สำนักงานการบินพลเรือนแห่งประเทศไทย
Civil Aviation Authority of Thailand

# Guidance Material on Aeronautical Study

CAAT-AGA-GM1901

Issue: 01

Revision: 00

Date: 10 May 2019

Approved By

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Director General

The Civil Aviation Authority of Thailand

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# 1 Introduction

## 1.1 Background

A. The Director General (DG) of The Civil Aviation Authority of Thailand (CAAT) is responsible for providing regulatory oversight of the persons and entities conducting air operations in Thailand, operating and/or maintaining Thailand registered aircraft, operating and/or maintaining aerodromes and heliports in Thailand, or providing an air navigation service in Thailand. As part of CAAT's regulatory oversight responsibility, the DG may issue, modify, suspend, or revoke certificates, licenses, authorizations, and/or approvals.

B. The DG may also make decisions and/or take actions to ensure appropriate compliance with the Aerodrome Regulations of Thailand.

C. The Guidance Material (GM) is published by CAAT. The GM is a means of circulating essential information of an administrative or technical nature to holders of CAAT's License and Certificate.

## 1.2 Purpose

A. The purpose of this Guidance Material is to provide supplementary guidance to aerodrome operators and applicants applying for an Aerodrome Establishment License and a Public Aerodrome Operating Certificate on the conduct of aeronautical study. It provides guidance on what is acceptable to CAAT to demonstrate compliance with Aerodrome Regulations.

## 1.3 Applicability

A. This Guidance Material applies to all persons or entities operating and/or maintaining aerodromes and/or heliports in Thailand and applicants applying for an Aerodrome Establishment License and a Public Aerodrome Operating Certificate.

## 1.4 Aeronautical Safety

A. An aeronautical study is a study of an aeronautical safety concern or non-compliance to identify possible solutions and select a solution that is acceptable without any reduction in the acceptable level of safety.

B. A comprehensive aeronautical study allows the aerodrome operator / applicant and the CAAT to ensure safety and to be assured that the regularity of operations of aircraft is not unnecessarily compromised in the event of a non-compliance. However, Regularity of operations might be compromised in order to maintain and achieve the acceptable level of safety.

C. The study can be undertaken in a variety of ways using different analytical methods and various safety management tools that are appropriate to each specific aeronautical study requirement.

D. An aeronautical study may contain many elements; however, hazard identification, risk assessment, risk mitigation and risk elimination are key components. Additionally, there may be aviation system constraints.

E. The goal of risk management in an aeronautical study is to identify hazards and assess risks, then to take appropriate action to minimise risk as much as is reasonably practicable to achieve the acceptable level of safety, as if the full compliance were in place.

F. The objectives of an aeronautical study for aerodrome operator / applicant are as follows:

1) To study the impact of deviations from the regulations;

2) To present alternative solutions to ensure the level of safety remains acceptable;

3) To estimate the effectiveness of each alternative;

4) To recommend operating procedures / restrictions or other measures to compensate for the deviation;

5) To check for any new hazards and their resulting risk arising from mitigation; and

6) To indicate the timescale for removal or re-assessment of any non-compliance.

G. Decisions made in respect of risks must balance the technical aspects of risk with the social and moral considerations that often accompany such issues.

H. These decisions may have a significant impact on an aerodrome's operation. Therefore, for an effective outcome, there should be appropriate involvement, consultation and a level of consensus as to their acceptability among all key stakeholders. However, in the end, some effect on operations may be necessary.

I. While this Guidance Material focuses on the safety outcomes, there may also be non-safety consequences, such as service level and commercial implication, or financial loss and operational loss of the aircraft, increased insurance costs, and damage to reputation.

J. This Guidance Material outlines the trigger factors that may lead to an aeronautical study, the key aspects of safety risk management, the conduct of the study, and the sample activities that should be included in the study.

K. However, this Guidance Material does not, and cannot, include a formula that is guaranteed to give the correct solution, nor does it instruct the aerodrome operator / applicant what it should value. The appropriate constraints and goals are left to the judgement of those carrying out the study. The aeronautical study should be seen as a framework for effective decision-making, rather than as a guaranteed process to come up with the correct outcomes. **Occasionally, an aeronautical study may prove that the intended change is not viable.**

L. This framework for conducting aeronautical studies proposes a systematic method for analysing risk issues, that may be complex, to help the aerodrome operator / applicant decide with confidence and, if necessary, to articulate these decisions for submission to the Aerodrome Standards Department (AGA) of The Civil Aviation Authority of Thailand.

