INTERNATIONAL CIVIL AVIATION ORGANIZATION

THE SECOND MEETING OF THE APANPIRG AERODROMES OPERATIONS AND PLANNING – WORKING GROUP (AOP/WG/2)

Yogyakarta, Indonesia, 3 – 5 June 2014

Agenda Item 4: Provision of AOP in the Asia/Pacific Region

PROPOSAL FOR THE AMENDMENT OF ANNEX 14, VOLUME I AND PROPOSED *PROCEDURES FOR AIR NAVIGATION SERVICES – AERODROMES (PANS–AERODROMES)*

(Presented by the Secretariat)

SUMMARY

The Air Navigation Commission at the twelfth meeting of its 193rd Session (4th June 2013) conducted a preliminary review of the proposals developed by the PANS — Aerodromes Study Group (PASG) for the amendment of Annex 14 — *Aerodromes*, Volume I — *Aerodrome Design and Operations*. The Commission also reviewed a draft of the PANS — Aerodromes document proposed by the study group and agreed that the amendment proposals and the draft PANS — Aerodromes document should be submitted to Member States and selected international organizations for comments. The proposed amendment to Annex 14, Volume I and the proposed PANS — Aerodromes are envisaged for applicability on 12 November 2015.

This paper relates to –

Strategic Objectives:

*A: **Safety** – Enhance global civil aviation safety*
*B: **Air Navigation Capacity and Efficiency –** Increase Capacity and improve efficiency of the global civil aviation system*
*E: **Environmental Protection** – Minimize the adverse environmental effects of civil aviation activities*

1. INTRODUCTION

1.1 The Air Navigation Commission at the twelfth meeting of its 193rd Session (4 June 2013) conducted a preliminary review of the proposals developed by the PANS — Aerodromes Study Group (PASG) for the amendment of Annex 14 — *Aerodromes*, Volume I — *Aerodrome Design and Operations*. The Commission also reviewed a draft of the PANS — Aerodromes document proposed by the study group and agreed that the amendment proposals and the draft PANS — Aerodromes document should be submitted to Member States and selected international organizations for comments. In State letter AN 4/1.1.53–13/81 dated 11 December 2013 Contracting States and appropriate international organizations have been requested for any comments on the proposals by 14 March 2014.

2. DISCUSSION

2.1 The main features of the proposed amendments are the following:

a) introductory information on PANS — Aerodromes and references to it in Annex 14, Volume I;

b) procedures on the stages for certifying an aerodrome, contents of an aerodrome manual, critical conditions of aerodrome certificate, management of change;

c) the establishment of a new section concerning aerodrome operations for the use of aerodromes undertaking an assessment of its compatibility for the type of traffic or operation the aerodrome is intending to operate; and

d) the draft first edition of PANS — Aerodromes.

2.2 ICAO State letter AN 4/1.1.53- 13/81 dated 11 December 2013 is placed at Attachment A to this working paper. The proposed amendment to Annex 14, Volume I and the proposed PANS — Aerodromes are envisaged for applicability on 12 November 2015.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper; and

b) discuss any relevant matters as appropriate.

…….

ATTACHMENT A

International Civil Aviation Organization | Organisation de l'aviation civile internationale | Organización de Aviación Civil Internacional | Международная организация гражданской авиации | منظمة الطيران المدني الدولي | 国际民用航空组织

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11 December 2013

Ref.: AN 4/1.1.53-13/81

Subject: Proposal for the amendment of Annex 14, Volume I and proposed *Procedures for Air Navigation Services — Aerodromes* (PANS — Aerodromes)

Action Required: Comments to reach Montreál by 14 March 2014

Sir/Madam,

1. I have the honour to inform you that the Air Navigation Commission, at the twelfth meeting of its 193rd Session held on 4 June 2013, conducted a preliminary review of the proposals developed by the PANS-Aerodromes Study Group (PASG) for the amendment of Annex 14 — *Aerodromes*, Volume I — *Aerodrome Design and Operations*. The Commission also reviewed a draft of the PANS — Aerodromes document proposed by the study group and agreed that the amendment proposals and the draft PANS — Aerodromes document should be submitted to Member States and selected international organizations for comments.

2. The main features of the proposed amendments are the following:

a) introductory information on PANS-Aerodromes and references to it in Annex 14, Volume I;

b) procedures on the stages for certifying an aerodrome, contents of an aerodrome manual, critical conditions of aerodrome certificate, management of change;

c) the establishment of a new section concerning aerodrome operations for the use of aerodromes undertaking an assessment of its compatibility for the type of traffic or operation the aerodrome is intending to operate; and

d) the draft first edition of PANS-Aerodromes.

3. The proposal for amendment of Annex 14, Volume I, is in Attachment B. The proposed PANS — Aerodromes document is at Attachment C. To facilitate better understanding, Attachment A to

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this State letter contains the background information on this subject as well as the rationale behind the proposal.

4. In examining the proposed amendments, you should not feel obliged to comment on editorial aspects as such matters will be addressed by the Air Navigation Commission during its final review of the draft amendment.

5. May I request that any comments you may wish to make on the amendment proposal be dispatched to reach me not later than 14 March 2014. The Air Navigation Commission has asked me to specifically indicate that comments received after the due date may not be considered by the Commission and the Council. In this connection, should you anticipate a delay in the receipt of your reply, please let me know in advance of the due date.

6. For your information, the proposed amendment to Annex 14 Volume I and the proposed PANS — Aerodromes are envisaged for applicability on 12 November 2015. Any comments you may have thereon would be appreciated.

7. The subsequent work of the Air Navigation Commission and the Council would be greatly facilitated by specific statements on the acceptability or otherwise of the proposal. Please note that for the review of your comments by the Air Navigation Commission and the Council, replies are normally classified as "agreement with or without comments", "disagreement with or without comments" or "no indication of position". If in your reply the expressions "no objections" or "no comments" are used, they will be taken to mean "agreement without comment" and "no indication of position", respectively. In order to facilitate proper classification of your response, a form has been included in Attachment D, which may be completed and returned together with your comments, if any, on the proposals in Attachments B and C.

Accept, Sir/Madam, the assurances of my highest consideration.

Raymond Benjamin
Secretary General

Enclosures:

A — Background information
B — Proposed amendment to Annex 14, Volume I
C — Proposed 1st Edition of PANS — Aerodromes
D — Response form

ATTACHMENT A to State letter AN 4/1.1.53- 13/81

BACKGROUND INFORMATION ON THE DEVELOPMENT OF 1ST EDITION OF *PROCEDURES FOR NAVIGATION SERVICES* (PANS) - *AERODROMES*

1.1 Annex 14, Volume I contains, *inter alia*, Standards and Recommended Practices (SARPs) that prescribe the physical characteristics and obstacle limitation surfaces to be provided for at aerodromes, and certain facilities and technical services normally provided at an aerodrome. Although the Annex provides some general requirements on aerodrome operations such as aerodrome emergency planning, it is mainly used as a design document and does not sufficiently address aerodrome operational management which is equally important for aerodrome safety and efficiency. There is therefore a need to develop an ICAO document that addresses procedures for aerodrome operational management as many challenges that aerodromes face today are of an operational nature, particularly where larger aircraft need to be accommodated and/or the development of the aerodrome is constrained.

1.2 High level requirements for the certification of aerodromes are available in Annex 14, Volume I. However, the Annex does not address operational procedures dealing with existing aerodromes. In reality, many existing aerodromes worldwide were not built to the full design standards specified in the existing Annex 14, Volume I and, in certain cases, it is impossible or impracticable for those aerodromes to render their infrastructure to be in accordance with the Annex design Standards. This mainly relates to physical characteristics of an aerodrome, including different separation distances. The situation is highlighted by the introduction of the Airbus A380 operations at a number of existing aerodromes. In order to ensure safety and enhance aerodrome operational efficiency, operational procedures should be put in place and should be taken into consideration in the aerodrome certification process.

1.3 A summary of the audit results conducted through the ICAO Universal Safety Oversight Audit Program reveal that a large number of the States audited have not yet certified or established a process for the certification of aerodromes. Many States have neither developed nor issued guidance to regulatory staff and aerodrome operators on the use of aeronautical studies and their evaluation in relation to granting exemptions or exceptions to requirements. Most States have not ensured that aerodrome operators implement a safety management system (SMS) as part of their aerodrome certification process. The provisions relating to runway friction, runway end safety areas, pavement use and the periodic testing and review of aerodrome emergency plans show a lack of compliance by a high percentage of the audited States. Other high percentages of non-satisfactory questions stem from weaknesses in a State's surveillance programme, including a lack of formal inspection procedure used for the continuing surveillance of aerodrome certificate holders and a lack of expertise in highly specialized areas such as rescue and fire fighting and wildlife/bird hazard control. Furthermore, many States have not provided sufficient guidance to regulatory staff and aerodrome operators on obstacle control and management.

1.4 The above areas where the findings were identified in the audits of many States are more related to aerodrome operational management. Annex 14, Volume I includes SARPs in these areas providing, in most cases, only general requirements; however, there is a lack of global operational procedures that would assist States to achieve compliance with the SARPs. For

example, Annex 14, Volume I provides SARPs for obstacle limitation surfaces and general requirements for obstacle removal but not for procedures on how to manage and control obstacles in the vicinity of aerodromes. The USOAP audits indicate that at many aerodromes worldwide, there is a lack of procedures on how to inspect and identify obstacles in the vicinity of aerodromes, initiate action to deal with obstacle control, coordinate with different stakeholders and find resolutions for the sake of safety and efficiency. A similar situation exists in many other aspects of aerodrome operational management, including wildlife/bird hazard management, winter operations, work in progress at aerodromes, maintenance and aerodrome surveillance inspections.

1.5 The Air Navigation Commission (AN Min 180-7) *agreed* that a phased approach to the development of a document called PANS-Aerodromes was preferred as this would allow for a methodical, chapter-by-chapter progression focusing on critical items first. Accordingly, the PANS-Aerodromes Study Group (PASG) was established comprising members from eleven (11) States and seven (7) international organizations with the objective of developing procedures in PANS-Aerodromes for the management of aerodrome operational issues.

1.6 The first edition of PANS-Aerodromes has been developed to assist States and operators to address priority issues identified by ICAO USOAP audits. It contains procedures on certification of aerodrome and the methodology to conduct an aerodrome compatibility study incorporating a safety assessment in order to manage proposed changes to the operations of the aerodrome. The second edition, expected to be available in 2018, will describe the processes and actions involved in the day-to-day operations of an aerodrome such as but not limited to runway and apron safety, airside inspections and wildlife hazard management. It is envisaged that the PANS-Aerodromes will contain useful procedures and processes that will enable States and aerodrome operators to deliver an enhanced safety and efficient performance in today’s challenging environment.

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ATTACHMENT B to State letter AN 4/1.1.53- 13/81

PROPOSED AMENDMENT TO

INTERNATIONAL STANDARDS

AND RECOMMENDED PRACTICES

Annex 14 — Aerodromes Volume I — *Aerodrome Design and Operations*

NOTES ON THE PRESENTATION OF THE PROPOSED AMENDMENT

The text of the amendment is arranged to show deleted text with a line through it and new text highlighted with grey shading, as shown below:

1.	~~Text to be deleted is shown with a line through it.~~	text to be deleted
2.	New text to be inserted is highlighted with grey shading.	new text to be inserted
3.	~~Text to be deleted is shown with a line through it~~ followed by the replacement text which is highlighted with grey shading.	new text to replace existing text

INITIAL PROPOSAL 1

PUBLICATIONS *(page xi)*
(related to the specifications of this Annex)

Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual (Doc 9830)
…
Manual on the ICAO Bird Strike Information System (IBIS) (Doc 9332)

Procedures for Air Navigation Services — Aerodromes (PANS-AERODROMES) (Doc xxxx)

Procedures for Air Navigation Services — Aircraft Operations (PANS-OPS) (Doc 8168)
Volume I — *Flight Procedures*
Volume II — *Construction of Visual and Instrument Flight Procedures*
…

INITIAL PROPOSAL 2

Rationale

The first edition of the PANS-Aerodromes has been developed to provide procedures to address the many operational challenges that aerodrome operators face today, particularly where large aeroplanes need to be accommodated at aerodromes where physical development is constrained. The proposed amendment to Annex 14, Volume I permits the use of PANS-Aerodromes in addressing issues faced by existing aerodromes and provides the necessary procedures to ensure continued safety of operations.

Annex 14 — Aerodromes Volume I — *Aerodrome Design and Operations*

CHAPTER 1. GENERAL

Introductory Note.— This Annex contains Standards and Recommended Practices (specifications) that prescribe the physical characteristics and obstacle limitation surfaces to be provided for at aerodromes, and certain facilities and technical services normally provided at an aerodrome. It also contains specifications dealing with obstacles outside those limitation surfaces. It is not intended that these specifications limit or regulate the operation of an aircraft.

….

This document sets forth the minimum aerodrome specifications for aircraft which have the characteristics of those which are currently operating or for similar aircraft that are planned for introduction. Accordingly, any additional safeguards that might be considered appropriate to provide for more demanding aircraft are not taken into account. Such matters are left to appropriate authorities to

evaluate and take into account as necessary for each particular aerodrome. Provisions for the accommodation of more demanding aircraft at existing aerodromes can be found in Procedures for Air Navigation Services (PANS)- Aerodromes *(Doc xxxx*). *Guidance on some possible effects of future aircraft on these specifications is given in the* Aerodrome Design Manual *(Doc 9157), Part 2.*

….

1.4 Certification of aerodromes

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1.4.1 States shall certify aerodromes used for international operations in accordance with the specifications contained in this Annex as well as other relevant ICAO specifications through an appropriate regulatory framework.

Note.— Specific procedures - on the stages of certifying an aerodrome is given in the Procedures for Air Navigation Services (PANS) – Aerodromes *(Doc xxxx). Further guidance on aerodrome certification can be found in* Doc 9774, *Manual on Certification of Aerodromes.*

….

1.4.4 As part of the certification process, States shall ensure that an aerodrome manual which will include all pertinent information on the aerodrome site, facilities, services, equipment, operating procedures, organization and management including a safety management system, is submitted by the applicant for approval/acceptance prior to granting the aerodrome certificate.

Note 1.— Contents of an aerodrome manual, including procedures for its submission and approval/acceptance, verification of compliance and granting of aerodrome certificate, are available in the PANS-Aerodromes *(Doc xxxx).*

Note 2.— The intent of a safety management system is to have in place an organized and orderly approach in the management of aerodrome safety by the aerodrome operator. Annex 19 — Safety Management *contains the safety management provisions applicable to certified aerodrome. Guidance on ~~an aerodrome~~ harmonized safety management system is given in the* Safety Management Manual (SMM) *(Doc 9859) and in the* Manual on Certification of Aerodromes *(Doc 9774). Procedures on the management of change, conduct of safety assessment, reporting and analyses of safety occurrences at aerodromes and continuous monitoring to enforce compliance with applicable specifications so that identified risks are mitigated can be found in* PANS-Aerodromes *(Doc xxxx).*

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Editorial Note.— Incorporate new section 1.7 following section 1.6 Reference Code

Rationale

A new section 1.7 is proposed for inclusion in Annex 14, Vol I, Chapter 1. The new section proposes two SARPs including the relevant notes and are directed to the use of the procedures in Chapters 3 and 4 of the PANS-Aerodromes. (Reference on the use of Chapter 2 of PANS-Aerodromes concerning aerodrome certification is contained in the proposed Note to paragraph 1.4.1 above.)

1.7 Aerodrome Operations

Introductory Note.— This section introduces Procedures for Air Navigation Services (PANS)–Aerodromes *(Doc xxxx)for the use of aerodromes undertaking an assessment of its compatibility for the type of traffic or operation the aerodrome is intending to accommodate. The material in the PANS-Aerodromes addresses operational issues faced by existing aerodromes and provides the necessary procedures to ensure the continued safety of operations. Where alternative measures, operational procedures and operating restrictions have been developed, these should be detailed in the aerodrome manual and reviewed periodically to assess their continued validity. The PANS-Aerodromes is not intended to substitute nor circumvent the provisions contained in this Annex. It is expected that new infrastructure on an existing aerodrome or a new aerodrome will fully comply with the requirements in this Annex. See Annex 15, 4.1.2 (c) on States' responsibilities on listing of differences with the related ICAO Procedures in the Aeronautical Information Publication.*

1.7.1 When the aerodrome accommodates an aeroplane that exceeds the certificated characteristics of the aerodrome, the compatibility between the operation of the aeroplane and aerodrome infrastructure and operations shall be assessed and appropriate measures be developed and implemented in order to maintain an acceptable level of safety during operations.

Note.— Procedures to assess the compatibility of the operation of a new aeroplane with an existing aerodrome can be found in the Procedures for Air Navigation Services–Aerodromes *(Doc xxxx).*

1.7.2 Information concerning alternative measures, operational procedures and operating restrictions implemented at an aerodrome arising from 1.7.1 shall be promulgated.

Note 1.— See Annex 15, Appendix 1, AD 2.20 on the provision of detail description of local traffic regulations.

Note 2.— See Procedures for Air Navigation Services–Aerodromes *(Doc xxxx), Chapter 3, section 3.6 on promulgation of safety information.*

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ATTACHMENT C to State letter AN 4/1.1.53- 13/81

INITIAL PROPOSAL 1

Doc XXXX
AGA/XXX

Procedures for
Air Navigation Services

Aerodromes

First Edition — 20XX

International Civil Aviation Organization

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INITIAL PROPOSAL 2

FOREWORD

1. HISTORICAL BACKGROUND

1.1 The first edition of the *Procedures for Air Navigation Services — Aerodromes* (PANS-Aerodromes) was prepared by the PANS-Aerodromes Study Group (PASG) and contains material that provides for the suitable and harmonized application of aerodrome Standards and Recommended Practices (SARPs) and operational procedures found in Annex 14 — *Aerodromes*, Volume I — *Aerodrome Design and Operations*.

1.2 The Air Navigation Commission, during its final review of Amendment 10 to Annex 14, Volume I, in June 2008, expressed the view that Annex 14, Volume I, was primarily a design document, and the SARPs therein were appropriate for designing new aerodromes. At existing aerodromes where full compliance with Standards cannot be achieved, alternative measures may be required in order to accommodate a specific type of aeroplane. It was suggested that a PANS-Aerodromes~~,~~ was needed which would include procedures on how to address such operational issues.

1.3 The Air Navigation Commission, during the seventh meeting of its 180th session on 26 February 2009, agreed to develop PANS-Aerodromes to complement Annex 14, Volume I.

Rationale

Paragraphs 1.1 to 1.3 provide historical information on the origins of PANS-Aerodromes, in line with those of existing PANS documents.

2. SCOPE AND PURPOSE

2.1 The PANS-Aerodromes are complementary to the SARPs contained in Annex 14, Volume I.

2.2 The PANS-Aerodromes specify, in greater detail than the SARPs, operational procedures to be applied by aerodrome operators to ensure aerodrome operational safety. PANS-Aerodromes specify procedures to be applied by both aerodrome regulators and operators for initial aerodrome certification and continuing aerodrome safety oversight as well as aerodrome

compatibility studies, in particular, where full compliance with the SARPs in Annex 14, Volume I, cannot be achieved.

2.3 The PANS-Aerodromes are not intended to substitute or circumvent the provisions contained in Annex 14, Volume I. It is expected that new infrastructure on an existing aerodrome or a new aerodrome will fully comply with the requirements in Annex 14, Volume I. The contents of PANS-Aerodromes are designed to enable the use of the procedures and methodologies described in the document to assess the operational issues faced by existing aerodromes in a changing and challenging environment and to address those issues to ensure the continued safety of aerodrome operations.

Rationale

The first edition of PANS-Aerodromes includes material on how to certificate an aerodrome, how to undertake a safety assessment as part of a safety management system and how to conduct an aerodrome compatibility study to assess any proposed change to the operation of the aerodrome. The material provides assistance on useful, relevant and current information, processes and procedures to the users in order to meet Annex 14, Volume I provisions by breaking down the requirements into easily understood steps and simple easy to follow processes. It is anticipated that this material will help the relevant users to deliver an enhanced aerodrome safety performance in today's challenging environment.

2.4 The PANS-Aerodromes focus on the priority areas identified by the ICAO Universal Safety Oversight Audit Programme in the domains of certification of aerodromes, safety assessment and operational procedures at existing aerodromes (aerodrome compatibility). Future editions will include topics that are relevant to the provision of uniform and harmonized procedures in aerodrome operations. This edition also deals with the operational requirements of fixed-wing aircraft and therefore the term "aeroplane" has been deliberately used throughout the document to indicate it does not include operational requirements for helicopters.

2.5 The procedures in this document are directed mainly towards aerodrome operators and consequently do not include procedures for aerodrome control service provided by the air traffic service (ATS), which are already covered in the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444).

3. STATUS

3.1 The PANS do not have the same status as SARPs. While SARPs are *adopted* by the Council in pursuance of Article 37 of the Convention on International Civil Aviation and are subject to the full procedure of Article 90, the PANS are *approved* by the Council and recommended to Contracting States for worldwide application.

3.2 While the PANS may contain material that may eventually become SARPs when it has reached the maturity and stability necessary for adoption as such, they may also comprise material prepared as an amplification of the basic principles in the corresponding SARPs and designed particularly to assist the user in the application of those SARPs.

4. IMPLEMENTATION

The implementation of procedures is the responsibility of Member States; they are applicable to actual operations only in so far as States have enforced them. However, with a view to facilitating their processing towards implementation by States, they have been prepared in a language that will permit direct use by aerodrome and State personnel to certify, oversee and manage the operational activities of aerodromes.

