



ICAO

AFI VOLCANIC ASH EXERCISE

AFI VOLCEX25/01

26 FEBRUARY 2026

FINAL EXERCISE REPORT

TABLE OF CONTENTS

TABLE OF CONTENTS	2
Abbreviations and Codes.....	3
1.0 INTRODUCTION	5
2.0 COOPERATING ORGANIZATIONS.....	7
3.0 COMMUNICATIONS	7
4.0 LOG OF EXERCISE OPERATION	8
5.0 LESSONS LEARNED	16
6.0 RECOMMENDATIONS	18
7.0 CONCLUSIONS.....	21
Appendix A: Cooperating Agencies.....	22
Appendix B: Volcanic Ash Information Flow and Coordination Process.....	25
Appendix C: Exercise Message Log.....	26
Attachment 1: Kenya Airways Safety Assessment.....	40
Attachment 2: Kenya ANSP Safety Assessment	40

Abbreviations and Codes

ACC	Area Control Centre
AFI	African-Indian Ocean region
AFTN	Aeronautical Fixed Telecommunication Network
AIM	Aeronautical Information Management
AIP	Aeronautical Information Publication
AMBEX	AFI Meteorological Bulletin Exchange
AMHS	ATS Message Handling System
AMO	Aerodrome Meteorological Office
AMS	Aeronautical Meteorological Station
AMSP	Aeronautical Meteorological Service Provider
AODEX	AFI OPMET Data Exchange
APP	Approach Control
ARO	ATS Reporting Office
ASHTAM	Special Series NOTAM for Volcanic Ash
ATM	Air Traffic Management
BCC	Bulletin Compilation Centre
CCC	Central Coordinating Committee
CNS	Communication, Navigation, Surveillance
COM	Communication
D-ATIS	Digital – Automatic Terminal Information Service
ESAF	ICAO Eastern and Southern African region
FIC	Flight Information Centre
FIR	Flight Information Region
GSM	Global System for Mobile Communications
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
KCAA	Kenya Civil Aviation Authority
KQA	ICAO Code for Kenya Airways
MET	Meteorological
MWO	Meteorological Watch Office
NOF	NOTAM Office

NOTAM	Notice to Airmen
OPINS	AFI Volcanic Ash Operational Instructions
OPMET	Operational Meteorological information
RCC	Rescue Coordinating Centre
RODB	Regional OPMET DataBank
SARPS	Standards and Recommended Practices
SIGMET	Significant Meteorological Information
SVO	State Volcano Observatory
TWR	Aerodrome Control Tower
UoN	University of Nairobi
VAA	Volcanic Ash Advisory
VAAC	Volcanic Ash Advisory Centre
VONA	Volcanic Ash Notice for Aviation
VOLCEX25/01	1 st Volcanic Ash Exercise of 2025
VO	Volcano Observatory
WACAF	Western and Central Africa region

1.0 INTRODUCTION

- 1.1 Volcanic ash exercises are designed to test and validate end-to-end system readiness including: volcanic activity alerting, Aeronautical Information Service (AIS) and Meteorological (MET) message routing; dissemination of volcanic ash information; Air Traffic Management (ATM) procedures, air traffic flow and capacity management; aircraft operator response, and collaborative decision-making (CDM) among all stakeholders in accordance with regional and global procedures as established by the International Civil Aviation Organization (ICAO).
- 1.2 The main objective of these exercises is to strengthen inter-agency coordination and operational preparedness in response to volcanic activity, thereby safeguarding the regularity, efficiency and safety of air navigation in the event of an actual volcanic eruption within the AFI Region.
- 1.3 The specific objectives of AFI VOLCEX25/01 were to:
 - a) Demonstrate coordination procedures between all participating organizations/parties i.e. VO, MWOs, ATS Centres, NOF, BCC, RCC, AIS, RODBs (Pretoria/Dakar), VAACs Toulouse, Users;
 - b) Assess the timely distribution of messages that includes; VONA, SIGMET, NOTAM, ASHTAM, VAA, Special Air Report messages;
 - c) Check and determine availability on the existing COM link/networks i.e. AMHS, AFTN, Radio link, D-ATIS etc.;
 - d) Check and demonstrate efficiency of the state Local Contingency Committee preparedness during the exercise;
 - e) Check the effectiveness of bilateral arrangements/agreements for provision of information between neighbouring States in case of a volcanic eruption;
 - f) Demonstrate transmission of air-reports on volcanic ash in accordance with Annex 3 (Aircraft ->ACC ->MWO ->VAAC), and;
 - g) Provide recommendations for amendment of the procedures on the basis of lessons learned and conclusions formulated.
- 1.4 These exercises are conducted bi-annually within the AFI region. The 1st and 2nd were led by Cape Verde and The Democratic Republic of Congo in 2021 and 2023 respectively. The Third ICAO AFI Volcanic Ash Exercise (VOLCEX25/01), initially scheduled for November 2025, was conducted on 26 February 2026 from 0900 to 1500 UTC to accommodate the availability of VAAC Toulouse. VOLCEX25/01

simulated the eruption of the Barrier Volcano in Kenya, located at N0219 E03634, with an elevation of 3,386 ft (1,032 m) and volcano number 222030.

- 1.5 The simulated ash plume reached FL550, with ash clouds moving northeast at 20KT from the surface to FL160, then east at 10KT between FL130 and FL250, and west at 20KT between FL200 and FL500. The plume affected the following States: Kenya, Ethiopia, South Sudan, Uganda, Democratic Republic of Congo, Rwanda, and Tanzania.
- 1.6 Pre-exercise preparations commenced in mid-2025. The framework of the VOLCEX25/01 Exercise Directive was developed based on guidance contained in the AFI Volcanic Ash Operational Instructions (OPINS). The final version of the Exercise Directive was subsequently disseminated to the cooperating agencies as provided under **Appendix A**. It was submitted to the International Civil Aviation Organization's Eastern and Southern African (ESAF) Office on 11 February 2026 for uploading on the ICAO website. The Directive was also published on the Kenya State Volcano Observatory website for reference.
- 1.7 In preparation for the exercise, NOTAM A0036/26 was issued one week prior to the scheduled activity to inform the aviation community of the forthcoming tabletop volcanic ash simulation in accordance with the requirements of the OPINS. Stakeholder sensitization was conducted on 24 February 2026 to ensure awareness of the exercise objectives, procedures, and communication arrangements.
- 1.8 Further to the exercise preparations, safety risk assessments were conducted by the aircraft operator, Kenya Airways, in accordance with the provisions of ICAO Doc 9974.
- 1.9 In addition, the Air Navigation Service Provider (ANSP) undertook a safety risk assessment in line with the requirements of Annex 19 to the Convention on International Civil Aviation and the guidance contained in ICAO Doc 9859 (Safety Management Manual). These assessments were aimed at ensuring that the exercise activities were conducted within an acceptable level of safety performance and in accordance with established safety management principles. These assessments are attached to this report.
- 1.10 Following a careful assessment of the prevailing operational environment, and in consultation with the AFI VOLCEX Steering Group (SG) Chairperson, the GO decision was made on the eve of the exercise based on the issuance of the preparatory NOTAM and confirmation that no actual volcanic activity or safety concerns were affecting aviation operations at the time.
- 1.11 The exercise was led by the Kenya Civil Aviation Authority (KCAA). Mr. Felix Odima, Principal Air Traffic Management Officer, served as the Exercise Leader assisted by Ms. Esther Nyaga, also a Principal Air Traffic Management Officer.

2.0 COOPERATING ORGANIZATIONS

- 2.1 The organizations that participated in VOLCEX25/01 are as provided in **Appendix A**.

3.0 COMMUNICATIONS

- 3.1 The exercise was coordinated through the Zoom platform; hosted by the ICAO ESAF Office.
- 3.2 Telephone or voice communications were preceded by the prefix **Exercise VOLCEX25/01** and ended with the phrase, **EXERCISE EXERCISE EXERCISE** as provided for in the AFI VA exercise Operational Instructions.
- 3.3 Telephone communication and email were used by the State Volcano Observatory, Nairobi, to communicate eruption details of the Barrier volcano and Volcano Observatory Notice for Aviation (VONA) to Nairobi ACC, Nairobi MWO and the VAAC Toulouse.
- 3.4 Telephone communications were used during inter-unit coordination.
- 3.5 Special air reports were transmitted by Kenya Airways flights with a special call sign, KQA 333, to the Nairobi ACC who relayed them to all traffic via VHF radio and via AFTN to Nairobi MWO. The Nairobi MWO transmitted the special air report received from the Nairobi ACC to VAAC Toulouse via AFTN.
- 3.6 AMHS and AFTN Platforms were used for handling SIGMETs and NOTAM during the exercise.
- 3.7 Volcanic ash information flow and coordination is depicted in **Appendix B**.

4.0 LOG OF EXERCISE OPERATION

OPENING CEREMONY

- 4.1 The opening ceremony of the 2025 AFI Volcanic Ash Exercise was graced by representatives from the ICAO ESAF and WACAF Offices. The session was moderated by the ESAF Regional Officer, Environment and Meteorology, and the WACAF Regional Officer Meteorology.
- 4.2 Welcoming remarks were delivered by the Director, Air Navigation Services (Kenya), followed by remarks from the Director, Aviation Safety (Kenya). The statement of the Director General of KCAA, who was engaged in other official duties, was delivered on his behalf by the Director, Aviation Safety (Kenya).
- 4.3 The Regional Director, WACAF delivered the opening remarks on behalf of the ICAO ESAF and WACAF Offices and officially declared the 2025 AFI Volcanic Ash Exercise open.
- 4.4 The exercise then progressed as outlined below, in accordance with the final Exercise Directive and the established volcanic ash contingency procedures.

EXERCISE TIMELINE

- 4.5 Nairobi Volcano Observatory initiated call to the Nairobi ACC at 0931Z, the Nairobi MWO at 0932Z and VAAC Toulouse at 0933Z informing the units that the Barrier Volcano, PSN N0219 E03634, erupted at 0900Z, colour code RED.
- 4.6 At 0932Z, Nairobi ACC advised the Duty technician through the tie-line to ensure that the tapes are recording, which was confirmed.
- 4.7 At 0934Z, the Volcano Observatory issued the 1st exercise VONA to the units in 4.1 above via email kenya-svo@uonbi.ac.ke.
- 4.8 At 0935Z, Nairobi ACC confirmed the receipt of the 1st Exercise VONA via email, acknowledging the same.
- 4.9 At 0937Z, Nairobi Volcano Observatory received ACC's acknowledgement of the VONA via email.
- 4.10 At 0944Z, Nairobi Volcano Observatory received VAAC Toulouse's acknowledgement of the VONA via email.
- 4.11 At 0945Z, VAAC Toulouse issued the 1st Exercise VAA/VAG via AFTN/AMHS.
- 4.12 At 0945Z, Nairobi ACC confirmed receipt of the 1st Exercise VAA/VAG from VAAC Toulouse via AFTN.

- 4.13 At 0946Z, Nairobi MWO confirms receipt of the 1st Exercise VAA/VAG from VAAC Toulouse via AFTN.
- 4.14 At 0946Z, 1st Exercise NOTAM was issued by Nairobi NOF through AFTN/AMHS.
- 4.15 At 0946Z, Nairobi ACC/FIC confirmed receiving the 1st NOTAM, V0006/26 via AFTN/AMHS.
- 4.16 At 0946Z, Nairobi MWO confirmed receiving the 1st NOTAM, V0006/26 via AFTN/AMHS.
- 4.17 At 0946Z, Nairobi RCC confirmed receipt of the 1st exercise NOTAM V0006/26 via AFTN/AMHS.
- 4.18 At 0947Z, Nairobi MWO issued the 1st SIGMET via AFTN/AMHS.
- 4.19 At 0947Z, Nairobi NOF confirmed receipt of the 1st SIGMET via AFTN/AMHS.
- 4.20 At 0947Z, Nairobi RCC confirmed receipt of the 1st exercise SIGMET via through AFTN/AMHS.
- 4.21 At 0948Z, Nairobi ACC confirmed receipt of the 1st SIGMET via AFTN/AMHS.
- 4.22 At 0950Z, broadcast made to all traffic on VHF radio by Nairobi ACC when prompted to apply ATC measures.
- 4.23 At 0952Z, Nairobi ACC called Nairobi RCC via telephone to inform of the eruption of the Barrier Volcano.
- 4.24 At 0953Z, neighbouring ACC/FICs, Addis ACC, Dar es Salam ACC and Juba FIC advised. Unable to reach Entebbe ACC on phone.
- 4.25 At 0954Z, shift Supervisor, advised. The shift supervisor escalates the information upwards to the Director General through the Deputy Director ATM and the Director ANS thereby activating the Nairobi FIR ATM contingency plan that includes the VACP.
- 4.26 At 0955Z, KQA333 makes a Special air report on Volcanic Ash through VHF radio to Nairobi ACC. ACC codes the special air report in accordance to Annex 11 requirements.
- 4.27 At 0956Z, Nairobi ACC made a broadcast to all traffic on frequency 121.3MHZ about the Special Air Report transmitted by KQA333.
- 4.28 At 0956Z, RCC activated its internal measures by putting the SAR in charge on standby;

