هيئة الطيران المدني
CIVIL AVIATION AUTHORITY

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Subject: Risk Assessment for Civil Aircraft Operations over or near Conflict Zones

Applicability: This Directive is applicable to all Operators regulated under the Oman Civil Aviation Authority, who are required to conduct risk assessment for Civil Aircraft Operations over or near Conflict Zones.

Effective Date: This Directive is effective from 1st July 2024.

Requirement and compliance timeline: The requirements of the CAD come into effect from 1st July 2024 and compliance is a continuous process for enhancement.

Remark: For any question concerning the technical content of this Directive, please contact the Flight Safety Department.

Reference Document: CAR-100 – Safety Management System, National Civil Aviation Security Program (Restricted) and National Security Assessment Methodology (Restricted).

Note: On cancellation, contents of this CAD will be transposed to a CAR.

26/6/2024

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CAD 02–01

Risk Assessment for Civil Aircraft Operations over or near Conflict Zones

Effective: 1st July 2024

1. PURPOSE AND SCOPE

This Directive contains advice to Oman, Civil Aircraft Operators, on the subject of Risk Assessments for Civil Aircraft Operations over or near Conflict Zones. It also contains consolidated guidance to support implementation of relevant ICAO Standards and Recommended Practices (SARPs), ICAO guidance material and industry best practices. It covers the risk from both deliberate acts and unintentional hazards to civil aircraft operations over or near conflict zones.

Due to the dynamic political situation across the world, conflict zones persist and change, sometimes suddenly and/or unpredictably, exposing civil aviation and the layover of flight crews to the risk of collateral damage or targeted attack. Military or terrorist conflicts may occur in any State at any time and pose risks to civil aircraft.

The primary objective of CAA Oman, with regard to assure the protection and safety of passengers, crew, ground personnel and the general public in all matters related to safeguarding against acts of unlawful interference with civil aviation.
According to ICAO regulations it is the responsibility of Member States to close any airspace over their territory in which the safety and security of air traffic cannot be guaranteed.

In addition, airlines evaluate conflict zone airspaces and mitigating measures internally. Political, diplomatic and financial interests of the involved stakeholders can lead to inconsistent assessments. Discrepancies in these assessments and resulting decisions can develop within airline groups and holdings and with codeshare airlines from different nations due to different national risk assessments and imposed restrictions. It is important to note that ultimately the operators and service providers are the entities that will conduct an operational risk assessment specific to the type and extent of their approved operations.

2. APPLICABILITY

This directive shall be applicable to all Operators regulated under the Oman Civil Aviation Authority.

3. EFFECTIVE DATE

This directive is effective from 1st July 2024.

4. DEFINITIONS

Air navigation service provider (ANSP). Any entity providing ATM and/or other air navigation services mentioned in the definition for Air navigation services.

Acts of unlawful interference. These are acts or attempted acts such as to jeopardize the safety of civil aviation, including but not limited to:
– unlawful seizure of aircraft;
– destruction of an aircraft in service;
– hostage-taking on board aircraft or on aerodromes;
– forcible intrusion on board an aircraft, at an airport or on the premises of an aeronautical facility;

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– introduction on board an aircraft or at an airport of a weapon or hazardous device or material intended for criminal purposes;
– use of an aircraft in service for the purpose of causing death, serious bodily injury or serious damage to property or the environment; and
– communication of false information such as to jeopardize the safety of an aircraft in flight or on the, passengers, crew, ground personnel or the general public, at an airport or on the premises of a civil aviation facility.

Aviation Security. Safeguarding civil aviation against acts of unlawful interference. This objective is achieved by a combination of measures and human and material resources.

Conflict Zones: Airspace over areas where armed conflict is occurring or is likely to occur between militarized parties, and is also taken to include airspace over areas where such parties are in a heightened state of military alert or tension, which might endanger civil aircraft.

Man-Portable Air Defense Systems (MANPADS). Shoulder-launched surface-to-air missile weapon systems. These have the capability of reaching aircraft from the ground to altitudes in excess of 25 000 ft (7 600 m) above ground level (AGL).

Overflight/Overflying. Passing over terrestrial areas (land or sea) at cruising altitude.

Risk index matrix. A matrix that is used during risk assessment to define the level of risk by considering the category of probability or likelihood against the category of consequence severity. This is a simple mechanism to increase visibility of risks and assist management decision-making.

Risk level. Acceptable level of safety performance (ALoSP).

Risk mitigation. The process of incorporating additional measures to lower the vulnerability to a specific scenario.

Safety. The state in which risks associated with aviation activities, related to, or in direct support of the operation of aircraft, are reduced and controlled to an acceptable level.

Spoofing. A source of intentional GNSS Interference, which is a deliberate interference that aims to mislead GNSS receivers into general false positioning solution.

Surface-to-Air missile (SAM). Any weapon that may be fired at an aircraft from the ground but in this context, is taken to mean advanced military equipment that is capable of attacking airborne targets at altitudes of at least 25,000 ft (7,600 m).

Threat. A man-made occurrence, individual, entity, or action that has, or indicates, the potential to harm life, information, operations, the environment and/or property.

Vulnerability. Factors or attributes that render an entity, asset, system, network or geographic area open to successful exploitation or attack or susceptible to a given threat or hazard.

Hazard. A condition or an object with the potential to cause or contribute to an aircraft incident or accident.

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5. RISKS POSED TO CIVIL AVIATION OPERATIONS OVER OR NEAR CONFLICT ZONES

This directive focuses primarily on the risk posed by long-range surface-to-air missiles (SAMs) as these are currently considered to pose the most significant risk to civil aircraft operating over or near conflict zones. However, some of the considerations and conclusions would apply also to air-to-air missiles launched from fighter aircraft.

The decision as to whether a civil aircraft will be flown through airspace that could otherwise be considered unsafe relies on the various parties involved, i.e., the State that manages the airspace, aircraft operators, ANSPs, the State of the Operator, ICAO, regional civil aviation authorities, and other stakeholders. This directive also describes the risk assessment processes leading to final decision-making and provides best practice. There are frequent reports from crews of GPS signal interference or jamming over or near conflict zones.

Fake satellite signals are broadcast to the device to fool it into believing it is somewhere else, or at a different point in time. False location and time readings, with potentially severe impacts on automated and autonomous devices and devices that rely on precise GNSS timing. Spoofing is a source of intentional GNSS Interference, which is a deliberate interference that aims to mislead GNSS receivers into general false positioning solution.

