, Russia - 3-6 June 2014)

**Agenda Item 5: Update on CPWG16 Action Items**

**Notable Information from Associated Air Traffic Management Meetings:  
“Volcanic Ash and PACOTS Generation”**

(Presented by the Federal Aviation Administration)

**SUMMARY**

This paper draws attention to a discussion of Air Traffic Management procedures relative to volcanic ash which was presented at the most recent meeting of the Informal Pacific ATC Coordinating Group (IPACG).

**1 Introduction**

1.1. IPACG/39 was held in Fukuoka, Japan during the week of February 3<sup>rd</sup>, 2014. At that meeting the Federal Aviation Administration (FAA) presented a paper titled, “Volcanic Ash and PACOTS Generation”. In as much as CPWG’s geographic area of concern includes Air Traffic Service routes which either transit or lay near to volcanically active areas, the concepts covered in the IPACG paper may be of interest – especially to those members of CPWG who do not attend the IPACG.

**2 Discussion**

2.1. FAA’s IPACG paper, “Volcanic Ash and PACOTS Generation”, copy attached, served two important functions; it detailed the “lessons learned” from a table top exercise of volcanic ash air traffic management procedures and, secondly, identified specific individual requirements / responsibilities for Operators, Civil Aviation Authorities, and Air Traffic Service Providers as regards flight thru, or adjacent to, areas of volcanic ash. The noted requirements and responsibilities were derived, or taken verbatim, from the International Civil Aviation Organization’s Documents 9859 (Safety Management Manual) and 4444 (Procedures for Air Navigation Services / Air Traffic Management).

**3 Recommendation**

3.1. The Meeting is invited to note the information provided in the attached IPACG paper and discuss the possible ramifications for CPWG.



**THE THIRTY-NINTH MEETING OF THE  
INFORMAL PACIFIC ATC CO-ORDINATING GROUP  
(IPACG/39)**

(Fukuoka, Japan, 3-7 February 2014)

Agenda Item 5: Air Traffic Management (ATM) Issues

**Volcanic Ash and PACOTS Generation**

(Presented by the Federal Aviation Administration)

**SUMMARY**

This paper discusses procedures for Pacific Organized Track System (PACOTS) Track Generation when volcanic activity is present.

**1. Introduction**

1.1. VOLKAM13 was the first volcanic ash exercise in Kamchatka under the auspices of International Civil Aviation Organization (ICAO) that involved the three states: Russian Federation, Japan and the United States. The exercise validated that inter- and intra-state coordination could be used in real events in the future, as well as being the basis for future exercises. The lessons learned from VOLKAM13 can be used to develop recommendations for future consideration.

1.2. The aims and objectives are based on input provided by participating VOLKAM13 agencies (Volcano Observatories (VO), Volcanic Ash Advisory Centres (VAAC), Meteorological Watch Offices (MWO), International Notice to Airmen (NOTAM) Offices (NOF), Area Control Centres (ACC), Air Traffic Management Centres (ATMC), civil aviation authorities (CAA) and airlines) with significant comments and main themes mapped to the aims and objectives as reproduced below.

**1.2.1. VOLKAM13 Lessons Learned and Recommendations:**

a. Lesson 1: Lack of direct communication between Fukuoka and Petropavlovsk- Kamchatsky (PK) Flight Information Regions (FIRs) resulted in alternate reroute proposal that utilized Khabarovsk and Sapporo Area Control Centers (ACCs) since they have a Letter of Agreement (LOA) and direct communications.