- 4.29 At 0958Z, Nairobi ACC transmits the special Air Report to Nairobi MWO via AFTN/AMHS;
- 4.30 At 0958Z, Nairobi ACC called Nairobi MWO called on tie-line to notify them that they have sent the Special Air Report and the MWO confirmed receipt;
- 4.31 At 1001Z, RCC activated its internal measures by putting the SAR SMCs on standby;
- 4.32 At 1002Z, RCC activated its internal measures by putting the cluster 1 agency 1 on standby
- 4.33 At 1004Z, RCC activated its internal measures by putting the cluster 1 agency 2 on standby
- 4.34 At 1004Z, Nairobi MWO relayed the special air report received from Nairobi ACC to VAAC Toulouse, RODB Dakar and RODB Pretoria via AFTN.
- 4.35 At 1005Z, Nairobi MWO did not receive the 2nd SIGMET from Entebbe since it was sent via email as reported by Entebbe MWO.
- 4.36 At 1008Z, RCC activated its internal measures by putting the cluster 1 agency 3 on standby.
- 4.37 At 1010Z, Entebbe issued the 2nd exercise NOTAM.
- 4.38 At 1010Z, Nairobi NOF confirms receipt of the 2nd NOTAM issued by Entebbe;
- 4.39 At 1011Z, RCC activated its internal measures by putting the cluster 1 agency 4 on standby;
- 4.40 At 1013Z, RCC activated its internal measures by putting the cluster 1 agency 5 on standby
- 4.41 At 1015Z, RCC called Dar es Salam RCC advising them of the eruption;
- 4.42 At 1018Z, RCC called Entebbe RCC but was unable to get a response.
- 4.43 At 1019Z, RCC called Addis RCC but line 1 was not going through.
- 4.44 At 1020Z, RCC called Addis RCC but line 2 was not going through;
- 4.45 At 1021Z, RCC called Juba ATC/RCC but the line was not going through;
- 4.46 At 1025Z, Juba AMO could not be reached to confirm receipt of SIGMETs due internet connectivity issues;
- 4.47 At 1030Z, Juba ARO could not be reached to confirm receipt of NOTAM due internet connectivity issues;

- 4.48 At 1030Z, Juba FIC applied ATC measures by making a broadcast to its traffic;
- 4.49 At 1040Z, there was no response from Addis MWO regarding 3rd exercise SIGMET;
- 4.50 At 1044Z, Nairobi NOF confirmed receipt of the 3rd Exercise NOTAM from Addis NOF;
- Identified Action:** The NOTAM had an error (coordinates mismatch) and went to the rejected NOTAM tray.
- 4.51 At 1045Z, Addis ACC/FIC applied ATC Measures by making a broadcast to all traffic and called Juba, Entebbe and Nairobi FIRs;
- 4.52 At 1053Z, the 4th Exercise SIGMET was received from Dar es Salaam MWO;
- 4.53 At 1058Z, the 4th Exercise NOTAM was received from Dar es Salaam NOF;
- 4.54 At 1100Z, Dar es Salaam ACC applied ATC measures by broadcasting on VHF radio to all traffic, updating ATC logbook, advising the supervisor;
- 4.55 At 1111Z, Kigali NOF reported sending 4th exercise ASHTAM but was not received by Nairobi NOF;
- 4.56 At 1116Z, the 5th exercise SIGMET from Kigali MWO was received by Nairobi ACC and Nairobi MWO;
- 4.57 At 1120Z, Kigali ACC applied ATC measures by broadcasting to all aircraft;
- 4.58 At 1125Z, there was no response from Kinshasa MWO regarding 6th exercise SIGMET;
- 4.59 At 1130Z, there was no response from Kinshasa NOF regarding 6th exercise ASHTAM/NOTAM;
- 4.60 At 1135Z, there was no response from Kinshasa ACC regarding application of ATC measures;
- 4.61 Between 1135Z and 1145Z VAAC Toulouse, Nairobi BCC, RODB Pretoria and Dakar and Kenya CAA oversight participated in the 1st teleconference;
- 4.62 Nairobi Volcano Observatory called the Nairobi ACC at 1146Z, Nairobi MWO at 1147Z and VAAC Toulouse at 1148Z informing that the Barrier Volcano, PSN N0219 E03634, erupted at time 0900Z, colour code RED;
- 4.63 At 1147Z, the Nairobi ACC advised the duty technician to check recording;
- 4.64 At 1148Z, the Nairobi Volcano Observatory sent the 2nd Exercise VONA;

- 4.65 At 1149Z, 2nd VONA issued by Nairobi Volcano Observatory via email received and acknowledged by Nairobi ACC;
- 4.66 At 1151Z, 2nd VAA/VAG received by Nairobi MWO and Nairobi ACC via AFTN;
- 4.67 At 1152Z, 2nd VONA issued by Nairobi Volcano Observatory received and acknowledged by Nairobi MWO;
- 4.68 At 1155Z, 7th exercise SIGMET issued by Nairobi MWO based on VAA/VAG via AFTN/AMHS;
- 4.69 At 1155Z, 7th exercise SIGMET received by Nairobi ACC and Nairobi RCC via AFTN/AMHS;
- 4.70 At 1156Z, 7th exercise SIGMET received by Nairobi NOF via AFTN/AMHS;
- 4.71 At 1201Z, 7th exercise NOTAM (V0007/26) issued by Nairobi NOF via AFTN/AMHS;
- 4.72 At 1201Z, 7th exercise NOTAM received by Nairobi ACC and Nairobi RCC via AFTN/AMHS;
- 4.73 At 1202Z, 7th exercise NOTAM received at Nairobi MWO via AFTN/AMHS;
- 4.74 At 1205Z, broadcast made to all traffic by Nairobi ACC when prompted to apply ATC measures;
- 4.75 At 1205Z, neighbouring FIRs, Addis FIR, DAR FIR and JUBA FIC were advised by Nairobi ACC via telephone;
- 4.76 At 1205Z, Nairobi ACC advised Nairobi RCC;
- 4.77 At 1205Z, Nairobi ACC advised the Supervisor;
- 4.78 At 1206Z, Nairobi RCC received a call from Nairobi ACC notifying of the eruption;
- 4.79 At 1211Z, KQA333 transmitted the 2nd special air report on VHF radio to Nairobi ACC;
- 4.80 At 1212Z, broadcast made to all traffic by Nairobi ACC on the frequency 121.3MHZ about the Special Air Report made by KQA333;
- 4.81 At 1214Z, ACC transmits the special Air Report by KQA333 to the Nairobi MWO via AFTN/AMHS;
- 4.82 At 1215Z, Nairobi ACC called the Nairobi MWO notifying them of the transmitted Special Air Report;

- 4.83 At 1217Z, Nairobi MWO relayed the 2nd special air report received from Nairobi ACC to VAAC Toulouse, RODB Dakar and RODB Pretoria via AFTN;
- 4.84 At 1222Z, Nairobi NOF received the 8th NOTAM from Entebbe NOF, earlier than slotted time (1225);
- 4.85 At 1225Z, Nairobi MWO did not receive the 8th SIGMET from Entebbe MWO;
- 4.86 At 1240Z, Juba AMO could not be reached to confirm receipt of 8th SIGMET due internet connectivity issues;
- 4.87 At 1245Z, Juba ARO could not be reached to confirm receipt of 8th NOTAM due internet connectivity issues;
- 4.88 At 1255Z, the 9th exercise SIGMET was not received from Addis MWO;
- 4.89 At 1255Z, the 9th exercise NOTAM from Addis NOF was received by Nairobi ACC;
- 4.90 At 1305Z, Addis ACC/FIC did not apply ATC Measures since they were not reachable on the zoom link;
- 4.91 At 1305Z, Addis ACC/FIC did not confirm application of ATC measures since they were not reachable on the zoom link;
- 4.92 At 1306Z, the 10th Exercise SIGMET from Dar es Salaam MWO was received by Nairobi ACC and Nairobi MWO via AFTN/AMHS;
- 4.93 At 1310Z, the 10th exercise NOTAM from Dar es Salaam MWO was received at Nairobi BCC and distributed accordingly via AFTN/AMHS;
- 4.94 At 1315Z, Dar es Salaam ACC applied ATC measures by broadcasting on VHF radio to all traffic, updating ATC logbook, advising the supervisor and neighbouring States;
- 4.95 At 1318Z, the 10th Exercise SIGMET from Dar es Salaam MWO was received at Nairobi NOF via AFTN/AMHS;
- 4.96 At 1318Z, the 10th exercise NOTAM was received by Nairobi NOF;
- 4.97 At 1320Z, the 11th Exercise SIGMET from Kigali MWO was received by Kigali NOF and Nairobi BCC and distributed accordingly via AFTN/AMHS;
- 4.98 At 1323Z, the 11th Exercise SIGMET from Kigali MWO was received by Nairobi NOF via AFTN/AMHS;
- 4.99 At 1328Z, the 11th Exercise ASHTAM from Kigali NOF was received by Nairobi BCC and distributed accordingly via AFTN/AMHS;

- 4.100 At 1330Z, Kigali ACC/FIC applied ATC measures by broadcasting to all aircraft, logging, and coordinated with Dar es Salaam and Entebbe FIRs;
- 4.101 At 1340Z, the 12th Exercise SIGMET was not received from Kinshasa MWO;
- 4.102 At 1345Z, the 12th Exercise NOTAM/ASHTAM was not received from Kinshasa NOF;
- 4.103 At 1350Z, Kinshasa ACC did not confirm application of ATC measures since they were not reachable on the zoom platform;
- 4.104 Between 1350Z and 1400Z VAAC Toulouse, Nairobi BCC, RODB Pretoria and Dakar and the KCAA oversight participated in the 2nd exercise teleconference;
- 4.105 Volcano Observatory called the Nairobi ACC at 1400Z, Nairobi MWO at 1401Z and VAAC Toulouse at 1402Z informing of the cessation of the unrest of the Barrier Volcano, colour code GREEN;
- 4.106 At 1402Z, Nairobi Volcano Observatory sent cancellation VONA to Nairobi ACC, Nairobi MWO and VAAC Toulouse via email;
- 4.107 At 1402Z, Nairobi MWO acknowledged receipt of the cancellation VONA;
- 4.108 At 1402Z, Nairobi ACC advised the Supervisor about the cessation of unrest of Barrier Volcano via phone;
- 4.109 At 1403Z, Nairobi ACC acknowledged receipt of the cancellation VONA;
- 4.110 At 1404Z, VAAC Toulouse acknowledged receipt of the cancellation VONA;
- 4.111 At 1406Z, Nairobi Volcano Observatory acknowledged receipt of the cancellation VONA;
- 4.112 At 1410Z, Exercise cancellation VAA/VAG sent by VAAC Toulouse and received by Nairobi MWO via AFTN/AMHS;
- 4.113 At 1411Z, Nairobi MWO issued the exercise cancellation SIGMET via AFTN/AMHS;
- 4.114 At 1411Z, exercise cancellation SIGMET received by Nairobi NOF via AFTN/AMHS;
- 4.115 At 1415Z, Nairobi RCC received a call from Nairobi ACC advising of the cessation of unrest of the Barrier volcano;
- 4.116 At 1415Z, all participating MWO were directed to cancel their SIGMETs.
- 4.117 At 1416Z, cancellation SIGMETs from Dar es Salaam and Kigali were received by Nairobi BCC via AFTN/AMHS;

- 4.118 At 1418Z, Nairobi NOF confirmed receipt of cancellation SIGMET from Dar es Salaam via AFTN/AMHS;
- 4.119 At 1426Z, Nairobi NOF issued a cancellation NOTAM V0008/26 for the exercise;
- 4.120 At 1426Z, cancellation NOTAM V0008/26 from Nairobi NOF received by Nairobi BCC and distributed accordingly via AFTN/AMHS;
- 4.121 At 1429Z, Cancellation NOTAM from Entebbe NOF and Kigali NOF were received by Nairobi NOF and Nairobi BCC via AFTN/AMHS, a minute earlier than required;
- 4.122 At 1430Z, All participating NOFs were directed to cancel their NOTAMs;
- 4.123 At 1435Z, Cancellation NOTAM from Dar es Salaam NOF was received by Nairobi NOF and Nairobi BCC via AFTN/AMHS;
- 4.124 At 1438Z, VOLCEX25/01 Exercise leader announces the cessation of the Exercise;
- 4.125 At 1439Z, Nairobi ACC advised the Supervisor of the cessation of the exercise;
- 4.126 At 1441Z, Cancellation NOTAM from Addis NOF was received by Nairobi NOF and Nairobi BCC via AFTN/AMHS;
- 4.127 Between 1440 - 1511Z, the last exercise teleconference was undertaken. All the participants lined up to speak did participate except the Entebbe, Addis and Kigali RCCs, Juba and Kinshasa NOFs and MWOs and ASECNA.
- 4.128 At 1512Z, the exercise leader handed the meeting over to the ICAO ESAF Secretariat.

CLOSING CEREMONY

- 4.129 At 1513Z, The ESAF Regional Officer, Environment and Meteorology thanked the Exercise leader and his assistant for the work well done and welcomed all to the closing ceremony.
- 4.130 Between 1514 – 1517Z, the closing speech by the Director General of the Kenya Civil Aviation Authority, who was engaged in other official duties, was delivered on his behalf by the Director of Aviation Safety. In her remarks, she noted that Kenya was pleased to have hosted the regional activity and acknowledged the support from the ICAO ESAF and WACAF Offices, as well as all participating agencies, for their dedication and participation. She emphasized that Kenya remains committed to working closely with AFI States, ICAO and partner institutions to further advance aviation safety.