M. An aeronautical study is most frequently undertaken during the planning of a new aerodrome or new aerodrome facility, or during the certification of an existing aerodrome; or subsequently, when the aerodrome operator / applicant applies for an exemption, as a result of development or a change in the aerodrome operational conditions from the Aerodrome Regulations.

N. It is the aeronautical study process that determines the site-specific need for services, and identifies and recommends a course of action, or presents options for the aerodrome operator / applicant to act upon. In all cases, the aeronautical study should document and demonstrate the site-specific need and rationale for the level of services, procedure designs, or operational requirements to provide an equivalent level of safety as if the study had not been required.

## 1.5 Trigger Factors

A. The scope of studies can range from minor adjustments to large scale aerodrome configuration.

B. The decision to undertake this type of study may be triggered by any one or more of a wide range of factors that may generate a non-compliance. These may include:

1) the number of movements or step change in traffic density, i.e. light / medium / heavy;

2) the types, and variety of types, of aircraft using the aerodrome (jet, turbo-prop, rotary, etc.); or on smaller operations, just an aircraft model change such as from B737-700 to B737-800 with winglets;

3) aerodrome characteristics and layouts;

4) aerodrome operator management structure;

5) local development – whether structural or use e.g. affecting wildlife or number of people congregating under flight paths; and

6) introduction of any form of new operation or facility.

C. An aeronautical study may be initiated by the CAAT, an aerodrome operator / applicant or another interested party, such as an air traffic service provider or air operators.

# 2 Overview

## 2.1 Aeronautical Study

A. Where an aerodrome operator / applicant is not able to comply with any standard or requirement stipulated in the Aerodrome Regulations, appropriate risk assessment and/or aeronautical studies shall be conducted to assess the impact of deviations from the standards or requirements. The purpose of such studies is to present alternative means of ensuring the safety of aircraft operations, to estimate the effectiveness of each alternative and to recommend procedures and/or alternative measures to compensate for the deviation.

B. An aeronautical study may only be undertaken in respect of subjects identified in Aerodrome Regulations or ICAO Annex 14 as appropriate for an aeronautical study, these are listed in Appendix A to this Guidance Material. In addition, an aeronautical study may be undertaken for reduced dimensions of a Runway End Safety Area (RESA), not for the absence of a RESA.

C. An aeronautical study can identify and evaluate aerodrome service options, including service increases or decreases, or the introduction or termination of services (such as the introduction of a rapid exit taxiway or removal of a grass runway).

D. The initial baseline study will be followed by a review of operational issues; this will typically involve an in-depth safety analysis based on quantifiable data, where available, and extensive consultation with aerodrome users and stakeholders using various interview and data gathering processes including a hazard identification workshop. This study may identify any changes that are required to ensure the safe, orderly, and efficient operation of the aerodrome.

E. The study will normally cover phases such as requirements definition, design evaluation, introduction to service, and routine operation. The aeronautical study can be presented in parts corresponding to these developing phases as information becomes available, but CAAT can only determine the acceptability of a study when it is complete.

## 2.2 Consultation

A. It is essential that, in conducting the aeronautical study, there is consultation with as wide a range of aerodrome users and other stakeholders as possible. The following may be included in the consultation:

1) Aerodrome operators (including adjacent affected aerodrome operators);

2) Aerodrome users;

3) Airspace user groups;

4) Aircraft operators and operator groups;

5) Pilot organisations;

6) Air traffic service providers; and

7) The Civil Aviation Authority of Thailand (CAAT).

## 2.3 Technical Analysis

A. Technical analysis will provide justification for a deviation on the grounds that an equivalent level of safety can be attained by other means. It is generally applicable on situations where the cost of correcting a problem that violates a standard is excessive but where the unsafe effects of the problem can be overcome by some procedural or other means which offer both practical and reasonable solutions.