*Note: The reroute of a Cathay Pacific flight from Hong Kong China to New York would have been 140 nautical miles (NM) longer, which would have contributed to a required fuel stop.*

b. Recommendation 1: Consider the development of LOA (especially for contingency situations) between oceanic sector of Fukuoka ATMC and Petropavlovsk- Kamchatsky ACC; other adjacent FIRs and/or ACCs who already have LOAs need to include contingency reroutes and consider the need to establish transitions from the North Pacific (NOPAC) to Russian Trans-East routes and vice-versa in this area or an alternative contingency coordination for specific cases to be considered in bilateral meeting between Japan and Russian Federation to be forwarded to the Cross Polar Working Group (CPWG).

c. Lesson 2: Consider alternate communications amongst ACCs and ATM Centers since correspondence via email was identified as slow for ATM measures and did not work between Fukuoka ATMC and Oakland Center.

d. Recommendation 2: Consider enhancing procedures for communications (using various methods) in a real event considering the various participants (ATM Centers, ACCs, etc.) and consider including in contingency plan being developed by CPWG considering the ATM VACP template.

e. Lesson 3: Some participants were not clear on procedures involving reroutes and associated ACC handover coordination whether they are tactical (en-route) or pre-flight.

f. Recommendation 3: Clarify procedures between ATS providers and Operators to address reroutes and associated ACC handover coordination whether they are tactical (en route) or pre-flight and publish them in national AIPs and reference in contingency plan.

g. Lesson 4: A Volcanic Ash Graphic (VAG) of 18 hours is not sufficient in formulating eastbound PACOTS since the route is effective 24 hours after issuance. The same is true for westbound tracks provided by Oakland ARTCC which are effective for up to 30 hours.

h. Recommendation 4:

- Communicate to the user that the confidence in PACOTS decreases considerably after 18 hours due to the absence of proper guidance (VAG is valid up to 18 hours in accordance with Annex 3)

- Recommendation 4: Monitor the International Airways Volcano Watch Operations Group (IAVWOPSG) on developments related to VAA/VAG, particularly to the extent of forecast

*Note that WP/31 of IAVWOPSG/7 recognizes recommendation 4/17 of IVATF that includes “assess the feasibility of providing Volcanic Ash Advisories (VAA), including graphics (VAG), beyond the current t+18 hour requirement.”*

i. Lesson 5: Participants were not clear how to use danger areas and if used, who and how is the danger area determined.

j. Recommendation 5: States consider the use of danger area in the context of IVATF recommendation 4/16 (that states should not declare a danger or restricted area in respect of volcanic ash, except over and in proximity to an erupting volcano).

*Note that this is aligned with section 1.2 of the ATM VACP template. Consider most appropriate term (danger area, restrictive area, prohibitive area) for this sub-region (Northwest Pacific that includes ICAO Regions EUR, APAC and NAM) and adapt the ATM VACP template, if necessary.*

k. Lesson 6: Determine who should issue NOTAMS for Petropavlovsk-Kamchatsky FIR. Anchorage Air Route Traffic Control Center (ARTCC) to request NOTAM for Petropavlovsk-Kamchatsky FIR when eruption occurs (for color codes orange and red) as per LOA\*, but this agreement could be reconsidered as PK may be able to request a NOTAM from NOF Moscow.

l Recommendation 6: Reconsider the NOTAM LOA that exists between PK ACC and Anchorage ARTCC to determine if there is a need to publish NOTAMS on volcanic ash for PK FIR by Anchorage and forward to CPWG

*\*Letter of Agreement (LOA) between PK ACC and Anchorage ARTCC concerning volcano information state: PK ACC will immediately notify Anchorage ARTCC of any observed or reported volcanic activity, and then Anchorage ARTCC is tasked with issuing a NOTAM advising of significant volcanic activity.*

m. Lesson 7: The timeliness of NOTAM distribution is unsatisfactory in Russian Federation and is likely due to the time it takes to translate. For example, when the time elapsed approaches 30 minutes, the volcanic ash cloud advances 55 km for the given speed of the volcanic ash cloud in this test event of 110 kilometers per hour (km/hr).

n. Recommendation 7: Russian AIS to consider expediting publication of NOTAMs specifically for volcanic ash.

o. Lesson 8: Teleconferences proved useful, however, they should be improved (background noise, style should be as clear and concise as possible) and considered for real-time events taking into account Collaborative Decision Making (CDM) to allow for interaction between operators and air navigation service providers (ANSPs) on reroutes published via NOTAM.

