

**HANDBOOK
ON THE
INTERNATIONAL AIRWAYS
VOLCANO WATCH (IAVW)**

**OPERATIONAL PROCEDURES
AND CONTACT LIST**

SECOND EDITION — 2004



*Approved by the Secretary General
and published under his authority*

DOCUMENT CHANGE RECORD ON THE WEB
Parts 1 to 4

DATE	SECTION PAGES AFFECTED
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 “ <i>volcano observatory</i> after <i>WMO</i> ”; para 4.5.1 a) added footnote no. 5; para 4.5.1 c) line 3, added “ <i>using the PNG format</i> ” after “ <i>graphical format</i> ” and deleted “(<i>in a position to do so</i>)”; page 4-10, added “ <i>see Appendix E – VONA</i> ”; 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”.
12.07.10	Part 2: Updated Wellington (New Zealand) area of responsibility text Replaced VAAC Map Part 4: New paragraph 4.3.3
8.07.10	Part 4: Replaced Appendix E with updated version Appendix F (new) was added
14.5.10	Part 2. Change to Toulouse VAAC area of responsibility
14.4.10	Part 4: VAAC Tokyo
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

DATE	SECTION PAGES AFFECTED
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
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 4: 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 renumber 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

DATE	SECTION PAGES AFFECTED
25.10.04	Part 4: AFTN address for ASHTAMs/NOTAMs
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 & 4: VAAC Tokyo

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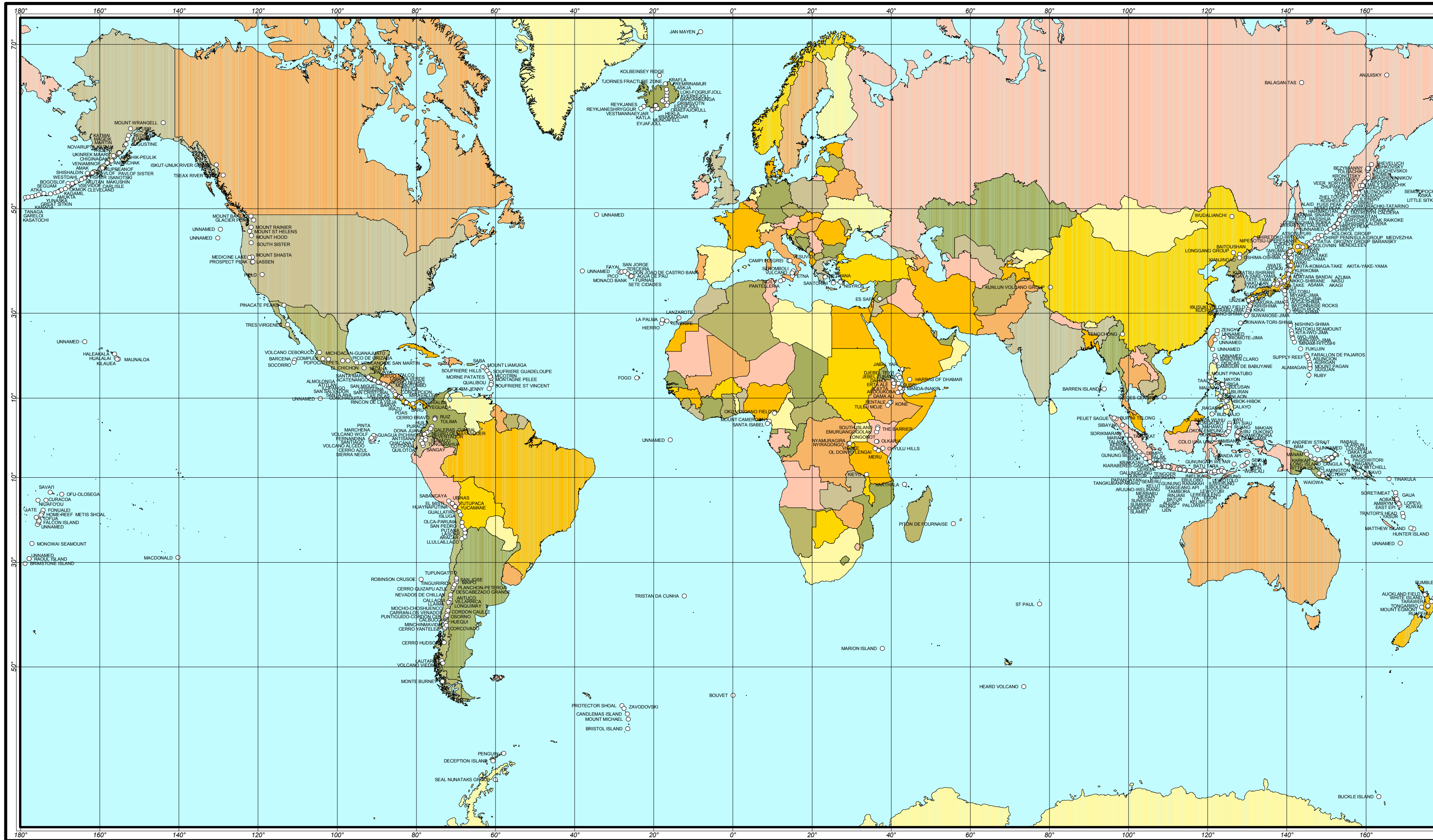
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Part 1

VOLCANOES ACTIVE DURING THE LAST 10 000 YEARS



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

VOLCANOES OF THE WORLD
 3000 0 3000 Km
 Mercator Projection

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 80025 (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 heading 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 to which the advisory information on volcanic ash should be sent.
7. ICAO location indicator of the ACCs in Column 6.

VOLCANIC ASH ADVISORY CENTRE	ICAO LOCATION INDICATOR	AREA OF RESPONSIBILITY	MWOs TO WHICH ADVISORY INFORMATION IS TO BE SENT		ACC TO WHICH ADVISORY INFORMATION IS TO BE SENT	
			Name	ICAO LOCATION INDICATOR	Name	ICAO LOCATION INDICATOR
1	2	3	4	5	6	7
Anchorage (United States)	PAWU	Anchorage Oceanic Anchorage continental Anchorage Arctic and west to E150 north of N60	Anadyr	UHMA	Anadyr	UHMA
			Anchorage	PAWW	Anchorage	PAZA
			Chaybukha	UHMG	Chaybukha	UHMG
			Chersky	UESS	Chersky	UESS
			Chokurdakh	UESO	Chokurdakh	UESO
			Edmonton	CWEG	Edmonton	CZEG
			Fairbanks	PAWU	Fairbanks	PAFA
			Kansas City	KKCI	Boston	KSBW
					Chicago	KORD
					Cleveland	KZOB
					Denver	KZDV
					Minneapolis	KZMP
					New York	KZNY
					Salt Lake	KZLC
					Seattle	KZSE
					Washington	KZDC
		Mys Shmidta	UHMI	Mys Shmidta	UHMI	
		Pevek	UHMP	Pevek	UHMP	
		Seymchan	UHMS	Seymchan	UHMS	
		Tiksi	UEST	Tiksi	UEST	
		Tokyo	RJTD	Tokyo	RJTG	
		Zyryanka	UESU	Zyryanka	UESU	
Buenos Aires (Argentina)	SABM	South of S10 between W10 and W90	Amazónica	SBEG	Amazónico	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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Darwin (Australia)	YPDM	Southward from N10 and from E100 to E160, and the Perth FIR between E100 and E75, Colombo FIR, and those parts of the Kuala Lumpur, Bangkok, Chennai, Yangon and Calcutta FIRs lying within N10 E100 to N20 E100 to N20 E82 to N10 E82 to N6 E78 to S2 E78 to S6 E75	Adelaide	YPRM	Adelaide	YPAD
			Bangkok	VTBD	Bangkok	VTBB
			Brisbane	YBRF	Brisbane Cairns	YBBN YBCS
			Chennai	VOMM	Chennai	VOMF
			Darwin	YDRM	Darwin	YPDN
			Gia Lam	VVGL	Hanoi Ho-Chi-Minh	VVNB VVTS
			Hobart	YMHF	Hobart	YMHB
			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
			Perth	YPRF	Perth	YPPH
			Port Moresby	AYPY	Port Moresby	AYPM
			Singapore	WSSS	Singapore	WSJC
			Sydney	YSRF	Sydney	YSSY
			Townsville	YBTL	Townsville	YBTL
			Ujung Pandang	WAAA	Ujung Pandang	WAAF
			Yangon	VYYY	Yangon	VYYF
London (United Kingdom)	EGRR	Bodø Oceanic, Reykjavik, Shanwick Oceanic, London, Scottish, Shannon	Amsterdam	EHDB	Amsterdam	EHAA
			Bodø	ENVN	Bodø Oceanic	ENOB
			Bordeaux	LFBD	Bordeau	LFBB
			Bremen	EDZM	Bremen	EDWW
			Brest	LFRN	Brest	LFRR
			Brussels	EBBR	Brussels	EBBU
			Edmonton	CWEG	Edmonton Gander	CZEG CZQX
			Exeter	EGTE	Exeter	EGTT
			København	EKMI	København	EKDK
			Lisboa	LPPT	Lisboa	LPPC
			London	EHHR	London Oslo Paris	EGTT ENOR LFFF
			Reykjavik	BIRK	Reykjavik Rovaniemi Scottish	BIRD EFPS EGPX
			Shannon	EINN	Shannon Stravanger	EISN ENSV
			Tromsø	ENVN	Tromso	ENTC
			Trondheim	ENVA	Trondheim	ENVA

