



**WORKING PAPER**

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PLANNING FOR GLOBAL AVIATION SAFETY IMPROVEMENT**

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**Theme 1: Reviewing the current situation**

**Topic 1.2: Emerging safety issues**

**REPORT ON THE DEVELOPMENT OF BEST PRACTICE GUIDANCE  
FOR CONDUCTING AND SHARING RISK ASSESSMENTS**

(Presented by the ICAO Secretariat)

**SUMMARY**

This paper summarizes the work carried out in developing best practice guidance for conducting and sharing risk assessments for civil aircraft operations over or near conflict zones, as one of the key recommendations of the Task Force on Risks to Civil Aviation arising from Conflict Zones (TF RCZ), which convened three meetings in Montréal, between August and December 2014.

**Action:** The conference is invited to:

- a) note the risk advice and best practice guidance contained in the appendix to this paper;
- b) urge States, air navigation service providers and operators to share risk information, particularly as it relates to the risk of overflying conflict zones; and
- c) recommend that ICAO continue to refine and update existing guidance material on risk assessment of civil aircraft operations over or near conflict zones.

**1. INTRODUCTION**

1.1 The Task Force on Risks to Civil Aviation arising from Conflict Zones (TF RCZ), which held its first, second and third meetings on 14-15 August, 25-26 August and 1-2 December 2014 underscored the importance of having robust arrangements in place to identify, assess and share information on, and respond to risks to civil aircraft from activities in conflict zones. It further recommended that best practice guidance for conducting and sharing risk assessments be developed for the benefit of States, air navigation service providers and industry.

**2. DISCUSSION**

**2.1 Risk advice developed by the Working Group on Threat and Risk**

2.1.1 In developing best practice guidance, as recommended by the TF RCZ, the Secretariat sought advice from the Aviation Security Panel Working Group on Threat and Risk (WGTR), in

accordance with its Terms of Reference to “provide risk assessment advice to ICAO and its Aviation Security Panel as needed”. The risk advice contained in the appendix was produced by the WGTR and draws on the knowledge and access to information of members of the WGTR, and on the risk assessment methodology developed by the group for assessing global security risks to civil aviation, as presented in the ICAO *Aviation Security Global Risk Context Statement (RCS)*. It includes:

- a) key risk factors to be taken into account in conducting risk assessments (Annex A);
- b) a brief summary of relevant information regarding key risk factors, and possible sources of information (Annex B);
- c) the risk assessment methodology used by the WGTR in developing advice contained in the appendix (Annex C); and
- d) a glossary of terms used in WGTR’s risk advice (Annex D).

2.1.2 As a working group of the Aviation Security Panel, the WGTR will report to the panel at its forthcoming meeting from 13 to 17 April 2015, at that time the attached material will be reviewed, finalized, and subsequently reported to the ICAO Council during its 205th Session. A final version of the WGTR’s risk advice will be incorporated in the next edition of the RCS.

## 2.3 Best practices shared by States

2.3.1 In order to ensure that the development of guidance material takes into account existing best practices on conducting and sharing risk assessments for operations over or near conflict zones, States were invited, through letter SMM 1/4-14/74 dated 15 October 2014, to share relevant information with ICAO by 3 November 2014. The letter generated 21 replies from Member States. The responses received indicate a varied approach to conducting and sharing risk assessments, while generally meeting the objectives of Standard 3.1.3 of Annex 17 — *Security*. Such best practices shared by States are being considered by ICAO in the development of new and/or revised guidance on risk assessments for civil aircraft operations conducted over or near conflict zones. As discussed in HLSC/15-WP/13, options are being explored with regard to a centralized platform on which authorized aviation officials can share relevant information on airspace use restrictions and other security matters.