- 4.131 At 1518Z, the ESAF Regional Officer for Environment and Meteorology, on behalf of the Regional Director of ICAO ESAF, delivered her remarks conveying appreciation to the Lead State, Kenya, for supporting ICAO and leading the activity. She also expressed gratitude to all participants for their constructive engagement during the exercise and extended appreciation to the Director General, KCAA. Further appreciation was given to the AFI VOLCEX Steering Group Chairperson for his exceptional leadership throughout the planning and execution of the exercise.
- 4.132 At 1521Z, on behalf of the WACAF Office, Regional Officer, ATM/SAR conveyed his appreciation to the participants, commending the Exercise Leader for conducting the exercise with professionalism and expertise. He also acknowledged the crucial roles played by Kenya Airways, the ANSPs, and all other participating stakeholders, noting that the lessons learned from the exercise would contribute to improvements in future activities.
- 4.133 At 1523Z, the ESAF Regional Officer for Environment and Meteorology, on behalf of the ESAF and WACAF Regional Directors, officially declared the 2025 AFI Volcanic Ash Exercise meeting closed.
- 4.134 For a full list of exercise messages issued, see **Appendix C**.

5.0 LESSONS LEARNED

- 5.1 The 7th edition of the AMBEX handbook does not contain all addresses to be used for exchange of messages.
- 5.2 Effective coordination among the participating agencies is necessary to ensure the successful delivery of the exercise.
- 5.3 Not all States are connected to the AFTN/AMHS network.
- 5.4 The Exercise leader should be an officer from Air Traffic Management (ATM) domain.
- 5.5 Where many States are participating, resulting in extended exercise duration, there is need for additional person(s) to assist the Exercise Leader.
- 5.6 Despite sensitization, some stakeholders were not aware of the volcanic ash exercise.
- 5.7 Although Kenya established Letters of Agreements with neighbouring States, these agreements do not include provisions for volcanic ash.
- 5.8 Changes in flight scheduling affected the transmission of Special Air Reports.

- 5.9 The transition from Microsoft Teams to Zoom on 26 February 2026 had some impact on the ability of certain participants to join and actively participate in the exercise.
- 5.10 The coded format of the Special Air Report provided in the AFI VACP, as transmitted by the MWO, is at variance with the provisions of Annex 3, C. 5.9.6 /ICAO Doc. 10157, PANS-MET, C. 3.1.3.
- 5.11 While Kenya has established the Nairobi FIR ATM contingency plan, which includes provisions for the Volcanic Ash Contingency Plan, it was not fully activated.
- 5.12 There is no specific guidance provided in the AFI VA exercise OPINS on how to communicate the GO/NO GO decision. The GO decision was based on the preparatory NOTAM issued on 19 February 2026, in the absence of any reported safety concerns.
- 5.13 The correct NOTAM series were not used by some States when reporting Volcanic ash information.
- 5.14 The ASHTAM/NOTAM series to be used during the exercises and real events as well as other aeronautical information, should be promulgated in the State's AIP under Gen 3.1.
- 5.15 Establishing points of contact with some State volcano observatories within the AFI region was unsuccessful for example, Cabo Verde, Eritrea, Comoros.
- 5.16 During the exercise, activities requiring operational priority but not warranting its suspension or cancellation, may necessitate the delay or temporary suspension of actions by a specific unit during its allocated exercise time slot.
- 5.17 Unexpected non-participation of key States, for example, constraints experienced by the Democratic Republic of Congo, which negatively impacted on the progression of the exercise.
- 5.18 Early withdrawal by some States impacted negatively on the smooth progression of the exercise.

6.0 RECOMMENDATIONS

- 6.1 Install an AMHS position at the Nairobi Volcano Observatory. This will facilitate the direct receipt and distribution of VONA messages via AMHS, improving both efficiency and reliability.
- 6.2 Establish a letter of Agreement between KCAA, the Meteorological Service Provider for Air Navigation and the State Volcano Observatory regarding volcanic ash as provided by ICAO Doc 9766.
- 6.3 Regular refresher training and bi-annual simulation exercises interfaced with the ICAO calendar for operational staff to strengthen coordination and response time.
- 6.4 Review the Nairobi FIR ATM contingency plan to incorporate all the provisions of ICAO Doc. 9766.
- 6.5 Review Letters of Agreement with neighbouring states to include provisions for volcanic ash.
- 6.6 The on-going project of updating the AMBEX handbook should be used to ensure correct addresses are used for addressing aeronautical messages.
- 6.7 ICAO to pursue the AFTN/AMHS connectivity amongst all States, e.g. between Nairobi FIR and Juba FIC and Djibouti.
- 6.8 Revise the AFI Volcanic Ash Exercise Operational Instructions to clearly state that the exercise leader should be from ATM service provider.
- 6.9 A provision to be made in the AFI Volcanic Ash Exercise Operational Instructions for an assistant to the exercise leader.
- 6.10 The AFI Volcanic Ash Exercise Operational Instructions should include standardized templates for each message to ensure consistency and clarity in communications during the exercise, e.g., VONA and Special Air Reports.
- 6.11 Participating airlines should be onboarded at the onset of exercise preparation through IATA to ensure participation and adequate coordination.
- 6.12 There is need to have effective mechanisms in place to ensure all aviation stakeholders are adequately sensitized regarding volcanic ash exercises and actual events, e.g. Interpretation of messages (NOTAM/SIGMETS) and timelines for airline staff.

- 6.13 Schedule a pre-exercise teleconference one day prior to the volcanic ash exercise using the ICAO platform to be used to enable participants familiarize themselves with the platform.
- 6.14 Ensure that during such exercises and real events, the State's ATM Contingency plan that incorporates the Volcanic Ash Contingency Plan, is fully activated to support dissemination of information.
- 6.15 Review the AFI VACP to ensure it aligns with the requirements of Annex 3, C. 5.9.6, for MWO to transmit special air reports received from the ACC in the format in which they are received (pg. 45, 55). Also, align the VONA template in the AFI VACP to the provision in ICAO Doc. 10157, PANS-MET, Appendix 7.
- 6.16 The ASHTAM / NOTAM series to be used during the exercises should be promulgated in the respective States' AIPs under Gen 3.1.
- 6.17 AFI VA OPINS should include specific guidance on how to communicate the GO/NO GO decision eg via email.
- 6.18 State Volcano Observatories within the AFI region should update their focal point details in ICAO Doc. 9766 to facilitate effective participation.
- 6.19 When operational circumstances not warranting the suspension or cancellation of the exercise become a priority in a particular unit during the exercise, there should be provision to delay or suspend the exercise action that should be undertaken by that unit at that time.
- 6.20 VAAC Toulouse to update their AMHS/AFTN address if it has changed since what was used (LFPWYMEU) was at variance to what is documented in ICAO Doc. 9766 (LFPWYMYX or LFPWYMCR).
- 6.21 Johannesburg Communication Centre and the NOTAM office are to be included as participants in future exercises for monitoring purposes.
- 6.22 Message delays between VAAC Toulouse and RODB Dakar to be investigated (Advisory messages were reported to have been received in +7 minutes).
- 6.23 The second SIGMET issued by Nairobi MWO during the second session was not received at RODB Pretoria. This needs to be investigated.
- 6.24 Meteorological Watch Offices (MWOs) are encouraged to use the correct channel of transmission, instead of email.
-

6.25 Participating States are requested to ensure full participation, as early withdrawal had a negative impact on the progression of the exercise.

6.26 States identified during the planning process, based on the VAAC Toulouse exercise scenarios, for participation in Volcanic Ash Exercises should ensure full and active engagement in the exercise.

7.0 CONCLUSIONS

- 7.1 The third ICAO AFI Volcanic Ash Exercise (VOLCEX25/01), conducted on 26 February 2026, proved to be an extremely valuable and successful event for all participating agencies from the AFI Region. The exercise successfully achieved its primary objective of simulating the response to the volcanic eruption of the Barrier Volcano in Kenya. It provided a critical platform to test and enhance inter-agency coordination, operational readiness, and the application of regional volcanic ash contingency procedures.
- 7.2 The exercise effectively demonstrated the activation of communication protocols and the dissemination of critical information, including VONA messages, SIGMETs, NOTAM, and Special Air Reports (ARS). The involvement of key stakeholders validated the collaborative decision-making processes essential for maintaining safety in the event of a real volcanic eruption. The simulation of ash clouds at multiple flight levels and affecting several neighboring states successfully tested the complexity of regional coordination.
- 7.3 While the exercise was a success, it also highlighted critical areas of improvement. The challenges experienced during the exercise underscore the need to investigate any shortcomings in the current communication infrastructure. This, along with the need for enhanced connectivity and adequate sensitization of stakeholders, provides a clear path for targeted improvements.
- 7.4 AFI VOLCEX25/01 was a successful test of existing communication infrastructure and procedures. The exercise was a crucial diagnostic tool that identified concrete steps to bolster the resilience and efficiency of the volcanic ash information chain in the AFI Region.
- 7.5 The lessons learned and the subsequent recommendations are instrumental in strengthening regional cooperation, improving communication networks, and ultimately enhancing the safety, regularity, and efficiency of international air navigation against the hazard of volcanic ash. The enthusiasm and cooperation demonstrated by all participants reaffirm the collective commitment to continuous improvement and operational preparedness.

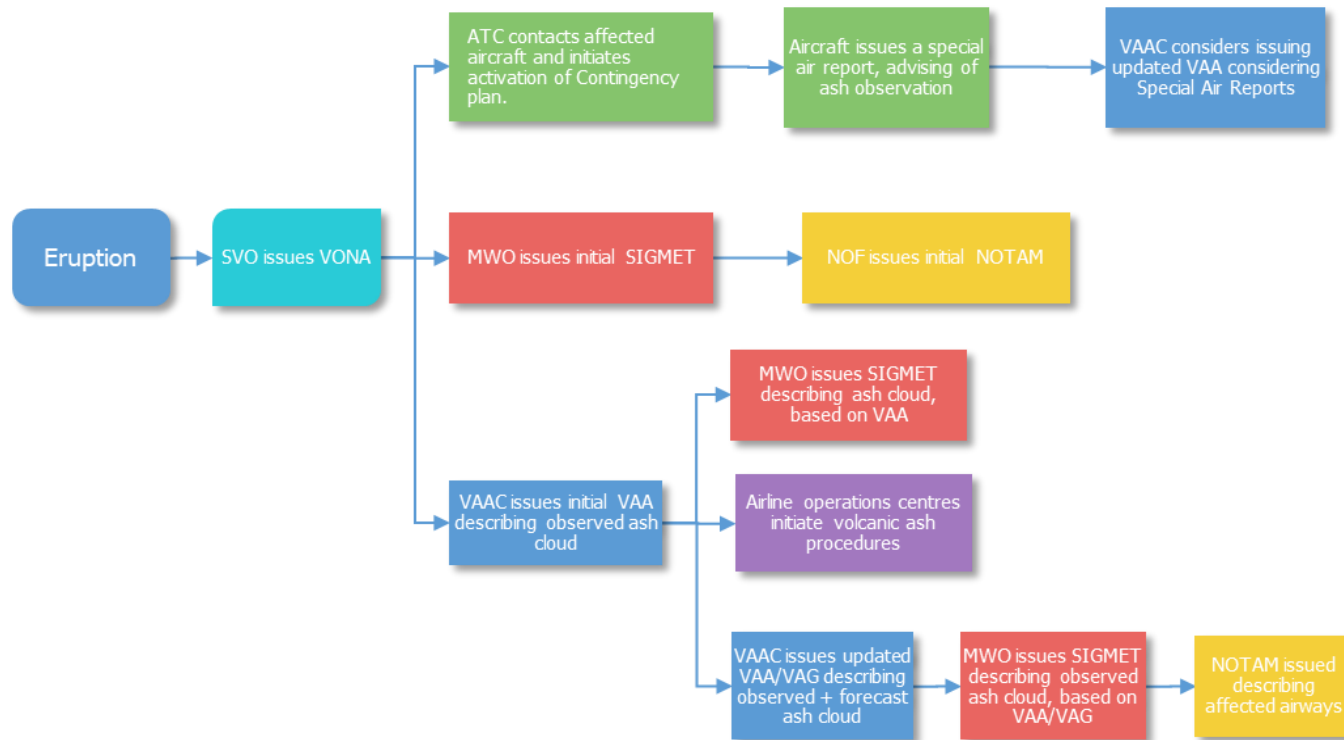
Appendix A: Cooperating Agencies

AREA OF RESPONSIBILITY	AGENCY	STATE/REGION
Chairperson, AFI VOLCEX SG	AFI VOLCEX SG	Kenya
Exercise Leader - ANSP	Kenya ANSP (ATM)	Kenya
Assistant Exercise Leader - ANSP	Kenya ANSP (ATM)	Kenya
VO	State Volcano Observatory -	Kenya
	State Volcano Observatory -	Ethiopia
	State Volcano Observatory -	Cameroun
	State Volcano Observatory -	Comoros
	State Volcano Observatory -	Cape Verde
	State Volcano Observatory -	D.R. Congo
	State Volcano Observatory -	Eritrea
VAAC	VAAC Toulouse	France
MWO	Nairobi MWO	Kenya
	Dar es Salaam MWO	Tanzania
	Entebbe MWO	Uganda
	Kigali MWO	Rwanda
	Kinshasa MWO	D.R. Congo
	Addis MWO	Ethiopia
	Juba AMO	South Sudan
NOF/ARO - ANSP	Nairobi NOF	Kenya

