Guidance for Developing and Coordinating Aviation Exercises for Meteorological Events

ICAO Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) – Meteorology Sub-group (MET SG)

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Contents

1. Background and Purpose

1.1. High impact meteorological events[1] such as tropical cyclones, volcanic eruptions and severe space weather can pose a risk to aviation, however the low frequency and irregular nature of these events means there can be long periods of inactivity. Therefore, it is important to exercise these events on a regular basis. Conducting exercises allows better coordination and preparedness for when these events eventually occur in real-life and so provides a form of risk mitigation.

1.2. At the 34th Meeting of the Asia and Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG), following recommendation by its Meteorology Sub-group (MET SG), it was agreed that the work of the previous Volcanic Ash Exercises (VOLCEX) Steering Group in arranging exercises was no longer required[2]. A new Meteorology Exercise (METEX) Advisory Group (AG) was instead formed under the MET SG to continue provide guidance to organizations on developing and coordinating exercises focused on high impact, low frequency meteorological events that pose a risk to aviation.

1.3. This document is intended to assist organizations (e.g. aeronautical meteorology service providers, national aviation authorities) to plan, conduct and report outcomes from exercises related to such events.

2. Exercise Scenarios

2.1. The first step in organizing an exercise is to identify what aspects of the aviation system you wish to exercise – e.g. the response to a space weather event, or the impact on a national network of volcanic ash deposition at a busy airport. Consideration should be given to what events may impact aviation in your region of the globe – and how recently they have occurred. For example, if there has been a significant volcanic event in the past year, there may be more value in exercising a different scenario.

2.2. Examples of high impact, low frequency meteorological events that can impact aviation include (but not limited to):

2.2.1. Volcanic unrest and/or eruption

[1] In the context of this document, the term ‘meteorological events’ is understood to include atmospheric hazards such as volcanic ash and space weather, as well as traditional meteorological hazards.

[2] Decision APANPIRG/34/14: Replacement of the VOLCEX Steering Group by the MET Exercise Advisory Group

2.2.2. Space weather impacts

2.2.3. Tsunamis

2.2.4. Tropical cyclones

2.2.5. Radiation leakage

2.2.6. Flooding

2.3. Coordinating with a warning provider or advisory centre (e.g. Volcanic Ash Advisory Centre (VAAC), Space Weather Centre (SWXC)) would be beneficial to decide on a credible scenario that will accurately test the key components of the aviation system and meet your exercise objectives.

2.4. Consideration should be made of the length of the exercise – typically, an exercise will be run during 'regular business hours' over one day but, if needed, could simulate a multi-day event during that time. For example, a volcanic ash exercise may have extra volcano observatory notice to aviation (VONA) reports provided as pre-exercise information to advise the participants of the increasing level of volcanic activity that would have been observed prior to the main exercise scenario.

3. Exercise Leader

3.1. An exercise should be led by a designated Exercise Leader, who is responsible for the overall running of the exercise.

3.2. The Exercise Leader would usually have duties such as:

- Making an exercise plan and determining the time for carrying out the exercise;
- Coordinating with various parties involved in the exercise;
- Preparing exercise materials; including objectives and expected outcomes;
- Developing guidelines for implementing the exercise;
- Guiding the course of the exercise according to the agreed exercise scenario to achieve the exercise objectives;
- Summarizing the exercise in a report; and
- Reporting the outcomes of the exercise to an appropriate body for further action and consideration (for example, to appropriate sub-group(s) of the APANPIRG).

3.3. The Exercise Leader can determine the continuation, postponement or cancellation of planned exercise activities, based on operational considerations on the day of the exercise.

4. Exercise Planning

4.1. When determining which parties should be invited to participate in the exercise, consider the following points:

4.1.1. If possible, include all organizations that would normally be involved in the response to a particular scenario. This would usually include, at a minimum:

4.1.1.1. Warning providers such as VAACs, SWXCs, Meteorological Watch Offices, national meteorological, hydrological or volcanological services

4.1.1.2. Air navigation service provider (ANSP)

4.1.1.3. Air traffic flow management (ATFM) organizations

4.1.1.4. NOTAM office

4.1.1.5. National aviation authority

4.1.1.6. Airlines

4.1.1.7. Airport operator, if relevant

4.1.1.8. If appropriate, military representation, emergency service providers and rescue coordination organizations should be considered.