p. Recommendation 8: Formalize teleconferences for real-time events taking into consideration CDM to address matters such as published reroutes via NOTAMs and operator's needs. The CDM process is intended to develop a consensus amongst ANSPs and operators noting that operators utilize the safety risk assessment approach. Procedures on arranging teleconferences and their attributes (lead considering where the volcano erupts, participants, their roles, use of web portal for information sharing, language, directive to mute microphones unless otherwise asked) should be provided in the contingency plan and considered by CPWG.

q. Lesson 9: Exercise directive should include VAAC handover from VAAC Tokyo to VAAC Anchorage to mimic real situations and test coordination (including sharing of information such as Volcano Activity Reports (VARs))

r. Recommendation 9: The exercise directive should include VAAC handover from VAAC Tokyo to VAAC Anchorage to test coordination (including sharing of information such as Volcano Activity Reports (VARs)) taking into consideration discussion on handover procedures in IAVWOPSG/7

s. Lesson 10: VAAs issued by AFTN and VAGS sent to SADIS/WIFS, however, VAA/VAG availability on VAAC Tokyo website preferred by the participants (United Airlines uses VAA/VAG in flight planning with assistance from their own met in determining how conservative the forecast is), noting the second VAG was sent to the participants by email to accommodate this need

t. Recommendation 10: Exercise test VAA/VAG to be available on website or link as specified in the exercise directive (noting this is not an issue with real-time events) with message indicating that the web site be used for back-up purposes (Noting users should obtain VAAs and VAGs via AFTN and SADIS/WIFS respectively)

u. Lesson 11: It was difficult to determine if the status and description of eruption – e.g. VONA not compliant with the VONA template; VAA did not contain color code noting it is optional in table a2-1 of annex 3. Also, height discrepancy of the volcanic ash cloud reported between KVERT (10 km), MWO (FL410) and ups special air-report on volcanic ash (FL310) was not resolved in the telecon.

*(Note that a second VONA was not issued, but determined to be in compliance with ICAO Doc 9766 which states VONA is issued by a VO when a color code changes or within a color-code level when an ash-producing event or other significant change in volcanic behaviour occurs)*

v. Recommendation 11: Clarify the status and description of eruption and if changes occur and make the information easily available:

- Monitor means of issuance of VONA in guidance material (ICAO Doc 9766) expected by November 2013 to support the introduction of VONA in Amendment 76 to Annex 3 (note 2 of 4.1). Also, indicate duration of event and if additional ash is expected.
- VONA should comply with VONA format and consider future changes provided by the World Organization of Volcano Observatories (WOVO).
- Consider posting test VONA on website
- Clarify how differences of volcanic ash height observed and reported would be handled by VAAC Tokyo (e.g. maximum height used) as well as reporting in terms of flight level for consistency. Include in exercise directive and contingency plan.
- Monitor results of IAVWOPSG with reference to including colour code in VAA (noting IAVWOPSG invited WOVO to develop further suitable guidance material, in view of fostering the

increased use of the aviation colour code and VONA by VOS)

w. Lesson 12: A SIGMET on volcanic ash issued by Yelizovo (PK) MWO did not include the forecast position at the end period of validity of SIGMET and the timelines and test code (9999) not observed in the first test SIGMET message

*Note: A forecast position was not included at the end period of validity of SIGMET because first VAA, issued by VAAC Tokyo had not forecast such position of VAA within PK FIR. However, in accordance with next VAA, VA cloud appeared again within PK FIR as observed, therefore MWO Yelizovo again issued test SIGMET about only OBS VA CLD. Perhaps in such case it should be done as “FCST 0440Z VA CLD MOV ANCHORAGE (OR ANOTHER) FIR” at the end period of validity of SIGMET.*

x. Recommendation 12:

- Clarify in next exercise when to include volcanic ash forecast in SIGMET and provide templates on SIGMET well in advance. Yelizovo (PK) MWO should also utilize the test code and provide SIGMET in a timely manner. If VAAC Tokyo does not forecast position of ash cloud within PK FIR that includes the end period of validity of SIGMET, MWO Yelizovo will indicate that VA cloud is moving toward another FIR (e.g. Anchorage, Fukuoka) – and could also consider issuing interim SIGMET based on the wind.
- To assist in the creation of SIGMET, consider depicting the FIR boundaries on VAG to allow easy (at-a-glance) interpretation of VA CLD position in relation to FIR boundaries

y. Lesson 13: Include more special air-reports on volcanic ash in next exercise considering standard communications (proper WMO header and communication flow: Aircraft-ACC- MWO-VAAC)

z. Recommendation 13: Include active participation by airlines in providing special air-reports on volcanic ash in the next exercise directive using routing in accordance to Annex 3 (Aircraft-ACC-MWO-VAAC)

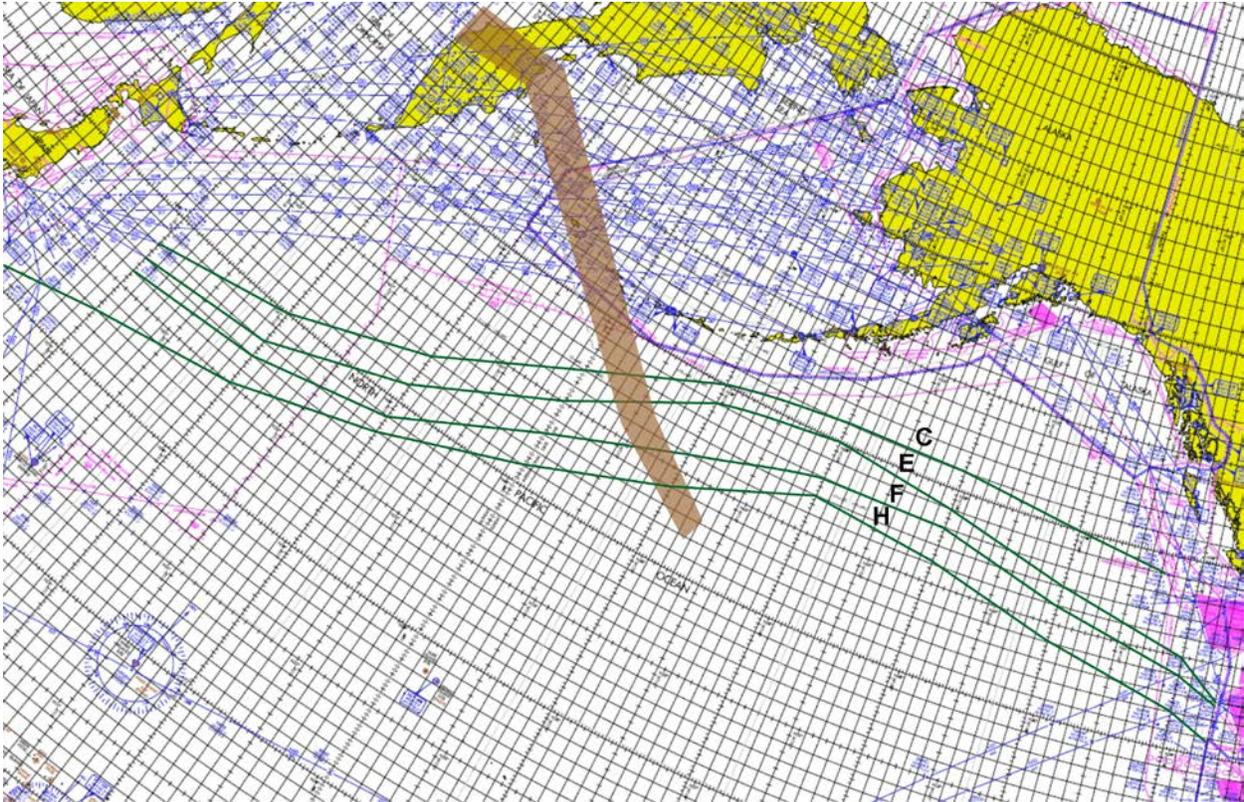
aa. Lesson 14: Exercise timeline was not practical between second and third issuance of VAA/VAG resulting in a considerably long lull time noting that in some facilities there was a shift change.

bb. Recommendation 14: Consider compressing the time between the second and third issuance of VAA/VAG in the exercise directive (for test purposes only).