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1	2	3	4	5	6	7
Montreal (Canada)	CWAO	Gander Oceanic Canadian Continental FIRs (including the Arctic Ocean) Reykjavik Søndre Strømfjord	Edmonton Reykjavik Søndrestrømfjord	CWEG BIRK BGSF	Edmonton Gander Moncton Montreal Reykjavic Søndrestrømfjord Toronto Vancouver Winnipeg	CZEG CZQX CZQM CZUL BIRD BGGL CZYZ CZVR CZWG
Tokyo (Japan)	RJTD	N60 to N10 – and from E90 to Oakland Oceanic and Anchorage Oceanic and Continental FIR boundaries	Bangkok Blagoveshchensk Beijing Bratsk Chita Gia Lam Guangzhou Hong Kong Incheon Irkutsk Khabarovsk Kirensk Kunming Lanzhou Magadan Magdagachi Manila Nikolayevdsk-na- Amure Okha Okhotsk Petropavlovsk- Kamchatsky Phnom-Penh Pyongyang Sanya Shanghai	VTBD UHBB ZBAA UIBB UIAA VGLL ZGGG VHHH RKSI UIII UHHH UIKK SPPP ZLXY UHMM UHBI RPLL UHNN UHSH UHOO UHPP VDPP ZKYP ZJSY ZSSS	Bangkok Blagoveshchensk Beijing Hohhot Taiyuan Bratsk Chita Hanoi Ho-Chi-Minh Guangzhou Changsha Guilin Nanning Hong Kong Incheon Irkutsk Khabarovsk Kirensk Kunming Chengdu Chongqing Lanzhou Xi'an Magadan Magdagachi Manila Nikolayevdsk-na- Amure Okha Okhotsk Petropavlovsk- Kamchatsky Phnom-Penh Pyongyang Sanya Shanghai Hefei Jinan Nanchang Nanjing Qingdao	VTBB UHBB ZBPE ZBHH ZBYN UIBB UIAA VVNB VVTS ZGZU ZGCS ZGKL ZGNN VHHH RKRR UIII UHHH UIKK ZPKM ZUDS ZUCK ZLHW ZLSN UHMM UHBI RPHI UHNN UHSH UHOO UHPP VDPP ZKKK ZJSY ZSHA ZSOF ZSTN ZSCN ZSNJ ZSQD

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			Name	ICAO LOCATION INDICATOR	Name	ICAO LOCATION INDICATOR
1	2	3	4	5	6	7
			Shenyang	ZYTX	Xiamen Shenyang Dalian Hailar Harbin	ZSAM ZYSH ZYTL ZBLA ZYHB
			Taibei	RCTP	Taibei	RCTP
			Tokyo	RJTD	Tokyo Fukuoka Naha Saporo	RJTG RJDG RORJ RJCG
			Ulan-Bator	ZMUB	Ulan-Bator	ZMUB
			Urumqi	ZWWW	Urumqi	ZWUQ
			Vladivostok	UHMM	Vladivostok	UHWW
			Wuhan	ZHHH	Wuhan	ZHWH
			Yuzhno-Sakhalinsk	UHSS	Yuzhno-Sakhalinsk	UHSS
Toulouse (France)	LFPW	Santa Maria Oceanic, AFI Region to S60, EUR Region west of E90 (except for London, Scottish and Shannon FIRs) and MID Region: south of N71, west of E90 ASIA Region (only Afghanistan)	Abu Dhabi	OMAA	Abu Dhabi	OMAA
			Accra	DGAA	Accra	DGAC
			Addis Ababa	HAAB	Addis Ababa	HAAA
			Aktau	UATE	Aralsk	UATA
			Aktyubinsk	UATT	Atyrau	UATG
			Alger	DAAG	Alger	DAAA
			Almaty	UAAA	Almaty	UAAA
			Amderma	ULDD	Amderma	ULDD
			Amilcar Cabral	GVAC	Amilcar Cabral/Sal	GVSC
			Amman	OJAC	Amman	OJAC
			Amsterdam	EHDB	Amsterdam	EHAA
			Ankara	LTAC	Ankara	LTAA
			Antananarivo	FMMI	Antananarivo	FMMM
			Arkhangelisk	ULAA	Arkhangelisk	ULAA
			Ashgabat	UTAA	Ashgabat	UTAA
			Asmara	HHAS	Asmara	HHAA
			Astana	UACC	Astana	UACC
			Astrakhan	URWA	Astrakhan	URWA
			Athinai	LGGG	Athinai	LGGG
			Atyrau	UATG	Aktau	UATE
			Baghdad	ORBB	Baghdad	ORBI
			Bahrain	OBBS	Bahrain	OBBI
			Baku	UBBB	Baku	UBBB
			Barcelona	LEBN	Barcelona	LECB
			Barnaul	UNBB	Barnaul	UNBB
			Beirut	OLBA	Beirut	OLBB
			Beograd	LYBE	Beograd	LYBA
			Bergen	ENVV	Bergen	ENTR
			Berlin	EDZB	Berlin	EDBB
			Beryozovo	USHB	Beryozovo	USHB

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			Bishkek	UAFM	Bishkek Osh	UAFM UAFO
			Bodo	ENVN	Bodø	ENOB
			Bordeaux	LFBD	Bordeaux	LFBB
			Bratislava	LZIB	Bratislava	LZBB
			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	LHBP	Budapest	LHBP
			Bujumbura	HBBA	Bujumbura	HBBA
			Cairo	HECA	Cairo	HECC
			Canarias	GCGC	Canarias	GCCC
			Casablanca	GMME	Casablanca	GMMM
			Chelyabinsk	USCC	Chelyabinsk	USCC
			Chennai	VOMM	Chennai (+Darwin)	VOMF
			Chisinau	LUKK	Chisinau	LUKK
			Dakar	GOOY	Dakar	GOOO
			Damascus	OSDI	Damascus	OSDI
			Dar-es-Salaam	HTDA	Dar-es-Salaam	HTDC
			De Bilt	EHDB	De Bilt	EHDB
			Delhi	VIDP	Delhi	VIDF
			Dhaka	VGZR	Dhaka (+Tokyo)	VGFR
			Dikson	UODD	Dikson	UODD
			Dushanbe	UTDD	Dushanbe	UTDD
			Dusseldorf	EDZE	Dusseldorf	EDDL
			Entebbe	HUEN	Entebbe	HUEC
			Essen	EDZE	Frankfurt	EDYY
			Gaborone/SSK	FBSK	Gaborone	FBGR
			Geneva	LSZH	Geneva	LSAG
			Gran Canaria	GCLP	Gran Canaria	GCGC
			Hamburg	EDZH	Hamburg	EDMM
			Harare	FVHA	Harare	FVHA
			Helsinki	EFHK	Helsinki	EFIN
			Istanbul	LTBA	Istanbul	LTBB
			Jeddah	OEJN	Jeddah	OEJD
			Johannesburg	FAJS	Cape Town Johannesburg Johannesburg Oceanic	FACA FAJA FAJO
			Kabul	OAKB	Kabul	OAKX
			Kaliningrad	UMKK	Kaliningrad	UMKK