5. PUBLICATION OF DIFFERENCES

The PANS do not carry the status afforded to SARPs adopted by the Council as Annexes to the Convention and therefore do not fall under the obligation imposed by Article 38 of the Convention to notify differences in the event of non-implementation. However, attention of States is drawn to the provision in Annex 15 — *Aeronautical Information Services*, related to the publication in their aeronautical information publication (AIP) of lists of significant differences between their procedures and the related ICAO procedures.

6. CONTENTS OF THE DOCUMENT

6.1 Chapter 1 — Definitions

Chapter 1 contains a list of terms and their technical meanings as used in this document.

6.2 Chapter 2 — Certification of aerodromes

6.2.1 Chapter 2 outlines the general principles and procedures to be followed through all of the suggested stages of certifying an aerodrome operator: the initial meeting between the State and the aerodrome operator, technical inspections of the aerodrome, approval/acceptance of all or relevant portions of the aerodrome manual, on-site verification of aerodrome operational aspects including the safety management system (SMS) of the operator, analysis of the deviations from regulatory requirements and issuance of the verification report, assessment of the corrective action plan, issuance of the certificate and continued safety oversight.

6.2.2 Appendix 1 to Chapter 2 contains a list of the main items to be inspected and/or audited in each of the technical and operational areas including the SMS of the operator. Appendix 2 concerns critical data related to safety occurrences. The attachments to Chapter 2 contain a list of possible subjects for an aerodrome manual, a checklist that can be used by the State to assess the acceptance of an aerodrome manual and initial certification of an aerodrome. It is appreciated that these will differ according to the legal basis of the State, but some States might find these helpful.

6.3 Chapter 3 — Safety assessments

Chapter 3 outlines the methodologies and procedures to be followed when undertaking a safety assessment. It includes a brief description of how a safety assessment fulfils an element of the overall SMS. An SMS should be employed by the aerodrome operator to ensure that it is able to control the safety risks it is exposed to as a consequence of the hazards it must face during the operations of the aerodrome.

6.4 Chapter 4 — Aerodrome compatibility

6.4.1 Chapter 4 outlines a methodology and procedures to assess the compatibility between aeroplane operations and aerodrome infrastructure and operations when an aerodrome accommodates an aeroplane that exceeds the certificated characteristics of the aerodrome.

6.4.2 This chapter addresses situations where compliance with the design provisions stipulated in Annex 14, Volume I, is either impractical or physically impossible. Where alternative measures, operational procedures and operating restrictions have been developed, these should be reviewed periodically to assess their continued validity.

6.4.3 The attachments to Chapter 4 contain selected aeroplane characteristics data. They are provided for convenience to allow the aerodrome operator to easily compare the characteristics of various commonly operated aeroplanes. However, the data will be subject to change, and accurate data should always be obtained from the aircraft manufacturers' documentation prior to any official assessment of compatibility.

6.5 Chapter 5 — Aerodrome operational management *(to be developed)*

Chapter 5 will outline the general principles and procedures to be followed in providing uniform and harmonized aerodrome operations.

Table A. Amendments to the PANS-Aerodromes

Amendment	*Source(s)*	*Subject(s)*	*Approved Applicable*
(1st Edition) (20xx)	PANS-Aerodromes Study Group (2009)	Procedures for Air Navigation Services — Aerodromes (PANS-Aerodromes)	

INITIAL PROPOSAL 3

ACRONYMS

AACG	A380 Airport Compatibility Group
AC	Advisory circular
ACI	Airports Council International
ACN	Aircraft classification number
AGL	Above ground level
AHWG	Ad hoc working group
AIP	Aeronautical information publication
APAPI	Abbreviated precision approach path indicator
A-SMGCS	Advanced surface movement guidance and control systems
ATIS	Automatic terminal information service
ATS	Air traffic service
CAA	Civil aviation authority
CAD	Common agreement document
CDM	Collaborative decision-making
CFIT	Controlled flight into terrain
FOD	Foreign object debris/damage
IAIP	Integrated aeronautical information package
IFR	Instrument flight rules
ILS	Instrument landing system
LVP	Low visibility procedures
NAVAID	Aid to air navigation
NLA	New larger aeroplane
OFZ	Obstacle free zone
OLS	Obstacle limitation surfaces
PAPI	Precision approach path indicator
PASG	PANS-Aerodromes Study Group (PASG)
PCN	Pavement classification number
PRM	Precision runway monitor
QFU	Magnetic orientation of runway
RESA	Runway end safety area
RFF	Rescue and fire fighting
RVR	Runway visual range
SARPs	Standards and Recommended Practices
SMM	Safety management manual
SMS	Safety management system
SSP	State safety programme
VASIS	Visual approach slope indicator system

VFR	Visual flight rules
VIS	Visibility
WGS-84	World Geodetic System — 1984

INITIAL PROPOSAL 4

Chapter 1

DEFINITIONS

When the following terms are used in this document, they have the following meanings:

Aerodrome infrastructure. Physical elements and related facilities of the aerodrome.

Applicable regulation. Regulations applicable to the aerodrome and to the aerodrome operator that are transposed from international specifications and other relevant regulations.

Advanced surface movement guidance and control system (A-SMGCS). A system providing routing, guidance and surveillance for the control of aircraft and vehicles in order to maintain the declared surface movement rate under all weather conditions within the aerodrome visibility operational level (AVOL) while maintaining the required level of safety (Doc 9830 — *Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual*).

Compatibility study. A study undertaken by the aerodrome operator to address the impact of introducing an aeroplane type/model new to the aerodrome. A compatibility study may include one or several safety assessments.

Critical aeroplane. The type of aeroplane which is the most demanding for the relevant elements of the physical infrastructure and the facilities for which the aerodrome is intended.

Mobile object. A movable device moving under the control of an operator, driver or pilot.

Obstacle. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that:

a) are located on an area intended for the surface movement of aircraft; or

b) extend above a defined surface intended to protect aircraft in flight; or

c) stand outside those defined surfaces and that have been assessed as being a hazard to air navigation (Annex 14 — *Aerodromes*, Volume I — *Aerodrome Design and Operations*).

Promulgation. The act of formally notifying official information to the aviation community.

Runway incursion. Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft (Doc 9870 — *Manual on the Prevention of Runway Incursions).*

Runway/taxiway excursion. Any occurrence at any aerodrome involving the departure, wholly or partly, of an aircraft from the runway/taxiway in use during take-off, a landing run, taxiing or manoeuvring.

Safety management system (SMS). A systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures (Annex 19 — *Safety Management*).

Safety manager. The responsible individual and focal point for the implementation and maintenance of an effective SMS. The safety manager directly reports to the accountable executive.

State safety programme (SSP). An integrated set of regulations and activities aimed at improving safety *(*Annex 19 — *Safety Management*).

Technical inspection. Visual and/or instrumental verification of compliance with technical specifications related to aerodrome infrastructure and operations.

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INITIAL PROPOSAL 5

Chapter 2

CERTIFICATION OF AERODROMES

2.1 GENERAL

2.1.1 Introduction

This chapter contains provisions with regard to the initial certification process and to continued oversight. General principles and procedures to be followed have been developed to assist States and aerodrome operators to meet their safety obligations.

2.1.2 Scope of certification

2.1.2.1 The scope of certification covers all relevant specifications established through the regulatory framework applicable to the aerodrome.

Note.— The relevant specifications stem from Annex 14, Volume I, Standards and Recommended Practices (SARPs), as well as other relevant additional requirements.

2.1.2.2 The scope of certification includes at least the subjects below:

a) compliance of the aerodrome infrastructure with the applicable regulations for the operations the aerodrome is intended to serve;

b) the operational procedures and their day-to-day application, when applicable, concerning:

1) aerodrome data and reporting;

2) access to the movement area;

3) aerodrome emergency plan;

4) rescue and fire fighting (RFF);

5) inspection of the movement area;

6) maintenance of the movement area;

7) snow and ice control, and other hazardous meteorological conditions;

8) visual aids and aerodrome electrical systems;

9) safety during aerodrome works;

10) apron management;

11) apron safety;

12) vehicles on the movement area;

13) wildlife hazard management;

14) obstacles;

15) removal of a disabled aeroplane;

16) low visibility operations; and

17) compliance of the safety management system (SMS) with applicable regulations.

Note 1.— Provisions on reporting aerodrome information in 2.1.2.2 b) 1) can be found in Annex 15 and the Manual on Certification of Aerodromes *(Doc 9774).*

Note 2.— Provisions related to the above operational procedures will be developed in subsequent editions of PANS-Aerodromes.

Rationale

The provision above amplifies the scope required of aerodrome certification in Annex 14, Volume I, 1.4.3, and is based on knowledge of States' and industry best practices. Further guidance can be found in Doc 9774 Appendix 1.

2.1.2.3 The aerodrome manual describes all the information, for each certified aerodrome, pertaining to the above scope of certification concerning the aerodrome site, facilities, services, equipment, operating procedures, organization and management, including its SMS.

Note.— The complexity and size of the aerodrome may necessitate the SMS to be included in a separate manual.

2.1.3 Continued oversight

Once the State has completed a thorough review of the compliance of an aerodrome with the applicable certification requirements, leading to the granting of the certificate to the aerodrome operator, continued oversight should be established by the State in order to ensure that compliance with regard to certification conditions and ongoing additional requirements are maintained.

2.1.4 Shared responsibilities and interfaces

Depending on the requirements of the State, the aerodrome operator may not be responsible for some of the subjects detailed in the above scope of certification. In this case, the aerodrome manual should clearly define, for each of these items, which coordination and procedures have been put into place in the case of multiple responsible stakeholders.

Note.— Where the aerodrome operator implements specific procedures related to other Annexes, these may be described in the aerodrome manual.

INITIAL PROPOSAL 6

2.2 AERODROME MANUAL

2.2.1 Use of the aerodrome manual

2.2.1.1 *Introduction*

An application for an aerodrome certificate shall be accompanied by an aerodrome manual produced in accordance with the applicable regulation. Once granted a certificate, the aerodrome operator is required to maintain the aerodrome manual in conformity with the applicable regulation and enable all aerodrome operating staff to have access to the relevant parts of the manual.

Note 1.— The term "operating staff" means all persons, whether or not they are employed by the aerodrome operator, whose duties are concerned either with ensuring safety of aerodrome operations or require them to have access to the aerodrome movement areas and all other areas within the aerodrome perimeter.

Note 2.— When considered suitable for security or management reasons, the aerodrome operator may restrict the access of some operating staff to parts of the aerodrome manual, if they are suitably briefed by other means to perform their duties adequately and this would not impair the safety of aerodrome operations.

Rationale

This procedure amplifies the requirement in Annex 14, Volume I, paragraph 1.4.4, concerning the need for an aerodrome manual as part of the certification process. It also complies with the intent of the Note to Annex 14, Volume I, section 1.4.

2.2.1.2 *Scope of the aerodrome manual*

2.2.1.2.1 The aim and objectives of the aerodrome manual and how it is to be used by operating staff and other stakeholders should be stated in the manual.

2.2.1.2.2 The aerodrome manual contains all the relevant information to describe the management and operational structure. It is the means by which all aerodrome operating staff are fully informed as to their duties and responsibilities with regard to safety, including information and instructions related to those matters specified in the applicable regulation. It describes the aerodrome services and facilities, all operating procedures, and any restrictions in place.

2.2.1.3 *Ownership of the aerodrome manual*

2.2.1.3.1 The aerodrome operator is responsible for developing and maintaining the aerodrome manual, as well as providing appropriate personnel access to it.

2.2.1.3.2 It is the responsibility of the aerodrome operator to be satisfied with the appropriateness of each provision of the aerodrome manual to a particular operation and to make amendments and additions as necessary.

2.2.1.4 *Format of the aerodrome manual*

2.2.1.4.1 As part of the certification process, the aerodrome operator shall submit, for approval/acceptance by the State, an aerodrome manual containing, *inter alia*, information on how operational procedures and their safe management will be delivered.

2.2.1.4.2 The aerodrome manual accurately reflects the aerodrome's SMS and shows, in particular, how the aerodrome intends to measure its performance against safety targets and objectives.

2.2.1.4.3 All aerodrome safety policies, operational procedures and instructions are contained in detail or cross-referenced to other formally accepted or recognized publications.

Note.— At larger aerodromes, the size and complexity of operations and related procedures may imply that these procedures cannot be included in a single document. For example, the aerodrome operator may develop and maintain an SMS manual to communicate its approach to the management of safety throughout the aerodrome. In such circumstances it is acceptable to identify within the aerodrome manual references to such provisions. It is essential that any referenced information, documentation and procedures be subjected to exactly the same systems of consultation and promulgation as the aerodrome manual. A computerized database containing the referenced procedures and information could be suitable for that purpose. For many smaller aerodromes the aerodrome manual can be both simple and brief as long as it covers procedures essential for safe day-to-day operations.

2.2.2 Contents of the aerodrome manual

2.2.2.1 The aerodrome manual shall contain, as a minimum, the following sections, including some of their requirements:

a) a table of contents;

b) a list of the corrigenda/amendments: this section should log the updates and/or corrections made to the aerodrome manual;

c) a distribution list;

d) aerodrome administrative data: an organizational chart should be provided, as well as the aerodrome operator’s safety responsibilities;

e) a description of the aerodrome: this includes maps and charts. The physical characteristics of the aerodrome should be documented, as well as the information regarding the RFF level, ground aids and main obstacles. Sufficiently detailed charts of the aerodrome should also be included (showing the aerodrome’s boundaries and different areas (manoeuvring area, apron, etc.). All deviations from the regulatory provisions authorized by the State should be listed together with their validity and references to the related documents (including any safety assessments);

f) a description of the intended operations, including:

1) the critical aeroplanes the aerodrome is intended to serve;

2) the category of runway(s) provided (non-instrument, instrument including non-precision and precision);

3) the different runways and their associated levels of service;

4) the nature of aviation activities (commercial, passenger, air transport, cargo, aerial work, general aviation); and

5) the type of traffic permitted to use the aerodrome (international/national, IFR/VFR, scheduled/non-scheduled); and

g) a description of each of the aerodrome operator's procedures related to the safety of aeronautical operations at the aerodrome. For each procedure:

1) the responsibilities of the aerodrome operator are clearly described;

2) the tasks that are to be achieved by the aerodrome operator or its subcontractors are listed; and

3) the means and procedures required to complete these tasks are described or appended, together with the necessary details such as the frequency of application and operating modes; and

h) a description of the operator's SMS (see Note following 2.1.2.3):

1) the SMS section of the manual is developed, and the related procedures and documents are enclosed, as well as the safety policy of the aerodrome operator signed by the accountable executive;

Note.— Annex 19 specifies a framework for the implementation of an SMS at an aerodrome.

2) the aerodrome SMS should be commensurate with the size of the aerodrome and with the level and complexity of the services provided.

Note.— A list of other possible topics for inclusion in the manual is given in Attachment A to this chapter.

2.2.2.2 Responsibilities attributed to other aerodrome stakeholders should be clearly identified and listed.

2.2.2.3 A list of subcontractors conducting services related to the aeronautical operations on behalf of the aerodrome operator is provided in the aerodrome manual. This list describes the type of services conducted as well as references to the safety-relevant sections of the contracts made between the aerodrome operator and the subcontractors.

2.2.3 Updating of the aerodrome manual

2.2.3.1 Responsibility for maintaining the accuracy of the aerodrome manual is clearly defined in the manual.

2.2.3.2 The manual is updated using a defined process and includes a record of all amendments, effective dates and amendment approvals.

2.2.3.3 The method of enabling all aerodrome operating staff to have access to the relevant parts of the manual is defined and can be demonstrated. Physical copies are numbered, and a list of holders is maintained by the person responsible for the accuracy of the aerodrome manual. Manuscript amendments are not acceptable.

Note.— A method of tracking amendments and ensuring their receipt should be established when using an electronic means of distribution.

2.2.3.4 Any amendments or additions should be communicated to the State in accordance with the continued oversight requirements established by the State.

INITIAL PROPOSAL 7

2.3 INITIAL CERTIFICATION

2.3.1 Points to be covered

2.3.1.1 When an aerodrome operator applies for initial certification, the State shall assess the compliance of that aerodrome with the applicable certification requirements described in 2.1.2. If the aerodrome is found to be compliant, a certificate is issued.

2.3.1.2 Compliance of the aerodrome is assessed through:

a) technical inspections of the infrastructure of the aerodrome and its equipment, as related to the requirements associated with the intended operations;

b) review of the aerodrome manual and supporting documentation and acceptance of its relevant safety parts; and

c) on-site verification of the aerodrome operator’s procedures, its organization and its SMS based upon the contents of the aerodrome manual.

Note 1.— Guidance on the initial certification process, including timelines, is shown at Attachment B.

Note 2.— Technical inspections are planned and conducted so that their results can be used for on-site verifications. Scope and methodologies for technical inspections and on-site verifications are detailed in Appendix 1 to Chapter 2.

Rationale

The aerodrome shall have a valid certificate to operate on a day-to-day basis. The prime purpose of the certification and continued oversight is to ensure the compliance of an aerodrome with the applicable certification requirements and to ensure that compliance with regard to certification conditions and additional ongoing requirements is maintained. In order to enable the aerodrome operator to maintain its compliance on a day-to-day basis, the prerequisite is to establish the applicable certification requirements and the compliance conditions for the aerodrome. This is ensured through the initial certification process. A single document for both the operator and the State who share the certification process was deemed to be desirable in order to avoid the potential inconsistencies brought by the existence of two parallel specifications documents for a single process.

2.3.2 Aerodrome technical inspections

2.3.2.1 The technical inspections of the aerodrome should include:

a) an inspection of the infrastructure, obstacle limitation surfaces (OLS), visual and non-visual aids and aerodrome equipment for the use of aeroplanes;

b) an inspection of the RFF services; and

c) an inspection of wildlife hazard management.

Note 1.— Two options are possible to carry out these inspections and are presented below.

Note 2.— The methodology for technical inspections is proposed in Appendix 1 to this chapter.

Option 1: full inspections by the State

2.3.2.2 At aerodromes where an SMS is not fully operational, full inspections should be conducted by the State.

2.3.2.3 Those inspections should be conducted using checklists developed by the State (see Appendix 1 for critical areas to be inspected).

2.3.2.4 If technical inspections have previously been conducted, and depending on the changes that occurred at the aerodrome since the last inspection, the State can undertake a follow-up inspection instead of a full inspection, which should consist of:

a) assessing that the conditions prevailing at the aerodrome that led to the conclusions of the previous technical inspections are still valid;

b) reviewing any new applicable regulation; and

c) reviewing the implementation of the previously accepted corrective action plan.

2.3.2.5 A report of the follow-up inspection should be produced, including any deviations or observations made during the follow-up inspection. Any immediate and corrective action can be taken, if needed, during follow-up inspections.

Option 2: demonstration of compliance by the operator

2.3.2.6 At aerodromes where an SMS has been fully implemented, the aerodrome operator should ensure that the requirements in the checklists provided by the State have been complied with.

Note.— According to the answers to the checklist, the aerodrome operator may need to undertake safety assessments and provide them, together with the completed checklists, to the State for acceptance.

Rationale

Notwithstanding that technical inspections may have been performed by the State prior to the aerodrome's application for a certificate, States and aerodrome operators may take advantage of the existence of a fully implemented SMS to simplify the certification process. For this reason, the two options described above have been developed for technical inspections. However the implementation of the certification regime may require more stringent regulatory requirements which may result in additional needs for safety assessments which may have been overlooked, even with a fully implemented SMS, due to different regulatory baseline.

2.3.2.8 The State should then analyse the documents completed by the applicant and conduct sample on-site checks according to this analysis.

Note 1.— The methodology that should be used for conducting on-site checks should be the same as the one used for other on-site inspections as described in Appendix 1.

Note 2.— For smaller aerodromes, the demonstration of compliance with infrastructure and equipment requirements by the aerodrome operator may consist only of a self-declaration, together with a list of authorized deviations, where appropriate. Guidance for certification of smaller aerodromes is available in Doc 9774.

Rationale

This procedure requires an analysis of the documents completed/submitted by the aerodrome operator and to accordingly conduct the necessary on-site checks.

2.3.3 Approval/acceptance of the aerodrome manual

2.3.3.1 Prior to on-site verification of the aerodrome (including procedures and SMS), the aerodrome manual is reviewed by the State.

Note 1.— As compliance of all safety-relevant procedures of the aerodrome operator is assessed during the on-site verification, acceptance at that stage consists of checking that all the information that should be contained in the aerodrome manual is provided.

Note 2.— The information required in the aerodrome manual is given in section 2.2.

Note 3.— The checklist given in Attachment C also shows the information required in the aerodrome manual, and has been organized to follow the list of topics given in Attachment A.

Rationale

The procedure above clarifies the need to review the aerodrome manual prior to on-site verification of the aerodrome operator.

2.3.3.2 Prior to the approval/acceptance of the aerodrome manual, the State should verify that:

a) the operator has submitted an application;

b) the aerodrome manual submitted by the aerodrome operator contains all the required information; and

c) all the operator's procedures within the scope of certification that will be needed by the on-site verification team are provided in the aerodrome manual.

2.3.3.3 The State formally informs the aerodrome operator when the aerodrome manual is accepted.

2.3.3.4 The aerodrome operator should inform the State of any changes to the approved/accepted aerodrome manual between the time of the application for a certificate and the end of the on-site verification.

2.3.4 On-site verification

2.3.4.1 The scope of the on-site verification covers the subjects included in the aerodrome manual.

2.3.4.2 The on-site verification confirms that the aerodrome operations are carried out effectively in accordance with the applicable regulation and procedures described in the manual.