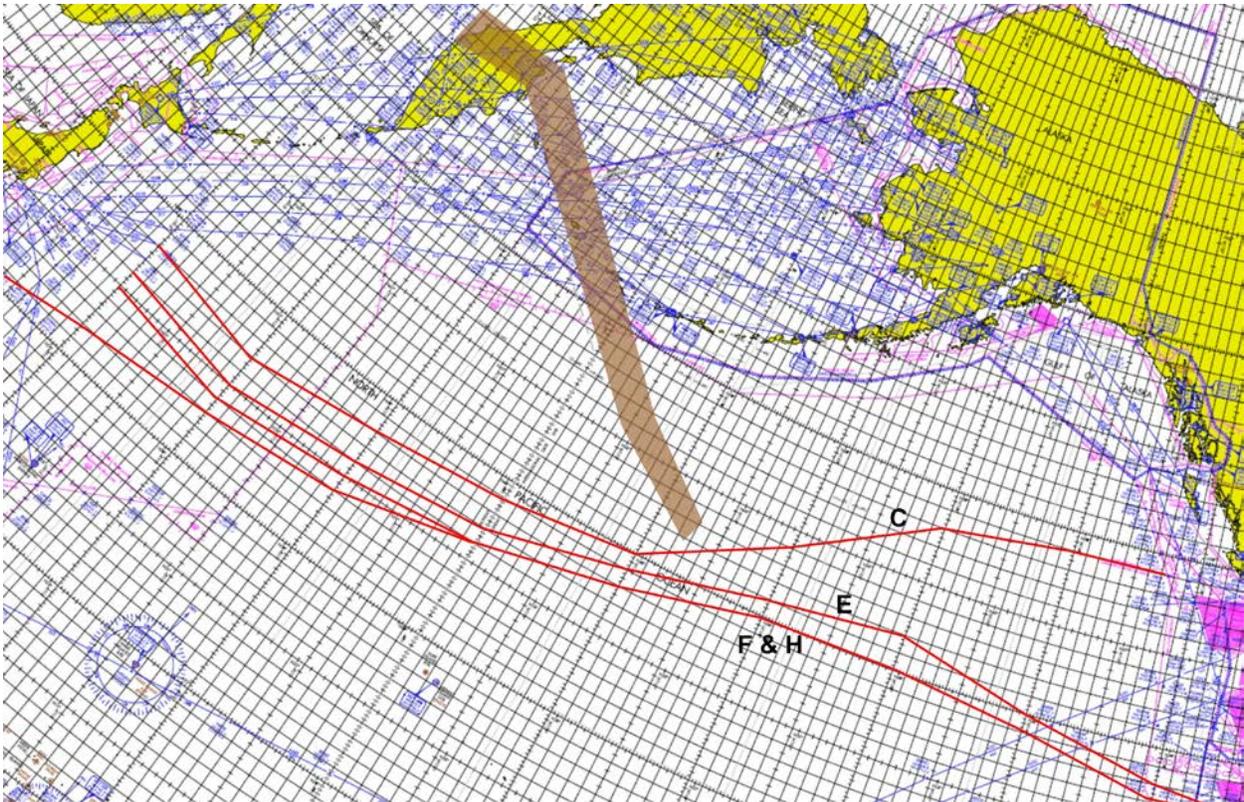
## 2. Discussion

2.1. The VOLKAM 13 exercise was a valuable exercise that provided many lessons learned and recommendations. Not all of the VOLKAM13 “lessons learned” fall into the scope of the IPACG meeting for action, but the meeting should consider addressing issues that lie within their jurisdiction.