2.3.2 The following are some general observations of best practices shared by States:

- a) the establishment at the State level of a multi-agency threat assessment centre, with participation from the civil aviation authority and the appropriate authority for civil aviation security, can ensure that civil aviation risk assessment takes into consideration the broadest possible range of relevant information, including security intelligence and air transport information;
- b) a focal point may be established within the national administration to function as the single contact for the communication of risk assessment information from the national security community to industry;
- c) risk assessment, including conflict zone risk assessment, should be carried out at appropriate intervals. For example, annual assessments may be satisfactory to establish risk at the strategic or contextual level whereas more frequent risk assessment may be appropriate when a specific threat is involved or when relevant information is quickly changing;

- d) industry must conduct its own risk assessments as part of operational planning to inform decision making, such as with respect to flight routing. To assist in this process, national authorities should share the results of risk assessments with industry. Granting security clearances to industry officials may facilitate the sharing of classified or sensitive information. On-line information platforms, face-to-face meetings and telephone calls are among the available means by which to communicate risk assessment information;
- e) State policy, legislation, regulations and procedures can set out the framework for risk assessment information sharing; and
- f) the sharing of risk assessment information may be conducted State to State, from State authorities to industry, and from industry to State authorities. Industry to State risk assessment information sharing can help ensure that operationally derived information is fully taken into account in risk assessment.

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## APPENDIX

### **Advice from the ICAO Working Group on Threat and Risk (WGTR) to the ICAO Secretariat, as a contribution to the work of the ICAO Task Force on risks to Civil Aviation Arising from Conflict Zones (TF RCZ)**

#### **Purpose and Scope**

1. This paper provides advice on the risks for civil aviation of overflying conflict zones at cruising altitudes. It covers the risk from both deliberate and unintentional attacks on civil aircraft.
2. Noting the fact that it is the responsibility of States to notify hazards in the airspace that they manage, and to coordinate activities so as to minimize any such hazards, the paper seeks to **provide broad advice on the global risks to civil aviation**, and from this to **identify the main risk factors** that could be taken into account by States or airlines or Air Navigation Service Providers (ANSPs) in conducting their own more geographically specific risk assessments. These are presented in Annex A. A brief summary of relevant information regarding these risk factors, and possible sources of information, is presented in Annex B. Notes on methodology and concepts, and on other terminology used in this paper are presented in further annexes.
3. The paper focuses primarily on long-range surface-to-air missiles (SAMs) as they are considered to represent the most significant risk of attack. However, some of the considerations and conclusions would apply also to air-to-air missiles launched from fighter aircraft, and these are covered briefly at the end of the paper.
4. It does not cover the risk that arises at lower altitudes (including during take-off and landing phases) from shorter-range SAMs such as Man-Portable Air Defence Systems (MANPADS), which has been the subject of other assessments, although many of the considerations may be the same.
5. This advice draws on the knowledge and access to information of members of the WGTR, and on the risk assessment methodology developed by the group for assessing global security risks to aviation as presented in the ICAO Risk Context Statement. It does not necessarily represent the views of States or organizations to which members of the group belong.

#### **Surface-to-air missiles – capability and proliferation**

6. The principal weapons of concern for these purposes are those SAMs with the capability of reaching aircraft at cruising altitudes (which for these purposes are taken to be altitudes in excess of 25 000 feet above ground level). These are large, expensive and complex pieces of military equipment, which are designed to be operated by trained personnel.
7. There are many different types of systems, with varying capabilities and technologies, but they are all designed to track and destroy military targets in flight. In this context, civil aircraft – due to their size, speed and predictable flight paths – represent a relatively easy and highly vulnerable target.
8. Many SAMs are mobile and can be moved quickly between locations. Some have radar systems integrated; others need to be linked to a separate radar system to identify targets. Many SAMs are located on warships.

9. The WGTR assesses that more than 70 States around the world have acquired SAMs as part of their military capability. Other States are interested in acquiring them and there are several ready suppliers, so this number is likely to continue to increase over time. Where older SAMs are currently deployed, they are likely, over time, to be replaced by more advanced and more mobile systems.

10. It is unlikely that non-State actors will have acquired SAMs direct from manufacturers, but the WGTR assesses that a small number of non-State actors may well have acquired them indirectly. These may either have been passed to them by States, or acquired through the seizure of former State assets during or following conflict situations. In either case, they could only be operated as designed – for example, with use of radar to identify the intended target - by fully trained personnel with all the necessary equipment.