	Dar es Salaam NOF	Tanzania
	Entebbe NOF	Uganda
	Kigali NOF	Rwanda
	Kinshasa NOF	D.R. Congo
	Addis NOF	Ethiopia
	Juba ARO	South Sudan
ACC/FIC - ANSP	Nairobi ACC/FIC	Kenya
	Dar es Salaam ACC/FIC	Tanzania
	Entebbe ACC/FIC	Uganda
	Kigali ACC/FIC	Rwanda
	Kinshasa ACC/FIC	D.R. Congo
	Addis ACC/FIC	Ethiopia
RCCs	Juba FIC	South Sudan
	Nairobi RCC	Kenya
	Dar es Salaam RCC	Tanzania
	Entebbe RCC	Uganda
	Kigali RCC	Rwanda
BCCs	Ethiopia RCC	Ethiopia
	Nairobi BCC	Kenya
	Kinshasa BCC	D.R. Congo
Airlines Coordination	IATA	IATA Africa and Middle East
Regulation	Kenya CAA	Kenya
Participating Airline	Kenya Airways	Kenya
International and inter-regional Exercise coordination	ICAO ESAF Office	Kenya
	ICAO WACAF Office	Senegal
OPMET Databanks	RODB Pretoria	South Africa
	RODB Dakar	Senegal

ASECNA	ASECNA	Senegal
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Appendix B: Volcanic Ash Information Flow and Coordination Process

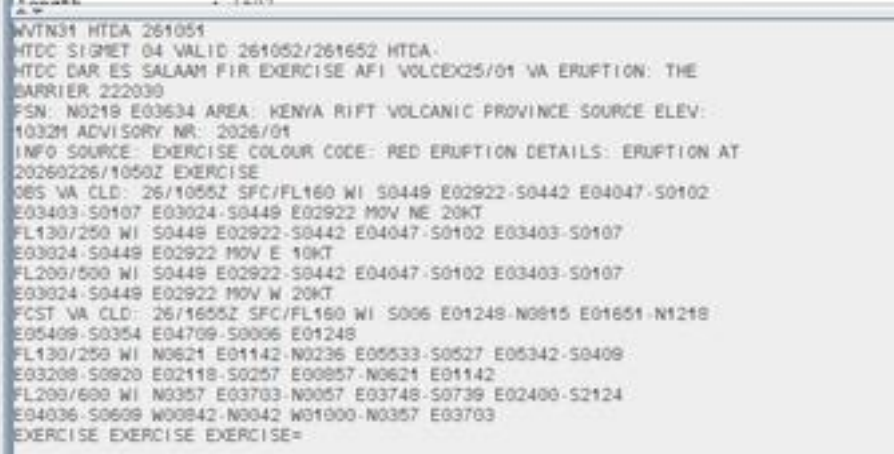
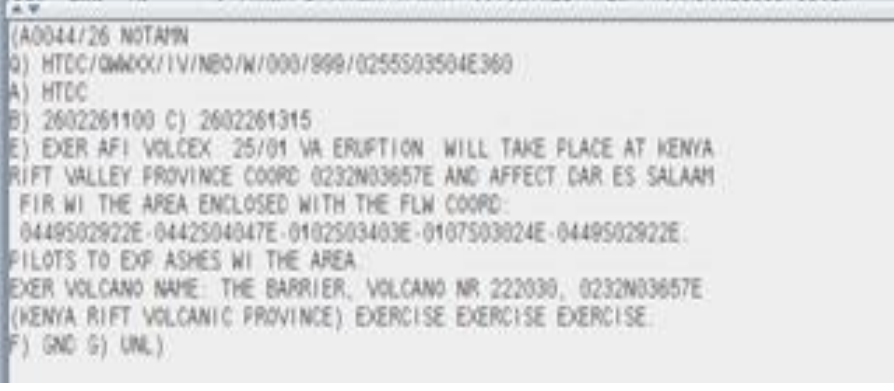


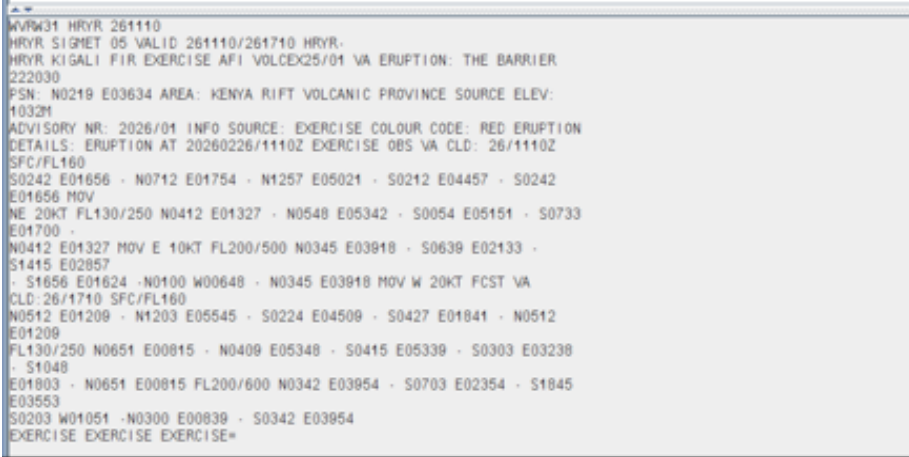
Appendix C: Exercise Message Log

MESSAGE/RESPONS IBLE UNIT/AERODROME	Product/Message	Remarks
1st VONA by Nairobi Volcano Observatory	1) VONA 2) STATUS: EXER 3) DTG: 20260226/0930Z 4) Volcano: BARRIER 222030 5) PSN: N0219 E03634 6) AREA: KENYA RIFT PROVINCE 7) SOURCE ELEV: 3386FT AMSL 8) NOTICE NR: 2026/1 9) CURRENT RED COLOUR CODE: 10)PREVIOUS Yellow COLOUR CODE: 11)SVO: NAIROBI VOLCANO OBSERVATORY 12)ACT STS: ERUPTION ONGOING SINCE 0900Z 13)ONSET: 20260226/0900Z 14)DUR: ONGOING EPISODIC 15)VA CLD HGT: 37000FT AMSL 16)HGT SOURCE: GND OBSERVER 17)MOV: NE 18)CTC: NAIROBI VOLCANO OBSERVATORY TEL +254 721 371975 E-mail: kenya-svo@uonbi.ac.ke https://volcanoobservatory.uonbi.ac.ke/ 19)RMK: NIL 20)NXT NOTICE: 20260226/1530Z EXERCISE EXERCISE EXERCISE	Transmitted via email

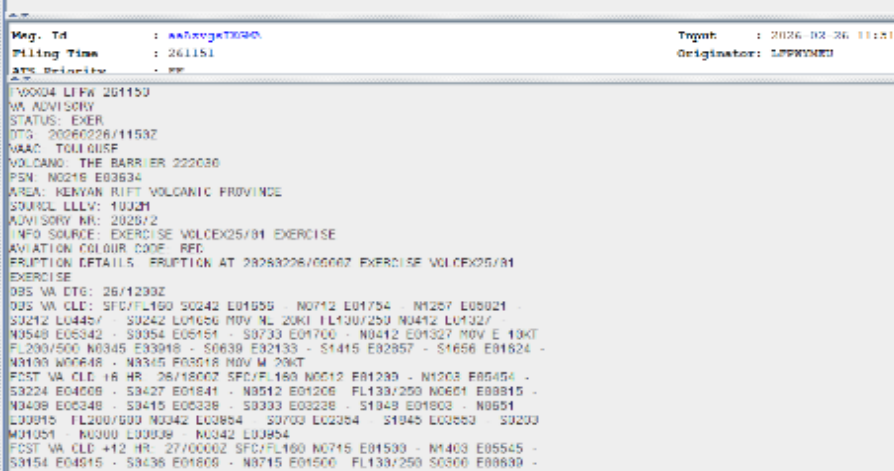
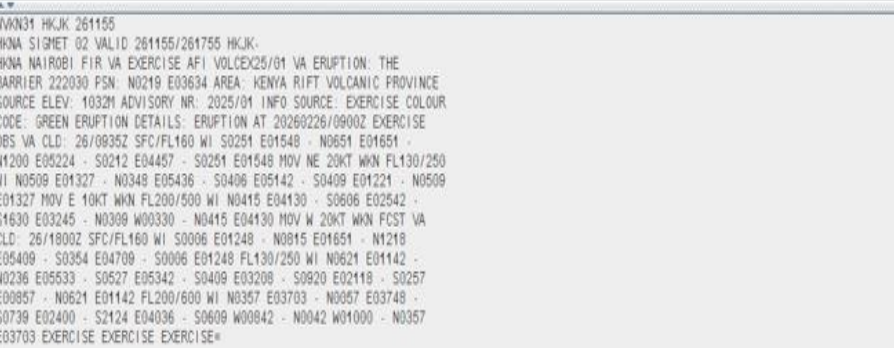
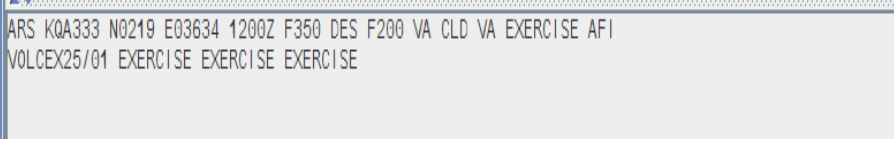
1st VAA/VAG from VAAC Toulouse	Msg. Id : aa3WSAs1XKRR Filing Time : 260945 ATS_Priority : FF Input : 2026-02-26 09:45:46.016 Originator : LFPWTMEU FX0004 LFPW 260945 VA ADVISORY STATUS: EXER DTG: 20260226/0945Z VAAC: TOULOUSE VOLCANO: THE BARRIER 222030 PSN: N0219 E03634 AREA: KENYAN RIFT VOLCANIC PROVINCE SOURCE ELEV: 1032M ADVISORY NR: 2026/1 INFO SOURCE: EXERCISE VOLCEX25/01 EXERCISE AVIATION COLOUR CODE: RED ERUPTION DETAILS: ERUPTION AT 20260226/0900Z EXERCISE VOLCEX25/01 EXERCISE OBS VA DTG: 26/0900Z OBS VA CLD: SFC/FL160 S0242 E01656 - N0712 E01754 - N1257 E05021 - S0212 E04457 - S0242 E01656 MOV NE 20KT FL130/250 N0412 E01327 - N0548 E05342 - S0054 E05151 - S0733 E01700 - N0412 E01327 MOV E 10KT FL200/500 N0345 E03918 - S0639 E02133 - S1415 E02857 - S1656 E01624 - N0100 W00648 - N0345 E03918 MOV W 20KT FCST VA CLD +6 HR: 26/1500Z SFC/FL160 N0512 E01209 - N1203 E05454 - S0224 E04509 - S0427 E01841 - N0512 E01209 FL130/250 N0651 E00815 - N0409 E05348 - S0415 E05339 - S0303 E03238 - S1049 E01803 - N0651 E00815 FL200/600 N0342 E03954 - S0703 E02354 - S1845 E03553 - S0203 W01051 - N0300 E00839 - N0342 E03954 FCST VA CLD +12 HR: 26/2100Z SFC/FL160 N0715 E01500 - N1403 E05545 - S0154 E04915 - S0436 E01809 - N0715 E01500 FL130/250 S0300 E00609 - N0439 E01439 - N0609 E04939 - S0124 E06109 - S0849 E02136 - S0300 E00609 FL200/600 N0321 E03927 - S0703 E02354 - S2009 E03921 - S0451	Transmitted via AFTN/AMHS
1st SIGMET – MWO - HKJK	WV0301 HKJK 260945 HKNA SIGMET 01 VALID 260945/261545 HKJK HKNA NAIROBI FIR VA EXERCISE AFI VOLCEX25/01 VA ERUPTION: THE BARRIER 222030 PSN: N0219 E03634 AREA: KENYA RIFT VOLCANIC PROVINCE SOURCE ELEV: 1032M ADVISORY NR: 2025/01 INFO SOURCE: EXERCISE COLOUR CODE: RED ERUPTION DETAILS: ERUPTION AT 20260226/0900Z EXERCISE OBS VA CLD: 26/0935Z SFC/FL160 WI S0251 E01548 - N0651 E01651 - N1200 E05224 - S0212 E04457 - S0251 E01548 MOV NE 20KT INTSFY FL130/250 WI N0509 E01327 - N0348 E05436 - S0406 E05142 - S0409 E01221 - N0509 E01327 MOV E 10KT INTSFY FL200/500 WI N0415 E04130 - S0606 E02542 - S1630 E03245 - N0309 W00330 - N0415 E04130 MOV W 20KT INTSFY FCST VA CLD: 26/1545Z SFC/FL160 WI S0006 E01248 - N0815 E01651 - N1218 E05409 - S0354 E04709 - S0006 E01248 FL130/250 WI N0621 E01142 - N0236 E05533 - S0527 E05342 - S0409 E03208 - S0920 E02118 - S0257 E00857 - N0621 E01142 FL200/600 WI N0357 E03703 - N0057 E03748 - S0739 E02400 - S2124 E04036 - S0609 W00842 - N0042 W01000 - N0357 E03703 EXERCISE EXERCISE EXERCISE	Transmitted via AFTN/AMHS
1st NOTAM – NOF – HKJK	V0006/26 NOTAMN (I) HKNA/OMMO/1V/NBO/1W/000/099/0210N03634E999 (J) HKNA (J) 2602260900 C) 2602261530EST (J) EXERCISE VOLCEX25/01 VA ERUPTION AT THE BARRIER 222030 PSN: N0219 E03634 AREA: KENYA RIFT PROVINCE WITH COLOUR CODE: RED. ERUPTION DETAILS: ERUPTION AT 20260226/0900Z EXERCISE OBS VA CLD: 26/0935Z SFC/FL160 0251E01548 N0651E01651 N1200E05224 S0212E04457 S0251E01548 MOV NE 10KT FL130/250 N0509E01327 N0348E05436 S0406E05142 S0409E01221 N0509E01327 MOV E 10KT FL200/500 N0415E04130 S0606E02542 S1630E03245 N0309W00330 N0415E04130 MOV W 20KT FCST VA CLD: 26/1536Z SFC/FL160 S0006E01248 N0815E01651 N1218E05409 S0354E04709 S0006E01248 FL130/250 N0621E01142 N0236E05533 S0527E05342 S0409E03208 S0920E02118 S0257E00857 N0621E01142 FL200/600 N0357E03703 N0057E03748 S0739E02400 S2124E04036 S0609W00842 N0042W01000 N0357E03703 EXERCISE EXERCISE EXERCISE (END G) UNL	Transmitted via AMHS

