Doc 9766-AN/968

HANDBOOK ON THE INTERNATIONAL AIRWAYS VOLCANO WATCH (IAVW)

OPERATIONAL PROCEDURES AND CONTACT LIST

Approved by and published under the authority of the Secretary General

INTERNATIONAL CIVIL AVIATION ORGANIZATION

DOCUMENT CHANGE RECORD

Parts 1 to 4

DATE	SECTION/PAGES AFFECTED	
16.9.24	Part 1	Addition of an introduction to the document
	Part 2	Updates concerning VAAC Darwin and VAAC Toulouse Update to the map; inclusion of ICAO GIS Aeronautical Data website link.
	Part 3	Updates to 3.1 and 3.3.
	Part 4	4.1.1 b) – clarification on the provision of meteorological information to volcano observatories 4.1.1 g) – update regarding how the Smithsonian GVP volcano list is being kept up to date 4.1.4 – inclusion of text concerning the importance of volcanic ash information for flight safety Note 1 to 4.1.5 – updating to Sendai Framework goals Note 2 to 4.1.5 – information on coordination between SVOs regarding volcanoes located at State borders 4.2 – substantial rewrite regarding actions to be taken by SVO Note 1 to 4.5.1 a) – addition of a reference to regional air navigation plans for the complete list of MWOs and ACCs/FICs associated with each VAAC, together with their contact information 4.6.1 a) – removal of suggestion to send volcanic ash advisory information to SITA AFTN address 4.6.1 c) – update VAG dissemination to VAAC website only, clarification of the name of VAAC in back-up advisories 4.6.1 f) – update of Global Volcanism Program information Note 2 to 4.6.1 i) update to the location of eruption source parameter data 4.6.2 – update to suggested inclusions in volcanic ash advisory information for re-suspended volcanic ash Deletion of 4.6.4 – no longer required 4.8 – update to reflect status indicator in volcanic ash advisory information and SIGMET templates Table 4-1, update to VAAC Darwin and VAAC Wellington AFTN addresses Table 4-2, VAACs Anchorage, Buenos Aires, Darwin, London, Montreal, Tokyo, Toulouse, Washington, Wellington contact details Table 4-3 – addition of IWXXM headers, update of some back-up headers, addition of VAACs Montreal and Darwin as VAAC Washington back-up

DATE	SECTION/PAGES AFFECTED	
		VAACs Table 4-4 – addition of 'UNASSIGNED' to aviation colour code and inclusion of explanatory note for re-suspended ash cases Appendix C – inclusion of Note to point 6 to clarify requirement for rebroadcast volcanic ash advisory information for ash near a VAAC boundary Appendix D – updates to VAAC backup requirements information Appendix F – addition of 'UNASSIGNED' to aviation colour code Appendix G – update of reference to ICAO Doc 9082, deletion point 6 due to broken link, deletion point 9 and following table as outdated Throughout – update to ensure consistent reference to State volcano observatories
	Part 5	See Part 5 change record
10.3.20	Part 2	Page 2-10, Washington
8.5.19	Part 5	Italy
6.1.19	Part 4	Table 4-2, VAAC Wellington contact numbers
8.11.18	Part 4	Editorial amendments (references)
	Appendix A	Editorial amendments (references)
6.4.18	Part 3	Updates to 3.1 and 3.2
	Part 4	Table 4-2, VAAC Anchorage e-mail address and homepage; VAAC Buenos Aires homepage, VAAC Tokyo e-mail address and homepage; and VAAC Washington e-mail address and homepage
2.3.18	Part 4	Table 4-2, VAAC Buenos Aires website address
30.11.17	Part 2	Update to VAACs Anchorage and Japan; update of VAAC Areas of Responsiblity map
	Part 4	Amendment to 4.1.1 b); amendments to Sections 4.2 to 4.6, including new Note 5 to 4.2.1, new Note 3 to 4.5.1 d), new note to 4.6.1. c), and new 4.6.2; updates to Tables 4-2 and 4-3
	Appendix A	Amendment to include "FIC(s)" and updating of references to MET tables, and amendment to 4.2.1
	Appendix F	Amendment to 4.1
	Appendix G	Amendment to paragraphs 2 and 3
16.8.16	Part 2	Updates to VAAC Toulouse MWO location names

DATE	SECTION/PAGES AFFECTED	
	Part 4	Table 4-2, VAAC Tokyo e-mail address
27.1.16	Part 2	Updates to VAACs London and Toulouse MWO location names and location indicators
30.6.15	Part 2	Update of description of London VAAC area of responsibility and updates to VAACs Anchorage, London, Montreal, Tokyo, Toulouse and Washington MWO and ACC/FIC location names and location indicators
	Part 4	Table 4-2, VAAC Wellington contact numbers Table 4-3, VAAC Buenos Aires back–up VAAC and VAG bulletin headers
26.11.14	Part 4	Amendment to paragraph 4.6.1 h) and deletion of Notes 1 and 3
	Appendix C	Amendment to existing text and insertion of new text
21.11.14	T of C	Addition of new sections in Part 4, Table 4-4 and Appendix G, update of page numbers
	Part 2	Changes to descriptions of areas of responsibility and updates to VAAC Tokyo MWO and ACC/FIC location names and location indicators
	Part 3	Update of link to Canadian Meteorological Centre
	Part 4	Update of phases of eruption in Section 4.1, new Sections 4.7 and 4.10, and change to Table 4-3 (IAVWOPSG/8 report refers) New Section 4.2 Amendments to Section 4.3 corresponding to new Table 4-4 Corrections to contact information in paragraphs 4.6.1 and 4.6.3 Editorial improvements to paragraph 4.6.1 Table 4-2, VAAC Buenos Aires and VAAC Montreal contact numbers Table 4-3, VAAC London back-up VAAC VAA and VAG bulletin headers New Table 4-4
	Appendix A	Editorial amendments (references)
	Appendix E	Amendments to lines 3, 7, 11 and 16 and minor editorial amendments
	Appendix G	New appendix
7.8.13	T of C	Addition of Part 4, Appendix F
	Part 2	Change of notation used for latitude and longitude to degrees and minutes and update of corresponding map
	Part 4	Correction to page 4-2 (“ISCS” replaced with “WIFS”), page 4-5 (numbering of sections of the NOTAM amended), insertion of new section 4.8
	Appendix C	Corrections (grammatical) to paragraph 1
	Appendix F	New appendix (Appendix G of IAVWOPSG/7 report refers)
6.11.12	Part 2	Addition of MWOs/ACCs to Tokyo and Toulouse VAACs

DATE	SECTION/PAGES AFFECTED	
25.8.12	Part 3	Correction of website URLs for VAACs Anchorage and Tokyo
17.8.12	Part 2	Rewording of the coordinates for the Toulouse area of responsibility Changes to names and location indicators of aerodromes under Toulouse area of responsibility
	Part 4	Table 4-2, VAAC Washington contact numbers Table 4-3, VAAC Wellington VAA and VAG bulletin headers
21.6.12	Part 4	Update to Table 4-2, VAAC contact numbers – Buenos Aires VAAC
5.6.12	Part 4 and Appendix A	Deletion of references to Vienna International OPMET Data Bank
	Appendix B	Change to title of Appendix B Updating of AFTN addresses for MID and AFI regions
17.2.12	Part 2	Change to Anchorage, Darwin, Washington and Wellington VAAC areas of responsibility and update of corresponding map
	Part 3	Update of VAAC Buenos Aires website URLs (English and Spanish)
	Part 4	Amendment of Sections 4.1, 4.2 and 4.5 Replacement of Section 4.7 (Appendix F of IAVWOPSG/5 report refers.) Table 4-2, update of administrative e-mail for VAAC Anchorage and website URLs for VAAC Buenos Aires (English and Spanish) Table 4-3, update of Tokyo VAG and Wellington VAA bulletin headers
	Appendix C	Miscellaneous amendments
7.10.11	Part 4	Update page 4-13, para 4.7.4, changed para ref. no. 4.6.2 to 4.7.3.
31.8.11	Part 4	Update to Table 4-3, VAA bulletin header
16.8.11	Part 4	Update to Table 4-2, VAAC contact numbers – Anchorage VAAC
8.2.11	Part 4	Update to Table 4-2, VAAC contact numbers – Wellington VAAC
9.12.10	Part 4	Updated page 4-7 added para 4.3.4; page 4.9, para 4.5.1, line 1, added "*volcano observatory"* after "*WMO"*; para 4.5.1 a) added footnote no. 5; para 4.5.1 c) line 3, added "*using the PNG format*" after "*graphical format*" and deleted *"(in a position to do so*)"; page 4-10, added "*see Appendix E – VONA";* page 4-17, Table 4-2. updated VAAC Buenos Aires URL.
25.8.10	Part 4	Updated page 4-7, para 4.3.3 changed the word "ASHTAM" to "NOTAM" and "airport" to "aerodrome".
12.7.10	Part 2	Updated Wellington (New Zealand) area of responsibility text Replaced VAAC Map
	Part 4	New paragraph 4.3.3
8.7.10	Part 4	Replaced Appendix E with updated version Appendix F (new) added
14.5.10	Part 2	Change to Toulouse VAAC area of responsibility
14.4.10	Part 4	VAAC Tokyo

DATE	SECTION/PAGES AFFECTED	
26.11.09	Part 3	Amendment to the URL address for New Zealand VAAC
25.9.09	Part 3	Amendment to the URL address for Buenos Aires VAAC
	Part 4	URL address for the eruption source parameters for volcanoes of the world, and introduction of information regarding the availability of ESP
29.5.09	Part 4	Guidance regarding the transmission of information to aviation by selected State observatories Update regarding the distribution (addresses) of ASHTAM/NOTAM for VA.
14.5.09	Part 4	Introduction of new heading “4.7 Action to be taken by pilots in the event of entry into a SO_2 cloud” and “Table A4-3 – Volcanic ash advisory bulletin headers”
12.3.09	Part 4	Update to Table 4-2, VAAC contact numbers
25.2.09	Parts 3 and 4	Amendment to the URL for Toulouse VAAC
	Part 4	Introduction of new sub-paragraphs 4.5.1 h) recommended practice for “gradual” advisory cessation and 4.6 on standard format of the VA advisories and VA SIGMET used for test purposes
15.12.08	Parts 3 and 4	New web page for VAAC Montreal
24.11.08	Part 4	Pages 4-12 and 14, update of VAAC Buenos Aires AFTN address
19.11.08	Part 2	Page 2-10, Wellington
	Part 4	Page 4-13, Indonesia
22.5.07	Part 4	Buenos Aires
5.11.07	Part 4	Buenos Aires
6.8.07	Part 2 Part 4	Introduction of changes resulting from the IAVWOPSG/3 Meeting Appendices
30.7.07	Part 4	Update of AFTN addresses to be used for sending air-reports, SIGMETs and volcanic ash advisories to London WAFC and SADIS
16.6.07	Part 4	Updated volcano level of alert colour code
14.11.06	Part 4	Introduction of relevant aspects of the Hyogo framework
9.6.06	Part 2	Editorials
	Part 3	Update of VAAC Tokyo homepage
	Part 4	Editorials
2.5.06	Part 4	VAAC Tokyo
24.4.06	Part 2	New format – Inclusion of location indicators for MWOs and ACCs
	Part 4	Deletion of WMO abbreviated headers for ASHTAM and NOTAMs, introduction of Appendix C on back-up procedures and update to VAACs London and Wellington

DATE	SECTION/PAGES AFFECTED	
31.1.06	Part 2	VAACs areas of responsibility
28.11.05	Part 5	Ecuador , Panama
1.11.05	Part 5	Argentina, Chile, Paraguay
30.6.05	Part 5	El Salvador
25.4.05	Part 4	VAAC Buenos Aires
	Part 5	Peru
24.2.05	Part 5	Introduction of Appendix A – Sample letter of Agreement between the ATS, MET authorities and vulcanological authorities and procedures on the transmission of information related to aircraft encounters with volcanic ash (former Appendix A renumbered as B)
29.10.04	Part 4	Introduction of Appendix A on operational procedures for the coordination and transfer of responsibility between VAACs for volcanic ash events
25.10.04	Part 4	AFTN address for ASHTAM/NOTAM
14.9.04	Part 3	VAAC Montreal
1.9.04	Part 2	VAAC Toulouse
16.8.04	Part 2	VAACs Anchorage, London and Toulouse
29.7.04	Part 2	VAACs Buenos Aires, Tokyo and Washington
	Part 3	3.3
	Part 5	Canada, Russian Federation
19.4.04	Parts 3 and 4	VAACs London and Tokyo
3.3.04	Part 2	VAAC Toulouse
	Part 5	Argentina
22.1.04	Parts 3 and 4	VAAC Tokyo

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Part 1

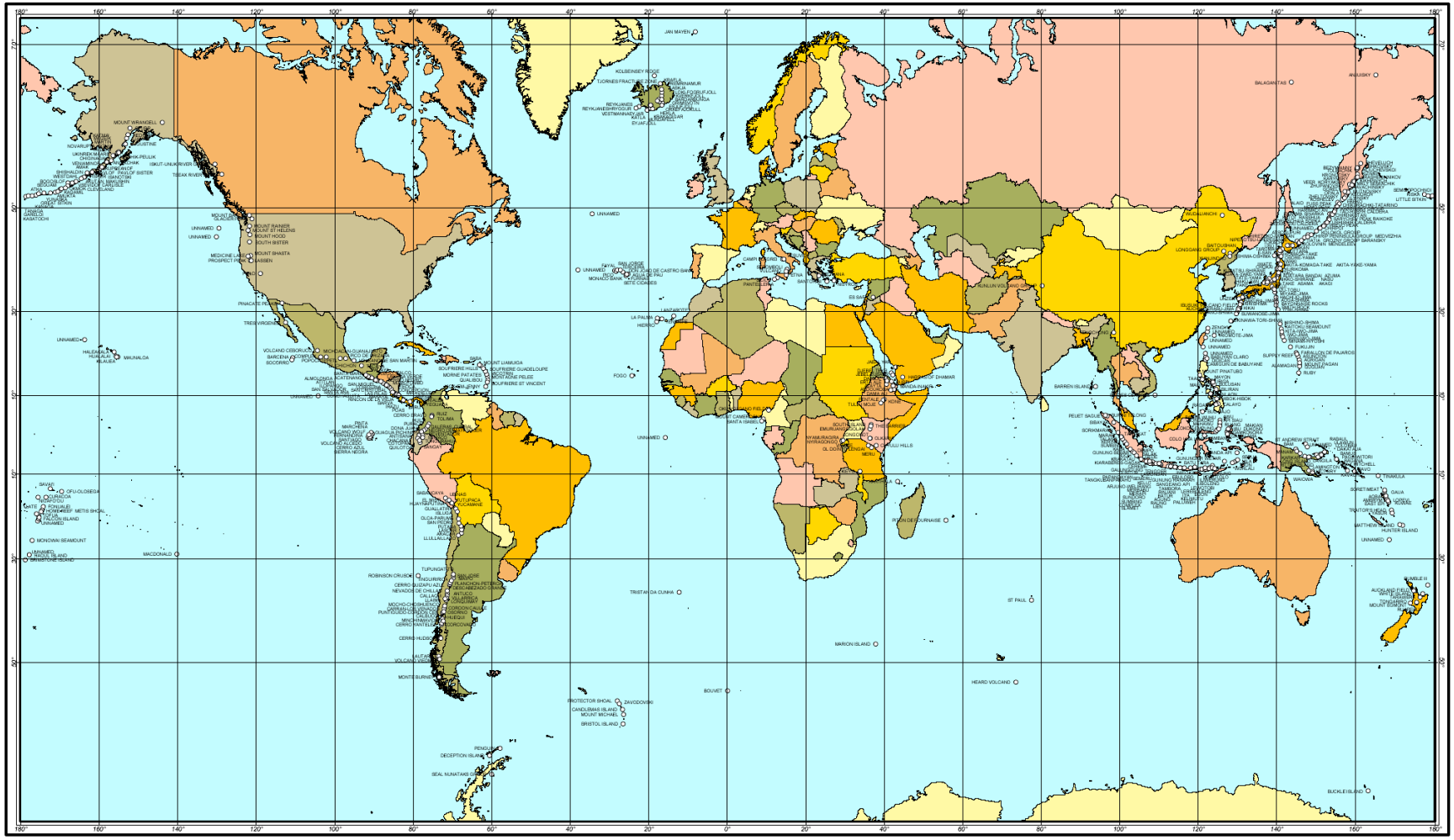
THE INTERNATIONAL AIRWAYS VOLCANO WATCH

1.1 INTRODUCTION

1.1.1 The international airways volcano watch (IAVW) defines a set of international arrangements for monitoring and providing warnings of volcanic ash in the atmosphere. The IAVW is based on the cooperation of both aviation and non-aviation operational units using information derived from observing sources and networks that are provided by States. The watch is coordinated by ICAO with the cooperation of other concerned international organizations.

1.1.2 The purpose of this handbook is to provide information on operational procedures and guidelines for the dissemination of information on volcanic eruptions and associated volcanic ash clouds and gas in areas which could affect routes used by international flights, and necessary arrangements prior to and during a volcanic eruption. It provides further context to the Standards and Recommended Practices (SARPs) provided in Annex 3 – *Meteorological Service for International Air Navigation*.