### **The historic threat to civil aviation**

11. SAM attacks on civilian airliners are extremely rare. So far as the group has been able to establish, there are three documented instances where the destruction of civilian airliners has been attributed to SAM attacks (other than MANPADS), one of which occurred below cruising altitude. There may, of course, have been other launches against civil aircraft that missed their target.

12. In each of the documented cases it is likely the event was **unintentional** – i.e. the intent was not to destroy a civilian airliner. The likelihood, in all cases, is that the intended target either was, or had been, mistakenly identified as a military aircraft or remotely piloted (unmanned) aircraft. Two of the known events occurred during periods of military conflict or high tension; the third appears to have occurred during a military training exercise.

13. The WGTR has been unable to identify any documented cases of an **intentional** SAM attack on a civilian aircraft.

### **The risk of intentional attack**

14. 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.

15. So far as the WGTR is able to establish, none of these terrorist groups currently have access to long-range SAMs (as distinct from MANPADS).

16. However, in making this assessment it is important to stress that:

- a) there is a high level of intent among some of these groups to attack aviation and therefore a strong likelihood that they would attempt to use SAMs in this way should the opportunity arise;
- b) some of these terrorist groups are thought to have sufficient resources to acquire SAMs - though they would find it difficult to do so, or to deploy them, without sponsorship and training from States;
- c) this position could change rapidly given the fluidity of current political and military events in some regions; and

d) this assessment is based on the information available to members of the group and may not be complete.

17. Such terrorist groups tend to operate more freely in areas of conflict where there is a breakdown of State control. Should they at some point succeed in acquiring SAMs, and the capability to operate them, the vulnerability of aircraft using airspace over those areas would be high. The ability to identify and target specific aircraft or airlines with some reliability would be relatively straightforward. The risk to civil aircraft in those circumstances could immediately become high.

18. With regard to the States and non-State actors who do currently have access to SAMs, there is no reason to believe that the intent currently exists deliberately to target civil aviation. However, the last two caveats in paragraph 16 above also apply here.

19. Overall, the WGTR would assess the current risk from intentional attack as **low**, primarily due to the fact that where intent may exist there is currently no evidence of capability (in terms of hardware and trained personnel). However, this situation could change and should be monitored closely.

20. Possible mitigations for this risk would include:

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

### **The risk of unintentional attack**

21. Past events would suggest there is a higher risk to civil aviation from unintentional attacks, in particular deliberate firing of missiles where the target is perceived as a military aircraft, but which either miss their intended target or are based on the misidentification of a civil aircraft.

22. However, as noted above, such events are rare. And here again there is a mismatch between intent and capability – in this case capability is high and widespread, but there is no evidence of any intent.

23. There are also well-established mitigations in place through existing airspace management, surveillance, navigation and communication systems which, if they are operating correctly, should enable civilian aircraft flying through controlled airspace to be readily identified.

24. Therefore at the global level the WGTR would assess that the risk of unintentional attack is also **low**.

25. 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.<sup>1</sup> In view of this, the group has attempted to identify the specific factors which seem most likely to be associated with an elevated level of risk in relation to an unintentional SAM attack on a civil aircraft with a view to the possible provision of guidance to States, carriers and ANSPs on undertaking their own, geographically specific risk assessments. These are presented in Annex A.

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<sup>1</sup> It is worth noting in this context that in the case of MANPADS the Risk Context Statement already differentiates between areas of conflict and proliferation, where the residual risk is assessed to be medium-high, and elsewhere, where the risk is assessed as medium-low.

26. Possible mitigations for this risk would include:

- a) conduct of specific risk assessments by States and/or airlines and/or ANSPs to inform routing decisions regarding operating over conflict zones or other areas of high tension and/or sensitivity;
- b) provision by ICAO and/or States and/or other bodies of guidance, and appropriate information (including information about the results of others' assessments), that would assist in making those risk assessments or in making routing decisions; and
- c) avoidance by civil aviation of airspace over conflict zones where the risk of unintentional attack is assessed as unacceptably high.