B. In conducting a technical analysis, an aerodrome operator / applicant should draw upon their practical experience and specialized knowledge. The aerodrome operator / applicant may also consult other specialists in relevant areas. When considering alternative procedures in the deviation approval process, it is essential to bear in mind the safety objective of the Aerodrome Regulations and the applicable standards and/or requirements so that the intent of the regulations is not circumvented.

# 3 Aeronautical Study for Aerodrome

## 3.1 The Aeronautical Study Contents

A. An aeronautical study is a study of an aeronautical problem carried out by an aerodrome operator / applicant to identify possible solutions and select a solution that is acceptable without degrading safety. The Aerodrome Standards Department (AGA) of The Civil Aviation Authority of Thailand will review these studies on a case by case basis and determine their acceptability.

B. An aeronautical study submitted to The Civil Aviation Authority of Thailand (CAAT) for determination of acceptability should comprise the following parts:

1) Aim of the study;
2) Background including system description;
3) Hazard identification and safety assessment;
4) Recommendations;
5) Conclusion; and
6) Monitoring of the deviation.

## 3.2 Aim of the Study

A. The aim of the study should be explicitly stated. It should:

1) resolve the safety concerns;
2) identify safety measures to be put in place to ensure safe aircraft operations in an aerodrome;
3) make reference to the specific regulations which the study is meant to address; and
4) indicate how the acceptable level of safety will be achieved and maintained.

B. An example to illustrate this would be as follow:

*"The aim of this aeronautical study is to address the operation of <name of aerodrome> with high ground on its north side that infringes the inner horizontal surface, and to put in place <list of safety measures> necessary to ensure safe operation of all aircraft at <name of aerodrome> with reference made to <reference to specific regulation>..."*

## 3.3 Background

A. Information on the current situation faced by the aerodrome operator / applicant, current procedures that have been put in place and other relevant details should be clearly stated and explained in this sub-section. Clear explanation should be provided, particularly on the following:

1) What is the current situation? i.e. a system description

2) Where are the areas that will be affected by the proposed deviation?

3) When will the aerodrome operator / applicant be able to comply with the specific standard if it is due to development of the aerodrome?

4) Why is there a need to review the current processes and procedures?

5) How will the proposed deviation affect the operation of aircraft at the aerodrome?

B. An example to illustrate this would be as follows:

*"All aerodrome are required by the regulation to comply with specific obstacle limitation surfaces according to the operation of the aerodrome. Due to high ground to the north of <name of aerodrome>. This study is undertaken to ensure the safe and efficient operation of <name of aerodrome> by identifying the hazards of the high ground, assessing the safety risks and determining appropriate actions and procedures…"*

## 3.4 Hazard Identification and Safety Risk Assessment

A. There is no standard methodology to conduct a safety assessment and it is up to the aerodrome operator / applicant to determine the appropriate methodology for each aeronautical study, depending on the size and complexity of the situation and the severity of the safety implications. However, the methodology adopted should be consistent with that established in the aerodrome operator's / applicant's Safety Management System (SMS).

### 3.4.1 The Concept of Risk

A. Risk assessment is a key step in an aeronautical study.

B. A risk scenario is a sequence of events with an associated frequency of occurrence and consequence. This sequence of events may be summarised as "hazard – threats – controls – key event – mitigations – consequences".

C. The hazard is what ultimately generates the loss; it may present a number of threats, each of which, without controls, will lead to the "key event". The key event is the point at which control of the hazard is lost. Once this point has been reached, mitigations may still avoid or reduce undesirable consequences. Controls are proactive defenses, while mitigations may be proactive or reactive.

D. The diagram representing the multiple hazards through a key event resulting in multiple consequences likened to a "Bow Tie".

