



Sixth Meeting of CNS/MET Sub-Group of APANPIRG

Bangkok, Thailand, 15 – 19 July 2002

Agenda Item 14: Regional preparations for the MET Divisional Meeting (2002)

THE NEW ZEALAND VOLCANIC ASH ADVISORY SYSTEM

(Presented by New Zealand)

SUMMARY

This paper describes the background, purpose, functions and responsibilities in the New Zealand Volcanic Ash Advisory System.

1. Introduction

1.1 The Civil Aviation Authority of New Zealand (CAA) now recognize the New Zealand civil aviation industry's ability to manage its operations in proximity to volcanic ash with the aid of accepted civil aviation procedures and new information flow systems described in this paper. The Volcanic Ash Advisory System (NZVAAS) is primarily provided through the interactions of aircraft operators, Airways Corporation of New Zealand (ACNZ) and Meteorological Service of New Zealand (MetService). There is also important ground based volcanic information input from the Institute of Geological and Nuclear Sciences (IGNS).

1.2 The CAA no longer takes any part in the provision of operational volcanic ash information; however, it does continue to promote awareness of the NZVAAS and an understanding of the volcanic ash threat to civil aviation in New Zealand.

1.3 This paper is intended to illustrate the relationships between the NZVAAS participating agencies and show their various obligations in providing enhanced volcanic ash information to the civil aviation industry. In doing so it sets out supplementary procedures to the accepted ICAO practices, in particular the International Airways Volcanic Watch (IAVW) and Volcanic Ash Advisory Centre (VAAC) obligations and responsibilities.

2. Development Background

2.1 The volcanic activity of Mt Ruapehu had a significant impact on civil aviation in New Zealand during 1995 and 1996. Many flights were cancelled and many more diverted or re-routed. These episodes were the first time volcanic ash has impacted on modern aviation in New Zealand. New Zealand has a number of active volcanoes on or near the mainland and a number of volcanoes within its IAVW area of obligation.

2.2 The CAA operated a special Volcanic Ash Watch Office throughout the 1995/6 periods of volcanic activity at Mt Ruapehu. The Office's prime task was to manage volcanic ash affected airspace, restricted and danger areas, through the issue of NOTAMs.

2.3 A CAA and airline industry fact-finding team went to North America in July/August 1996 where it sought advice on ways of operating aircraft near volcanic ash with minimum disruption.

It was widely accepted that there was an increasing risk to aviation worldwide from the ejection of volcanic ash into the atmosphere. As a result of the fact-finding team's report, the way that ash affected airspace was managed and the type and volume of information available on that airspace was reviewed. The main issues to safely allow civil aviation to continue in proximity to volcanic ash were; ownership of the advisory system, improving alerts, improved tracking and drift prediction, operational communication and on-going education.

2.4 Work has continued in New Zealand to address these issues including: awareness promotion articles and posters printed and distributed by the CAA; incorporation by airlines of procedures to routinely report volcanic and ash activity using the standard VAR forms and procedures; improved ground based monitoring of volcanoes and implementation of alert paging systems linked to seismic monitoring equipment by IGNS; MetService has reviewed and strengthened its production of volcanic ash SIGMETs and its use of ash trajectory and dispersion models and ACNZ has set up a system to manage alternative routes affected by volcanic ash and implemented a CAA defined set of standard, ready to use, Volcanic Hazard Area NOTAM.

2.5 Success in reducing the disruptive effects of ash on aviation is determined by information on the eruptions and the communication of relevant information to all interested parties. The NZVAAS primarily contemplates the three most risky volcanoes; Ruapehu, Ngauruhoe and White Island but does take into account any other volcano in New Zealand's area of responsibility.

3. The Main Volcanoes

3.1 New Zealand has a number of volcanoes, each with its own eruptive characteristics. Scientific study indicates that the majority must be considered as dormant, rather than extinct, and that they will produce eruptions at some indeterminate time in the future. New Zealand volcanoes can be classed as those that are frequently active or reawakening and those that are not. The cone volcanoes Ruapehu, White Island and Ngauruhoe are classified as frequently active and pose a real threat to aviation in New Zealand. Prior to any eruption, physical precursors are expected to be identifiable; these may develop over time frames of days (and possibly only hours) for the basaltic sites, over months for andesitic sites, and over years for the rhyolitic sites. Such precursors provide the basis for the formulation and issue of warning information.

