Executive Directorate
Executive Director’s Office

Report on occurrences over the high seas involving military aircraft in 2014


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1. Executive summary

Recently, safety concerns have been expressed by some EU Member States which have reported an increase in occurrences (e.g. AIRPROX, airspace infringements) involving civil and military aircraft and an increase in non-cooperative military traffic\(^1\) over the high seas.

While similar occurrences have been reported by several EU Member States over the last years, it seems that the most affected EU Member States in 2014 were the Baltic States.

Taking into account this situation, and the possible hazard to civil aviation safety, the European Commission mandated EASA to launch a technical analysis on these reported occurrences and to report its conclusions and recommendations.

The aim of the technical analysis was to assess the severity of the situation in general terms by analysing these reported occurrences and in particular the most severe ones. In addition, and taking into account the current operational scenario (e.g. traffic density and complexity of the airspace over the Baltic Sea), an assessment of the safety risk for civil aviation and its evolution has been conducted. EASA (hereinafter referred to as the ‘Agency’) conducted the technical analysis by first collecting data and information about the reported occurrences from the most affected Member States and Air Navigation Service Providers (ANSPs), and also by discussing and cooperating with the North Atlantic Treaty Organization (NATO) and the International Civil Aviation Organization (ICAO).

Based on the results of the technical analysis, the Agency made the following observations:

— Over the past years, there has been a significant increase in ‘non-cooperative’ military activity and an increase in the total number of military flights over the Baltic Sea.

— The number of safety occurrences involving civil and non-cooperative military aircraft over the high seas, and in particular over the Baltic Sea, has significantly increased in 2014, compared with past years.

— The risk assessment conducted using the ARMS\(^2\) method concludes that the risk to civil aviation is high and this means that mitigating measures to reduce the risk to an acceptable level need to be taken.

— Aggravating factors to the increase in safety risk are the lack of situation awareness of civil Air Traffic Control (ATC) units and of civil aircraft, and the increased complexity of the airspace due in particular to new operational concepts (e.g. free route airspace).

The issue of safety occurrences involving civil and non-cooperative military traffic has been recently discussed at two different fora within ICAO (European Air Navigation Planning Group (EANPG) and High-Level Safety Conference (HLSC)), which led to two additional conclusions addressed to Contracting States mainly emphasizing the need to enhance civil-military coordination to effectively

\(^1\) ‘non-cooperative military traffic/flight/aircraft’ in this report means military traffic/flight/aircraft with no flight plan in the ATM system, and no communication with civil ATC, and no active transponder, or no coordination with civil ATC.

\(^2\) ARMS (Aviation Risk Management Solutions) method for Operational Risk Assessment (ORA).
mitigate the identified safety risk in these cases. The Agency fully agrees with these two conclusions as it considers that it supports the actions that need to be taken to mitigate the safety risk.

On the basis of this analysis and in addition to the above mentioned conclusions by the HLSC and by the EANPG, the Agency recommends the following:

1. Although the Chicago Convention does not apply to state aircraft, the Agency recommends ICAO to continue working in close coordination with the Contracting States, the relevant military authorities and organisations, and other relevant stakeholders and to further update Circular 330 taking into account the results of this analysis and the work carried out in the area of civil/military coordination since its publication.

2. The Agency recommends that Member States endorse and fully apply the practices promulgated in ICAO Circular 330 and its subsequent updates.

3. The Agency recommends that Member States closely coordinate to develop (if not already accomplished) and to harmonise the operational requirements and instructions for state aircraft operations in order to ensure that, when flying over the high seas, ‘due regard’ for civil aircraft is always maintained. The Agency also recommends making these procedures publicly available so that civil flight crews are aware of such procedures.

4. In addition, the Agency recommends that ICAO considers initiating amendments to Article 3 of the Chicago Convention in a way that requires Contracting States to publish their regulations or procedures in force regarding the ‘due regard’ concept for the safety of civil aircraft.

5. The Agency recommends that Member States work closely together to further develop and harmonise concrete civil/military coordination procedures for ATM at European Union level. These coordination procedures should address, among other things, the timely dissemination of information when non-cooperative military traffic is likely to fly over the high seas within neighbouring Area Control Centers (ACCs). Similar coordination has to be implemented at the tactical level between Air Defence and ATC units when scramble aircraft becomes airborne for interceptions.

6. The Agency recommends that the European Union promotes at the ICAO EURO NAT level, the principle of prior notification by all States when conducting flights in controlled airspace within the Flight Information Regions (FIRs) for which European Member States have the responsibility to provide Air Traffic Services (ATS).

7. Member States should notify the Agency of related safety occurrences in a timely manner, if similar occurrences occur in the future. The Agency should be provided with the relevant available data without delay for the occurrence analyses to be facilitated. The Agency is closely monitoring the evolution of the situation. The Agency can decide to take immediate actions such as the publication of Safety Information Bulletins if it is timely alerted.

8. In cases where non-cooperative traffic over the high seas is highly probable, and where primary radar systems are still used by state/military air defence units, the Agency
2. Introduction

Recently, safety concerns have been expressed by some EU Member States which have reported an increase in occurrences (e.g. AIRPROX, airspace infringements) involving civil and military aircraft and an increase in non-cooperative military traffic over the high seas.

While similar occurrences have been reported by several EU Member States over the last years, it seems that the most affected EU Member States in 2014 were the Baltic States, even though several other EU Member States identified an increased intensity of such flights, for instance in the Atlantic, the Black or Aegean Sea.

Taking into account this situation, and the possible hazard it poses to civil aviation safety, the European Commission mandated the Agency to launch a technical analysis on the reported occurrences and to report its conclusions and recommendations to the European Commission.

Attachment C: European Commission mandate contains the European Commission’s mandate to the Agency.

As a first step, the Agency requested support, data and information from the civil aviation authorities of the most affected EU Member States in the Baltic Sea, from some other EU Member States with coasts at the North Sea and at the Atlantic, and from other relevant civil aviation stakeholders, such as the ICAO Regional Office in Paris. In addition, the Agency has requested support from military stakeholders through NATO.

The aim of the Agency was to collect as much factual information as possible regarding the reported occurrences (location, date, flight level or altitude, high seas or territorial airspace, estimated proximity between civil and military aircraft, civil aircraft operator, whether or not the transponders of the involved military aircraft were on, whether or not there were Airborne Collision Avoidance System (ACAS) alerts, whether the conflict was detected by military or civil radar, airspace classification, classification of the occurrence by Safety Investigation Authorities/national Civil Aviation Authority and/or ANSPs). The Agency has received data and information from the most affected Member States and ICAO and NATO has supported the analysis.