In assessing risk to flight over or near conflict zones, two main scenarios are predominant for civil flight:

(i) Risk of shootdown, inadvertent or intentional

(a) The risk of intentional attack

Some terrorist groups are known to have a continuing and active interest in attacking civil aviation. Aircraft are seen as iconic targets whose destruction can have major impacts, not only through loss of life, but also in terms of economic consequences, publicity, political reaction and loss of public confidence.

However, this situation could change and should be monitored closely. Possible mitigations for this risk would include:

- counter-proliferation measures; and
- avoidance of airspace within range of a possible attack.

(b) The risk of unintentional attack

Past events, would suggest there is a higher risk to civil aviation as an unintended target when flying over or near conflict zones, in particular the deliberate firing of a missile whose target is perceived to be a military aircraft, but which either misses its intended target or is based on the misidentification of a civil aircraft. However, this risk may vary significantly over time, and from place to place, as a result of events, and higher levels of risk are particularly associated with overflying areas of armed conflict.

Avoidance by civil aircraft of airspace over conflict zones where the risk of unintentional attack is assessed as unacceptably high.

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(c) Air to air attacks

The risk factors (and mitigations) associated with an unintentional attack using air-to-air missiles launched by a military aircraft, due to misidentification of civilian aircraft flying in combat zones or zones of high tension/sensitivity, would be broadly similar to those for SAMs.

6. CURRENT CONFLICT ZONE INFORMATION SOURCES

(i) The State that Manages the Airspace

States play a major role in providing various parties with essential risk information related to the airspace above conflict zones that feed into their decision-making processes. States are required under Annex 17 to keep under constant review the level and nature of threats to civil aviation in their territory and the airspace above it, and adjust their security programmes accordingly based upon a security risk assessment. National intelligence agencies should support national systems for addressing risks arising from conflict zones and should support the State's contribution to the sharing of threat information.

(ii) Conflict Zone Information Bulletin (CZIB)

EASA publishes recommendations for areas of armed conflicts via Conflict Zone Information Bulletins (CZIB). A Conflict Zone Information Bulletin (CZIB) is a bulletin which can convey information or recommendations regarding Risks to civil aviation arising from Conflict Zones (RCZ). The European Aviation Safety Agency (EASA) compiles data developed primarily by European governments to issue timely insights on the EASA website.

(iii) Conflict Zones Network of Focal Points, Risks to Civil Aviation Arising from Conflict Zones (RCZ)

This European initiative combines shared information about conflict zones from several stakeholder groups and oversees the content of CZIBs.

(iv) Notice to Airmen (NOTAM)

Threats from a conflict zone which is considered a reportable hazard for air navigation should include information as specific as possible regarding the nature and extent of threats arising from the conflict and its consequences for civil aviation. Warnings about conflict zone risks and instructions on air space restrictions are contained in NOTAMs.

(v) Aeronautical Information Publication (AIP)

AIP contains aeronautical information of a permanent nature as well as temporary changes of long duration to this information. Temporary changes of longer duration (three months or longer) and information of short duration which contain extensive text and/or graphics are normally published as AIP Supplements. The AIP forms the basic element of the aeronautical information products supplied by Aeronautical Information Services. The products also include the amendment service to the AIP, AIP Supplements, NOTAM, pre-flight information bulletins (PIB), Aeronautical Information Circulars (AIC), checklists and lists of valid NOTAMs.

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(vi) Aeronautical Information Circular (AIC)

An AIC is a notice containing information that does not qualify for the origination of a NOTAM or for inclusion in the AIP, but which relates to flight safety, air navigation, technical, administrative or legislative matters.

(vii) Open source

Open source information such as newspapers, magazines, television and information from social media platforms may be used to identify potential threats to the operator's flight routes and destinations. Possible means to stay up to date about risks to the aviation sector and other developments related to security throughout the world are to subscribe to daily newsletters and to regularly consult databases. However, the use of the media as an important source of public information could also introduce a "geographical bias", in which the risks of flying over or near conflict zones that are remote from the operator's geographical home area are not identified.

7. CONDUCTING RISK ASSESSMENTS FOR FLYING OVER OR NEAR CONFLICT ZONES

Principally, the need for any safety measures will depend on the results of the risk assessment conducted by the State or States responsible for providing ATS. Flight operations by civil aircraft through the airspace should only be allowed to continue if the risks can be mitigated to an acceptable level.

Aircraft operators, associations of the civil airline industry, airline pilots, civil air navigation service providers, air traffic controllers, adjacent or other States with additional information, or in some cases the relevant ICAO Regional Office in order to support the conduct of a risk assessment, if required.

(i) Introduction

Armed conflicts pose an unpredictable risk to civil aircraft operations, in particular where the State is not in control of the territory below its sovereign or delegated airspace. The information on the presence and type of weaponry in such areas, as well as the information on who controls them, can be classified or otherwise not be readily available. These facts convey a variety of risk factors that need to be appropriately considered in any operational risk assessment process.

The characteristics of armed conflicts require a risk assessment process that should appropriately consider both security and safety elements. Although security and safety assessments are different in nature, and follow distinct processes, they need to be complementary. The integration of these two types of assessment is also necessary to consider any possible cross-interference between the two. Security deals with the intentional act to commit an act of unlawful interference, whereas safety is concerned with the management of hazards stemming from unintentional negative impact on the performance of the systems related to the operation. A comprehensive risk assessment process will address all potential actions involving implications for civil aircraft operations over or near conflict zones.

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Security assessments are, in general, more qualitative in nature as they need to determine threats based on the intent and capability of involved actors. Such assessments encompass the inclusion, validation and evaluation of available security intelligence and include determination on whether there is a credible threat of an intentional act of unlawful interference against a flight so as to jeopardize its safety. Where such intent cannot be determined, intelligence information about military capabilities may nonetheless be a valuable source for the identification of hazards that could pose an unintentional risk to civil aviation. The available information on existing threats and hazards is the necessary input to the risk assessment process which serves to inform decisions on whether to continue civil aircraft operations over or near conflict zones.

A complete risk assessment is based on an assessment of threat likelihood, consequence, vulnerability and hazards. However, when looking at the risk associated with flying over or near conflict zones, some general assumptions can be made. First, it can be assumed that the reasonable worst-case consequences of successfully downing a passenger aircraft are high, based upon the loss of life and economic repercussions of the attack.
Secondly, it can be assumed that for the vast majority of civil aircraft there are no mitigating actions available once it is on a dedicated flight path at cruising altitude when a SAM is deployed. Therefore, the most important risk factor when discussing conflict zones is the threat.