3.2 A volcanic eruption will produce a number of hazards, including ash that will have an effect on hundreds of kilometres of airspace. A volcanic event may build up over weeks to years and be relatively difficult to predict in its probable course and timing. However, ash ejected into the atmosphere can be tracked and its course predicted using conventional and developing meteorological methods. There is therefore a need for flexibility when undertaking volcanic planning. How these issues are managed can depend upon the known characteristics of each volcano, the amount of ash ejected and the prevailing conditions at the time of, or during, the event.

4. Volcano Alert Level

4.1 Ongoing volcano surveillance enables the background, or normal status, of a volcano or volcanic field to be determined. Variations of monitored parameters may indicate a change of status and the onset of an eruptive episode. An assigned 'Scientific Alert Level' defines the status of a volcano at any given time. [Table 1 in Attachment 1 sets out the Scientific Alert Level criteria.](#)

4.2 The New Zealand Volcano Scientific Alert Levels are based on a six-level system, with each level defining a change of status at the volcano or field. The lowest level (*dormancy*) is signified by '0' and the highest (large hazardous eruption) by '5'. The scale or size of an event will vary from volcano to volcano, ie; a Level '3' event at Ruapehu will be larger than a Level '3' at Ngauruhoe. Where information from the IGNS volcano surveillance programme indicates a change in a volcano's status (either up or down), IGNS will adjust the Scientific Alert Level by issuing a 'Science Alert Bulletin'.

4.3 In the case of a volcano in the ‘re-awakening’ category, a move from Level ‘0’ to Level ‘1’ does not necessarily signal imminent volcanic activity. Historically, seismic and deformation episodes have occurred at Taupo, Auckland, Rotorua, Okataina, and Raoul Island, which would have resulted in an adjustment to a level ‘1’ alert with no accompanying eruption threat. Similar episodes leading to Level ‘1’ alerts for volcanoes in the ‘re-awakening’ category may be expected every 5 - 10 years.

4.4 Importantly, for the civil aviation community a change in the Scientific Alert Level triggers the immediate generation, or change of, a NOTAM on a Volcanic Hazard Area (VHA).

5. **System Participation Roles**

5.1 Set out in [Attachment 1](#) is a schematic diagram showing the lines of communication and responsibility of participants in the NZVAAS.

5.2 ***Civil Aviation Authority of New Zealand***

5.2.1 The CAA is responsible for ensuring a satisfactory means exists whereby civil aviation aircraft operations can be safely carried out near volcanic ash. The CAA is not responsible for providing any service to airlines to directly assist them with such operations. The CAA’s role is to:

- (a) Review the effectiveness of the volcanic ash information system from time to time.
- (b) Ensure ACNZ, MetService and IGNS have any delegations or permissions required under the Civil Aviation Act 1990 to carry out their roles.
- (c) Publish, in the appropriate medium a clear statement of how the volcanic ash information system works in New Zealand.
- (d) Continue to publish any appropriate educational or technical information on aircraft operation in or near volcanic ash, the volcanic situation in New Zealand or any other relevant material.
- (e) Establish any new Volcanic Hazard Areas (VHA) that may be needed to cover volcanoes other than those contemplated in this paper.

5.3 ***Meteorological Service of New Zealand Ltd***

5.3.1 MetService’s responsibility is to provide civil aviation with enhanced and timely volcanic ash SIGMETs and any other volcanic activity or ash information packages required pursuant to New Zealand’s ICAO obligations, and to maintain volcanic NOTAMs. MetService’s role is to:

- (a) Maintain a watch over actual and possible volcanic events through the use of satellite and land based meteorological information systems and the use of atmospheric trajectory and dispersion models.
- (b) Notify IGNS of any possible eruption detected in New Zealand not already notified by IGNS.
- (c) Use suitable atmospheric trajectory and dispersion models to identify the probable path of ejected ash.
- (d) Use all appropriate internal and external procedures to generate timely SIGMETs to notify civil aviation of the present and likely future position of volcanic ash in New Zealand’s area of responsibility.
- (e) Maintain a Volcanic SIGMET watch and update the SIGMET bulletin as frequently as possible and within the ICAO guide-lines.
- (f) Provide any extra information such as satellite imagery, ash trajectory information or other graphics that may be requested by civil aircraft operators.
- (g) Provide information to IGNS such as wind profile data or independent observation information that may be appropriate.