The Agency assessed the severity of the situation in general terms by analysing these reported occurrences and in particular the most severe ones. In addition, and taking into account the current operational scenario (e.g. traffic density and complexity of the airspace over the Baltic Sea) and the expected evolution (traffic increase and new Air Traffic Management (ATM) operational concepts, such as free route airspace), an safety risk assessment to civil aviation and its evolution has been conducted. In order to do so, a comparison of similar occurrences over the past years has been carried out.

3 ‘non-cooperative military traffic/flight/aircraft’ in this report means military traffic/flight/aircraft with no flight plan in the ATM system, and no communication with civil ATC, and no active transponder, or no coordination with civil ATC.
Not all the information and data received was harmonised and therefore a thorough comparison has not been possible. However, the analysis of the information has been complemented with discussions with the most affected stakeholders during the analysis. In addition, it is important to highlight that it has not been possible to validate some of the information related to occurrences and other data collected (e.g. missing or estimated information regarding proximity of the encounter). The non-availability of civil radar data (as the non-cooperative military traffic was not visible to civil Secondary Surveillance Radar (SSR) systems) rendered this analysis difficult.

The Agency believes that it has fulfilled all the tasks requested by the European Commission’s mandate in the given timescale. This report presents the results of the analysis as well as conclusions and recommendations taking into account the geopolitical context and the available data.

Attachment A contains a list of acronyms and definitions used in this report.

Attachment B contains a list of related bibliography and related articles in the web.

3. Context and scope of the analysis

3.1. Context

Non-cooperative military flights over the high seas within the Flight Information Regions (FIRs) of EU Member States are not new. This situation has been existing in several areas for years.

The situation is usually intensified when the geopolitical situation is unstable, and it stabilises when the geopolitical situation normalises again.

Indeed, EU Member States whose coasts are at the Black Sea, the Mediterranean Sea, the North Sea, the Atlantic and the Baltic Sea experience this situation sometimes more frequently.

In these cases, efficient civil/military cooperation and tactical procedures are the key to successfully keep the safety level of civil aviation acceptable.

The unexpected increase in non-cooperative military traffic over the Baltic Sea in 2014 has been subject to massive media attention, which has been aggravated by a subsequent increase in the number of occurrences involving civil and non-cooperative military traffics.

This situation together with the request of some affected EU Member States, such as Denmark, Finland and Sweden, for common action at European Union level have been the major drivers for the European Commission’s mandate to the Agency to conduct this analysis.

Furthermore, the issue has been lately discussed in two different forums within ICAO which has led to two additional conclusions as summarised below:

- At the last European Air Navigation Planning Group (EANPG/56) meeting which lead to the agreement of the following Conclusion:
  ‘EANPG Conclusion 56/03 – Safety concerns regarding operations involving civil and military aircraft over the High Seas

That, noting the growing safety concern regarding events involving civil and military aircraft over the High Seas, the ICAO Regional Director, Europe and North Atlantic, on behalf of the EANPG, encourage States and International Organizations concerned to take action, in accordance with EANPG Conclusion 51/03, to review and enhance at national and international level their civil/military arrangements and coordination procedures involving...’
Occurrences over the high seas involving military aircraft in 2014

all State authorities concerned, with a view to reducing the risk of serious incidents or accidents.’

- The Second High-Level Safety Conference (HLSC 2015), which was held at Montreal, Canada, from 2 to 5 February 2015, where the Working Paper (WP82) regarding the increased number of occurrences involving civil and military aircraft in the high-sea airspace was presented by some European Union Member States. The States’ views regarding strengthening of the coordination between civil and military operations were strongly supported and agreed by the Conference and resulted in the following conclusion: ‘HLSC 2015 Conclusion 1/2 – ...e) States should ensure the safety of civil aircraft through civil/military coordination as outlined in the ICAO Circular 330 (Civil/Military Cooperation in Air Traffic Management) and should update that Circular on a regular basis.’

Prior to the 2nd HLSC the Agency produced a progress report of this analysis. This progress report has been used as basis for this report.

The main result of the discussions is that enhancing civil/military coordination is essential to effectively mitigate the safety risk in these cases.

It needs to be recognised that it is difficult to predict the evolution of the geopolitical situation and that this is beyond the control of civil aviation regulators.

It is equally not sensible suggesting taking dramatic measures, such as declaring the area as a no-fly zone for European civil aircraft operators. This would have enormous economic consequences.

Therefore, the Agency’s analysis results, conclusions and recommendations included in Chapters 5 and 6 aim to proactively reduce the severity of the safety risk resulting from the occurrences and to mitigate this safety risk.

3.2. ICAO principles and EU Member States’ obligations over the high seas (civil and state/military aircraft)

In order to better understand the context, it is necessary to recall the applicable ICAO principles for state aircraft and also the Member States’ obligations in this context. The paragraph below contains extracts from Article 3 of the Chicago Convention (ICAO Doc 7300). Attachment D: Relevant principles, standards, recommended practises and guidance in the ICAO material extracts other relevant principles, standards, recommended practises and guidance contained in other relevant ICAO material.

‘Civil and state aircraft

a) This Convention shall be applicable only to civil aircraft, and shall not be applicable to state aircraft.

b) Aircraft used in military, customs and police services shall be deemed to be state aircraft.

c) No state aircraft of a contracting State shall fly over the territory of another State or land thereon without authorization by special agreement or otherwise, and in accordance with the terms thereof.

d) The contracting States undertake, when issuing regulations for their state aircraft that they will have due regard for the safety of navigation of civil aircraft.’ (Article 3)
Occurrences over the high seas involving military aircraft in 2014

In Europe, some relevant provisions are included in the Standardised European Rules of the Air (SERA) (Commission Implementing Regulation (EU) No 923/2012⁴), which entered into force in October 2012 and which is applicable since December 2014. This Regulation is practically a direct transposition of ICAO Annex 2 and of some relevant parts of ICAO Annex 11 and few parts of ICAO Annex 3.

This Regulation is directly applicable in all EU Member States in the airspace under their sovereignty (including territorial waters). For the high seas, SERA mirror the Chicago Convention and refer to ICAO Annex 2 and to the Convention. When Member States have taken the responsibility to provide ATS over the high seas, SERA refers to ICAO Annex 11 as applicable for the provision of ATS.

3.3. Scope of the Agency’s analysis

Considering that the most affected EU Member States in 2014 were the Baltic States, and in order to ensure the completion of the analysis within the given timescale, the Agency limited the scope of the analysis to the analysis of the occurrences that took place over the Baltic Sea.

It is, however, important to mention that the conclusions and recommendations can be equally applied by other affected EU Member States which are having similar occurrences.

3.3.1. Today’s situation over the Baltic Sea

As it can be concluded from Figure 1 — Limits of the territorial waters of the Baltic Sea, the Baltic Sea has relatively narrow portions of high seas. This figure presents the limits of the territorial waters, the Baltic Sea Protected Areas (BSPA) and the limits of the Exclusive Economic Zone (EEZ) although these two limits are not relevant in this analysis. Figure 2 presents the FIRs in the Baltic Sea. Both figures present the portions of high seas airspace for which each Baltic State is responsible for the provision of ATS.