2.3.4.3 The on-site verification of the SMS is normally included at this stage of initial certification, but depending on the implementation status of the SMS at the aerodrome, a specific verification of the SMS can be conducted separately.

Note.— Because the aerodrome operator's SMS may not yet be fully operational, its effectiveness will be assessed during continued oversight and will constitute an important factor in deciding the continued oversight that will be carried out.

2.3.4.4 On-site verification of the SMS focuses explicitly on the components required for granting the certificate and, when applicable, covers all other requirements for an SMS.

Note 1.— The minimal SMS components that are to be in operation before the certificate can be granted are described in Appendix 1.

Note 2.— SMS requirements also apply to the aerodrome operator's subcontractors in the domains within the scope of certification.

2.3.4.5 When technical inspections have been previously conducted by the State, the on-site verification takes into account the results of the previous technical inspections and the associated corrective actions, if relevant.

2.3.4.6 If the on-site verification team notices any deviations from the technical inspection reports, they are included in the team's report.

2.3.4.7 If the aerodrome operator is not directly responsible for some of the activities within the scope of certification, the on-site verification ensures that there is appropriate coordination between the aerodrome operator and the other stakeholders.

Note 1.— The methodology used to conduct on-site verifications is available in Appendix 1.

Note 2.— Because the scope of certification is broad, a sampling method for verifying particular subjects may be used rather than the whole scope.

2.3.4.8 At the end of an on-site verification, a preliminary list of findings is given to the aerodrome operator.

2.3.4.9 An on-site verification report is also sent to the aerodrome operator after the classification of findings by the State.

2.3.5 Analysis of the findings and monitoring of the related corrective action plans

2.3.5.1 In case of findings, the State requires the operator to develop a corrective action plan proposing ways to eliminate or mitigate the findings, with deadlines for each subsequent action.

2.3.5.2 The State may impose immediate compensatory measures on the aerodrome operator, if necessary, until actions have been taken to remove or mitigate the findings.

2.3.6 Issuance of the certificate

2.3.6.1 Once the corrective action plans are accepted, and mitigation measures are agreed upon, the State grants the aerodrome certificate to the applicant. An appendix may be attached to the certificate describing the essential conditions prevailing at the aerodrome, which may include:

a) the aerodrome reference code;

b) critical aeroplane type;

c) the operational conditions for the accommodation of critical aeroplanes for which the facility is provided;

d) RFF category;

e) the operational restrictions at the aerodrome; and

f) the authorized deviations related to aerodrome compatibility described in Chapter 4, their inherent operational conditions/restrictions and validity.

2.3.6.2 The State may accept a deviation on the basis of a safety assessment if permitted by the State's ~~legal and~~ regulatory framework.

Note 1.— The methodology for conducting safety assessments is available in Chapter 3.

Note 2.— All accepted deviations are listed in the aerodrome manual (see 2.2.2.1 e)).

Rationale

The procedure above provides for the acceptance of a deviation on the basis of a safety assessment. A list of accepted deviations should be drawn up. Further guidance on the methodology for conducting safety assessments is provided in Chapter 3.

2.3.6.3 The validity of the certificate is either unlimited in time and kept valid as long as the granting conditions are maintained or limited in time.

2.3.6.4 During the period of validity of the certificate, the State monitors the timely implementation of the corrective action plans within the continued oversight developed in 2.5 below.

2.3.7 Promulgation of the status of certification

2.3.7.1 The State shall promulgate the status of certification of aerodromes in the aeronautical information publication, including:

a) aerodrome name and ICAO location indicator;

b) date of certification and, if applicable, validity of certification; and

c) remarks, if any.

2.3.7.2 Where safety concerns have been observed on the aerodrome, special conditions or operational restrictions may be attached to the certificate and published in the aeronautical information publication (AIP) or by NOTAM until completion of the corrective action plan. In this case, validity may be shortened to be consistent with the duration and content of the corrective action plan. Other possible measures that may be taken by the State include suspension and revocation of the certificate.

Rationale

This provision requires the publication of safety information considered to be of operational significance.

INITIAL PROPOSAL 8

2.4 AERODROME SAFETY COORDINATION

2.4.1 Introduction

This section specifies the role of the State in the coordination process and the interaction between the aerodrome operator and other stakeholders which is necessary for the safety of operations at the aerodrome.

2.4.2 Coordination of the aerodrome stakeholders

2.4.2.1 The State verifies that coordination exists between the aerodrome operator, aeroplane operators, air navigation service providers and all other relevant stakeholders to ensure the safety of operations.

2.4.2.2 The aerodrome operator should ensure that all users of the aerodrome, including fixed-based operators, ground-handling agencies and other organizations that perform activities independently at the aerodrome in relation to flight or aircraft handling, comply with the safety requirements of its SMS. The aerodrome operator monitors such compliance.

Rationale

The above procedures describe the need for adequate safety coordination between the various stakeholders as part of the safety management process. The role of the aerodrome operator to ensure compliance by other stakeholders in the aerodrome operator's safety management system is described here, including the responsibility for monitoring of such compliance.

2.4.3 State's feedback on occurrences

2.4.3.1 Aerodrome operators are required to report safety occurrences at their aerodromes to their State in accordance with the applicable regulation, which can be achieved as part of the aerodrome's SMS.

Note.— Annex 13 — Aircraft Accident and Incident Investigation, *contains international SARPs on the mandatory reporting of accidents and serious incidents, including their definitions.*

2.4.3.2 Aerodrome operators shall report accidents and serious incidents, including:

a) runway excursions;

b) undershoots;

c) runway incursions; and

d) landing or take-off on a taxiway.

2.4.3.3 In addition to accidents and serious incidents, aerodrome operators should report safety occurrences of the following types:

a) foreign object debris/damage- (FOD) related event;

b) other excursions (i.e. from a taxiway or apron);

c) other incursions (i.e. on taxiway or apron);

d) wildlife strike-related event; and

e) ground collisions.

Note.— Appendix 2 details the list of safety occurrences types and related critical data which should be reported at an aerodrome. The related tasks for reporting these occurrences and to feed the data when required are shared and coordinated between the various aerodrome stakeholders.

2.4.3.4 Aerodrome operators should ensure that analysis of safety occurrences at the aerodrome is performed by competent personnel.

2.4.3.5 Aerodrome operators should coordinate with all users of the aerodrome, including aircraft operators, fixed-based operators, ground-handling agencies, air navigation service providers and other stakeholders to improve the completeness and accuracy of the collection of safety occurrences and their related critical data.

Rationale

The procedure above describes the need for the aerodrome operator to coordinate with users of the aerodrome to ensure completeness and accuracy of safety information collected.

2.4.3.6 The State should review and analyse the information provided by the operator in the occurrences reports to ensure that:

a) all occurrences in 2.4.3.2 and 2.4.3.3 are adequately analysed by the aerodrome operator;

b) significant trends are identified (either on a specific aerodrome or at a national level). Further in-depth analysis on the subject should be carried out if required so that the appropriate actions can be taken; and

c) the most serious/significant occurrences should be carefully followed up by the State.

2.4.3.7 The output of these analyses by the State can be used as input for the planning of continued oversight.

Note.— Variations in the frequency of occurrences reports on a specific aerodrome could be considered to be an indicator of a potential problem in the reporting culture on the aerodrome or a specific danger that should have been studied by the aerodrome operator. The continued oversight of the reporting processes or subjects with a high frequency of occurrence should be reinforced.

2.4.4 Management of change

2.4.4.1 As part of their SMS, aerodrome operators should have in place procedures to identify changes and to examine the impact of those changes on aerodrome operations.

Note 1.— Changes on an aerodrome can include changes to procedures, equipment, infrastructures, work safety and special operations.

Note 2.— Further guidance on the management of change can be found in Doc 9859, Chapter 4.

2.4.4.2 A safety assessment will be carried out to identify hazards and propose mitigation actions for all changes that are found to have an impact on the aerodrome operations.

Note 1.— Depending on the scope of the envisaged change as well as the level of the impact on operations, the methodology and level of detail required to carry out the required safety assessment may vary.

Note 2.— The types of changes that have to be assessed are described in section 2.4.4.3, and the key principles on safety assessments are available in Chapter 3, Safety Assessments.

2.4.4.3 *Need for a safety assessment according to the category of changes*

2.4.4.3.1 *Routine tasks*. Routine tasks can be described as the actions related to an activity or service that are detailed in formal procedures, which are subject to periodic review, and for which the personnel in charge are adequately trained. These tasks may include ~~and~~ movement area inspections, grass cutting on runway strips, sweeping of apron areas, regular and minor maintenance of runways, taxiways, visual aids, radio navigation and electrical systems.

Rationale

The procedure above provides clarification on what can be considered as routine tasks in the context of change management.

2.4.4.3.1.1 Because these tasks are established and managed through specific procedures, training, feedback and reviews, the changes related to routine tasks do not have to be assessed using the safety assessment methodology developed in Chapter 3.

2.4.4.3.1.2 The actions resulting from the regular assessment, feedback and review process related to these tasks should ensure that any changes related to them are managed, thus ensuring the safety of the specific task. However, a change related to a routine task for which feedback is not yet sufficient cannot be considered as sufficiently mature. Therefore, a safety assessment using the methodology developed in Chapter 3 should be carried out.

2.4.4.3.2 *Specific changes*. Impact on the safety of aerodrome operations may result from:

a) changes in the characteristics of infrastructures or the equipment;

b) changes in the characteristics of the facilities and systems located in the movement area;

c) changes in runway operations (e.g. type of approach, runway infrastructure, holding positions);

d) changes to or significant operations on one of the aerodrome networks (energy, telecom, thermal);
e) changes that affect conditions as specified in the aerodrome's certificate;

f) long-term changes related to contracted third parties; and

g) changes to the organizational structure of the aerodrome.

Note.— When the change involves an aeroplane type/model new to the aerodrome, a compatibility study, as specified in Chapter 4, is conducted.

Rationale

This procedure provides clarification on what can be considered as specific changes in the context of change management.

2.4.4.3.2.1 For any change in aerodrome operations as defined above, a safety assessment should be conducted.

2.4.5 Obstacle control

2.4.5.1 Obstacle control raises an issue for each State in regard to the responsibilities of each potential party involved. The responsibilities of those parties have to be clearly defined as follows:

a) who is responsible for obstacle surveys; and

b) when obstacles are identified, who is responsible for taking action (i.e. removal, marking, lighting, displacement, instrument procedures) and enforcing that action.

Rationale

The SARPs in Annex 14, Volume I, Chapter 4, deal with obstacle restriction and removal; however, they do not assign responsibility to the appropriate parties. The procedure above describes the need for defining the responsibilities of the stakeholders involved in obstacle control.

2.4.5.2 Once the responsibilities have been defined, appropriate authority should be given to the entity responsible for the enforcement action required.

Note.— Guidance on the control of obstacles, roles and responsibilities of stakeholders and the practices of certain States can be found in Doc 9137 — Airport Services Manual, *Part 6 —* Control of Obstacles.

2.4.6 Oversight of third parties

Compliance of third parties with the safety provisions established by the aerodrome operator as specified in 2.4.2.2 should be monitored using the appropriate means.

INITIAL PROPOSAL 9

2.5 CONTINUED AERODROME SAFETY OVERSIGHT

2.5.1 General

2.5.1.1 The scope of initial certification is described in 2.3. This section describes the procedures for continued aerodrome safety oversight. Continued oversight actions may not need to be as exhaustive but should be based on principles ensuring that compliance is maintained throughout the planning of adequate oversight actions.

2.5.1.2 Specific and targeted actions, in addition to the planned activities, may be carried out by the State, for example, in relation to changes, analysis of occurrences, aerodrome works/safety, monitoring of corrective action plans, or those related to the State safety plan. States may also have to address other issues regarding aerodrome safety depending on the aerodrome organization, such as obstacle control or oversight of ground handlers.

Note.— In order to have a complete perspective on aerodrome compliance, the results of those technical inspections undertaken during initial certification should be available for the team verifying the aerodrome operational procedures on site.

2.5.2 Continued oversight principles

2.5.2.1 The State should plan continued oversight actions in such a way as to ensure that each subject covered by
the scope of certification is subject to oversight (see 2.1.2).

Note.— The planning of continued oversight actions by the State may take into account the aerodrome safety performance and risk exposure. See 2.5.4 below.

Rationale

The continued aerodrome safety oversight is structured according to three basic principles, i.e.:

a) the safety oversight programme and planning cycle should be adapted to the aerodrome's risk exposure and safety performance;

b) following the state of development of the operator's SMS, the oversight verifications should progressively shift from verification of compliance with technical and operating specifications to assessment of the actual performance of the SMS;

c) in case of safety concerns, the operations at the aerodrome cannot be suspended without serious disruption of the aviation system; hence the preventative and corrective actions by the State shall be different from the ones applied to aeroplane operators and specific to the aerodrome context.

2.5.2.2 The development and operation of an aerodrome's SMS should ensure that the aerodrome operator takes appropriate actions regarding the safety on the aerodrome.

Note.— When an aerodrome has a fully developed and operational SMS, the continued oversight of the aerodrome does not have to be as exhaustive as for one with a developing SMS. Oversight activities in this case should focus on the SMS itself in order to ensure that the aerodrome SMS is operating continuously and adequately.

2.5.2.3 Sample checks of the aerodrome's compliance with certification requirements and specifications should be carried out in order to ensure the SMS has identified all deviations, if any, and adequately managed them. This also provides an indication on the level of maturity of the SMS. Consequently, a periodic audit cycle should be developed which consists of:

a) at least one audit of the SMS; and

b) sample checks on specific subjects.

2.5.2.4 If the SMS of the aerodrome operator is not fully implemented, specific oversight actions should target the SMS to ensure it is developing adequately and at a normal pace. In this case, the SMS should be audited as appropriate until it is considered to be sufficiently mature.

Note.— The maturity of the SMS is determined by the results of the oversight actions, according to the criteria developed in Appendix 1.

2.5.3 Audit of selected items

2.5.3.1 If initial certification has already taken place, the continued oversight actions of a subject may not consist of a complete audit of all the subject items but only a selection of them.

Note.— An aerodrome can be assessed through an analysis of the safety occurrences at the aerodrome, including any significant development, change or other known information that may highlight subjects of concern.

2.5.3.2 The audit of the selected items should consist of:

a) a desk-based audit of the appropriate documents, and

b) an on-site audit.

2.5.3.3 The same checklists as those used for initial certification of the subject items should be used, but if a sampling item selection is made, only the selected checklist items should be audited.

2.5.4 Influence of aerodrome safety performance and risk exposure

2.5.4.1 The number of audits of the SMS during the period should be determined taking into account the following criteria:

a) the regulator's confidence in the operator's SMS. This confidence is evaluated using the results of the SMS audits or other oversight actions. For example, feedback on the operator's occurrence reporting and management system might indicate that the analyses of the safety occurrences are not carried out as adequately as desired, or that a significant number of incidents have arisen on the aerodrome; and

b) other factors contributing to the level of risk at the aerodrome, for example, the complexity of the aerodrome, the aerodrome's infrastructure or organization, the density of traffic, type of operations and other specific conditions.

Note.— The content of an SMS audit may be developed using the criteria in Appendix 1.

2.5.4.2 For aerodromes with a fully implemented SMS, in addition to the audit of the SMS, some sample subjects should be checked to ensure that the SMS has identified all safety-critical issues. This also helps to ensure that the SMS is operating adequately. The selection of these subjects should be determined taking into account:

a) an analysis of the safety occurrences on the aerodrome;

b) known information related to safety at the aerodrome that may highlight subjects of concern;

c) specific subjects most significant for safety;

d) the complexity of the aerodrome;

e) any significant development or change to airport infrastructure; and

f) the subjects previously selected in order to cover all within a certain number of oversight cycles.

2.5.5 Continued oversight plans and programmes

2.5.5.1 Following the above principles, an oversight plan should be determined by the State, for each certified aerodrome and communicated to the aerodrome operator. This plan should ensure that:

a) for aerodromes where an SMS is not fully functional:

1) each subject within the scope of certification appears at least once and is subject to specified oversight actions; and

2) the SMS is audited as appropriate;

Note 1.— The development of an SMS may be phased. During a phased implementation, only the elements under development within a specific phase will be assessed and reviewed.

Note 2.— It may be appropriate to audit an immature SMS at least once a year.

b) for the aerodromes with a fully functional SMS:

1) the SMS is audited at least once; and

2) other oversight actions on selected subjects are conducted as appropriate.

2.5.5.2 At the end of each year, the plan and programme should be updated to show the oversight actions that have actually been carried out, including observations on certain actions that have not been undertaken as planned.

2.5.6 Unannounced inspections

2.5.6.1 Planning of the aerodrome audit is intended to assist the regulator and aerodrome in planning resources and manpower and in ensuring a consistent and adequate level of oversight. However, it does not prevent the State from carrying out unannounced inspections, if deemed necessary.

2.5.6.2 These inspections follow the same methodology as the scheduled audit or technical inspection as appropriate and may be carried out using the same checklists or could be aimed at a specific subject of concern.

Note.— Unannounced inspections work in principle against the objective of an effective safety culture and are to be used only in exceptional circumstances.

2.5.7 Monitoring of corrective actions plans

2.5.7.1 Corrective actions plans resulting either from initial certification or from continued oversight audits or technical inspections should be monitored by the State until all items are closed to ensure that mitigating actions are carried out to the standard and timescale agreed.

2.5.7.2 The State should regularly review the status of each pending action.

2.5.7.3 When a deadline has been reached, the State should make sure that the related corrective actions have been adequately implemented.

2.5.7.4 Where a corrective action plan does not result in appropriate action being taken within acceptable timelines, increased oversight can be taken by the State.

2.5.8 Increased oversight

2.5.8.1 When an aerodrome's corrective action plan does not ensure that appropriate corrective action has been taken within acceptable timelines, and after coordination between the State and the operator, the State may decide that increased oversight of this operator is necessary. The scope of increased oversight may cover specific subjects or be all-encompassing.

2.5.8.2 The State should notify the aerodrome operator in writing:

a) that it is being placed under increased oversight and outline the subjects concerned and from which date;

b) the reasons for the increased oversight and what it consists of; and

c) what actions are required by the aerodrome.

2.5.8.3 When an aerodrome is placed under increased oversight, the State should:

a) carry out appropriate oversight actions on the subjects concerned;

b) follow very carefully the implementation of the corrective actions plan; and

c) allocate sufficient time/resources to the oversight of the concerned aerodrome.

2.5.8.4 The oversight actions carried out under increased oversight are the same as those carried out normally, but are more exhaustive and address all the subjects concerned.

2.5.8.5 When increased oversight is concluded on an aerodrome for a specific subject, the State should advise the aerodrome operator in writing, stating the end of the procedure and the reason.

2.5.8.6 The aerodrome certificate can be amended, suspended or revoked according to the outcomes of the increased oversight

Rationale

Appendices 1 and 2 to Chapter 2 in subsequent pages provide further guidance on the scope of technical inspections and on-site verifications and the reporting of critical data related to safety occurrences. These provide important information complementing the requirements of the relevant procedures. These are followed by Attachments A, B and C to Chapter 2 which provide guidance on a list of possible subjects that could be included in an aerodrome manual, the process for initial certification including an indicative timeline, and a checklist of the components of the manual. The format of Chapter 2 closely follows the existing format in Doc 8168, *Procedures for Air Navigation Services — Aircraft Operations* and Doc 9868, *Procedures for Air Navigation Services — Training* which are divided into appendices and attachments.

INITIAL PROPOSAL 10

Appendix 1 to Chapter 2

TECHNICAL INSPECTIONS AND ON-SITE VERIFICATIONS

1. INTRODUCTION

1.1 The aim of this section is to list the main items to be reviewed during the initial certification.

1.2 The following list may be expanded in accordance with applicable certification requirements.

1.3 By following these lists, States should base their checks on the same items while adapting their checklists to the applicable regulation, thus harmonizing their inspections.