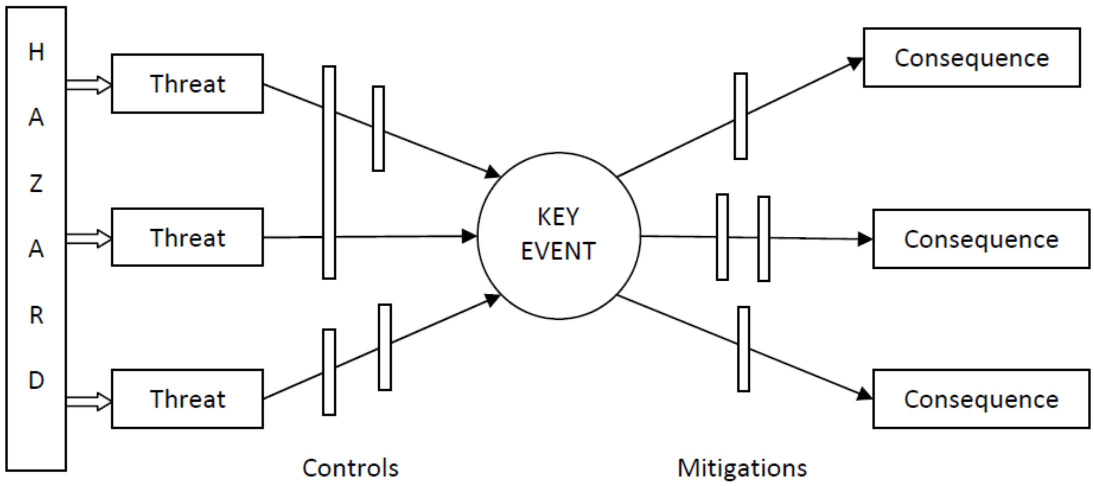


**Figure 1** Generic Risk Scenario Diagram

E. For example, a rainstorm (the hazard) may result in standing water on a runway (a threat) and reduced braking performance (another threat). The key event in this case is loss of control of the aircraft on the runway; this may result in damage or injury (the consequence). Controls might include tyre design, anti-skid braking systems, improved runway surface drainage and improved instrument approach, while mitigations could include improved friction and improved runway shoulders and graded areas. The consequences are the damages and injuries that may result.

F. The risk is the combination of likelihood (or probability) and severity of the consequence which is the damage or injury resulting from the loss of control of the aircraft. It, therefore, includes the probability of loss of control and the severity of damage or injury.

### 3.4.2 Acceptable Risk

A. "Acceptable risk" is based on the concept that no activity is without some risk, however small. The level of risk that is acceptable varies with the type of activity and according to the consequences; in general, the acceptable level of risk for adventure activities is higher than that for normal day-today activities, and higher for single fatality accidents than for those with multiple fatalities.

B. Perceptions of risk can be divided into three broad categories:

1) risks that are so high that they are intolerable;

2) risks that are low enough to be acceptable; and

3) risks between these two categories, these need to be reduced / mitigated to an acceptable level.

C. If the risk does not meet the pre-determined acceptability criteria, an attempt must always be made to reduce it to a level that is acceptable, using appropriate mitigation procedures. If the risk cannot be reduced to or below the acceptable level, it may be regarded as tolerable if:

1) the risk is below the pre-determined intolerable level; and

2) the risk has been reduced to a level that is as low as reasonably practicable (ALARP); and

3) the benefits of the proposed system or changes are sufficient to justify tolerating the risk.

D. The issue of voluntary and involuntary risk needs to be considered as a factor of acceptable risk. Tolerance of risk depends on the extent to which a person (who is the subject of the consequences of that risk) perceives they have control of the decision to accept the risk or not.

E. Typically, people are willing to take voluntary risks with probabilities of occurrence a thousand times greater than those of involuntary or imposed risks e.g. a person will accept higher levels of risk in choosing to drive a car, than they will tolerate as a bus passenger. Most of our aviation risk relates to involuntary or imposed risk for those affected by the consequences e.g. a passenger of an aircraft.

3.4.3 Hazard Identification

A. An aerodrome operator / applicant shall develop and maintain a process that ensures that hazards associated with its products or services are identified.

B. Hazard identification shall be based on a combination of reactive, proactive and predictive methods of safety data collection. All identified hazards shall be recorded.

***NOTE:*** *Appendix B contains a sample of hazard log. An aerodrome operator / applicant may use this to formulate its own hazard log to suit the aeronautical study.*

C. Safety risk assessment and mitigation: An aerodrome operator / applicant shall develop and maintain a process that ensures analysis, assessment, and control of the safety risks associated with identified hazards.

D. Risk mitigation measures may work through reducing the probability of occurrence, or the severity of the consequences, or both. Achieving the desired level of risk reduction may require the implementation of more than one control or mitigation measure.