- (h) When notified by IGNS of a change in the official activity level (Scientific Alert Levels) immediately request ACNZ to issue the appropriate NOTAM.
- (i) Maintain the currency of any related NOTAM in liaison with ACNZ.
- (j) Maintain a watch on technological developments and apply any advances in this area to operations.

5.4 *Airways Corporation of New Zealand Ltd*

5.4.1 The responsibility of ACNZ is to provide to civil aviation the NOTAM service, access to volcanic SIGMET and appropriate VAR information pursuant to New Zealand's ICAO obligations. It also collects, from aircraft, VAR information and disseminates this information to MetService, IGNS and accessible aircraft operators. The ACNZ role is to:

- (a) Ensure that meteorological reports (METARs, SPECIs) passed to MetService and civil aviation contains appropriate information on the presence (or not as the case may be during a volcanic episode) of volcanic ash or other volcanic phenomena.
- (b) Ensure that all AIREPs containing information on volcanic ash and Volcanic Activity Reports (VARs) received from aircraft are passed with utmost urgency to MetService and any other addressees on the VAR distribution list.
- (c) Ensure that updated Volcanic SIGMETs routinely provided by MetService are expeditiously passed to aircraft in flight, especially those operating in the vicinity of any ash.
- (d) Upon the receipt of a notification from MetService that the Scientific Alert Level of a given volcano has been changed, immediately issue the appropriate NOTAM. ([Table 2 in Attachment 1 defines the vertical and horizontal limits of the VHA for given scientific alert levels](#))
- (e) Notify MetService 24 hours before the expiry of any given NOTAM and request an update or confirmation of cancellation.
- (f) Set up a system to notify operators which routes and procedures will be affected by each level of volcanic activity.
- (g) Ensure that VFR or IFR aircraft that require an ATC clearance to operate within the areas of concern will not be granted a clearance without a specific route request from the pilot.

5.5 *Institute of Geological and Nuclear Sciences*

5.5.1 The prime responsibility of IGNS is to keep MetService informed as to any volcanic activity taking place in New Zealand. The role of IGNS is:

- (a) Maintain monitoring of volcanoes in New Zealand territory and the VAAC area of responsibility, particularly Ruapehu, Ngauruhoe and White Island, on a 24-hour basis. This should encompass the ability to confirm or deny any reported or suspected ash eruption.
- (b) Notify MetService of any change in assessed official activity level (ie; Scientific Alert Levels) immediately that decision has been made.
- (c) Notify MetService should the risk assessment of any volcano change positively or negatively (ie; Scientific Alert Bulletin).
- (d) Advise MetService of any new eruption information as it becomes available. This includes information on; eruption time and expected activity period, eruption type (steam, gas, ash) and any other relevant advice.

5.6 *Aircraft Operators*

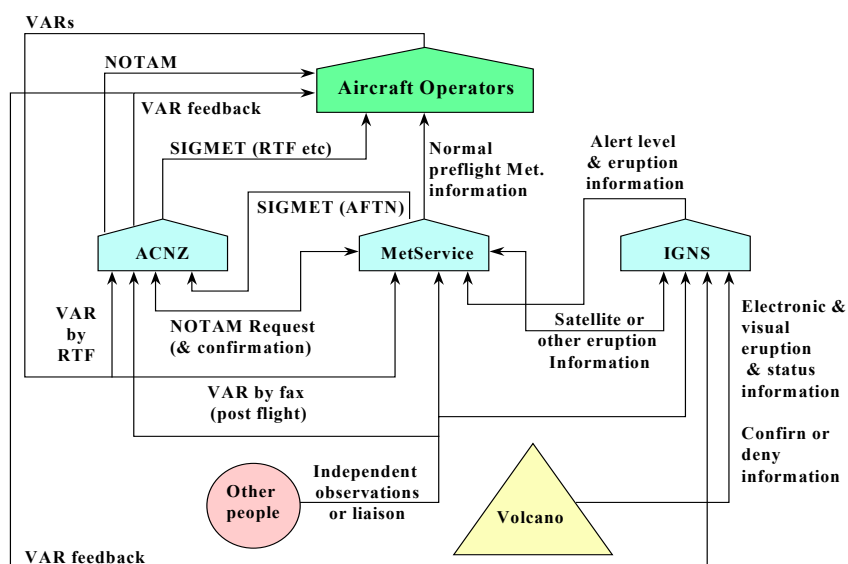
5.6.1 The responsibility of aircraft operators is to ensure their aircraft do not operate in volcanic ash and to provide Volcanic Activity Reports (VARs) when appropriate. Their role is to:

- (a) Ensure procedures are incorporated in operations manuals for the reporting of volcanic events and ash, including the generation and distribution of these reports (VARs) following the prescribed international guidelines (ICAO).
- (b) Ensure that aircrew are fully aware of their civil aviation regulatory obligations insofar as Volcanic Conditional areas (NOTAM) are concerned.
- (c) Ensure that aircrew have adequate background knowledge of the atmospheric and airframe effects of volcanic events especially in the context of the New Zealand volcanic situation.
- (d) Ensure procedures are incorporated in operations manuals for the safe operation of aircraft near areas of volcanic ash.
- (e) Ensure ACNZ is aware of their particular ash episode re-route preferences.

6. **Action by the Meeting**

6.1 The meeting is invited to

- (a) Note the content, and
- (b) Exchange views on the various matters discussed in this paper.

Schematic 1, New Zealand Volcanic Ash Advisory System**Table 1, New Zealand Volcanic Scientific Alert Level System**

FREQUENTLY ACTIVE VOLCANOES White Island, Tongariro -Ngauruhoe, Ruapehu		SCIENTIFIC ALERT LEVEL	REAWAKENING VOLCANOES Kermadecs, Northland, Auckland, Mayor Island, Rotorua, Okataina, Taupo, Egmont	
Volcano Status	Indicative Phenomena		Indicative Phenomena	Volcano Status
Usual dormant or quiescent state.	Typical background surface activity; seismicity, deformation and heat flow at low levels.	0	Typical background surface activity; seismicity, deformation and heat flow at low levels.	Usual dormant or quiescent state.
Signs of volcano unrest.	Departure from typical background surface activity.	1	Apparent seismic, geodetic, thermal or other unrest indicators	Initial signs of possible volcano unrest. No eruption threat.
Minor eruptive activity.	Onset of eruptive activity, accompanied by changes to monitored indicators.	2	Increase in number or intensity of unrest indicators (seismicity, deformation, heat flow etc.).	Confirmation of volcano unrest. Eruption threat.
Significant local eruption in progress.	Increased vigour of ongoing activity and monitored indicators.	3	Minor eruptions. High increasing trends of unrest indicators, significant effects on volcano and possibly beyond.	Minor eruptions commenced. Real possibility of hazardous eruptions.
Hazardous local eruption in progress.	Significant change to ongoing activity and monitoring indicators. Effects beyond volcano.	4	Eruption of new magma. Sustained high levels of unrest indicators, significant effects beyond volcano.	Hazardous local eruption in progress. Large scale eruption now possible.
Large hazardous eruption in progress.	Destruction with major damage beyond volcano. Significant risk over wider areas.	5	Destruction with major damage beyond active volcano. Significant risk over wider areas.	Large hazardous volcanic eruption in progress.

Table 2, Automatic Volcanic Hazard Area Limits for NOTAM

Volcano Alert Level	Radius from Vent (nm)	Volcanic Hazard Area Upper Limit			
		Ruapehu (NZC 314)	Ngauruhoe (NZC 313)	White Island (NZC 211)	Any other NZ volcano
1	3	12,200ft AMSL	10,500ft AMSL	4,500ft AMSL	3000 ft above vent
2	8	FL 150	FL 150	FL 150	FL 150
3	16	FL 330	FL 330	FL 330	FL 330
4	27	FL 480	FL 480	FL 480	FL 480
5	>50	unlimited	unlimited	unlimited	Unlimited