ICAO

SECURITY AND FACILITATION

Protection of Civil Aviation Infrastructure Against Unmanned Aircraft

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INTERNATIONAL CIVIL AVIATION ORGANIZATION

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REFERENCE DOCUMENTS AND RESOURCES

The guidance material found in this document is designed to assist stakeholders in protecting civil aviation infrastructure from unmanned aircraft systems (UAS), and in undertaking appropriate coordination and consultation with all involved stakeholders to ensure a comprehensive and holistic approach to address associated threats and risks. Additional information on addressing the sightings of UAS in the vicinity of an airport can be found in the ICAO *Aviation Security Manual* (Doc 8973 — Restricted).

To further assist Member States, readers can find below references to Annex 17 — *Aviation Security* Standards and to protocol questions (PQs) developed under the ICAO Universal Security Audit Programme — Continuous Monitoring Approach (USAP-CMA).

ANNEX 17 — *AVIATION SECURITY*, TWELFTH EDITION

Standard 2.1.3, as found in Amendment 18 to Annex 17 to the Convention on International Civil Aviation (the Chicago Convention), provides for the protection of passengers and the general public against acts of unlawful interference, as well as the need for rapid response to increased threat.

Standards 3.1.3 and 3.1.5 require that the threat level to civil aviation be under constant review, and that procedures be implemented to share relevant information with appropriate operational stakeholders in order to facilitate the conduct of security risk assessments.

2.1.3 Each Contracting State shall ensure that such an organization and such regulations, practices and procedures:

a) protect the safety of passengers, crew, ground personnel and the general public in all matters related to safeguarding against acts of unlawful interference with civil aviation; and

b) are capable of responding rapidly to meet any increased security threat.

3.1.3 Each Contracting State shall keep under constant review the level and nature of threat to civil aviation within its territory and airspace above it, and establish and implement policies and procedures to adjust relevant elements of its national civil aviation security programme accordingly, based upon a security risk assessment carried out by the relevant national authorities.

3.1.5 Each Contracting State shall establish and implement procedures to share, as appropriate, with relevant airport operators, aircraft operators, air traffic service providers or other entities concerned, in a practical and timely manner, relevant information to assist them to conduct effective security risk assessments relating to their operations. (*see Annex 17, Twelfth Edition for additional notes*)

A helpful and regularly updated set of tools to assist States in realizing effective UAS operational guidance and safe domestic operations is available on the ICAO public website at the following address: https://www.icao.int/safety/UA/UASToolkit

States should also consider the safe development and deployment of UAS Traffic Management (UTM) systems. Such systems may assist authorities with identifying which drones are operating legally and those that may be operating illegally or with malicious intent. They could provide key information during incident response activities. UTM guidance material can be found on the ICAO public website at the following address: https://www.icao.int/safety/UA/Pages/UTM-Guidance.aspx

UNIVERSAL SECURITY AUDIT PROGRAMME — CONTINUOUS MONITORING APPROACH (USAP-CMA) PROTOCOL QUESTIONS

The USAP-CMA PQs were developed to standardize the conduct of activities under the ICAO USAP-CMA and assist States in preparation for USAP-CMA audits and in monitoring their own aviation security oversight system. Below are those PQs pertinent to Annex 17 Standards 2.1.3, 3.1.3 and 3.1.5.

Standard 2.1.3

1. If the State has established various levels of threat, have the related comprehensive security countermeasures also been established?

   a) Identify the documentation in which the levels of threat and corresponding countermeasures are established.

   b) Verify whether such countermeasures are consistent with the national requirements for various security measures and appear appropriate to the various levels of threat.

2. If the State does not use various levels of threat, has the State established a process to respond rapidly to any increased security threat?

   a) Verify whether a process for responding rapidly to any increased security threat by implementing appropriate countermeasures has been established.