1.2 VOLCANOES ACTIVE DURING THE LAST 10 000 YEARS



VOLCANOES OF THE WORLD

3000 0 3000 Km

Mercator Projection

Volcanoes with Eruptions During the Last 10,000 Years
Prepared in 1995 by Roland Pool, Smithsonian Institution,
Global Volcanism Program, NHB MRC 119, Washington, DC 20560

A 101x147 cm map, This Dynamic Planet, showing these volcanoes, earthquake epicenters, impact craters, plus tectonic and physiographic data is available from: US Geological Survey, Map Distribution Center, Box 25256, Federal Center, Denver, CO 800225 (800) USA-MAPS

Part 2

VOLCANIC ASH ADVISORY CENTRES (VAACs) DESIGNATED BY ICAO AND THEIR RESPONSIBILITIES

(Note.— VAACs maintain a 24-hour watch)

EXPLANATION OF THE TABLE

Column

1. Location of the volcanic ash advisory centre (VAAC).

2. ICAO location indicator of VAAC (for use in the WMO header of advisory bulletin).

3. Area of responsibility for the preparation of advisory information on volcanic ash by the VAAC in Column 1.

4. MWOs to which the advisory information on volcanic ash should be sent.

5. ICAO location indicator of the MWOs in Column 4.

6. ACCs/FICs to which the advisory information on volcanic ash should be sent.

7. ICAO location indicator of the ACCs/FICs in Column 6.

			MWOs to which advisory information is to be sent		ACCs to which advisory information is to be sent	
Volcanic ash advisory centre	ICAO loc. ind.	Area of responsibility	Name	ICAO loc. ind	Name	ICAO loc. ind
1	2	3	4	5	6	7
Anchorage (United States)	PAWU	Anchorage Oceanic, Anchorage Continental, Oakland Oceanic North of N4300 E16500, N4812 W15000, N4812 W12800 Anchorage Arctic, and West to E15000, North of N6000	Anchorage	PAWW	Anchorage	PAZA
			Edmonton	CWEG	Edmonton	CZEG
			Fairbanks	PAWU	Fairbanks	PAFA
			Kansas City	KKCI	Boston Chicago Cleveland Denver Minneapolis New York Salt Lake Seattle Washington	KSBW KORD KZOB KZDV KZMP KZNY KZLC KZSE KZDC
			Magadan	UHMM	Magadan	UHMM
			Tokyo	RJTD	Tokyo	RJTG
			Yakutsk	UEEE	Yakutsk	UEEE
			Yelizovo (Petropavlovsk-Kamchatsky)	UHPP	Petropavlovsk-Kamchatsky)	UHPP
Buenos Aires (Argentina)	SABM	South of S1000 between W01000 and W09000	Amazònica	SBEG	Amazònico	SBAZ
			Antofagasta	SCFA	Antofagasta	SCFZ
			Asunción	SGAS	Asunción	SGFA
			Brasilia	SBBR	Brasilia	SBBS
			Buenos Aires (Aeroparque)	SABE	Ezeiza	SAEF/SAEU
			Comodoro Rivadavia	SAVC	Comodoro Rivadavia	SAVF/SAVU
			Córdoba	SACO	Córdoba	SACF/SACU
			Curitiba	SBCT	Curitiba	SBCW
			La Paz	SLLP	La Paz	SLLF
			Lima-Callao	SPIM	Lima	SPIM
			Mendoza	SAME	Mendoza	SAMF/SAMV
			Montevideo	SUMU	Montevideo	SUEO
			Puerto Montt	SCTE	Puerto Montt	SCTZ
			Punta Arenas	SCCI	Punta Arenas	SCCZ
			Recife	SBRF	Recife Atlantico	SBRE SBAO
			Resistencia	SARE	Resistencia	SARR/SAEU
			Santiago	SCEL	Santiago	SCEZ

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Volcanic ash advisory centre	ICAO loc. ind.	Area of responsibility	Name	ICAO loc. ind	Name	ICAO loc. ind
1	2	3	4	5	6	7
Darwin (Australia)	YMMC	Southward from N2000 and from E08200 to E10000, and Southward from N1000 and from E10000 to E16000, and the Colombo, Melbourne and Brisbane FIRs	Bangkok	VTBD	Bangkok	VTBB
			Brisbane	YBRF	Brisbane	YBBB
			Chennai	VOMM	Chennai	VOMF
			Colombo	VCBI	Colombo	VCBI
			Gia Lam	VVGL	Hanoi Ho-Chi-Minh	VVNB VVTS
			Honiara	AGGH	Honiara	AGGH
			Jakarta	WIII	Jakarta	WIIF
			Kota Kinabalu	WBKK	Kota Kinabalu	WBFC
			Kuala Lumpur	WMKK	Kuala Lumpur	WMFC
			Manila	RPLL	Manila	RPHI
			Melbourne	YMRF	Melbourne	YMMM
			Port Moresby	AYPY	Port Moresby	AYPM
			Singapore	WSSS	Singapore	WSJC
			Ujung Pandang	WAAA	Ujung Pandang	WAAF
			Yangon	VYYV	Yangon	VYYF
London (United Kingdom)	EGRR	South of the North Pole and North of N7100 between the Prime Meridian and E09000 Bødo Oceanic, Finland, Kobenhavn, London, Norway, Reykjavik, Scottish Shannon Shanwick Oceanic and Sweden	Bergen	ENVV	Norway	ENOR
					Bremen	EDWW
					Brest-Bretagne	LFRB
					Brussels	EBBU
			Chopina W Warszawie	EPWA	Warszava	EPWW
			Danish Meteorological Institute	EKMI	Kobenhavn	EKDK
			De Bilt	EHDB	Amsterdam	EHAA
			Edmonton	CWEG	Edmonton Gander	CZEG CZQX
			Helsinki (MET Institute)	EFKL	Finland	EFIN
					Kalingrad	UMKK
			Lisboa	LPPT	Lisboa	LPPC
					Madrid	LECM
			MET Office Exeter	EGRR	London Scottish	EGTT EGPX
			Oslo	ENMI	Norway*	ENOR
					Paris	LFFF
			Reykjavik	BIRK	Reykjavik	BIRD
					Riga	EVRR
					Sankt Peterburg/ Pulkovo	ULLI
			Shannon	EINN	Shannon Tallinn	EISN EETT
			Stockholm	ESSA	Sweden	ESSA
					Tallinn	EETT
			Tromso	ENVN	Norway	ENOR

			MWOs to which advisory information is to be sent		ACCs to which advisory information is to be sent	
Volcanic ash advisory centre	ICAO loc. ind.	Area of responsibility	Name	ICAO loc. ind	Name	ICAO loc. ind
1	2	3	4	5	6	7
					Trondheim	ENVA
			Vilnius/Intl	EYVI	Vilnius	EYVL
Montreal (Canada)	CWAO	Søndrestrøm, Gander Oceanic, Canadian Continental FIRs (including the Arctic Ocean)	Edmonton	CWEG	Edmonton Gander Moncton Montreal	CZEG CZQX CZQM CZUL
			Reykjavik	BIRK	Reykjavic	BIRD
			Kangerlussuaq	BGSF	Søndrestrøm Toronto Vancouver Winnipeg	BGGL CZYZ CZVR CZWG
Tokyo (Japan)	RJTD	N9000 to N6000 and from E09000 to E15000 and N6000 to N1000 and from E09000 to Oakland Oceanic and Anchorage Oceanic and Continental FIR boundaries except the area within N2000 E09000 to N2000 E10000 to N1000 E10000 to N1000 E09000	Aktobe	UATT	Aktobe	UATT
			Almaty	UAAA	Almaty	UAAA
			Astana	UACC	Astana	UACC
			Bangkok	VTBS	Bangkok	VTBB
			Beijing	ZBAA	Beijing Huhhot Taiyuan	ZBPE ZBHH ZBYN
			Chulman	UELL	Chulman	UELL
			Gia Lam	VVLL	Ha Noi Ho Chi Minh	VVNB VVTS
			Guanzhou	ZGGG	Guandzhou Changsha Guillin Nanning	ZGGG ZGHA ZGKL ZGNN
			Hong Kong	VHHH	Hong Kong	VHHH
			Incheon	RKSI	Incheon	RKRR
			Irkutsk	UIII	Irkutsk	UIII
			Khabarovsky	UHHH	Khabarovsky	UHHH
			Krasnoyarsk	UNKL	Krasnoyarsk	UNKL
			Kunming	ZPPP	Kunming Chengdu Chongqing	ZPPP ZUUU ZUCK
			Lanzhou	ZLLL	Lanzhou Xi'an	ZLLL ZLXY
			Magadan	UHMM	Magadan	UHMM
			Manila	RPLL	Manila	RPHI
			Mirny	UERR	Mirny	UERR
			Murmanansk	ULMM	Murmanansk	ULMM
			Phnom-Penh	VDPP	Phnom-Penh	VDPP
			Pyongyang (Sunan)	ZKPY	Pyongyang	ZKKP
			Sanya	ZJSY	Sanya	ZJSY
			Shanghai	ZSSS	Shanghai Hefei Jinan Nanchang Nanjing Qingdao Xiamen	ZSSS ZSOF ZSJN ZSCN ZSNJ ZSQD ZSAM

			MWOs to which advisory information is to be sent		ACCs to which advisory information is to be sent	
Volcanic ash advisory centre	ICAO loc. ind.	Area of responsibility	Name	ICAO loc. ind	Name	ICAO loc. ind
1	2	3	4	5	6	7
			Shenyang	ZYTX	Shenyang Dalian Hailar Harbin	ZYTX ZYTL ZBLA ZYHB
			Shymkent	UAII	Shymkent	UAII
			Taibei	RCTP	Taibei	RCTP
			Tokyo	RJTD	Fukuoka JCAB ATMC Tokyo Fukuoka Naha Sapporo	RJJJ RJTG RJDG RORG RJCG
			Ulaanbaatar	ZMUB	Ulaanbaatar	ZMUB
			Urumqi	ZWWW	Urumqi	ZWWW
			Wuhan	ZHHH	Wuhan	ZHHH
			Yakutsk	UEEE	Yakutsk	UEEE
			Yelizovo (Petropavlovsk-Kamchatsky)	UHPP	Yelizovo (Petropavlovsk-Kamchatsky)	UHPP
Toulouse (France)	LFPW	Santa Maria Oceanic FIR, AFI Region down to the South Pole, EUR Region (except for Finland*, Kobenhavn, London, Norway*, Scottish, Shannon and Sweden FIRs) West of E09000 and South of N7100, MID Region, and ASIA Region West of E09000 North of N2000 (plus Mumbai, Chennai (West of E08200) and Male FIRs)	Abu Dhabi Intl	OMAA	Emirates FIR	OMAE
			Accra	DGAA	Accra	DGAC
			Addis Ababa	HAAB	Addis Ababa	HAAA
			Alger/CRT	DAMM	Alger	DAAA
			Amman/Queen Alia	OJAI	Amman (ACC/FIC)	OJAC
			Ankara	LTAC	Ankara	LTAA
			Antananarivo	FMMI	Antananarivo	FMMM
			Arkhangelisk	ULAA	Naryan-Mar	ULAM
			Ashgabat	UTAA	Ashgabat	UTAA
			Asmara	HHAS	Asmara	HHAA
			Athinai	LGAT	Athinai	LGGG
			Atyrau	UATG	Aktau	UATE
			Baghdad Intl	ORBI	Baghdad	ORBS*
			Bahrain Intl	OBBI	Bahrain FIR	OBBB
			Barcelona	LEBN	Barcelona	LECB
			Banja Luka	LQBK	Sarajevo	LQSB
			Beirut/Beirut Intl	OLBA	Beirut/Beirut Intl	OLBA
			Beograd	LYBE	Beograd	LYBA
			Bergen	ENVV	Bergen	ENTR
			Berlin	EDZB	Berlin	EDBB
			Bishkek/Manas	UCFM	Bishkek/Manas Osh	UCFM UAFO
			Bodo	ENVN	Bodø	ENOB
			Bordeaux	LFBD	Bordeaux	LFBB
			Bratislava/ M.R. Stefanik	LZIB	Bratislava	LZBB

			MWOs to which advisory information is to be sent		ACCs to which advisory information is to be sent	
Volcanic ash advisory centre	ICAO loc. ind.	Area of responsibility	Name	ICAO loc. ind	Name	ICAO loc. ind
1	2	3	4	5	6	7
			Brazzaville	FCBB	Brazzaville	FCCC
			Bremen	EDZM	Bremen	EDWW
			Brest	LFRN	Brest	LFRR
			Brindisi	LIBR	Brindisi	LIBB
			Brussels	EBBR	Brussels	EBBU
			Bucuresti	LROM	Bucuresti	LRBB
			Budapest Liszt ferenc Intl	LHBP	Budapest FIR	LHCC
			Bujumbura	HBBA	Bujumbura	HBBA
			Cairo Intl	HECA	Cairo/ACC	HECC
			Canarias	GCGC	Canarias	GCCC
			Casablanca	GMMC	Casablanca	GMMM
			Chelyabinsk	USCC	Chelyabinsk	USCC
			Chennai	VOMM	Chennai (+Darwin)	VOMF
			Chisinau	LUKK	Chisinau	LUKK
			Chopina W. Warszawie	EPWA	Warszawa	EPWW
			Dakar	GOBD	Dakar	GOOO
			Damascus/Intl	OSDI	Damascus/Intl	OSDI
			Dar-es-Salaam	HTDA	Dar-es-Salaam	HTDC
			De Bilt	EHDB	Amsterdam	EHAA
			Delhi	VIDP	Delhi	VIDF
			Dhaka	VGZR	Dhaka (+Tokyo)	VGFR
			Dnepropetrovsk	UKDV	Dnepropetrovsk	UKDV
			Dushanbe	UTDD	Dushanbe	UTDD
			Dusseldof	EDZE	Dusseldorf	EDDL
			Entebbe	HUEN	Entebbe	HUEC
			Essen	EDZE	Frankfurt	EDYY
			Estonian Environment Agency	EEMH	Tallinn	EETT
			Frankfurt	EDZF	Langen	EDGG
			Gaborone/SSK	FBSK	Gaborone	FBGR
			Geneva	LSZH	Geneva	LSAG
			Gran Canaria (MET)	GCGC	Canarias	GCCC
			Hamburg MET Reg Centre	EDZH	Bremen Maastricht	EDWW EDYY
			Harare	FVHA	Harare	FVHA
			Hedyar Aliyev Intl	UBBB	Hedyar Aliyev Intl	UBBB
			Helisinki (MET Institute)	EFKL	Finland	EFIN
			(Israel) Meteorological Service	LLBD	Tel-Aviv	LLTA
			Istanbul	LTBA	Istanbul	LTBB

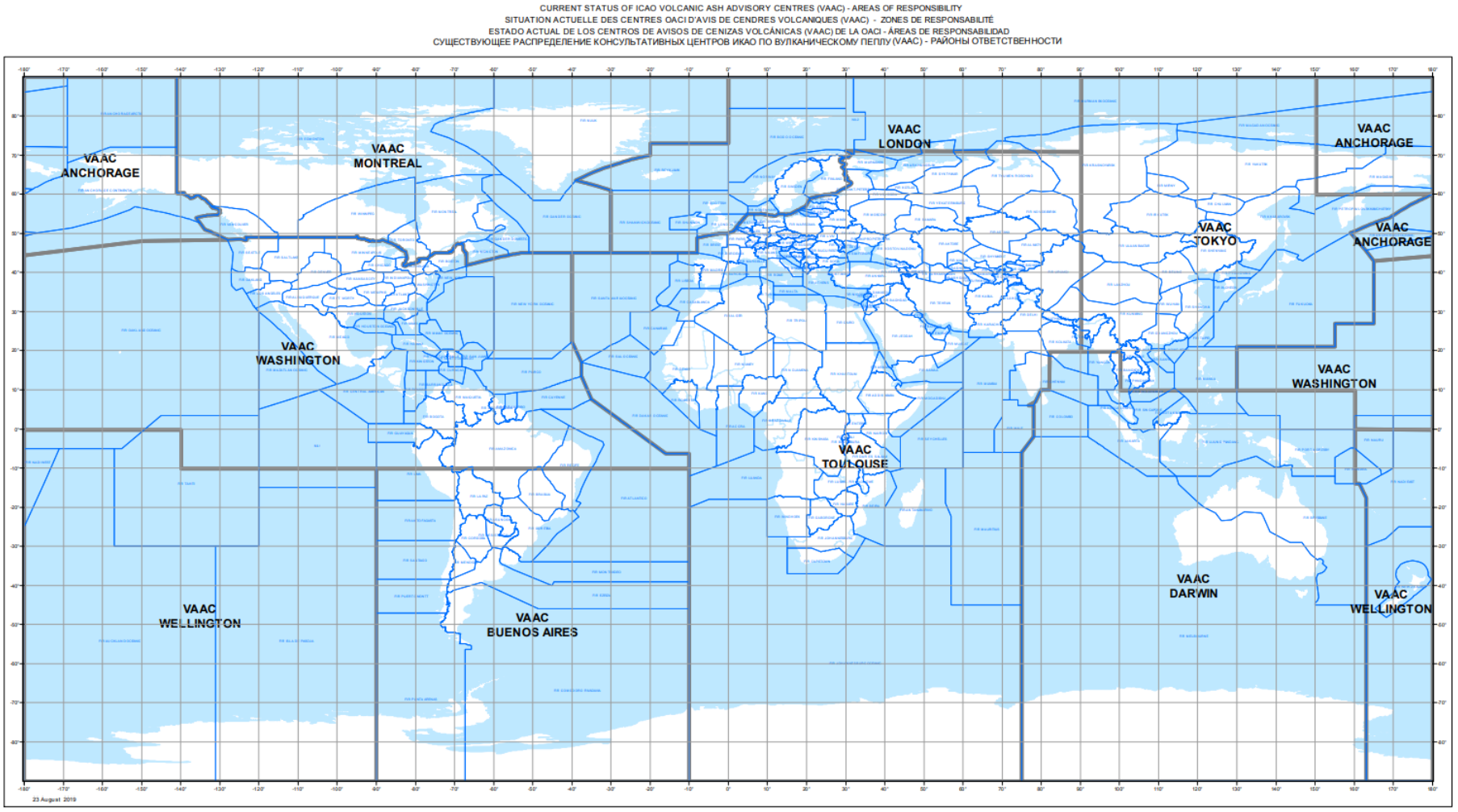
			MWOs to which advisory information is to be sent		ACCs to which advisory information is to be sent	
Volcanic ash advisory centre	ICAO loc. ind.	Area of responsibility	Name	ICAO loc. ind	Name	ICAO loc. ind
1	2	3	4	5	6	7
			Jeddah/King Abdulaziz Intl	OEJN	Jeddah FIR	OEJD
			Johannesburg	FAJS	Cape Town Johannesburg Johannesburg Oceanic	FACA FAJA FAJO
			Kabul	OAKB	Kabul	OAKX
			Kaliningrad	UMKK	Kaliningrad	UMKK
			Kano	DNKN	Kano	DNKK
			Karachi	OPKC	Karachi	OPKR
			Kathmandu	VNKT	Kathmandu	VNSM
			Kazan	UWKD	Kazan	UWKD
			Khartoum	HSSS	Khartoum FIR/SRR	HSSS
			Kigali	HRYR	Kigali	HRYR
			Kinshasa	FZAA	Kinshasa	FZAZ
			Kirov	USKK	Kirov	USKK
					København	EKDK
			Kolkata	VECC	Kolkata (+Darwin)	VECF
			Kotlas	ULKK	Kotlas	ULKK
			Kuwait/Intl	OKBK	ACC/Aerodrome Control Tower	OKAC
			Kyiv	UKBV	Kyiv	UKBV
			Lahore	OPLA	Lahore	OPLR
			Larnaka	LCLK	Nicosia	LCCC
			Lilongwe	FWLI	Lilongwe	FWLL
			Lisboa	LPPT	Lisboa Santa Maria	LPPC LPPO
			Ljubljana/Brnik	LJLJ	Ljubljana	LJLA
					London	EGTT
			Luanda	FNLU	Luanda	FNAN
			Luqa	LMML	Malta	LMMM
			Lusaka	FLLS	Lusaka	FLFI
			L'viv	UKLV	L'viv	UKLV
			Madrid	LEMM	Madrid	LECM
			Mahe	FSIA	Seychelles	FSSS
			Male	VRMM	Male	VRMF
			Malmo	ESSA	Malmo	ESMM
			Malta	LMML	Malta	LMMM
			Mauritius	FIMP	Mauritius	FIMM
			Maputo	FQMA	Beira	FQBE
			Milano	LIMM	Milano Padova	LIMM LIPP
			Minsk	UMMM	Minsk	UMMV