E. The process becomes one of iteration following the steps below:

1) Systematically identify possible hazards through a combination of reactive, proactive, and predictive safety data collection methods. Normally, this will include holding a hazard identification workshop;

2) Evaluate the severity of the consequences of the key event occurring;

3) Evaluate the probability of it happening; and

4) Determine whether the consequent risk is tolerable and within the aerodrome operators's / applicant's acceptable safety performance criteria. If not, take action to reduce the risk to a tolerable level by reducing the severity of the consequences and/or the probability of them arising.

F. Risk mitigation strategies can include:

1) **Elimination –** redesign or substitute to remove the hazard;

2) **Substitution –** replacement or proposal with a less hazardous alternative;

3) **Engineering Controls –** use equipment or other measures to segregate the hazard from those exposed;

4) **Administrative or Operational Controls –** identify, design, promulgate, and implement procedures to operate safely;

5) **Safety Contingencies –** reduce the severity by measures ranging from protective equipment and similar safety measures to improving emergency response; or

6) **Cease Operation.**

3.4.4 The Seven Step Safety Risk Process

A. Risk assessment and mitigation requires a systematic approach. The complete process can be divided into seven steps and may be iterative (see Figure 2).

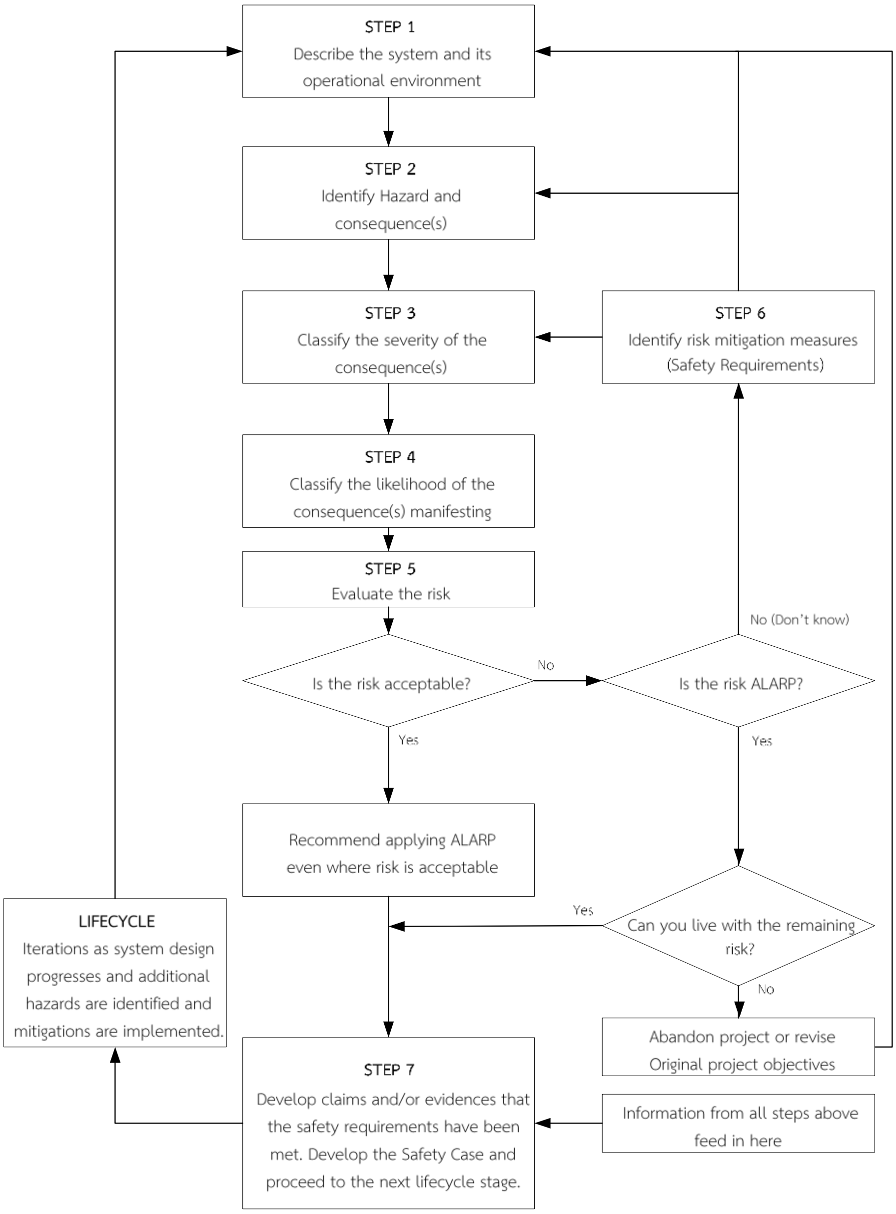


**Figure 2** The Seven Step Approach

***NOTE:*** *Having decided that a mitigation measure may be suitable, it will be necessary to repeat steps 3, 4, and 5 in order to evaluate the acceptability of the risk with that proposed mitigation measure in place.*

### 3.4.5 Risk Evaluation

A. A risk assessment matrix should be used. This matrix provides a relationship between the probability and severity of a consequence of a hazard occurring. The risk indexes (combinations of the risk probability values and the risk severity values) should be placed in a risk tolerable table, categorized as follows:

1) **Intolerable –** Unacceptable under the existing circumstances.

2) **Tolerable –** Acceptable based on risk mitigation. It may require management decision.

3) **Acceptable –** Acceptable as is. No risk mitigation required.

***NOTE:*** *Appendix C provides an example of risk assessment matrix and risk tolerability.*

### 3.4.6 Risk Control

A. Risk control / mitigation measures should be developed to address the potential hazard or to reduce the risk probability or severity of the consequence when the risk is classified to be tolerable to a level acceptable by the aerodrome operator / applicant. There are three broad categories for risk control / mitigation and they are as follows:

1) **Avoidance –** the operation or activity is cancelled as the risks exceed the benefits of continuing the operation or activity;