   Note. — *While PQ.1.155 is looking for the methodology used to carry out risk assessments and adjust elements of the NCASP, this PQ aims to evaluate whether there is a mechanism to apply the risk assessment methodology rapidly in response to new or increased threats.*

Standard 3.1.3

1. Is an appropriate risk assessment methodology available and utilized for adjusting relevant elements of the security measures established in the NCASP?

   a) Review the risk assessment methodology for adjusting relevant elements of the security measures established in the NCASP.

   b) Verify whether the risk assessment methodology includes the three components of the risk (threat, consequence, vulnerability) for each threat scenario considered.

   c) Verify whether the risk assessment methodology addresses the following types of threat, among others: […] airborne threats such as remotely piloted aircraft system threats.

Standard 3.1.5

1. Has the State established and implemented procedures to share with relevant airport and aircraft operators, ATSPs or other entities concerned, in a practical and timely manner, relevant information to assist them to conduct effective security risk assessments relating to their operations?

   a) Identify the documentation in which these procedures are established.

   b) Review any written notifications/documentation related to the dissemination of such information according to a need-to-know principle.

INTRODUCTION

In terms of scope, the guidance contained in this document does not consider the safety, certification and air traffic management issues surrounding the legitimate use of unmanned aircraft (UA) for transportation or other commercial or professional purposes. Rather, it focuses on measures that might be taken by States to prevent, respond to, or mitigate the impacts of acts of unlawful interference against civil aviation using UA.

TERMINOLOGY

Multiple terms are used for unmanned aircraft systems (UAS) and their components. UAS are comprised of an unmanned aircraft (UA), a control or remote pilot station (RPS), a data link (C2 Link) between the UA and its control station/RPS for managing the flight, and possibly other components such as launch and recovery equipment.

Remotely piloted aircraft (RPA) are a subset of UA that may be fully certificated in accordance with aviation standards. Another type of UA is unmanned free balloons. Some Member States may, under their existing legislation, also include model aircraft within the category of small UA. Most UA operate as part of a system (UAS). **Figure 1** illustrates the different types of UA.

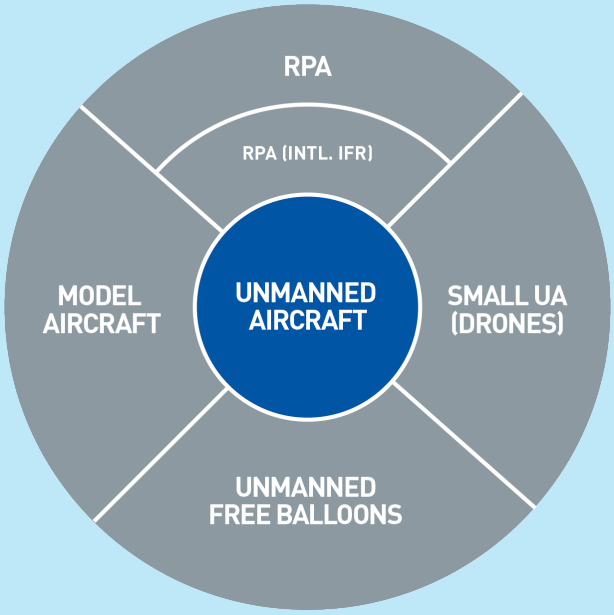


Figure 1. Types of UA

THREAT AND RISK PICTURE

In order to counter the threat posed by UA, the approach should be multidisciplinary (regulation, training, systems, safety promotion, incident response, etc.) and involve all relevant actors (appropriate authorities, air navigation service providers (ANSP), airports operators, local law enforcement, etc.).

When appropriate authorities are assessing the threat and risk associated with UA these can be categorized in three broad types:

a) **small UA, typically with a payload of not more than 1 kg, a flying time normally no more than 1-2 hours, low cost, easy to obtain, maintain and operate, used extensively for recreational purposes and smaller-scale commercial and professional activities;**

b) **medium UA/RPA, with larger payloads (such as up to 10 kg) and longer flying times (several hours), mostly used for commercial and professional purposes such as parcel delivery, infrastructure survey, etc.; and**

c) **large RPA, normally requiring full airworthiness certification and operator oversight provided by the civil aviation authority. These aircraft are very costly and require a sophisticated organization infrastructure to support operations.**

Threats posed by UAS

UAS have become increasingly popular as technological advancements have improved their capability and reduced their cost, making them affordable and accessible to the general public. Consequently, the major concerns posed by UA in the civil aviation environment are mostly related to the reckless use of UA in airspace and possible ignorance of the owner/operator.