			MWOs to which advisory information is to be sent		ACCs to which advisory information is to be sent	
Volcanic ash advisory centre	ICAO loc. ind.	Area of responsibility	Name	ICAO loc. ind	Name	ICAO loc. ind
1	2	3	4	5	6	7
			Mogadishu	HCMM	Mogadishu	HCSM
			Monrovia	GLRB	Conakry	GUCY
			Moscow/Vnukovo	UUWW	Moscow/Vnukovo	UUWW
			Mumbai	VABB	Mumbai	VABF
			Munchen MET Reg Centre	EDZM	Munchen	EDMM
			Murmansk	ULMM	Murmansk	ULMM
			Muscat/Muscat Intl	OOMS	Muscat/FIR	OOMM
			N'Djamena	FTTJ	N'Djamena	FTTT
			Nairobi	HKJK	Nairobi	HKNA
			Niamey	DRRN	Niamey	DRRR
			Odesa	UKOV	Odesa	UKOO
			Ohrid	LWOH	Skopje	LWSK
			Osh	UCFO	Osh	UCFO
			Oslo	ENMI	Oslo	ENOS
			Palma de Mallorca	LEPA	Baleares	LECP
			Perm	USPP	Perm	USPP
			Praha	LKPR	Praha	LKAA
			Riga	EVRA	Riga	EVRR
			Rome Centro Met	LIBB	Brindisi Roma	LIBB LIRR
			Roberts	GLRB	Roberts	GLRB
			Rostov-na-donu	URRR	Rostov-na-donu	URRV
			Rovaniemi	EFRO	Rovaniemi	EFPS
			Sal	GVAC	Sal	GVSC
			Samara	UWWW	Samara	UWWW
			Samarkand	UTSS	Nukus FIR	UTNR
			Sana'a/Intl	OYSN	Sana'a/Intl	OYSN
			Sankt-Petersburg, AFTN/CIDIN Com Centre, FIR (AFTMU)	ULLL	Sankt-Petersburg	ULLI
			Seychelles	FSIA	Seychelles	FSSS
			Simferopol	UKFF	Simferopol	UKFF
			Skopje	LWSK	Skopje	LWSK
			Sofia	LBSF	Sofia	LBSR
					Sweden	ESAA
			Zurich	LSZH	Geneva Sweden	LSAW ESAA
			Syktyvkar	UUYY	Syktyvkar	UUYY
			Tallinn	EEMH	Tallinn	EETT
			Tashkent	UTTT	Samarkand FIR Tashkent/Yuzhny FIR	UTDS UTTR

			MWOs to which advisory information is to be sent		ACCs to which advisory information is to be sent	
Volcanic ash advisory centre	ICAO loc. ind.	Area of responsibility	Name	ICAO loc. ind	Name	ICAO loc. ind
1	2	3	4	5	6	7
			Tehran/Mehrabad	OIII	Tehran (ACC/FIC/FIR)	OIIX
			Tbilisi	UGTB	Tbilisi	UGGG
			Tirana	LATI	Tirana	LAAA
			Toulouse	LFPW	Bordeaux Reims Paris Marseille Brest	LFBB LFEE LFFF LFMM LFRR
			Tripoli	HLLT	Tripoli FIR/SRR	HLLL*
			Tromso	ENVN	Stavanger	ENSV
			Trondheim	ENVV	Trondheim	ENTR
			Tunis	DTTA	Tunis	DTTC
			Urumqi	ZWWW	Urumqi (+Tokyo)	ZWUQ
			Varna	LBWN	Varna	LBWR
			Valencia	LEVA	Barcelona Madrid	LECB LECM
			Vilnius/Intl	EYVI	Vilnius	EYVL
			Vologda	ULWW	Vologda	ULWW
			Wien	LOWW	Wien	LOVV
			Windhoek	FYWH	Windhoek	FYWH
			Yerevan	UDYZ	Yerevan	UDEE
			Zagreb	LDZA	Zagreb	LDZO
			Zurich	LSZH	Zurich	LSAZ

			MWOs to which advisory information is to be sent		ACCs to which advisory information is to be sent	
Volcanic ash advisory centre	ICAO loc. ind.	Area of responsibility	Name	ICAO loc. ind	Name	ICAO loc. ind
1	2	3	4	5	6	7
Washington (United States)	KNES	New York Oceanic Oakland Oceanic South of N4300 E16500 to N4820 W15000 to N4820 W12800, United States Continental FIRs, New York Oceanic FIR North of S1000 W14000 East of 0000 W14000 and North of S10000 W14000 to S1000 W03000 Nadi and Nauru FIRs North of Equator	Amazònico	SBEG	Amazònica	SBAZ
			Caracas	SVMI	Maiquetia	SVZM
			Fort de France	TFFF	Cayenne	SOOO
			Darwin	YDRM	Darwin	YPDN
			Edmonton	CWEG	Edmonton Gander	CZEG CZQX
			Guayaquil	SEGU	Guayaquil	SEGU
			Habana	MUHA	Habana	MUFH
			Honolulu	PHFO	Honolulu Oakland Guam	PHZH KZOA PGZU
			Kansas City	KKCI	Houston Oceanic Miami Oceanic Nassau New York San Juan	KZHU KZMA MYNA KZNY TJZS
			Kingston	MKJP	Kingston	MKJK
			Lima-Callao	SPIM	Lima	SPIM
			México	MMMX	Mazatllán México	MMZT MMEX
			Panamá	MPTO	Panamá	MPZL
			Port-au-Prince	MTPP	Port-au-Prince	MTEG
			Port-of-Spain	TTPP	Piarco	TTZP
			Recife	SBRF	Recife Atlantico	SBRE SBAO
			Santa Fé de Bogotá	SKBO	Barranquilla Bogotá	SKEC SKED
			Santo Domingo	MDSD	Santo Domingo	MDCS
			Tegucigalpa	MHTG	Central American	MHTG
			Timehri	STCJ	Georgetown	SYGC
			Tokyo	RJTD	Tokyo	RJTG
			Willemstad	TNCC	Curacao	TNCF
			Zandery	SMJP	Paramaribo	SMPM
Wellington (New Zealand)	NZKL	Southward from the Equator and from E16000 to W14000, except for the Melbourne and Brisbane FIRs, and Southward from S1000 and from W14000 to W09000	Brisbane	YBRF	Brisbane	YBBB
			Honiara	AGGH	Honiara	AGGH
			Honolulu	PHFO	Honolulu	PHZH
			Melbourne	YMRF	Melbourne	YMMM
			Nadi	NFFN	Nadi	NFFF
			Tahiti	NTAA	Tahiti	NTTT
			Wellington	NZKL	Auckland Christchurch	NZZO NZZC

*Not listed in Doc 7910.



Note.— Flight information regions (FIRs) within each volcanic ash advisory centre's area of responsibility can also be viewed graphically at https://gis.icao.int/portal/home/index.html.

Part 3

USEFUL WEBSITES

Note.— These addresses are included for back-up information only, and it should be clearly understood that operational reliance on volcanic ash information obtained from websites cannot be assured.

3.1 VOLCANIC ASH ADVISORY CENTRES

Anchorage:	https://www.weather.gov/vaac
Buenos Aires:	https://ssl.smn.gob.ar/vaac/buenosaires/inicio.php?lang=en (English)
	https://ssl.smn.gob.ar/vaac/buenosaires/inicio.php?lang=es (Spanish)
Darwin:	http://www.bom.gov.au/aviation/volcanic-ash/
London:	https://www.metoffice.gov.uk/services/transport/aviation/regulated/vaac
Montreal:	http://meteo.gc.ca/eer/vaac/index_e.html (English)
	http://meteo.gc.ca/eer/vaac/index_f.html (French)
Tokyo:	https://www.data.jma.go.jp/vaac/data/index.html
Toulouse:	http://vaac.meteo.fr
Washington:	https://www.ssd.noaa.gov/VAAC/messages.html
	https://www.ospo.noaa.gov/Products/atmosphere/vaac/index.html
Wellington:	http://vaac.metservice.com

Note.— The homepage of each VAAC normally contains hyperlinks to the homepages of the other VAACs.

3.2 WORLDWIDE WEEKLY VOLCANIC ACTIVITY REPORTS

Smithsonian Institution:	http://volcano.si.edu/reports_weekly.cfm
United States Geological Survey: (USA volcanoes only)	http://volcanoes.usgs.gov

Note.— These sites provide excellent up-to-date reports on active volcanoes.

3.3 OTHER SITES

Note.— Volcano observatory websites are included in Part 5, International Airways Volcano Watch Contact List.

Global Volcanism Program (GVP)	http://volcano.si.edu/
World Organization of Volcano Observatories (WOVO)	https://wovo.iavceivolcano.org/
WOVOdat – Data on Volcanic Unrest	https://wovo.iavceivolcano.org/wovodat
Eruption source parameters for volcanoes of the world	https://www.bgs.ac.uk/geology-projects/volcanoes/eruption-source-parameters
HYSPLIT dispersion model	https://www.ready.noaa.gov/HYSPLIT.php
NOAA/CIMSS Volcanic Cloud Monitoring Web Portal	https://volcano.ssec.wisc.edu
Support to Aviation Control Service (SACS)	https://sacs.aeronomie.be/
Catalogue of Icelandic Volcanoes	https://icelandicvolcanos.is
European Catalogue of Volcanoes and Volcanic Areas	https://volcanos.eurovolc.eu
Global Sulphur Dioxide Monitoring Home Page	https://so2.gsfc.nasa.gov/
NASA Worldview	https://worldview.earthdata.nasa.gov/
Global Volcanic Lightning Monitor	http://wwlln.net/USGS/Global/

Note.— Useful background information on volcanic ash and its impact on aviation may be found in the Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds *(Doc 9691). Information on obtaining ICAO documents is available on the ICAO Store at https://store.icao.int.*

Part 4

INTERNATIONAL AIRWAYS VOLCANO WATCH

OPERATIONAL PROCEDURES FOR THE DISSEMINATION OF INFORMATION ON VOLCANIC ERUPTIONS AND ASSOCIATED VOLCANIC ASH CLOUDS IN AREAS WHICH COULD AFFECT ROUTES USED BY INTERNATIONAL FLIGHTS, AND NECESSARY ARRANGEMENTS PRIOR TO AND DURING A VOLCANIC ERUPTION

4.1. PROCEDURES PRIOR TO A VOLCANIC ERUPTION

4.1.1 In order to permit efficient application of the measures noted in 4.2 to 4.8, States responsible for flight information regions (FIRs) in which there are active or potentially active volcanoes in proximity to routes used by international flights should make arrangements to ensure that:

a) active or potentially active volcanoes are instrumentally and visually monitored (such as by seismological means supplemented by other information available) by designated volcano observatories supported by appropriate authorities, resourcing and quality management systems;

b) systems and channels of communication are in place to make available to volcano observatories appropriate meteorological information useful for assessing volcanic plume height or a cloud of re-suspended volcanic ash[1] (in particular data derived from Doppler weather radar, ceilometers, lidar, passive infrared sensors, satellite remote sensing and visual observations by trained meteorological observers);

c) 24-hour contact details are shared between the area control centre/flight information centre (ACC/FIC), meteorological watch office (MWO) and volcano observatories and relevant volcanic ash advisory centre (VAAC);

d) information on increasing volcanic activity, volcanic eruption[2] or volcanic ash cloud in areas which could affect routes used by international flights, available from one or more observing sources, such as volcanological, seismological, geological, meteorological, or the police/military networks and domestic aviation, is passed **immediately** to the ACC/FIC and the MWO concerned;

Note.— Where information comes from supplementary sources such as the research community, States are strongly encouraged to make arrangements consistent with the appropriate scientific protocols as advised by the International Union of Geodesy and Geophysics (*IUGG).*

e) the State international NOTAM office personnel are familiar with the issuance of ASHTAMs[3] (or NOTAMs for volcanic ash);

f) information, preferably supplemented by charts, concerning volcanoes in the FIRs for which the State is responsible is included in the State aeronautical information publication in accordance with the *Procedures for Air Navigation Services – Aeronautical Information Management* (PANS-AIM, Doc 10066), Appendix 2, Section ENR 5.3.2;

1. Re-suspended volcanic ash will typically be due to (strong) surface winds that have allowed previously deposited volcanic ash to be lifted above ground level and carried (potentially some distance) on the wind. A cloud of re-suspended volcanic ash may or may not be associated with an ongoing or recent eruption and, indeed, may be associated with an eruption that occurred at any point in the past. In some instances it may not be possible to determine the source volcano of the volcanic ash that has been re-suspended.
2. The term “eruption” in Part 4 of this document refers to the start or continuation of an eruption, or its cessation.
3. The ASHTAM is a special series NOTAM specifically for volcanic activity.

g) information concerning the State's active or potentially active volcanoes are reflected within the Smithsonian Global Volcanism Program (GVP) volcano list[4] and all State agencies responsible for issuing information on volcanic activity ensure their operational volcano lists are regularly updated; and

h) air traffic management (ATM) contingency arrangements in respect of volcanic ash are made and promulgated, as necessary, for air routes crossing FIRs for which the State is responsible, in coordination with adjacent FIRs.

4.1.2 States must promulgate a requirement for pilots to make and transmit a special aircraft observation, in accordance with Annex 3, 5.5 g) and h), in the event that pre-eruption volcanic activity or a volcanic eruption is observed or a cloud of volcanic ash is encountered or observed (including a cloud of re-suspended volcanic ash) which may affect the safety of other aircraft operations, and to record a special air-report in accordance with Annex 3, 5.9. In addition, the International Air Transport Association (IATA), the International Federation of Air Line Pilots' Associations (IFALPA) and the International Council of Aircraft Owner and Pilot Associations (IAOPA) should bring this requirement to the attention of pilots and airline operating centres and highlight its significance for the international airways volcano watch (IAVW) and the importance of transmitting these observations in a timely manner.

Note.— Pre-eruption volcanic activity in this context means unusual and/or increasing volcanic activity which could presage a volcanic eruption.

4.1.3 It is essential that the foregoing arrangements be made in every State concerned and their efficacy continually maintained. In the case of volcanic ash, the hazard to jet transport aircraft is greatest within the first few hours following an eruption; hence speed of notification between all links in the chain of communication is critical. States may wish to consider drawing up letters of agreement between the parties involved, in particular, the civil aviation and meteorological authorities and the State volcano observatory, to record the agreed responsibilities of each party.

4.1.4 Given the initial eruption phase is the most safety critical period, airlines and other users need accurate and timely pre-eruption activity information. Together with the use of risk-based principles, this information will assist operators by providing the opportunity to avoid airspace, which they assess to be at high risk. The pre-flight risk assessment of the available information will determine how an airline will select a route in the vicinity of a volcano in pre-flight planning, which is exhibiting signs of activity. Updates applicable to aircraft in flight will indicate to pilots if avoidance of such high-risk airspace is warranted. Ensuring the consistent receipt of an up-to-date VONA is integral to the successful execution of these safety-related actions.

4.1.5 In order to assist States in enhancing the coordination between the different States' authorities/agencies involved in the IAVW, a sample letter of agreement covering the coordination and responsibilities between meteorological authorities, ATS authorities and State volcano observatories for the provision and exchange of information relevant to volcanic ash is provided in Appendix A.

Note 1.— Consistent with the Sendai Framework for Disaster Risk Reduction 2015–2030 and its global target to "substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030", together with relevant principles such as integration and local, regional and global partnership approaches, States are urged to consider the above as part of an integrated suite of arrangements for other related volcanic hazards, such as ashfall on airports, populated areas and agricultural zones, shipping hazards, volcanic tsunami and rainfall that may induce dome collapse, lahar activity or slope failure.

Note 2.— Given the variation between States in capacity and the cross-border nature of the volcanic ash hazard, all States are encouraged to take note of arrangements in the surrounding regions, and where appropriate and invited, to assist in any reasonable manner. For volcanoes located on the border of two or more States, agreements between State volcano observatories should be made in order to coordinate efforts, with appropriate communication protocols in place.

4. State volcano observatories may contact the Smithsonian GVP to update any necessary volcano data. Contact details are available on the Smithsonian GVP website (see Part 3, 3.3).