The threat likelihood, which is derived from looking at intent and capability of an attack when flying over or near a conflict zone, either intentional or otherwise, is the key driver of the risk assessment and will determine the mitigating actions to be taken, if any. Any mitigating actions to reduce vulnerability will need to take place prior to the flight reaching the conflict zone, so understanding the threat in advance of the operation is the key factor. As such, the risk assessment guidance will focus heavily on a prior threat assessment, starting with the collection of relevant information from any available sources.

For reference, risk assessment methodologies for all risk inputs threats, hazards, consequences, and vulnerabilities in addition to that the risk assessment guidance for security is contained in:

(a) ICAO Doc 10108, Aviation Security Global Risk Context Statement (Restricted);
(b) ICAO Doc 8973, Aviation Security Manual (Restricted), Appendix 37;
(c) ICAO Doc 9985, Air Traffic Management Security Manual (Restricted); and
(d) ICAO Doc 10084, Risk Assessment Manual for Civil Aircraft Operations Over or Near Conflict Zones.

Additional risk assessment guidance for safety is contained in ICAO's Safety Management Manual (SMM) (Doc 9859) and is complemented by the Safety Management Implementation (SMI) website which serves as a repository for the sharing of examples and tools.

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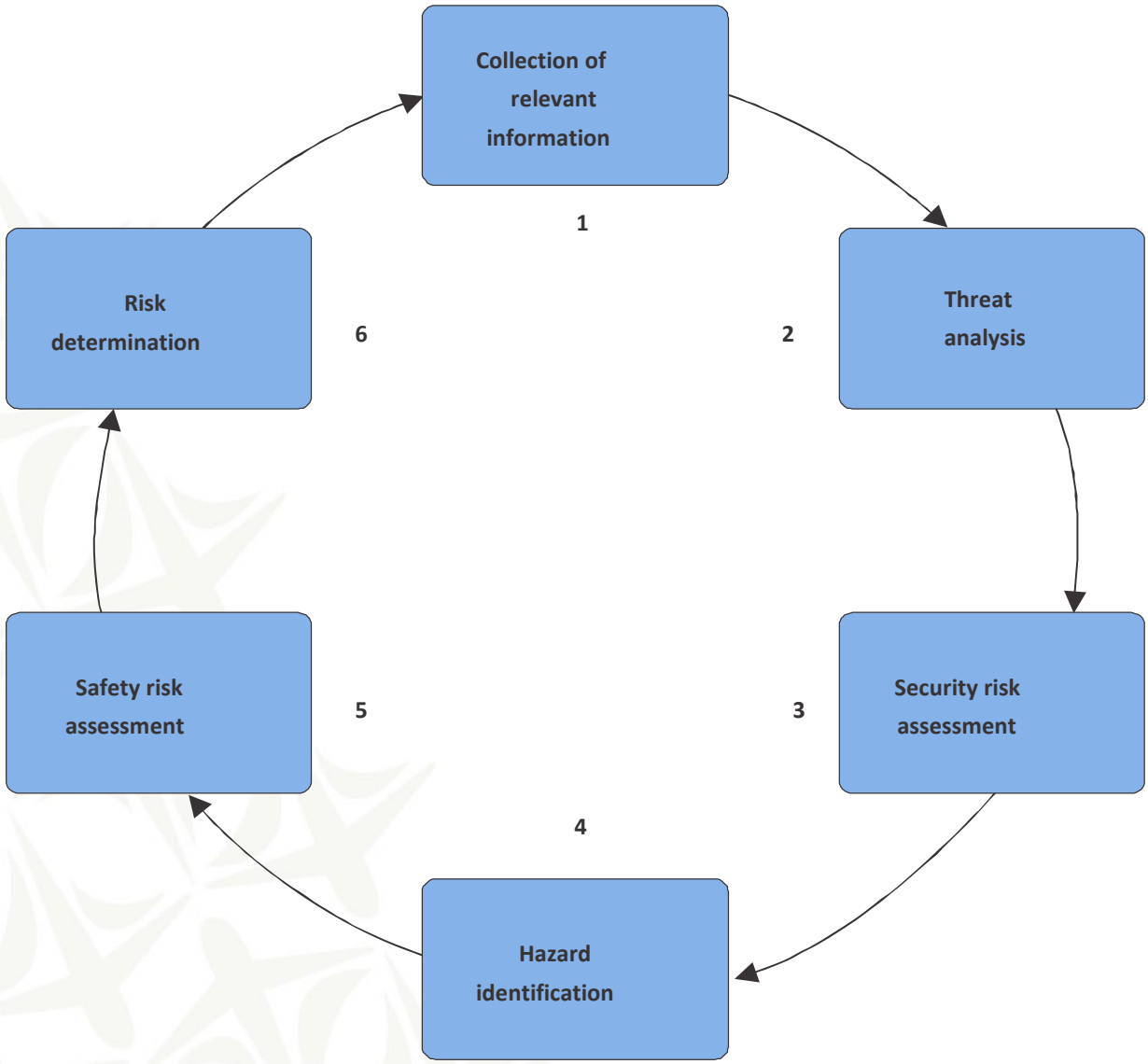
(ii) Risk assessment cycle

The collection of relevant information, the subsequent threat analysis, the security risk assessment, the hazard identification, the safety risk assessment, and lastly the risk determination constitutes necessary steps in the continuous risk assessment cycle (see Figure 1). This cycle involves specific processes and decisions to address all aspects of risk exposure. A detailed description and flow chart (Figure 2) of the process is outlined in the following section. Emphasis is placed on the ready availability of appropriate information which is a prerequisite for a functioning risk assessment process. The outcome is unique for each aircraft operator or service provider, based on individual risk tolerance.