While the airspace over the Baltic Sea is not the most complex in Europe, it is nevertheless relatively complex. There are four different Functional Airspace Blocks (FABs) in the Baltic Sea. There are also major traffic flows from both northern-to-southern and eastern-to-western Europe.

It shall also be noted that most of the airspace, in particular the upper airspace above FL195, in the EU Baltic States’ FIRs is controlled airspace classified as Class ‘C’. This means that for a civil aircraft to access the airspace, it is mandatory to file a flight plan or to use two-way communication or to request ATC clearance or to be equipped with transponders and to have their transponders on.

Under these circumstances, the presence of non-cooperative military flights over the Baltic Sea makes the situation more complex and it can be hazardous to civil traffic because if civil ATC is not aware of them, traffic information cannot be provided in a timely manner to civil aircraft flying in the same narrow parts of airspace.

Taking into account the narrow parts of high-sea airspace over the Baltic Sea, there is also a natural tendency to have more airspace infringements. Since this airspace configuration is not new, the number of airspace infringements and occurrences should be comparable over the years, or at least

An agency of the European Union

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proportionate to traffic increase. However, the figures stemming from the data provided to the Agency show a definitive increase in the number of occurrences and also in the number of infringements over the past 3 years:

— 4 occurrences (AIRPROX) involving civil and military aircraft in 2012,
— 6 occurrences (5 AIRPROX and 1 airspace infringement) in 2013,
— 16 occurrences (13 AIRPROX and 3 airspace infringements) in 2014, and
— 3 airspace infringements in January 2015\(^5\),

where 13 out of the 16 occurrences in 2014 involved uncooperative military traffic.

The detailed analysis of the occurrences and the subsequent risk assessment are included in Chapter 4.

\(^5\) 3 infringements were reported only until the end of February 2015. The Agency has been made aware that additional occurrences have taken place in March 2015 but at the time of finalising the report in March 2015, there is not sufficient information to properly amend the report to take into account these new occurrences.
Figure 1 — Limits of the territorial waters of the Baltic Sea. Source: livinginthebalticsea.com
3.3.2. Possible evolution of the situation if no action is taken

While the evolution of a given geopolitical situation cannot be predicted, it is important to reflect on the potential development of the situation described in 3.3.1 from the point of view of aviation safety taking into account the expected traffic growth.

The overall air traffic growth in Europe has been studied by Eurocontrol⁶.

Figure 3 illustrates the expected average annual growth in a 20-year forecast of IFR flight movements in Europe until the year 2035. This figure shows that in 20 years from now the traffic can increase to even more than 50% in four of the Baltic States.

This forecast trend together with the planned deployment of the new SESAR concepts⁷ and technologies (such as free route airspace, dynamic sectorisation, and advanced Flexible Use of Airspace (FUA) concepts) and new CNS infrastructure necessary to support the implementation of these new concepts are likely to jeopardise the safety of civil traffic if the necessary civil/military coordination is not strengthened and if there is not appropriate involvement of all interested parties in the decision-making process regarding the implementation of these concept over the Baltic Sea.

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⁷ The deployment of these new SESAR concepts and technologies are indeed needed to be able to accommodate the expected traffic growth in a safe manner.
The implementation of these concepts over the high seas requires involvement and commitment from all States using that airspace.

The existing ‘due regard’ policies to ensure safety of civil traffic might need to be reviewed to guarantee that they are equally effective after implementing these new SESAR concepts.

All these considerations would need to be properly evaluated to ensure the safe deployment of the new technologies in such a demanding and changing environment. Appropriate contingency procedures would need to be put in place to effectively mitigate the safety risk should similar occurrence take place in this foreseen future scenario.

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4. Data received, risk and trend analysis

4.1. Occurrences reported to the Agency

The Agency has collected the occurrences contained in which were reported from the affected Baltic States. Not all the reported events could be classified as ‘occurrences’, in accordance with Regulation (EU) No 376/2014 on reporting, analysis and follow-up of occurrences in civil aviation, but the information is considered relevant to better understand the situation. The following occurrences have been reported:

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Out of the 16 occurrences reported in 2014, 13 involved non-cooperative military traffic. The occurrences took place in controlled airspace within the FIRs of EU Member States, and in most of the cases over the high seas.

4.2. Analysis of the occurrences

In most of the reported occurrences, civil ATC was alerted by the air defence centers about the presence of non-cooperative military traffic, and following this, the civil ATC passed the information on to the civil pilot. There were few cases where the civil pilot was able to establish visual contact with the non-cooperative military traffic and few cases where the civil pilot identified the traffic in ACAS. In few cases the civil aircraft made avoiding action following an ACAS Traffic Advisory (TA) and subsequent ACAS Resolution Advisory (RA). In two cases, the pilot and ATC reports indicated that if no avoiding action had been taken, the chance of collision would have been very high.

All reported occurrences were thankfully resolved. National civil/military tactical cooperation procedures were successfully applied and civil ATC and civil pilots were informed on time. However, in a couple of cases early traffic information would have been desired. In addition, it would have also most likely helped to apply cross border civil-military coordination at least on tactical level.

As mentioned in 4.1, it is important to note that most of these occurrences took place over the high seas. Article 3 of the Chicago Convention excludes the application of the Convention to state aircraft and the same Article defines military aircraft as state aircraft.

According to the short description of the reported events, non-cooperative aircraft were most likely military surveillance or reconnaissance aircraft. State aircraft could be involved in ‘partially compliant operations’ which are described in ICAO Circular 330. As these aircraft are state aircraft and they were flying over the high seas, the Chicago Convention does not apply. Moreover, it is important to understand that the closest reported proximity between a civil and a military aircraft was 0.5 NM horizontally and 300 ft vertically. From the civil aviation point of view, this is an AIRPROX in which separation minima standards applicable to that airspace for civil traffic have been violated. If the operation was conducted in Visual meteorological Conditions (VMC), the principle of ‘see and avoid’ and other applicable Visual Flight Rules (VFR) could have been applied by the non-cooperative military traffic. However, it should be noted that pilot in command of the civil aircraft and pilot in command of military aircraft are not trained in similar manner to fly in close proximity and the civil

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8 3 infringements were reported only until the end of February 2015. The Agency has been made aware that additional occurrences have taken place in March 2015 but at the time of finalising the report in March 2015, there is not sufficient information to properly amend the report to take into account these new occurrences.

9 The transponders of the intercepting aircraft were activated.

10 Partially compliant operations are unlikely to be fully compliant with the ICAO SARPs for the duration of their activity but may, where required, offer partial compliance.