2.2. On 15 and 20 October, 2013 there were eruptions of Kamchatka Volcano Klyuchevskoy which led to ash plumes which had an effect on the PACOTS Tracks. American Airlines (AAL) presented a case study of events on 16 October 2013 during the eruption at the CPWG/16 meeting (CPWG WP/04). Ash levels were forecasted to reach FL280. Based on subsequent advisories issued by Tokyo Volcanic Ash Advisory Center (VAAC) and volcanic ash Significant Meteorological Information (SIGMETs) issued by a contract weather information provider, there was concern of possible greater impact than originally anticipated. This caused a revision to the Pacific tracks 10 degrees south of their original location.



INITIAL 16/10/13 WESTBOUND PACOTS WITH KLYUCHEVSKOY ASH PLUME PROJECTION



REVISED 16/10/13 WESTBOUND PACOTS WITH KLYUCHEVSKOY ASH PLUME PROJECTION

2.3. Following coordination with the FAA Air Traffic Control System Command Center (ATCSCC), other airlines, Anchorage and Oakland ARTCCs, the AAL dispatcher arranged a reroute to an airborne aircraft. The flight crew had to work out the revised routing with the domestic ATC Controller working the flight at the time. It took the flight crew 30-45 minutes to work out the final routing up through Canada with ATC.

2.4. During the discussion of the events, the FAA arranged for an ad-hoc telecom with the operators. Some of the participants were domestic dispatchers and did not understand the volcanic situation in the Pacific airspace. The airlines agreed that international dispatchers should be involved. At CPWG/16, the FAA agreed to look into issues relating to communications between dispatchers and the ATCSCC. Another similar volcanic event occurred during which three different agencies were issuing SIGMETs for a similar area

### **3. Action by the meeting**

3.1. The FAA requests that the IPACG Providers Meeting should work together to develop procedures for PACOTS publication when a Volcanic Ash event is encountered. The FAA has considered the events of the VOLKAM13 exercise and the Klyuchevskoy eruption and would like to propose the following procedures as a starting point for Planning Team discussions:

3.2. From the VOLKAM13 exercise Communications are a key point of determining the proper actions to be taken in the event of a volcanic ash event. VOLKAM13 Lesson Learned number 8 calls for formalized teleconferences for Collaborative Decision Making (CDM). It is important that all of the correct participants have a chance to participate in the CDM teleconference. The FAA ATCSCC frequently uses CDM teleconferences as an effective means of creating timely discussion where all participants can be involved in the discussion as it progresses. In the event of the Klyuchevskoy Ash event, the FAA arranged for an Ad-Hoc telecom to discuss the eruption and PACOTS plans. In the future when a volcanic ash event occurs that affects traffic flows between the IPACG ATC service providers (normally PACOTS traffic), a teleconference should be arranged with all of the affected parties. This would include ANSPs, international operators, and VAACs. Unless speaking teleconference participants would be directed to place their phones on mute to prevent unwanted background noise.

3.3. From VOLKAM13 Lesson 4, a VAG is valid for 18 hours in the future. PACOTS Tracks are generated as much as 24 to 30 hours ahead of the valid times. Confidence in the accuracy of the VAG is reduced after the 18 hour outlook. It may be necessary to delay publication of the PACOTS tracks until there is an accurate Volcanic Ash forecast which covers the valid time of the affected PACOTS Track.

3.4. In the teleconference, the parties would hopefully reach agreement on the affected airspace by the ash plume. In the event that agreement cannot be reached on the airspace affected by the ash plume but credible evidence exists that the PACOTS routes will be impacted by the ash plume, then the PACOTS Tracks would be generated around the forecast ash plume. This conservative approach will give better opportunity for aircraft to remain clear of the forecasted ash.