(Figure 1) Risk assessment cycle



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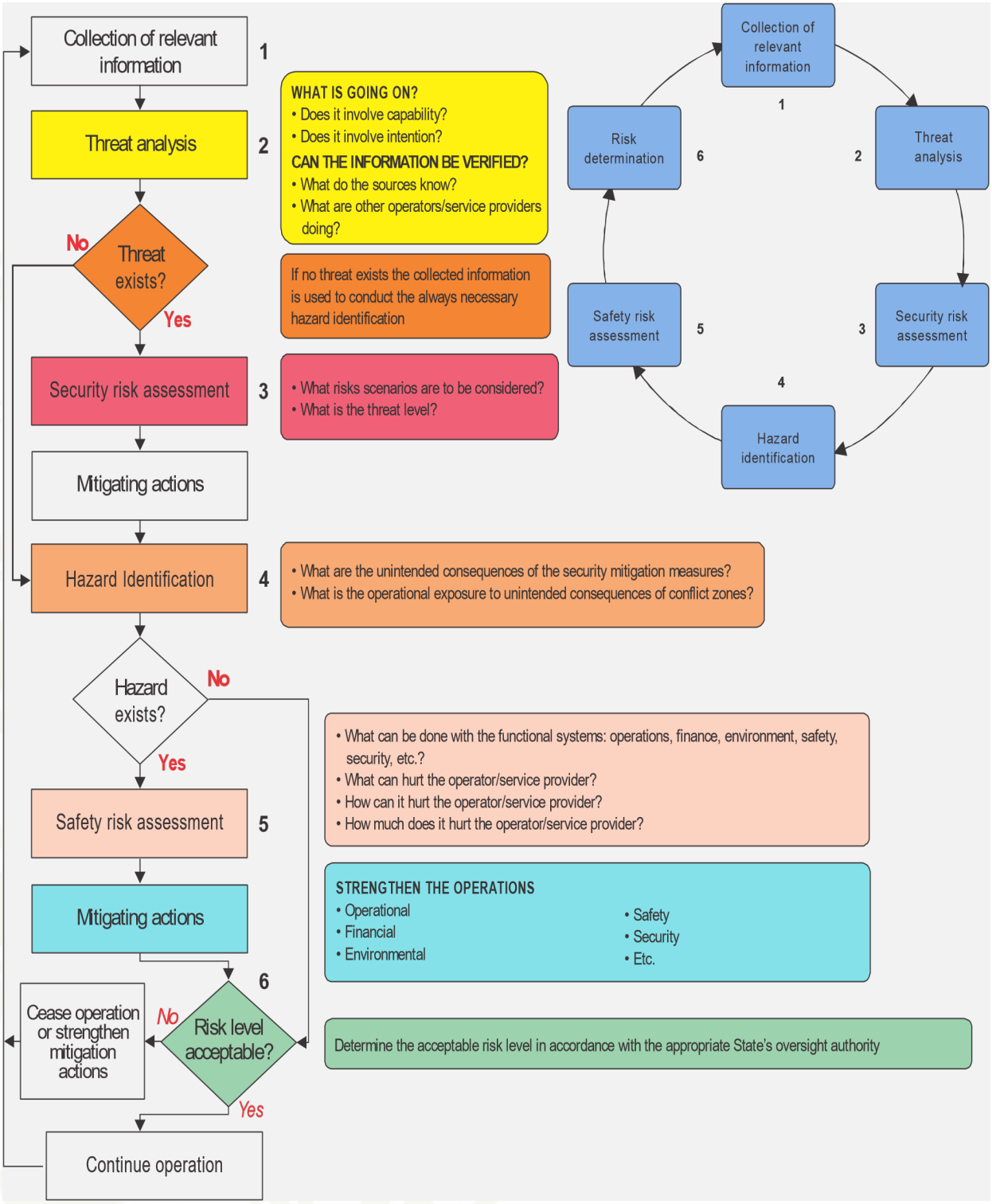
(Figure 2) Flow chart of the risk assessment cycle for operators



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8. COLLECTION OF RELEVANT INFORMATION

Relevant information and intelligence to determine existing threats and hazards may not always be readily available to States, aircraft operators, and Air Navigation Service Providers (ANSPs). States may obtain such information through direct intelligence gathering or through the exchange and sharing of such information with partner States. This information, where available and disseminated, should be the primary source for operators and service providers to conduct their own risk assessment, but should not be considered in isolation if other sources are available.

Aircraft operators and ANSPs may collect relevant information (Step 1 on the flow chart in Figure 2) through a variety of available formal and informal sources. There is a clear benefit to cross-validating available information in order to establish a comprehensive risk picture.

(i) Threat Analysis

Threat analysis focuses primarily on the evaluation of existing intent and capability, based on the information collected, to determine the presence of an intentional act of unlawful interference that could cause the loss of lives. The evaluation of likelihood may be inherently more difficult for threats than for hazards. This is because threat includes a component of intent which is generally not quantifiable, and therefore its assessment is based on qualitative narratives. In many cases information about intent may be classified, for example, because it comes from intelligence sources. Information about capability may also be security classified where it comes from intelligence or military sources; however, such information may to some extent be found in the public domain. Both quantitative and qualitative methods are available to this process, and a combination of historical data as well as scenario-building should be applied to appropriately assess likelihood. Qualitative methods can help to consider, for example, the likelihood of the threat increasing over time or uncertainties that need to be considered.

(ii) Hazard Identification

Any information gathered for the conduct of a threat analysis may also be used to identify hazards related to the operation over or near conflict zones. Hazards in this context relate to the operational exposure to unintended consequences emanating from areas with conflict. This includes the identification of existing operational hazards (e.g. weather, high terrain), but also hazards resulting directly from the conflicts (e.g. separation from military traffic, availability of air traffic services). Furthermore, the hazard identification process (Step 4) should also focus on the identification of any unintended consequences that may result from mitigating actions taken in response to an identified threat (e.g. fuel calculations to maintain higher single engine ceiling, or additional fuel for longer routings to avoid conflict zones.

(iii) Risk Assessment

The risk assessment process aims to determine the existing risk, focusing on likelihood, vulnerability and consequences of identified threats and hazards. However, as stated in Introduction for the security

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risk assessment the assumption can be made that the consequences of an aircraft being attacked by a SAM are likely to include the loss of the aircraft and all on board, as well as possible additional casualties on the ground and wider economic costs. Nor are the available mitigating actions and resulting vulnerabilities likely to vary. This is different for the safety risk assessment (Step 5) in terms of unintended consequences of mitigating actions against the threat as stated in hazard identification. Furthermore, the risk assessment process serves as a mechanism to determine the acceptability of the residual risk and to prioritize, identify and establish mitigating actions to lessen the risk. This will help to define if an operation can be continued or needs to be suspended.