The inherent difficulty in preventing the acquisition and use of UAS, in addition to the limited ability to track them near airports, results in an overall increased vulnerability to acts of unlawful interference targeting civil aviation infrastructure. Incidents and other developments in the illegal use of UAS as a vector of attack on aviation facilities and systems are increasing the risk from this kind of attack.

When States are assessing associated threats and risks with UAS, consideration should be given to consulting the ICAO *Aviation Security Global Risk Context Statement* (Doc 10108 – restricted) to the extent practicable.

Weaponized UA are becoming more advanced and more accessible to terrorists, who have demonstrated increased interest and willingness to use this vector of attack in the civilian environment. Mitigations against such attacks currently appear to be lagging behind the development of the threat.

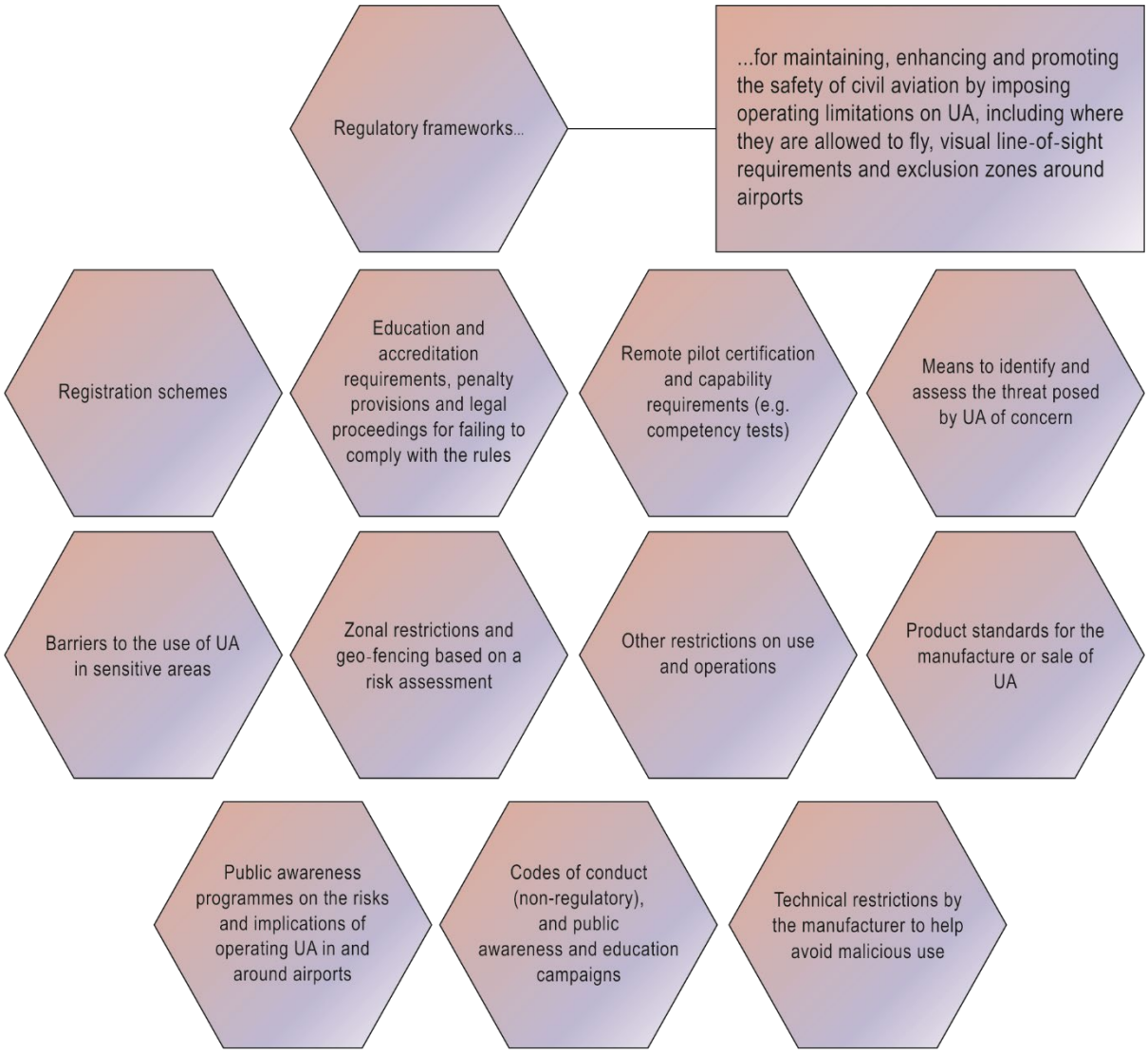
The misuse of UA in regulated airspace could impact civil aviation operations and constitute an act of unlawful interference if it endangers aviation safety. This can result in forced closure of an airport over an extended period, thereby potentially causing safety-related incidents, the cancellation of hundreds of flights, with disruption to tens of thousands of passengers and substantial economic damage.