11 The proximity has been estimated from a primary or secondary radar plot, or a pilot report, or a combination of some of the three.

[ED0.1]

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aircraft performance may not support such operations. This may endanger the safe conduct of the flight.

In order to better understand all these circumstances, it would have been necessary to study and evaluate the regulations applicable to state aircraft ensuring ‘due regard’ for civil aircraft. However, these regulations are neither harmonised nor they are publicly available in all ICAO Contracting States. Indeed, Article 3(d) of the Chicago Convention does not require the publication of such regulations by Contracting States. As a matter of fact, there are only few States that publish them.12

It has to be noted that that NATO ATM Committee has endorsed the policy guidance on the status and conduct of flights by civil and military aircraft when operating in support of a NATO or NATO-led missions and operations and which provides an harmonised set of provisions for the conduct of NATO flights over the high seas having due regard for the safety of civil aviation. This policy was approved by NATO Council on the 20 of February 2015 and bears many similarities with the one published by the United States of America (U.S. DoD).

Harmonisation and publication of such regulations and applicable procedures for state aircraft ensuring ‘due regard’ to civil aircraft and awareness by civil pilot and ATC of them would have probably helped to better understand the scenario and the procedures applied by state aircraft other than the national state aircraft.

4.3. Severity and risk assessment

It is important to note that there are no harmonised measures to classify and deal with AIRPROX across the Europe Union. There are no publicly available statistics on AIRPROX. Due to this lack of harmonisation and the lack of consolidated data in relation to AIRPROX, it has been impossible to compare the results.

Nevertheless, and as reported by the affected Member States, all occurrences that are subject to an Air Proximity Report (separation minima infringement or inadequate separation) are investigated at national level (by the ANSP, by the relevant national safety investigation authority or by the national civil aviation authority), and their severity is somehow determined (including Instrument Flight Rule (IFR)/Visual Flight Rule (VFR) encounters where no separation minima are defined, or events which occur outside the controlled airspace).

Based on available data, the most severe AIRPROX were classified by the relevant national safety investigation authority as Category B ‘safety not assured’. This classification is in accordance with the AIRPROX severity classification contained in ICAO Doc 4444 and is described in Attachment E: ICAO AIRPROX severity classification.

In some cases, the AIRPROX was classified as Category C ‘no risk of collision’. However, in most of the cases there was not sufficient information to classify the severity of the AIRPROX and, therefore, they should have been be classified as Category D ‘risk not determined’.

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12 USA is one of the States that makes these regulations publically available: U.S. DoD Instruction Number 4540.01, March 28, 2007. In addition, on 20 February 2015, NATO Council approved NATO policy for Civil/Military aircraft operating in support of NATO or NATO-led operations. The applicable procedures are very similar to those of the USA.
In accordance with the definitions contained in Commission Implementing Regulation (EU) No 1035/2011\(^\text{13}\), “risk” means the combination of the overall probability or frequency of occurrence of a harmful effect induced by a hazard and the severity of that effect’.

In order to assess severity and probability, a risk model is required and for the purpose of this report the Methodology for Operational Risk Assessment\(^\text{14}\) presented by the Aviation Risk Management Solutions (ARMS) Working Group to EASA in 2010 has been used. The ARMS method is used by many airlines and it allows assessing an event and a safety issue in a structured manner by analysing undesirable operational states and related preventive and recovery barriers. The ARMS method is summarised in in Attachment F: Summary of the ARMS.

**Event Risk Classification (ERC):**

First of all, the assessment of the risk associated with the occurrences\(^\text{15}\) has been performed.

In order to do so, the ARMS method requires answering the following two questions:

<table>
<thead>
<tr>
<th>Question 1:</th>
<th>How could the event be escalated into an accident outcome (examples are included into the right of the ERC matrix in Figure 5)? Typically, the escalation could be due to actions by the people involved, the way the hazard interferes with the flight, and the effectiveness of the barriers.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Improbable scenarios are not filtered as Question 2 takes the (low) probability into account.</td>
</tr>
<tr>
<td></td>
<td>- Among the scenarios with an accident outcome, the most credible one is selected in the corresponding row in the matrix in Figure 5.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 2:</th>
<th>What was the effectiveness of the remaining barriers between this event and the most credible accident outcome?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- To access the remaining “safety margin”, both the number and robustness of the remaining barriers between this event and the accident scenario in Question 1 should be considered.</td>
</tr>
<tr>
<td></td>
<td>- Barriers that already failed are ignored. Only the barrier which worked and any subsequent barriers still in place are taken into account.</td>
</tr>
</tbody>
</table>

Answer to question 1: the most severe AIRPROX in the occurrences reported were classified as Category B. Based on the available information, there was a considerable loss of separation from the civil aviation point of view. Therefore, it is justified to state that the most severe (worst-case scenario) outcome possible is indeed ‘mid-air collision’\(^\text{16}\).

Answer to question 2: taking into account the mid-air collision model presented in Figure 4, it is important to clarify that none of the ATM related safety barriers could have worked because the non-cooperative military aircraft did not activate their transponders (or they did not have radio

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\(^{15}\) These are the reported occurrences. In order to be conservative, the risk assessment of the most severe occurrences has been performed.

\(^{16}\) An event, that has occurred, has no risk today. The actual event needs to be extrapolated into what accident outcome could credibly have occurred. The risk is then classified taking into consideration the barriers that avoided this event from being an accident.
contact or their transponders were not interoperable with civil SSR systems). An ACAS barrier did not exist either because of that same reason. Therefore, the remaining barriers were pilot visibility and providence\(^\text{17}\). The event did not result in a collision because of the last-minute urgent civil-military tactical coordination. However, there is no guarantee that these barriers will always and effectively prevent the collision to happen. Everything would depend on the pilot visibility and on the timely and systematic application of civil-military coordination procedures. Therefore, the latter can only be considered to have limited or minima effectiveness and this is the choice selected in Figure 5 – ERC matrix. Source: ARMS method

\[\text{Mid-Air Collision Model AIM}\]

\[
\text{Accident Near Collision Imminent Collision Loss of Separation Tactical Conflict Pre tactical conflict}
\]

\[
\text{Pilot/ Providence ATM}
\]

Figure 4 – Mid-Air Collision Model – Source: NATS

<table>
<thead>
<tr>
<th>Question 2</th>
<th>Question 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>What was the effectiveness of the remaining barriers between this event and the most credible accident scenario?</td>
<td>If this event had escalated into an accident outcome, what would have been the most credible outcome?</td>
</tr>
<tr>
<td>Effective</td>
<td>Limited</td>
</tr>
<tr>
<td>50</td>
<td>102</td>
</tr>
<tr>
<td>10</td>
<td>21</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
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<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Typical accident scenarios

- Loss of control, mid air collision, uncontrollable fire on board, explosions, total structural failure of the aircraft, collision with terrain
- High speed taxiway collision, major turbulence injuries
- Pushback accident, minor weather damage
- Any event which could not escalate into an accident, even if it may have operational consequences (e.g. diversion, delay, individual sickness)

\(^{17}\) Which is not normally considered a barrier but as the chance factor.