There are several ways in which a risk assessment can be conducted. The specific process undertaken by a State, operator or service provider is dependent upon a number of factors, including resources, information that is available, and information that can be collected. Regardless of the risk methodology selected, there are certain characteristics that need to be met, including clearly defined risk inputs, a set scoring methodology for risk, and an understanding of what is an acceptable level of risk.

It is important that the initial assessment of the existing risk be based on the existing threats and hazards without considering any mitigation actions. This allows the determination of whether any measures can and should be applied to reduce the existing risk, and if so, which ones. Because risk assessment is a cyclical process, the residual risk needs to be evaluated in the same way as the initial risk assessment was conducted after any possible mitigation actions have been identified and their implementation factored in. It should be noted that consequences associated with hazards are determined in terms of severity and impact to the affected State, aircraft operators or service providers (Step 6). They should be evaluated by considering loss of lives and equipment, financial loss, reputational impact and other relevant factors.

The illustrative risk assessment process in Figure 2 is an inclusive mechanism to determine the correlated operational risk from operations over or near conflict zones and serves as enabler for an informed risk-based decision on the continuation of affected operations. The six components collection and sharing of relevant information, threat analysis, security risk assessment, hazard identification, safety risk assessment, and risk determination are complementary in nature and build on interfaces designed to address appropriately any unintended consequences of applied mitigation strategies. It is important to consider this process as a continuous mechanism that should be an ongoing activity. Emphasis is placed on the availability of appropriate information which is the prerequisite for a functioning risk assessment process.

The described risk assessment process is designed as a mechanism that is continuously applied to the relevant operation and initiated by changes in the operating environment or specific time intervals. Furthermore, the process is cyclical and does not conclude with the determination of risk acceptability. The outcomes of the assessment are re-integrated in the volume of available information and applied in the execution of the successive process.

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The outcome of the risk assessment process is individual for each operation and may vary between States and between operators and service providers based on the same information, for example, due to different risk acceptability. It is therefore important that the acceptable operational risk may need to be defined in a dialogue between the State and the operators and service providers under the State's oversight authority.

Additional mitigation actions may need to be developed where the determined operational risk level exceeds the organization's risk tolerance. Thus, if the determined operational risk is not acceptable, the process needs to identify effective and efficient measures to lower the risk to an acceptable level. These measures are intended to strengthen operation and should be implemented in the functional domain which is most relevant to the identified concern (e.g. a security-related high operational risk may best be addressed through the implementation of mitigating actions in the security domain, whereas a safety-related high risk can be addressed through measures in that domain).

However, as noted above, in the case of a potential SAM attack on civil aircraft, the only mitigation action available is likely to be avoidance of the affected airspace. At the same time, implementation of effective mitigating actions may create indirect vulnerabilities that must be monitored by the entity conducting the measures. For example, avoiding airspace over or near a conflict zone may cause greater air traffic in other flight routes, and any safety implications of that must be assessed. Additionally, flying at higher altitudes may require more fuel or a decrease in the aircraft payload. Understanding the costs, benefits, and toll on resources is a key factor when determining mitigation actions.

9. SECURITY RISK ASSESSMENT FACTORS, INFORMATION, SOURCES, METHODOLOGY AND CONCEPT

Key Risk Factors to Be Considered in Conducting A Risk Assessment for Operations over or near Conflict Zones:

(i) In order to assist the conduct of relevant, geographically-specific risk assessments by States or aircraft operators, the factors which seem most likely to be associated with an elevated level of risk in relation to an attack on overflying civil aircraft using SAMs are presented in this directive.

(ii) The risk of an unintentional attack against civilian aircraft is low, but will vary significantly from place to place as a result of events on the ground.

(iii) The local presence of SAMs is clearly a pre-condition for such an attack. However, complete and reliable information on the military deployment of SAMs will not be available in many cases. Also, their availability is widespread and growing, and many of them are highly mobile. This is therefore only likely to be a useful factor in assessing risk if their presence in an area can be ruled out with high confidence.

(iv) The existence of armed conflict, internal or external, in an area over which a flight is operating is a significant risk factor. This should be taken to include the threat of conflict where the parties are on a high state of military alert or heightened tension. At any given time, however, the areas (which may include areas over the high seas) that are subject to conflict may be numerous and widespread.

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(v) For this reason, it may be useful to identify more specific and refined criteria in assessing the risk of an unintentional attack. In that context, when flying over or near conflict zones where it may be assumed that SAMs are available to a party engaged in the conflict, the most important risk factors are considered to be:

(a) use of military aircraft in a combat role or for hostile reconnaissance by at least one party in the conflict. Increasingly this could include remotely piloted (unmanned) aircraft;

(b) use of aircraft to transport ground troops or military equipment by at least one party (such aircraft may be more difficult to distinguish from civil aircraft, particularly where operating near air corridors and close to civil aircraft cruising altitudes);

(c) poorly trained or inexperienced personnel operating SAMs. (This may also be associated with the absence of robust command and control procedures for authorizing launch and is likely to increase the risk of misidentification of civil aircraft.) This risk may be difficult to evaluate, but is likely to be the highest where SAMs may have been acquired by non-State actors;

(d) lack of effective air traffic management over the relevant airspace, for example, perhaps due to a conflict situation, or the State responsible for that airspace not being in full control of its own territory, or not able to fulfil its air traffic control, coordination and promulgation obligations; and

(e) routing passes over or close to locations or assets of high strategic importance that may be considered vulnerable to aerial attack in a conflict situation.

(vi) As noted above, knowledge that SAMs are in the possession of a terrorist group that is known or suspected to be likely to launch an intentional attack on civil aircraft would strongly indicate the need to avoid all airspace that may be within range of attack from areas where such groups are able to freely deploy them.

10. RELEVANT INFORMATION AND POSSIBLE SOURCES

(i) Bearing in mind the key risk factors identified to be taken into account when conducting a risk assessment, States or aircraft operators wishing to conduct their own assessment of the risk of flying over or near a particular zone of conflict or high tension may wish to understand:

(a) the types of military equipment available to the parties and, in particular, the likelihood that they may have access to SAMs. This might be evidenced by reporting of the use of missile attacks against military aircraft;

(b) the broader military capabilities of parties. Larger State military actors would be more likely to have access to SAMs and the training to use them. At the same time, they are likely to have more robust command and control regimes and be better trained in target identification than non-State actors;

(c) the nature of the conflict, and in particular whether one side was reported to be using, or was considered likely to use, air power against the other;

(d) indications or notifications of the loss of effective control over the relevant airspace by the State or organization responsible for providing air navigation services; and

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(e) specific areas or locations that may be of particular strategic importance or sensitivity in the context of the conflict, such as key infrastructure or sites of military importance, and which might therefore be considered as likely targets for air attack and are more likely to be guarded by SAMs.