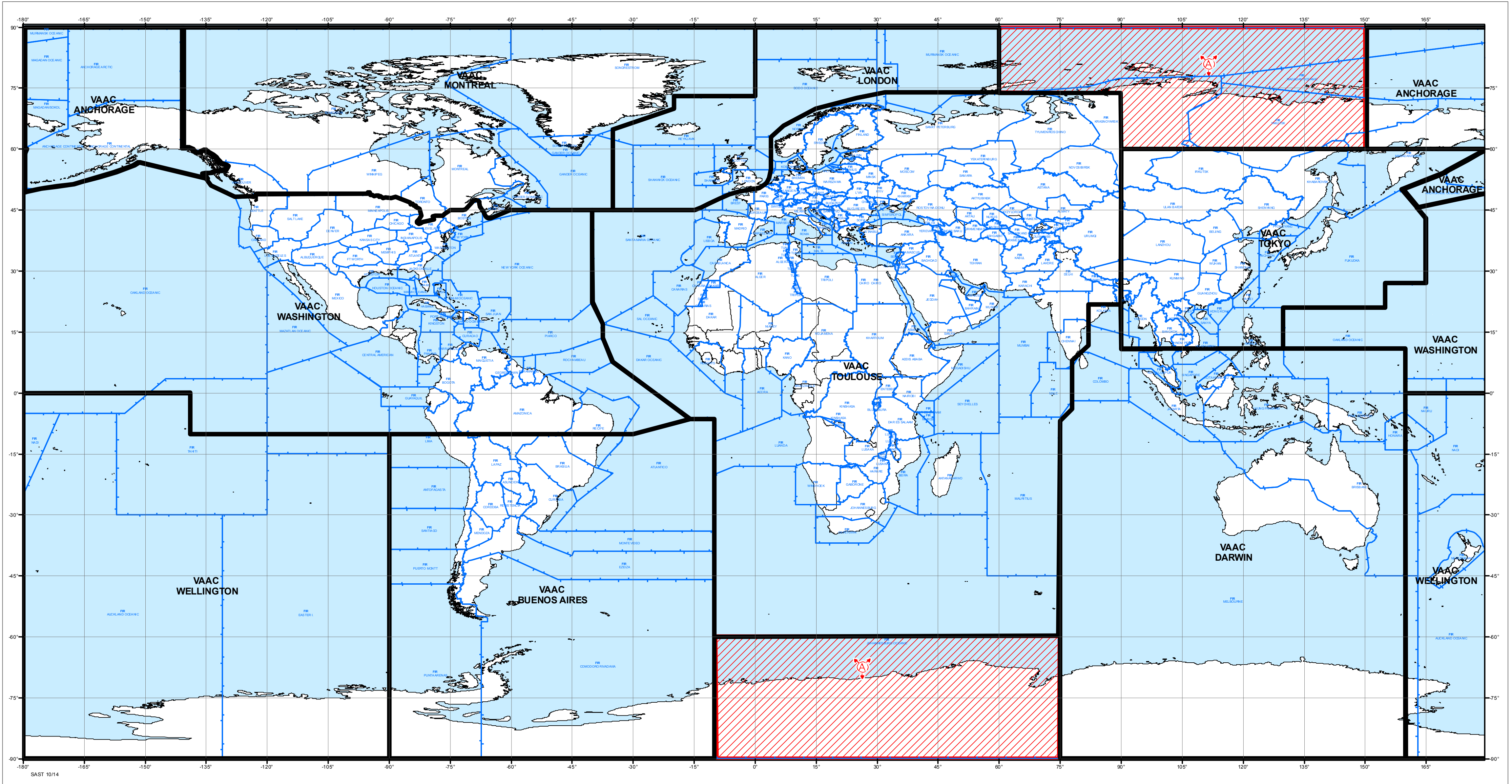
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1	2	3	4	5	6	7
			Kano	DNKN	Kano	DNKK
			Karachi	OPKC	Karachi	OPKR
			Kathmandu	VNKT	Kathmandu	VNSM
			Kazan	UWKD	Kazan	UWKD
			Khanty-Mansiysk	USHH	Khanty-Mansiysk	USHH
			Kharkiv	UKHV	Kharkiv	UKHH
			Khartoum	HSSS	Khartoum	HSSS
			Kigali	HRYS	Kigali	HRYS
			Kinshasa	FZAA	Kinshasa	FZAZ
			Kirov	USKK	Kirov	USKK
			København	EKMI	København	EKDK
			Kolkata	VECC	Kolkata (+Darwin)	VECF
			Kolpashevo	UNLL	Kolpashevo	UNLL
			Kostanay	UAUU	Kostanay	UAUU
			Kotlas	ULKK	Kotlas	ULKK
			Krasnoyarsk	UNKL	Krasnoyarsk (+Tokyo)	UNKL
			Kurgan	USUU	Kurgan	USUU
			Kuwait	OKBK	Kuwait	OKBK
			Kyiv	UKBB	Kyiv	UKBV
			Kyzylorda	UAOO	Kyzylorda	UAOO
			Lahore	OPLA	Lahore	OPLR
			Larnaka	LCLK	Nicosia	LCCC
			Lilongwe	FWLI	Lilongwe	FWLL
			Lisboa	LPPT	Lisboa	LPPC
			Ljubljana	LJLJ	Ljubljana	LJLA
			London	EGTE	London	EGTT
			Luanda	FNLU	Luanda	FNAN
			Lusaka	FLLS	Lusaka	FLFI
			L'viv	UKLL	L'viv	UKLL
			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	LIMM
			Minsk	UMMM	Minsk	UMMV
			Mogadishu	HCMM	Mogadishu	HCSM
			Monrovia	GLRB	Conakry	GUCY
			Moscow	UUWW	Moscow	UUWW
			Mumbai	VABB	Mumbai	VABF
			München	EDZW	München	EDMM

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1	2	3	4	5	6	7
			Murmansk	ULMM	Murmansk	ULMM
			Muscat	OOMM	Muscat	OOMS
			Mys- Kamenny	USDK	Mys-Kamenny	USDK
			N'Djamena	FTTJ	N'Djamena	FTTT
			Nairobi	HKJK	Nairobi	HKNA
			Niamey	DRRN	Niamey	DRRR
			Norilsk	UOOO	Norilsk	UOOO
			Novosibirsk	UNNT	Novosibirsk	UNNT
			Nukus	UTNN	Nukus	UTNN
			Odesa	UKOO	Odesa	UKOO
			Offenbach	EDZO	Offenbach	EDYY
			Ohrid	LWOH	Ohrid	LWSK
			Omsk	UNOO	Omsk	UNOO
			Orenburg	UWOO	Orenburg	UWOO
			Oslo	ENMI	Oslo	ENOS
			Palma de Mallorca	LEPA	Baleares	LECP
			Paris	LFPS	Paris	LFFF
			Pechora	UUYP	Pechora	UUYP
			Penza	UWPP	Penza	UWPP
			Perm	USPP	Perm	USPP
			Petrozavodsk	ULPB	Petrozavodsk	ULPP
			Praha	LKPR	Praha	LKAA
			Reims	LFML	Reims	LFEE
			Riga	EVRA	Riga	EVRR
			Rome	LIIB	Rome	LIRR
			Roberts	GLRB	Roberts	GLRB
			Rostov-na-donu	URRR	Rostov-na-donu	URRR
			Rovaniemi	EFRO	Rovaniemi	EFPS
			Salekhard	USDD	Salekhard	USDD
			Samara	UWWW	Samara	UWWW
			Samarkand	UTSS	Samarkand	UTSD
			Sana'a	OYSN	Sana'a	OYSC
			Sankt-Petersburg	ULLI	Sankt-Petersburg	ULLI
			Lisboa	LPPT	Santa Maria Oceanic	LPPO
			Sarajevo	LQSA	Sarajevo	LQSB
			Semipalatinsk	UASS	Semipalatinsk	UASS
			Seychelles	FSIA	Seychelles	FSSS
			Shymkent	UAIL	Shymkent	UAIL
			Surgut	USRR	Surgut	USRR
			Simferopol	UKFF	Simferopol	UKFF
			Skopje	LWSK	Skopje	LWSK
			Sofia	LBSF	Sofia	LBSR
			Stockholm	ESSA	Stockholm	??????

VOLCANIC ASH ADVISORY CENTRE	ICAO LOCATION INDICATOR	AREA OF RESPONSIBILITY	MWOs TO WHICH ADVISORY INFORMATION IS TO BE SENT		ACC TO WHICH ADVISORY INFORMATION IS TO BE SENT	
			Name	ICAO LOCATION INDICATOR	Name	ICAO LOCATION INDICATOR
1	2	3	4	5	6	7
			Sykyvkar	UUYU	Sykyvkar	UUYU
			Tallinn	EEMH	Tallinn	EETT
			Tarko-Sale	USDS	Tarko-Sale	USDS
			Tashkent	UTTT	Tashkent	UTTR
			Tehran	OIIX	Tehran	OIIX
			Tel Aviv	LLLL	Tel Aviv	LLTA
			Tbilisi	UGGG	Tbilisi	UGGG
			Tirana	LATI	Tirana	LAAA
			Toulouse	LFPW	Marseille	LFMM
			Tripoli	HLLT	Tripoli	HLLL
			Tromso	ENVN	Stavanger	ENSV
			Trondheim	ENVV	Trondheim	ENTR
			Tunis	DTTA	Tunis	DTTC
			Turukhansk	UOTT	Turukhansk	UOTT
			Tyumen	USTR	Tyumen	USTR
			Ufa	UWUU	Ufa	UWUU
			Uralsk	UARR	Uralsk	UARR
			Urumqi	ZWWW	Urumqi (+Tokyo)	ZWUQ
			Varna	LBWN	Varna	LBWR
			Velikie Luki	ULOL	Velikie Luki	ULOL
			Vilnius	EYVI	Vilnius	EYVL
			Volgograd	URWW	Volgograd	URWW
			Vologda	ULWW	Vologda	ULWW
			Vorkuta	UUYW	Vorkuta	UUYW
			Warszawa	EPWA	Warszawa	EPWW
			Wien	LOWW	Wien	LOVV
			Windhoek	FYWH	Windhoek	FYWH
			Yekaterinburg	USSS	Yekaterinburg	USSS
			Yeniseisk	UNII	Yeniseisk (+Tokyo)	UNII
			Yerevan	UDYZ	Yerevan	UDDD
			Zagreb	LDZA	Zagreb	LDZO
			Zhekazgan	UAKD	Zhekazgan	UAKD
			Zurich	LSZH	Zurich	LSAZ
Washington (United States)	KNES	New York Oceanic, Oakland Oceanic and United States continental FIRs, North of S10 W140	Amazónico	SBEG	Amazónica	SBAZ
			Caracas	SVMI	Maiquetia	SVZM
			Cayenne	SOCA	Rochambeau	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

VOLCANIC ASH ADVISORY CENTRE	ICAO LOCATION INDICATOR	AREA OF RESPONSIBILITY	MWOs TO WHICH ADVISORY INFORMATION IS TO BE SENT		ACC TO WHICH ADVISORY INFORMATION IS TO BE SENT	
			Name	ICAO LOCATION INDICATOR	Name	ICAO LOCATION INDICATOR
1	2	3	4	5	6	7
			Kansas City	KKCI	Houston Oceanic Miami Oceanic Nassau San Juan	KZHU KZMA MYNA TJZS
			Kingston	MKJP	Kingston	MKJK
			Lima-Callao	SPIM	Lima	SPIM
			México	MMMX	Mazatlán 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 E160 to W140, and Southward from S10 and from W140 to W90	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

CURRENT STATUS OF ICAO VOLCANIC ASH ADVISORY CENTRES (VAAC) - AREAS OF RESPONSIBILITY
 SITUATION ACTUELLE DES CENTRES OACI D'AVIS DE CENDRES VOLCANIQUES (VAAC) - ZONES DE RESPONSABILITÉ
 ESTADO ACTUAL DE LOS CENTROS DE AVISOS DE CENIZAS VOLCÁNICAS (VAAC) DE LA OACI - ÁREAS DE RESPONSABILIDAD
 СУЩЕСТВУЮЩЕЕ РАСПРЕДЕЛЕНИЕ КОНСУЛЬТАТИВНЫХ ЦЕНТРОВ ИКАО ИО ВУЛКАНИЧЕСКОМУ ПЕПЛУ (VAAC) - РАЙОНЫ ОТВЕТСТВЕННОСТИ



Part 3

USEFUL WEB SITES

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 web sites cannot be assured.