REGULATORY MEASURES

PRINCIPLES

Coordination of responsibilities between State, local, and airport authorities should be in place to allow for appropriate agencies to intervene against UA determined as threats to civil aviation. States should consider what authorities and arrangements are necessary in order to provide sufficient power to relevant authorities to deter, track, identify, and employ appropriate countermeasures against UA, and prosecute offenders. This includes the introduction of new criminal offences, penalties and other legal sanctions.

Regulations, together with public awareness, technology and training, can help limit the number of UA incursions at airports. They provide the legal basis to enable Member States to implement measures that will make deliberate incidents easier to identify and respond to, irrespective of the intent. Such measures may include the following:



COUNTER-UAS TECHNOLOGY

The development of technological responses to UAS, like disabling unauthorized UA sighted in airport areas, is paramount in fighting the growing threat. Many manufacturers around the world are offering a wide range of possible counter-UAS solutions for civil aviation, based on both existing and new technologies. Many of these possible solutions are aimed at providing a capability to detect, track, identify and mitigate the risks posed by UA, which is a necessary first requirement for counter-UAS technology. Some solutions also offer the capability to disable or destroy the UA, using a range of techniques, including weapons (e.g. ballistics or lasers), capture (using nets or other UA) or electromagnetic interference (e.g. jamming).

However, since the use of such technologies is still in its infancy, there are currently no agreed upon standards on the matter. It is also important to ensure that none of these technological solutions create another set of issues ranging from electromagnetic interference with navigational systems, telecommunications and nearby installations (e.g. hospitals) to damage on the ground and bodily injury (e.g. when disabling a UA that subsequently may fall onto a populated area).

States are encouraged to closely engage with other aviation stakeholders to identify potential solutions and to determine who should and how best to implement counter measures in respect of UA.

States and industry partners should carry out field trials to evaluate the effectiveness and safety implications of commercial off-the-shelf counter-UAS equipment material that could be used at airports and other critical national infrastructure sites.

When developing or acquiring counter-UAS solutions, stakeholders should determine:

a) whether they are effective;

b) which circumstances they work best in;

c) who should be authorized to use them;

d) which combination of solutions is necessary;

e) if there are potential negative or unforeseen impacts of their use, both in the airport environment and beyond, and whether these impacts can be adequately mitigated;

f) if there are any legal limitations and/or implications on their use; and

g) whether they are future-proof and effective as UAS technology evolves.

PREPAREDNESS AND INCIDENT RESPONSE

PRINCIPLES

In addition to effective technical counter-UAS solutions, a non-technological approach can help minimize and mitigate the potential impacts of the malicious use of UA, particularly if the primary intent is to cause disruption.

The response to a UA incursion should always prioritize civil aviation and public safety and follow a pre-established decision-making process. The response to a reported incursion needs to be rapid, effective and proportionate to the risk at all stages of the incursion, and may have to be made with limited information. Further decisions may need to be taken as an incident develops, and more information becomes available.

Closing an airport or relevant airspace may not always be the most appropriate response to a reported UA incursion, depending on a wide range of possible factors, including the wider safety implications of a mass diversion event as well as the challenges inherent in the reopening of the airport/airspace.

The ability to respond rapidly, effectively and proportionally can be significantly enhanced by having in place robust and coordinated procedures that are agreed and practiced in advance between all relevant parties and stakeholders (which include airport managers, air traffic control services, air operators, pilots, remote pilots, police, local authorities and national civil aviation and security agencies).