[EDO.1]
Figure 5 – ERC matrix. Source: ARMS method

In accordance with the ARMS method, the risk indices are not linear but exponential to reflect needed difference in “weight” between the classes. The result is that for the occurrences analysed there was a significant safety risk.

Safety Issue Risk Assessment (SIRA):

The Event Risk Classification results and the evolution of the occurrences over the years as shown in Figure 6, Figure 7 and Figure 8 below led the Agency to conclude that there is a safety issue and therefore a Safety Issue Risk Assessment\(^{18}\) has been conducted using the available data provided by the most affected Member States and using the ARMS method.

Figure 6 - Number of occurrences per year

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\(^{18}\) The difference between ERC and SIRA is that ERC provides a classification of the risk associated with the occurrence when it took place while SIRA is more foresight in the sense that it assess the risk associated to the existing or future operational environment based on the assessment of the probability of the past occurrences and if no action is taken.
1. Definition of the safety issue:
   - Safety Issue statement: occurrences involving non-cooperative military aircraft over the high seas
   - Description of hazard: presence of non-cooperative military aircraft over the high seas in the proximity to civil traffic. It is an ATM hazard.

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19 The number of IFR movements includes the total of IFR movements per year within the FIRs of the Baltic States that have reported occurrences.

[E00.1]

FO.GEN.00400-003 © European Aviation Safety Agency. All rights reserved. ISO 9001 certified. Proprietary document. Copies are not controlled. Confirm revision status through the EASA intranet/intranet.
• Related accident scenario: because non-cooperative military aircraft is neither visible to civil ATC nor it is in radio contact with civil ATC, civil ATC cannot effectively separate civil traffic from such non-cooperative military aircraft should conflict arise. This scenario can lead to a catastrophic outcome.
• Aircraft types considered: mainly civil airliners (Airbus A320, B737) and military aircraft
• Location considered: high seas within the Baltic Sea.
• Time period under study: time period for which data has been derived for this SIRA. To analyse the potential accident scenario the data used is mainly the data available from 2014.

2. Analysis of the potential accident scenario:
• The triggering event is the presence of ‘non-cooperative military aircraft’. The probability of this to occur is estimated at $2 \times 10^{-4}$ (2 every 10000 IFR movements). To calculate this probability, the data from 2014 has been used. The sum of all IFR movements in 2014 from the most affected Member States has been used.
• The Undesirable Operational State (UOS) is the AIRPROX between the non-cooperative military aircraft and the civil aircraft which in 2014 has occurred 3 times per 100 ‘non-cooperative military flights’ ($3 \times 10^{-2}$). This number could be even higher in the future but there is no data available to make a more accurate correlation and that is the reason why, the value from 2014 has been used.
• In relation to the recoverability from the UOS, if no action is taken and taking into account the future traffic growth and the expected increase in traffic complexity, it is justified to say that the remaining barriers could fail once every 100 times. This is also consistent with Figure 4 for the last remaining barriers.
• The accident outcome is deemed to be “Catastrophic”

3. When inserting the above calculated frequencies in the SIRA excel tool of the ARMS method, the results are:
• UOS frequency is estimated to be $1 \times 10^{-6}$;
• Mean Accident frequency is estimated to be $1 \times 10^{-8}$; and
• The safety risk class is ‘improvement’ which in accordance with ARMS means that ‘the risk is unacceptable but tolerable for a short period of time and that mitigating actions are required” as stated in Attachment F: Summary of the ARMS Method for Operational Risk Assessment.

In accordance with the ARMS method, the risk assessment concludes that the risk is high and this means that mitigating measures to reduce the risk to an acceptable level need to be taken.

4.4. Assessment of the mitigating actions taken in relation to the occurrences

Assessing mitigating actions is a very important part of risk assessment process.

In all the occurrences, all the mitigating actions taken reduced the severity of the effect of the hazard as it is not possible to reduce the probability of occurrence\(^{20}\).

For instance, an example of mitigating action was to enhance civil/military coordination in order to maintain civil ATC awareness of the non-cooperative military traffic. In these cases, air-policing forces (as an intermediate measure) have assisted by intercepting the non-cooperative military aircraft and

\(^{20}\) The probability of occurrence depends on the stability of the geopolitical situation and this cannot be predicted.
have kept their transponders on, in order to make civil ATC aware of the non-cooperative military traffic position so that it could provide traffic information to civil traffic.

Another example of mitigating action was civil ATC awareness of the national regulations and procedures applicable to state aircraft for ensuring ‘due regard’ for civil traffic and further enhancement of the tactical civil/military coordination procedures.

In few EU Member States, more permanent measures for the reduction of the severity of the effect of the hazard are being discussed. For instance, the technical feasibility and possibility for military ATC to share primary surveillance radar data, where primary radar systems are still used by state/military air defence units, with civil ATC in cases where non-cooperative military traffic over the high seas is highly probable.

Indeed, the only possibility to detect aircraft which are operating without transponder or without two-way communications is via primary surveillance radar. The primary surveillance radar detects the rough horizontal location of a target but may not provide indication of the actual vertical position/height of that particular target. Therefore, it would be helpful to pass this data on to the surrounding aircraft as traffic information in their proximity.

However, primary surveillance data is not generally used today by civil Area Control Centers (ACCs).

4.5. Trend analysis

The data reported to the Agency shows an increase in the number of occurrences involving civil and non-cooperative military aircraft over the Baltic Sea.

To complete the analysis, the Agency has also requested the affected Member States as well as NATO to provide information and statistics about the number of non-cooperative military flights and the number of national airspace infringements over the Baltic Sea in the past years. It has been difficult to obtain exact numbers and figures about non-cooperative military activity over the high seas in the Baltic Sea. In addition, it is important to note that it is even more difficult to obtain non-repeated data.

According to the information provided by two EU Baltic States, the number of military flights without flight plan in 2014 within their FIRs has significantly increased (5 times more than in 2012 for one Member State, and 2 times more than in 2012 for the second one). In addition, the overall number of military flights within the FIRs of the Baltic States has also increased by about 3 times when compared with that of 2012. The number of national airspace infringements has also increased by 5 times when compared with that of 2012 (at least for two EU Member States reporting this data).

Taking into account the geography of the Baltic Sea, it could be estimated that the overall increase in non-cooperative military flights over the Baltic Sea is about 3 times when compared with 2012.