3.1 VOLCANIC ASH ADVISORY CENTRES

Anchorage:	http://aawu.arh.noaa.gov/vaac.php
Buenos Aires:	http://www.smm.gov.ar/?mod=vaac&id=1
Darwin:	http://www.bom.gov.au/info/vaac
London:	http://www.metoffice.gov.uk/aviation/vaac/index.html
Montreal:	http://meteo.gc.ca/eer/vaac/index_e.html (English) http://meteo.gc.ca/eer/vaac/index_f.html (French)
Tokyo:	http://www.jma.go.jp/jma/jma-eng/jma-center/vaac/index.html
Toulouse:	http://www.meteo.fr/vaac/
Washington:	http://www.ssd.noaa.gov/VAAC/washington.html
Wellington:	http://www.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://www.volcano.si.edu/gvp
United States Geological Survey:	http://volcanoes.usgs.gov

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

3.3 OTHER SITES

Alaska Volcano Observatory:	http://www.avo.alaska.edu
Canadian Meteorological Centre:	http://www.msc-smc.ec.gc.ca/cmc/index_e.html
Caribbean Disaster Emergency Response Agency:	http://www.cdera.org
Global Volcanism Network Bulletin:	http://www.nmnh.si.edu/gvp/ http://www.osei.noaa.gov/TOMS/ http://toms.gsfc.nasa.gov http://www.geo.mtu.edu/~boris/ETNA_news.html
Institute of Volcanic Geology and Geochemistry FED RAS	http://www.kcs.iks.ru/ivgig/index.html
Kamchatkan Volcanic Eruption Response Team (KVERT)	http://www.kcs.iks.ru/ivgig/kvert/index.html http://geopubs.wr.usgs.gov/fact-sheet/fs064-02/
Current information release from KVERT	http://www.avo.alaska.edu/avo4/updates/kvertweekly.htm
Michigan Technical University:	http://www.geo.mtu.edu/volcanoes
Puff Tracking Model	http://puff.images.alaska.edu/index.html
VAFTAD:	http://www.ssd.noaa.gov/VAAC/vaftad.html
WAFS Internet:	http://weather.noaa.gov/fax/wafsfax.shtml
World Organization of Volcano Observatories (WOVO)	http://wovo.org http://www.wovo.org/dir-contents.htm (contacts)
Preliminary spreadsheet of eruption source parameters for volcanoes of the world	http://pubs.usgs.gov/of/2009/1133/

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). ICAO documents are available from the Document Sales Unit at sales_unit@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
PRE-ERUPTION ARRANGEMENTS**

4.1. PRE-ERUPTION PROCEDURES

4.1.1 In order to permit efficient application of the measures noted in 4.2, 4.3, 4.4 and 4.5, 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) information on increasing volcanic activity, volcanic eruption or cessation thereof, or volcanic ash cloud in areas which could affect routes used by international flights, available from one or more observing sources, such as vulcanological, seismological, geological, meteorological, or the police/military networks and domestic aviation, is passed **immediately** to the area control centre/flight information centre (ACC/FIC) and the meteorological watch office (MWO) concerned;
- b) appropriate channels of communication are established between such sources of observation (especially vulcanological observing stations) and the nearest ACC/FIC and MWO to ensure that, in the event of an eruption, the information reaches the ACC/FIC/MWO as speedily as possible;
- c) access to information from available geostationary and polar-orbiting weather satellites and other sources, such as volcanic ash advisory centres (VAACs), is arranged through the national meteorological authority concerned in order to obtain, as far as practicable, information regarding the extent and trajectory of volcanic ash clouds (see 4.4.1 a));
- d) access to vulcanological advice is made available to the ACC/FIC and MWO and, in the Provider States concerned, to the VAAC, including 24-hour telephone contact numbers at which a vulcanologist can be contacted in an emergency;

Note.— A convenient forum to explore ways and means to implement the foregoing measures is the National Disaster Committee or any similar consultative body.

- e) the State international NOTAM office personnel are familiar with the issuance of ASHTAMs¹ (or NOTAMs for volcanic ash);
- f) information, preferably supplemented by charts, concerning volcanoes in the FIRs for which the State is responsible should be included in the State aeronautical information publication in accordance with Annex 15, Appendix 1, Section ENR 5.3.1; and
- g) 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 Contracting States shall promulgate a requirement for pilots to make and transmit a special aircraft observation, in accordance with 5.5.1 g) and h) of Annex 3, in the event that pre-eruption volcanic activity or a volcanic eruption is observed or a cloud of volcanic ash is encountered or observed which may affect the safety of other aircraft operations, and to record a special air-report in accordance with Annex 3, Chapter 5, 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 their significance for the 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 vulcanological agency, to record the agreed responsibilities of each party. Since Annex 3, paragraph 3.6 requires that selected State volcano observatories should send information about pre-eruption volcanic activity, a volcanic eruption and/or volcanic ash in the atmosphere to associated ACC, MWO and VAAC, the State concerned, may, if it so wishes, recover reasonable costs related to the transmission of such information.

1. The ASHTAM is a special series NOTAM specifically for volcanic activity.

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

Note. — In order to enhance stronger linkages, coherence and integration with States' disaster risk reduction units, Contracting States are encouraged to send back to States' volcano observatories any relevant information regarding volcanic ash to the extent and in a form agreed between the VAAC and the volcano observatory concerned. The sample letter of agreement could be used to document such agreements.

4.2 ACTION TO BE TAKEN BY THE ACC IN THE EVENT OF A VOLCANIC ERUPTION

In the event of significant pre-eruption volcanic activity, a volcanic eruption occurring or a volcanic ash cloud being reported 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 in relevant adjacent FIRs. Issue an ASHTAM or a NOTAM through the State International Notam Office (NOF), in accordance with Annex 15, Chapter 5, 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 ISCS 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.

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.— A volcano level of alert colour code has been developed for aviation which may be used by some vulcanological agencies to report volcanic activity information to aviation. In those States where the colour code has been introduced by the vulcanological agency, it is useful to include the reported colour code in ASHTAMs or NOTAMs issued for volcanic activity. The aviation volcano level of alert colour code is:

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

The colour code for the level of alert indicating the status of activity of the volcano and any change from a previous status of activity should be provided to the area control centre by the responsible vulcanological agency in the State concerned, e.g. "RED ALERT FOLLOWING YELLOW" OR "GREEN ALERT FOLLOWING ORANGE".

- 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 and 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.

4.3 ACTION TO BE TAKEN BY THE NOF IN THE EVENT OF A VOLCANIC ERUPTION

4.3.1 In the event of significant pre-eruption volcanic activity, a volcanic eruption occurring, or a volcanic ash cloud being reported 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 gateway at EGZZVANW. 4.3.2 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 the 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 the VAAC Washington as follows, showing the four sections of the message:

1	ZCZC GG KWBCYMYX 151840 SEGUYNXX	USUAL AFTN HEADER ENVELOPE
2	A0623/00 NOTAMN 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	ACTUAL NOTAM

4 NNNN USUAL AFTN ENDING
ENVELOPE

4.3.3 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.

4.3.4 Since volcanic ash deposition at an aerodrome is a phenomena 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.

4.4 ACTION TO BE TAKEN BY THE MWO IN THE EVENT OF A VOLCANIC ERUPTION

4.4.1 On receipt from the ACC/FIC of information concerning a volcanic eruption and/or the existence of a volcanic ash cloud, 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, to the WAFC London SADIS at the address specified in Appendix B, according to the region containing the area affected, the WAFC Washington at KWBCYMYX, and the Vienna International OPMET Data Bank at LOZZMMSS;

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.

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, 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
- c) issue a SIGMET message for volcanic ash for a validity period of 6 hours in alphanumerical message 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 (see 4.4.1 a)), the WAFIC London at the address specified in Appendix B, according to the region containing the area affected, the WAFIC Washington at KWBCYMYX, the Vienna International OPMET Data Bank at LOZZMMSS 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 messages for volcanic ash issued outside the EUR Region to be transmitted to the EUR Region should be addressed in accordance to the EUR FASID Table MET 2B 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.