Examples of such procedures could include, as part of the airport operator's crisis management plan:

a) a local contingency plan setting out decision-making responsibilities and protocols, including criteria or trigger points and lines of communication;

b) roles and actions by each entity involved in implementing the local contingency plan, including clarification of whether each entity will play a leading or supporting role;

c) a common threat assessment protocol or template to be used for undertaking dynamic risk assessments based on the facts available, including the assessment of behaviour of UA and likely motivation, in order to inform an appropriate response (a template drone incursion threat assessment form can be found in **Appendix**);

d) the development of protocols for different threat levels, with clear thresholds for escalation and suggested responses at each level;

e) training and exercises (tabletop or drills) for staff involved in threat assessment processes and emergency response, including ANSPs, airlines, airport stakeholders, safety and security entities; and

f) procedures, methods and technologies for the reporting of sightings, whether by pilots, staff or the public.

LOCAL CONTINGENCY PLAN

A local contingency plan (also referred to as “plan” in this document) should be based on a vulnerability assessment to account for the operational, environmental and structural characteristics of each airport and their surroundings. Such an assessment should inform the development of mitigating and response measures (e.g. identification of likely launch sites of UA).

A plan should also incorporate a 3-dimensional (3D) zonal map, classifying airspace within and around the airport according to the level of risk likely to be caused by a UA incursion, and also representing the legal restrictions around UA operations at the airport (e.g. no-fly zone areas and clearance distances), as well as any other key features such as runways. A threat zone map along these lines can assist both threat assessment and decision-making processes, as well the development of mitigation measures.

Threat zone maps should be provided to airport staff to assist them in reporting UA sightings, to enhance situational awareness and facilitate an effective response to potential incursion.

Airport operators should develop their own 3D threat zone map in coordination with local ANSPs as follows:

a) Zone A should cover the areas of the runway(s) and immediate approaches within the airport perimeter;
b) Zone B should cover airport property within the airport perimeter or beyond, as applicable; and
c) Zone C should cover areas of concern outside of the airport perimeter such as approach and departure paths, fuel supplies and air navigation facilities.

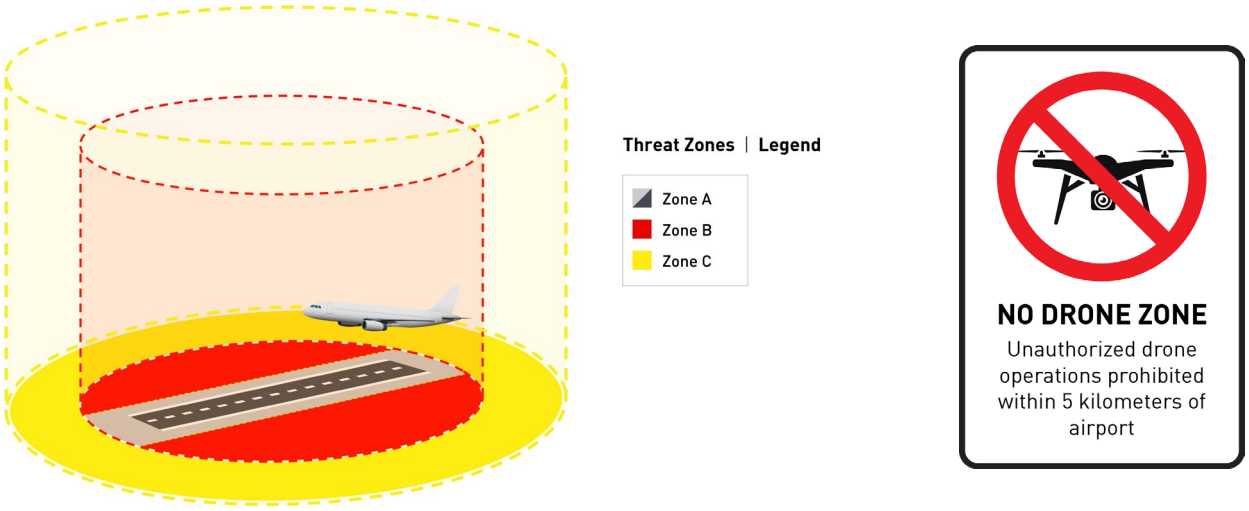


Figure 2. Concept of threat zone map and no fly-zone

Figure 2 illustrates what such a threat zone map might be. Note that the ceilings of the 3 zones are indicative only and should be determined by the relevant authorities.