Another interesting figure that helps to better understand the scenario in that part of airspace is the evolution of the number of initiated scrambles21. While it is difficult to obtain exact figures, and the numbers of scrambles provided include also those which were initiated either because of loss of communication or in order to identify small General Aviation (GA) aircraft, it can be estimated, in

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21 In military aviation, scramble means the act of quickly getting military aircraft airborne to react to an immediate threat, usually to intercept non-cooperative aircraft.
general terms, that the number of scrambles initiated to intercept non-cooperative military aircraft in the high seas over the Baltic Sea has also increased in 2014 compared to 2013.

The information which NATO makes publicly available\(^\text{22}\) indicates that scrambles initiated to intercept non-cooperative military aircraft have increased more than 3 times in 2014 compared to 2013. However, this information may not contain the total number of air-policing missions over the Baltic Sea.

5. Conclusions

The results of the analysis lead the Agency to conclude:

1. Based on the reported occurrences, the number of occurrences (i.e. AIRPROX between civil and non-cooperative military aircraft over the high seas over the Baltic Sea, within the FIR of EU Member States, etc.) has significantly increased in 2014, when compared to the data of past years.

2. Until now all the occurrences were thankfully resolved and civil-military tactical coordination procedures, although not harmonised among the affected Member States, have been successfully and effectively applied.

3. Over the past years the ‘non-cooperative’ military activity and total number of military flights have increased over the Baltic Sea.

4. This, together with the expected increase and complexity of traffic, may lead to an increase in workload for both civil pilots and civil air traffic controller.

5. In addition, the presence of non-cooperative traffic in controlled airspace bears the risk that some ATC clearances may lead to an encounter without the civil ATCO being aware of that.

6. In accordance with the ARMS method\(^\text{23}\), the risk assessment concludes that the risk is high and this means that mitigating measures to reduce the risk to an acceptable level need to be taken.

7. Aggravating factors to the safety risk is the lack of situation awareness of civil ATC units and of civil aircraft, as this awareness is based on cooperative surveillance (SSR) only and the non-cooperative military flight has no active transponder, neither filed a flight plan nor has it been in radio contact with civil ATC.

8. Moreover, it is important to add to the already complex environment, the on-going plans for free route airspace implementation as well as the plans for the implementation of new ATM systems which will probably challenge the interoperability between civil and military ATM systems. If not properly addressed this may create a potential impact on safety.

9. The Agency recognises that significant work has been carried out by ICAO with regard to the definition and promotion of best practices on civil/military cooperation in ATM and which resulted in the publication of ICAO Circular 330.

10. Additional and remarkable work has been carried out by the ICAO European and North Atlantic (EUR/NAT) Office, which defined best practices and guidelines on the flexible use of airspace (FUA) over the high seas.


\(^{23}\) ARMS (Aviation Risk Management Solutions) method for Operational Risk Assessment (ORA).
11. The Agency agrees with the conclusions and recommendations from the EANPG/51, EANPG/56 and from the 2nd ICAO HLSC as it considers that it supports the actions that need to be taken to mitigate the safety risk.

6. Recommendations

The Agency, based on the results of this analysis and the conclusions summarised in Chapter 5, makes the following recommendations.

1. Although the Chicago Convention does not apply to state aircraft, the Agency recommends ICAO to continue working in close coordination with the Contracting States, the relevant military authorities and organisations, and other relevant stakeholders to further update Circular 330 taking into account the results of this analysis and the work carried out in the area of civil/military coordination since its publication.

2. The Agency recommends that Member States endorse and fully apply the practices promulgated in ICAO Circular 330 and its subsequent updates.

3. The Agency recommends that Member States closely coordinate to develop (if not already accomplished) and to harmonise the operational requirements and instructions for state aircraft operations in order to ensure that, when flying over the high seas, ‘due regard’ for civil aircraft is always maintained. The Agency also recommends making these procedures publicly available so that civil flight crews are aware of such procedures.

4. In addition, the Agency recommends that ICAO considers initiating amendments to Article 3 of the Chicago Convention in a way that requires Contracting States to publish their regulations or procedures in force regarding the ‘due regard’ concept for the safety of civil aircraft.

5. The Agency recommends that Member States work closely together to further develop and harmonise the concrete civil/military coordination procedures for ATM at European Union level. These coordination procedures should address, among other things, the timely dissemination of information when non-cooperative military traffic is likely to fly over the high seas within neighbouring Area Control Centers (ACCs). Similar coordination has to be implemented at the tactical level between Air Defence and ATC units when scramble aircraft becomes airborne for interceptions.

6. The Agency recommends that the European Union promotes at the ICAO EURO NAT level, the principle of prior notification by all States when conducting flights in controlled airspace within the FIRs for which European Member States have the responsibility to provide ATS.

7. Member States should notify the Agency of related safety occurrences in a timely manner, if similar occurrences occur in the future. The Agency should be provided with the relevant available data without delay for the occurrence analyses to be facilitated. The Agency is closely monitoring the evolution of the situation. The Agency can decide to take immediate actions such as the publication of Safety Information Bulletins if it is timely alerted.
8. In cases where non-cooperative traffic over the high seas is highly probable, and where primary radar systems are still used by state/military air defence units, the Agency recommends that this primary surveillance radar data be provided to civil ATC units to the maximum possible extent.
### Attachment A: Acronyms and definitions list