4.2 ACTION TO BE TAKEN BY THE STATE VOLCANO OBSERVATORY PRIOR TO AND DURING A VOLCANIC ERUPTION

4.2.1 A State volcano observatory (SVO) is a volcano observatory designated by regional air navigation agreement to monitor active or potentially active volcanoes within a State, and to provide information on volcanic activity and/or volcanic ash in the atmosphere. The designated SVOs in each ICAO Region are listed in the relevant regional electronic air navigation plan (eANP), Volume I, Part V – Meteorology (MET), Table MET I-1, respectively.

4.2.2 Prior to an eruption, an SVO should take the following actions:

a) maintain an up-to-date contact list of relevant agencies; and

b) conduct routine testing of the agreed dissemination channels.

Note 1.— The key role of SVOs in providing timely reports of volcanic unrest and eruptions to the aviation sector has been well established within the framework of the IAVW.

Note 2.— The map of VAAC areas of responsibility is shown in Part 2. A list of SVOs, ACCs/FICs, MWOs and FIRs is given in Part 5.

4.2.3 In the event of significant changes in pre-eruption volcanic activity, a volcanic eruption or a significant change in eruptive activity, and/or observation of volcanic ash in the atmosphere, an SVO should take the following actions:

a) immediately forward the available information to its associated ACCs/FICs, MWOs and VAACs by telephone, or other agreed communication platform, to inform them of the significant activity; and

b) follow up with the issuance of a Volcano Observatory Notice for Aviation (VONA).

Note 1.— The VONA has been developed for SVOs (or equivalent scientific agencies) to disseminate critical, operationally relevant information about volcanic activity.

Note 2.— SVOs may issue new VONA when there are changes in the plume height or movement. If emissions are intermittent but regular, new VONA do not need to be issued for each new emission.

Note 3.— A State may wish to further strengthen coordination among the agencies involved in dissemination and exchange of information relevant to volcanic ash, including the issuance of VONA, by writing a letter of agreement between the civil aviation and meteorological authorities and the volcanological agency. A sample letter of agreement is provided in Appendix A.

Note 4.— Where capability exists, SVOs may include re-suspended ash in the context of 4.2.3 above.

4.2.4 Along with basic volcano information (name, identifying number and location), the VONA is a summary of volcanic activity and observations about ash emission (or lack thereof). The VONA is intended for aviation users and not scientists.

4.2.5 The VONA includes fields for the current and previous volcano level of alert colour codes for aviation, as described in Table 4-4. The aviation colour code level is determined by the SVO and explicitly addresses the condition of the referenced volcano, and not the dispersed volcanic ash cloud resulting from an eruption. Thus, the aviation colour code could be decreased after eruptive activity has ended, while a dispersed ash cloud remains a concern to aviation. Colour codes help dispatchers, pilots and air traffic controllers to quickly ascertain the status of numerous volcanoes as they plan and execute flights over broad regions of the globe. The volcano level of alert colour codes for aviation are a key component of the global standardization of information provided by SVOs to aviation users.

4.2.6 Aviation colour code **GREEN** should only be issued for volcanoes that are monitored by an SVO using ground-based instrumentation that are sufficient to establish that a volcano is in a typical background level. For volcanoes where the background level cannot be determined, the aviation colour code level of **UNASSIGNED** should be applied. Should pre-eruption or eruptive activity at an unmonitored volcano be detected by remote sensing, distant geophysical networks or eyewitness reports, the aviation colour code (**YELLOW**-**ORANGE**-**RED**) may be utilized. When activity decreases, the volcano goes back to **UNASSIGNED**, without going through **GREEN**.

4.2.7 VONA should be in abbreviated plain language, using approved ICAO abbreviations and numerical values of self-explanatory nature, and should be in accordance with the template shown in Appendix E. When no approved ICAO abbreviations are available, English plain language text, kept to a minimum, should be used to describe elements for which the template allows the use of free text.

4.2.8 An SVO should issue a VONA under the following circumstances:

a) when volcano level of alert colour code is changed; or

b) within a colour-code level when an ash-producing event or other significant change in volcanic behaviour occurs; or

c) where SVO capability exists, for episodes of observed re-suspended ash that could pose a hazard to aviation.

4.2.9 Re-suspended volcanic ash will typically be due to (strong) surface winds that have allowed previously deposited volcanic ash to be lifted above ground level and carried (potentially at some distance) on the wind. A cloud of re-suspended volcanic ash may or may not be associated with an ongoing or recent eruption and, indeed, may be associated with an eruption that occurred at any point of time in the past. In some instances, it may not be possible to determine the source volcano of the volcanic ash that has been re-suspended. In this case, the VONA may list the volcano details as **UNKNOWN** and the aviation colour code as **UNASSIGNED**.

4.2.10 To ensure aviation users have up-to-date volcanic activity information for their risk management processes, VONA should be updated; when observing:

a) significant changes in pre-eruption volcanic activity;

Note.— Pre-eruption volcanic activity in this context means unusual and/or increasing volcanic activity that could presage a volcanic eruption.

b) a volcanic eruption, or a significant change in eruptive activity; and/or

c) volcanic ash in the atmosphere.

Note.— Because the aviation colour code is assigned based on volcanic activity, VONA issued for re-suspended ash only, due to meteorological conditions, should not include an increase in colour code level.

4.2.11 The use of the aviation colour code by an SVO does not preclude or replace the use of other established alert level schema for ground-based hazards. Although it is recommended that SVOs assign volcano level of alert colour codes for aviation, if they do not, a VONA may still be issued leaving the colour-code fields blank.

4.2.12 A VONA should be disseminated to the State volcano observatory's associated ACCs/FICs, MWOs and VAACs. VONA may be disseminated using e-mail and may also be made available via a public website.

4.2.13 In accordance with *ICAO's Policies on Charges for Airports and Air Navigation Services* (Doc 9082), the costs associated with the transmission of information from SVOs to their associated ACCs/FICs, MWOs and VAAC are subject to cost recovery. Guidance on cost recovery by SVOs is provided in Appendix G.

4.3 ACTION TO BE TAKEN BY THE ACC PRIOR TO AND DURING A VOLCANIC ERUPTION

In the event of significant pre-eruption volcanic activity, a volcanic eruption occurring or a volcanic ash cloud being reported (including a cloud of re-suspended volcanic ash) in areas which could affect routes used by international flights, the ACC/FIC responsible for the FIR concerned, on receiving information of the occurrence, should take the following actions:

a) Pass this information **immediately** to aircraft in flight which could be affected by the volcanic ash cloud and advise ACCs/FICs in relevant adjacent FIRs. Issue an ASHTAM or a NOTAM through the State International NOTAM Office (NOF), in accordance with the PANS-AIM (Doc 10066), giving details of the pre-eruption activity, volcanic eruption and ash cloud, including the name and geographical coordinates of the volcano, the date and time of the eruption, the flight levels and routes or portions of routes which could be affected and, as necessary, routes temporarily closed to air traffic. Include in the address list for ASHTAMs or NOTAMs concerning volcanic activity the associated MWO (see Part 2 of this document), all VAACs and the SADIS WIFS gateway at EGZZVANW.

*Note 1.— In issuing an ASHTAM or a NOTAM concerning significant pre-eruption volcanic activity, or for volcanic eruptions **not** producing ash plumes, it is recommended that the ASHTAM or NOTAM text include the following actual wording, as appropriate:*

"INCREASED VOLCANIC ACTIVITY REPORTED FOR VOLCANO (NAME AND LAT/LONG) AIRCRAFT ADVISED TO EXERCISE CAUTION UNTIL FURTHER NOTICE AND MAINTAIN WATCH FOR ASHTAM/NOTAM/ SIGMET FOR AREA".

or

"VOLCANO (NAME AND LAT/LONG) ERUPTED (DATE/TIME UTC) BUT NO ASH PLUME REPORTED, AIRCRAFT ADVISED TO AVOID FLYING WITHIN ... KM OF THE VOLCANO UNTIL FURTHER NOTICE, MAINTAIN WATCH FOR ASHTAM/NOTAM/SIGMET FOR AREA".

Use of such language in an ASHTAM or a NOTAM ensures that large volumes of airspace are not rendered unavailable to aircraft unnecessarily until such time as a volcanic ash plume/cloud is actually reported, or observed from satellite data and, where available, ground-based and airborne data.

Note 2.— In order to ensure speedy transmission of initial information to aircraft, the first ASHTAM or NOTAM issued may simply contain information that an eruption and/or ash cloud has been reported and the date/time and location. It is not necessary to await further detailed information; this may be included in subsequent ASHTAMs or NOTAMs as it becomes available.

Note 3.— Volcano level of alert colour codes for aviation should be used by SVOs to report volcanic activity information (see 4.2.5). In States where the volcano level of alert colour codes for aviation have been introduced by the SVO, it is highly desirable to include the reported colour code in ASHTAMs or NOTAMs issued for volcanic activity.

b) Activate contingency arrangements, including the implementation of alternative routes bypassing the area likely to be affected by the volcanic ash cloud, in coordination with ACCs/FICs responsible for adjacent FIRs.

c) Advise the associated MWO(s) and VAAC of the volcanic eruption and/or the existence of volcanic ash cloud (including the forwarding of all special air-reports in accordance with existing provisions in Annex 11, 4.2.3) and maintain continuous coordination with the MWO to ensure consistency in the issuance and content of ASHTAMs or NOTAMs and SIGMETs.

d) Cancel the ASHTAM or NOTAM as soon as it is considered that the volcano has reverted to its normal state and the airspace is not contaminated by volcanic ash.

4.4 ACTION TO BE TAKEN BY THE NOF PRIOR TO AND DURING A VOLCANIC ERUPTION

4.4.1 In the event of significant pre-eruption volcanic activity, a volcanic eruption occurring or a volcanic ash cloud being reported (including a cloud of re-suspended volcanic ash) in areas which could affect airspace in the FIRs of the State in which the NOTAM Office (NOF) is designated, the NOF should issue an ASHTAM (or a NOTAM for volcanic activity) based on information provided by the ACC responsible for the FIR concerned. The ASHTAM or NOTAM must be cancelled, in consultation with the ACC, as soon as it is considered that the airspace is not contaminated by volcanic ash. Include in the address list for ASHTAM or NOTAM concerning volcanic activity the associated MWO (see Part 2 of this document), all VAACs and the SADIS WIFS gateway at EGZZVANW.

4.4.2 In addition to addressing the ASHTAM (or NOTAM) to other NOFs for whom the information is of direct operational significance, the NOF should include in the address list the VAAC responsible for the FIRs concerned. The States responsible for FIRs in which there are active volcanoes and the AFTN switching centres designated to receive NOTAM or ASHTAM are listed in Table 4-1.

As an example, an ASHTAM issued by the Tegucigalpa NOF would be sent to VAAC Washington as follows:

ZCZC
GG KWBCYMYX
170630 MHTGYNYX
VAMH0001 MHTG 04170630

ASHTAM

A. CENTRAL AMERICAN FIR
B. 04170555
C. VOLCAN SAN CRISTOBAL.14004-02
D. 124211N0870024W
E. YELLOW ALERT
F. SFC/11000FT
G. E/SE
H. VOR/DME MGA A317 TUKOR CNL
I. VOR/DME MGA A317 TUKOR RTE AVBL. ALT RTE
MGA VOR/DME A502 BERTA GABOS A317.
VOR/DME/CAT/ABVL
J. INSTITUTO NACIONAL DE ESTUDIOS TERRITORIALES. DPTO. DE SISMOLOGÍA
K. GNE AVIATION CTN WIND 60KM/H E/SE FM VOLCANO

NNNN

A similar example, this time showing a NOTAM issued by Guayaquil NOF, would be sent to VAAC Washington as follows, showing the three sections of the message:

1 ZCZC USUAL AFTN HEADER ENVELOPE
GG KWBCYMYX
151840 SEGUYNYX

2 A0623/00 NOTAMN ACTUAL NOTAM
Q) SEGU/QWWXX/IV/NBO/W/000
/250/0128S 07826W030
A) SEGU
B) 0002151830
C) 0002171830
E) SIGNIFICANT VOLCANIC ACT
TUNGURAHUA VA MOV W.
AWY RESTRICTIONS AND ALT
RTE NOTIFIED BY ATC

3 NNNN USUAL AFTN ENDING
ENVELOPE

4.4.3 In case of a need to issue a NOTAM regarding volcanic ash deposition at an aerodrome, the following guidelines are suggested:

a) in cases when a forecast of impending ash deposition is available, a NOTAM should be issued stating the time period when ash is expected to commence at an aerodrome;

b) a NOTAM should be issued when ash reaches an aerodrome or begins to accumulate on the ground at an aerodrome. The NOTAM should report if the aerodrome is still open for operation;

c) a new NOTAM should be issued every 4 hours while deposition is occurring or present in the air at the aerodrome, or more frequently as needed for occurrence of heavy ash deposition. If a friction test of runway surfaces has been made with a mu-meter, that value and the time it was made should be reported; and

d) a final NOTAM should be issued when clean-up activities are completed and operations have resumed.

4.4.4 Since volcanic ash deposition at an aerodrome is a phenomenon which could prompt the issuance of an aerodrome warning, close coordination is recommended between each NOF and the aerodrome meteorological office(s) in its area of responsibility concerning the issuance of such warnings.

4.5 ACTION TO BE TAKEN BY THE MWO PRIOR TO AND DURING A VOLCANIC ERUPTION

4.5.1 On receipt from the ACC/FIC of information concerning a volcanic eruption and/or the existence of a volcanic ash cloud (including a cloud of re-suspended volcanic ash), the MWO should take the following steps:

a) notify the VAAC designated to provide advice on volcanic ash trajectories for the FIR for which the State is responsible that a volcanic eruption and/or ash cloud has been reported, provide available relevant details and request advisory information on the extent and trajectory of volcanic ash. In particular, special air-reports of pre-eruption volcanic activity, a volcanic eruption, volcanic ash cloud or aircraft encounter with volcanic ash received by MWOs should be transmitted to their associated VAACs, WAFC London SADIS at the address specified in Appendix B according to the region containing the area affected and WAFC Washington at KWBCYMYX;

Note 1.— The area of responsibility of the VAACs and the MWOs to which volcanic ash advisory information is to be sent are given in the ICAO regional air navigation plans and in Part 2 of this document. Where there is a difference, defer to the regional air navigation plan.

Note 2.— The contact numbers that the MWOs should use to notify volcanic eruptions/volcanic ash cloud to the VAAC are given in Table 4-2.

b) as soon as practicable, advise the associated ACC/FIC whether or not the volcanic ash cloud is identifiable from satellite images/data and, if possible,

c) provide regular information based on advice received from the VAAC on the horizontal and vertical extent of the cloud and the trajectory of the cloud; and

d) issue a SIGMET information for volcanic ash for a validity period of 6 hours in alphanumeric format and, if in a position to do so, in graphical format based on the advisory information provided by the VAAC concerned. Update SIGMET information at least every 6 hours. Include in the SIGMET address all VAACs, WAFC London at the address specified in Appendix B according to the region containing the area affected, WAFC Washington at KWBCYMYX and the regional OPMET data bank(s) responsible. Maintain continuous coordination with the associated ACC/FIC to ensure consistency in the issuance and content of SIGMETs, and ASHTAMs or NOTAMs. SIGMET information for volcanic ash issued outside the EUR Region to be transmitted to the EUR Region should be addressed as follows:

Source	**Responsible EUR Gateway and Address to be used**	
AFI	France	LFZZMAFI
MID	Austria	LOZZMMID
ASIA	UK	EGZZMASI
CAR	UK	EGZZMCAR
NAM	UK	EGZZMNAM
NAT	UK	EGZZMNAT
PAC	UK	EGZZMPAC
SAM	UK	EGZZMSAM

Note 1.— The associated ACC/FIC should automatically be on the address list for all SIGMETs issued by the MWO.

Note 2.— In order to ensure speedy transmission of initial information to aircraft, the first SIGMET issued may simply contain information that an ash cloud has been reported and the date/time and location. It is not necessary to await further detailed information before issuing the first SIGMET. Such information may be included in subsequent SIGMETs as it becomes available.

Note 3.— A cloud of re-suspended volcanic ash is to be reported in a SIGMET information in exactly the same way as for a volcanic ash cloud, that is, using the abbreviation VA CLD and associated elements.

4.5.2 In the event that the MWO becomes aware of the occurrence of pre-eruption activity, a volcanic eruption or ash cloud from any source other than its associated ACC/FIC, that information should be passed **immediately** to the associated ACC/FIC. The procedures in 4.5.1 should then be followed, as necessary.

4.5.3 In the event that a meteorological office becomes aware of the occurrence of pre-eruption activity, a volcanic eruption or ash cloud from any source, the information should be passed **immediately** to its associated MWO for onward transmission to the ACC/FIC.

4.6 ACTION TO BE TAKEN BY VAACs IN THE EVENT OF A VOLCANIC ERUPTION

4.6.1 Upon detection of a volcanic eruption or a volcanic ash cloud or upon receipt of information from an ACC, MWO, volcano observatory or any other source[5] that a volcanic eruption has been reported and/or a volcanic ash cloud has been observed (including a cloud of re-suspended volcanic ash in the FIR for which the MWO is responsible, the VAAC should:

a) initiate the volcanic ash computer trajectory/dispersion model in order to provide advisory information[6] on volcanic ash trajectories to the MWOs, ACCs and, to the extent possible, to the operators concerned;

b) review satellite images/data of the area for the time of the event to ascertain whether a volcanic ash cloud is identifiable and, if so, its extent;

c) prepare and issue advisory information on the extent and forecast trajectory of the volcanic ash cloud in:

1) alphanumeric format, using abbreviated plain language as shown below;

2) digital ICAO meteorological information exchange model (IWXXM)[7]

3) graphical format[8] (using the PNG format) for transmission to the MWOs, ACCs/FICs and, to the extent possible, the operators concerned in the VAAC area of responsibility, to WAFC London at the address specified in Appendix B according to the region containing the area affected, WAFC Washington at KWBCYMYX, and other VAACs. Advisory information on volcanic ash issued outside the EUR Region to be transmitted to the EUR Region should be addressed as stated in 4.5.1 d).