1.4 The oversight audit checklist can be based on the same lists.

2. TECHNICAL INSPECTIONS

2.1 Infrastructure and ground aids

Initial certification of the infrastructure and ground aids includes:

a) Obstacle restrictions:

1) OLS:

i) the surfaces are defined;

ii) as few objects as possible exceed the OLS;

iii) any obstacles that do penetrate the OLS are appropriately marked and lit. Operational restrictions may apply as appropriate;

2) obstacle free zone (OFZ):

i) these surfaces are defined when required;

ii) no object exceeds the OFZ unless essential for the safety of air navigation and is frangible;

3) objects on the areas near the runway or the taxiways (runway strips, clearway, stop way, runway end safety area, taxiway strips, radio altimeter operating area, pre-threshold area) comply with the requirements;

b) Physical characteristics:

1) in order to facilitate the verification of compliance of the physical characteristics of the aerodrome, States may use the reference code method developed in Annex 14, Volume I. The reference code provides a simple method for interrelating the numerous specifications concerning the characteristics of aerodromes so as to provide a series of aerodrome facilities that are suitable for the aeroplanes that are intended to operate at the aerodrome;

2) the aerodrome operator may indicate in its aerodrome manual the reference code chosen for each element of the movement area so that the State can check compliance of the runways and taxiways and their associated characteristics against the requirements of the reference code as well as other specifications (bearing strength, surface characteristics, slopes);

3) runways:

i) the physical characteristics:

– are compliant with the applicable regulation and the reference code;

– some characteristics are adequately and regularly measured;

ii) the published declared distances are in accordance with the situation on site;

iii) the areas near the runway (runway shoulders, runway strips, clearway, stopway, runway end safety area, radio altimeter operating area, pre-threshold area) are compliant with the applicable regulation and the reference code in terms of width, length, type of surface, resistance, slopes, grading and objects on them;

iv) the relevant separation distances are compliant with the applicable regulation and the reference code;

4) taxiways:

i) the physical characteristics (width, curve radius, extra taxiway width, longitudinal and transverse slopes, radius of turn-off curve for rapid exit taxiways, surface type, bearing strength) are compliant with the published reference code for each taxiway;

ii) the taxiway shoulders and strips are compliant with their reference code in terms of width, type of surface, slopes and objects on them;

iii) the taxiways on bridges are compliant with their reference code in terms of width;

iv) the relevant separation distances are compliant with applicable regulations and the reference code;

5) service roads:

i) road-holding positions are established at the intersection of a road and a runway at a distance compliant with the aerodrome reference code;

6) holding bays, runway-holding positions and intermediate holding positions:

i) the holding bays, runway-holding positions and intermediate holding positions are located in accordance with the applicable aerodrome reference code;

c) Electrical systems:

1) adequate primary power supply is available;

2) the switch-over time meets the requirements;

3) when required, a secondary power supply is available;

4) the air traffic service (ATS) has feedback on the status of ground aids when required;

d) Visual aids:

1) markings:

i) all the markings:

– are in place where required;

– are located as required and in the required number;

– have the dimensions and colours required;

ii) this includes, when required:

– the runway markings (runway designation marking, threshold marking, runway centre line marking, runway side stripe marking, aiming point marking, touchdown zone marking, runway turn pad marking);

– the taxiway markings (taxiway centre line marking, taxiway side stripe marking, runway-holding position marking, intermediate holding position marking);

– the apron markings;

– the mandatory instruction markings;

– the information markings (that do not have to be displayed but are to be compliant when displayed);

– a road-holding position marking (that is compliant with the applicable regulation);

– a VOR aerodrome checkpoint marking;

– a non-load bearing surface marking;

2) signs:

i) all the signs:

– are in place where required;

– are located as required;

– have the dimensions and colours required;

– have an adequate lighting system when required;

– are frangible when required;

ii) this includes when required;

– mandatory instruction signs (runway designation signs, runway-holding position signs, Category I, II and III holding position signs, no entry signs);

– information signs (direction signs, location signs, runway vacated signs, runway exit signs, intersection take-off signs, destination signs, road-holding position signs, VOR checkpoint signs, aerodrome identification sign);

3) lights:

i) there should not be any non-aeronautical lights that might endanger the safety of an aeroplane;

ii) all the aeronautical lights:

– are displayed when required;

– are located as required and in the required number;

– have the required colours;

– comply with their serviceability levels or maintenance objectives;

– are frangible when elevated as required;

iii) this includes, when required:

– the approach lighting system;

– the runway lead-in lighting systems;

– the visual approach slope indicator system (VASIS);

- the runway lights (runway centre line lights, runway edge lights, runway threshold identification lights, runway end lights, runway threshold and wing bar lights, runway touchdown zone lights, stopway lights, runway turn pad lights);

- the taxiway lights (taxiway centre line lights, taxiway edge lights, stop bars, intermediate holding position lights, rapid exit taxiway indicator lights);

- de-icing/anti-icing facility exit lights;

- runway guard lights;

- road-holding position lights;

- unserviceability lights;

- aeronautical beacons;
- obstacle lights;

4) markers:

i) all the markers:

- are in place where required;

- are located as required and in the required number;

- have the required colours;

- are frangible;

ii) this includes, when required:

- the taxiway markers (taxiway edge markers, taxiway centre line markers);

- the unpaved runway edge markers;

- the boundary markers;

- the stopway edge markers;

- the edge markers for snow-covered runways;

- unserviceability markers;

5) indicators:

i) a wind direction indicator:

- is provided;

- is located in accordance with Annex 14, Volume I;

– complies with the characteristics requirements;

– is illuminated at an aerodrome intended for use at night.

2.2 RFF services

Initial certification of RFF services includes:

a) Level of protection:

1) the level of protection is promulgated in the AIP;

2) the aerodrome operator has a procedure to regularly reassess the traffic and update the level of protection including unavailability;

3) the aerodrome operator has made arrangements with the aeronautical information services, including ATS, to provide up-to-date information in case of any change in the level of protection;

b) RFF personnel:

1) the number of RFF personnel is consistent with the level of protection and also with the other tasks that may be attributed to RFF personnel;

2) the training of all RFF personnel is adequate and monitored;

3) the training facilities, which may include simulation equipment for training on aeroplane fires, are available;

4) the procedures that RFF personnel follow are kept up to date;

c) Response:

1) the RFF service is provided with an up-to-date map of its response area, including the access roads;

2) the response time complies with the applicable regulation and is regularly tested. This check should be formalized in the RFF procedures;

3) the RFF service has procedures that describe this response and ensure that in case of an incident/accident a report is written and filed;

4) a communication and alerting system is provided between the fire station, the control tower and the RFF vehicles;

d) Rescue equipment:

1) the number of RFF vehicles is consistent with the applicable regulation;

2) the RFF service has a procedure describing the maintenance of the RFF vehicles and ensuring that this maintenance is formally monitored;

3) the types and quantities of the extinguishing agents, including the reserve supply, are consistent with the applicable regulation;

4) the protective clothing and respiratory equipment provided are consistent in quality and quantity in accordance with the applicable regulation, and the respiratory equipment is properly checked and their quantities formally monitored;

5) specific rescue equipment is provided in adequate number and type when the area to be covered by the RFF service includes water;

6) any other equipment required by the applicable regulation is provided in sufficient number.

2.3 Wildlife hazard management

The following checks on wildlife hazard management can either be a technical inspection or included in the audit of the aerodrome operator's procedures:

a) The required equipment is provided;
b) Fences are provided as required;

c) The aerodrome operator has a procedure describing the actions taken for discouraging the presence of wildlife, including:

1) who is in charge of those actions and what their training is;

2) how and when these actions are carried out, including reporting and filing of these actions;

3) what equipment is used to conduct these actions;

4) analyses of the aerodrome vicinity and the preventive actions to be taken subsequently to discourage wildlife;

5) monitoring of these actions, including, where applicable, the conduct of appropriate wildlife assessments;

6) coordination with ATS;

d) The aerodrome operator has a procedure to:

1) record and analyse the incidents involving animals;

2) collect the animals' remains;

3) monitor the corrective actions to be taken subsequently; and

4) report to the State incidents involving animals.

3. ON-SITE VERIFICATION OF THE OPERATOR'S PROCEDURES AND SMS

3.1 On-site verification of the operator's procedures

On-site verification of the aerodrome operator's procedures should include the following:

a) Aerodrome data and reporting:

1) completeness, correctness and integrity of the data reported in accordance with the AIP including:

i) data collection, including the status of the movement area and its facilities;

ii) data validity checks;

iii) data transmission;

iv) changes to published data, whether permanent or not;

v) checks of the information once published;

vi) information update after construction works;

2) formal coordination with ATS;

3) formal coordination with the aeronautical information services;

4) publication of the required information in the aeronautical publication;

5) information published in accordance with the situation on site;

b) Access to the movement area:

1) there is an up-to-date plan clearly showing all the access points to the movement area;

2) the aerodrome operator has a procedure describing the inspection of access points and fences;

Note.— Procedures for access to the manoeuvring areas are often markedly different from those for the apron areas.

c) Aerodrome emergency plan:

1) there is an up-to-date aerodrome emergency plan;

2) there are regular exercises in relation to the emergency plan;

3) the aerodrome operator has a procedure describing the tasks in the emergency plan;

4) the aerodrome operator regularly verifies the information in the emergency plan, including keeping an up-to-date list of the persons and contact details in the emergency plan;

5) the aerodrome operator has a procedure describing its roles and responsibilities during emergencies;

6) the aerodrome operator has a procedure describing the involvement of, and coordination with, other agencies during emergencies;

7) the required minimum emergency equipment is available, including an adequately equipped emergency operation centre and mobile command post;

d) RFF:

1) a technical inspection of the various elements of the RFF services in 2.2 b) is held prior to the audit;

2) the checks that are to be done during the aerodrome operator's on-site verification consist only of verifying the timely implementation of the corrective action plan subsequent to the technical inspection;

3) if on-site verification reveals new deviations, they should be included in the on-site verification report;

e) Inspection of the movement area. The aerodrome operator has a procedure to:

1) ensure there is coordination with ATS for the inspection of the movement area;

2) describe the inspections, if performed by the aerodrome operator, including:

i) frequency and scope;

ii) reporting, transmission and filing;

iii) actions to be taken and their monitoring;

3) assess, measure and report runway surface characteristics when the runway is wet or contaminated and their subsequent promulgation to ATS;

f) Maintenance of the movement area. The aerodrome operator has a procedure to:

1) periodically measure the runway surface friction characteristics, assessing their adequacy and any action required;

2) ensure there is a long-term maintenance plan, including the management of the runway surface friction characteristics, pavement, visual aids, fencing, drainage systems and electrical systems and buildings.

g) Snow and ice control, and other hazardous meteorological conditions:

1) at aerodromes subjected to snow and icing conditions:

i) the aerodrome operator has a snow and ice control plan, including the means and procedures used as well as the responsibilities and criteria for closing and reopening the runway;

ii) there should be formal coordination for snow and ice removal between the aerodrome operator and ATS;

2) for other hazardous meteorological situations that may occur at the aerodrome (such as thunderstorms, strong surface winds and gusts, sandstorms), the aerodrome operator should have procedures describing the actions that have to be taken and defining the responsibilities and criteria for suspension of operations on the runway;

3) the aerodrome operator has formal coordination with the meteorological service provider in order to be advised of any significant meteorological conditions;

h) Visual aids and aerodrome electrical systems:

1) if the aerodrome operator is responsible for the maintenance of visual aids and electrical systems, procedures exist describing:

i) the tasks — routine and emergency ones, including inspections of luminous and non-luminous aids and their frequency and power supply maintenance;

ii) reporting, transmission and filing of reports;

iii) monitoring of subsequent actions;

iv) coordination with ATS;

2) if the aerodrome operator is not in charge of maintenance of visual aids and electrical systems, the organization in charge needs to be clearly identified, ensuring there are formal coordination procedures with the aerodrome operator, including agreed objectives;

3) obstacle marking is taken into account;

i) Safety during aerodrome work:

1) when executing work on the aerodrome, the aerodrome operator has a procedure describing the:

i) necessary notification to the different stakeholders;

ii) risk assessment of the aerodrome work;

iii) roles and responsibilities of the various parties, including their relationship and the enforcement of safety measures;

iv) safety monitoring during the work;

v) reopening of facilities, where relevant;

vi) necessary coordination with ATS;

j) Apron management. When an apron management service is provided, the aerodrome operator has a procedure to ensure:

1) coordination with ATS;

2) the use of acceptable aeroplanes for each parking stand formally identified;

3) a compliant apron safety line is provided;

4) general safety instructions for all the agents on the apron area;

5) the placement and pushback of the aeroplane;

k) Apron safety management:

1) the aerodrome operator has a procedure for the inspection of the apron area (see j));

2) there is coordination with other parties accessing the apron, such as fuelling companies, de-icing companies and other ground handling agencies;

l) Vehicles on the movement area. The aerodrome operator has a procedure to ensure:

1) the vehicles on the movement area are adequately equipped;

2) the drivers have followed the appropriate training;

3) if the aerodrome operator is responsible for the training of vehicular drivers on the manoeuvring area, an appropriate training plan, including recurrent training and awareness actions, is available;

4) if the aerodrome operator is not in charge of this training or some of this training, the service provider is clearly identified and there is formal coordination between them;

Note.— Guidance on the knowledge required by operators of vehicles can be found in Annex 14, Volume I, Attachment A, section 19.

m) Wildlife hazard management. Checks on wildlife hazard management can either be a technical inspection or included in the on-site verification of the operator's procedures:

1) if the domain has not been inspected during the technical inspections, the on-site verification team should check the points listed in 2.3 c) above;

2) if a technical inspection has been carried out prior to the on-site verification, the latter consists in checking the timely implementation of the corrective action plan subsequent to the technical inspection;

3) if the on-site verification reveals new deviations, these have to be included in the on-site verification report;

n) Obstacles. The aerodrome operator has a procedure to ensure:

1) there is an obstacle chart;

2) the aerodrome operator has an obstacle monitoring procedure describing the checks, their frequency, filing and follow-up actions;

3) the aerodrome operator has a procedure to ensure that the obstacles do not represent a danger for safety and that appropriate action is taken when required;

o) Removal of a disabled aeroplane:

1) there is a plan for the removal of a disabled aeroplane describing the role and responsibility of the aerodrome operator, including the necessary coordination with other agencies and the means available or that can be made available;

p) Low visibility operations:

1) there is coordination between the aerodrome operator and ATS, including awareness of the status of both low visibility procedures (LVP) and the deterioration of visual aids;

2) the aerodrome operator has a procedure describing the actions to be taken when LVP is in process (vehicle control, visual range measurement if necessary);

3) the visibility (VIS or runway visual range (RVR)) and the ceiling are adequately evaluated and the related equipment regularly maintained.

3.2 On-site verification of the SMS

a) As a minimum, the items to be in place when granting the initial certification are:

1) safety policy: a safety policy has been endorsed by the accountable executive to reflect the organization's commitments regarding safety;

2) operator's organizational structure: the aerodrome operator has appointed an accountable executive and a safety manager;

b) The safety manager should be independent from any operational task regarding aerodrome safety. The criteria for assessing the operator's SMS structure might be tailored to the size of the operator, notably concerning the independence of the safety manager;

c) The capability and competence of the aerodrome operator should be assessed so as to ensure sufficient management commitment to and responsibility for safety at the aerodrome. This is usually achieved through the competence of the accountable executive;

1) responsibilities and assignments: the aerodrome operator has formally defined the responsibilities of each staff member regarding safety as well as the lines of responsibility;

2) training: the aerodrome operator formally monitors the staff's and subcontractors' training, ensuring that it is adequate, and takes action when necessary;

3) accident and incident reporting: the aerodrome operator has a procedure ensuring that:

i) incidents are reported by staff and subcontractors, including a description of the actions in place in order to be able to report them;

ii) incidents are promptly analysed and the actions to be subsequently taken are monitored;

iii) the reports and analyses of the incidents are filed;

iv) incidents are reported to the State;

v) coordination is in place with other stakeholders;

4) existing hazards at the aerodrome: the aerodrome operator should have a procedure in order to identify, analyse and assess hazards to the safe operation of aeroplanes and to put in place suitable mitigating measures;

5) risk assessment and mitigation of changes: the aerodrome operator has a procedure ensuring that for any change at the aerodrome, its impact on safety is analysed, listing the subsequent hazards that could be generated. This procedure describes who conducts the analysis, when and how the hazards are monitored, what actions are subsequently taken, and the criteria leading to the analysis. These assessments are filed;

6) safety indicators: the aerodrome operator sets and monitors its own safety indicators that illustrate its safety criteria, in order to be able to analyse the potential deficiencies;

Note.— Ensure coordination with previous safety indicators as set by the State.

7) safety audits: the aerodrome operator has a safety audit programme in place which includes a training programme for those involved;

8) safety promotion: the aerodrome operator should have a process to promote safety-related information.

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Appendix 2 to Chapter 2

CRITICAL DATA RELATED TO SAFETY OCCURRENCES REPORTED AT AERODROMES FOR THE MONITORING OF SAFETY

Note.— The provisions in this appendix do not override the requirements in Annex 13 — Aircraft Accident and Incident Investigation*, concerning the mandatory reporting of certain types of accidents/serious incidents and the responsibilities of the various parties involved.*

When safety occurrences of the following types are reported, the following critical data should be collected when relevant and feasible. This may require a collaborative effort from the aerodrome operator, ANSP or other involved parties commensurate with the severity of the potential risk attached to each occurrence.

1. Runway excursions

a) type of event (lateral veer-off, overrun)

b) landing/take-off

c) type of approach if it is a landing event

d) time precision (day/night) and event hour

e) aeroplane type;

f) runway:

   i) dimensions (width/length)

   ii) slopes

   iii) displaced threshold (yes/no, and if so, distance between the runway threshold and the runway edge)

   iv) runway end safety area (RESA) (yes/no, and if so, orientation, dimensions and structure)

   v) contaminated runway (yes/no, and if so, contaminant type (slush, snow, ice, water, other (to be specified), contaminant height)

g) wind (direction and strength, visibility)

h) precisions on the exit:

   i) exit speed or estimation

ii) aeroplane angle with the runway edge

iii) distance between the touchdown and the exit

iv) description of the trajectory of the aeroplane once on the runway strip and/or RESA

i) precisions on the location of the aeroplane once stopped.

Note 1.— For overruns, information to be reported includes longitudinal position in relation to the threshold location and/or end of runway surface and lateral position in relation to runway lateral edge or runway centre line.

Note 2.— Runway excursions are serious incidents, if not accidents, according to Annex 13, Attachment C. This would normally imply that the State's accident/incident investigation authority needs to become involved, and coordination with the relevant authorities is therefore required.

2. Undershoot (land short of runway)

a) type of event (land short, undershoot)

b) type of approach

c) ground-based vertical guidance available and operational (instrument landing system (ILS), precision approach path indicator (PAPI), abbreviated precision approach path indicator (APAPI))

d) time precision (day/night) and event hour

e) wind

f) visibility

g) aeroplane type

h) runway:

i) dimensions (width/length)

ii) slopes

iii) displaced threshold (yes/no, and if so, distance between the runway threshold and the runway edge)

iv) RESA (yes/no, and if so, magnetic orientation of runway (QFU), dimensions and structure)

v) contaminated runway (yes/no, and if so, contaminant type (slush, snow, ice, water, other (to be specified), contaminant height)

i) precisions on the undershoot (aeroplane speed at touchdown, distance between the touchdown and the runway edge, causes of the event)

i) description of the trajectory of the aeroplane after touchdown.

Note.— Undershoots are serious incidents, if not accidents, according to Annex 13, Attachment C. This would normally imply that the State's accident/incident investigation authority needs to become involved, and coordination with the relevant authorities is therefore required.

3. Runway incursion

a) entities involved (aeroplane/vehicle; aeroplane/aeroplane)

b) time precision (day/night) and event hour

c) aeroplane type, landing/take-off, type of approach

d) vehicle type, location

e) runway:

i) dimensions (width/length)

ii) slopes/line of sight

iii) displaced threshold (yes/no, and if so, distance between the runway threshold and the runway edge)

iv) rapid exits

v) wind

vi) visibility

f) precisions on the incursion

i) description of the trajectories and speeds of both vehicles/aeroplanes

ii) estimated distances (horizontal and vertical) between the entities involved

iii) contaminated operational surfaces in the incursion area (yes/no, and if so, contaminant type (slush, snow, ice, water, other (to be specified), contaminant height).

Note 1.— Runway incursions classified with severity A are serious incidents according to Annex 13, Attachment C. This would normally imply that the State's accident/incident investigation authority needs to become involved, and coordination with the relevant authorities is therefore required.

Note 2.— Guidance on prevention of runway incursions, including severity classification, is available in Doc 9870 — Manual on the Prevention of Runway Incursions).

4. Landing or take-off on a taxiway

a) landing/take-off

b) type of approach when relevant

c) time precision (day/night) and event hour

d) wind

e) visibility

f) aeroplane type

g) taxiway:

   i) dimensions (width/length)

   ii) slopes

   iii) RESA (yes/no, and if so, QFU, dimensions and structure)

h) precisions on the event:

   i) possible contributing factors (e.g. congestion of the work area, inadequate lighting, limited space, procedure not applied, works, inadequate or misleading marking).

Note.— Landing and take-off on taxiways are serious incidents according to Annex 13, Attachment C. This would normally imply that the State's accident/incident investigation authority needs to become involved, and coordination with the relevant authorities is therefore required.

5. FOD-related events

a) type of event

b) location (runway, orientation, or taxiway, stand), location of FOD, including where possible lateral and longitudinal positions

c) time precision (day/night) and event hour

d) FOD description:

   i) name (if possible)

   ii) shape and dimensions

   iii) material

iv) colour

v) origin (if known: lighting, infrastructure, works, animals, aeroplane, environment (wind, etc.)).

6. Other excursions (i.e. from the taxiway or apron)

a) type of event

b) location

c) time precision (day/night) and event hour

d) aeroplane type

e) taxiway:
   i) dimensions (width/length)

   ii) slopes

   iii) if in a curved section: fillets (yes/no, and characteristics)

   iv) contaminated taxiway (yes/no, and if so, contaminant type (slush, snow, ice, water, other (to be specified) and contaminant height)

f) wind (direction and strength)

g) precisions on the exit (exit speed or estimation, aeroplane angle with the taxiway edge, in a straight or a curved section, causes of the event)

h) precisions on the location of the aeroplane once stopped.

7. Other incursions (i.e. on taxiway or apron)

Same data as for item 2 (undershoot).

8. Birds/wildlife strike-related events

To be conducted in accordance with ICAO bird strike information system (IBIS) data (ingestion, collision). If there has been no collision, and the animal was avoided, it is important to know the location of the animal at the time the avoided collision occurred.

9. Ground collisions

a) type of event (ground collision)

b) location

i) apron

ii) manoeuvring area

iii) runway, taxiway

iv) contaminant (if relevant: type and height)

v) wind (if relevant)

c) time precision (day/night) and event hour

d) phase of flight (e.g. taxi out, departure roll, engine start/pushback)

e) aeroplane(s) involved

i) type of aeroplane and trajectory

f) vehicle(s) involved

i) type of vehicle and trajectory

g) material damages (to both aeroplane(s) and/or vehicle(s))/human damages and location of the damages

h) phase of operation, if ground handling is involved

i) description of the collision:

i) estimated speed of both vehicle(s) and/or aeroplane(s)

ii) description of the trajectories of the aeroplane(s) and/or the vehicle(s).