4.1.2. Consider the exercise objectives and whether there is value in extending the exercise into a neighboring flight information region (FIR) and including representatives from these regions too.

4.1.3. Consider relevant observers that might benefit from observing the exercise.

4.1.4. Giving participants plenty of notice for the exercise is important, to ensure organizations can make relevant staff available.

4.1.4.1. If possible, use a polling tool to allow participants to choose from a range of potential exercise dates – this will help maximize participation from the proposed participating organizations.

4.2. Once a core set of participants is identified, the exercise organizer may want to consider sharing an overview of the exercise plan with the core participants for feedback and suggestions including any additional participants that should be included, or useful extensions on the plan.

4.2.1. It is not recommended to share detailed information on the exercise scenario – for example information on the exact areas and altitudes that will be impacted during the exercise. Participants should react to information that is shared as the exercise progresses; by having too many details in advance, participants are less likely to fully exercise their current processes and may get less of an opportunity to learn.

4.2.1.1. For example, an exercise organizer may say that an exercise will include a space weather event that impacts GNSS-based communication and navigation in a particular FIR. The timing and severity of the planned impact in the exercise does not need to be shared ahead of time.

4.3. Creating a run sheet or flow chart of the *likely* progress of the exercise can be a useful way for an exercise organizing team to determine what activities are required ahead of time.

4.3.1. For example, a flow chart may describe the initial stages of an event and will help prompt thinking about what actions may be taken during the exercise (Figure 1).

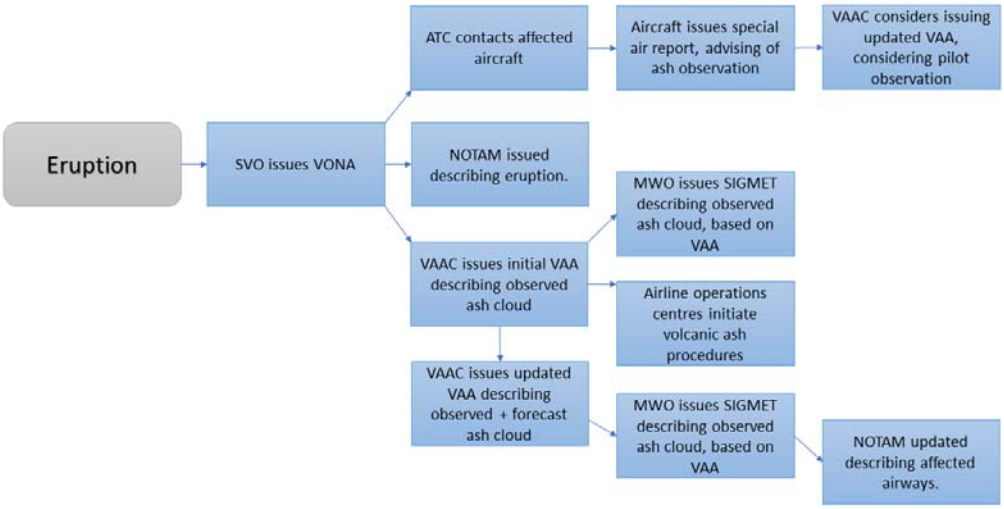

Figure 1. Example flow chart for initial stages of a volcanic ash exercise.

4.3.2. Further, a flow chart may help exercise organizers to consider what variables they may like to insert – for example, they may request an airline participant to send a special air report that describes the event occurring just outside the warning/advisory area, to exercise the process of the warning service provider updating their message.

4.3.3. It is worth ensuring the exercise plan includes an opportunity at the end for participants to share any immediate lessons learned, while they remain 'fresh' in their minds.

4.4. The event organizers should confirm with the warning service provider what the advisory extent or warning geographic location is ahead of time. Alternatively, the organizer may supply the warning service provider with exercise material such as exercise satellite images (see example in Figure 2 below) and exercise model output to indicate the area affected, for the provider to react to as part of the exercise. Note – it is important that other participants do not receive detailed information ahead of the exercise and that the exercise is allowed to unfold more in line with a real event.