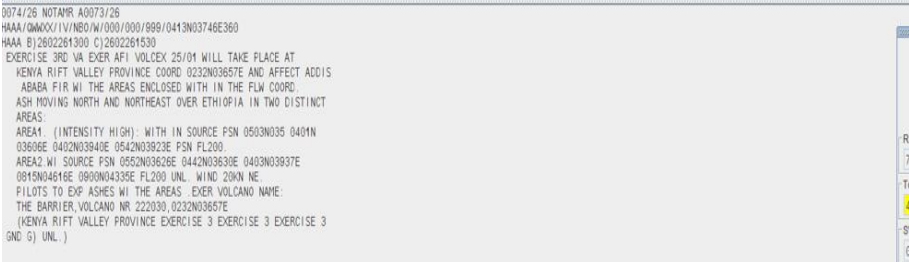
2nd SIGMET – MWO – HUEN	WVUG31 HUEN 261220Z HUEC SIGMET 02 VALID 261220/261820 HUEN- HUEC ENTEBBE FIR/UIR VA EXERCISE VOLCAFI 25/01 VA ERUPTION THE BARRIER LOC N0219 E03634 AREA KENYAN RIFT VOLCANIC PROVINCE VA CLD OBS AT 1210Z FL200/350 ROUND S0033 E02970 – S0143 E02955 – S0185 E03141 – S0008 E03038 – N0001 E02955 – S0003 E02970 MOV E 16KT WKN EXERCISE EXERCISE EXERCISE=	Sent via email
2nd NOTAM-NOF- HUEN	*** (V0001/26 NOTAMN Q) HUEC/QMWOX/IV/NBO/W/000/999/0219N03634E099 A) HUEC B) 2602260900 C) 2602261530EST E) EXERCISE VOLCEX25/01 VA ERUPTION AT THE BARRIER 222030 PSN: N0219 E03634 AREA KENYA RIFT PROVINCE WITH COULOR CODE RED. ERUPTION DETAILS: ERUPTION AT 20260226/0930Z EXERCISE OBS VA CLD: 26/0935Z SFC/FL160 S0251E01548 N0651E01651 N1200E05224 S0212E04457 S0251E01548 MOV NE 20KT FL130/250 N0508E01327 N0348E05436 S0406E05142 S0408E01221 N0508E01327 MOV E 10KT FL200/500 N0415E04130 S0606E02542 S1630E03245 N0309W00330 N0415E04130 MOV W 20KT FCST VA CLD: 26/1535Z SFC/FL160 S0606E01248 N0815E01851 N1218E05409 S0354E04709 S0006E01248 FL130/250 N0621E01142 N0236E05533 S0527E05342 S0408E03208 S0920E02118 S0257E00857 N0621E01142 FL200/600 N0357E03703 N0057E03748 S0738E02480 S2124E04036 S0609W00842 N0042W01000 N0357E03703 EXERCISE EXERCISE EXERCISE F) GND G) UNL)	Transmitted via AFTN/AMHS
3rd SIGMET - MWO - HAAB	Not received	Not received
3rd NOTAM-NOF- HAAB	*** (A0074/26 NOTAMR A0073/26 Q) HAAA/QMWOX/IV/NBO/W/000/000/999/0413N03746E360 A) HAAA B) 2602261300 C) 2602261530 E) EXERCISE 3RD VA EXER AFI VOLCEX 25/01 WILL TAKE PLACE AT KENYA RIFT VALLEY PROVINCE COORD 0232N03657E AND AFFECT ADDIS ABABA FIR WI THE AREAS ENCLOSED WITH IN THE FLW COORD. ASH MOVING NORTH AND NORTHEAST OVER ETHIOPIA IN TWO DISTINCT AREAS: AREA1. (INTENSITY HIGH): WITH IN SOURCE PSN 0503N035 0401N 03606E 0402N03940E 0542N03923E PSN FL200. AREA2 WI SOURCE PSN 0552N03626E 0442N03630E 0403N03937E 0815N04616E 0900N04335E FL200 UNL. WIND 20KN NE. PILOTS TO EXP ASHES WI THE AREAS. EXER VOLCANO NAME: THE BARRIER VOLCANO NR 222030, 0232N03657E (KENYA RIFT VALLEY PROVINCE EXERCISE 3 EXERCISE 3 EXERCISE 3 F) GND G) UNL.)	Transmitted via AFTN

4th SIGMET- MWO-HTDA	 WVTN31 HTDA 261051 HTDC SIGMET 04 VALID 261052/261652 HTDA: HTDC DAR ES SALAAM FIR EXERCISE AFI VOLCEX25/01 VA ERUPTION: THE BARRIER 222030 FSN: N0219 E03634 AREA: KENYA RIFT VOLCANIC PROVINCE SOURCE ELEV: 1032M ADVISORY NR: 2026/01 INFO SOURCE: EXERCISE COLOUR CODE: RED ERUPTION DETAILS: ERUPTION AT 20260226/1050Z EXERCISE OBS VA CLD: 26/1055Z SFC/FL160 WI S0449 E02922-S0442 E04047-S0102 E03403-S0107 E03024-S0449 E02922 MOV NE 20KT FL130/250 WI S0449 E02922-S0442 E04047-S0102 E03403-S0107 E03024-S0449 E02922 MOV E 10KT FL200/500 WI S0449 E02922-S0442 E04047-S0102 E03403-S0107 E03024-S0449 E02922 MOV W 20KT FCST VA CLD: 26/1655Z SFC/FL160 WI S006 E01248-N0615 E01651-N1218 E05409-S0354 E04709-S0066 E01248 FL130/250 WI N0621 E01142-N0236 E05533-S0527 E05342-S0409 E03208-S0920 E02118-S0257 E00857-N0621 E01142 FL200/600 WI N0357 E03703-N0057 E03748-S0739 E02400-S2124 E04036-S0609 W00842-N0042 W01000-N0357 E03703 EXERCISE EXERCISE EXERCISE=	Transmitted via AFTN
4th NOTAM-NOF- HTDA	 (A0044/26 NOTAMN Q) HTDC/QMNOX/IV/NBO/W/000/899/0255S03504E360 A) HTDC B) 2602261100 C) 2602261315 E) EXER AFI VOLCEX 25/01 VA ERUPTION WILL TAKE PLACE AT KENYA RIFT VALLEY PROVINCE COORD 0232N03657E AND AFFECT DAR ES SALAAM FIR WI THE AREA ENCLOSED WITH THE FLW COORD: 0449S02922E-0442S04047E-0102S03403E-0107S038024E-0449S02922E: PILOTS TO EXP ASHES WI THE AREA EXER VOLCANO NAME: THE BARRIER, VOLCANO NR 222030, 0232N03657E (KENYA RIFT VOLCANIC PROVINCE) EXERCISE EXERCISE EXERCISE F) GND G) UNL)	Transmitted via AFTN

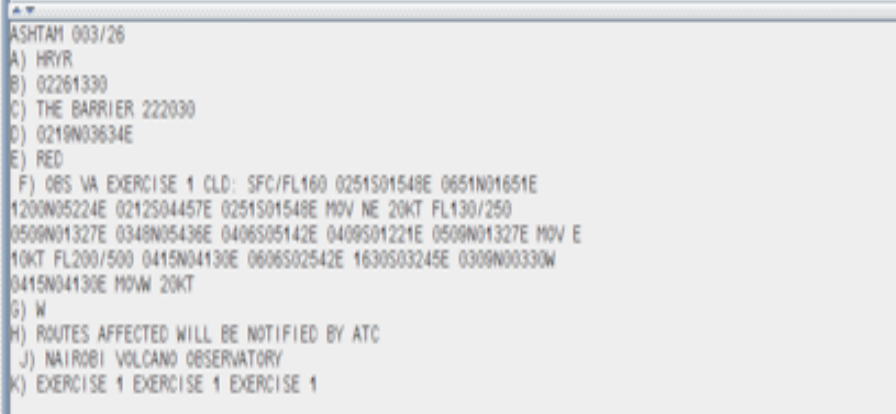
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5th ASHTAM - NOF - HRYR	Not received	Not received
6th SIGMET – MWO - FZAA	Not received	Not received
6th NOTAM – NOF - FZAA	Not received	Not received

2nd VONA by Nairobi Volcano Observatory	1) VONA 2) STATUS: EXER 3) DTG: 20260226/1150Z 4) Volcano: BARRIER 222030 5) PSN: N0219 E03634 6) AREA: KENYA RIFT PROVINCE 7) SOURCE ELEV: 3386FT AMSL 8) NOTICE NR: 2026/2 9) CURRENT COLOUR CODE: RED 10) PREVIOUS COLOUR CODE: RED 11) SVO: NAIROBI VOLCANO OBSERVATORY 12) ACT STS: ERUPTION ONGOING SINCE 0900Z 13) ONSET: 20260226/0900Z 14) DUR: 2 HR 50 MIN 15) VA CLD HGT: 37000FT AMSL 16) HGT SOURCE: GND OBSERVER 17) MOV: NE 18) CTC: NAIROBI VOLCANO OBSERVATORY TEL +254 721 371975 E-mail: kenya-svo@uonbi.ac.ke https://volcanoobservatory.uonbi.ac.ke/ 19) RMK: NIL 20) NXT NOTICE: 20260226/1750Z EXERCISE EXERCISE EXERCISE	Transmitted via email
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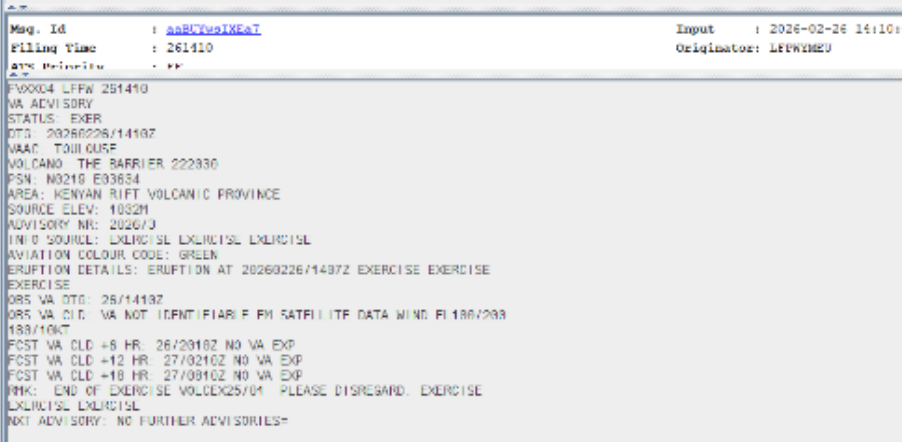
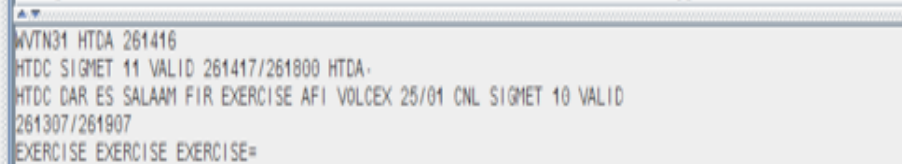
2nd VAA/VAG from VAAC Toulouse		Transmitted via AFTN/AMHS
7th SIGMET- MWO-HKJK		Transmitted via AFTN/AMHS
7th NOTAM-NOF- HKJK		Transmitted via AFTN/AMHS
2nd Special Air Report sent from Nairobi MWO to VAAC		Transmitted via AFTN/AMHS