(ii) Those who do not have reliable access to this sort of information may wish to consider subscribing to services provided by organizations that specialize in providing information and analysis about conflict and security issues. Some aircraft operators are known to be already using such information and analysis to inform their risk assessments.

(iii) Open source websites can also be used to gather relevant information that could be used in undertaking a risk assessment. In some cases, a membership is necessary to achieve full access.

11. SECURITY RISK ASSESSMENT METHODOLOGY AND CONCEPT

(Source: Doc 8973 – Aviation Security Manual - Restricted)

(i) A risk assessment method is described in this section. This method should assist States and relevant authorities in carrying out their own risk assessment of possible and/or potential concerns and threats in a logical, consistent and clear manner. The same methodology is used by the ICAO Global Risk Context Statement (RCS), which serves as a tool for developing evidence-based risk assessments and modifying possible mitigation actions that States may implement to achieve risk-based security programmes.

(ii) It is readily acknowledged that the responsibility for assessing the nature and level of threat to civil aviation within a State may be delegated to another entity, such as an intelligence service or a military component, and not to the civil aviation authority. This guidance material is provided primarily to assist States in meeting their requirements under Annex 17 to conduct risk assessment processes for civil aviation.

(iii) The described risk assessment method is comparable to existing good practices for risk management systems, adapted to take account of the particular issues associated with the threat from terrorism. The risk assessment process comprises three elements as follows:

(a) analysis of plausible threats, likelihoods and consequences;
(b) residual risk assessment; and
(c) recommendations for further risk-based work and possible mitigation.

(iv) The key components for completion of the risk assessment are:

(a) threat scenario identification and description of a credible attack comprising a target;
(b) likelihood of an attack the probability or likelihood of that attack being attempted, based on terrorist intentions and capabilities but NOT considering current security measures;
(c) consequences the nature and scale of the consequences of the specific attack, in human, economic, political and reputational terms under a reasonable worst-case scenario;

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(d) current mitigating measures the relevant SARPs (which may not all be in Annex 17 and which it is normally assumed are being effectively applied; where that is clearly not the case, the residual risk will be higher), national civil aviation security programmes (NCASPs), aviation security programmes (ASPs) and any other factors which assist in mitigating the threat. It is assumed that no threat can be entirely mitigated;

(e) residual vulnerability the extent of the remaining vulnerabilities once the current mitigating measures have been considered;

(f) residual risk the overall risk which remains, assuming current mitigating measures have been implemented, taking account of threat likelihood and consequences; and

(g) possible additional mitigation identified measures that Member States, ICAO or others may implement to further mitigate residual risks where necessary.

(v) It is important that the risk assessment identify the possible or potential scenarios carefully, being specific and thorough in considering each form of threat. Threats could be directed at air traffic control facilities or navigational equipment, as well as aircraft, including different forms of aviation, such as general aviation, passenger aircraft and cargo-only aircraft. The means and methods by which a threat could be carried out should also be evaluated. This would include how a weapon or explosive device could be constructed or concealed, the means by which it might be conveyed (e.g. whether person- or vehicle-borne) and by whom (e.g. a staff member, passenger or member of the public), how it could be concealed, and how it could be activated or utilized in order to perpetrate an act of unlawful interference.

(vi) Likelihood, consequences and vulnerability may be scored on a five-point scale from HIGH to LOW. The general meanings of the scores, in each case, are given below.

(vii) For likelihood:

(a) HIGH means a very plausible scenario, with an actual attack of this kind having occurred in the past few years, or strong evidence of capability, intent and planning;

(b) MEDIUM-HIGH means a clearly plausible scenario, with relatively recent examples or evidence of early attack planning or hostile reconnaissance;

(c) MEDIUM means an essentially plausible scenario, with some evidence of intent and capability and possibly some examples, but no evidence of current attack planning;

(d) MEDIUM-LOW means a scenario for which there are no, or no recent, examples, but some evidence of intent, yet with a method apparently not sufficiently developed for a successful attack scenario or probably superseded by other forms of attack; and

(e) LOW means a theoretically plausible scenario but with no examples or signs of attack or attack planning, and a theoretical intent but no apparent capability.

(viii) For consequences, the scores mean that, in a realistic worst-case scenario, the consequences can be expected to be along the lines in Table A-1.

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TABLE A-1. CONSEQUENCES UNDER EACH LIKELIHOOD CATEGORY

CONSEQUENCES			
LIKELIHOOD	**HUMAN**	**ECONOMIC**	**OTHER**
HIGH (rated as 9 or 10)	Hundreds of deaths	Billions of dollars	Severe disruption to services and confidence in the aviation system
MEDIUM-HIGH (rated as 7 or 8)	Some but not all of the HIGH consequences above		
MEDIUM (rated as 5 or 6)	Tens of deaths	Tens or hundreds of millions of dollars	Substantial disruption to services and confidence in the aviation system
MEDIUM-LOW (rated as 3 or 4)	Some but not all of the MEDIUM consequences above		
LOW (rated as 1 or 2)	Possibly some deaths and injuries	Some economic impact	Some disruption to services and confidence in the aviation system

(ix) For vulnerability:

(a) HIGH means no mitigating measures are in general effect, either because there is no Annex 17 requirement or because no realistic effective measures are available;

(b) MEDIUM-HIGH means that mitigation has a limited scope and that important areas and aspects of the risk are not covered by Annex 17, NCASPs and ASPs requirements or measures in general effect;

(c) MEDIUM means that features of both MEDIUM-HIGH and MEDIUM-LOW are present;

(d) MEDIUM-LOW means that mitigating measures are generally in place, but they may be immature or only partially effective. For instance, the broad national requirements may be in place for all areas and aspects, but they are capable of being further developed or better implemented in practice; and

(e) LOW means that clear Annex 17, National civil aviation security programme (NCASPs) and/or aviation security programme (ASPs) requirements exist and that mitigating measures generally regarded as effective are in widespread use.

(x) Residual risk is assessed on a five-point scale. The ranking is derived from the other scores, and it involves some elements of judgement as well as the aggregation of the scores assigned to likelihood, consequences and vulnerability. Scores assigned to each of the aforementioned parameters reflect a consensual analysis based on the information currently available – reflecting the fact that there is generally limited data to draw upon. The mathematical formula used to calculate residual risk in this methodology is presented in the Table A-2.