4.4.2 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 4.4.1 should then be followed, as necessary.

4.4.3 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.

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

4.5.1 On receipt of information from an ACC, MWO, volcano observatory or any other source² that a volcanic eruption has been reported and/or a volcanic ash cloud has been observed 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 information³ on volcanic ash trajectories to the MWOs, ACCs and, to the extent possible, to the airlines⁴ 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 alphanumerical message format, as shown below, and, graphical format⁵, (using the PNG format) for transmission to the MWOs, ACCs and, to the extent possible, to the airlines³ concerned in the VAAC area of responsibility, to the WAFC London at the address specified in Appendix B, according to the region containing the area affected, the WAFC Washington at KWBCYMYX, the Vienna International OPMET Data Bank at LOZZMMSS and other VAACs. Advisory information on volcanic ash issued outside the

2. 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 g) should be followed.

3. On some occasions, the VA 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 VA advisory with complete forecast information included.

4. Advisory information from VAACs is intended to assist MWOs in the preparation of the SIGMET. However, in order to provide airline operators with the earliest possible advance information on volcanic ash, an AFTN address (EGLLSITV) has been provided on the SITA network to which VAACs may send their advisories for onward distribution to airline operators by SITA. SIGMETs for volcanic ash will, of course, be disseminated in accordance with the relevant regional air navigation plan OPMET exchange tables.

5. Volcanic ash advisories in graphical format will be included on the London and Washington satellite broadcasts. An example of the graphical format is given in the Appendix 1 to Annex 3.

EUR Region to be transmitted to the EUR Region should be addressed in accordance with EUR FASID Table MET 2B (see 4.4.1 c).

The volcanic ash advisory message should contain the following information:

message type

- VOLCANIC ASH ADVISORY

issue time, date and name of issuing VAAC

- 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 area in which the volcano is located and the latitude/longitude

- name of State or area (e.g. oceanic) and latitude/longitude of volcano

source(s) of information

- volcano agency (see Appendix E, volcano observatory notice for aviation (VONA) format) or special AIREP, 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 message

next advisory

- expected time of issuance of next advisory.

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 4.4.1 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 4.4.1 a);

- d) monitor subsequent satellite information to assist in tracking the movement of volcanic ash cloud;
- e) continue to issue updated advisory information to MWOs, ACCs and airlines⁶ 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 satellite data, 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 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 Network, 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, Chapter 5, 5.9 refers), the information should be sent to the Smithsonian Institution Global Volcanism Network and to ICAO in order to keep up to date the database for encounters between aircraft ash clouds (Doc 9691, Appendix I refers). To that end the following mail addresses should be used:

gvn@volcano.si.edu
iavwopssec@icao.int

- g) in cases where volcanic ash cloud crosses the boundary between VAAC areas of responsibility, the first VAAC should retain responsibility for the issuance of advisories until such time as the handover of responsibility has been agreed between VAACs. Standardized operational procedures for the coordination and transfer of responsibility between VAACs for volcanic ash events are at Appendix C.

Note.— This means that, while the volcanic ash cloud straddles the common boundary, only one VAAC will issue advisories at any one time, and these advisories must be sent by each VAAC to MWOs and ACCs in their respective areas of responsibility.

VAACs should insert a note in their “last”/“first” advisory of the message and graphical series that the “handover”/“takeover” will take place at that

6. Advisory information from VAACs is intended to assist MWOs in the preparation of the SIGMET. However, in order to provide airline operators with the earliest possible advance information on volcanic ash, an AFTN address (EGLLSITV) has been provided on the SITA network to which VAACs may send their advisories for onward distribution to airline operators by SITA.

message/graphic number.

- h) 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, the VAAC may choose to 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. — 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.

- j) to provide rapid access to eruption source parameters (ESP) data for immediate use by forecasters in ash transport and dispersion models a preliminary spreadsheet of eruption source parameters of the world is available at <http://www2.icao.int/en/anb/met-aim/met/iavsopsg/>.

4.5.2 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.

4.5.3 For those VAACs which have not yet implemented a computer volcanic ash dispersion forecast model, on receipt of information from an MWO, or from any other source in its area of responsibility, that a volcano has erupted and/or volcanic ash cloud has been reported from the FIR for which the MWO is responsible, the VAAC should immediately contact the VAAC Washington at the following 24-hour contact numbers:

Tel.: +1 (301) 763-8444

Fax: +1 (301) 763-8333

to request initiation of the United States Volcanic Ash Forecast Transport and Dispersion (VAFTAD) model and the provision of the necessary trajectory forecasts. Alternatively, VAACs may interactively run a dispersion model via the Internet at the following web site: <http://www.arl.noaa.gov/vaftad.html>. This site also contains a number of model runs of hypothetical volcanic eruptions, generally of recently active volcanoes or those suspected to become active. If for any reason the VAAC Washington is unable to respond, or contact cannot be achieved, recourse should be made to the VAACs London, Montreal or Toulouse at the 24-hour contact numbers given in 4.4.1 to run their dispersion models.

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

4.6.1 When a volcanic ash test/exercise is carried out to check the IAVW procedures, the following should be applied:

- a) the VAAC concerned should issue a volcanic ash (VA) advisory test message highlighting that the advisory refers to a test message by using “VA TEST” or “VA EXERCISE” (followed by the name of the exercise if wished) in elements 9, 11 and 17 of the VA advisory message (Annex 3, Table A2-1 refers) as part of the element description. The VA advisory message will emphasize that the message refers to a test/exercise by repeating “VA TEST” or “VA EXERCISE” as many as practicable in element 17;
- b) the MWO concerned should issue a volcanic ash SIGMET highlighting that the SIGMET refers to a test message by including “VA TEST” or “VA EXERCISE” (followed by the name of the exercise, if wished) in element “Phenomenon” of SIGMET message (Annex 3, Table A6-1 refers).

4.7 ACTION TO BE TAKEN BY PILOTS IN THE EVENT OF ENTRY INTO A SO₂ CLOUD

4.7.1 There is a possible association between volcanic ash and sulphur dioxide gas (SO₂). The following paragraphs provide guidance and recommended actions to be taken by pilots in the event of entering in a SO₂ cloud, with the understanding that they constitute only examples and do not necessary cover all the practices being applied by operators.

4.7.2 The presence of a sulfurous gas, (SO₂) at altitude is the result of volcanic activity. SO₂, best described as a sulfur odor similar to a struck match will only be detectable for a short period because of the olfactory fatigue resulting in loss of the ability to smell the odor of SO₂. Sensitivity to odors while in-flight is paramount to the safety of flight. “Electrical Smoke and Fire” and SO₂ are two odors that are described as somewhat similar requiring a means to verify which odor is present.

4.7.3 After determining there are no secondary indications that would result from and indicate an electrical fire, the crew should continue to determine the source of the odor. The first decision by the crew is to establish whether the odor is generated from inside or outside the aircraft. In order for the crew to make this determination and confirm if the odor is transient or not, at the direction of the captain, a crew member should don an oxygen mask and breathe 100% oxygen for the period of time that results in a complete change of air within the cockpit.

4.7.4 The crew member should breathe 100% oxygen for the length of time determined in 4.7.3 to regain the ability to smell the SO₂. After the appropriate time period, the crew member should remove their oxygen mask and determine if the odor is still present. If the crew member affirms the continued presence of SO₂, it is recommended the captain report their findings to the controlling ATC facility and company dispatch as soon as practicable.

4.7.5 It is recommended the reporting pilot use the Volcanic Activity Report form (VAR) Section 1, Items 1-8. Following the submission of the VAR, the crew should remain vigilant for signs of inadvertent entry into a volcanic ash cloud. The crew should also request periodic updates of any volcanic activity along their route of flight from the controlling ATC facility and company dispatch.

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

Argentina	– sent to SAZZMAMX EGZZVANW
Cameroon	– sent to LFPWYMYX EGZZVANW
Canada	– sent to CWAQYMYU EGZZVANW
Cape Verde	– sent to LFPWYMYX EGZZVANW
Chile	– sent to SAZZMAMX EGZZVANW
China	– sent to RJTDYMYX EGZZVANW
Colombia	– sent to KWBCYMYX EGZZVANW
Comoros	– sent to LFPWYMYX EGZZVANW
Costa Rica	– sent to KWBCYMYX EGZZVANW
Democratic Republic of the Congo	– sent to LFPWYMYX 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 YPDMYMYX 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 YPDMYMYX EGZZVANW

Peru	– sent to KWBCYMYX SAZZMAMX EGZZVANW
Philippines	– sent to RJTDYMYX YPDMYMYX EGZZVANW
Portugal	– sent to LFPWYMYX EGZZVANW
Russian Federation	– sent to KWBCYMYX RJTDYMYX EGZZVANW
Solomon Islands	– sent to NZKYMYX YPDMYMYX EGZZVANW
Spain	– sent to LFPWYMYX EGZZVANW
Trinidad and Tobago	– sent to KWBCYMYX EGZZVANW
Vanuatu	– sent to NZKYMYX EGZZVANW

Table 4-2. VAAC contact numbers
(4.4.1 a) refers)