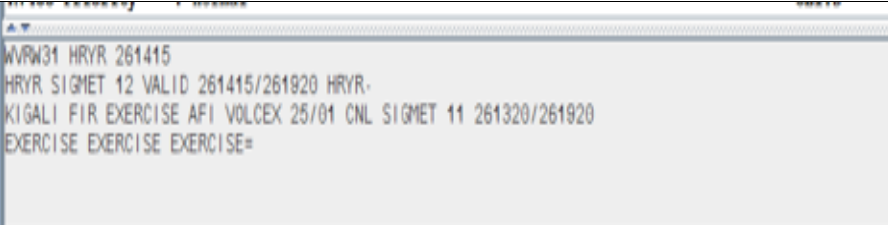
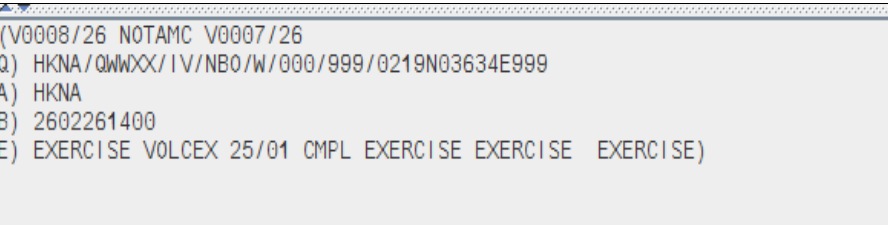
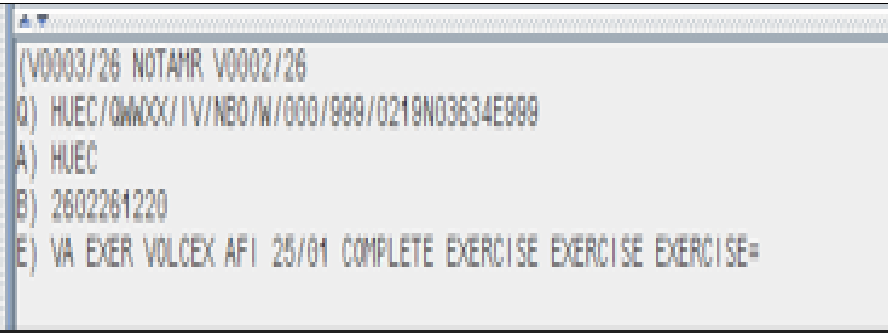
Toulouse and the RODBs.		
8th SIGMET from Entebbe MWO	Not received	
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9th SIGMET – MWO - HAAB	Not received	Not received
9th NOTAM-NOF-HAAB	 0074/26 NOTAMR A0073/26 HAAA/QMXX/IV/NB0/W/000/999/0413N03746E360 HAAA B)2602261300 C)2602261530 EXERCISE 3RD VA EXER AFI VOLCEX 25/01 WILL TAKE PLACE AT KENYA RIFT VALLEY PROVINCE COORD 0232N03657E AND AFFECT ADDIS ABABA FIR W/ THE AREAS ENCLOSED WITH IN THE FLW COORD. ASH MOVING NORTH AND NORTHEAST OVER ETHIOPIA IN TWO DISTINCT AREAS: AREA1. (INTENSITY HIGH): WITH IN SOURCE PSN 0503N035 0401N 03606E 0402N03640E 0542N03623E PSN FL200 AREA2 W/ SOURCE PSN 0552N03626E 0442N03633E 0403N03937E 0815N04516E 0800N0433E FL200 UNL WIND 20KN NE PILOTS TO EXP ASHES W/ THE AREAS EXER VOLCANO NAME: THE BARRIER VOLCANO NR 222030,0232N03657E (KENYA RIFT VALLEY PROVINCE EXERCISE 3 EXERCISE 3 EXERCISE 3 END G) UNL.)	Transmitted via AFTN

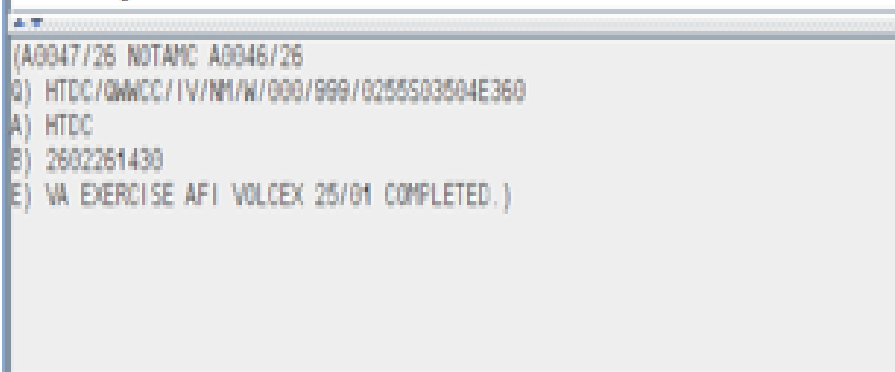
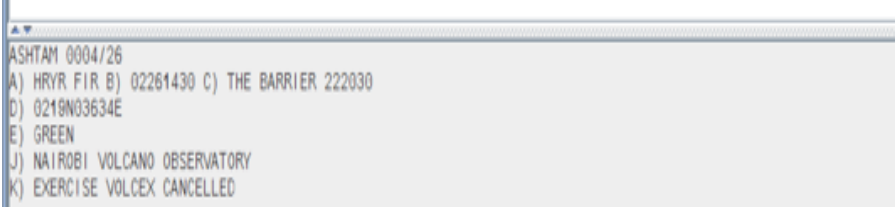
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CANCELLATION NOTAM – NOF – HRYR		Transmitted via AMHS
UNKOWN ADDRESSES RESULTING TO NON-ROUTING		Updated AMBEX handbook (AODEX) necessary

Attachment 1: Kenya ANSP Safety Assessment

Attachment 2: Kenya Airways Safety Assessment (Bowtie)



SAFETY RISK ASSESSMENT REPORT ON VOLCEX 2025

FEBRUARY 2026

Kenya Civil Aviation Authority
P.O. Box 30163 - 00100, Nairobi Kenya.
E-mail: info@kcaa.or.ke • Website: www.kcaa.or.ke

Executive Summary

This safety assessment sought to examine, evaluate and analyse the safety impact of the VOLCEX (Volcanic Ash Contingency Exercises) 2025 on ATS operations aimed at complying with the International Civil Aviation organization (ICAO) safety management standards and recommended practices as outlined in Annexes 11 and 19 relating to safety assessments and as domesticated in the Kenya Civil Aviation Regulations, namely The Civil Aviation (Air Traffic Services) Regulations, as amended and The Civil Aviation (Safety Management) Regulations, as amended.

This assessment exercise revealed four (4) specific hazards and other safety related issues. In terms of generic classification, two (2) hazards are organizationally related hazards, one (1) is technically related while one (1) is a human related hazard. During the analysis, the inherent safety risks of the consequences of the five (5) hazards were assessed as “acceptable based on risk mitigation” if the VOLCEX 2025 was to be carried out.

However, at post-implementation of the mitigations, should the: a) the additional actions suggested herein be implemented as stipulated, the residual safety risks of the consequences of three (3) hazards would be within the tolerable region while one (1) hazard would be in the acceptable region.

Distribution Table

Organization	Department
KCAA	Director, ANS
KCAA	Deputy Director, ANS/MET
KCAA	Deputy Director, ATM
KCAA	Deputy Director, ES
KCAA	Deputy Director, AIM
KCAA	Assistant Director, ATM OPS (ACC)
KCAA	Assistant Director, ANS-SMS

Change History

Version	Date	Reason for Change	Pages Affected
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3.0			
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Status	Name	Date	Signature
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Reviewed:	Collins Ochillo	24 th February 2026	
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Acknowledgement

I wish to formally acknowledge and commend your participation in this safety assessment exercise. Your commitment to upholding the principles of safety and professionalism is deeply appreciated and reflects the high standards we strive to maintain within our operational environment.

Your invaluable contributions – through thoughtful observations, constructive feedback, and collaborative engagement – have been instrumental in enhancing our safety protocols, ensuring compliance with regulatory expectations and also enabled the completion of VOLCEX 2025 safety risk assessment and mitigation exercise.

Sincere gratitude goes to the following colleagues:

VOLCEX 2025		
	NAME	DESIGNATION
1	Nathan Kipruto	PATMO-ACC
2	Maureen Isika	PATMO/SMSC-JKIA
3	Samuel Akoolo	SAIMO-ACC/SAG member
4	Samuel Muraguri	PATMO-ACC
5	Simon Kimaiyo	PATMO- ACC
6	Eric Kirimi	PATMO APP/SAG Member
7	Esther Nyaga	PATMO APP /SAG Member
8	Faith Titany	ATMO II
9	James Singoei	PAIMO

Table of Contents

Table of Contents	5
Abbreviations and Definitions	6
Codes and Abbreviations.....	6
Definitions of Terms	7
1 Introduction	8
1.1 Purpose and Scope.....	9
1.2 Safety Assumptions	11
2 Methodology.....	12
3 Findings of the Safety Assessments	13
3.1 System Description.....	13
3.2 Hazard Identification Process	14
3.2.1 Classification of Hazards: Generic and Specific	14
3.2.2 Safety Risk Assessment of the Consequence(s) of the Specific Component (s) of the Generic Hazards	16
3.3 Safety Recommendations	20
4 Conclusion	21
5 References	22
6 Appendices	24
6.1 Appendix I Safety Risk Management Process.....	24
6.2 Appendix II ICAO 5 by 5 Safety Risk Assessment Matrix	24

Abbreviations and Definitions

Codes and Abbreviations

ACC	Area Control Centre
ADANSSMSC	Assistant Director Air Navigation Services SMS Coordinator
AFI	Africa and India Ocean
AIP	Aeronautical Information Publication
AIREP	Aircraft Reports
AIM	Aeronautical Information Management
ALARP	As Low As Reasonably Practicable
ANS	Air Navigation Services
ANSP	Air Navigation Service Provider
APP	Approach
ATC	Air Traffic Control
ATMO	Air Traffic Management Officer
ATS	Air Traffic Services
CICTT	Commercial Aviation Safety Team ICAO Common Taxonomy Team
DANS	Director Air Navigation Services
DDAIM	Deputy Director Aeronautical Information Management
DDATM	Deputy Director Air Traffic Management
ECAST	European Commercial Aviation Safety Team
DATIS	Digital Automatic Terminal Information Service
FIR	Flight Information Region
HIRM	Hazards Identification and Risk Mitigation
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
KCAA	Kenya Civil Aviation Authority
LOA	Letters Of Agreement
LOC-I	Loss Of Control In flight
MAC	Mid-Air Collision
MET	Meteorology
NOTAM	Notice To Airmen
PANS-ATM	Procedures for Air Navigation Services Air Traffic Management
PAIMO	Principal Aeronautical Information Management Officer
PATMO	Principal Air Traffic Management Officer
SAG	Safety Action Group
SAIMO	Senior Aeronautical Information Management Officer

SCF-PP	System Control Function- Power Plant
SM-ICG	Safety Management International Collaboration Group
SMS	Safety Management System
SMSC	Safety Management Systems Coordinator
SOP	Standard Operating Procedures
SSP	State Safety Program
TMA	Terminal Control Area
UTC	Universal Time Coordinated
VOLCEX	Volcanic Ash Exercises
WG	Workgroup

Definitions of Terms

Hazard	A condition or an object with the potential to cause or contribute to an aircraft incident or accident.
Inherent risk	Risk associated to the worst foreseeable (or credible) situation subject to analysis
Operational Requirements	These include procedures that must be followed for the operations defined for the application to be properly executed, or functional requirements on what information (and how it) should be presented to the controller.
Residual risk	Risk that takes into account the effect of the safety actions that could be implemented to improve system's safety performance by bringing down risk to an acceptable level.
Safety Assumptions	These include main characteristics about the environment or procedure in which the application is specified to operate.
Safety Recommendations	These include procedures that could be implemented by the operator.

1 Introduction

Volcanic ash presents one of the most serious natural hazards to aviation, with the potential to disrupt operations, damage aircraft systems, and compromise passenger safety. Exercises such as VOLCEX 2025 are therefore indispensable in strengthening aviation resilience and preparedness. These exercises serve multiple strategic purposes such as Safety Assurance, operational continuity, enhanced coordination.

Ultimately, volcanic ash exercises are strategic investments in aviation safety, operational resilience, and international collaboration. They demonstrate Kenya's and the region's commitment to aligning with ICAO standards while safeguarding the integrity of air transport.

VOLCEX are invaluable for testing aviation preparedness, but they can unintentionally create hazards which can affect the safety of operations. This report aims to assess the safety implications of the VOLCEX 2025 focusing on the potential risks and mitigation strategies necessary to ensure continued safety and efficiency in air traffic management.

The primary objective of this safety assessment is to evaluate the impact of Volcanic exercise on various stakeholders, including air traffic controllers, pilots and flight operations. By identifying potential hazards and analysing their consequences, this report seeks to provide a comprehensive overview of the safety measures required to maintain high standards of aviation safety. The management of safety risks associated with change is a critical requirement of the SSP/SMS framework.