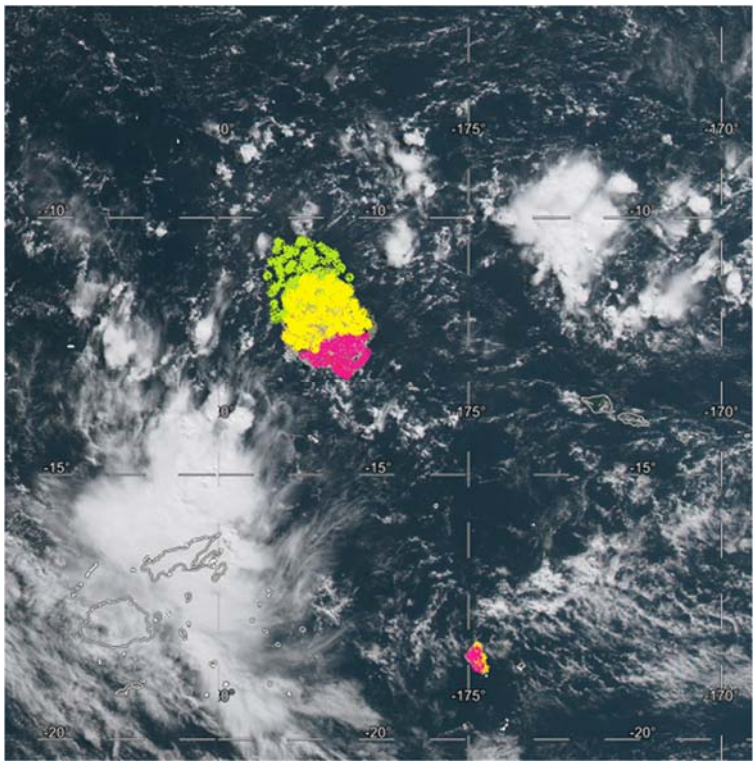

Figure 2. Example of a mocked up 'exercise satellite image', used to prompt VAAC and State volcano observatory action during a 2020 VOLCEX exercise.

5. Exercise Directive

5.1. An exercise directive is a document intended for participants that describes the planned exercise, including the scope of the exercise, participants involved, exercise rundown, communication strategies, and any fallback plan for the exercise in case of postponement.

5.2. An exercise directive typically begins with a high-level description of the scenario being planned, along with inclusion of the exercise objectives. This allows the reader to understand the intent of the exercise and where effort should be focused.

5.3. The exercise directive then typically includes information on:

5.3.1. How the exercise will be conducted

5.3.1.1. Will the exercise be carried out as an in-person exercise? Will it be carried out with participants connecting virtually? A combination of both?

5.3.2. Who the participants in the exercise are

5.3.2.1. Who is the exercise organizer?

5.3.2.2. Will you include any contact information?

5.3.3. How communication will occur during the exercise

5.3.3.1. Some messages may be sent through 'operational' systems – such as advisories or SIGMETs that use the 'EXER' status indicator. Where available (such as in a volcanic ash advisory), a remark field can be utilized to emphasize the message has been issued as part of an exercise.

5.3.3.2. Other messages may be sent via email or other non-operational method, to reduce the risk of leakage into the operational environment and causing disruption if users believe the scenario is live.

5.3.3.3. Regardless of the chosen method(s) of issuance, it is highly recommended to ensure a NOTAM is issued ahead of time to publish the exercise date and time, so that non-participating airspace users can ignore any related messages they may see on the day.

5.3.3.4. If possible, it would also be worth including information in the relevant Aeronautical Information Publication (AIP) Supplement, so that organizations such as flight planning tool providers can be aware of the exercise and manually intervene, so messages do not display in operational systems. However, such tool providers must ensure their tools fully display the exercise nature of any 'EXER' messages received, to avoid any confusion by users of their tools.

5.3.3.5. Past exercises have shown that despite pre-exercise communication, sometimes exercise advisories and/or SIGMETs disseminated through operational systems are mistaken for operational information. Therefore, it would be highly encouraged to make an extra announcement prior to the exercise (for example, via email), in addition to the NOTAM and AIP exercise announcement information. This would increase the likelihood of regular receivers of such information being aware of the exercise, ensuring the 'EXER' status indicator will not be overlooked.