27. There could also be some risk of unintentional attacks on civil aviation from SAM test or training launches, and as noted above, there is evidence that at least one such incident has occurred in the past. However, it is understood that large numbers of such launches take place each year without incident. The risk from these is considered to be low provided they are conducted in closed airspace, as is usually the case, and with robust planning and supervision.

#### **Air-to-air attacks**

28. The group has also briefly considered the risk of attacks on civil aircraft, from air-to-air missiles launched by military aircraft. The risk factors (and mitigations) associated with unintentional attack due to misidentification of civilian aircraft flying in combat zones or zones of high tension/sensitivity would be broadly similar to those for SAMs, except that:

- a) military aircraft are less likely to be available to non-State actors; and
- b) military pilots are considered less likely to misidentify a civilian aircraft as a military target.

29. Such air-to-air attacks could also occur as a deliberate act where a civilian aircraft is perceived by State authorities as a potential means of terrorist attack, usually because it has reported an incident on board (e.g. breach of the cockpit or hijack), or is exhibiting suspicious behaviour (e.g. not communicating with Air Traffic Control or deviating from its filed flight plan). The risk of terrorists successfully commandeering aircraft for use as a weapon is currently assessed by the group as medium-low, as reflected in the RCS, and instances of failed communication, which occur relatively frequently, are normally resolved successfully by use of standard intervention procedures.

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**Annex A****Key risk factors to be taken into account in conducting a risk assessment**

1. In order to assist the conduct of relevant, geographically specific risk assessments by States or airlines, the group has considered the factors which seem most likely to be associated with an elevated level of risk in relation to an attack on over-flying civil aircraft using SAMs.
2. As noted above, 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.
3. 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. And as noted above, 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 clearly ruled out.
4. 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 (see Annex D). However, at any given time the areas (which may include maritime areas) that are subject to conflict may be numerous and widespread. Again, therefore, this may not in itself represent a very useful factor for use in risk assessments.
5. The group has therefore attempted to identify more specific and useful criteria for an unintentional attack. In that context, **when overflying areas of conflict 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 the other party in the conflict. Increasingly this could include remotely piloted (unmanned) aircraft;
  - b) **use of aircraft to transport ground troops or military equipment** by the other party (such aircraft may be more difficult to distinguish from civil airliners, particularly where operating near air corridors and close to airline cruising altitudes);
  - c) **poorly trained or inexperienced personnel** being used to operate SAMs. (This may also be associated with 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 highest where SAMs may have been acquired by **non-State actors**;
  - d) **lack of effective air traffic management** over the relevant airspace, for example because, perhaps due to a conflict situation, the State responsible for that airspace is not in full control of its own territory, or is not able to fulfil its appropriate authority oversight and control 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.



6. As noted above, knowledge that **SAMs were 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 avoidance of any airspace that might be within range of attack from areas where such groups were able freely to deploy them.

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**Annex B****Relevant information and possible sources**

1. Bearing in mind the risk factors identified in Annex A, States or airlines wishing to conduct their own assessment of the risk of overflying a particular zone of conflict or high tension would ideally 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) 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; and
  - e) indications or notifications of the loss of effective control over the relevant airspace by the State or organization responsible for providing air navigation services.
2. Those who do not have reliable access to this sort of information may wish to consider subscribing to services provided by certain organizations that specialize in providing information and analysis about conflict and security issues. Some airlines are known to be using these already to inform their risk assessments.
3. 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. Below is an extract from a longer list that has been supplied to the ICAO Secretariat. (NB: this is NOT an exhaustive list and no assessment is offered of the accuracy and completeness of the information provided).
  - [www.janes.com](http://www.janes.com)
  - [www.siteintelgroup.com](http://www.siteintelgroup.com)
  - <https://acd.iiss.org>
  - [www.crisisgroup.org](http://www.crisisgroup.org)
  - [www.fas.org](http://www.fas.org)
  - [www.dhs.gov](http://www.dhs.gov)
  - [www.stratfor.com](http://www.stratfor.com)
  - [www.ict.org.il](http://www.ict.org.il)
  - [www.csis.org](http://www.csis.org)
  - [www.gcsp.ch](http://www.gcsp.ch)
  - [www.rand.org](http://www.rand.org)
  - [www.un.org/terrorism/](http://www.un.org/terrorism/)