UA sighting reporting mechanism

A plan should include local arrangements for the reporting and handling of information around UA sightings. These should incorporate awareness-raising and reporting processes for ANSP and air traffic control staff, airport staff, as well as the local community.

A plan should therefore include the following:

a) protocols for the collection and recording of relevant information in relation to UA sightings;

b) provisions for the prompt communication of UA sightings information to those designated within the plan as being responsible for carrying out threat assessments and for making decisions on a proportionate response; and

c) broader communications plans that will ensure in the event of a reported incursion that appropriate and timely messages are conveyed, as applicable, to air traffic controllers, pilots, aircraft operators, relevant government agencies, staff, the public and media. Public communications strategies should incorporate social media and factor in appropriate deterrence messaging.

Communications between air traffic controllers and pilots in flight should be concise and include critical and actionable information only. Communications should be provided to assist pilots in their on-board decision-making, and should, where possible, use standardized terminology.

Drills and real-life exercises should be regularly conducted to ensure all entities and staff involved in implementing the contingency plan understand their roles and responsibilities. Staff should receive initial and recurrent training that includes some understanding of UAS types and capabilities. More information on crisis management, including emergency response measures, can be found in Chapter 17 of the ICAO *Aviation Security Manual* (Doc 8973 - Restricted).

DECISION-MAKING PROCESS

THREAT ASSESSMENT

Although the vast majority of UA incursions are likely to be accidental (e.g. due to negligence, ignorance of applicable measures or loss of control), airport operators and relevant authorities should take appropriate actions to respond to any incursions that may jeopardize aviation safety, whether such incursions are malicious in nature or not. Should an incursion be determined to pose a serious and immediate danger to the safety and security of people on the ground or in the air, a more rapid response should be executed, which may escalate to include measures with significant operational and safety impacts (e.g. diversion of air traffic, airspace and runway closure or use of counter-UAS measures).

When assessing the threat posed by a UA incursion, a wide range of possible factors needs to be taken into account, including the reliability of the information received, reported location, flight behaviour and direction. Following this assessment, an appropriate response should be activated in close coordination with all entities involved and/or affected by the incursion.

Such threat assessments are dynamic due to the limited availability of relevant information at the beginning of an event, and therefore need to be conducted repeatedly, sometimes several times, as the event progresses and more information becomes available. However, urgent responses should not be delayed by such repeated assessments.

States and airport operators, in collaboration with relevant authorities, should therefore develop their own threat assessment tool to inform appropriate and proportionate decision-making process to respond to UA incursions and/or sightings. A template UA incursion threat assessment form can be found in the **Appendix**.

Figure 3:
UA incursion – Decision-making process

Figure 3 provides template decision-making processes starting from the reporting of a UA flying within, above or near a zone of concern, as defined by local contingency plans. It aims to assist authorities in determining whether the threat is credible and should lead to actions. Additional considerations such as the conduct of authorized UA activity should also be taken into account.