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Table A-2

	Threat (T)		Consequence (C)		Vulnerability (V)	Risk Score	Risk Rating
HIGH	9-10	+	9-10	+	9-10	25.6 to 30	HIGH
MEDIUM-HIGH	7-8	+	7-8	+	7-8	19.6 to 25.5	MEDIUM-HIGH
MEDIUM	5-6	+	5-6	+	5-6	13.6 to 19.5	MEDIUM
MEDIUM-LOW	3-4	+	3-4	+	3-4	7.6 to 13.5	MEDIUM-LOW
LOW	1-2	+	1-2	+	1-2	3.0 to 7.5	LOW

(xi) If the obtained risk rating after applying the calculation formula is not aligned with common knowledge of what the residual risk should look like for a particular scenario, the assessment of each parameter's score for a particular scenario can be reviewed, and adjusted if necessary. If, after this review, any of the parameter assessments are modified, the mathematical formula should be applied again using the updated scores.

(xii) Table A-1 illustrates the threat and risk assessment process, which starts by identifying the threat and then determines the associated residual risk. The following steps consist of designing and implementing appropriate mitigating measures in order to lower that residual risk to an acceptable level. The process ends when the risk associated with a specific threat, for which new measures were implemented, reaches an acceptable level. It begins again when any aspect of the analysis changes.

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12. SAFETY RISK ASSESSMENT METHODOLOGY

(Source: ICAO Doc 9859 – Safety Management Manual)

(i) Safety risk probability

Safety risk probability is the likelihood that a safety consequence or outcome will occur. It is important to envisage a variety of scenarios so that all potential consequences can be considered. The following questions can assist in the determination of probability:

(a) Is there a history of occurrences similar to the one under consideration, or is this an isolated occurrence?

(b) What other equipment or components of the same type might have similar issues?

(c) What is the number of personnel following, or subject to, the procedures in question?

(d) What is the exposure of the hazard under consideration? For example, during what percentage of the operation is the equipment or activity in use?

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Taking into consideration any factors that might underlie these questions will help when assessing the probability of the hazard consequences in any foreseeable scenario.

An occurrence is considered foreseeable if any reasonable person could have expected the kind of occurrence to have happened under the same circumstances. Identification of every conceivable or theoretically possible hazard is not possible. Therefore, good judgment is required to determine an appropriate level of detail in hazard identification. Service providers should exercise due diligence when identifying significant and reasonably foreseeable hazards related to their product or service.

Table B-1 presents a typical safety risk probability classification table It includes five categories to denote the probability related to an unsafe event or condition, the description of each category, and an assignment of a value to each category. This example uses qualitative terms; quantitative terms could be defined to provide a more accurate assessment. This will depend on the availability of appropriate safety data and the sophistication of the organization and operation.

Table B-1. Safety risk probability table

Likelihood	Meaning	Value
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**

Note. — This is an example only. The level of detail and complexity of tables and matrices should be adapted to the particular needs and complexities of each organization.

(ii) Safety risk severity

Once the probability assessment has been completed, the next step is to assess the severity, considering the potential consequences related to the hazard. Safety risk severity is defined as the extent of harm that might reasonably be expected to occur as a consequence or outcome of the identified hazard. The severity classification should consider:

(a) fatalities or serious injury which would occur as a result of:

- being in the aircraft;
- having direct contact with any part of the aircraft, including parts which have become detached from the aircraft; or
- having direct exposure to jet blast; and
- damage.

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(b) damage or structural failure sustained by the aircraft which:

(a). adversely affects the structural strength, performance or flight characteristics of the aircraft;
(b). would normally require major repair or replacement of the affected component;

(c) damage sustained by ATS or aerodrome equipment which:

(a). adversely affects the management of aircraft separation; or
(b). adversely affects landing capability.

The severity assessment should consider all possible consequences related to a hazard, considering the worst foreseeable situation. Table B-2 a typical safety risk severity table. It includes five categories to denote the level of severity, the description of each category, and the assignment of a value to each category. As with the safety risk probability table, this table is an example only.

(iii) Example of a safety risk assessment methodology

Table B-2. Example safety risk severity table

Severity	Meaning	Value
Catastrophic	• Aircraft/equipment destroyed • Multiple deaths	**A**
Hazardous	• A large reduction in safety margins, physical distress or a workload such that operational personnel 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 operational personnel 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**

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(iv) Safety risk tolerability

The safety risk index rating is created by combining the results of the probability and severity scores. In the example above, it is an alphanumeric designator. The respective severity/probability combinations are presented in the safety risk assessment matrix in Table B-3. The safety risk assessment matrix is used to determine safety risk tolerability. Consider, for example, a situation where the safety risk probability has been assessed as Occasional (4), and the safety risk severity has been assessed as Hazardous (B), resulting in a safety risk index of (4B).

Table B-3. Example safety risk matrix

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

Note. — In determining the safety risk tolerability, the quality and reliability of the data used for the hazard identification and safety risk probability should be taken into consideration.

(a) The index obtained from the safety risk assessment matrix should then be exported to a safety risk tolerability table that describes — in a narrative form — the tolerability criteria for the particular organization. Table B-4 presents an example of a safety risk tolerability table. Using the example above, the criterion for safety risk assessed as 4B falls in the “intolerable” category. In this case, the safety risk index of the consequence is unacceptable. The organization should therefore take risk control action to reduce:

- the organization’s exposure to the particular risk, i.e., reduce the probability component of the risk to an acceptable level;
- the severity of consequences related to the hazard, i.e., reduce the severity component of the risk to an acceptable level; or
- both the severity and probability so that the risk is managed to an acceptable level.

(b) Safety risks are conceptually assessed as acceptable, tolerable or intolerable. Safety risks assessed as initially falling in the intolerable region are unacceptable under any circumstances. The probability and/or severity of the consequences of the hazards are of such a magnitude, and the damaging potential of the hazard poses such a threat to safety, that mitigation action is required or activities are stopped.