Note 1.— Ground collisions involving aeroplanes can be incidents, serious incidents or accidents. If classified as an incident, they are normally investigated as part of the aerodrome's SMS. If classified as a serious incident or accident, this would normally imply that the State's accident/incident investigation authority needs to become involved, and coordination with the relevant authorities is therefore required.

Note 2.— Ground collisions not involving aeroplanes can be an incident and investigated as part of the aerodrome's SMS.

Attachment A to Chapter 2

LIST OF POSSIBLE SUBJECTS COVERED IN AN AERODROME MANUAL

The contents of an aerodrome manual include:

a) List of updates;

b) Aerodrome administrative data;

c) Description of the aerodrome, including dimensions and related information;

d) List of authorized deviations;

e) Duties, means and procedures of the applicant to ensure safety in each area include:

1) aerodrome data and reporting;

2) access to the movement area;

3) aerodrome emergency plan;

4) RFF;

5) inspection of the movement area;

6) maintenance of the movement area;

7) snow and ice control, and other hazardous meteorological conditions;

8) visual aids and aerodrome electrical systems;

9) safety during aerodrome works;

10) apron management;

11) apron safety management;

12) vehicle control on the movement area;

13) wildlife hazard management;

14) obstacles;

15) removal of disabled aeroplanes;

16) low visibility operations;

f) SMS.

Attachment B to Chapter 2

INITIAL CERTIFICATION PROCESS

1. AERODROME CERTIFICATION SCHEME

It may not be possible to certify all aerodromes at the same time, depending on the number of aerodromes in the State. Therefore, a programme for the certification of aerodromes in the State, including the schedule, has to be prepared. The State plans a certification programme, taking into account the number of trained oversight personnel within the State, according to the following main parameters.

1.1 Scope of operations and traffic

1.1.1 An important consideration to be taken into account is the level of commercial operations. For States having a large number of aerodromes, different deadlines for certification may be established based on traffic thresholds. These criteria allow the State to certify higher traffic aerodromes with priority.

1.1.2 The number of aircraft movements may be an important parameter. This is partly taken into account with the passenger volume, but the types of aeroplanes used can have an impact on the criteria used for certification. This impact is taken into account when needed through the applicable regulation itself as some specifications may or may not apply, depending on the number of movements (e.g. RFF service).

1.2 Complexity of infrastructure design

1.2.1 The inspection of infrastructure and ground aids is often the first step of the initial certification process and contributes to the assessment of the conformity of the infrastructure, taking into account its complexity. Periodic infrastructure and ground aids inspections are also an important part of the continued oversight.

1.2.2 Issues arising from complex aerodrome design will also be dealt with through feedback obtained through the reporting of accidents/incidents occurring on the aerodrome as part of the aerodrome’s SMS.

1.3 Level/maturity of SMS implementation

1.3.1 Because the SMS requirements for the certification of the aerodrome operators may be new, this aspect of the operation may require major efforts by the aerodrome operator to achieve compliance.

1.3.2 For an aerodrome which is already certified or being certified, for which the SMS is in its initial phase, the level/maturity of SMS implementation can be expected to be effective only after a certain period of time. Consequently, initial certification of the operator's SMS may need to be tailored to the size of the operator and the maturity of its SMS. Specific attention to the SMS during on-site verification is therefore necessary.

2. SUMMARY OF THE CERTIFICATION PROCESS

2.1 The certification process for an aerodrome that is already operational can be summarized as follows:

a) as soon as an aerodrome meets the legal criteria for certification, a meeting is held between the State and the aerodrome operator;

b) during this meeting, the State presents the certification process and deadlines to the aerodrome operator. The aerodrome operator develops the aerodrome manual as soon as it enters the initial certification process, so as to submit it no later than six months after the meeting;

c) during this six-month period the State:

   1) completes the technical inspections so that the results are available for the on-site verification; and

   2) assembles the on-site verification team at least two months before the deadline for submission of the aerodrome manual and informs the aerodrome operator of the team members.

Note.— The main items subject to technical inspections and the minimal checks to be performed are listed in Appendix 1.

2.2 When all the conditions have been met, the aerodrome manual is accepted/approved no later than three months after it was first submitted. This period includes any exchange of communication between the aerodrome operator and the State if needed – some information may be lacking at the beginning, thus preventing the State from accepting the manual at first.

2.3 During this period, the on-site verification team, together with the aerodrome operator, plans the time and dates of the on-site verification with the objective of allowing the aerodrome operator a four-month period to mitigate any deviations before the certification deadline.

2.4 As soon as the aerodrome manual is accepted, it is sent to the on-site verification team with all the procedures enclosed. The on-site verification and inspection reports should be

sent by the State to the aerodrome operator no later than one month after the on-site verification/inspection closing meeting.

2.5 The aerodrome operator submits to the State corrective action plans no later than two months after having received the certification/inspection reports. The State and the aerodrome operator require two months minimum after the last report to agree to the corrective action plans before granting the certificate.

2.6 For aerodromes already operating, the overall process, until delivery of the certificate, could consequently last 18 months.

Note.— The SMS on-site verification can be disconnected from the aerodrome operator's on-site verification in regard to compliance with its operational procedures and in this case:

— *the deadline for the submission of the SMS part of the aerodrome manual can be longer, but will nevertheless not exceed six additional months;*

— *the deadline for the SMS on-site verification can be longer, but the SMS on-site verification will nevertheless be conducted at least three months before the certification deadline to be in line with the required period of two months for the operator and the State to define an accepted corrective action plan .*

2.7 A flow chart on the certification process is given in Figure 2-B-1.

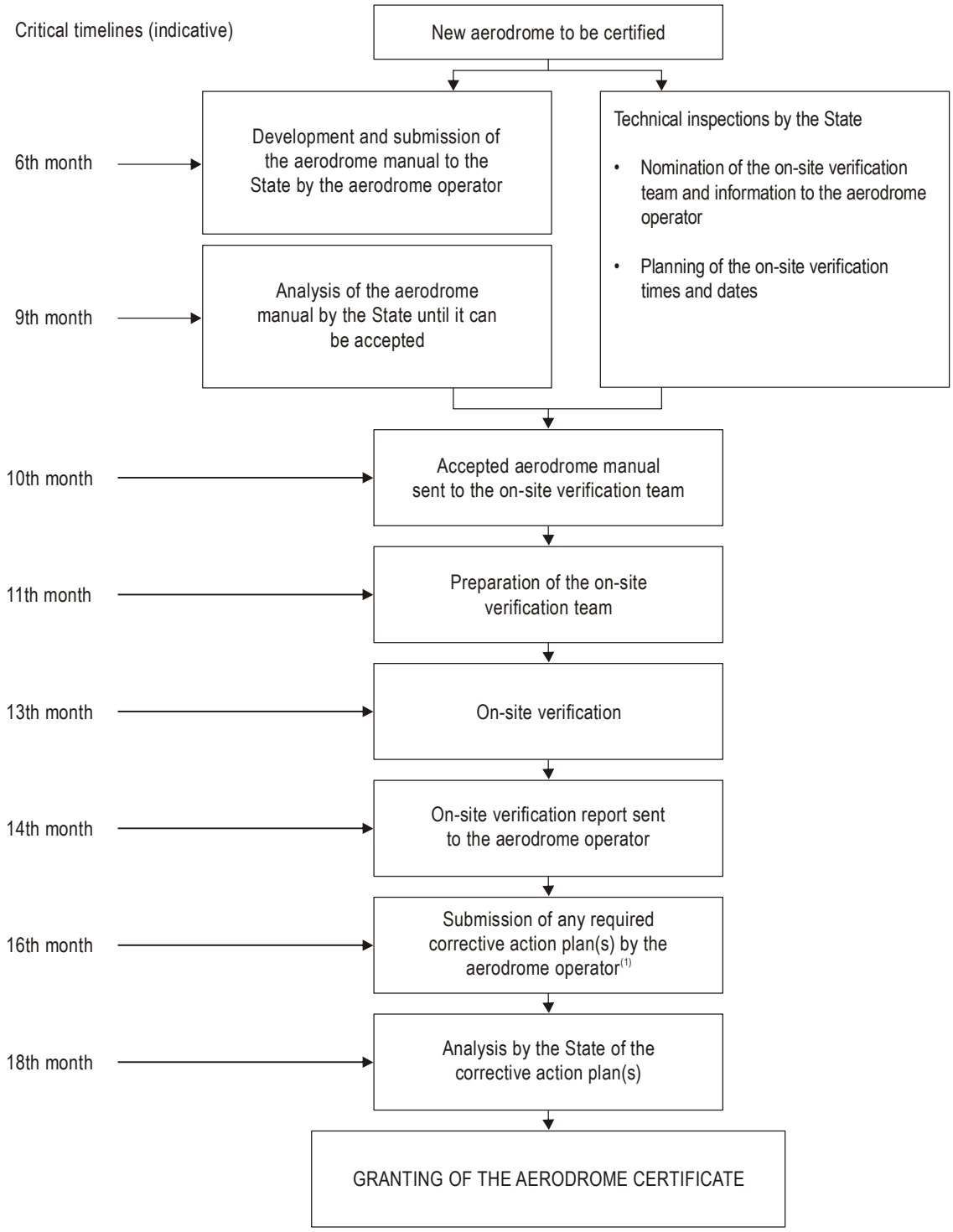

Figure 2-B-1. The certification process

(1) This corrective action plan covers the on-site verification of the operator's certification and can be combined with the corrective action plans related to the technical inspections and initial SMS on-site verification that follow the same methodology and which could have been sent before.

Attachment C to Chapter 2

CHECKLIST OF THE COMPONENTS OF AN AERODROME MANUAL

		YES	NO
1.	**Introduction**		
a)	Purpose of the aerodrome manual		
b)	Legal position regarding aerodrome certification as contained in the applicable regulation		
c)	Distribution of the aerodrome manual		
d)	Procedures for distributing and amending the aerodrome manual and the circumstances in which amendments may be needed		
e)	Checklist of pages		
f)	Preface by licence holder		
g)	Table of contents		
h)	Glossary of terms		

Note.— This section will contain a short explanation of the general terms used in the aerodrome manual including job titles and abbreviations.

2.	**Technical administration**		
a)	Name and address of the aerodrome		
b)	Name and address of the aerodrome operator		
c)	The name of the accountable executive		

	YES	NO
3. Description of the aerodrome (aerodrome characteristics)		
a) Details of the following:		
i) latitude and longitude of the aerodrome reference point in World Geodetic System — 1984 (WGS-84) format;		
ii) elevations of: • aerodrome		
• apron		
b) Plans showing the position of the aerodrome reference point, layout of the runways, taxiways and aprons; the aerodrome markings and lighting (including precision approach path indicator (PAPI), visual approach slope indicator system (VASIS) and obstruction lighting); the siting of navigation aids within the runway strips. It will not be necessary for these plans or the information called for in subparagraphs c) to f) below to accompany all copies of the aerodrome manual, but they are to be appended to the licence holder's master copy and to the copy kept with the State regulator. Operating staff are to be provided with scaled–down copies or extracts of plans relevant to their duties.		
c) Description, height and location of obstacles that infringe upon the standard protection surfaces and whether they are lighted should be noted in the aeronautical publications.		
d) Procedures for ensuring that the plans are up to date and accurate.		
e) Data for, and the method used to calculate, declared distances and elevations at the beginning and end of each declared distance.		
f) Details of the surfaces, dimensions and classification or bearing strengths of runways, taxiways and aprons.		
4. List of authorized deviations, if any.		
5. Operational procedures for:		
5.1 Promulgation of aeronautical information		
The system of aeronautical information service available and the		

	YES	NO
system that the certificate holder uses to promulgate AIP requirements.		
5.2 Control of access		
Control of access to the aerodrome and its operational areas, including the location of notice boards, and the control of vehicles in the operational areas.		
5.3 Emergency planning		
a) The aerodrome operator's arrangements in response to an emergency. These arrangements should take account of the complexity and size of the aeroplane operations.		
b) Description of actions to be taken by the aerodrome operator as part of plans for dealing with different emergencies occurring at the aerodrome or in its vicinity.		
c) Contact list of organizations, agencies and persons of authority.		
d) Procedures for the appointment of an on-scene commander for the overall emergency operation and description of responsibilities for each type of emergency.		
e) Reporting mechanism in the event of emergency.		
f) Details of tests of aerodrome facilities and equipment to be used in emergencies, including the frequency of those tests.		
g) Details of the exercises to test emergency plans, including the frequency of those exercises.		
h) Arrangements for personnel training and preparation for dealing with emergencies.		
5.4 Rescue and fire fighting (RFF) services		
a) Policy statement on the RFF categories to be provided.		
b) Where the senior aerodrome fire officer or designated fire watch officers have specific safety accountabilities, these should be included in the relevant chapter of the aerodrome manual.		

	YES	NO
c) Policy and procedures indicating how depletion of the RFF service is to be managed. This should include the extent to which operations are to be restricted, how pilots are to be notified and the maximum duration of any depletion.		
d) At aerodromes where a higher category of RFF is available by prior arrangement, the aerodrome manual should clearly state the actions necessary to upgrade the facility. Where necessary, this should include actions to be taken by other departments.		
e) The aerodrome operator's objectives for each RFF category provided should be defined, including a brief description of:		
i) amounts of extinguishing agents provided;		
ii) discharge rates;		
iii) number of foam-producing appliances;		
iv) manning levels;		
v) levels of supervision.		
f) Procedures for:		
i) monitoring the aeroplane movement areas for the purpose of alerting RFF personnel;		
ii) indicating how the adequacy of the response time capability of the RFF services throughout their functions and locations is monitored and maintained;		
iii) indicating how RFF personnel engaged in extraneous duties are managed to ensure that response capability is not affected.		
g) Where the aerodrome provides specialist equipment such as rescue craft, emergency tenders, hose layers, and appliances with aerial capability, details should be included in the aerodrome manual. Procedures to be followed if these facilities are temporarily unavailable should also be included.		
h) Where the aerodrome is reliant upon other organizations to provide equipment which is essential for ensuring the safe operation of the aerodrome (perhaps water rescue), policies or letters of agreement		

	YES	NO

should be included in the aerodrome manual. Where necessary, contingency plans in the event of non-availability should be described.

i) A statement describing the process by which aerodrome operators ensure the initial and continued competence of their RFF personnel, including the following:

   i) realistic fuel fire training;

   ii) breathing apparatus training in heat and smoke;

   iii) first aid;

   iv) low visibility procedures (LVP);

   v) any legal requirements;

   vi) health and safety policy with regard to training of personnel in the use of respiratory protection equipment and personal protection equipment.

j) Procedures indicating how accidents in the immediate vicinity of the aerodrome are to be accessed. Where difficult environs exist, the aerodrome manual should indicate how these are to be accessed.

k) Where local authorities or the aerodrome operator expects the RFF facility to respond to domestic fires or special services, procedures for managing their impact upon normal aeroplane RFF responses should be included.

l) Where the aerodrome operator expects the RFF facility to respond to aeroplane accidents landside, the policy should be clearly described, including procedures to manage the effects on continued aeroplane operations.

m) The availability of additional water supplies should be described.

n) Aerodrome operator's arrangements for ensuring the adequacy of responses in abnormal conditions, i.e. LVP.

5.5 Inspections of the movement area

		YES	NO
a)	Routine aerodrome inspections, including lighting inspections, and reporting, including the nature and frequency of these inspections.		
b)	Inspecting the apron, runways and taxiways following a report of debris on the movement area, an abandoned take-off due to engine, tire or wheel failure, or any incident likely to result in debris being left in a hazardous position.		
c)	Sweeping of runways, taxiways and aprons.		
d)	Measurement and promulgation of water, slush and other contaminants including depths on runways and taxiways.		
e)	Assessment and promulgation of runway surface conditions:		
	i) details of inspection intervals and times;		
	ii) completion and effective use of an inspection checklist;		
	iii) arrangements and methods for carrying out inspections on FOD, lighting, pavement surface, grassing;		
	iv) arrangements for reporting the results of inspections and for follow-up;		
	v) arrangements and means of communication with air traffic control during an inspection;		
	vi) arrangements for keeping an inspection logbook and the location of the logbook.		
5.6	**Maintenance of the movement area**		
	Promulgation of information on the aerodrome operational state, temporary withdrawals of facilities, runway closures, etc.:		
	i) arrangements for maintaining the paved areas, including the runway friction assessments;		
	ii) arrangements for maintaining the unpaved runways and taxiways;		
	iii) arrangements for maintaining the runway and taxiway strips;		

	YES	NO
iv) arrangements for maintaining aerodrome drainage;		
v) arrangements for maintaining the visual aids, including the measurement of intensity, beam spread and orientation of lights;		
vi) arrangements for maintaining the obstacle lighting;		
vii) arrangements for reporting and action taken in the event of failure or unsafe occurrence.		
5.7 Snow and ice control, and other hazardous meteorological conditions		
Description of the procedures.		
5.8 Visual aids		
a) Responsibilities with respect to the aerodrome ground lighting system.		
b) A full description of all visual aids available on each approach, runway, taxiway and apron, including above ground level (AGL) signs, markings and signals.		
c) Procedures for operational use and brilliancy settings of the AGL system.		
d) Standby and emergency power arrangements, including operating procedures both in LVP and during main power failure situations.		
e) Procedures for routine inspection and photometric testing of approach lights, runway lights and PAPIs.		
f) The location of and responsibility for obstacle lighting on and off the aerodrome.		
g) Procedures for recording inspection and maintenance of visual aids and actions to be taken in the event of failures.		
h) The control of work, including trenching and agricultural activity, which may affect the safety of the aeroplane.		

	YES	NO
5.9 Apron management		
a) Arrangements between air traffic control, the aerodrome operator and the apron management unit.		
b) Arrangements for allocating aeroplane stands.		
c) Arrangements for initiating engine start and ensuring clearance of aeroplane pushback.		
5.10 Apron safety management		
a) Means and procedures for jet blast protection.		
b) Enforcement of safety precautions during aeroplane refuelling operations.		
c) Arrangements for apron sweeping and cleaning.		
d) Arrangements for reporting incidents and accidents on an apron.		
e) Arrangements for enforcing the safety compliance of all personnel working on the apron.		
f) Arrangements for the use of advanced visual docking systems, if provided.		
5.11 Vehicles on the movement area		
a) Details of the applicable traffic rules (including speed limits and the means of enforcing the rules).		
b) Method and criteria for allowing drivers to operate vehicles on the movement area.		
c) Arrangements and means of communicating with air traffic control.		
d) Details of the equipment needed in vehicles that operate on the movement area.		
5.12 Wildlife hazard management		
a) Arrangements and method for dispersal of bird and other wildlife.		

	YES	NO
b) Measure to discourage birds and other wildlife.		
c) Arrangements for assessing wildlife hazards.		
d) Arrangements for implementing wildlife control programmes.		
5.13 Obstacles		
a) Arrangements for monitoring the height of buildings or structures within the boundaries of the obstacle limitation surfaces (OLS).		
b) Arrangements for controlling new developments in the vicinity of aerodromes.		
c) The reporting procedure and actions to be taken in the event of the appearance of unauthorized obstacles.		
d) Arrangements for removal of an obstacle.		
5.14 The removal of a disabled aeroplane		
a) Details of the capability for removal of a disabled aeroplane.		
b) Arrangements for removing a disabled aeroplane, including the reporting and notifying procedures and liaison with ATC.		
5.15 Dangerous goods		
Arrangements for special areas on the aerodrome to be set up for the storage of dangerous goods.		
5.16 Low visibility operations		
a) Obtaining and disseminating meteorological information, including runway visual range (RVR) and surface visibility.		
b) Protection of runways during LVP if such operations are permitted.		
c) The arrangement and rules before, during and after low visibility operations, including applicable rules for vehicles and personnel operating in the movement area.		

		YES	NO
5.17	**Protection of sites for radar, navigation aids and meteorological equipment**		
a)	Description of the areas to be protected and procedures for their protection.		
6.	**Safety management system (SMS)**		
a)	Safety policy.		
b)	Operator's structure and responsibility. This should include:		
	i) the name, status and responsibilities of the accountable executive;		
	ii) the name, status and responsibilities of the safety manager;		
	iii) the name, status and responsibilities of other senior operating staff;		
	iv) the name, status and responsibilities of the official in charge of day-to-day operations;		
	v) instructions as to the order and circumstances in which the above-named staff may act as the official in charge or accountable executive;		
	vi) an organizational chart supporting the commitment to the safe operation of the aerodrome as well as one simply showing the hierarchy of responsibility for safety management.		
c)	Training.		
d)	Complying with regulatory requirements relating to accidents, incidents and mandatory occurrence reporting.		
e)	Hazard analysis and risk assessment.		
f)	The management of change.		
g)	Safety criteria and indicators.		

		YES	NO
h)	Safety audits.		
i)	Documentation.		
j)	Safety-related committees.		
k)	Safety promotion.		
l)	Responsibility for monitoring the contractors and third parties operating on the aerodrome.		

INITIAL PROPOSAL 11

Rationale

The material in Chapter 3 is intended to help users undertake the safety assessment required in Chapters 2 and 4 of the PANS-Aerodromes. It outlines the methodologies and procedures, including a list of topics to be followed when undertaking a safety assessment in the specific domain of aerodromes. It also includes references to and complements Annex 19 and Doc 9859, *Safety Management Manual (SMM)* which, respectively, provide the high-level safety management responsibilities and processes, and generic safety management guidance.