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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<tbody>
<tr>
<td>ACC</td>
<td>Area Control Center</td>
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<td>ATC</td>
<td>Air Traffic Control</td>
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<tr>
<td>ATS</td>
<td>Air Traffic Service</td>
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<td>ACAS</td>
<td>Airborne Collision Avoidance System</td>
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<tr>
<td>EANPG</td>
<td>European Air Navigation Planning Group</td>
</tr>
<tr>
<td>ERC</td>
<td>Event Risk Classification</td>
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<tr>
<td>FUA</td>
<td>Flexible Use of Airspace</td>
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<td>HLSC</td>
<td>High-Level Safety Conference</td>
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<tr>
<td>NATO</td>
<td>North Atlantic Treaty Organization</td>
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<tr>
<td>SESAR</td>
<td>Single European Sky ATM Research</td>
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<td>SIRA</td>
<td>Safety Issue Risk Assessment</td>
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<tr>
<td>STCA</td>
<td>Short Term Conflict Alert</td>
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<tr>
<td>TSU</td>
<td>Traffic Service Unit</td>
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<tr>
<td>UOS</td>
<td>Undesirable Operational State</td>
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<table>
<thead>
<tr>
<th>Term</th>
<th>Description/definition</th>
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<tbody>
<tr>
<td>AIRPROX</td>
<td>ICAO Doc 4444 PANS-ATM defines AIRPROX as a situation in which, in the opinion of a pilot or air traffic services personnel, the distance between aircraft as well as their relative position and speed have been such that the safety of the aircraft involved may have been compromised.</td>
</tr>
<tr>
<td>Airspace infringement</td>
<td>Airspace infringement occurs when an aircraft enters controlled airspace structures in ICAO airspace classes A to E without previously requesting and obtaining clearance from the controlling air traffic services unit of that airspace, or enters the airspace under conditions that were not contained in the clearance.</td>
</tr>
<tr>
<td></td>
<td>It should be noted that VFR traffic cannot infringe class E airspace because under ICAO rules neither an ATC clearance nor radio communication is required to enter or operate within it, unless filed national differences call for one or the other (or both). Traffic following IFRs can infringe class E airspace when not in receipt of a clearance to enter it.</td>
</tr>
<tr>
<td>Non-cooperative military traffic/flight/aircraft</td>
<td>For the purpose of this report, and in order to simplify the terminology, ‘non-cooperative military traffic/flight/aircraft’ means military traffic/flight/aircraft with no flight plan in the ATM system, and no communication with civil ATC, and no active transponder, or no coordination with civil ATC.</td>
</tr>
<tr>
<td>Occurrence</td>
<td>Article 2(7) of Regulation (EU) No 376/2014 on the reporting, analysis and follow-up of occurrences in civil aviation[^24] defines ‘occurrence’ as any safety-related event which endangers or which, if not corrected or addressed, could endanger an aircraft, its occupants or any other person and includes in particular an accident or serious incident.</td>
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<tr>
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<tr>
<td>Risk</td>
<td>In accordance with Commission Implementing Regulation (EU) No 1035/2011, ‘risk’ means the combination of the overall probability, or frequency of occurrence of a harmful effect induced by a hazard and the severity of that effect.</td>
</tr>
<tr>
<td>Scramble</td>
<td>In military aviation, it is the act of quickly getting military aircraft airborne to react to an immediate threat, usually to intercept non-cooperative aircraft.</td>
</tr>
</tbody>
</table>

Attachment B: Bibliography

2. ICAO Annex 2, Rules of the Air.
Attachment C: European Commission mandate to EASA

20141128 Letter to KY from JAM.pdf
Attachment D: Relevant principles, standards, recommended practices and guidance in the ICAO material

Chicago Convention (ICAO Doc 7300)

The main concepts are included in Part I ‘Air Navigation’, and are quoted below highlighting the main principles:

— ‘Sovereignty: The contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory.’ (Article 1)

— ‘Territory: For the purposes of this Convention the territory of a State shall be deemed to be the land areas and territorial waters adjacent thereto under the sovereignty, suzerainty, protection or mandate of such State.’ (Article 2).

— ‘Rules of the air

Each Contracting State undertakes to adopt measures to insure that every aircraft flying over or maneuvering within its territory and that every aircraft carrying its nationality mark shall, wherever such aircraft may be, shall comply with the rules and regulations [... in force.]’ (Article 12)

— ‘Each contracting State undertakes to keep its own regulations in these respect uniform, to the greatest possible extent, with those established from time to time under this Convention

— Over the high seas, the rules in force shall be those established under this Convention

— Adoption of international standards and procedures

  o “Each contracting State undertakes to collaborate in securing the highest practicable degree of uniformity in regulations, standards, procedures, and organization in relation to aircraft, personnel, airways and auxiliary services in all matters in which such uniformity will facilitate and improve air navigation”

  o “To this end the International Civil Aviation Organization shall adopt and amend from time to time, as may be necessary, international standards and recommended practices and procedures” dealing with communication systems and air navigation aids, including ground marking, characteristic of airports and landing areas, rules of the air, licensing, airworthiness....and such other matters concerned with the safety, regularity and efficiency of air navigation.... (Summary of Article 37).

Annex 2 to the Chicago Convention (Rules of the Air)

— Interception

‘Interception of civil aircraft shall be governed by appropriate regulations and administrative directives issued by Contracting States in compliance with the Convention on International Civil Aviation, and in particular Article 3(d) under which Contracting States undertake, when issuing regulations for their State aircraft, to have due regard for the safety of navigation of civil aircraft.’ (Article 3.8.1). Attachment A is also relevant.

Annex 11 (Air Traffic Services)
— ‘2.17 Coordination between military authorities and air traffic services

2.17.1 Air traffic services authorities shall establish and maintain close cooperation with military authorities responsible for activities that may affect flights of civil aircraft.

2.17.2 Coordination of activities potentially hazardous to civil aircraft shall be effected in accordance with 2.18.

2.17.3 Arrangements shall be made to permit information relevant to the safe and expeditious conduct of flights of civil aircraft to be promptly exchanged between air traffic services units and appropriate military units.’

— ‘2.18 Coordination of activities potentially hazardous to civil aircraft

2.18.1 The arrangements for activities potentially hazardous to civil aircraft, whether over the territory of a State or over the high seas, shall be coordinated with the appropriate air traffic services authorities. The coordination shall be effected early enough to permit timely promulgation of information regarding the activities in accordance with the provisions of Annex 15.

2.18.2 The objective of the coordination shall be to achieve the best arrangements which will avoid hazards to civil aircraft and minimize interference with the normal operations of such aircraft.

2.18.3 The appropriate ATS authorities shall be responsible for initiating the promulgation of information regarding the activities.

2.18.4 Recommendation.— If activities potentially hazardous to civil aircraft take place on a regular or continuing basis, special committees should be established as required to ensure that the requirements of all parties concerned are adequately coordinated.

2.18.5 Adequate steps shall be taken to prevent emission of laser beams from adversely affecting flight operations.

2.18.6 Recommendation.— In order to provide added airspace capacity and to improve efficiency and flexibility of aircraft operations, States should establish procedures providing for a flexible use of airspace reserved for military or other special activities. The procedures should permit all airspace users to have safe access to such reserved airspace.’

ICAO Doc 4444 (PANS Air Traffic Management))

— ‘16.1 RESPONSIBILITY IN REGARD TO MILITARY TRAFFIC

16.1.1 It is recognized that some military aeronautical operations necessitate non-compliance with certain air traffic procedures. In order to ensure the safety of flight operations the appropriate military authorities shall be asked, whenever practicable, to notify the proper air traffic control unit prior to undertaking such manoeuvres.

16.1.2 A reduction of separation minima required by military necessity or other extraordinary circumstances shall only be accepted by an air traffic control unit when a specific request in some recorded form has been obtained from the authority having jurisdiction over the aircraft.

[EDO.1]
concerned and the lower minima then to be observed shall apply only between those aircraft. Some recorded form of instruction fully covering this reduction of separation minima must be issued by the air traffic control unit concerned.

16.1.3 Temporary airspace reservation, either stationary or mobile, may be established for the use of large formation flights or other military air operations. Arrangements for the reservation of such airspace shall be accomplished by coordination between the user and the appropriate ATS authority. The coordination shall be effected in accordance with the provisions of Annex 11 and completed early enough to permit timely promulgation of information in accordance with the provisions of Annex 15.’