5. When initial notification of the eruption is received from a source other than an ACC/MWO, this information should be passed immediately by telephone to the relevant ACC and/or MWO. Thereafter, the procedures in a) to h) should be followed.
6. On some occasions, the volcanic ash advisory could be the first information received by ACC/FIC concerning hazardous conditions which may be encountered by an aircraft in flight. The VAAC has the option to issue a volcanic ash advisory without forecast as a first piece of information to quickly warn the ACC/FIC. The first advisory will, as soon as possible, be followed by a volcanic ash advisory with complete forecast information included.
7. Digital IWXXM volcanic advisory information is accompanied by the appropriate metadata. The technical specifications for IWXXM are contained in the *Manual on Codes* (WMO-No. 306), Volume I.3, *Part D – Representation Derived from Data Models*. Guidance on the implementation of IWXXM is provided in the *Manual on the ICAO Meteorological Information Exchange Model* (Doc 10003).
8. Volcanic ash advisories in graphical format will be included on the WAFC London and WAFC Washington aeronautical fixed service Internet-based services. An example of the graphical format is given in Annex 3, Appendix 1.

The volcanic ash advisory information should contain the following information:

message type
— VA ADVISORY

issue time, date and name of issuing VAAC or VAAC area, when issued as a back-up volcanic ash advisory[9]
— time (UTC), day/month/year; volcanic ash advisory centre issuing advisory

name of volcano and volcano reference number
— volcano name (if known) and reference number (International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI))

the State or region in which the volcano is located and the latitude/longitude
— name of State or region (such as oceanic) and latitude/longitude of volcano

source(s) of information
— volcano agency (see Appendix E) or special air-report, etc.

details of eruption
— time (UTC), day/month/year of the eruption

details of ash cloud
— vertical extent in flight levels and horizontal extent in kilometres (nautical miles) and boundary of ash cloud in degrees and minutes

trajectory of ash cloud
— indication of direction and speed of movement of ash cloud at selected flight levels in broad descriptive terms

forecast movement of ash cloud
— forecast boundaries of ash cloud in degrees and minutes at selected flight levels for 6, 12 and 18 hours following time of issuance of advisory information

next advisory
— expected time of issuance of next advisory.

Note.— When issuing a volcanic ash advisory information for a cloud of re-suspended volcanic ash, the components listed at 4.6.2 should be used by a VAAC in place of some of the components listed above.

In order for the VAAC to initiate the monitoring of volcanic ash from satellite data and the forecast of volcanic ash trajectories, MWOs are expected to notify the relevant VAAC immediately on receipt of information that a volcanic eruption has occurred or volcanic ash has been observed in the FIR for which they are responsible in accordance with 4.5.1 a). In particular, any special air-reports of pre-eruption volcanic activity, a volcanic eruption or volcanic ash cloud, received by MWOs, should be transmitted without delay to the associated VAAC and to other addresses in accordance with 4.5.1 a);

d) monitor subsequent satellite information to assist in tracking the movement of volcanic ash cloud;

9. When a VAA is issued on behalf of another VAAC as a back-up service, the VAAC name should be the name of the VAAC on behalf of which the VAA is being issued.

e) continue to issue updated advisory information to MWOs, ACCs/FICs and operators concerned at least at 6-hour intervals, and preferably more frequently, until such time as it is considered that the volcanic ash cloud is no longer identifiable from observations, no further reports of volcanic ash are received from the area and no further eruptions of the volcano are reported;

Note.— If volcanic ash is not identifiable from satellite data, and where available ground-based and airborne data, and the VAAC has reasonable doubts about the existence of volcanic ash in the atmosphere, it should be indicated in the REMARKS section of the volcanic ash advisory.

f) maintain regular contact with other VAACs, as necessary, and the Smithsonian Institution Global Volcanism Program, in order to keep up to date on the activity status of volcanoes in the VAAC area of responsibility. In the specific case of reception of information regarding an aircraft encounter with volcanic ash (Annex 3, 5.9 refers), the information should be sent to the Smithsonian Institution Global Volcanism Program and to ICAO in order to keep up to date the database for encounters between aircraft ash clouds (Doc 9691, Appendix D refers). To that end the following e-mail address should be used: gvp@si.edu.

g) undertake a collaborative decision analysis and forecasting process when volcanic ash is approaching an adjacent FIR outside of a volcanic ash advisory centre's area of responsibility;

Note.— Collaborative decision analysis and forecasting procedures are described in 4.10.

h) in cases where a volcanic ash cloud is expected to approach within 300 NM of the boundary of another VAAC area of responsibility, the first (primary) VAAC will initiate the operational procedures for the coordination and may request transfer of responsibility between VAACs for volcanic ash events; and

Note 1.— Standardized operational procedures for the coordination and transfer of responsibility between VAACs for volcanic ash events are provided in Appendix C.

Note 2.— To facilitate VAACs' rapid access to volcanic ash advisories issued by other VAACs, Table 4-3 provides a listing of the WMO bulletin headers, for each product (volcanic ash in the advisory in the alphanumeric and graphical format, respectively) being used by the VAACs.

i) in the event of long-lived volcanic ash clouds no longer being identifiable on satellite imagery, and, where available ground-based and airborne data, use the method of "gradual" advisory cessation by extrapolating forecast ash boundaries such that the previous 6-, 12- and 18-hour forecasts become the current analysis position in 6-and 12-hour forecasts respectively, with no ash boundary specified for the 18-hour forecast.

Note 1.— The above procedure (which is reducing the outlook period of 6 hours at each issue) should be applied unless remote sensing data or air-reports suggest there has been an error in the forecasts issued.

Note 2.— To provide rapid access to eruption source parameters data for immediate use by forecasters in ash transport and dispersion models, a database of eruption source parameters for volcanoes of the world is available at the British Geological Survey website provided in Part 3, 3.3 of this document.

4.6.2 Where there is a cloud of re-suspended volcanic ash for which there is no eruption and the source volcano is either unknown or known, the VAACs should use the following components in the volcanic ash advisory information in place of some of those described at 4.6.1 c) above:

	Source volcano unknown	*Source volcano known*
Name of volcano and volcano reference number	Unknown	Volcano name (if known) and reference number (International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI))
Location of the volcano	Unknown	Latitude/longitude of volcano
State or region in which the volcano is located	Unknown	Name of State or region (e.g. oceanic)
Summit elevation	Unknown	Height of the summit of the ash source being re-suspended
Details of the eruption	NO ERUPTION – RE-SUSPENDED VA	NO ERUPTION – RE-SUSPENDED VA
Remark	RE-SUSPENDED VA	RE-SUSPENDED VA

Note.— It may be more appropriate to use "Unknown" in some fields, when the volcano details may be significantly different from the volcanic ash field being re-suspended.

4.6.3 In the event of interruption of operation of one VAAC, its functions should be carried out by another VAAC or another meteorological centre, as designated by the VAAC Provider State concerned. The back-up procedures agreed by the VAACs given in Appendix D should be applied in order to provide the VAAC services as needed.

4.7 ACTION TO BE TAKEN BY OPERATORS IN THE EVENT OF A VOLCANIC ERUPTION

In the event of an eruption, operators should request their pilots to report, when appropriate, any observation related to a volcanic ash cloud including the absence of visible ash and all other relevant information such as observational conditions. The operators should then forward this information to the association VAAC in a timely manner.

Note.— Visible ash is defined in the Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds *(Doc 9691).*

4.8 ACTION TO BE TAKEN BY VAACs OR MWOs REGARDING VOLCANIC ASH TEST PROCEDURES

When a volcanic ash test or exercise is carried out to check the IAVW procedures, a status indicator of either TEST or EXER shall be used, in accordance with the templates for the volcanic ash advisory information (Annex 3, Table A2-1 refers) or SIGMET information (Annex 3, Table A6-1A refers). In the volcanic ash advisory, further information on the name of the test or exercise may be provided in the RMK section.

4.9 GUIDANCE TO PILOTS ON THE DETECTION OF SULPHUROUS GASES ON THE FLIGHT DECK

4.9.1 The following paragraphs provide explanatory material and guidance about recommended actions to be taken by flight crew in the event of smelling sulphur gases during flight, with the understanding that the guidance constitutes examples and does not necessarily cover all practices being applied by operators.

4.9.2 Volcanic eruptions emit various gases along with magma, including sulphur dioxide (SO_2) and hydrogen sulphide (H_2S). Volcanoes are the only sources of large quantities of sulphur gases at cruise altitudes, and both SO_2 and H_2S are detectable by smell. Thus, the smell of sulphur gases in the cockpit may indicate volcanic activity that has not yet been detected or reported and/or possible entry into an ash-bearing cloud. In some cases when sulphur gases are smelled, there may be little ash in the cloud owing to ash fallout during prior dispersion of the cloud, but flight crew do not have the means to determine directly that the cloud is non-hazardous and thus should seek to exit the cloud.

4.9.3 SO_2 is identifiable as the sharp, acrid odour of a freshly struck match. H_2S, also known as sewer gas, has the odour of rotten eggs. Sulphur gases may be detectable only for a short period of time because of "olfactory fatigue" (temporary loss of the ability to smell a particular odour).

4.9.4 Inhalation of SO_2, even at low concentrations (<5 ppm), can cause respiratory tract irritation especially in people with asthma and chronic obstructive pulmonary disease. When SO_2 gas combines with water in the atmosphere, a sulphate aerosol primarily composed of dilute sulphuric acid is formed. Flying through sulphuric acid aerosols has caused crazing of acrylic windows, fading of exterior paint and accumulation of sulphate deposits in engines. SO_2 gas is colourless, but under certain conditions of reflection and refraction of sunlight, a sulphuric acid aerosol may be a visible atmospheric feature, such as a layer of haze of variable colour (brownish, yellowish, bluish, or whitish). Ash particles likely will be present in aerosol haze but possibly in minor or trace amounts.

4.9.5 "Electrical smoke and fire" and SO_2 are two odours described as somewhat similar. After determining there are no secondary indications that would result from and indicate an electrical fire, the flight crew must establish whether the sulphur odour is transient or not. This is best achieved by flight crew donning oxygen mask(s) and breathing 100% oxygen for the period of time that results in a complete change of air within the cockpit and also allows the sense of smell to be regained. After the appropriate time period, the flight crew should remove the oxygen mask and determine if the odour is still present.

4.9.6 If the flight crew affirms the continued presence of sulphur gas, the controlling area control centre and airline operation centres must be informed as soon as practicable to request information about any relevant volcanic activity and the whereabouts of possible volcanic clouds. It is recommended that the reporting pilot use the volcanic activity form (VAR), section 1, items 1-8, which is a special air-report. Upon landing, the flight crew should complete VAR (items 9-16) and submit it per the instruction on the VAR form to VAAC Darwin.

4.10 COLLABORATIVE DECISION ANALYSIS AND FORECASTING GUIDELINES AND PROCEDURES BETWEEN VAACs FOR VOLCANIC ASH ADVISORIES

4.10.1 Collaborative decision analysis and forecasting (CDAF) is a critical process to improve the quality of information provided in the volcanic ash advisories.

4.10.2 When volcanic ash is approaching an adjacent VAAC a CDAF process should occur between the VAACs if volcanic ash:

a) is located within 300 NM (555 km), or other distance as agreed between the VAACs concerned, of an adjacent VAAC boundary;

b) is forecast within 300 NM (555 km), or other distance as agreed between the VAACs concerned, of an adjacent VAAC boundary; or

c) is forecast to cross the VAAC boundary.

4.10.3 The lead VAAC will initiate collaboration with the adjoining VAAC(s) by Internet chat or telephone.

Note.— Multilingual chat rooms will be set up and used for VAAC collaboration.

4.10.4 If the participating VAACs have collaboration tools, such as a geospatially enabled collaboration tool, the CDAF session should be conducting using these tools. The primary VAAC will propose the proper time to initiate a geo-enabled volcanic ash collaboration session. This should be done at least one hour before ash potentially impacts other VAAC area.

4.10.5 In the case of an initial notification of a volcanic ash event, it would be highly unlikely to begin the CDAF process and use of a collaborative tool any sooner than about twenty minutes after the initial notification. The steps in the CDAF process are as follows:

a) partners/stakeholders become aware of a major[10] volcanic ash event;

b) initial conversations, analysis/forecasting, coordination of messaging, dissemination of text and graphical products;

c) after the initial suite of products (such as advisories) has been sent, a message is sent to coordinate a collaborative session[11];

d) the message contains the following information:

   1) time of collaboration;

   2) platform or tool to use;

   3) instructions (such as what folder to join and what the name of the session will be, such as VAAC Anchorage will join the "Alaska" folder and will join the session yyyymmdda. The next session will be yyyymmddb); and

   4) telephone conference line and passcode;

e) the lead VAAC leads the collaborative session;

10. A volcanic event which either bridges or is forecast to extend across two or more VAAC boundaries.
11. Message will likely be an e-mail, or lead collaborator may wish to call participants first to ensure they are able to participate.

f) at the pre-determined time, all participants log into the agreed platform or tool that will support the CDAF;

g) the users join the pre-determined folder and session name;

h) the collaboration leader facilitates the session and shows the data relative to the eruption with annotation as needed;

i) participants ask for control from the leader and are handed off in an orderly/organized fashion;

j) rules of engagement include no talking over one another, proper etiquette and respect for participants on the call;

k) the collaboration leader keeps the collaborative session moving along and ends the session when completed, keeping the workload of participants in mind;

l) before the collaboration session ends, the collaboration leader informs the participants of the next session, if needed.

An example of a message to initiate a collaborative session is:

```
TO: All collaboration participants during xxxx volcano event

FROM: VAAC xxxx

SUBJECT: Collaborative Decision Analysis and Forecast Session –
yyyymmdd hhmm UTC

A CDAF session is scheduled for yyyymmdd hhmm UTC. The session is
expected to last no longer than xx minutes.

The purpose of the session is to ensure proper situational awareness of
xxxx volcano eruption and its impact. Please be ready to share information
concerning xxxx eruption. Format must be in .kml and may reside on a web
page or on your local drive.

Telcon information: 1-888-999-9999 passcode 12345#

Start session: join xxxx folder and yyyymmdda session
Wait for the collaborative session leader to join for further
instruction.

Thank you.
```

4.11 GUIDANCE FOR CONDUCTING VOLCANIC ASH EXERCISES IN ICAO REGIONS

To facilitate the conduct of volcanic ash exercises intended to develop and practice the response to volcanic activity in the various ICAO regions, Appendix F provides appropriate guidance to be followed by States and stakeholders involved.

TABLES

Table 4-1. Addresses for NOFs to use to send ASHTAMs or NOTAMs on volcanic activity to their associated VAAC
(*4.4.2 refers)*

Argentina	– sent to SAZZMAMX EGZZVANW
Cabo Verde	– sent to LFPWYMYX EGZZVANW
Cameroon	– sent to LFPWYMYX EGZZVANW
Canada	– sent to CWAOYMYU EGZZVANW
Chile	– sent to SAZZMAMX EGZZVANW
China	– sent to RJTDYMYX EGZZVANW
Colombia	– sent to KWBCYMYX EGZZVANW
Comoros	– sent to LFPWYMYX EGZZVANW
Congo	– sent to LFPWYMYX EGZZVANW
Costa Rica	– sent to KWBCYMYX EGZZVANW
Ecuador	– sent to KWBCYMYX EGZZVANW

El Salvador	– sent to KWBCYMYX EGZZVANW
Eritrea	– sent to LFPWYMYX EGZZVANW
Ethiopia	– sent to LFPWYMYX EGZZVANW
France (Île de la Réunion)	– sent to LFPWYMYX EGZZVANW
French Antilles (France)	– sent to KWBCYMYX EGZZVANW
Greece	– sent to LFPWYMYX EGZZVANW
Guatemala	– sent to KWBCYMYX EGZZVANW
Guyana	– sent to KWBCYMYX EGZZVANW
Iceland	– sent to EGRRYMYX EGZZVANW
Indonesia	– sent to YMMCYMYX EGZZVANW
Italy	– sent to LFPWYMYX EGZZVANW
Japan	– sent to RJTDYMYX EGZZVANW
Kenya	– sent to LFPWYMYX EGZZVANW
Mexico	– sent to KWBCYMYX EGZZVANW
Montserrat (United Kingdom)	– sent to KWBCYMYX EGZZVANW
New Zealand	– sent to NZKLYMYX EGZZVANW

Nicaragua – sent to
KWBCYMYX
EGZZVANW

Papua New Guinea – sent to
YMMCYMYX
EGZZVANW

Peru – sent to
KWBCYMYX
SAZZMAMX
EGZZVANW

Philippines – sent to
RJTDYMYX
YMMCYMYX
EGZZVANW

Portugal – sent to
LFPWYMYX
EGZZVANW

Russian Federation – sent to
KWBCYMYX
RJTDYMYX
EGZZVANW

Solomon Islands – sent to
NZKLYMYX
YMMCYMYX
EGZZVANW

Spain – sent to
LFPWYMYX
EGZZVANW

Trinidad and Tobago – sent to
KWBCYMYX
EGZZVANW

Vanuatu – sent to
NZKLYMYX
EGZZVANW

Table 4-2. VAAC contact numbers

(4.5.1 a) refers)

Note.— Telephone numbers should always be used first. E mail addresses and fax numbers are provided as back-up.