An example to illustrate this would be as follow:

*"To prohibit aircraft to land or take-off from <name of aerodrome>, which is obstructed by <name of high ground> high ground obstacles."*

2) **Reduction –** The frequency of the operation or activity is reduced, or action is taken to reduce the magnitude of the consequences of the accepted risks; and

An example to illustrate this would be as follow:

*"To reduce the number of aircraft operating to land or take-off from <name of aerodrome> and to only operate in VMC."*

3) **Segregation of exposure –** Action is taken to isolate the effects of the consequences of the hazard or build-in redundancy to protect against it.

An example to illustrate this would be as follows:

*"To prohibit all flight operations, including circling, to the north of the <name of aerodrome> runway <designation>."*

## 3.5 Recommendations

A. To allow the aerodrome operator / applicant and CAAT to be assured that the proposed deviation will not pose a reduction in the level of safety, the aerodrome operator / applicant should recommend operating procedures / restrictions or other measures that will address any safety concerns. In addition, the aerodrome operator / applicant should estimate the effectiveness (through trials, surveys, simulations, etc.) of each recommendation listed to identify the best means to address the proposed deviation.

B. The aerodrome operator / applicant should also ensure that the affected parties are well informed of such changes. The notification procedure including process flow, time frame, and different means of notification such the Aeronautical Information Publication (AIP) in accordance with the AIRAC cycle, if applicable, and Notice to Airmen (NOTAM) should be included in the study.

C. An example to illustrate this would be as follow:

*"The following are some of the operating procedures / restrictions or other measures as well as their measured effectiveness, which could be adopted to ensure safe aircraft operations in <name of aerodrome>:*

*<Name of the operating procedures/restrictions or other measures and their corresponding measured effectiveness>*

*The notification procedure to the affected parties is as follow:*

*<Description of the notification procedure including process flow, time frame, and different means of notification>*

## 3.6 Conclusion

A. The aerodrome operator / applicant, after taking into account all the necessary considerations listed above, should be able to summarise and conclude the results of the aeronautical study, and come to a decision on any safety measures that should be adopted. The aerodrome operator / applicant should also specify a date to put in place all the necessary safety measures and show how they maintain the same level of safety with the recommended safety measures mentioned in the aeronautical study, as well as stating the interim measures until all such safety measures are implemented.