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Table B-4. Example of safety risk tolerability

Safety Risk Index Range	*Safety Risk Description*	*Recommended Action*
5A, 5B, 5C, 4A, 4B, 3A	**Intolerable**	Take immediate action to mitigate the risk or stop the activity. Perform priority safety risk mitigation to ensure additional or enhanced preventative controls are in place to bring down the safety risk index to tolerable.
5D, 5E, 4C, 4D, 4E, 3B, 3C. 3D, 2A, 2B, 2C, 1A	**Tolerable**	Can be tolerated based on the safety risk mitigation. It may require management decision to accept the risk.
3E, 2D, 2E, 1B, 1C, 1D, 1E	**Acceptable**	Acceptable as is. No further safety risk mitigation required.

13. RECOMMENDATIONS

Even if it is currently not possible to totally avoid flights in and over conflict zones, in principle ECA objects to those flights because of the associated inevitable increased risks. In order to keep the risks as low as possible, CAA Oman recommends:

(i) It is advising airlines to avoid such airspaces because of the high risk that an aircraft could be shot down by mistake.

(ii) Flights over and into conflict zones cause a significant reduction in safety and security and involve the risk of collateral damage. These flights should in principle be avoided and only be conducted after a thorough risk assessment and the implementation of appropriate mitigation measures.

(iii) Where conflict zones are overflown, to conduct a risk assessment and to take appropriate risk mitigation measures to ensure a safe and secure flight and that appropriate risk mitigation measures are implemented.

(iv) Notices to Airmen (NOTAM) and other communications containing necessary information and advice should be updated and passed to the flight crew in real-time. Long term information about such conflict zones should not be taken out of NOTAMs or should be distributed to flight crews in a different way.

(v) To fully support the Commander in his/her responsibility, the airline should pass on all relevant security information in a mandatory, detailed and timely manner. This applies in particular to short-term changes in risk factors before and during the flight and when crews may be in or close to those areas of conflicts. Furthermore, training should be implemented in dealing with specific dangers related to flights into and over conflict zones.

(vi) The final responsibility for the actual routing always lies with the Commander, who is responsible for the safety and security of passengers, crew and the aircraft, based on the flight crews' assessment of

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information provided by the airline during the briefing and inflight, (ICAO Annex 6, Part II, Chapter 3.2). If in doubt as to the acceptable level of risk, caution should take precedence.

(vii) In addition, the final responsibility of the Commander about the conduct of the flight or any change to its routing should never be challenged, e.g., by the open or indirect threat of sanctions and his/her decision should not be influenced by economic pressure. This should be explicitly spelled out in an airline's safety policy and be clearly communicated in the above-mentioned training.

(viii) Operators should take all relevant information into account in their own risk assessments, alongside any available guidance or directions from their national authority as appropriate.

(ix) Closely monitored latest operational information on 'Closures and warnings' issued by means of ICAO State Letters, NOTAMs, AICs/AIPs, EASA CZIB.

(x) Aircraft operator in determining the flight routes to use, aircraft operators should as a matter of best practice ensure that flights will not commence unless risk assessments are carried out and appropriate mitigation actions are taken to ensure the safety and security of the aircraft on the intended route from the aerodrome of departure to the aerodrome of arrival, including the intended take-off, destination, En-route alternate aerodromes and aircraft in emergency requiring a landing. This includes assessing the airspace over or near areas where there is armed conflict posing a risk to civil aviation. In planning the conduct of operations through areas of armed conflict or the potential for armed conflict, operators should give due regard to (but not be limited to):

(a) any additional fuel required for in-flight diversion out of the conflict area;
(b) any deferred item in accordance with the minimum equipment list, if applicable for take-off and departure from the conflict zone without refueling;
(c) consideration of emergency and non-normal procedures, such as depressurization and engine failure;
(d) availability and serviceability of aircraft equipment needed to facilitate identification of the aircraft by military units;
(e) use of procedures and means to ensure that pertinent authorities are advised of flight plan; and
(f) ensuring monitoring of the appropriate frequencies.

(xi) The absence of any restrictions in foreign airspace should not preclude the operator from making its own determination on the safety/security risks of the airspace to be flown through. Various information sources can be used (e.g. government advisories, other aircraft operators, open-source intelligence) including in-house departments tasked with flight route management.

(xii) Operators have a need to know of any airspace restrictions or (potential) hazards/threats that affect the safety of their operations. This material includes available information and recommendations on conflict zones which should be incorporated into their risk assessment and decision-making processes. Operators should furthermore share their own risk assessment information with their national authorities and are encouraged to share this information with other operators and service providers.

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(xiii) The operator should ensure that there is a mechanism to facilitate the necessary information, and advice is updated and passed to the pilot-in-command in real time. While this information can nearly always be provided before take-off, in some instances, because of rapidly changing circumstances, it must be provided in-flight in a similar way as information is provided en-route for in-flight re-planning, as this could result in a change to the intended route.

(xiv) Flight crews should maintain extra vigilance when operating over, or near, the area of an armed conflict. For example, maximum effort should be taken to facilitate identification of the aircraft by military units (i.e. weather radar, transponder, radio altimeter, lighting) and ensure that appropriate radio communication frequencies are monitored.

14. RISK REGISTER

A risk register shall be maintained in accordance with CAR 100 Appendix 8 – Safety Risk Register Form.

15. COMPLIANCE REQUIREMENT

Compliance to this directive is imperative. Operators regulated under the Oman Civil Aviation Authority shall continue to obtain approvals from Flight Safety Department and Aviation Security and Facilities Department, respectively, for Risk Assessment and to finally Operate Civil Aircraft over or near Conflict Zones. The Operators shall continue to comply with all existing regulations and directives stipulated by CAA Oman pertaining to Civil Aircraft Operations over or near Conflict Zones.

16. COMPLIANCE TIMELINE:

This directive is effective from 1st July 2024 and compliance is a continuous process for enhancement.

17. REFERENCE DOCUMENTS:

- Civil Aviation Regulation-100 – Safety Management System
- National Civil Aviation Security Program (Restricted)
- National Security Risk Assessment Methodology (Restricted)
- ICAO Doc 10084, Risk Assessment Manual for Civil Aircraft Operations over or near Conflict Zones.
- ICAO Doc 9859, Safety Management Manual
- ICAO Doc 8973, Aviation Security Manual (Restricted)
- ICAO Doc 9985, Air Traffic Management Security Manual
- List of active Conflict Zone Information Bulletin (CZIB's)

18. NOTE:

For any question concerning the technical or procedural content of this directive, please contact the Flight Safety Department pertaining to Flight Safety and Aviation Security Department pertaining to Aviation Security and Facilities Department, respectively.

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