Chapter 3

SAFETY ASSESSMENTS FOR AERODROMES

Note 1.— The objective of a safety assessment, as part of the risk management process of an SMS, is described in 3.3.1.

Note 2.— An aeronautical study, where permitted in Annex 14, Volume I, may be carried out when aerodrome standards cannot be met as a result of development. Such a study is most frequently undertaken during the planning of a new aerodrome or during the certification of an existing aerodrome. An aeronautical study is conducted to assess the impact of deviations from the aerodrome standards specified in Annex 14, Volume I, and the national regulations, to present alternative means of ensuring the safety of aircraft operations, to estimate the effectiveness of each alternative and to recommend procedures to compensate for the deviation (Doc 9774 — Manual on Certification of Aerodromes*, Appendix 3).*

Note 3.— Where alternative measures, operational procedures and operating restrictions have been developed arising from safety assessments, these should be reviewed periodically to assess their continued validity. The procedures in this chapter are not intended to substitute or circumvent the provisions contained in Annex 14, Volume I. It is expected that new infrastructure on an existing aerodrome or a new aerodrome will fully comply with the requirements in the Annex.

3.1 INTRODUCTION

3.1.1 A certified aerodrome operator implements an SMS acceptable to the State that, as a minimum:

a) identifies safety hazards;

b) ensures that remedial action necessary to maintain safety is implemented;

c) provides for continuous monitoring and regular assessment of the achieved safety; and

d) aims to make continuous improvement to the overall safety of the aerodrome.

Note 1.— Annex 19 — Safety Management *contains the framework for the implementation and maintenance of an SMS by a certified aerodrome. The appendix contains a description of the four components comprising the framework, i.e. safety policy and objectives, safety risk management, safety assurance and safety promotion.*

Note 2.— Further guidance on SMS is available in Doc 9859, Safety Management Manual (SMM).

3.1.2 This chapter describes how a safety assessment can be undertaken as part of the aerodrome's SMS. By applying the methodology and procedures described here, the aerodrome operator can demonstrate compliance with some of the minimum requirements described in 3.1.1.

3.2 SCOPE AND APPLICABILITY

3.2.1 This chapter presents a general methodology to conduct safety assessments on an aerodrome. Additional tools and particularly appropriate checklists, such as those found in Chapter 4, can help identify hazards, assess safety risks and eliminate or mitigate those risks when necessary. The suitability of the mitigation proposed and the need for alternative measures, operational procedures or operating restrictions for the specific operations concerned should be comprehensively evaluated. Section 3.4 details how the State will validate the conclusion of the safety assessment, when appropriate, to ensure safety is not compromised. Section 3.5 specifies how to promulgate appropriate information for use by the various aerodrome stakeholders and noticeably by the pilots and aircraft operators.

3.2.2 The safety assessment process addresses the impact of a safety concern, including a change or deviation, on the safety of operations at the aerodrome and takes into consideration the aerodrome's capacity and the efficiency of operations, as necessary.

3.3 BASIC CONSIDERATIONS

3.3.1 A safety assessment is an element of the risk management process of an SMS that is used to assess safety concerns arising from, *inter alia*, deviations from standards and applicable regulations, identified changes at an aerodrome specified in 2.4.5, or when any other safety concerns arise.

Note.— Changes on an aerodrome can include changes to procedures, equipment, infrastructures, safety works, special operations, regulations, organization, etc.

3.3.2 When a safety concern, change or a deviation has an impact on several aerodrome stakeholders, consideration shall be given to the involvement of all stakeholders affected in the safety assessment process. In some cases, the stakeholders impacted by the change will need to conduct a separate safety assessment themselves in order to fulfil the requirements of their SMSs and coordinate with other relevant stakeholders. When a change has an impact on multiple stakeholders, a collaborative safety assessment should be conducted to ensure compatibility of the final solutions.

3.3.3 A safety assessment considers the impact of the safety concern on all relevant factors determined to be safety-significant. The list below provides a number of items that may need to be considered when conducting a safety assessment. The items in this list are not exhaustive and in no particular order:

a) aerodrome layout, including runway configurations; runway length; taxiway, taxilane and apron configurations; gates; jet bridges; visual aids; and the RFF services infrastructure and capabilities;

b) types of aircraft, and their dimensions and performance characteristics, intended to operate at the aerodrome;

c) traffic density and distribution;

d) aerodrome ground services;

e) air-ground communications and time parameters for voice and data link communications;

f) type and capabilities of surveillance systems and the availability of systems providing controller support and alert functions;

g) flight instrument procedures and related aerodrome equipment;

h) complex operational procedures, such as collaborative decision-making (CDM);

i) aerodrome technical installations, such as advanced surface movement guidance and control systems (A-SMGCS) or other air navigation aids;

j) obstacles or hazardous activities at or in the vicinity of the aerodrome;

k) planned construction or maintenance works at or in the vicinity of the aerodrome;

l) any local or regional hazardous meteorological conditions (such as wind shear); and

n) airspace complexity, ATS route structure and classification of the airspace, which may change the pattern of operations or the capacity of the same airspace.

Note.— Chapter 4 outlines the methodology and procedures to assess the adequacy between aeroplane operations and aerodrome infrastructure and operations.

3.3.4 Subsequent to the completion of the safety assessment, the aerodrome operator is responsible for implementing and periodically monitoring the effectiveness of the identified mitigation measures.

3.3.5 The State reviews the safety assessment provided by the aerodrome operator and its identified mitigation measures, operational procedures and operating restrictions, as required in section 3.4, and is responsible for the subsequent regulatory oversight of their application.

Note.— A list of references to the existing studies that may assist aerodrome operators in developing their safety assessments is available in Appendix B to Circular 305 — Operation of New Larger Aeroplanes at Existing Aerodromes. *New and updated references will be included in other appropriate documents as they become available. However, it is to be noted that each study is specific to a particular deviation or change; hence, caution should be exercised in considering applicability to other situations and locations. Inclusion of these references does not imply ICAO endorsement or recognition of the outcome of the studies, which remains the ultimate responsibility of the State in accordance with the Convention on International Civil Aviation.*

3.4 SAFETY ASSESSMENT PROCESS

3.4.1 Introduction

Note.— Guidance on continuous improvement of the SMS as part of the safety assurance component of the SMS framework is available in Doc 9859.

3.4.1.1 The primary objective of a safety assessment is to assess the impact of a safety concern such as a design change or deviation in operational procedures at an existing aerodrome.

3.4.1.2 Such a safety concern can often impact multiple stakeholders; therefore, safety assessments often need to be carried out in a cross-organizational manner, involving experts from all the involved stakeholders. Prior to the assessment, a preliminary identification of the required tasks and the organizations to be involved in the process is conducted.

3.4.1.3 A safety assessment is initially composed of four basic steps:

a) definition of a safety concern and identification of the regulatory compliance;

b) hazard identification and analysis;

c) risk assessment and development of mitigation measures; and

d) development of an implementation plan for the mitigation measures and conclusion of the assessment.

Note 1.— A safety assessment process flow chart applicable for aerodrome operations is provided in Attachment B; a generic safety risk management process can be found in Doc 9859.

Note 2.— Certain safety assessments may involve other stakeholders such as ground handlers (concerning changes to apron operations), air operators and ATS (for new procedures), flight procedure designers, providers of radio navigation signals, including signals from satellites.

3.4.2 Definition of a safety concern and identification of the regulatory compliance

3.4.2.1 Any perceived safety concerns are to be described in detail, including timescales, projected phases, location, stakeholders involved/affected as well as their potential influence on specific processes, procedures, systems and operations.

3.4.2.2 The perceived safety concern is first analysed to determine whether it is retained or rejected. If rejected, the justification for rejecting the safety concern is to be provided and documented.

3.4.2.3 An initial evaluation of compliance with the appropriate provisions in the regulations applicable to the aerodrome is conducted and documented.

3.4.2.4 The corresponding areas of concern are identified before proceeding with the remaining steps of the safety assessment, with all relevant stakeholders.

Note.— It may be useful to review the historical background of some regulatory provisions to gain a better understanding of the safety objective of those provisions.

3.4.2.5 If a safety assessment was conducted previously for similar cases in the same context at an aerodrome where similar characteristics and procedures exist, the aerodrome operator may use some elements from that assessment as a basis for the assessment to be conducted. Nevertheless, as each assessment is specific to a particular safety concern at a given aerodrome the suitability for reusing specific elements of an existing assessment is to be carefully evaluated.

3.4.3 Hazard identification

3.4.3.1 Hazards related to infrastructure, systems or operational procedures are initially identified using methods such as brain-storming sessions, expert opinions, industry knowledge, experience and operational judgement. The identification of hazards is conducted by considering:

a) accident causal factors and critical events based on a simple causal analysis of available accident and incident databases;

b) events that may have occurred in similar circumstances or that are subsequent to the resolution of a similar safety concern; and

c) potential new hazards that may emerge during or after implementation of the planned changes.

3.4.3.2 Following the previous steps, all potential outcomes or consequences for each identified hazard are identified.

Note.— Further guidance on the definition of risk can be found in Doc 9859.

3.4.3.3 The appropriate safety objective for each type of risk should be defined and detailed. This can be done through:

a) reference to recognized standards and/or codes of practices;

b) reference to the safety performance of the existing system;

c) reference to the acceptance of a similar system elsewhere; and

d) application of explicit safety risk levels.

3.4.3.4 Safety objectives are specified in either quantitative terms (e.g. identification of a numerical probability) or qualitative terms (e.g. comparison with an existing situation). The selection of the safety objective is made according to the aerodrome operator's policy with respect to safety improvement and is justified for the specific hazard.

3.4.4 Risk assessment and development of mitigation measures

3.4.4.1 The level of risk of each identified potential consequence is estimated by conducting a risk assessment. This risk assessment will determine the severity of a consequence (effect on the safety of the considered operations) and the probability of the consequence occurring and will be based on experience as well as on any available data (e.g. accident database, occurrence reports).

3.4.4.2 Understanding the risks is the basis for the development of mitigation measures, operational procedures and operating restrictions that might be needed to ensure safe aerodrome operations.

3.4.4.3 The method for risk evaluation is strongly dependent on the nature of the hazards. The risk itself is evaluated by combining the two values for severity of its consequences and probability of occurrence.

Note.— A risk categorization tool in the form of a safety risk (index) assessment matrix is available in Doc 9859.

3.4.4.4 Once each hazard has been identified and analysed in terms of causes, and assessed for severity and probability of its occurrence, it must be ascertained that all associated risks are appropriately managed. An initial identification of existing mitigation measures must be conducted prior to the development of any additional measures.

3.4.4.5 All risk mitigation measures, whether currently being applied or still under development, are evaluated for the effectiveness of their risk management capabilities.

Note.— The exposure to a given risk (e.g. duration of a change, time before implementation of corrective actions, traffic density) is taken into account in order to decide on its acceptability.

3.4.4.6 In some cases, a quantitative approach may be possible, and numerical safety objectives can be used. In other instances such as changes to the operational environment or procedures, a qualitative analysis may be more relevant.

Note 1.— An example of a qualitative approach is the objective of providing at least the same protection as the one offered by the infrastructure corresponding to the appropriate aerodrome reference code for a specific aeroplane.

Note 2.— Chapter 4 provides a list of typical challenges related to each part of the aerodrome infrastructure and the potential solutions proposed.

3.4.4.7 States should provide suitable guidance on risk assessment models for aerodrome operators.

Note 1.— Risk assessment models are commonly built on the principle that there should be an inverse relationship between the severity of an incident and its probability.

Note 2.— Methodologies for risk management can be found in Attachment B.

3.4.4.8 In some cases, the result of the risk assessment may be that the safety objectives will be met without any additional specific mitigation measures.

3.4.5 Development of an implementation plan and conclusion of the assessment

3.4.5.1 The last phase of the safety assessment process is the development of a plan for the implementation of the identified mitigation measures.

3.4.5.2 The implementation plan includes time frames, responsibilities for mitigation measures as well as control measures that may be defined and implemented to monitor the effectiveness of the mitigation measures.

3.5 APPROVAL OR ACCEPTANCE OF A SAFETY ASSESSMENT

Note.— The safety assessment conducted by the aerodrome operator is a core SMS function. Management approval and implementation of the safety assessment, including future updates and maintenance, are the responsibility of the aerodrome operator. The State may, for specific reasons, require the submission of the specific safety assessment for approval/acceptance.

3.5.1 The State establishes the type of safety assessments that are subject to approval/acceptance and determines the process used for that approval/acceptance.

Rationale

Safety assessments conducted by service providers is a core SMS function of all service providers. Each safety assessment itself (development and ownership), including management approval, implementation and future updates/ maintenance, should be the responsibility of the service provider. The State (CAA) should not require formal approval of service providers' safety assessments. By so doing, the State (CAA) may be having excessive control over service providers' performance of their SMS hazard identification & risk assessment process (SMS elements 2.1 & 2.2). There is no expectation for formal approval of service providers' safety assessments by the State (CAA) in the SMS or SSP framework. SSP element 2.2 expects the State (CAA) to have a process for agreement on service providers' safety performance indicators only. Regulatory oversight of safety assessments is part of the regulator's routine oversight (surveillance) of the service provider's SMS. The regulator should not be committing itself to the routine review, decision making or approval of safety assessments performed by service providers for the simple reason that doing so may result in a backlog of safety assessments waiting for regulatory approval. It is possible for a regulator to require service provider(s) to submit specific safety assessments for the regulator's review, for specific reasons, such as part of a safety-case to support applications for alternate means of compliance. Other than such occasions, the regulator may ask to review (sample check) a service provider's safety assessments during an organization or SMS audit. The regulator should not be responsible for a service provider's safety assessments. It is to be noted that where a CAA is also an aerodrome operator, it will be up to the State to ensure the necessary segregation between regulatory (SSP) and service provider (SMS) functions.

3.5.2 Where required in 3.5.1, a safety assessment subject to approval/acceptance by the State shall be submitted by the aerodrome operator prior to implementation.

3.5.3 The State analyses the safety assessment and verifies that:

a) appropriate coordination has been performed between the concerned stakeholders;

b) the risks have been properly identified and assessed, based on documented arguments (e.g. physical or Human Factors studies, analysis of previous accidents and incidents);

c) the proposed mitigation measures adequately address the risk; and

d) the time frames for planned implementation are acceptable.

Note.— It is preferable to work with a team of the State's operational experts in the areas considered in the safety assessment.

3.5.4 On completion of the analysis of the safety assessment, the State:

a) either gives formal approval/acceptance of the safety assessment to the aerodrome operator as required in 3.5.1; or

b) if some risks have been underestimated or have not been identified, coordinates with the aerodrome operator to reach an agreement on safety acceptance; or

c) if no agreement can be reached, rejects the proposal for possible resubmission by the aerodrome operator; or
d) may choose to impose conditional measures to ensure safety.

3.5.5 The State should ensure that the mitigation or conditional measures are properly implemented and that they fulfil their purpose.

3.6 PROMULGATION OF SAFETY INFORMATION

3.6.1 The aerodrome operator determines the most appropriate method for communicating safety information to the stakeholders and ensures that all safety-relevant conclusions of the safety assessment are adequately communicated.

3.6.2 In order to ensure adequate dissemination of information to interested parties, information that affects the current integrated aeronautical information package (IAIP) or other relevant safety information is:

a) promulgated in the relevant section of the IAIP or automatic terminal information service (ATIS); and

b) published in the relevant aerodrome information communications through appropriate means.

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Rationale

A flow chart to be used for the conduct of a safety assessment is provided in Attachment A to Chapter 3.

Attachment A to Chapter 3

SAFETY ASSESSMENT FLOW CHART

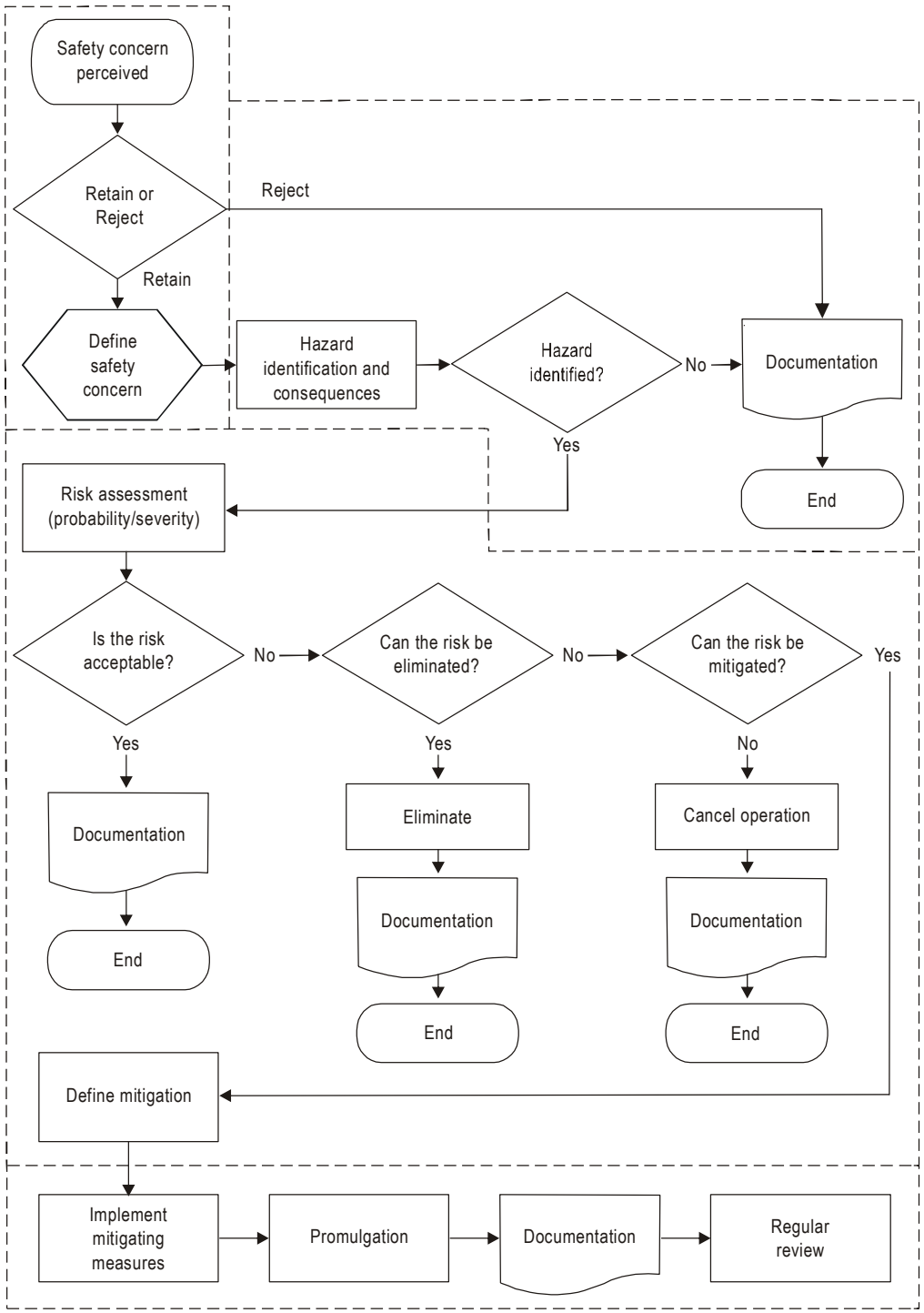

Figure 3-A-1. Flow chart to be used for the conduct of a safety assessment

Attachment B to Chapter 3

SAFETY ASSESSMENT METHODOLOGIES FOR AERODROMES

Note.— Further guidance on safety risk probability, severity, tolerability and assessment matrix can be found in Doc 9859 — Safety Management Manual (SMM).

1. Depending on the nature of the risk, three methodologies can be used to evaluate whether it is being appropriately managed:

a) *Method type "A".* For certain hazards, the risk assessment strongly depends on specific aeroplane and/or system performance. The risk level is dependent upon aeroplane/system performance (e.g. more accurate navigation capabilities), handling qualities and infrastructure characteristics. Risk assessment, then, can be based on aeroplane/system design and validation, certification, simulation results and accident/incident analysis.

b) *Method type "B".* For other hazards, risk assessment is not really linked with specific aeroplane and/or system performance but can be derived from existing performance measurements. Risk assessment, then, can be based on statistics (e.g. deviations) from existing operations or on accident analysis; development of generic quantitative risk models can be well adapted.

c) *Method type "C".* In this case, a "risk assessment study" is not needed. A simple logical argument may be sufficient to specify the infrastructure, system or procedure requirements, without waiting for additional material, e.g. certification results for newly announced aeroplanes or using statistics from existing aeroplane operations.

Risk assessment method

2. The risk assessment takes into account the probability of occurrence of a hazard and the severity of its consequences; the risk is evaluated by combining the two values for severity and probability of occurrence.

3. Each identified hazard must be classified by probability of occurrence and severity of impact. This process of risk classification will allow the aerodrome to determine the level of risk posed by a particular hazard. The classification of probability and severity refers to potential events.

4. The severity classification includes five classes ranging from "catastrophic" (class A) to "not significant" (class E). The examples in Table 3-B-1, adapted from Doc 9859 with aerodrome-specific examples, serve as a guide to better understand the definition.

5. The classification of the severity of an event should be based on a "credible case" but not on a "worst case" scenario. A credible case is expected to be possible under reasonable

conditions (probable course of events). A worst case may be expected under extreme conditions and combinations of additional and improbable hazards. If worst cases are to be introduced implicitly, it is necessary to estimate appropriate low frequencies.