Any significant safety-related change to the Air Traffic Services (ATS) system can create hazards which have the potential to affect the safety of operations. While these changes may need to be made, focus should be on implementing them without affecting safety performance. Safety management practices require that hazards resulting from change be systematically identified, and strategies to manage the consequential safety risks be developed, implemented and subsequently evaluated. Only then should these changes be effected after a systematic safety assessment has demonstrated that an acceptable level of safety will be met, and users have been consulted. When appropriate, the responsible

authority shall ensure that adequate provision is made for post-implementation monitoring to verify that the defined level of safety continues to be met.

An ATS Safety Management Systems (SMS) shall include safety assessments in respect of, but not limited to the proposals for significant airspace reorganizations, for significant changes in the provision of ATS procedures applicable to an airspace or an aerodrome, and for the introduction of new equipment, systems or facilities, such as: a) a reduced separation minimum to be applied within an airspace or at an aerodrome; b) a new operating procedure, including departure and arrival procedures, to be applied within an airspace or at an aerodrome; c) a reorganization of the ATS route structure; d) a re-sectorisation of an airspace; e) physical changes to the layout of runways and/or taxiways at an aerodrome; and, f) implementation of new communications, surveillance or other safety-significant systems and equipment, including those providing new functionality and/or capabilities.

1.1 Purpose and Scope

The primary purpose of a VOLCEX safety assessment is to demonstrate that aviation operations can be conducted safely during a volcanic ash event whether simulated or real by systematically identifying, evaluating and mitigating associated risks.

ICAO's DOC 9766 -Handbook on the International Airways Volcano Watch explicitly supports and calls for volcanic ash exercises (VOLCEX). It provides guidance for conducting the exercises and encourages regular regional exercises to test coordination, information flow

and end-to-end readiness. DOC 9974- Flight safety and Volcanic ash provides the safety risk management philosophy exercised during VOLCEX.

In volcanic ash exercises, Air Navigation Services Providers are however required to ensure compliance with the International Civil Aviation organization (ICAO) safety management standards and recommended practices as outlined in Annexes 11 and 19 relating to safety assessments and as domesticated in the Kenya Civil Aviation Regulations, namely The Civil Aviation (Air Traffic Services) Regulations, as amended and The Civil Aviation (Safety Management) Regulations, as amended.

The Regulator requires the ANSP to carry out safety assessment considering all relevant factors determined to be safety-significant, including: a) Types of aircraft and their performance characteristics, including aircraft navigation capabilities and navigation performance; b) Traffic density and distribution; c) Airspace complexity, ATS route structure and classification of the airspace; d) Aerodrome layout, including runway configurations, runway lengths and taxiway configurations; e) Type of air-ground communications and time parameters for communication dialogues, including controller intervention capability; f) Type and capabilities of surveillance system, and the availability of systems providing controller support and alert functions; and, g) Any significant local or regional weather phenomena.

This purpose of this assessment was assessing safety risks related to the VOLCEX to ensure the continuity of safe operations. The team further suggested measures that need to be developed and implemented to mitigate identified risks to acceptable levels. This will ensure that the VOLCEX does not compromise the safety of air traffic operations.

The scope of the safety assessment includes; assessing the operational impact of the VOLCEX to ATCOS and flight safety, identifying hazards and recommending mitigation strategies.

The ANS team sought to analyse and evaluate the safety consequences of the VOLCEX through the application of safety risk management process shown in Appendix I.

1.2 Safety Assumptions

- 1 There will be no operational impact on live operations.
- 2 Information flow is reliable and timely
- 3 Cross-border coordination works as designed.
- 4 ATM, AIS, MET and communication systems are assumed to be operational, reliable and capable of supporting message flow.
- 5 All messages (voice, NOTAM, AIREP etc) are clearly marked with 'EXERCISE'
- 6 Stakeholders are informed (ATCOs and airlines)
- 7 Participants are competent and briefed on exercise objectives

2 Methodology

The safety assessment considered safety-significant factors such as: a) traffic density; b) current procedures including inter-ATS unit coordination procedures and processes; c) airspace complexity, ATS route structure and classification of the airspace; d) reliability of the of ground-air communications including controller intervention capability.

Brainstorming sessions were organized and conducted consisting of ANS staff from various departments which included Air Traffic Controllers currently working at the ACC to identify potential hazards of this exercise.

Guided by the Risk Management Process shown in Appendix I, hazards expected to occur during the process of the volcanic ash exercise as well as the foreseeable hazards which may emerge during the exercise identified. An objective qualitative analysis technique was applied on these identified hazards or safety-related issues to evaluate their severities (of the most credible outcomes) as well as probabilities of the safety risks of their consequences.

Acceptability of both inherent and residual risks was then assessed using safety risk tolerability matrix shown in Appendix II.

To guarantee completeness of the assessment exercise, a systematic approach was adopted by performing the following four (4) tasks:

- 1) Systems description
- 2) Hazard identification process
- 3) Safety risk assessment process
- 4) Safety risk control/mitigation process

3 Findings of the Safety Assessments

3.1 System Description

A simulated volcanic eruption of The Barrier Volcano situated at the Southern end of Lake Turkana, Turkana County in the Rift Valley will erupt and produce volcanic ash with a plume reaching and affecting FL600 being transported in a North Easterly direction at 20KT between the SFC and F160, Easterly direction at 10KT between F130 and F250, and in a westerly direction a wind of 20 Kts to affect air traffic services (ATS) routes between the surface and F600 from 0900 UTC to 1500 UTC on 26 February 2026. The Barrier will begin as an active shield volcano but develop into a larger multi-vent volcanic complex over time.

The simulated eruption will directly have a significant impact on ATS routes and airspace over the following FIRs/States; Nairobi FIR, HKNA (Kenya), Entebbe FIR, HUEC (Uganda), Kigali FIR, HRYR (Rwanda), Dar Es Salaam FIR, HTDC (Tanzania), Khartoum FIR, HSSS (South Sudan), Addis Ababa FIR, HAAA (Ethiopia) and Kinshasa FIR, FZAA (DR Congo).

KCAA ANS has a robust safety culture through which will identify and address potential hazards and carry out safety assessments to identify and mitigate any potential risks associated with operations.

3.2 Hazard Identification Process

3.2.1 Classification of Hazards: Generic and Specific

The assessment revealed four (04) specific hazards and other safety related issues as shown in Table 1. Regarding the generic classification of the identified hazard- one (1) is a technical related hazard, one (1) as human related and two (2) as organization related.

No.	Specific Hazards Description	Generic Classification	Unsafe Event	Credible Outcomes/ Consequences of the Identified Hazards
01	ATC workload management during VOLCEX	HUMAN. Cognitive	Loss of situational awareness during VOLCEX	MAC
02A	Volcanic ash presence in airspace	TECH. Aircraft	Aircraft operation in ash-contaminated airspace	LOC-I

02B	Volcanic ash presence in airspace	TECH. Aircraft	Engine ingestion of volcanic ash	SCF-PP
03	VOLCEX communication	ORG. Operational policies/procedures	VOLCEX communication breakdown (lack/misinterpretation)	MAC
04	Special use airspace management during VOLCEX	ORG. Operational policies/procedures	Infringement of special use airspaces during VOLCEX	MAC

Table 1: List of the identified hazards, generic classification, associated unsafe events and credible outcome

3.2.2 Safety Risk Assessment of the Consequence(s) of the Specific Component (s) of the Generic Hazards

3.2.2.1 Assessment of the Safety Risks of the Consequences of the Hazards

To determine the safety risks of the consequences of the four (4) hazards, qualitative ICAO 5 by 5 risk assessment matrix shown in Appendix II was used. Existing defences were considered, where available. The results of assessment are summarised as follows as depicted in Table II:

3.2.2.1.1 Inherent Safety Risks of the Consequences of the Hazards.

VOLCEX 2025

Inherent safety risks of the four (5) hazards (i.e. 1-4) were assessed as tolerable i.e. "acceptable based on risk mitigation". This implies that the ANSP should closely monitor and adhere to the implementation of the existing defences/controls and additional mitigations recommended herein.

3.2.2.1.2 Residual Safety Risks of the Consequences of the Hazards.

This analysis was based on an "objective" subjective assessment though the values will have to be verified against the actual outcome after the implementation of the suggested safety requirements. These mitigations that have been suggested herein when considered and implemented would be able to lower the safety risks of the consequences of the identified hazards to a level as low as reasonably practicable (ALARP).

VOLCEX 2025

At post-implementation stage of all the mitigations, the analyses revealed that:

- a) the residual safety risks of the consequences of three (3) tolerable hazards (i.e., no. 02-04) would remain in the tolerable region (yellow) and
- b) one (1) tolerable hazard (no. 1) would be in the acceptable region (green).

No.	Specific Description	Hazards	Inherent Risks	Mitigations	Responsible Office	Residual Risks
01	ATC management during VOLCEX	workload during	2C	Existing Mitigation 1. Provision of additional personnel 2. Sensitization of ATCOs on requirements during VOLCEX 2025 Additional Mitigation. 1. Additional sensitization to particular shift to be involved in VOLCEX 2025 2. Scheduled AFI stakeholders' sensitization before the VOLCEX	1. DDATM 2. KENYA-lead state	2D
02 A	Volcanic ash presence in airspace (unsafe event: Aircraft operation in ash-contaminated airspace)		3C	Existing Mitigation 1. Activation of the Volcanic Ash contingency plan Additional Mitigation 1. Industry sensitization on volcanic activity response	1. KCAA	2C

02 B	Volcanic ash presence in airspace (unsafe event: Engine ingestion of volcanic ash)	4C	Existing Mitigation 1. Activation of the Volcanic Ash contingency plan Additional Mitigation 1. Industry sensitization on volcanic activity response	1. KCAA	2B
03	VOLCEX communication	4C	Existing Mitigations 1. Mandatory prefix 'EXERCISE' to all communication 2. Pre-exercise stakeholders' sensitizations Additional Mitigations 1. Broadcast of VOLCEX message on D-ATIS 2. Post-mock exercise review 3. Additional personnel in ACC (safety/monitoring ATCO)	1. DDATM 2. Kenya-Lead state 3. DDATM	3D
			Existing Mitigations		

04	Special use airspace management during VOLCEX	3B	1. Civil/military coordination procedures 2. Pre-exercise stakeholders' sensitizations 3. Radar coverage for monitoring Additional Mitigations 1. Broadcast of VOLCEX message on D-ATIS 2. Post-mock exercise review 3. Additional personnel in ACC (safety/monitoring ATCO)	1. D.DATM 2. Kenya-Lead state 3. D.DATM	2B
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Table 2: List of the identified hazards and their Recommended Mitigations and Safety Management Guidelines/Procedures

3.3 Safety Recommendations

To this end, the team recommended the following:

- Additional sensitization to particular shift to be involved in VOLCEX 2025
- AFI stakeholder's sensitization before the VOLCEX
- Industry sensitization on volcanic activity response
- Broadcast of VOLCEX message on D-ATIS
- Post-mock exercise review
- Additional personnel in ACC (safety/monitoring ATCO)
- Prior VOLCEX NOTAM promulgation

4 Conclusion

In total, this assessment exercise revealed four (4) specific hazards and other safety related issues. In terms of generic classification, two (2) hazards were organizational related, one (1) hazard is technical related and one (1) hazard is human related. During the analysis, the inherent safety risks of the consequences of the hazard was assessed as tolerable i.e. "acceptable based on risk mitigation" if the VOLCEX is to be carried out.

However, at post-implementation of the mitigations with additional actions, the residual safety risks of the consequences of one hazard would be in the acceptable region while three (3) hazards would remain the tolerable region.