B. An example to illustrate this would be as follow:

*"The results of this aeronautical study have concluded that <obstacle in the inner horizontal surface> would have posed a reduction in the level of safety. However, by adopting prohibition of flight on that side of the aerodrome, this reduction in the level of safety can be safely addressed. These safety measures will be put in place on <proposed date> to address the proposed deviation. With these safety measures put in place, the same level of safety can be achieved as if the <the cause of the study> had not occurred due to segregation of the hazard from the operation."*

## 3.7 Monitoring of the Deviation

A. After the completion of the aeronautical study, the aerodrome operator / applicant should monitor the status of the deviation and ensure that the implemented recommendations have been effectively carried out, and that the level of safety is not compromised at any time. This assessment is to allow feedback into the safety assessment process, if required.

B. An example to illustrate this would be as follow:

*"<Name of the aerodrome operator / applicant> will monitor the deviation's status <fixed period of time> and ensure the safety measure has been effectively carried out and the level of safety is not compromised at any time. <Name of the aerodrome operator / applicant> will review the safety assessment process, if required. Any inadvertent flight on the north side of the aerodrome shall be investigated and reported to CAAT, together with any necessary enhancement of procedures to avoid any repetition."*

C. For temporary deviations, the aerodrome operator / applicant should also notify CAAT after the deviation has been corrected.

## 3.8 Submission of Aeronautical Study to The Civil Aviation Authority of Thailand

A. The aerodrome operator / applicant should note the guidance provided in this Guidance Material and use the suggested checklist provided in Appendix D to ensure that any aeronautical study submitted to CAAT for consideration of acceptance is thoroughly conducted and documented.

B. The CAAT can assist in identifying whether an aeronautical study is required and the appropriate methodology for the aeronautical study and will review the outcome of the aeronautical study.

## Appendix A: Aeronautical Study Applicability

***NOTE:*** *Appendix A provides example of list of non-compliance which an aeronautical study may be applied or considered.*

1. Dimensions of a runway end safety area;
2. Width of a radio altimeter operating area;
3. The separation distance between the centre line of a taxiway and the centre line of a runway, the centre line of a parallel taxiway, or an object;
4. Anything which may endanger aeroplanes on the movement area or in the air within the limits of the inner horizontal surface and conical surface;
5. Permitting new objects or extensions of existing objects above approach surface, transitional surface, conical surface, and inner horizontal surface; or above any of the surfaces required by Aerodrome Regulations;
6. Permitting existing objects above the approach surface, transitional surface, take-off climb surface, conical surface, and inner horizontal surface; or above any of the surfaces required by Aerodrome Regulations;
7. Objects which extend to a height of 150 m or more above ground elevation;
8. Marking and lighting of a fixed obstacle that extends above a take-off climb or an approach surface within 3,000 m of the surface's inner edge; or above a transitional surface; or above a horizontal surface; or other objects that could constitute a hazard to aircraft;
9. Marking and lighting of overhead wires, cables, etc., crossing a river, waterway, valley, or highway; and their supporting towers; and other objects outside the obstacle limitation surfaces;
10. Extended beam spread of medium and high-intensity obstacle lights;
11. Use of high-intensity obstacle lights;
12. Marking and lighting of wind turbine rotor blades, nacelle, and supporting mast;
13. The wheel clearances above threshold;
14. The azimuth spread of the PAPI/APAPI light beam;
15. Removal of, or actions for objects above a PAPI/APAPI obstacle protection surface; and
16. Not providing a location sign in conjunction with a direction sign.

## Appendix B: Hazard Log

***NOTE:*** *Appendix B provides aerodrome operator / applicant with a suggested hazard log for safety assessment of an aeronautical study. Aerodrome operator / applicant may use this log as a guide to formulate his own log. This log should be constantly updated throughout the aeronautical study life-cycle.*

| S/N | Type of Operation or Activity | Hazard and Description | Consequences Identified | Risk Index | Risk Tolerability | Risk Control / Mitigation | Residual Risk Index | Residual Risk Tolerability | Action, if any to further reduce risk(s) and the resulting risk index and the residual risk tolerability |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Aircraft Operation | High ground north of the aerodrome intruding into the inner horizontal surface | • Flight into terrain | 5A | Unacceptable | • Prohibit flight north of aerodrome publish prohibited area for circling with altitude | 1A | Acceptable | • Monitor compliance |
| | | | • Turbulence and windshear effects | 4B | Unacceptable | • Publish warning of turbulence and windshear for relevant wind direction | 3C | Tolerable | • Monitor reports from pilots, review need for improved wind sensors |