Table 3-B-1. Severity classification scheme with examples
(*adapted from Doc 9859 with aerodrome-specific examples*)

Severity class	*Definition*	*Examples*
A Catastrophic	– accident – equipment destroyed – loss of aircraft – multiple deaths	– collision between aircraft and/or other object during take-off or landing
B Hazardous	– a large reduction in safety margins / no safety barriers remaining – the outcome is not under control – major equipment damage – serious or fatal injury to a number of people	– runway incursion, significant potential for an accident, extreme action to avoid collision – attempted take-off or landing on a closed or engaged runway – take-off/landing incidents, such as undershooting or overrunning
C Major	– serious incident or accident – significant reduction in safety margins – serious equipment damage – injury to persons	– runway incursion, ample time and distance (no potential for a collision) – collision with obstacle on apron/ parking position (hard collision) – employee falling down from height – missed approach with ground contact of the wing ends during the touchdown – large fuel puddle near the aircraft while passengers are on-board
D Minor	– nuisance, operations limitations – minor incident – minor damage to the aircraft, vehicles or objects	– hard braking during landing or taxiing – damage due to jet blast (objects) – expendables are laying around the stands – collision between maintenance vehicles on service road – breakage of drawbar during pushback (damage to the aircraft) – slight excess of maximum take-off weight – aircraft rolling into passenger bridge (slight collision) – forklift that is tilting – complex taxiing instructions/procedures

Severity class	*Definition*	*Examples*
E Not significant	– non-significant consequences – circumstances which may lead to a non-significant reduction in safety and no immediate effect on safety	– slight increase in braking distance – temporary fencing collapsing because of strong winds – cart losing baggage

6. The probability classification includes five classes ranging from “extremely improbable” (class 1) to “frequent” (class 5) as shown in Table 3-B-2.

7. The probability classes presented in Table 3-B-2 are defined with quantitative limits. It is not the intention to assess frequencies quantitatively; the numerical value serves only to clarify the qualitative description and support a consistent expert judgement.

8. The classification refers to the probability of events per year. This is reasoned through the following:

a) many hazards at airports are not directly related to aircraft movements;

b) the assessment of hazards can be based on expert judgement without any calculations.

Table 3-B-2. Probability classification scheme

Probability class	*Meaning*
5 Frequent	Likely to occur many times (has occurred frequently)
4 Reasonably probable	Likely to occur sometimes (has occurred infrequently)
3 Remote	Unlikely to occur (has occurred rarely)
2 Extremely remote	Very unlikely to occur (not known to have occurred)
1 Extremely improbable	Almost inconceivable that the event will occur

9. The aim of the matrix is to provide a means of obtaining a safety risk index. The index can be used to determine tolerability of the risk and to enable the prioritization of relevant actions in order to decide about risk acceptance.

10. Given that the prioritization is dependent on both probability and severity of the events, the prioritization criteria will be two-dimensional. Three main classes of hazard mitigation priority are defined in Table 3-B-3:

a) hazards with high priority — intolerable;

b) hazards with mean priority — tolerable;

c) hazards with low priority — acceptable.

11. The risk assessment matrix has no fixed limits for tolerability but points to a floating assessment where risks are given risk priority for their risk contribution to aircraft operations. For this reason, the priority classes are intentionally not edged along the probability and severity classes in order to take into account the imprecise assessment.

Table 3-B-3. Risk assessment matrix with prioritization classes

Probability	*Risk assessment matrix*					
Frequent	**5**	Intolerable				
Reasonably probable	**4**					
Remote	**3**			Tolerable		
Extremely remote	**2**					
Extremely Improbable	**1**					Acceptable
Severity		A Catastrophic	B Hazardous	C Major	D Minor	E Not significant

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Rationale

Chapter 4 outlines the methodologies and procedures for aerodrome operators intending to undertake an assessment of the compatibility of the aerodrome for the type of traffic or operation the aerodrome is intending to accommodate. It amplifies the requirement of the (new) proposed paragraph 1.7.1, Annex 14, Volume I. The chapter addresses those situations where compliance with the design provisions stipulated in Annex 14, Volume I, is either impractical or physically impossible.

The various elements of the aeroplane's physical and operational characteristics and their influence/impact on the aerodrome infrastructure are provided. For each infrastructure, the relevant Annex 14, Volume I, SARP including the associated guidance material in the *Aerodrome Design Manual* (Doc 9157) is described. Next, the challenges, hazards and issues relating to the specific infrastructure item faced during aerodrome operations are enumerated, and finally, potential solutions are proposed that do not compromise safety.

Some of the material in this chapter has been extracted from Cir 305, *Operation of New Larger Aeroplanes at Existing Aerodromes* — the latter developed as part of a twofold Action Plan initiated by the Air Navigation Commission — and others suitably modified/augmented based on aerodrome best practices.

Chapter 4

AERODROME COMPATIBILITY

4.1 INTRODUCTION

4.1.1 This chapter outlines a methodology and procedures to assess the compatibility between aeroplane operations and aerodrome infrastructure and operations when an aerodrome accommodates an aeroplane that exceeds the certificated characteristics of the aerodrome.

4.1.2 A compatibility study should be performed collaboratively between affected stakeholders which includes the aerodrome operator, the aeroplane operator, ground handling agencies as well as the various air navigation service providers (ANSPs).

4.1.3 The following steps describe the arrangement, to be appropriately documented, between the aeroplane operator and aerodrome operator for the introduction of an aeroplane type/subtype new to the aerodrome:

a) the aeroplane operator submits a request to the aerodrome operator to operate an aeroplane type/subtype new to the aerodrome;

b) the aerodrome operator identifies possible means of accommodating the aeroplane type/subtype including access to movement areas and, if necessary, considers the feasibility and economic viability of upgrading the aerodrome infrastructure; and

c) the aerodrome operator and aircraft operator discuss the aerodrome operator's assessment, and whether operations of the aeroplane type/subtype can be accommodated and, if permitted, under what conditions.

4.1.4 The following procedures should be included in the aerodrome compatibility study:

a) identify the aeroplane's physical characteristics and operational requirements (see Attachments A and B);

b) identify the applicable regulatory requirements;

c) establish the adequacy of the aerodrome infrastructure and facilities vis-à-vis the requirements of the new aeroplane (see the appendix to this chapter);

d) identify the changes required to the aerodrome; ~~and~~

e) document the compatibility study; and

f) perform the required safety assessments identified during the compatibility study (see Chapter 3 on safety assessment).

Note 1.— A compatibility study may require a review of the obstacle limitation surfaces at an aerodrome as specified in Chapter 4, Annex 14, Volume I. Further guidance on the function of these surfaces is given in Doc 9137, Part 6 — Control of Obstacles. *Where required, reporting of obstacles is prescribed in Annex 4 —* Aeronautical Charts *and Annex 15 —* Aeronautical Information Services.

Note 2.— For aerodrome operations in low visibility conditions, additional procedures may be implemented in order to safeguard the operation of aeroplanes. Further guidance on operations in low visibility conditions are available in Doc 9137 — Airport Services Manual, *Part 8 —* Airport Operational Service, *Doc 9476 —* Manual of Surface Movement Guidance and Control Systems (SMGCS) *and Doc 9830 —* Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual.

Note 3.— Additional processes that ensure suitable measures are in place to protect the signal produced by the ground-based radio navigation equipment may be necessary at aerodromes with precision instrument approaches.

4.1.5 The result of the compatibility study should enable decisions to be made and should provide:

a) the aerodrome operator with the necessary information in order to make a decision on allowing the operation of the specific aeroplane at the given aerodrome;

b) the aerodrome operator with the necessary information in order to make a decision on the changes required to the aerodrome infrastructure and facilities to ensure safe operations at the aerodrome with due consideration to the harmonious future development of the aerodrome; and

c) the State with the information which is necessary for its safety oversight and the continued monitoring of the conditions specified in the aerodrome certification.

Note 1.— Each compatibility study is specific to a particular operational context and to a particular type of aeroplane.

Note 2.— See Annex 6, Part 1, Chapter 4, regarding the obligation of the aeroplane operator.

Note 3.— Information resulting from the compatibility study that is considered to be of operational significance is published in accordance with Annex 14, Volume I, 2.13.1, and Annex 15.

4.2 IMPACT OF AEROPLANE CHARACTERISTICS ON THE AERODROME INFRASTRUCTURE

4.2.1 General

4.2.1.1 Introducing new types of aeroplanes into existing aerodromes may have an impact on the aerodrome facilities and services, in particular, when the aeroplane characteristics exceed the parameters that were used for planning the aerodrome.

4.2.1.2 The parameters used in aerodrome planning are defined in Annex 14, Volume I, which specifies the use of the aerodrome reference code determined in accordance with the characteristics of the aeroplane for which an aerodrome facility is intended. The aerodrome reference code provides a starting point for the compatibility study but should not be the sole means used to conduct the analysis and to substantiate the aerodrome operator's decisions and the State's safety oversight actions.

Note ~~1~~.— The individual facilities required at an aerodrome are interrelated by the aerodrome reference code. The design of these facilities, including a description of the aerodrome reference code, can be found in Annex 14, Volume I, and are transposed by States into national regulations.

4.2.1.3 Section 4.2.2 enumerates the potential impact of aeroplane characteristics on the aerodrome infrastructure and operations.

4.2.2 Consideration of the aeroplane's physical characteristics

The aeroplane's physical characteristics may influence the aerodrome dimensions, facilities and services in the movement area. These characteristics are detailed in Attachment A.

4.2.3 Consideration of the aeroplane's operational characteristics

In order to adequately assess aerodrome compatibility, aeroplane operational characteristics should be included in the evaluation process. The operational characteristics can include the infrastructure requirements of the aeroplane as well as ground servicing requirements. These characteristics are detailed in Attachment B.

4.3 PHYSICAL CHARACTERISTICS OF AERODROMES

In order to adequately assess the aeroplane's compatibility, aerodrome physical characteristics should be included in the evaluation process. These characteristics are detailed in the appendix.

Appendix to Chapter 4

PHYSICAL CHARACTERISTICS OF AERODROMES

1. INTRODUCTION

Each paragraph within this section is structured as follows:

Introduction

This section provides the rationale, including the basis and objectives for the various elements of the physical infrastructure required in Annex 14, Volume I, Chapter 3. References are made, where necessary, to other ICAO documents.

Challenges

This section identifies possible challenges based on experience, operational judgement and analysis of hazards linked to an infrastructure item in relation to ICAO provisions. Each compatibility study should determine the challenges relevant for the accommodation of the planned aeroplane at the existing aerodrome.

Potential solutions

This section presents possible solutions related to the identified problems. Where it is impracticable to adapt the existing aerodrome infrastructure or operations in accordance with the applicable regulation, the compatibility study or, where necessary, safety assessment, determines the appropriate solutions/possible risk mitigation measures to be implemented.

Note 1.— Where possible solutions have been developed, these should be reviewed periodically to assess their continued validity. These possible solutions are not intended to substitute or circumvent the provisions contained in Annex 14, Volume I.

Note 2.— Procedures on the conduct of a safety assessment can be found in Chapter 3.

2. RUNWAYS

2.1 Runway length

Note 1.— Runway length is a limiting factor on aeroplane operations and should be assessed in collaboration with the aeroplane operator. Indicative guidance material on runway length can be found in Attachment B.

Note 2.— Longitudinal slopes can have an effect on aeroplane performance.

2.2 Runway width

Introduction

2.2.1 The runway width is primarily related to the outer main gear wheel span and the clearance required on either side of the outer main gear wheels when the aeroplane is centred on the runway.

Note.— Guidance is given in Doc 9157 — Aerodrome Design Manual, *Part 1 —* Runways.

2.2.2 Runway width is also related to the operational behaviour demonstrated by the aeroplane. It might be advisable to consider other factors of operational significance in order to have a margin for factors such as wet or contaminated runway pavement, crosswind conditions, crab angle approaches to landing, aeroplane controllability during aborted take-off, and engine failure procedures.

Note.— Guidance is given in Doc 9157, Part 1.

Challenges

2.2.3 The main issue associated with available runway width is structural damage/fatalities associated with an aeroplane veering off the runway during take-off, rejected take-off or during the landing.

2.2.4 The main causes and accident factors are:

a) for take-off/rejected take-off:

1) aeroplane (asymmetric spin-up and/or reverse thrust, malfunctioning of control surfaces, hydraulic system, tires, brakes, nose-gear steering, centre of gravity and power plant (engine failure, foreign object ingestion));

2) temporary surface conditions (standing water, snow, dust, residuals (rubber), FOD, damage to the pavement and runway friction coefficient);

3) permanent surface conditions (horizontal and vertical slopes and runway friction characteristics);

4) meteorological conditions (heavy rain, crosswind, strong/gusty winds, visibility); and

5) Human Factors (crew, maintenance, balance, payload security);

b) for landing:

1) aeroplane/airframe (malfunction of the landing gear, control surfaces, hydraulic system, brakes, tires, nose-gear steering and power plant (reverse and thrust lever linkage));

2) temporary surface conditions (standing water, snow, dust, residuals (e.g. rubber), FOD, damage to the pavement and applying runway friction coefficient);

3) permanent surface conditions (horizontal and vertical slopes and runway friction characteristics);

4) prevailing meteorological conditions (heavy rain, crosswind, strong/gusty winds, thunderstorms/wind shear, reduced visibility);

5) Human Factors (i.e. hard landings, crew, maintenance);

6) ILS localizer signal quality/interference, where autoland procedures are used;

7) any other localizer signal quality/interference of approach aid equipment; and

8) speed.

Note.— An analysis of lateral runway excursion reports shows that the causal factor in aeroplane accidents/incidents is not the same as for take-off and landing. Mechanical failure is, for instance, a frequent accident factor for runway excursions during take-off, while hazardous meteorological conditions such as thunderstorms are more often associated with landing accidents/incidents. Engine reverse thrust system malfunction and/or contaminated runway surfaces have also been a factor in a significant number of veer-offs during landing (other subjects are relevant to the aeroplane such as brake failures and high crosswinds).

Potential solutions

2.2.5 The lateral runway excursion is linked to specific aeroplane characteristics, performance/handling qualities, controllability in response to such events as aeroplane mechanical failures, pavement contamination and crosswind conditions. This type of excursion belongs to the category for which risk assessment should be based on aeroplane performance and handling qualities. Certified limitations of the specific aeroplane should be key factors to be considered in order to ensure that this kind of hazard is under control. Other factors may affect minimum runway width, such as winter operations or reduced friction characteristics on the pavement.

Note.— Handling qualities can relate to the specific training of the aircrew in narrow runway operations as well as standard operating procedures.

2.2.6 For a specific aeroplane, it may be permissible to operate on a runway with a narrower width if an appropriate civil aviation authority has approved the aeroplane for such operations by validating that safety is not adversely affected.

Note.— The maximum demonstrated crosswind performance figures are included in the aircraft flight manual.

2.2.7 Potential solutions can be developed from providing the following facilities, single or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) paved inner shoulders of adequate bearing strength to provide an overall width of the runway and its (inner) shoulders of the recommended runway width according to the reference code;

b) paved/unpaved outer shoulders with adequate bearing strength to provide an overall width of the runway and its shoulder of the recommended runway width according to the reference code;

c) additional runway centre line guidance and runway edge markings;

d) increased full runway length FOD inspection, when required or requested; and

e) precision approaches.

2.2.8 Aerodrome operators should also take into account the possibility that certain aeroplanes are not able to make a 180-degree turn on narrower runways. When there is no proper taxiway at the end of the runway, providing a suitable runway turn pad is recommended.

2.2.9 Snow removal should be provided at least up to the position of the outboard engine’s intake section area to avoid snow ingestion unless specific aeroplane characteristics/procedures exist to avoid snow ingestion (significant ground clearance of the engines preventing snow ingestion, specific take-off procedure).

Note.— Guidance is given in Doc 9137, Part 2.

2.2.10 Aerodromes which use embedded (inset) runway edge lights should take into account additional consequences such as:

a) more frequent cleaning intervals for the embedded lights, as dirt will affect the function more quickly compared to elevated runway edge lights;

b) earlier execution of snow removal operations, as the inset lights are likely to be affected by snow more quickly; and

c) in addition bi-directional inset lights can facilitate snow removal procedures on a wider range.

2.2.11 Location and specifications for runway signs should be considered due to the increased size of the aeroplane's wingspan (engine location) as well as the increased thrust rating from the aeroplane's engines.

Note.— Particular care should be given while manoeuvring on runways having a width less than recommended to prevent the wheels of the aeroplane from leaving the pavement, while avoiding the use of large amounts of thrust that could damage runway lights and signs and cause erosion of the runway strip. For affected runways a close inspection, as appropriate, is generally considered to detect the presence of debris that may be deposited during 180-degree turns on the runway after landing.

Simultaneous use of parallel runways

Note.— Simultaneous use of parallel runways is included in the PANS-ATM.

Surface of runways

Note.— The surface of the runway can have an effect on aeroplane performance.

2.3 Runway shoulders

Introduction

2.3.1 The runway shoulder may be divided into two areas;

a) the inner shoulder is an area along the runway capable of supporting an aeroplane in the event it runs off the runway, without inducing structural damage to the aeroplane and so prepared as to resist object ingestion by engines and jet blast effects when the aeroplane axis is on the centre one-third of the runway; and

b) the outer shoulder is an area along the runway inner shoulder so prepared as to resist object ingestion by engines and jet blast effects when the aeroplane axis is on the centre one-third of the runway.

2.3.2 Both the inner and outer shoulders of a runway should be capable of minimizing any damage to an aeroplane veering off the runway. In some cases, the bearing strength of the natural ground may be sufficient without additional preparation to meet the requirements for shoulders. The prevention of ingestion of objects from jet engines should always be taken into account particularly for the design and construction of the shoulders. In case of specific preparation of the shoulders, visual contrast, such as the use of runway side-stripe markings, between runway and runway shoulders, may be required.

Note.— Guidance is given in Doc 9157, Part 1.

Challenges

2.3.3 Runway shoulders have three main functions:

a) to minimize any damage to an aeroplane running off the runway ;

b) to provide jet blast protection and to prevent engine FOD ingestion; and

c) to support ground vehicle traffic, RFF vehicles and maintenance vehicles.

Note.— Inadequate width of existing runway bridges is a special topic that needs careful evaluation.

2.3.4 Potential issues associated with runway shoulder characteristics (width, soil type, bearing strength) are:

a) aeroplane damage that could occur after excursion onto the runway shoulder due to inadequate bearing capacity;

b) shoulder erosion causing ingestion of foreign objects by jet engines due to unsealed surfaces; consideration should be given to the impact of FOD on aeroplane tires and engines as a potentially major hazard; and

c) difficulties for RFF services to access a damaged aeroplane on the runway due to inadequate bearing strength.

2.3.5 Factors to be considered are:

a) runway centre line deviations;

b) power plant characteristics (engine height, location and power); and

c) soil type and bearing strength (aeroplane mass, tire pressure, gear design).

Potential solutions

2.3.6 Possible solutions can be developed by providing the following facilities, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) *Excursion onto the runway shoulder*. Provide the suitable shoulder as detailed in section 2.3;

b) *Jet blast*. Information about outer engine position, jet blast velocity contour and jet blast directions at take-off is needed to calculate the required width of shoulders that has to be enhanced for protection against jet blast. Lateral deviation from the runway centre line should also be taken into account;

Note.— Jet blast velocity data are available in the "Aircraft Characteristics for Airport Planning" manuals on the websites of the respective manufacturers.

c) *RFF vehicles*. Operational experience with aeroplanes currently operated on existing runways suggests that an overall width of the runway and its shoulders which is compliant with the requirements is adequate to permit intervention on aeroplanes by occasional RFF vehicle traffic. However, longer upper-deck escape chutes may reduce the margin between the shoulder edge and the extension of escape slides and reduce the supporting surface available to rescue vehicles; and

d) *Additional surface inspections*. It may be necessary to adapt the inspection programme for FOD detection.

2.4 Runway turn pads

Introduction

2.4.1 Turn pads are generally provided when an exit taxiway is not available at the runway end. A turn pad allows an aeroplane to turn back after landing and before take-off and to position itself correctly on the runway.

Note.— Guidance on typical turn pads is given in Doc 9157 Part 1, Appendix 4. In particular, the design of the total width of the turn pad should be such that the nose-wheel steering angle of the aeroplane for which the turn pad is intended will not exceed 45 degrees.

Challenges

2.4.2 For minimizing the risk of a turn pad excursion, the turn pad should be designed sufficiently wide to permit the 180-degree turn of the most demanding aeroplane that will be operated. The design of the turn pad generally assumes a maximum nose landing gear steering angle of 45 degrees, which should be used unless some other condition applies for the particular type of aeroplane, and considers clearances between the gears and the turn pad edge, as for a taxiway.

2.4.3 The main causes and accident factors of the aeroplane veering off the turn pad pavement are:

a) aeroplane characteristics that are not adequate and aeroplane failure (ground manoeuvring capabilities, especially long aeroplanes, malfunctioning of nose-gear steering, engine, brakes);

b) adverse surface conditions (standing water, loss of control on ice-covered surfaces, friction coefficient);

c) loss of the turn pad visual guidance (markings and lights covered by snow or inadequately maintained); and

d) Human Factors, including incorrect application of the 180-degree procedure (nose-wheel steering, asymmetric thrust, differential breaking).

Note.— No turn pad excursions with passenger injuries have so far been reported. Nevertheless, an aeroplane disabled on a turn pad can have an impact on runway closure.

Potential solutions

2.4.4 The ground manoeuvring capabilities available from airframe manufacturers (in the "Aircraft Characteristics for Airport Planning" manuals) are one of the key factors to be considered in order to determine whether an existing turn pad is suitable for a particular aeroplane. The speed of the manoeuvring aeroplane is also a factor.