- [www.army-technology.com](http://www.army-technology.com)
- [www.naval-technology.com](http://www.naval-technology.com)
- [www.nonproliferation.org](http://www.nonproliferation.org)
- [www.nato.int](http://www.nato.int)

4. A number of States routinely issue guidance, advice or directions to their own airlines, sometimes in the form of NOTAMs, about the risks of using certain airspace or overflying certain areas. Some of these may be obtained from open sources. Some States may be willing to share them for more general use. ICAO is currently considering the establishment of a repository or mechanism whereby these could be shared more widely.

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**Annex C****Risk assessment methodology and concepts**

1. The ICAO WGTR has established a methodology to enable it to provide advice on aviation security risks in a logical, consistent and clear manner, and to assist States and entities in performing risk assessments of their own. It is not a precise scientific or mathematical exercise but is designed to assist in the analysis and understanding of different threat scenarios, and to generate a **relative** ranking of current residual or remaining risk. The WGTR has previously used it to assess the threat to civil aviation from terrorist attacks by a range of different methods, including from MANPADS. Further details can be found in the ICAO Risk Context Statement 2014.
2. The risk assessment methodology comprises these key components:
  - a) *Scenario* – identification and description of a credible attack comprising a target and the means of attack – in this case a missile attack on an overflying aircraft;
  - b) *Likelihood* – the probability or likelihood of that attack occurring, based on intentions and capabilities of any potential perpetrators (but not taking into account mitigation measures);
  - c) *Consequences* – the reasonable worst case consequences of the specific attack in human, economic, political and reputational terms. In any scenario involving a missile attack the consequences are likely to be considerable, including as a reasonable worst case, substantial loss of life;
  - d) *Current mitigations* – any relevant measures generally in place to mitigate the threat, including ICAO SARPs, which it is assumed are being effectively applied. (Where that is not the case, the residual risk will be higher);
  - e) *Residual vulnerabilities* – the extent of the remaining vulnerabilities once the current mitigating measures have been taken into account; and
  - f) *Residual risk* – the relative size of the problem that remains, taking into account all of the above factors. It is assumed that no risk can be entirely eliminated but that risks must be acceptably managed.
3. This methodology is generally used in relation to intentional attacks on civil aviation perpetrated by terrorists. However, most of the elements and concepts are also appropriate for use when considering unintentional attacks.

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## Annex D

### Note on terminology used in this paper

In order to avoid potential misunderstandings or uncertainty, some of the terms used in this paper are defined in more detail below. These are not dictionary or official definitions, but an explanation of the way in which the terms have been used in the context of this paper.

*Air-to-air missiles* are missiles fired at an aircraft from another aircraft.

*Civil aircraft* is used here in the sense of non-military aircraft. It could include passenger airliners, cargo aircraft and business or private jets (*Note.*— to be reconciled with the definition contained in Article 3 of the Chicago Convention).

*Conflict zones* is used here to denote areas where armed attacks are occurring or are likely to occur between two militarized parties, and is also taken to include areas where such parties are in a heightened state of military alert or tension.

*Cruising altitude* refers to altitudes where aircraft are in level flight (i.e. not in take-off or landing phases). Normal cruising altitudes may vary including by aircraft type and terrain. In this context, we are considering aircraft operating at more than 25 000 feet above ground level, where they would be outside the range of even the most advanced MANPADS.

*MANPADS* or Man-Portable Air Defence Systems are shoulder-launched surface-to-air missiles. They are widely available in many countries, particularly in conflict areas, portable and can be used with relatively limited training. They are capable of bringing down aircraft, but not of reaching cruising altitudes.

*Overflying* here means passing over terrestrial areas (land or sea) at cruising altitude.

*Risk* here refers to the residual likelihood of an event happening after mitigation measures have been taken into account. It factors in intent, capability, consequences and vulnerability.

*Surface to Air Missiles (SAMs)* can denote any weapon that may be fired at an aircraft from the ground (including MANPADS), 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 feet.