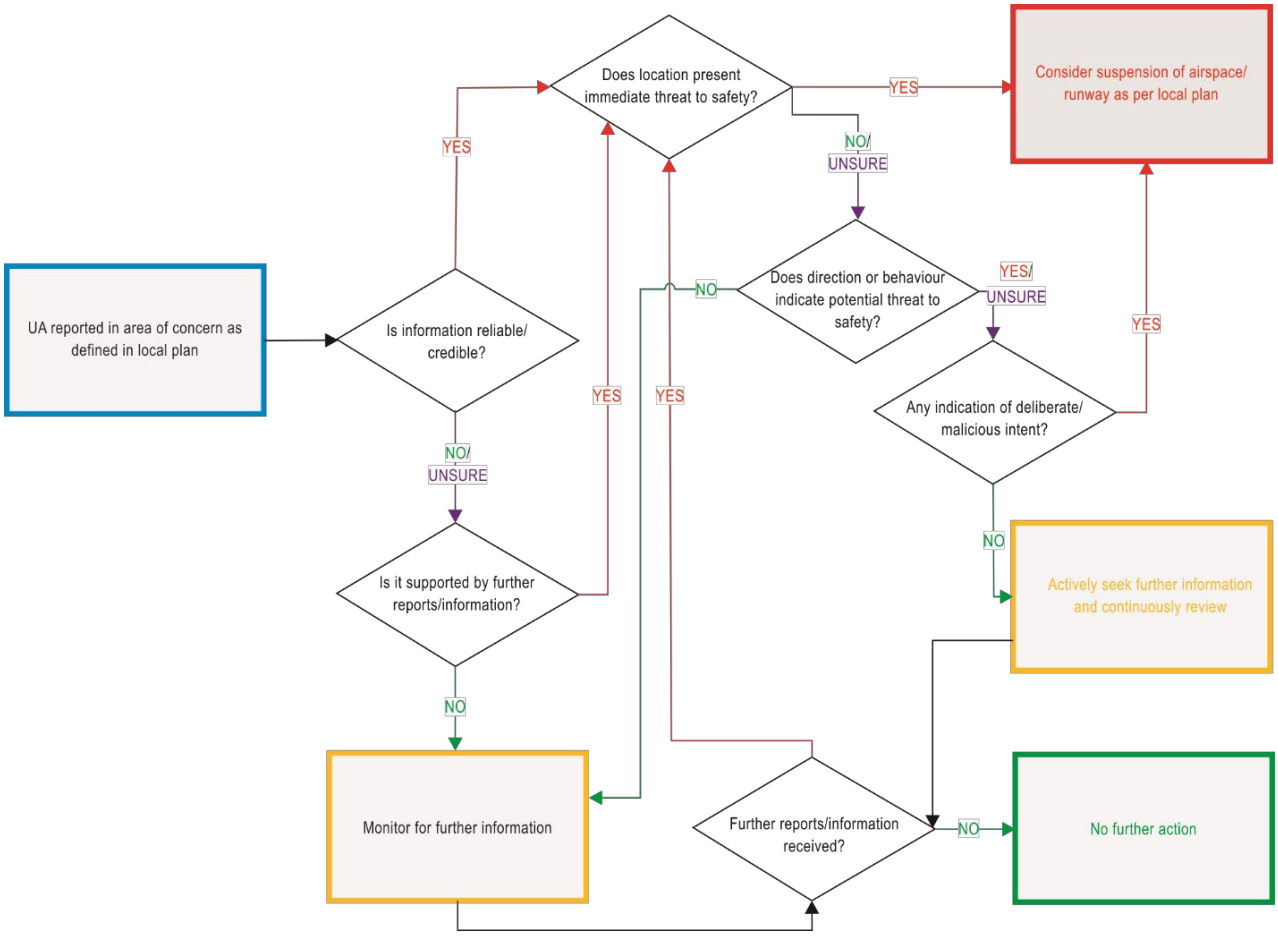


Figure 3. UA incursion – Decision-making process

APPENDIX

UNMANNED AIRCRAFT (UA) INCURSION
THREAT ASSESSMENT FORM

Part 1 — UA identification			
Number of UA	**Single (1) UA** ☐	**Multiple UA** ☐	**Number:**
Initial reporter Was/were the UA directly sighted by the reporter: ☐ How many UA:_____ Was/were notification of sighting received by the reporter: ☐ How many UA:_____		Full name: Role: Contact details: Means of notification (e.g. social media):	
Local time and date of initial sighting/notification			
Location (provide as much detail as possible such as proximity to the runway or prominent landmark, altitude, etc.)			
Flight direction and speed (e.g. towards/away from runway, fast/slow)			
Does the UA wobble?	Yes ☐	No ☐	Unsure ☐
Does the flight seem controlled?	Yes ☐	No ☐	Unsure ☐
Is the altitude consistent?	Yes ☐	No ☐	Unsure ☐
Does it climb and descend?	Yes ☐	No ☐	Unsure ☐
Physical characteristics of UA reported (size, colour, markings, fixed wing/multicopter, number of rotors, etc.)			
Payload (if any) (is it carrying something?)			
UA reported in area of concern? **YES** ☐ **NO** ☐ **How many: _____**			