5.3.4. How participants interact during the exercise

5.3.4.1. Outside of the expected exercise messages (NOTAM, SIGMET etc), it is useful to provide a method for participants to discuss other actions they may be simulating during the exercise. This could be in the form of a virtual online meeting or other instant messenger tools.

5.3.4.2. An example for a volcanic ash exercise could be a VAAC telling other participants that they would brief their communications team on the eruption – an ANSP may then decide to connect their communications team with the VAAC communications team to ensure consistent messaging to media. Another example would be a VAAC sharing a satellite image which they had annotated to show where the volcanic ash signature was visible, and where a sulfur dioxide signature was visible. A further example would be an airline advising that in such a scenario, they would divert an affected flight to a nearby airport.

5.3.4.3. Using a 'chat' tool can act as a place to share copies of any messages sent, so that exercise observers can maintain a good understanding of the exercise activities as it progresses. Further, it allows participants to be aware of

all messages disseminated and advise if they have not received an expected message (e.g. 'EXER' SIGMET).

5.3.4.4. A chat tool can also allow participants to inform others of any problems they may encounter during the exercise.

5.3.5. How any postponement decision will be made and communicated

5.3.5.1. If a real event occurs on the day of the scheduled exercise, it may be appropriate to postpone (or cancel) the exercise. In addition, it is good practice to confirm on the morning of the exercise that it will go ahead (or not) and to communicate that decision to all participants.

6. On the Day of the Exercise

6.1. An important task for participants is to keep logs of messages they both receive and disseminate, along with a record of actions they took (or would take, if a real event) during the exercise. This is important when reviewing the exercise outcomes and helps identify any opportunities for improvement in the system.

6.2. Having a mid-exercise 'check in' can be a useful opportunity to check with participants on how the exercise is going for them. Are they able to access all exercise material? Have they noted any problems so far (e.g. leakage of exercise material into operations), or identified any issues that would occur if the exercise was real?

6.3. The Exercise Leader should supervise the exercise as it progresses – is the flow of information delivered by each party appropriate? Is the time difference required for publishing information and the content of the information disseminated appropriate? Are there actions being taken that are not in accordance with the predetermined scenario – and is this a problem or a useful deviation?

6.4. The Exercise Leader should organize a debrief at the end of the exercise. This is important to gather initial reflections, lessons learned, and any recommendations from exercise participants. Core participants can be asked to provide a short summary of what worked well, what they found challenging and what they learned during the exercise. This should be followed up by written summaries from the participants (in addition to their exercise logs), to assist the Exercise Leader and exercise organizers to write the exercise report.

7. Exercise Report

7.1. An exercise report should briefly describe the exercise objectives and summarize the outcomes. The focus should be on the lessons learned during the exercise and any recommendations for improvement.

7.2. A draft report should be shared with participants for review and to ensure that there is agreement on any recommendations made.

7.3. Once published, participants should be encouraged to share the exercise report within their organizations and with industry peers, if possible. This ensures that lessons learned can benefit other service providers and aviation users and have a greater impact on aviation safety.

7.4. The Exercise Leader should report outcomes and findings of the exercise to an appropriate body such as the APANPIRG MET SG (and other sub-groups, as appropriate) so that issues, lessons learned, and recommendations can be shared with all Asia and Pacific States.

7.5. The Exercise Leader should provide a copy of the finalized report to the METEX AG so outcomes can be shared with other potential Exercise Leaders and placed in an exercise archive on the ICAO Asia and Pacific Office e-documents site.

7.6. The exercise organizers should follow up on any recommendations after a suitable period, to ensure that they are being acted upon.

7.7. Exercise participants should be encouraged to utilize connections made during the exercise to improve their own contact lists for the purpose of communication during a real event in the future.

8. Useful Documents and Websites

8.1. Appendix of useful links:

8.1.1. Handbook on the International Airways Volcano Watch (ICAO Doc 9766) (available here)

8.1.2. Manual on Space Weather (ICAO Doc 10100)

8.1.3. Annex 3 – Meteorological Service for International Air Navigation

8.1.4. https://www.icao.int/APAC/Pages/eDocs.aspx

8.1.4.1. Asia and Pacific Regional SIGMET guide

8.1.4.2. Previous exercise documentation