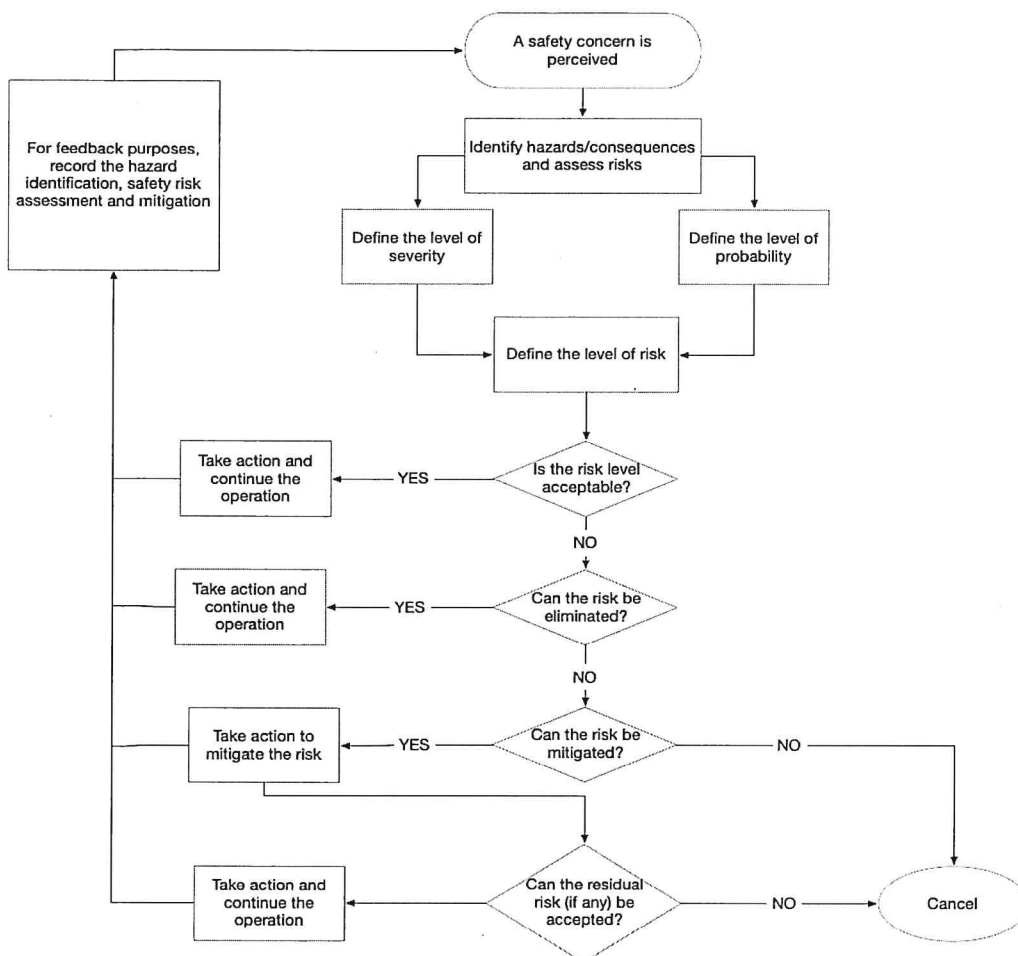
5 References

Reference, Title	Author, Identifier	Date
Annex 2 Rules of the Air	ICAO	Tenth Edition July, 2005
Annex 11 Air Traffic Services, Fourteenth Edition	ICAO	July, 2016
Annex 19 Safety Management	ICAO	July, 2016
ICAO Doc 4444 Procedures for Air Navigation Services Air Traffic Management (PANS – ATM), Sixteenth Edition.	ICAO	2016
ICAO Doc 7474 AFI Air Navigation Plan	ICAO	2006
ICAO Doc 8168 Procedures for Air Navigation Services Aircraft Operations Volume I Flight Procedures, Fifth edition	ICAO	2006
ICAO Doc 9691 Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds	ICAO	Second Edition — 2007
ICAO Doc 9766 Handbook on International Airways Volcano Watch	ICAO	Fourth Edition, Sept 2024
ICAO DOC 9974 Volcanic Ash and Flight Safety	ICAO	First Edition, 2012
ICAO Doc 9859 Safety Management Manual	ICAO	2018
AFI Volcanic Ash Contingency Plan	ICAO	First Edition, September 2021
CICTT Aviation Occurrence Category	CAST/ICAO	October, 2011
CICTT Hazard Taxonomy	CAST/ICAO	March, 2014
ECAST SMS WG - Guidance on Hazard Identification	Ilias Maragakis, EASA <i>et al</i>	March, 2009
SM-ICG Development of Common Taxonomy for Hazards		April, 2010
The Civil Aviation Act (No. 21 Of 2013), Revised Edition (2014)	Kenya Government	2014
The Civil Aviation (Air Traffic Services) Regulations	Kenya Government	2018
The Civil Aviation (Safety Management) Regulations	Kenya Government	2018

Safety Assessment Report on VOLCEX 2025

6 Appendices

6.1 Appendix I Safety Risk Management Process



6.2 Appendix II ICAO 5 by 5 Safety Risk Assessment Matrix

Safety Risk Probability

<i>Severity</i>	<i>Meaning</i>	<i>Value</i>
Frequent	Likely to occur many times (has occurred frequently)	5
Occasional	Likely to occur sometimes (has occurred infrequently)	4
Remote	Unlikely to occur, but possible (has occurred rarely)	3
Improbable	Very unlikely to occur (not known to have occurred)	2
Extremely improbable	Almost inconceivable that the event will occur	1

Safety Risk Severity

Severity	Meaning	Value
Catastrophic	— Equipment destroyed — Multiple deaths	A
Hazardous	— A large reduction in safety margins, physical distress or a workload such that the operators cannot be relied upon to perform their tasks accurately or completely — Serious injury — Major equipment damage	B
Major	— A significant reduction in safety margins, a reduction in the ability of the operators to cope with adverse operating conditions as a result of an increase in workload or as a result of conditions impairing their efficiency — Serious incident — Injury to persons	C
Minor	— Nuisance — Operating limitations — Use of emergency procedures — Minor incident	D
Negligible	— Few consequences	E

Safety Risk Tolerability

Risk Probability		Risk Severity				
		Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent	5	5A	5B	5C		
Occasional	4	4A	4B			
Remote	3	3A				3E
Improbable	2				2D	2E
Extremely Improbable	1		1B	1C	1D	1E

Interpretation

Tolerability description	Assessed risk index	Suggested criteria
Intolerable region	5A 5B 5C 4A 4B 3A	Unacceptable under the existing circumstances
Tolerable region		Acceptable based on risk mitigation. It may require management decision.
Acceptable region	3E 2D 2E 1B 1C 1D 1E	Acceptable

VOLCANIC ASH RISK BOWTIE - ICAO DOC 9974 APPENDIX 4 FORMAT

Kenya Airways | Ref: KQ/AOC/4/CSMF/002/S1/CLASS2 | ICAO Doc 9691, 9974, 9766

T- ID	THREAT (Events leading to Top Event)	THREAT BARRIER/CONTROL (Preventive)	ESCALATION FACTOR (What defeats barrier)	ESCALATION FACTOR CONTROL	EFFECTIVENESS	TOP EVENT (Central Hazard)	EFFECTIVENESS	ESCALATION FACTOR CONTROL	ESCALATION FACTOR (What defeats barrier)	CONSEQUENCE BARRIER/CONTROL (Mitigative)	CONSEQUENCE (Outcomes from Top Event)	C- ID
T1	Undetected/Unreported Volcanic Eruption Probability: Remote	PC-1A: State Volcano Observatory 24/7 seismic network monitoring with automated eruption alert	Seismograph network failure; observatory unstaffed overnight or during public holidays; single-duty officer model with no cover.	Significant AFI region seismic monitoring coverage gaps; no redundant detection pathway if observatory fails.	MEDIUM	AIRCRAFT ENCOUNTERS ACTIVE VOLCANIC ASH CLOUD IN FLIGHT	HIGH	No real-time ash concentration sensor on aircraft; crew reliant on visual cues and engine EGT/RPM changes which may lag actual ingestion event.	Multiple simultaneous engine flame-out before QRH execution; crew overwhelmed by concurrent warnings and alarms.	RB-1A: Engine ash ingestion detection with immediate QRH execution — thrust reduction, ash cloud exit, emergency declaration	Engine Damage/Multi-Engine Failure Severity: Catastrophic (5A)	C1
T2	Delayed or Inaccurate VAA Issued by VAAC Probability: Probable	PC-1B: VAAC Toulouse independent satellite surveillance of known AFI volcanic areas (Independent of VONA)	Cloud cover masking ash plume; satellite pass timing gaps over equatorial region; VAAC detection capability may not cover all AFI active volcanoes at all times.	VAAC detection is reactive rather than predictive; no automated ash plume detection algorithm in operational use across full AFI region.	HIGH		HIGH	Ash event may simultaneously affect multiple alternates; pre-flight ash boundary may not reflect post-departure rapid expansion.	All alternates within fuel range contaminated with ash; diversion airport runway closed for ash clearance at time of arrival.	RB-1B: Pre-planned diversion to nearest suitable ash-free airport with contingency fuel provision	Windscreen Abrasion - Reduced/Zero Visibility Severity: Hazardous (4B)	C2
T3	Failure to Issue VA SIGMET or Delayed Issuance Probability: Remote	PC-2: VAAC 24/7 duty roster with mandatory initial VAA within 6h of VONA receipt; update every 6h; immediate amendment on PIREP receipt	NWP model input error; PIREP not relayed to VAAC; satellite data latency during night passes over AFI region.	Single VAAC (Toulouse) responsible for entire AFI region; no cross-check mechanism between adjacent VAACs.	HIGH		HIGH	Many AFI aerodromes lack ash-specific runway friction assessment procedures; standard RCAM may not account for volcanic ash braking coefficient.	ILS unserviceable at destination or diversion airport; runway friction degraded to below landing minima by ash deposits.	RB-2: Instrument approach and landing using ILS/precision procedures only — regardless of forward visibility	Pitot-Static Contamination/Unreliable Airspeed Severity: Hazardous (4B)	C3
T4	NOTAM/ASHTAM Not Issued or Delayed Probability: Remote	PC-3: Nairobi MWO mandatory VA SIGMET issuance with Priority FF on receipt of VAA; include vertical extent, horizontal boundary, movement, and intensity	VAA not received by MWO due to AFTN/AMHS circuit failure; MWO duty forecaster unavailable or not monitoring AFTN for VAA traffic.	No automated alert to MWO when VAAC issues VAA; reliant on MWO actively monitoring AFTN output — not suitable during high-workload periods.	HIGH		HIGH	Ash particle size may be below pilot probe particle size protection threshold; simultaneous contamination of all three ADC pilot systems possible in dense ash cloud.	All three ADC systems simultaneously contaminated; crew training deficiency in unreliable airspeed recovery procedure.	RB-3: Unreliable airspeed procedure execution with ATC radar groundspeed advisory and priority landing clearance	Cabin Pressurization Failure Severity: Hazardous (4B)	C4
T5	Incorrect Flight Plan Routing Through Ash Airspace Probability: Probable	PC-4: NOF mandatory ASHTAM and NOTAM (Series V) issuance on receipt of VA SIGMET; distribute to all NOFs, SADIS WIFS, RODB Pretoria, and RODB Dakar	SIGMET not received by NOF due to AFTN circuit failure; NOF staffing gap during overnight or weekend; distribution list not current.	No automated cross-check between SIGMET issuance and NOTAM issuance; PIB compilation may lag NOTAM issuance by up to 2 hours.	HIGH		HIGH	Lower altitude ash layer may not be depicted in VAA; crew may descend into uncharted ash contamination at lower flight levels.	Emergency descent path into a further ash layer at lower altitude; volcanic lightning in ash cloud; crew incapacitation prior to descent initiation.	RB-4: Emergency descent procedure with crew oxygen donning and ATC priority clearance to below FL100	Emergency Diversion to Non-Nominated Airport Severity: Major (3B)	C5
T6	Crew Deviation from Approved Routing into Ash Cloud Probability: Remote	PC-5A: Dispatcher mandatory ash SIGMET/NOTAM/ASHTAM check during pre-flight planning; supervisor review required for routes within 100NM of active ash boundary	SIGMETs not available on pre-flight planning system; ash boundary updated after flight plan filed and clearance issued.	No automated routing filter flagging ash SIGMET areas on planning system; relies entirely on dispatcher vigilance during high-workload periods.	MEDIUM		MEDIUM	Many AFI aerodromes lack ash-specific equipment and trained personnel for rapid volcanic ash assessment and clearance.	No ash deposit assessment procedure at diversion aerodrome; aerodrome ops not equipped or trained to assess volcanic ash contamination rapidly.	RB-5A: Aerodrome volcanic ash contamination inspection and runway friction assessment before accepting diverting aircraft	Airport Closure - Ash Deposits Severity: Major (3B)	C6
T7	Rapid Ash Cloud Expansion Beyond Forecast Boundary Probability: Remote	PC-5B: ATC pre-departure coordination check of filed route against all active VA SIGMETs before issuing departure clearance	ATC not monitoring SIGMET status in real time; SIGMET boundary not overlaid on ATC display or flight data processing system.	No ATC system SIGMET overlay on radar display in most AFI ACCs; route vs. SIGMET cross-check is entirely manual.	MEDIUM		HIGH	ERP may not include volcanic ash-specific procedures or pre-notification arrangements with diversion airports.	ERP not rehearsed for volcanic ash-specific diversion scenario; key ERP personnel unreachable during event.	RB-5B: Airline Emergency Response Plan (ERP) activation and multi-agency notification within 15 minutes of emergency declaration	Hull Loss/Fatal Accident Severity: Catastrophic (5A)	C7
T8	Crew PIREP Not Transmitted or Notelayed to MWO Probability: Probable	PC-6A: Pre-departure crew briefing on all active VA SIGMETs and NOTAMs; FOO to provide updated SIGMET status at aircraft departure time	SIGMET issued or amended after crew signed off pre-flight documentation; crew complacency for known volcanic region; crew briefing not updated with latest SIGMET.	No automated crew alerting system for post-briefing SIGMET updates; ACARS SIGMET relay to crew is airline-dependent and not universally implemented.	HIGH		MEDIUM	Most AFI airports lack ash-specific clearance equipment; standard snow removal equipment is inadequate for volcanic ash and can aerosolise fine particles.	Volume of ash deposit exceeds airport mechanical clearance capacity; ash re-deposits during clearance operations due to ongoing eruption.	RB-6A: Airport volcanic ash contingency plan activation — clearance, friction testing, and NOTAM closure/reopening	Regulatory Non-Compliance Finding Severity: Major (3B)	C8