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

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	Jeffrey.Osiensky@noaa.gov Eugene.M.Petrescu@noaa.gov
Homepage:		http://vaac.arh.noaa.gov
		http://aawu.arh.noaa.gov

VAAC Buenos Aires

Tel.:	Operational	+(54 11) 5167 6767, Ext. 18238/18233/18103 +(54 11) 5167 6705
	Administrative	+(54 11) 5167 6767, Ext. 18235 +(54 11) 5167 6707
Fax:		+(54 11) 5167 6709
AFTN:		SAZZMAMX
E-mail:	Operational	vmsr@smn.gov.ar bue.vaac@smn.gov.ar sovaacbue@smn.gov.ar
	Administrative	metaer@smn.gov.ar cbenitez@smn.gov.ar
Homepage:		http://www.smm.gov.ar mod=VAAC & id=1

VAAC Darwin

Tel.:	Operational	+61 (8) 8920 3830 (PABX)
		+61 (8) 8927 9189 (direct)
	Administrative	+61 (8) 8920 3867
Fax:		+61 (8) 8920 3829
AFTN:		YPDMYMYX
E-mail:	Operational	darwin.vaac@bom.gov.au
	Administrative	darwin.vaac.admin@bom.gov.au
Homepage:		http://www.bom.gov.au/info/vaac/

VAAC London

Tel.:	Operational	+44 1392 884167
	Administrative	+44 1392 886095
Fax:	Operational	+44 1392 884549
	Administrative	+44 1392 884549
AFTN:		EGZZVANW
E-mail:	Operational	vaac@metoffice.gov.uk
	Administrative	nigel.gait@metoffice.gov.uk
Homepage:		http://www.metoffice.gov.uk/aviation/vaac/index.html

VAAC Montreal

Tel.:	Operational	+1 (514) 421 4635
	Administrative	+1 (514) 421 4704
Fax:	Operational	+1 (514) 421 4639
	Administrative	+1 (514) 421 4679
AFTN:		CWAOYMYU
E-mail:	Operational	vaac@ec.gc.ca
	Administrative	rene.servranckx@ec.gc.ca
		dov.bensimon@ec.gc.ca
Homepage:		http://meteo.gc.ca/eer/vaac/index_e.html

VAAC Tokyo

Tel.:	Operational	+81 (3) 3212 6203
	Administrative	+81 (3) 3284 1749
Fax:		+81 (3) 3212 6446
AFTN:		RJTDYMYX
E-mail:	Operational	vaac@eqvol2.kishou.go.jp
	Administrative	vaac-adm@eqvol2.kishou.go.jp
Homepage:		http://ds.data.jma.go.jp/svd/vaac/data/index.html

VAAC Toulouse

Tel.:	Operational	+33 (5) 61 07 82 30 or 07 85 10
	Administrative	+33 (5) 61 07 82 37/82 39
Fax:	Operational	+33 (5) 61 07 82 54
	Administrative	+33 (5) 61 07 82 09
AFTN:		LFPWYMYX or LFPWYMCR
E-mail:	Operational	vaac@meteo.fr
	Administrative	philippe.husson@meteo.fr
Homepage:		http://www.meteo.fr/vaac/

VAAC Washington

Tel.:	Operational	+1 (301) 763-8444/8298
	Administrative	+1 (301) 763 8444
Fax:		+1 (301) 763 8333/8592
AFTN:		KWBCYMYX
E-mail:	Operational	w-vaac@noaa.gov
	Administrative	Grace.Swanson@noaa.gov
	Additional information	davida.streett@noaa.gov
Homepage:		http://www.ssd.noaa.gov/VAAC/

VAAC Wellington

Tel.:	Operational	+64 (4) 470 0816 (24/7 helpline)
	Administrative	+64 (4) 470 0731
Fax:		+64 (4) 470 0801
AFTN:		NZKLYMYX
E-mail:	Operational	vaac@metSERVICE.com
	Administrative	marcel.roux@metSERVICE.com
	Additional information	ray.thorpe@metSERVICE.com
Homepage:		http://vaac.metSERVICE.com

Table 4-3. Volcanic ash advisory bulletin headers
(4.5.1 h) refers)

VAAC	Back-up VAAC	Bulletin Headers		Remarks
		VAA	VAG	
Anchorage		FVAK21 PAWU FVAK22 PAWU FVAK23 PAWU FVAK24 PAWU FVAK25 PAWU	PFXD21 PAWU PFXD22 PAWU PFXD23 PAWU PFXD24 PAWU PFXD25 PAWU	
	Washington			
Buenos Aires		FVAG01 SABM FVAG02 SABM FVAG03 SABM FVAG04 SABM FVAG05 SABM		
Darwin		FVAU01 ADRM FVAU02 ADRM FVAU03 ADRM FVAU04 ADRM FVAU05 ADRM FVAU06 ADRM	PFXD01 ADRM PFXD02 ADRM PFXD03 ADRM PFXD04 ADRM PFXD05 ADRM PFXD06 ADRM PFXD07 ADRM PFXD08 ADRM PFXD09 ADRM PFXD10 ADRM	
	Tokyo Wellington	FVFE01 RJTD FVPS01 NZKL		
London		FVXX01 EGRR FVXX02 EGRR FVXX03 EGRR	PFXD01 EGRR PFXD02 EGRR PFXD03 EGRR	
	Toulouse	FVXX05 EGRR	PFXD05 EGRR	
Montreal		FVCN01 CWAO to FVCN04 CWAO	PFXD01 CWAO PFXD02 CWAO	

VAAC	Back-up VAAC	Bulletin Headers		Remarks
		VAA	VAG	
	Washington	FVCN03 CWAO FVCN04 CWAO	PFXD03 CWAO PFXD04 CWAO	
Tokyo		FVFE01 RJTD	VAG available only at the VAAC website	
			QHVA10 RJTD QHVA15 RJTD	Graphical format chart of VA observation Graphical format chart of VA forecast
Toulouse		FVXX01 LFPW FVXX02 LFPW FVXX03 LFPW FVXX04 LFPW	PFXD01 LFPW to PFXD04 LFPW PFXD06 LFPW to PFXD09 LFPW	(T4 format) (png format) [where PFXDnn and PFXDnn+5 are the same VAG in T4 and png]
	London	FVXX05 EGRR	PFXD05 EGRR	(png format)
Washington		FVXX20 KNES FVXX21 KNES FVXX22 KNES FVXX23 KNES FVXX24 KNES FVXX25 KNES FVXX26 KNES FVXX27 KNES	PFXD20 KNES PFXD21 KNES PFXD22 KNES PFXD23 KNES PFXD24 KNES PFXD25 KNES PFXD26 KNES PFXD27 KNES	
Wellington		FVPS0 NZKL1	To be provided in due time	

APPENDIX A

Sample Letter of Agreement between the Air Traffic Services (ATS), Meteorological Authorities and Vulcanological Authorities

*Directives for coordination between area control centres (ACCs),
meteorological watch offices (MWOs) and vulcanological 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 [vulcanological authority]³ is to establish the directives for the necessary coordination between ATS units, meteorological watch offices and vulcanological 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 vulcanological 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* and in 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 aviation volcano colour code, 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 vulcanological authority.
 4. Name of the State concerned.
 5. Number of appendices agreed upon 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 LOA 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]¹, the [meteorological authority]² and the [vulcanological authority]³ 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][ACCs][volcanic ash advisory centres (VAACs) and selected volcano observatories] concerned shall make suitable arrangements in order to facilitate vulcanological 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 FASID Table MET 3C identifies the selected State volcano observatories which are to notify VAAC, MWOs and ACCs on volcanic pre-eruption, volcanic eruption and volcanic ash.

4.1.1.2 The [meteorological authority], through the [meteorological watch office (MWO)]⁸ included in the FASID Table MET 3C of [ANP]⁹, is responsible for issuing SIGMET(s) on volcanic ash, i.e. providing up-to-date information on existing and forecasted volcanic ash clouds, and forecasted trajectories at different flight levels based on the latest information received from vulcanological observatories or from the corresponding VAAC to those area control centres 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)

4.2.1 [The MET Authority], through the [ACC]¹⁰ included in the FASID Table MET 3C of [ANP], 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) vulcanological observatories;
- b) the associated VAAC; or

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

8. Name(s) of the meteorological watch office(s).

9. Title of corresponding ANP.

10. Name of the area control centre.

- c) the associated MWO.

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

4.2.2 The ACC should also issue an ASHTAM or NOTAM through the State International NOTAM Office (NOF) in accordance with Annex 15, Chapter 5, giving details of the pre-eruption activity, volcanic eruption and ash cloud, including 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 vulcanological authority

4.3.1 [*The vulcanological observatory*] included in the FASID Table MET 3C of the[ANP] is responsible for the provision of up-to-date information on existing and forecasted 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 vulcanological information will be supplied in accordance with the guidelines stipulated in the attachment to this Letter of Agreement.

4.3.2 The vulcanological 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 VULCANOLOGICAL 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 vulcanological 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 VULCANOLOGISTS

6.1 Courses or on-the-job training for meteorological, ATS personnel and vulcanologists 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 IN 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 vulcanological observatory**

1.1.1 The vulcanological observatory shall immediately provide information on significant pre-eruption volcanic activity, volcanic eruptions or the presence of volcanic ash clouds to the relevant ACCs [*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) given at Appendix E.