ICAO Doc 9974 Chapter 2 states:

#### **THE AIRCRAFT OPERATOR**

2.3 ICAO's generic safety risk assessment process is described in the *Safety Management Manual* (SMM) (Doc 9859). An approach, aligned with an operator's SMS, would be equally appropriate. The material in this document is designed to provide States with information to support operators in developing the safety risk assessment, within their SMS, covering the volcanic cloud hazard.

#### **2.4 Responsibilities**

- a) The operator is responsible for the safety of its operations.
- b) In order to decide whether or not to operate into airspace forecast to be, or aerodromes known to be, contaminated with volcanic ash, the operator should have in place an identifiable safety risk assessment within its SMS.

*Note.— Guidance on the production of a safety risk assessment is provided in Appendices 1 (Guidelines for completing a safety risk assessment), 2 (Procedures to be considered when conducting a safety risk assessment) and 3 (Hazards and risks to be considered by aircraft operators). Each operator should develop its own list of procedures and hazards since these have to be relevant to the specific equipment, experience and knowledge of the operator, and to the routes to be flown.*

## THE CIVIL AVIATION AUTHORITY

2.3 ICAO's safety risk assessment process is described in the *Safety Management Manual* (SMM) (Doc 9859). An approach, aligned with an organization's SMS, would be equally appropriate.

2.10 The State is advised that the CAA exercising oversight of an operator that intends to undertake operations into airspace forecast to be, or aerodromes known to be, contaminated with volcanic ash should establish a methodology for evaluating the safety risk assessment process of the operator's SMS particular to volcanic ash. The operator should not be prevented from operating through, under or over, airspace forecast to be affected by a VAA, VAG or SIGMET provided it has demonstrated in its SMS the capability to do so safely. The guidance set out in Appendix 6 indicates a process that the CAA can use to achieve this outcome.

3.5. The operator is responsible for the safety of their operations. As long as the operator has completed a safety risk assessment within their SMS, it is their decision to operate in airspace forecast to be contaminated with volcanic ash. If the PACOTS are generated around forecast ash plume, this typically drives the PACOTS Tracks further south than the optimum placement of the tracks. This creates inefficiency in the PACOTS Tracks and causes extra fuel burn but maintains a safe location for the PACOTS Track. If an operator has completed their safety risk assessment, and determined that it is safe for them to fly a UPR north of the ash plume influenced PACOTS, the IPACG ANSPs would allow it.

3.6. The Air Traffic Controller responsibilities in the event of an ash cloud are covered in ICAO Doc 4444 paragraph 15.8:

### 15.8 PROCEDURES FOR AN ATC UNIT WHEN A VOLCANIC ASH CLOUD IS REPORTED OR FORECAST

15.8.1 If a volcanic ash cloud is reported or forecast in the FIR for which the ACC is responsible, the controller should:

- a) relay all information available immediately to pilots whose aircraft could be affected to ensure that they are aware of the ash cloud's position and the flight levels affected;
- b) suggest appropriate re-routing to the flight crew to avoid an area of known or forecast ash clouds;
- c) inform pilots that volcanic ash clouds are not detected by relevant ATS surveillance systems;
- d) if the ACC has been advised by an aircraft that it has entered a volcanic ash cloud the controller should:
  - 1) consider the aircraft to be in an emergency situation;
  - 2) not initiate any climb clearances to turbine-powered aircraft until the aircraft has exited the ash cloud; and
  - 3) not initiate vectoring without pilot concurrence.

*Note.— Experience has shown that the recommended escape manoeuvre for an aircraft which has encountered an ash cloud is to reverse its course and begin a descent if terrain permits. The final responsibility for this decision, however, rests with the pilot.*

3.7. In the event that an aircraft flight plans a UPR north of the PACOTS into an ash cloud, the ANSP will follow the procedure listed above to make sure the aircraft is aware of the ash cloud. If the operator elects to continue through the ash cloud because they have completed their safety assessment and found the risk to be acceptable, that is their prerogative.

3.8. The meeting is requested to discuss this topic and develop procedures for handling volcanic ash clouds. This is especially important as it relates to PACOTS Track Generation.