VAAC Anchorage

Tel:	Operational	+1 (907) 266-5110
	Administrative	+1 (907) 266-5116
Fax:		+1 (907) 266-5169
AFTN:		via KWBCYMYX
E-mail:	Operational	a-vaac@noaa.gov
	Administrative	albert.pietrycha@noaa.gov nathan.eckstein@noaa.gov
Homepage:		https://www.weather.gov/vaac https://www.weather.gov/aawu

VAAC Buenos Aires

Tel:	Operational	+(54 11) 5197 5391 +(54 11) 5167 6767, Ext. 18913 +(54 11) 5167 6767, Ext. 18821
	Administrative	+(54 11) 5167 6767, Ext. 18905
Tel:		+(54 11) 5167 6767, Ext. 18838/39 +(54 11) 5167 6707 +(54 11) 5197 5391
AFTN:		SAZZMAMX
E-mail:	Operational	bue.vaac@smn.gob.ar
	Administrative	jadiaz@smn.gob.ar cribero@smn.gob.ar
Homepage:		https://ssl.smn.gob.ar/vaac/buenosaires/inicio.php?lang=es https://ssl.smn.gob.ar/vaac/buenosaires/inicio.php?lang=en

VAAC Darwin

Tel:	Operational	+61 (3) 9910 1721 +61 (3) 9910 1720
	Administrative	+61 (3) 9669 4973
Fax:		+61 (3) 9662 1222 +61 (3) 9662 1223
AFTN:		YMMCYMYX
E-mail:	Operational	darwin.vaac@bom.gov.au
	Administrative	darwin.vaac.admin@bom.gov.au
Homepage:		http://www.bom.gov.au/aviation/volcanic-ash/

VAAC London

Tel:	Operational	+44 330 135 4267 +44 330 135 4271 (alternative)
	Administrative	+44 330 135 0264
Fax:	Operational	+44 1392 44 7221
	Administrative	+44 1392 44 7221
AFTN:		EGZZVANW
E-mail:	Operational	vaac@metoffice.gov.uk
	Administrative	mark.seltzer@metoffice.gov.uk
Homepage:		https://www.metoffice.gov.uk/services/transport/aviation/regulated/vaac

VAAC Montreal

Tel:	Operational	+1 (514) 421 4635
	Administrative	+1 (514) 421 5296
Fax:	Operational	+1 (514) 421 4639
	Administrative	+1 (514) 421 4679
AFTN:		CWAOYMYU
E-mail:	Operational	vaac@ec.gc.ca
	Administrative	dov.bensimon@ec.gc.ca gabriel.servranckx@ec.gc.ca
Homepage:		http://meteo.gc.ca/eer/vaac/index_e.html

VAAC Tokyo

Tel:	Operational	+81 (3) 3434 9120
	Administrative	+81 (3) 3434 9119
Fax:	Operational	+81 (3) 3434 9121
AFTN:		RJTDYMYX
E-mail:	Operational	vaac.tokyo@volash.kishou.go.jp vaac.tokyo@jma.go.jp
	Administrative	vaac.tokyo-adm@volash.kishou.go.jp
Homepage:		https://www.data.jma.go.jp/vaac/data/index.html

VAAC Toulouse

Tel:	Operational	+33 (0) 5 61 07 82 30 or +33 (0) 5 61 07 85 10
	Administrative	+33 (0) 5 61 07 82 39 or +33 (0) 5 61 07 82 37
AFTN:		LFPWYMYX or LFPWYMCR
E-mail:	Operational	vaac@meteo.fr
	Administrative	sarah.puginier@meteo.fr
Homepage:		http://vaac.meteo.fr/

VAAC Washington

Tel:	Operational	+1 (301) 683 1401
	Administrative	+1 (301) 683 1400
Fax:		+1 (301) 683 1405
AFTN:		KWBCYMYX
E-mail:	Operational	w-vaac@noaa.gov
	Administrative	jamie.kibler@noaa.gov
Homepage:		https://www.ospo.noaa.gov/Products/atmosphere/vaac/index.html https://www.ospo.noaa.gov/Products/atmosphere/vaac/messages.html

VAAC Wellington

Tel:	Operational	+64 4 470 0808
	Administrative	+64 27 2512 259
AFTN:		NZKLYMYX
E-mail:	Operational	vaac@metservice.com
	Administrative	aviation.manager@metservice.com
	Additional Information	ray.thorpe@metservice.com
Homepage:		http://vaac.metservice.com

Table 4-3. Volcanic ash advisory bulletin headers
(4.6.1 h), Note 2 refers)

VAAC	Back-up VAAC	Bulletin Headers			Remarks
		VAA	VAA (IWXXM)	VAG	
Anchorage		FVAK21 PAWU FVAK22 PAWU FVAK23 PAWU FVAK24 PAWU FVAK25 PAWU	LUAK21 PAWU LUAK22 PAWU LUAK23 PAWU LUAK24 PAWU LUAK25 PAWU	PFXD21 PAWU PFXD22 PAWU PFXD23 PAWU PFXD24 PAWU PFXD25 PAWU	
	Washington	As above	As above	As above	
Buenos Aires		FVAG01 SABM FVAG02 SABM FVAG03 SABM FVAG04 SABM FVAG05 SABM	LUAG01 SABM LUAG02 SABM LUAG03 SABM LUAG04 SABM LUAG05 SABM	PFXD01 SABM PFXD02 SABM PFXD03 SABM PFXD04 SABM PFXD05 SABM	
	Washington	As above	As above	As above	
Darwin		FVAU01 ADRM FVAU02 ADRM FVAU03 ADRM FVAU04 ADRM FVAU05 ADRM FVAU06 ADRM FVAU07 ADRM FVAU08 ADRM FVAU09 ADRM FVAU10 ADRM	LUAU01 ADRM LUAU02 ADRM LUAU03 ADRM LUAU04 ADRM LUAU05 ADRM LUAU06 ADRM LUAU07 ADRM LUAU08 ADRM LUAU09 ADRM LUAU10 ADRM	PFXD01 ADRM PFXD02 ADRM PFXD03 ADRM PFXD04 ADRM PFXD05 ADRM PFXD06 ADRM PFXD07 ADRM PFXD08 ADRM PFXD09 ADRM PFXD10 ADRM	
	Tokyo	As above	As above	As above	
	Wellington	FVAU01 ADRM FVAU02 ADRM FVAU03 ADRM FVAU04 ADRM FVAU05 ADRM FVAU06 ADRM			
London		FVXX01 EGRR FVXX02 EGRR	LUXX01 EGRR LUXX02 EGRR	PFXD01 EGRR PFXD02 EGRR	
	Toulouse	FVXX05 LFPW		PFXD05 LFPW	
Montreal		FVCN01 CWAO FVCN02 CWAO	LUCN01 CWAO LUCN02 CWAO	PFXD01 CWAO PFXD02 CWAO	
	Washington	FVCN03 CWAO FVCN04 CWAO	LUCN03 CWAO LUCN04 CWAO	PFXD03 CWAO PFXD04 CWAO	
Tokyo		FVFE01 RJTD	LUFE01 RJTD	PFXD01 RJTD	
	Darwin	As above	As above		

VAAC	Back-up VAAC	Bulletin Headers			Remarks
		VAA	**VAA (IWXXM)**	**VAG**	
Toulouse		FVXX01 LFPW FVXX02 LFPW FVXX03 LFPW FVXX04 LFPW	LUXX01 LFPW LUXX02 LFPW LUXX03 LFPW LUXX04 LFPW	PFXD01 LFPW PFXD02 LFPW PFXD03 LFPW PFXD04 LFPW PFXD06 LFPW PFXD07 LFPW PFXD08 LFPW PFXD09 LFPW	PFXD[01-04] LFPW : T4 format PFXD[06-09] LFPW : png format Where PFXDnn and PFXDnn+5 are the same VAG in T4 and png.
	London	FVXX05 LFPW	LUXX05 LFPW	PFXD05 LFPW	PFDX05 EGRR : png format
Washington		FVXX20 KNES FVXX21 KNES FVXX22 KNES FVXX23 KNES FVXX24 KNES FVXX25 KNES FVXX26 KNES FVXX27 KNES	LUXX20 KNES LUXX21 KNES LUXX22 KNES LUXX23 KNES LUXX24 KNES LUXX25 KNES LUXX26 KNES LUXX27 KNES	PFXD20 KNES PFXD21 KNES PFXD22 KNES PFXD23 KNES PFXD24 KNES PFXD25 KNES PFXD26 KNES PFXD27 KNES	
	Darwin	As above	As above	As above	The Darwin and Montreal VAACs will share Washington VAAC headers. Coordination will take place during back up on what headers to use for each erupting volcano.
	Montreal	As above	As above	As above	
Wellington		FVPS01 NZKL FVPS02 NZKL FVPS03 NZKL FVPS04 NZKL FVPS05 NZKL	LUPS01 NZKL LUPS02 NZKL LUPS03 NZKL LUPS04 NZKL LUPS05 NZKL	PFXD01 NZKL PFXD02 NZKL PFXD03 NZKL PFXD04 NZKL PFXD05 NZKL	(png format) [relates to the 5 VAG bulletins]
	Darwin	As above	As above	As above	

Table 4-4. Volcano aviation colour codes
(4.2.5 refers)

Level of alert	Status of activity of volcano
GREEN	Volcano is in normal, non-eruptive state. *or, after a change from a higher alert level*: Volcanic activity considered to have ceased, and volcano reverted to its normal, non-eruptive state.
YELLOW	Volcano is experiencing signs of elevated unrest above known background levels. *or, after a change from a higher alert level*: Volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase.
ORANGE	Volcano is exhibiting heightened unrest with increased likelihood of eruption. *or* Volcanic eruption is underway with no or minor ash emission. *[specify ash-plume height if possible].*
RED	Eruption is forecast to be imminent with significant emission of ash into the atmosphere likely. *or* Eruption is underway with significant emission of ash into the atmosphere *[specify ash-plume height if possible]*.
UNASSIGNED	There is insufficient information available to assess the current status of the volcano or volcanic activity.

Note.— The aviation colour code applies only to current volcanic activity associated with a volcano and does not apply to re-suspended volcanic ash.

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APPENDIX A

SAMPLE LETTER OF AGREEMENT BETWEEN THE AIR TRAFFIC SERVICES, METEOROLOGICAL AUTHORITIES AND STATE VOLCANO OBSERVATORIES

Directives for coordination between area control centres (ACCs)/flight information centres (FICs), meteorological watch offices (MWOs) and State volcano observatories and responsibility for the provision/exchange of information relevant to volcanic ash

Effective date:

1. OBJECTIVE

1.1 The objective of this Letter of Agreement between the [*ATS authority*][1], the [*meteorological authority*][2] and the [*State volcano observatory*][3] is to establish the directives for the necessary coordination between ATS units, meteorological watch offices and State volcano observatories to ensure the provision of specific information on pre-eruption volcanic activity, volcanic eruptions and volcanic ash cloud required for civil (international and national) air navigation, in accordance with international agreements (see 1.4) and [national air navigation regulatory documents].

1.2 This Letter of Agreement provides guidelines on the responsibilities of ATS units, meteorological watch offices and State volcano observatories in relation to the mutual exchange of information related to volcanic ash.

1.3 This Letter of Agreement is in accordance with the Standards and Recommended Practices and Procedures of ICAO, contained in Annex 3 – *Meteorological Service for International Air Navigation*, Annex 11 – *Air Traffic Services*, Annex 15 – *Aeronautical Information Services,* the *Procedures for Air Navigation Services – Aeronautical Information Management* (PANS-AIM, Doc 10066) and the *Procedures for Air Navigation Services – Air Traffic Management* (PANS-ATM, Doc 4444), as well as the provisions contained in the relevant regional air navigation plan publications and in the aeronautical information publication of [*State*][4] (AIP-[*State*]). This Letter of Agreement is also based on the guidance material in the *Manual on Coordination between Air Traffic Services, Aeronautical Information Services* and *Aeronautical Meteorological Services* (Doc 9377), the *Aeronautical Information Services Manual* (Doc 8126) and the *Handbook on the International Airways Volcano Watch* (IAVW) – *Operational Procedures and Contact List* (Doc 9766).

1.4 This Letter of Agreement includes _____[5] appendices, regarding detailed national directives and arrangements pertaining to the use of the volcano level of alert colour code for aviation, the ASHTAM format, abbreviations, list of contact points and means of communication, stations/offices and contact numbers, etc.

2. REVISIONS

2.1 When, for special or unforeseen reasons, a significant change in the coordination between the three parties involved or the services mentioned in this Agreement becomes necessary, the respective officers-in-charge, through mutual agreement, may effect temporary changes or amendments, provided that these changes are not intended to last more than _____[6] days.

1. Name of the ATS authority.
2. Name of the meteorological authority
3. Name of the State volcano observatory.
4. Name of the State concerned.
5. Number of appendices agreed by the three parties to the Letter of Agreement,
6. Figure to be agreed locally: six days appears to be a suitable period.

2.2 Permanent revisions to the Letter of Agreement may be made by the authorities who approve and sign this Agreement. This Letter of Agreement is to be reviewed annually. A complete cancellation of this Letter of Agreement may be made, in writing, by the parties to the agreement within a notice period of _____[7] days.

3. GENERAL

3.1 In order to contribute to the efficiency and safety of international air navigation in [*State*] the [*ATS authority*], the [*meteorological authority*] and the [*State volcano observatory*] will collaborate to ensure fast and efficient coordination to minimize the impact of the presence of volcanic ash in the atmosphere.

3.2 The [*MWOs*][8][*ACCs/FICs*][9][*volcanic ash advisory centres (VAACs) and selected volcano observatories*] concerned shall make suitable arrangements in order to facilitate volcanological briefings as well as inter-agency consultations and to establish reliable communications to undertake an effective coordination.

4. RESPONSIBILITIES

4.1 Responsibilities of the [*meteorological authority*] and the meteorological watch offices

4.1.1 **General**

4.1.1.1 Table MET 1-1 of the eANP identifies the selected State volcano observatories which are to notify the VAAC, MWOs and ACCs/FICs on volcanic pre-eruption, volcanic eruption and volcanic ash.

4.1.1.2 The [*meteorological authority*], through the [*MWO*] included in Table MET II-1 of the eANP, is responsible for issuing SIGMET(s) on volcanic ash, that is, providing up-to-date information on existing and forecast volcanic ash clouds, and forecast trajectories at different flight levels based on the latest information received from State volcano observatories or from the corresponding VAAC to those ACCs/FICs that need it in order to carry out their functions. The provision of any information related to volcanic activity and the presence of volcanic ash clouds in the atmosphere should be in accordance with the guidelines provided in the attachment to this Letter of Agreement.

4.2 Responsibilities of the [*ATS authority*] and area control centres (ACCs))/flight information centres (FICs)

4.2.1 The [*ATS authority*], through the [*ACC/FIC*] included in Table MET II-1 of the eANP, is responsible to provide up-to-date information on existing volcanic ash clouds and trajectory forecasts at different flight levels to pilots and airline operation centers. This information should be based on the latest information received from:

a) State volcano observatories;

b) the associated VAAC; or

c) the associated MWO;

and passed immediately to aircraft in flight that could be affected by the volcanic ash, and to the adjacent ACCs/FICs.

7. Figure to be agreed locally: 180 days appears to be a suitable period.

4.2.2 The ACC/FIC should also issue an ASHTAM or NOTAM through the State International NOTAM Office (NOF) in accordance with the PANS-AIM (Doc 10066), giving details of the pre-eruption activity, volcanic eruption and ash cloud, including the name and geographical coordinates of the volcano, date and time of eruption, flight levels and routes affected and, if necessary, routes to be closed to air traffic. The provision of any information related to volcanic activity and the presence of volcanic ash clouds in the atmosphere should be in accordance with the guidelines provided in the attachment to this Letter of Agreement.

4.3 Responsibility of the State volcano observatory

4.3.1 The [*State volcano observatory*] included in Table MET 1-1 of the eANP is responsible for the provision of up-to-date information on existing and forecast volcanic activity and volcanic ash clouds based on the latest information received from direct or remote observation sources to the [*ACC*], the [*MWO*] and the [*VAAC*] concerned. The necessary volcanological information will be supplied in accordance with the guidelines stipulated in the attachment to this Letter of Agreement.

4.3.2 The volcanological information provided will, as far as possible, be in the format described in step 1 of the attachment in order to facilitate easy interpretation by ATS personnel.

5. ATS UNITS, MWOs AND STATE VOLCANO OBSERVATORIES COORDINATION MEETINGS

Regular and/or ad hoc coordination meetings between the chiefs of the ATS units, chiefs of meteorological watch offices and chiefs of State volcano observatories, and other interested parties, aimed at improving the services provided to aircraft, will be convened as deemed necessary to ensure the safety of air navigation in accordance with the provisions as identified in 1.3.

6. COURSES FOR METEOROLOGISTS, AIR TRAFFIC CONTROLLERS AND VOLCANOLOGISTS

6.1 Courses or on-the-job training for ATS and meteorological personnel, and volcanologists, will be organized periodically with the objective of familiarizing personnel with the activities performed by the other services.

6.2 Periods and dates for these courses will be agreed by the [*ATS authority*], the [*meteorological authority*] and the [*vulcanological authority*] taking into account the availability of personnel and the necessary equipment.

Attachment

GUIDELINES FOR HANDLING VOLCANIC ACTIVITY RELATIVE TO AERONAUTICAL INFORMATION DISSEMINATION

(Complementary to Part 4 of the Handbook on the International Airways Volcano Watch (IAVW) – Operational Procedures and Contact List *(Doc 9766))*

STEP 1

1.1 **Action to be taken by the State volcano observatory**

1.1.1 The State volcano observatory shall immediately provide information on significant pre-eruption volcanic activity, volcanic eruptions or the presence of volcanic ash clouds to the relevant ACCs/FICs [*list the centres*], [*VAAC*] and the associated MWOs [*list the offices*]. The information provided should be in accordance with the format of the volcano observatory notice for aviation (VONA) format given in Appendix E of Doc 9766.

STEP 2

2.1 **Action to be taken by the ACC/FIC**

2.1.1 The ACC/FIC concerned shall immediately pass the reported information to the aircraft in flight that could be affected by the volcanic ash cloud and to the relevant ACCs/FICs in the adjacent flight information regions (FIRs).

2.1.2 On the reception of special air-reports for volcanic ash by an ACC/FIC, the following action should be taken:

a) the information should be transmitted immediately to all aircraft concerned; and

b) the information should be forwarded to the associated MWO.