STEP 2**2.1 Action to be taken by the ACC**

2.1.1 The ACC 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 in the adjacent flight information regions (FIRs).

2.1.2 On the reception of special air-reports for volcanic ash by an ACC, 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 shall verify that a SIGMET has been issued before discontinuing the transmission of the special air report.

2.1.3 The ACC concerned shall ensure that the content of the ASHTAM is consistent with any SIGMET issued for their FIR. Further, the ACC shall ensure that any ASHTAM or NOTAM issued follows the guidance of Annex 15.

2.1.4 The ACC 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 Action 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, Brazilia, and Vienna International OPMET data bank.

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 vulcanological 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 MET service.

STEP 3

3.1 Action to be taken by 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) aviation colour code for level of alert indicating volcanic activity, if available (Annex 15);
- e) horizontal and vertical extent of volcanic ash cloud initially based on the special air report and subsequently based on the MWO, aeronautical MET 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 MET 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 vulcanological observatory and/or MWO, aeronautical MET 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 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 ICAO format (see Annex 15, Appendices 3 and 6), 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 (see example in the *Handbook on the International Airways Volcano Watch (IAVW) — Operational Procedures and Contact List* (Doc 9766), Table 4-1). This enables

the receiving AFTN or MET switching centre to forward the ASHTAM/NOTAM for volcanic activity to the VAAC concerned on internal MET 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**

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

APPENDIX C

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

1. As soon as one of the VAACs learns of an eruption (for a volcano erupting within 5° degrees latitude of the VAACs boundary) or when an ash cloud is expected to come within 5° (latitude) of the VAACs and/or FIR boundary, an information /coordination phone call will be made. The possibility of a hand-off will be discussed, if appropriate.

2. Hand-off of operational responsibility shall be coordinated by the lead VAAC with adjacent affected VAACs and MWOs when the ash cloud is not less than 5° (latitude) from a VAAC and/or FIR boundary. In the rare situation of large or persistent ash emissions, adjacent responsible VAACs, upon coordination, may agree to divide the operational forecast responsibility.

3. Once a hand-off has been decided, the last volcanic ash advisory issued by the lead VAAC before hand-off will include the following at the end of the message (in the REMARKS):

“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 CWA0, FVXX21 KWBC, FVAK20 PANC, 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 CWA0.”

4. The first volcanic ash advisory issued by the VAAC that has taken over responsibility will include the following:

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

Where:

cccc is the name of the VAAC which had the lead before the hand-off

dddd is the name of the VAAC which has taken over

eeee is the full bulletin header (e.g FVAK PANC 261200) of the last message issued by the VAAC which had the lead before the hand-off.

Example:

“VAAC ANCHORAGE HAS TRANSFERRED RESPONSIBILITY OF THIS EVENT TO VAAC MONTREAL. THIS ADVISORY UPDATES MESSAGE FVAK20 PANC 261200.”

5. When the lead VAAC is issuing messages covering a portion of another VAAC's area of responsibility, or an ash cloud is approaching (within 5 degrees of latitude) the area of responsibility of a non-lead VAAC, the non-lead VAAC should issue a volcanic ash advisory directing the user to the correct product. The following wording is suggested:

“PLEASE SEE **ffff** ISSUED BY VAAC **gggg** WHICH DESCRIBES CONDITIONS OVER OR NEAR THE VAAC **hhhh** AREA OF RESPONSIBILITY.”

Where:

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

gggg is the name of the lead VAAC

hhhh is the name of the VAAC re-broadcasting the lead VAAC message

Example of rebroadcast message issued by VAAC Montreal:

PLEASE SEE FVAK20 PANC 121200 ISSUED BY VAAC ANCHORAGE WHICH DESCRIBES CONDITIONS OVER OR NEAR THE VAAC MONTREAL AREA OF RESPONSIBILITY”

6. For situations in which two or more distinct ash clouds would be present (different eruptions or one eruption for which the ash cloud has divided in two or more distinct parts), the “hand-off” only applies to the ash cloud approaching or crossing VAAC boundaries.
7. The ending of an advisory for a volcanic ash event shall be performed by the lead VAAC, upon coordination with the adjacent affected VAACs and MWOs.
8. Only the lead VAAC shall issue volcanic ash advisories in graphical format on ISCS or SADIS.

APPENDIX D

BACK-UP PROCEDURES FOR VOLCANIC ASH ADVISORY CENTERS

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, i.e. 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, e.g. 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 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 giving the origin of the message; and
- f) the back-up arrangements should be tested at least annually.

Editorial Note.— Most of the VAACs already have a nominated back-up site. This back-up site may be another meteorological centre in the same Contracting State or it may be another VAAC. Details about the back-up sites and their contact details together with examples will also be included in the Handbook (Doc 9766) by the Secretariat in due course.

APPENDIX E

FORMAT OF VOLCANO OBSERVATORY NOTICE FOR AVIATION (VONA)

Explanation of the format of a Volcano Observatory Notice for Aviation (VONA) which is issued by a VO when a colour code changes (up or down) or within a colour-code level when an ash-producing event or other significant change in volcanic behaviour occurs.

(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 <http://www.volcano.si.edu/world/>)
- (4) Current Aviation Colour Code: **GREEN, YELLOW, ORANGE, OR RED** 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 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.
- (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 such as 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 such as
monitoring data, observatory
actions, volcano's previous
activity, etc.

(15) Contacts:

Names, phone numbers (voice
and fax), email addresses.

(16) Next Notice:

"A new VONA will be issued
if conditions change
significantly or the colour
code is changes." Indicate if
final notice for an event.
Include URL of Web site
where latest volcanic
information is posted.

APPENDIX F

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

In the *Handbook on the International Airways Volcano Watch (IAVW)* —
Operational Procedures and Contact List (Doc 9766) replace paragraph 4.7 by the
following:

4.7.1 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.

4.7.2 Volcanic eruptions emit various gases along with magma, including sulphur dioxide (SO₂) and hydrogen sulphide (H₂S). Volcanoes are the only sources of large quantities of sulphur gases at cruise altitudes, and both SO₂ and H₂S 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.

4.7.3 SO₂ is identifiable as the sharp, acrid odour of a freshly struck match. H₂S, 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).

4.7.4 Inhalation of SO₂, even at low concentrations (<5 ppm), can cause respiratory tract irritation especially in people with asthma and chronic obstructive pulmonary disease. When SO₂ 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. SO₂ 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.

4.7.5 "Electrical Smoke and Fire" and SO₂ 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.

4.7.6 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 Report form (VAR) Section 1, Items 1-8, which is a Special AIREP. Upon landing the Flight Crew should complete VAR (items 9-16) and submit the VAR per the instruction on the VAR form to the Darwin VAAC.

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Part 5

INTERNATIONAL AIRWAYS VOLCANO WATCH CONTACT LIST

5.1 ALPHABETICAL LISTING

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

5.2 LIST OF STATES BY ICAO REGION**AFI**

Cameroon
Cape Verde
Comoros
Democratic Republic of the Congo
Eritrea
Ethiopia
France (Île de la Réunion)
Kenya

French Antilles (France)
French Guiana (France)
Grenada
Guatemala
Guyana
Honduras
Jamaica
Mexico
Montserrat (United Kingdom)
Netherlands Antilles (Netherlands)
Nicaragua
Panama
Paraguay
Peru

ASIA/PAC

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

Puerto Rico (United States)
Trinidad and Tobago
Saint Kitts and Nevis
Saint Vincent and the Grenadines
Saint Lucia
Suriname
Uruguay
Venezuela

CAR/SAM

Antigua and Barbuda
Argentina
Bolivia
Brazil
Chile
Colombia
Costa Rica
Cuba
Dominican Republic
Ecuador
El Salvador

EUR

France
Greece
Italy
Portugal
Russian Federation
Spain

NAM/NAT

Canada
Iceland
United States

DOCUMENT CHANGE RECORD

Part 5

DATE	SECTION PAGES AFFECTED
9.12.10	Bolivia, 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
8.9.08	New entry: Dominican Republic
26.8.08	Updates to: Cameroon, Cape Verde, Comoros, Dem. Rep. of 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

ANTIGUA AND BARBUDA

**Volcano
observatory
or authority**

FIR PIARCO

ACC

Tel./Fax: +1 (268) 462 4703

MWO

Tel.: +1 (268) 462 3229

Fax: +1 (268) 462 4606

ARGENTINA

Volcano observatory or authority	Servicio Geológico y Minero Argentino (SEGEMAR)	Tel./Fax: +54 (11) 4349 3176 E-mail: olapid@secind.mecon.gov.ar
FIR	EZEIZA	
ACC		Tel./Fax: +54 (11) 4480 2203 AFTN: SAEZZRZX E-mail:
MWO	AEROPARQUE	Tel./Fax: +54 (11) 4514 1612 AFTN: SABEYMYX SAZZMAMX E-mail: omaaer@meteofa.mil.ar
FIR	CORDOBA	
ACC		Tel./Fax: +54 (351) 433 5350 AFTN: SACOZRZX E-mail: acccba@hotmail.com
MWO	CORDOBA	Tel.: + 54 (351) 434 1479 AFTN: SACOYMYX SAZZMAMX E-mail: omacba@meteofa.mil.ar Fax: +54 (351) 475 6427
FIR	MENDOZA	
ACC		Tel./Fax: +54 (261) 448 7486 AFTN: SAMEZRZX E-mail: apelplumerillo@ciudad.com.ar
MWO	MENDOZA	Tel./Fax: +54 (261) 448 7468 AFTN: SAMEYMYX SAZZMAMX E-mail: omadoz@meteofa.mil.ar
FIR	RESISTENCIA	
ACC		Tel./Fax: +54 (372) 244 0939 AFTN: SAREZRZX