# Appendix C: Risk Probability & Severity, Risk Assessment Matrix, and Risk Tolerability

***NOTE:*** *Appendix C provides aerodrome operator / applicant with a suggested risk probability and severity, and risk assessment matrix to be included in an aeronautical study. Aerodrome operator / applicant may use this as a guide for developing their own risk probability and severity, and risk assessment matrix tailored to his individual situation.*

## 1 Risk Probability

| Probability of Occurrence | | |
|---|---|---|
| Likelihood | Meaning | Value |
| Frequent | Likely to occur many times (has occurred frequently) | 5 |
| Occasional | Likely to occur sometimes (has occurred infrequently) | 4 |
| Remote | Unlikely to occur, but possible (has occurred rarely) | 3 |
| Improbable | Very unlikely to occur (not known to have occurred) | 2 |
| Extremely improbable | Almost inconceivable that the event will occur | 1 |

## 2 Risk Severity

| Severity of Occurrence | | |
|---|---|---|
| Severity | Meaning | Value |
| Catastrophic | — Equipment destroyed<br>— Fatality | A |
| Hazardous | — A large reduction in safety margins, physical distress or a workload such that the operators cannot be relied upon to perform their tasks accurately or completely<br>— Serious injury<br>— Major equipment damage | B |
| Major | — A significant reduction in safety margins, a reduction in the ability of the operators to cope with adverse operating conditions as a result of an increase in workload or as a result of conditions impairing their efficiency<br>— Serious incident<br>— Injury to persons | C |
| Minor | — Nuisance<br>— Operating limitations<br>— Use of emergency procedures<br>— Minor incident | D |
| Negligible | — Few consequences | E |

## 3 Risk Assessment Matrix

| Risk probability | | Risk severity | | | | |
|---|---|---|---|---|---|---|
| | | Catastrophic<br>A | Hazardous<br>B | Major<br>C | Minor<br>D | Negligible<br>E |
| Frequent | 5 | 5A | 5B | 5C | 5D | 5E |
| Occasional | 4 | 4A | 4B | 4C | 4D | 4E |
| Remote | 3 | 3A | 3B | 3C | 3D | 3E |
| Improbable | 2 | 2A | 2B | 2C | 2D | 2E |
| Extremely improbable | 1 | 1A | 1B | 1C | 1D | 1E |

## 4 Risk Tolerability

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

## Appendix D: Aeronautical Study Checklist

***NOTE:*** *The purpose of this form is to provide aerodrome operator / applicant with a suggested checklist for reviewing of an aeronautical study. Aerodrome operator / applicant may use this checklist as a guide for developing an aeronautical study tailored to his individual situation.*

| AERONAUTICAL STUDY CHECKLIST | | | |
|---|---|---|---|
| Checklist for Aeronautical Study | Yes | No | Remarks |
| 1. Aim of the study including:<br>b) Address safety concerns;<br>c) Identify safety measures; and<br>d) Make reference to specific standards or requirements in Aerodrome Regulations. | | | |
| 2. Consultation with stakeholders, senior management team, and divisions / departments affected. | | | |
| 3. The study is approved by the accountable executive of the organization. | | | |
| 4. Background information on the current situation. | | | |
| 5. Proposed date for complying with the standards / requirements, if the deviation is due to development of the aerodrome. | | | |
| 6. Safety assessment including:<br>a) identification of hazards and consequences; and<br>b) risk management. | | | |
| 7. The safety assessment used in the study (e.g. hazard identification workshop, hazard log, risk probability and severity, risk assessment matrix, risk tolerability, risk control / mitigation, and re-assessment of the risk) | | | |
| 8. Recommendations (including operating procedures / restrictions or other measures to address safety concern) of the aeronautical study and **how the proposed deviation will not pose a reduction in the level of safety**. | | | |
| 9. Estimation of the effectiveness of each recommendation listed in the aeronautical study. | | | |
| 10. Notification procedure including process flow, time frame, and the publication used to promulgate the deviation. | | | |
| 11. Conclusion of the study. | | | |
| 12. Monitoring of the deviation. | | | |
| 13. Notification to Aerodrome Standard Department (AGA) of The Civil Aviation Authority of Thailand once the temporary deviation has been corrected. | | | |