The special air-reports for volcanic ash should be disseminated to aircraft for a period of 60 minutes after their issuance or until the issuance of a SIGMET from the associated MWO. The ACC/FIC shall verify that a SIGMET has been issued before discontinuing the transmission of the special air-report.

2.1.3 The ACC/FIC concerned shall ensure that the content of the ASHTAM is consistent with any SIGMET issued for their FIR. Further, the ACC/FIC shall ensure that any ASHTAM or NOTAM issued follows the guidance in the *Procedures for Air Navigation Services – Aeronautical Information Management* (PANS-AIM, Doc 10066).

2.1.4 The ACC/FIC concerned shall activate contingency arrangements, including implementation of alternative routes.

2.1.5 Transmit special air-reports for volcanic ash received by voice communications and those received by data link communication to the associated MWO, and World Area Forecast Centres (WAFCs) London and Washington.

2.2 A**ction to be taken by the MWO**

2.2.1 The MWO shall immediately forward special air-reports for volcanic ash received to its associated VAAC, WAFCs London and Washington and to the Washington and Brazilia International OPMET data banks.

2.2.2 The MWO shall ensure the reception of information from its associated VAAC on the extent and trajectory of volcanic ash.

2.2.3 The MWO shall immediately inform the ACC whether or not the volcanic ash cloud is identifiable from satellite images based on advice received from the VAAC.

2.2.4 The MWO shall issue SIGMETs in accordance with Annex 3 based on information received from the VAAC and/or State volcano observatory and/or ACC. However, during critical conditions where an initial volcanic eruption already poses a danger to aviation, the MWO shall immediately provide to the ACC a trajectory forecast of volcanic ash based, inter alia, on the forecasts of numerical models used by the aeronautical meteorological service.

STEP 3

3.1 **Action to be taken by the ACC**

3.1.1 The ACC shall submit a request for the promulgation of an ASHTAM/NOTAM for volcanic ash to its associated NOTAM Office (NOF)/Aeronautical Information Service (AIS). The request shall contain the following:

a) date and time of volcanic activity or eruption, or presence of ash clouds;

b) name and number of the volcano (Smithsonian Tables);

c) coordinates (latitude/longitude expressed in whole degrees) of the volcano and/or the radial and distance of the volcano from a navigational aid (NAVAID);

d) volcano level of alert colour code for avation indicating volcanic activity, if available (Doc 9766, Table 4-4 refers);

e) horizontal and vertical extent of volcanic ash cloud initially based on the special air-report and subsequently based on the MWO, aeronautical meteorological service or VAAC report;

f) forecast direction of movement of the ash cloud at selected levels based on the advice from the MWO, the aeronautical meteorological service or the VAAC report;

g) air routes or portions of air routes and flight levels affected or expected to become affected;

h) closure of airspace, air routes or portions of air routes, and availability of alternate routes;

i) source of information (air-report and or State volcano observatory and/or MWO, aeronautical meteorological service and/or VAAC) indicating whether an eruption has actually occurred or ash cloud reported, or not; and

j) additional information.

Note.— Initially items a), b), c), and d) shall be disseminated immediately pending receipt of additional information from units concerned.

3.2 **Action to be taken by the NOF/AIS**

3.2.1 The NOF shall promulgate an ASHTAM/NOTAM for volcanic activity based on information provided by the ACC and in accordance with the PANS-AIM (Doc 10066), Appendices 3 and 5, and transmit to other NOFs for which the information is of direct operational significance.

3.2.2 The NOF shall compile a separate message to be transmitted, via AFTN, to the [*associated VAAC*] which shall be encapsulated within a dummy WMO abbreviated heading (Doc 9766, Table 4-1 refers). This enables the receiving AFTN or meteorological switching centre to forward the ASHTAM/NOTAM for volcanic activity to the VAAC concerned on internal meteorological communications circuits.

Note.— Significant changes in the activity of the volcano shall be reported accordingly.

3.3 The ACC concerned shall, upon receipt of significant information relating to volcanic activity, request the NOF to revise or cancel the ASHTAM.

— — — — — — — —

APPENDIX B

AFTN ADDRESSES TO BE USED TO PROMULGATE SPECIAL AIR-REPORTS, SIGMETS AND VOLCANIC ASH ADVISORIES TO LONDON WAFC AND SADIS VIA APPROPRIATE GATEWAY

Region	Address
EUR	EGZZWPXX
NAM	EGZZMNAM
NAT	EGZZMNAT
CAR	EGZZMCAR
SAM	EGZZMSAM
PAC	EGZZMPAC
ASIA	EGZZMASI
MID	LOZZMMID
AFI	LFZZMAFI

— — — — — — — —

APPENDIX C

OPERATIONAL PROCEDURES FOR THE COORDINATION AND TRANSFER OF RESPONSIBILITY BETWEEN VAACS FOR VOLCANIC ASH EVENTS

Note.— The primary VAAC is defined as the VAAC with responsibility for coordinating the production of advisories for a) an ash cloud from a volcanic eruption originating within its designated area of responsibility; or b) an ash cloud, of unknown origin, reported in its area of responsibility (including false alarms).

1. As soon as one of the VAACs learns of an eruption (for a volcano erupting within 300 NM of the volcanic ash advisory centre's boundary) or when an ash cloud is expected to come within 300 NM of the VAAC and/or FIR boundary, an information/coordination contact will be made, normally by the primary VAAC. The possibility of a handover will be discussed, if appropriate.

2. Handover of operational responsibility shall be discussed/coordinated by the primary VAAC with adjacent affected VAACs when the ash cloud is expected to be not less than 300 NM from a VAAC and/or FIR boundary. The primary VAAC will coordinate with the neighbouring VAAC(s) to produce a coordinated product covering both areas of responsibility. The primary VAAC may produce a single product covering both areas of responsibility or both (all) VAACs may agree to produce seamless products covering their own areas of responsibility.

3. In some situations, there may be agreement that provision of information can best be served by the primary VAAC from "start to finish". In such a case, a message in the remarks section of the volcanic ash advisory would advise users of who has the responsibility (see paragraph 6). However, in situations of large or persistent ash emissions or for other reasons, adjacent responsible VAACs, upon coordination, may agree to divide the operational forecast responsibility and issue their own volcanic ash advisory (see paragraph 8). Examples of this and other situations of coordination and transfer of responsibility between VAACs are given at the end of this appendix.

4. In the case where a handover has been decided, VAACs should insert a note in their "last"/"first" volcanic ash advisory and volcanic ash advisory in graphical format that the handover will take place at that message/graphic number. The last volcanic ash advisory issued by the VAAC before handover will include the following at the end of the message (in the remarks section):

> "THE RESPONSIBILITY FOR THIS ASH EVENT IS BEING TRANSFERRED TO VAAC **aaaa** THE NEXT ADVISORY WILL BE ISSUED BY VAAC **aaaa** BY **xxxx** UTC UNDER HEADER **bbbb**."
>
> Where:
>
> **aaaa** is the name of the VAAC taking over
>
> **bbbb** is the bulletin header that will be used by the VAAC taking over (FVCN01 CWAO, FVXX21 KNES, FVAK22 PAWU, etc.)
>
> **xxxx** is the time in UTC
>
> Example:
>
> "THE RESPONSIBILITY FOR THIS ASH EVENT IS BEING TRANSFERRED TO VAAC MONTREAL. THE NEXT ADVISORY WILL BE ISSUED BY VAAC MONTREAL BY 2200 UTC UNDER HEADER FVCN01 CWAO."

5. The first volcanic ash advisory issued by the VAAC that has taken over responsibility will include the following at the end of the message (in the remarks section):

"VAAC **cccc** HAS TRANSFERRED RESPONSIBILITY OF THIS EVENT TO VAAC **dddd**. THIS ADVISORY UPDATES MESSAGE **eeee**."

Where:

cccc is the name of the VAAC issuing the advisories before the handover

dddd is the name of the VAAC that has taken over

eeee is the full bulletin header (such as FVAK22 PAWU 261200) of the last message issued by the VAAC issuing the advisories before the handover

Example:

"VAAC ANCHORAGE HAS TRANSFERRED RESPONSIBILITY OF THIS EVENT TO VAAC MONTREAL. THIS ADVISORY UPDATES MESSAGE FVAK22 PAWU 261200."

6. When a VAAC is issuing messages covering a portion of another volcanic ash advisory centre's area of responsibility, or an ash cloud is approaching (that is, expected within 300 NM) the area of responsibility of another VAAC, that other VAAC should:

a) issue a volcanic ash advisory directing the user to the correct product. The following wording is suggested:

"PLEASE SEE **ffff** ISSUED BY VAAC **gggg** THAT DESCRIBES CONDITIONS OVER OR NEAR THE VAAC **hhhh** AREA OF RESPONSIBILITY."

Where:

ffff is the full bulletin header of the message issued by the first VAAC

gggg is the name of the first VAAC

hhhh is the name of the VAAC re-broadcasting the first volcanic ash advisory centre's message

Example of re-broadcast message issued by VAAC Montreal:

"PLEASE SEE FVAK22 PAWU 121200 ISSUED BY VAAC ANCHORAGE THAT DESCRIBES CONDITIONS OVER OR NEAR THE VAAC MONTREAL AREA OF RESPONSIBILITY"

or

b) send the first volcanic ash advisory as it is by changing only the WMO header in order to address the normal recipients within the other volcanic ash advisory centre's area of responsibility.

Note.— For volcanoes located within 500 km (300 NM) of a VAAC border, it may be that no rebroadcast volcanic ash advisory is required due to the volcanic ash cloud being forecast to move away from the VAAC border for the duration of the forecast period.

7. When two or more distinct ash clouds are present (different eruptions or one eruption for which the ash cloud has divided in two or more distinct parts), the handover only applies to the ash cloud approaching or crossing VAAC boundaries.

8. When adjacent responsible VAACs, upon coordination, have agreed to divide the operational forecast responsibility and issue their own volcanic ash advisory because of large or persistent ash emissions or for other reasons:

a) the primary VAAC will ensure consistency at the border with adjacent VAACs;

b) if the ash cloud is expected to move within 300 NM of the area of responsibility of a third (fourth) VAAC with no common border with the primary VAAC, the second (third) VAAC is responsible for initiating coordination; and

c) the second (third) VAAC is also responsible to ensure consistency at the border with the third (fourth) VAAC.

9. When two or more VAACs are issuing their own volcanic ash advisories for an ash cloud that stretches across their borders (see paragraph 8), the VAACs will coordinate a common issue time for their volcanic ash advisories and will include the following at the end of their message (in the remarks section):

"PLEASE SEE ALSO **ffff** ISSUED BY VAAC **gggg** (and **f'f'f'f'** ISSUED BY VAAC **g'g'g'g'**) THAT DESCRIBE(S) CONDITIONS NEAR THE VAAC **hhhh** AREA OF RESPONSIBILITY."

Where:

ffff, **f'f'f'f'** are the bulletin header of the message issued by neighbouring VAACs

gggg, **g'g'g'g'** are the names of the neighbouring VAACs

hhhh is the name of the VAAC issuing the volcanic ash advisory for its area of responsibility

Example of the remarks section for a message issued by VAAC Toulouse:

"PLEASE SEE ALSO FVAG01 SABM 121200 ISSUED BY VAAC BUENOS AIRES AND FVAU01 121200 ADRM ISSUED BY VAAC DARWIN THAT DESCRIBE CONDITIONS NEAR THE VAAC TOULOUSE AREA OF RESPONSIBILITY"

10. The ending of an advisory for a volcanic ash event shall be performed by the primary VAAC, upon coordination with the adjacent affected VAACs and MWOs. When more than one VAAC is issuing advisories, the ending of advisories will be coordinated between the VAACs involved.

11. VAACs should document in their handover processes as part of their quality management system as a minimum:

a) the contact points at the neighbouring VAACs (telephone, e-mail address, websites);

b) when a call to discuss the handover process will be initiated;

c) from what date/time a handover will take place; and

d) a discussion and agreement of where the volcanic ash cloud is expected to be located at handover time and beyond.

12. VAACs should establish a collaborative mechanism (such as a secure web page) for sharing volcanic ash observational information and dispersion forecast data for evaluation of the handover.

Example 1 of coordination and transfer of responsibility between VAACs:

A single volcanic ash cloud is emitted from a volcano in VAAC A's area of responsibility and becomes "detached" from it following the end of the eruption. It drifts from the area of responsibility of VAAC A to that of VAAC B. When it is within 300 NM of the area of responsibility of VAAC B (or sooner, if one of the VAACs feels it is necessary), VAAC A contacts VAAC B to discuss coordination with respect to this volcanic ash cloud. If it is decided that the volcanic ash cloud will move either completely or partially into VAAC B's area of responsibility, the two VAACs will discuss at what moment VAAC B will become the primary VAAC and take over responsibility for issuance of volcanic ash advisories and volcanic ash advisories in graphical format. Until this handover occurs, VAAC A remains responsible for issuing these products.

Should the volcanic ash cloud in the above scenario be large enough to require coordination with a third VAAC (VAAC C), the same procedure as described between the first two VAACs would apply between the primary VAAC (either A or B in the scenario above, depending on the timing and position of the volcanic ash cloud) and VAAC C.

Example 2 of coordination and transfer of responsibility between VAACs:

A single volcanic ash cloud is emitted from a volcano in VAAC A's area of responsibility and remains "attached" to the volcano during an extended eruption (that is, the eruption continues). The primary VAAC (VAAC A) retains responsibility for issuing volcanic ash advisories and volcanic ash advisories in graphical format for this volcanic ash cloud, but consults the other affected VAACs and accounts for their analysis and forecast positions of the volcanic ash cloud over their area of responsibility. The primary VAAC has the responsibility for coordinating all of this information and contacting the other VAACs. However, if one of the non- primary VAACs feels the need to contact the primary VAAC, it may do so at any time.

Should the volcanic ash cloud described in the preceding paragraph be large enough that having its analysis and forecast position reflected in only one volcanic ash advisory is unwieldy, its advisories shall be issued by multiple VAACs. This would be the case where the volcanic ash cloud covers the areas of responsibility of several VAACs. Each VAAC then has the responsibility of contacting its neighbouring VAACs (as many as required by the position of the volcanic ash cloud) to coordinate the analysed and forecast positions of the volcanic ash cloud along the boundaries between VAACs. In this case, each VAAC is considered to be the primary VAAC for its own products.

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APPENDIX D

BACK-UP PROCEDURES FOR VAACS

The following guidelines on back-up procedures should be followed by VAACs:

a) a back-up site should be established;

b) back-up sites should have the full capability of the primary site, that is, the ability to monitor ash dispersal, run atmospheric dispersion models, produce and distribute the volcanic ash advisory;

c) the back-up site should be chosen as to maximize efficiency, for example this will normally be at an alternative 24/7 production facility with pre-existing facilities for the VAAC capability;

d) back-up sites should maintain up-to-date contact and distribution (AFS and e-mail) lists as per the VAAC;

e) in the event of the back-up site becoming operational, volcanic ash advisories issued by the back-up VAAC will contain information in the RMK section of the VAA (and in metadata for IWXXM back-up VAA) giving the origin of the message; and

f) the back-up arrangements should be tested at least annually.

Note.— The nine VAACs have back-up arrangements in place with at least one other VAAC. The back-up information will be disseminated in accordance with the information in Table 4-3.

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APPENDIX E

VOLCANO OBSERVATORY NOTICE FOR AVIATION (VONA) FORMAT

(1) VOLCANO OBSERVATORY NOTICE FOR AVIATION – VONA	
(2) Issued:	Universal (Z) date and time (YYYYMMDD/HHMMZ).
(3) Volcano:	Name and number (per Smithsonian database at https://volcano.si.edu/)
(4) Current aviation colour code:	**GREEN, YELLOW, ORANGE, RED OR UNASSIGNED** in upper-case bold font
(5) Previous aviation colour code:	Lower-case font, not bold
(6) Source:	Name of volcano observatory (volcanological agency)
(7) Notice number:	Create unique number for each VONA that includes year
(8) Volcano location:	Latitude, longitude in NOTAM format (N or S deg min W or E deg min)
(9) Area:	Regional descriptor
(10) Summit elevation:	nnnnn FT (nnnn M)
(11) Volcanic activity summary:	Concise statement that describes activity at the volcano. If known, specify time of onset and duration (local and UTC) of eruptive activity. If the eruption is ongoing at the time of VONA release, indicate "eruption and ash emission is continuing".
(12) Volcanic cloud height:	Best estimate of ash-cloud top in nnnnn FT (nnnn M) above summit or AMSL (specify which). Give source of height data (ground observer, pilot report, radar, etc.). "UNKNOWN" if no data available or "NO ASH CLOUD PRODUCED" if applicable.
(13) Other volcanic cloud information:	Brief summary of relevant cloud characteristics (colour of cloud, shape of cloud, direction of movement, etc.) Specify if cloud height is obscured or suspected to be higher than what can be observed clearly. "UNKNOWN" if no data available or "NO ASH CLOUD PRODUCED" if applicable.
(14) Remarks:	Optional. Brief comments on related topics (monitoring data, observatory actions, volcano's previous activity, etc.)
(15) Contacts:	Names, telephone and e-mail addresses.
(16) Next notice:	"A new VONA will be issued if conditions change significantly or the colour code is changed." Include URL of website where latest volcanic information is posted.

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APPENDIX F

GUIDANCE FOR CONDUCTING VOLCANIC ASH EXERCISES IN ICAO REGIONS

1. OVERVIEW

1.1 Volcanic ash exercises should be conducted by ICAO on a regional basis in order to practice and develop inter-agency response to volcanic activity, in order to maintain safety, regularity and efficiency of aviation in the event of a volcanic eruption. This guidance recognizes that there is significant regional variation in the nature, frequency, observation of and response to volcanic eruptions. The frequency and scope of volcanic ash exercises is the responsibility of the ICAO region concerned. Where frequent volcanic activity results in adequate information about system performance, exercises may be omitted or constrained to infrequent, extraordinary situations or be held only to test revised procedures.

1.2 Volcanic ash exercises should be facilitated via the ICAO Regional Office concerned and support the regular assessment of system performance (in accordance with quality management principles), in particular the assessment of the safety performance which is required by ICAO safety management provisions.