ARGENTINA

MWO	RESISTENCIA	Tel.:	+54 (372) 243 6278
		AFTN:	SAREYMYX SAZZMAMX
		E-mail:	omasis@meteofa.mil.ar
		Fax:	+54 (372) 243 6285
FIR	COMODORO RIVADAVIA		
ACC		Tel.:	+54 (297) 454 8375
		AFTN:	SAVCZRZX
MWO	COMODORO RIVADAVIA	Tel./Fax:	+54 (297) 454 8018
		AFTN:	SAVCYMYX SAZZMAMX
		E-mail:	omacriv@meteofa.mil.ar
NOF	EZEIZA	Tel./Fax:	+54 (11) 4480 2260
		AFTN:	SAEZYNYX
		E-Mail:	notamezeiza@yahoo.com.ar

AUSTRALIA

Volcano observatory or authority	Bureau of Meteorology HQ Melbourne	Tel.: +61 (3) 9669 4586 Fax: +61 (3) 9669 4695
	Australian Geological Survey Organization	Tel.: +61 (2) 6249 9377 E-mail: wjohnson@agso.gov.au Fax: +61 (2) 6249 9986

FIR BRISBANE

MWO

Tel.:	+61 (8) 8920 3830 +61 (8) 8920 3833
AFTN:	YPDMYMYX
Fax:	+61 (8) 8927 9276 +61 (8) 8920 3829

ACC

Tel.:	+61 (7) 3866 3224
AFTN:	YBBBZRZX
Fax:	+61 (7) 3866 3257

NOF BRISBANE

AFTN:	YBBBYNYX
Fax:	+61 (7) 3866 3553

BOLIVIA

**Volcano
observatory
or authority**

FIR LA PAZ

ACC Tel./Fax: +591 (2) 281 0203
AFTN: SLLPZRZX

MWO LA PAZ Tel.: +591 (2) 2114232
AFTN: +591 (2) 212 4129
SLLPYMYX
E-mail: ovmbolivia@yahoo.es
Fax: +591 (2) 231 6686

NOF LA PAZ Tel./Fax: +591 (2) 231 6686
Ext. 152
AFTN: SLLPYNYX
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BRAZIL

**Volcano
observatory
or authority**

FIR	AMAZONICA		
ACC		Tel.:	+55 (92) 3652 5318 SBAZZRZX SBAZZQZX
		AFTN:	
		Fax:	+55 (92) 3652 5371
MWO	MANAUS/CINDACTA IV	Tel.:	+55 (92) 652 5375
		AFTN:	SBMUYFTH
		E-mail:	cmv-az@cindacta4.decea.gov.br
FIR	BRASILIA		
ACC		Tel.:	+55 (61) 3364 8404
		AFTN:	SBBRZRZX
		Fax:	+55 (61) 3365 8321
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
		AFTN:	SBREYMYX
		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

BRAZIL

FIR CURITIBA

ACC

Tel.: +55 (41) 3356 3475
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SBCWZRZX
AFTN: +55 (41) 3251 5484
Fax:

MWO

CURITIBA/CINDACTA II Tel.:

+55 (41) 3356 6216
+55 (41) 3251 5357
SBCWYMYXAFTN:
E-mail: cmv-cw@cindacta2.aer.mil.br

NOF

BRASILIA

Tel.: +55 ((61) 364 8353
AFTN: SBBRYNYX
E-mail: nofbrazil@cindacta1.aer.mil.br
Fax: +55 (61) 3364 8354

CAMEROON

Volcano observatory or authority	Institut de recherches géologiques et mini res Yaoundé Contact: Dr. J. Hell	Tel.: +237 22 210 316 E-mail: jhell@iccnet.cm irgm@iccnet.cm Fax: +237 22 210 316
FIR	BRAZZAVILLE	Tel.: +242 810 479 +242 815 151 AFTN: FCCCZQZX Fax: +242 810 459
ACC	DOUALA DOUALA	Tel: +237 424 848 AFTN: FKKDYDYX Tel.: +237 33 428 850 AFTN: FKKDYMYX E-mail: camerounmto@asecna.org Fax: +237 33 427 117
MET		
MWO	BRAZZAVILLE	Tel: +242 282 00 50/282 00 51 +242 536 14 88/565 04 41 E-Mail: congomto@asecna.org Fax: +242 282 00 50/282 00 51
NOF	BRAZZAVILLE	AFTN: FCCCYNYX

CANADA

Volcano observatory or authority	Geological Survey of Canada Contact: Dr. Catherine Hickson	Tel.: +1 (604) 666 9772 General phone no.: +1 (604) 666 0529 E-mail: chickson@nrcan.gc.ca Fax: +1 (604) 666 7507
FIR	EDMONTON	
ACC		Tel.: +1 (780) 890 8397 AFTN: CZEGZQZX Fax: +1 (780) 890 8011
MWO		Tel: +1 (780) 951 8904 AFTN: CWEGYMYX Fax: +1 (780) 951 8872
FIR	MONCTON	
ACC		Tel.: +1 (506) 867 7173 AFTN: CZQMZQZX Fax: +1 (506) 867 7180
MWO	Edmonton	Tel: +1 (780) 951 8904 AFTN: CWEGYMYX Fax: +1 (780) 951 8872
FIR	MONTREAL	
ACC		Tel.: +1 (514) 633 3365 AFTN: CZULZQZX Fax: +1 (514) 633 3043
	Back-up (OSS)	Tel.: +1 (514) 633 3211 Fax: +1 (514) 633 2873
MWO	Edmonton	Tel: +1 (780) 951 8904 AFTN: CWEGYMYX Fax: +1 (780) 951 8872
FIR	TORONTO	
ACC		Tel.: +1 (905) 676 4509 AFTN: CZYZZQZX Fax: +1 (905) 676 3121

CANADA

MWO	Edmonton	Tel:	+1 (780) 951 8904
		AFTN:	CWEGYMYX
		Fax:	+1 (780) 951 8872
FIR	WINNIPEG		
ACC		Tel.:	+1 (204) 983 8338
		AFTN:	CZWGZQZX
		Fax:	+1 (204) 984 0030
MWO	Edmonton	Tel:	+1 (780) 951 8904
		AFTN:	CWEGYMYX
		Fax:	+1 (780) 951 8872
FIR	VANCOUVER		
ACC		Tel.:	+1 (604)586-4500
		AFTN:	CZVRZQZX
		Fax:	+1 (604) 586-4502
	Back-up (OSS)	Tel.:	+1 (604)586-4590
		Fax:	+1 (604) 586-4597
MWO	Edmonton	Tel:	+1 (780) 951 8904
		AFTN:	CWEGYMYX
		Fax:	+1 (780) 951 8872
FIR	GANDER DOMESTIC AND OCEANIC		
ACC		Tel.:	+1 (709) 651-5207
		AFTN:	CZQXZQZX
		Fax:	+1 (709) 651-5234
MWO	Edmonton	Tel:	+1 (780) 951 8904
		AFTN:	CWEGYMYX
		Fax:	+1 (780) 951 8872
	Civil Aviation Contingency Operations (CACO)	Tel.:	+1 (613) 992 6853
			+1 (877) 992 6853
		AFTN:	CYHQYAYB
		Fax:	+1 (613) 993 7768
NOF	NAV CANADA	Tel:	+1 (613) 248-4087
		AFTN:	CYHQNOCX
		Fax:	+1 (613) 248-3983

CAPE VERDE

Volcano observatory or authority	Serviço Nacional de Meteorologia e Geofísica P.O. Box 76 Ilha do Sal	Tel.: AFTN: E-mail: Fax:	+238 2411 658/241 1276 +238 2411371 GVACYMYX presimet@cvtelecom.cv +238 2411294
	Laboratório de Engenharia de Cabo Verde, Ministério de Infraestruturas e Transportes, Praia	Tel.:	+238 261 5706
FIR	SAL OCEANIC	Tel: Fax:	+238 2433 3970 +238 2411730
ACC		Tel.:	+238 2411970 +238 2411730
		AFTN: Fax:	GVSCZRZX +238 2411219
MWO		Tel.:	+238 2411276
		AFTN: E-mail: Fax:	GVACYMYX presimet@cvtelecom.cv +238 2411294
NOF	SAL	AFTN: Tel: Fax:	GVACYNYX +238 241 2502 +238 241 3336

CHILE

Volcano observatory or authority	Southern Andes Volcano Observatory (SAVO)	Tel.: +56 (45) 270 700 Mobile: 09 643 0245 E-mail: hmoreno@sernageomin.cl dvasualto@sernageomin.cl Fax: +55 (92) 625 0371
	SERNAGEOMIN, Santiago	Tel.: +56 (2) 737 5050 Mobile: 09 649 5377 E-mail: jnaranjo@sernageomin.cl josenaranjo@manquehue.net +56 (2) 737 9253 Fax:
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