Part 2 — Credibility/Verification			
Credibility: do the details provided enhance the credibility of the initial report?	YES ☐	NO ☐	Unsure ☐
Reliability: does the identity of the reporter(s) enhance the reliability of the initial report?	YES ☐	NO ☐	Unsure ☐
Imagery of CCTV of the UA? (attach any available images to this form)			
Remote pilot identified? (if so, provide details of location, distance from UA, and remote pilot)			
Additional reports? (is the initial report supported by further sightings)			
Time and date of additional sighting(s)/notification(s)			
Location of additional sightings (provide as much detail as possible such as proximity to the runway or prominent landmark, altitude, etc.)			
Flight direction and speed (e.g. towards/away from runway, fast/slow)			
Additional details of physical characteristics of UA reported (size, colour, lights, markings, fixed wing/multicopter, number of rotors, etc.)			
Details of additional witness(es)			
Full name: Role: Contact details: Means of notification (e.g. social media):	Full name: Role: Contact details: Means of notification (e.g. social media):	Full name: Role: Contact details: Means of notification (e.g. social media):	
UAS detection system? If a UAS detection system is available, has it confirmed the report? (add detail provided by the system)			
Is the information in the initial report reliable/credible?	**YES** ☐	**NO** ☐	**Unsure** ☐
Is the initial report supported by further information?	**YES** ☐	**NO** ☐	**Unsure** ☐

Part 3 — Location and direction
Location: is the reported location known with a reasonable degree of certain/accuracy?
Current safety threat: Does the reported location represent an immediate threat to the safety of aviation?
Direction: is the direction of travel known?
Predictability: is the UA being flown in a predictable manner (e.g. travelling in a straight line)?
Potential safety threat: are the reported location, behaviour and direction of flight likely to indicate a potential threat to the safety of aviation?
Does the location represent an immediate threat to safety? **YES** ☐ **NO** ☐ **Unsure** ☐ **Can the direction/behaviour lead to a potential threat to safety?** **YES** ☐ **NO** ☐ **Unsure** ☐

Part 4 — Behaviour and intent
Is there any known/authorized UA activity in taking place in the area, and if so, is there any evidence to link the sighting(s) to such activity?
Did the UA appear to be deliberately focusing on or targeting an airport or aircraft? (if so, provide details on what the target appeared to be and the behaviour of the UA, such as hovering/circling/approaching)
Was the UA stationary or circling within an area of concern?
Was the UA being flown in a manner suggesting an inexperienced remote pilot or lack of control? (e.g. dipping and wobbling flight)
Are there any environmental conditions affecting flight behaviour? (e.g. time of day, weather conditions, visibility etc.)
Was there any indication of being used to facilitate other possible threats? (e.g. reconnaissance, delivering payload)
Are there any high-profile VIP persons or special events at the airport at the time of the sighting(s)?
Is there any other information suggesting a potential reason for a deliberate incursion/targeting?
Is there evidence of a deliberate intent to endanger or interfere with aviation? **YES** ☐ **NO** ☐ **Unsure** ☐

Part 5 — Other relevant information
Any other information to verify as a threat to aviation safety?
Any other information to discredit as a threat to aviation safety?
Any other relevant information?
Does this increase or decrease the assessment of a potential threat to the safety of aviation? **YES** ☐ **NO** ☐ **Unsure** ☐

	Part 6 — Triangulated threat assessment		
	Assessor 1 Full name: Role: Contact details:	**Assessor 2** Full name: Role: Contact details:	**Assessor 3** Full name: Role: Contact details:
No credible information to indicate UA incursion in area of concern No further action required	☐	☐	☐
Credible information but no indication of potential threat to aviation safety Monitor for further information	☐	☐	☐
Credible information of potential threat to aviation safety Actively seek further information and continuously review	☐	☐	☐
Credible information of immediate threat to aviation safety Consider suspension of relevant airspace/runway	☐	☐	☐

— END —