ICAO Circular 330\textsuperscript{25} (Civil/Military Cooperation in Air Traffic Management)

It is based on ICAO Doc 9554 ‘Manual Concerning Safety Measures Relating to Military Activities Potentially Hazardous to Civil Aircraft Operations’, and provides the following guidance to Member States:

— **Guidance on the ICAO institutional and regulatory framework**

‘1.2.3 As a consequence of Article 3, in particular subparagraph 3 (d), States are required to safeguard navigation of civil aircraft when setting rules for their State aircraft. This leaves it up to the individual State to regulate these operations and services, generating a wide diversity of military regulations. However, especially in congested airspace, harmonized regulation is a precondition for a safe, efficient and ecologically sustainable aviation system.

1.2.4 At the same time, States are aware of the limitations of ICAO SARPs and designated Annexes to the Convention, including PANS and regional supplementary procedures (SUPPs), as they relate to State/military aircraft and their services. Indeed, as seen above, Article 3 of the Convention specifically exempts State aircraft from compliance with articles of the Convention.’

— **Guidance on airspace organization and management**

‘3.2.6 The safe and efficient joint use of airspace by civil and military operations rests on understanding and accommodating the airspace requirements of all users on a fair and equitable basis, while respecting State sovereignty and national/international security, defence and law enforcement obligations.’

— **Guidance on State aircraft operations**

‘5.1.1 In accordance with the Chicago Convention, Article 3 (b), “Aircraft used in military, customs and police services shall be deemed to be State aircraft”. In broad terms, the right to access all airspace, within the limits of the operational needs, is a crucial requirement to enable the military, customs and police to perform the security, defence and law enforcement

\textsuperscript{25} ICAO Circular 330-AN/189 ‘Civil/Military Cooperation in Air Traffic Management’, 2011.
missions mandated by their States and by international agreements. It is, therefore, a fundamental requirement that each State be able to train and operate its State aircraft effectively. In this manner, it is vital for State aircraft to be provided access to sufficient space, enabling adequate opportunities for the training and execution of security, defence and law enforcement elements.

5.1.2 In pursuit of their tasks, operators of State aircraft should, where practicable, respect international, regional and State civil aviation legislation and aim for compliancy. However, it is recognized that the nature of the defence and security tasks can create unique situations that need special handling and considerations. In this regard, this chapter will first explain what roles are performed by military and non-military flights under the title of “State aircraft”. It will then highlight circumstances when State aircraft can be fully compliant or partially compliant with international civil aviation rules and procedures, as provided for in ICAO SARPs, and the general expectations for handling such aircraft by an air navigation service provider (ANSP).
## Attachment E: ICAO AIRPROX severity classification

<table>
<thead>
<tr>
<th>ICAO AIRPROX Classification (ICAO Doc 4444)</th>
<th>Description</th>
</tr>
</thead>
</table>
| AIRPROX CAT A                             | **AIRPROX — Risk Of Collision:**  
  ‘The risk classification of an aircraft proximity in which serious risk of collision has existed’ |
| AIRPROX CAT B                             | **Safety Not Assured:**  
  ‘The risk classification of an aircraft proximity in which the safety of the aircraft may have been compromised’ |
| AIRPROX CAT C                             | **No Risk Of Collision:**  
  ‘The risk classification of an aircraft proximity in which no risk of collision has existed’ |
| AIRPROX CAT D                             | **Risk Not Determined:**  
  ‘The risk classification of an aircraft proximity in which insufficient information was available to determine the risk involved or inconclusive or conflicting evidence precluded such determination’ |
Attachment F: Summary of the ARMS Method for Operational Risk Assessment

**ARMS in a Nutshell**

**Event Risk Classification**

**HOW TO DO IT:**

1. Answer Question 1: Think how the event could have escalated into an accident outcome (see example in the right of the ERC matrix). Typically, the escalation could be due to actions by the people involved, the way the hazard interacts with the flight and barrier behaviour.
   - Do not filter out improbability. Question 2 will take the (low) probability into account.
   - Among the scenarios with an accident outcome, pick the most credible, and select the corresponding row in the matrix.

2. Answer Question 2:
   - To assess the remaining safety margin, consider both the number and robustness of the remaining barriers between this event and the accident scenario identified in Question 1.
   - Barriers, which already failed are ignored.
   - Select the column of choice. See section 4.2 for detailed guidance.

**RESULT**:

- Immediate action & further investigation required
- More refined Risk Assessment and/or investigation required
- No action required. Contributes to the Safety Database.

21 ERC Risk Index number → Use in database analysis (trending & statistics)

---

**Safety Assessment**

**START HERE**

**ERC**

**First step for all incoming data**

**HOW TO DO IT:**

1. Answer Question 1: Think how the event could have escalated into an accident outcome (see example in the right of the ERC matrix). Typically, the escalation could be due to actions by the people involved, the way the hazard interacts with the flight, and barrier behaviour.
   - Do not filter out improbability. Question 2 will take the (low) probability into account.
   - Among the scenarios with an accident outcome, pick the most credible, and select the corresponding row in the matrix.

2. Answer Question 2:
   - To assess the remaining safety margin, consider both the number and robustness of the remaining barriers between this event and the accident scenario identified in Question 1.
   - Barriers, which already failed are ignored.
   - Select the column of choice. See section 4.2 for detailed guidance.

**RESULT**:

- Immediate action & further investigation required
- More refined Risk Assessment and/or investigation required
- No action required. Contributes to the Safety Database.

21 ERC Risk Index number → Use in database analysis (trending & statistics)

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**Quick Reference Guide**

**SIRA**

**Safety Issue Risk Assessment**

**Used for:**

- Safety Issues
- Safety Assessments, when quantifiable
- (Management of Change process)

**HOW TO DO IT:**

1. Define the Safety Issue precisely:
   - Scope the issue in terms of hazards, locations, artefacts, etc. See section 4.8.1 for detail.

2. Develop the related potential accident scenarios:
   - There may be several accident scenarios within one Safety Issue (see Glossary).
   - Select the most critical scenarios (one or more) for the risk assessment.

**Analyses (each) Scenario using the SIRA model (above):**

1. Identify the accident outcome of the scenario.
2. Identify what is considered the triggering event (see section 6.9 for detail).
3. Decide what you consider as the UOR.
4. List the avoidance and recovery barriers and review their robustness.

**Run the SIRA with numbers:**

1. Consider using the SIRA Excel tool.
2. Select a known or an estimated value for each of the 4 SIRA components.

**RESULT**:

- “Stop”: Discontinues the concerned part of the operation until acceptable risk level.
- “Ignore”: Still unacceptable risk but tolerable for a short time. Action required.
- “Review”: Frequent monitoring required, as the issue is at the limit of acceptability.
- “Monitor”: Monitor through the routine database analysis.
- “Acceptable” No specific action required.