1.3 Reports of the exercises or performance assessments should be reviewed by an appropriate sub-group or sub-groups within the ICAO region concerned. The focus of these reviews should be the development of improved provisions. Recommendations for improvements to global ICAO provisions, based on the regional review of the exercises, should be brought to the attention of the ICAO Planning and Implementation Regional Group (PIRG) concerned and/or to the International Airways Volcano Watch Operations Group (IAVWOPSG).

1.4 A volcanic ash exercises steering group may be established by a PIRG to coordinate all aspects of the organization and conduct of the exercises. The steering group should have representatives from, as a minimum, the volcanic ash advisory centres (VAACs) concerned, air navigation service providers (ANSPs), airspace users and regulators.

2. EXERCISES AND PERFORMANCE ASSESSMENTS

2.1 Volcanic ash exercises should be held at a frequency to be determined by the ICAO region concerned. They should be held at least every three years where the frequency of real eruptions is low and additionally as soon as practicable when significant changes to the procedures have been implemented.

2.2 Volcanic ash exercises should be designed to test volcanic activity alerting, aeronautical information service (AIS) and meteorological (MET) message routing, volcanic ash information, air traffic control procedures, air traffic flow and capacity management and aircraft operator response and the collaborative decision making (CDM) between the various actors in accordance with regional and global procedures.

2.3 Exercises can only simulate a real event, while operation of the aviation system must continue normally and be unaffected by the exercise. The planning of the exercise needs to ensure that detrimental effects on the system performance are avoided, but that nevertheless useful experience and information is generated.

2.4 A complete, system-wide exercise for volcanic ash contamination is an extremely complex undertaking since such an event involves a great number and variety of stakeholders. It might therefore be useful to constrain exercises to specific parts of the whole system, with other parts of the system being subject to testing at subsequent exercises.

3. OBJECTIVES

3.1 The exercises should be designed to:

a) practice the conduct of volcanic activity response in accordance with the regional reference documents;

b) verify existing information, AIS and MET message routing via AFTN addresses, relevant e-mail addresses, telephone and fax numbers, and internet addresses (URLs);

c) maintain appropriate information and message routing between all involved agencies and organizations;

d) provide volcanic activity response training for key personnel involved;

e) allow regulators to assess the preparedness and operational response in terms of planning, process and procedures of operators; and

f) provide, when appropriate, recommendations for amendment of the reference documents, in accordance with the lessons learned and conclusions contained in the final exercise report.

3.2 Exercises may also be designed to test suggested new procedures on a limited scale before regional/global implementation.

3.3 Exercise and system performance assessments should be aimed at a critical review of existing provisions and their further improvement.

4. CONCEPTS

4.1 Each exercise should involve a simulated volcanic contamination (such as eruption of a volcano or a re-suspended cloud of volcanic ash) affecting air navigation. Simulated ash clouds may cross international boundaries, depending on the objectives of the exercise and may affect more than one VAAC area of responsibility. Exercises may utilize real-time meteorological conditions, archived data or a scenario.

4.2 Each exercise may have different objectives, which the scenario will be designed to address. For example, any or all of the activities listed below may be tested depending on the scope of the exercise:

a) AFTN, e-mail addresses, websites, message routing and voice communications;

b) alerting and observation of ash (such as use of VONA and VAR);

c) VAAC response (such as volcanic ash information);

d) ATS response (including air traffic control and AIS for NOTAM issuance);

e) air traffic management (ATM) response;

f) aircraft operator response (including safety risk assessment);

g) meteorological watch office response (that is, SIGMET); and

h) suitability of information, its frequency, format and content.

5. PLANNING AND REPORTING

5.1 Each ICAO region should establish an appropriate structure (such as focal point or steering group) for the conducting of regional volcanic ash exercises and system performance assessments. For each exercise, an exercise leader should be appointed and a planning meeting held approximately three months before the exercise is due to take place.

5.2 An exercise directive should be published prior to the exercise which clearly describes the exercise scenario, participating agencies and any special instructions.

5.3 After the exercise, initial exercise reports should be prepared by all participating agencies. A debrief meeting should be held soon after the exercise to discuss the exercise reports. The exercise leader should then produce a consolidated final exercise report for consideration by the relevant ICAO group.

6. ICAO REFERENCE MATERIAL

Annex 3 – *Meteorological Service for International Air Navigation*

Annex 11 – *Air Traffic Services*

Annex 15 – *Aeronautical Information Services*

Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM, Doc 4444)

Manual on Volcanic Ash, Radioactive material and Toxic Chemical Clouds (Doc 9691)

Global Air Navigation Plan (Doc 9750)

Global ATM Operational Concept (Doc 9854)

Flight Safety and Volcanic Ash (Doc 9974)

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APPENDIX G

COST RECOVERY FOR ISSUANCE OF VONA

1. In accordance with *ICAO's Policies on Charges for Airports and Air Navigation Services* (Doc 9082), Chapter 3, 3.1.1, the costs of providing all aeronautical information to be charged to users of that information may be recovered.

2. This includes information provided by State volcano observatories for international aviation. Annex 3 sets out the mandate for States to recover the costs of State volcano observatories when providing information for international aviation, specifically:

> **"3.6 State volcano observatories**
>
> Contracting States with active or potentially active volcanoes shall arrange that State volcano observatories monitor these volcanoes and when observing:
>
> a) significant pre-eruption volcanic activity, or a cessation thereof;
>
> b) a volcanic eruption, or a cessation thereof; and/or
>
> c) volcanic ash in the atmosphere
>
> shall send this information as quickly as practicable to their associated ACC/FIC, MWO and VAAC.
>
> *Note 1.— Pre-eruption volcanic activity in this context means unusual and/or increasing volcanic activity which could presage a volcanic eruption.*
>
> *Note 2.— Doc 9766 contains guidance material about active or potentially active volcanoes."*

3. The VONA is a well-defined template for providing the information contemplated to VAACs, ACCs/FICs and MWOs.

4. Notwithstanding the mandate in Annex 3, it is up to each State concerned to determine whether cost recovery is undertaken and the specific approach used. Typically, a State's Civil Aviation Authority would recommend to its government what approach should be taken (see Doc 9082, Chapter 3).

5. For volcano observatories interested in investigating whether cost recovery is possible, there are two basic initial steps:

a) estimate what observatory costs are legitimately aviation related; and

b) open discussions with the State Civil Aviation Authority and meteorological authority to discuss possible approaches and ensure that all parties act in a coordinated manner.

6. Additional explanation of these issues is provided in a 2009 document entitled *Guidance for State Volcano Observatories: the International Airways Volcano Watch,* prepared by the Australian Bureau of Meteorology, the New Zealand Civil Aviation Authority, ICAO and the World Organization of Volcano Observatories (WOVO), among others.

Additional advice and examples

7. The VONA delivers urgent information about activity at a specific volcano in a concise manner easily understood by non-volcanologists such as dispatchers, pilots and aviation meteorologists. Thus, when writing a VONA, avoid volcanological jargon and choose terms that will be understood by non-experts. The resulting VONA should be a simple and direct message that is focused on the specific situation at the volcano.

8. It should be noted that volcano observatory information products for aviation are not limited to VONA. In this regard, the VONA should be treated as a base-line product and volcano observatories are encouraged to provide supplementary reports with a greater level of detail, where appropriate. For example, during an eruption in Iceland the Icelandic Meteorological Office, with input from the Institute of Earth Sciences, may send frequent (several times a day) volcanic activity status reports summarizing eruption plume characteristics to VAAC London for use in its ash-dispersion model. Such status reports are not considered to be VONA. Similarly, volcano observatories in the Russian Federation and the United States issue daily reports on the status of volcanoes, and these are not VONA. The VONA is intended for significant changes in activity.

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DOCUMENT CHANGE RECORD

Part 5

DATE	PAGES AFFECTED
16.9.24	Argentina, Australia, Bolivia (Plurinational State of), Cabo Verde, Cameroon, Canada, Chile, Comoros, Costa Rica, Ecuador, France, French Antilles (France), French Guiana (France), Greece, Iceland, Île de la Réunion (France), Île de Mayotte (France), Indonesia, Italy, Japan, Montserrat (United Kingdom), New Zealand, Papua New Guinea, Paraguay, Peru, Philippines, Portugal, Russian Federation, Solomon Islands, Spain, Trinidad and Tobago, United States, Uruguay New entries : Ascension Island (United Kingdom), Norway, Tristan da Cunha (United Kingdom) Update to 5.2 to reflect redefined ICAO Regions
10.3.20	France, Antilles (France), French Guiana (France), Île de la Réunion (France), Mayotte (France)
8.5.19	Italy
30.11.17	Japan, Russian Federation
22.8.16	Portugal
30.6.14	Iceland, Île de la Réunion (France)
21.11.14	Congo, Russian Federation
6.11.12	Argentina, Cabo Verde, Cameroon, Congo, Japan
17.8.12	Argentina, Brazil
5.6.12	Mexico
17.2.12	Spain
9.12.10	Bolivia (Plurinational State of), Dominican Republic, Ecuador, Guyana, Honduras, Mexico, Netherlands Antilles and Panama – contact information updated
19.10.10	Cameroon – contact information updated
20.9.10	Brazil – contact information updated
12.7.10	Montserrat (United Kingdom) – contact information updated
25.9.09	Update to Mexico
21.4.09	Update to Suriname
25.2.09	New entries: Cuba, Honduras, Jamaica and Puerto Rico (United States) Updates to: Dominican Republic, Mexico, Netherlands Antilles (Netherlands) and Trinidad and Tobago
16.12.08	New entry: Netherlands Antilles (Netherlands)
17.10.08	Update to Cameroon

DATE	PAGES AFFECTED
8.9.08	New entry: Dominican Republic
26.8.08	Updates to: Cabo Verde, Cameroon, Comoros, Congo and CAR/SAM States
22.2.08	Portugal
5.11.07	Canada
16.4.07	Russian Federation
12.2.07	Guyana, Paraguay and Uruguay
4.12.06	Greece, Iceland, Italy, Portugal, Russian Federation and Spain
24.4.06	Canada and Peru
16.3.06	Kenya
3.3.06	Argentina, Brazil and Chile
28.11.05	Ecuador, Panama
1.11.05	Argentina, Chile, Paraguay
30.6.05	El Salvador
25.4.05	Peru

Part 5

INTERNATIONAL AIRWAYS VOLCANO WATCH CONTACT LIST

5.1 ALPHABETICAL LISTING

Antigua and Barbuda
Ascension Island (United Kingdom)
Argentina
Australia
Bolivia (Plurinational State of)
Brazil
Cabo Verde
Cameroon
Canada
Chile
China
Colombia
Comoros
Congo
Costa Rica
Cuba
Dominican Republic
Ecuador
El Salvador
Eritrea
Ethiopia
France
France (Île de la Réunion)
France (Île de Mayotte)
French Antilles
French Guiana (France)
Greece
Grenada
Guatemala
Guyana
Honduras
Iceland
Indonesia
Italy
Jamaica
Japan
Kenya
Mauritius
Mexico
Montserrat (United Kingdom)
Netherlands Antilles (Netherlands)
New Zealand
Nicaragua
Pakistan
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Puerto Rico (United States)
Portugal
Russian Federation
Saint Kitts and Nevis
Saint Lucia
Saint Vincent and the Grenadines
Solomon Islands
Spain
Suriname
Trinidad and Tobago
Tristan da Cunha (United Kingdom)
United States
Uruguay
Vanuatu
Venezuela (Bolivarian Republic of)

5.2 LIST OF STATES BY ICAO REGION

ESAF

Comoros
Eritrea
Ethiopia
France (Île de la Réunion)
Kenya
Mauritius

ASIA/PAC

Australia
China
Indonesia
Japan
New Zealand
Pakistan
Papua New Guinea
Philippines
Solomon Islands
Vanuatu

CAR/SAM

Argentina
Bolivia (Plurinational State of)
Brazil
Chile
Colombia
Ecuador
Guyana
Panama
Paraguay
Peru
Suriname
Uruguay
Venezuela (Bolivarian Republic of)

EUR/NAT

France
Greece
Iceland
Italy
Portugal
Russian Federation
Spain

NACC

Antigua and Barbuda
Canada
Costa Rica
Cuba
Dominican Republic
El Salvador
French Antilles (France)
French Guiana (France)
Grenada
Guatemala
Honduras
Jamaica
Mexico
Montserrat (United Kingdom)
Netherlands Antilles (Netherlands)
Nicaragua
Puerto Rico (United States)
Saint Kitts and Nevis
Saint Lucia
Saint Vincent and the Grenadines
Trinidad and Tobago
United States

WACAF

Cabo Verde
Cameroon
Congo

ANTIGUA AND BARBUDA

Volcano observatory or authority			
FIR	PIARCO		
ACC		Tel./Fax:	+1 (268) 462 4703
MWO		Tel.: Fax:	+1 (268) 462 3229 +1 (268) 462 4606

ASCENSION ISLAND (UNITED KINGDOM)

Volcano observatory or authority	British Geological Survey	Tel.:	+131 667 1000 (switchboard) +131 650 0417 (direct)
		E-mail:	sclou@bgs.ac.uk
		Internet:	www.bgs.ac.uk

ARGENTINA

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FIR	EZEIZA		
ACC		Tel.: Mobile: AFTN: Fax: E-mail:	+54 (11) 4480 2264 +54 (11) 4317 6000 Ext: 57264 +54 (11) 5802 4160 SAEZZRZX SAEZZQZX +54 (11) 4480 2344 acc.ezeiza@eana.com.ar
MWO	AEROPARQUE	Tel./Fax: AFTN: E-mail:	+54 (11) 4514 1612 SABEYMYX SAZZMAMX omaaer@smn.gov.ar
FIR	CORDOBA		
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			+54 (297) 537 4714
		AFTN:	SAVCZRZX
			SAVCZQZX
		E-mail:	acc.comodoro@eana.com.ar
MWO	COMODORO RIVADAVIA	Tel./Fax:	+54 (297) 454 8018
		AFTN:	SAVCYMYX
			SAZZMAMX
		E-mail:	omacrv@smn.gov.ar
NOF	EZEIZA	Tel./Fax:	+54 (11) 2260 4480
		AFTN:	SAEZYNYX
		E-Mail:	nofezeiza@eana.com.ar

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Volcano observatory or authority	Bureau of Meteorology Melbourne (VAAC Darwin)	Tel.: E-mail: Fax:	+61 (3) 9910 1721 darwin.vaac@bom.gov.au +61 (3) 9662 1223
	Geoscience Australia	Tel.: Internet: E-mail:	+61 (2) 6249 9966 https://www.ga.gov.au hazards@ga.gov.au
FIR	BRISBANE		
MWO	BRISBANE	Tel.: AFTN:	+61 (7) 3239 8650 YBBBYMYX
ACC	BRISBANE	Tel.: AFTN: Fax:	+61 (2) 6268 5063 YBBBYNYX +61 (2) 6268 5044
NOF	BRISBANE & MELBOURNE	AFTN: Fax:	YBBBYNYX +61 (7) 3866 3553
FIR	MELBOURNE		
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BOLIVIA (PLURINATIONAL STATE OF)

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FIR	LA PAZ		
ACC		Tel./Fax: AFTN:	+591 (2) 281 0203 SLLPZRZX
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NOF	LA PAZ	Tel.:/Fax: AFTN: E-mail:	+591 (2) 231 6686 Ext. 126 SLLPYNYX ais@aasana.bo

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		E-mail:	cmv-az@cindacta4.decea.gov.br
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ACC		Tel.:	+55 (61) 3364 8404
		AFTN:	SBBRZRZX
		Fax:	+55 (61) 3364 8418
MWO	BRASILIA/CINDACTA I	Tel.:	+55 (61) 3364 8358
		AFTN:	SBBSYMYX
		E-mail:	cmv-bs@cindacta1.aer.mil.br
FIR	RECIFE		
ACC		Tel.:	+55 (81) 3462 2742
		AFTN:	SBRFZRZX
		Fax:	+55 (81) 3462 4927
MWO	RECIFE/CINDACTA III	Tel.:	+55 (81) 2129 8093
			+55 (81) 2129 8094
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		E-mail:	cmv-re@cindacta3.aer.mil.br
FIR	ATLANTICO		
ACC		Tel.:	+55 (81) 3343 6215
		AFTN:	SBAOZRZX
MWO	RECIFE/CINDACTA III	Tel.:	+55 (81) 2129 8093
			+55 (81) 2129 8094
		AFTN:	SBREYMYX
		E-mail:	cmv-re@cindacta3.aer.mil.br

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ACC		Tel./Fax:	+55 (41) 3356 3475 +55 (41) 3251 5342
		AFTN:	SBCWZRZX
MWO	CURITIBA/CINDACTA II	Tel.:	+55 (41) 3356 6216 +55 (41) 3251 5357
		AFTN:	SBCWYMYX
		E-mail:	cmv-cw@cindacta2.aer.mil.br
NOF	BRASILIA	Tel./Fax:	+55 (61) 364 8353
		AFTN:	SBRJYNYX
		E-mail:	nofbrazil@cindacta1.aer.mil.br

CABO VERDE

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NOF	SAL	Tel: AFTN: E-mail: Fax:	+238 241 2090 GVACYNYX sgia.nof@asa.cv +238 241 3264

CAMEROON

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FIR	BRAZZAVILLE	Tel.: AFTN: Fax:	+242 810 479 +242 815 151 FCCCZQZX +242 810 459
FIC	DOUALA	Tel: AFTN:	+237 33 42 4428 FKKDYDYX
MET	DOUALA	Tel.: AFTN: E-mail: Fax:	+237 33 42 4428 FKKDYMYX cmpdla@yahoo.fr +237 33 42 7122
MWO	BRAZZAVILLE	Tel.: AFTN E-mail:	237 42 03 785 FCBBYMYX cvmbrazza@yahoo.fr
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MWO		Tel.: AFTN: Fax:	+1 (780) 951 8904 CWEGYMYX +1 (780) 951 8872
FIR	MONCTON		
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