Note.— Taxi cameras can assist the flight crew in preventing the wheels of the aeroplane from leaving the full-strength pavement during normal ground manoeuvring. The taxi camera system or marshaller guidance should be required on an aeroplane dispatched to an aerodrome with turn pads having a width less than that required.

2.4.5 For a specific aeroplane, it may be permissible to operate on a runway turn pad not provided in accordance with Annex 14, Volume I, specifications, considering:

a) the specific ground manoeuvring capability of the specific aeroplane (notably the maximum effective steering angle of the nose landing gear);

b) the provision for adequate clearances;

c) the provision for appropriate marking and lighting;

d) the provision of shoulders;

e) the protection from jet blast; and

f) if relevant, protection of the ILS.

In this case, the turn pad can have a different shape. The objective is to enable the aeroplane to align on the runway while losing the least runway length as possible. The aeroplane is supposed to taxi at slow speed.

2.4.6 An example of a turn pad based on the minimum dimension required to perform the manoeuvre is shown in Figure 4-1. The following values are generally used:

γ = 30 degrees,

e is the same separation as for taxiways to objects; and

e' is a specific margin for the rotation, to take into account possible oversteering and which can be chosen as follows:

	Code letter					
	A	B	C	D	E	F
e’	1.5 m	2.25 m	5.7 m (a)) or 8.8 m (b))	8.8 m	8.8 m	8.8 m

a) if the turn pad is intended to be used by aeroplanes with a wheel base less than 18 m;

b) if the turn pad is intended to be used by aeroplanes with a wheel base equal to or greater than 18 m; and

c) e’ is the distance between the centre line of the nose-wheel track to the pavement edge.

Note.— Further advisory material on turn pads can be found on the aircraft manufacturers’ websites and in their airport planning manuals.

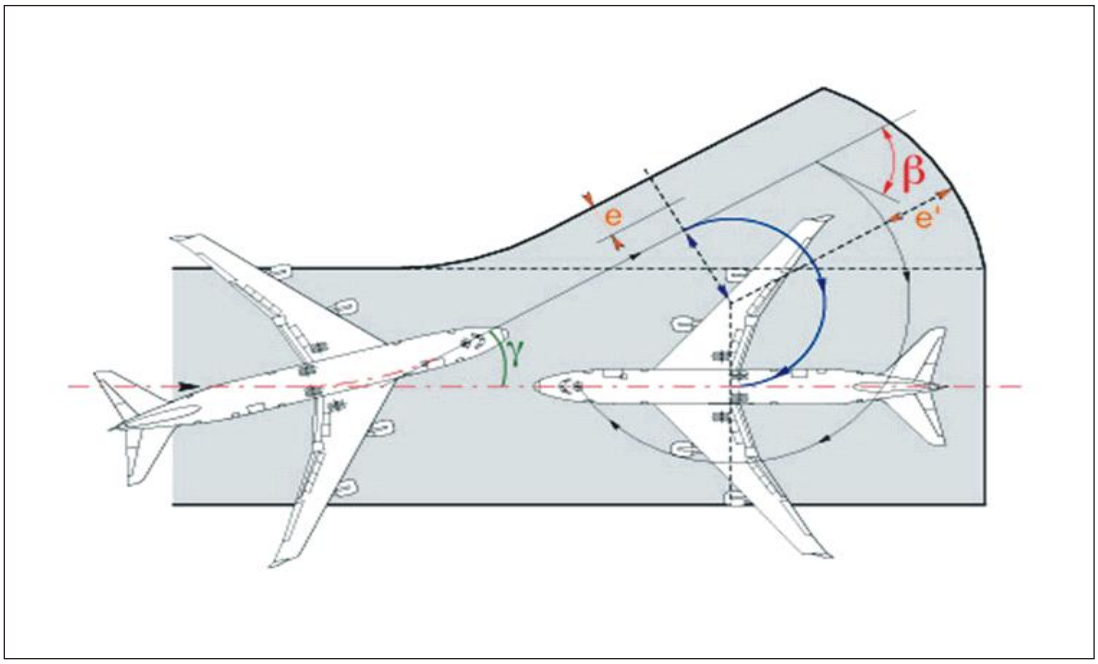

Figure 4-1. Example of minimum turn pad dimension

2.4.7 In order to assist a pilot in knowing where the aeroplane should be positioned when the pilot initiates the turn-around manoeuvre, some form of visual guidance can be provided. Alignment poles can be installed far enough away from the runway so that they are not obstructions, but remain within the range of vision of the pilot. Such poles can be set in a way that when the two poles align with one another, the pilot's position is essentially at the location where the turn-around manoeuvre should be initiated. The poles can be painted bright orange to aid in their visibility and can be set 20 to 30 metres apart, so that it is easy to detect when the two poles are in alignment with the pilot's eye. By carefully setting the two poles, any aeroplane up to the size of the most demanding (or critical) aeroplane will be able to easily perform the manoeuvre without placing the nose gear of the aeroplane off the pavement edge as the aeroplane carries out the manoeuvre.

Note.— In the event that a turn pad is either not available or does not allow an aeroplane to perform a turn-around, a tow vehicle may be used to manoeuvre the aeroplane via a series of short back and forth movements to bring the aeroplane into alignment with the runway centre line. If the shoulders of a turn pad are paved or are otherwise suitable to support the occasional pass of the aeroplane landing gear, a turn-around manoeuvre may be used. The manoeuvre guidance is generally provided by a marshaller.

2.5 RUNWAY STRIPS

2.5.1 Runway strip dimensions

Introduction

2.5.1.1 A runway strip is an area enclosing a runway and any associated stopway. Its purpose is to:

a) reduce the risk of damage to an aeroplane running off the runway by providing a cleared and graded area which meets specific longitudinal and transverse slopes, and bearing strength requirements; and

b) protect an aeroplane flying over it during landing, balked landing or take-off by providing an area which is cleared of obstacles, except for permitted aids to air navigation.

2.5.1.2 Particularly, the graded portion of the runway strip is provided to minimize the damage to an aeroplane in the event of a veer-off during a landing or take-off operation. It is for this reason that objects should be located away from this portion of the runway strip unless they are needed for air navigation purposes and are frangibly mounted.

Note.— The dimensions and characteristics of the runway strip are detailed in Annex 14, Volume I, Chapter 3, 3.4, and Attachment A.

Challenges

2.5.1.3 Where the requirements on runway strips cannot be achieved, the available distances, the nature and location of any hazard beyond the available runway strip, the type of aeroplane and the level of traffic at the aerodrome should be reviewed. Operational restrictions may be applied to the type of approach and low visibility operations that fit the available ground dimensions, while also taking into account:

a) runway excursion history;

b) friction and drainage characteristics of the runway;

c) runway width, length and transverse slopes;

d) navigation and visual aids available;

e) relevance in respect of take-off or aborted take-off and landing;

f) scope for procedural mitigation measures; and

g) accident report.

2.5.1.4 An analysis of lateral runway excursion reports shows that the causal factor in aeroplane accidents/incidents is not the same for take-off and for landing. Therefore, take-off and landing events may need to be considered separately.

Note.— Mechanical failure is a frequent accident factor in runway excursions during take-off, while hazardous meteorological conditions such as thunderstorms are more often present with landing accident/incidents. Brake failures or engine reverse thrust system malfunctions have also been factors in a significant number of landing veer-offs.

2.5.1.5 Lateral deviation from the runway centre line during a balked landing with the use of the digital autopilot as well as manual flight with a flight director for guidance have shown that the risk associated with the deviation of specific aeroplanes is contained within the OFZ.

Note.— Provisions on OFZ are given in Annex 14, Volume I, and in Cir 301, New Larger Aeroplanes — Infringement of the Obstacle Free Zone: Operational Measures and Aeronautical Study.

2.5.1.6 The lateral runway excursion hazard is clearly linked to specific aeroplane characteristics, performance/ handling qualities and controllability in response to such events as aeroplane mechanical failures, pavement contamination and crosswind conditions. This type of hazard comes under the category for which risk assessment is mainly based on flight crew/aeroplane performance and handling qualities. Certified limitations of the specific aeroplane is one of the key factors to be considered in order to ensure that this hazard is under control.

Potential solutions

2.5.1.7 Potential solutions can be developed by providing the following facilities, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) improving runway surface conditions and/or the means of recording and indicating rectification action, particularly for contaminated runways, having knowledge of runways and their condition and characteristics in precipitation;

b) ensuring that accurate and up-to-date meteorological information is available and that information on runway conditions and characteristics is passed to flight crews in a timely manner, particularly when flight crews need to make operational adjustments;

c) improving the aerodrome management's knowledge, recording, prediction and dissemination of wind data, including wind shear, and any other relevant meteorological information, particularly when it is a significant feature of an aerodrome's climatology;

d) upgrading the visual and instrument landing aids to improve the accuracy of aeroplane delivery at the correct landing position on runways; and

e) in consultation with aeroplane operators, formulating any other relevant aerodrome operating procedures or restrictions and promulgating such information appropriately.

2.5.2 Obstacles on runway strips

Introduction

2.5.2.1 An object located on a runway strip which may endanger aeroplanes is regarded as an obstacle, according to the definition of "obstacle" and should be removed, as far as practicable. Obstacles may be either naturally occurring or deliberately provided for the purpose of air navigation.

Challenges

2.5.2.2 An obstacle on the runway strip may represent either:

a) a collision risk for an aeroplane in flight or for an aeroplane on the ground that has laterally veered off the runway; and

b) a source of interference to navigation aids.

Note.— Mobile objects that are beyond the OFZ (inner transitional surface) but still within the runway strip, such as vehicles and holding aeroplanes at runway-holding positions, or wing tips of aeroplanes taxiing on a parallel taxiway to the runway, should be considered.

Note.— Provisions on OFZ are given in Annex 14, Volume I, and in Circular 301.

Potential solutions

2.5.2.3 A natural obstacle should be removed or reduced in size wherever possible; alternatively, grading of the area allows reduction of the severity of damage to the aeroplane.

2.5.2.4 Other fixed obstacles should be removed unless they are necessary for air navigation, should be frangible and should be so constructed as to minimize the severity of damage to the aeroplane.

2.5.2.5 An aeroplane considered to be a moving obstacle within the runway strip should respect the requirement on the sensitive areas installed to protect the integrity of the ILS and should be subject to a separate safety assessment.

Note.— Provisions on ILS critical and sensitive areas are given in Annex 10 — Aeronautical Telecommunications, *Volume I —* Radio Navigation Aids.

2.5.2.6 Visual and instrument landing aids may be upgraded to improve the accuracy of aeroplane delivery at the correct landing position on runways, and in consultation with aeroplane operators, any other relevant aerodrome operating procedures or restrictions may be formulated and such information promulgated appropriately.

3. RUNWAY END SAFETY AREA (RESA)

Introduction

3.1 A RESA is primarily intended to reduce the risk of damage to an aeroplane undershooting or overrunning the runway.

Challenges

3.2 Identification of specific issues related to runway overruns and undershoots is complex. There are a number of variables that have to be taken into account, such as prevailing meteorological conditions, the type of aeroplane, the load factor, the available landing aids, runway characteristics, the overall environment, as well as Human Factors.

3.3 When reviewing the RESA, the following aspects have to be taken into account:

a) the nature and location of any hazard beyond the runway end;

b) the topography and obstruction environment beyond the RESA;

c) the type of aeroplanes and level of traffic at the aerodrome and actual or proposed changes to either;

d) overrun/undershoot causal factors;

e) friction and drainage characteristics of the runway which have an impact on runway susceptibility to surface contamination and aeroplane braking action;

f) navigation and visual aids available;

g) type of approach;

h) runway length and slope, in particular, the general operating length required for take-off and landing versus the runway distances available, including the excess of available length over that required;

i) the location of the taxiways and runways;

j) aerodrome climatology, including predominant wind speed and diversion and likelihood of wind shear; and

k) aerodrome overrun/undershoot and veer-off history.

Potential solutions

3.4 Potential solutions can be developed by providing the following facilities, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) restricting the operations during adverse hazardous meteorological conditions (such as thunderstorms);

b) defining, in cooperation with aeroplane operators, hazardous meteorological conditions and other factors relevant to aerodrome operating procedures and publishing such information appropriately;

c) improving an aerodrome's database of operational data, detection of wind data, including wind shear and other relevant meteorological information, particularly when it is a significant change to an aerodrome's climatology;

d) ensuring that accurate and up-to-date meteorological information, current runway conditions and other characteristics are detected and notified to flight crews in time, particularly when flight crews need to make operational adjustments;

e) improving runway surfaces in a timely manner and/or the means of recording and indicating necessary action for runway improvement and maintenance (e.g. friction measurement and drainage system), particularly when the runway is contaminated;

f) removing rubber build-up on runways according to a scheduled time frame;

g) repainting faded runway markings and replacing inoperative runway surface lighting identified during daily runway inspections;

h) upgrading visual and instrument landing aids to improve the accuracy of aeroplane delivery at the correct landing position on runways (including the provision of ILSs);

i) reducing declared runway distances in order to provide the necessary RESA;

j) installing suitably positioned and designed arresting systems as a supplement or as an alternative to standard RESA dimensions when necessary (see Note 1);

k) increasing the length of a RESA and/or minimizing the potential obstruction in the area beyond the RESA; and

l) publishing provisions, including the provision of an arresting system, in the AIP.

Note 1.— Further guidance on arresting systems can be found in Annex 14, Volume I, Attachment A.

Note 2.— In addition to the AIP entry, information/instructions are promulgated to local runway safety teams and others to promote awareness in the community.

4. TAXIWAYS

4.1 General

Introduction

4.1.1 Taxiways are provided to permit the safe and expeditious surface movement of aeroplanes.

4.1.2 A sufficiently wide taxiway permits smooth traffic flow while facilitating aeroplane ground steering.

Note.— Guidance material is given in Doc 9157, Part 2; Section 1.2 and Table 1-1 provide the formula for determining the width of a taxiway.

Challenges

4.1.3 The issue arises from a lateral taxiway excursion.

4.1.4 Causes and accident factors can include:

a) mechanical failure (hydraulic system, brakes, nose-gear steering);

b) adverse surface conditions (standing water, loss of control on ice-covered surfaces, friction coefficient);

c) loss of the taxiway centre line visual guidance (markings and lights covered by snow or inadequately maintained);

d) Human Factors (including directional control, orientation error, pre-departure workload); and

e) aeroplane taxi speed.

Note.— The consequences of a taxiway excursion are potentially disruptive. However, consideration should be given to the greater potential impact of deviation of a larger aeroplane in terms of blocked taxiways or disabled aeroplane removal.

4.1.5 Pilot precision and attention are key issues since they are heavily related to the margin between the outer main gear wheel and the taxiway edge.

4.1.6 Compatibility studies related to taxiway width and potential deviations can include:

a) the use of taxiway deviation statistics to calculate the taxiway excursion probability of an aeroplane depending on taxiway width. The impact of taxiway guidance systems and meteorological and surface conditions on taxiway excursion probability should be assessed whenever possible;

b) view of the taxiway from the cockpit, taking into account the visual reference cockpit cut-off angle and pilot eye height; and

c) the aeroplane outer main gear wheel span.

Potential solutions

4.1.7 Potential solutions can be developed by providing the following facilities, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) the provision of taxiway centre line lights;

b) conspicuous centre line marking;

c) the provision of on-board taxi camera systems to assist taxi guidance;

d) reduced taxi speed;

e) the provision of taxi side-stripe markings;

f) taxiway edge lights (inset or elevated);

g) reduced wheel-to-edge clearance, using taxiway deviation data;

h) enhanced snow bank clearance (engine positions);

i) snow and ice control surface measures implemented on taxiway entrances to the runway, especially high-speed taxiway exits;

j) the use of alternative taxi routes; and

k) the use of marshaller services (follow-me guidance).

Note 1.— Taxi cameras are designed to ease the taxi and can assist the flight crew in preventing the wheels of the aeroplane from leaving the full-strength pavement during normal ground manoeuvring.

Note 2.— Taxiways that are not provided with suitable shoulders may be restricted in operation.

4.1.8 Special attention should be given to the offset of centre line lights in relation to centre line markings, especially during winter conditions when distinguishing between markings and offset lights can be difficult.

4.1.9 Location and specifications for taxiway signs should be considered due to the engine location as well as the increased thrust in the aeroplane engines.

4.2 Taxiway curves

Introduction

4.2.1 Annex 14, Volume I, 3.9.6, contains provisions on taxiway curves. Additional guidance is included in Doc 9157, Part 2.

Challenges

4.2.2 Any hazard will be the result of a lateral taxiway excursion on a curved section.

4.2.3 The main causes and accident factors are the same as for a taxiway excursion on a straight taxiway section. The use of the cockpit-over-centreline steering technique on a curved taxiway will result in track-in of the main landing gear from the centre line. The amount of track-in depends on the radius of the curved taxiway and the distance from the cockpit to the main landing gear.

4.2.4 The consequences are the same as for lateral taxiway excursions on straight sections.

4.2.5 The required width of the curved portions of taxiways is related to the clearance between the outer main wheel and the taxiway edge on the inner curve. The hazard is related to the combination of the outer main gear wheel span and the distance between the nose gear/cockpit and the main gear. Consideration should be given to the effect on airfield signs and other objects nearby of jet blast from a turning aeroplane.

4.2.6 Certain aeroplanes may require wider fillets on curved sections or taxiway junctions.

Potential solutions

4.2.7 The solutions below are not in any particular order, are not exhaustive and should comply with additional measures of aeroplane operators and other stakeholders (e.g. in respect of operational limitations), applied in cooperation to reduce possible hazards associated to the width of the taxiway.

4.2.8 Potential solutions can be developed by providing the following facilities, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) the widening of existing fillets or the provision of new fillets;

b) reduced taxi speed;

c) the provision of taxiway centre line lights and taxi side-stripe markings (and inset taxiway edge lights);

d) reduced wheel-to-edge clearance, using taxiway deviation data;

e) pilot judgemental oversteering;

f) additional markings for oversteering guidance for the most demanding aeroplanes; and

g) publication of provisions in the appropriate aeronautical documentation.

Note 1.— Taxi cameras are designed to ease the taxi and can assist the flight crew in preventing the wheels of the aeroplane from leaving the full-strength pavement during normal ground manoeuvring.

Note 2.— Particular care should be taken while manoeuvring on taxiways having a width less than that specified in Annex 14, Volume I, to prevent the wheels of the aeroplane from leaving the pavement, while avoiding the use of large amounts of thrust that could damage taxiway lights and signs and cause erosion of the taxiway strip. Affected taxiways should be closely inspected, as appropriate, for the presence of debris that may be deposited while taxiing into position for take-off.

Note 3.— Operations on taxiway curves that are not provided with suitable taxiway fillets should be restricted.

4.2.9 Special attention should be given to the offset of centre line lights in relation to centre line markings.

4.2.10 Location and specifications for taxiway signs should be considered due to the increase in the size of aeroplanes as well as the increased thrust in aeroplane engines.

5. RUNWAY AND TAXIWAY MINIMUM SEPARATION DISTANCES

Introduction

5.1 A minimum distance is provided between the centre line of a runway and the centre line of the associated parallel taxiway for instrument runways and non-instrument runways.

Note 1.— Doc 9157, Part 2, section 1.2, and Table 1-5, clarify that the runway/taxiway separation is based on the principle that the wing tip of an aeroplane taxiing on a parallel taxiway should be clear of the runway strip.

Note 2.— It is permissible to operate with lower separation distances at an existing aerodrome if a safety assessment indicates that such lower separation distances would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes. See Note 2 to Table 3-1, and Notes 2, 3 and 4 to 3.9.8 of Annex 14, Volume I.

Note 3.— Doc 9157, Part 2, has related guidance in 1.2.46 to 1.2.49. Furthermore, attention is drawn to the need to provide adequate clearance at an existing aerodrome in order to operate an aeroplane with the minimum possible risk.

Challenges

5.2 The potential issues associated with runway/parallel taxiway separation distances are:

a) the probability of a collision between an aeroplane running off a taxiway and an object (fixed or mobile) on the aerodrome;

b) the probability of a collision between an aeroplane leaving the runway and an object (fixed or mobile) on the aerodrome or the risk of a collision of an aeroplane on the taxiway that infringes on the runway strip; and

c) possible ILS signal interference due to a taxiing or stopped aeroplane.

5.3 Causes and accident factors can include:

a) Human Factors (crew, ATS);

b) hazardous meteorological conditions (such as thunderstorms and wind shear);

c) aeroplane mechanical failure (such as engine, hydraulic system, flight instruments, control surfaces and autopilot);

d) surface conditions (standing water, loss of control on ice-covered surfaces, friction coefficient);

e) lateral veer-off distance;

f) aeroplane position relative to navigation aids, especially ILS; and

g) aeroplane size and characteristics (especially wingspan).

Note.— Common accident/incident databases deal with lateral runway excursions but do not include accident reports relative to in-flight collisions and ILS signal interference. Therefore, the causes and accident factors specific to the local environment and identified above for runway separation issues are mainly supported by local aerodrome experience. The huge variety and complexity of accident factors for collision risk should be emphasized.

Potential solutions

5.4 Potential solutions can be developed by providing the following facilities, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) place a restriction on the wingspan of aeroplanes using the parallel taxiway or on the runway, if continued unrestricted taxiway or runway operation is desired;

b) consider the most demanding length of aeroplane that can have an impact on runway/taxiway separation and the location of holding positions (ILS);

c) change taxiway routing so that the required runway airspace is free of taxiing aeroplanes; and

d) employ tactical control of aerodrome movements.

Note.— A-SMGCS could be utilized as a supporting means to the proposed solutions especially in low visibility conditions.

6. TAXIWAY AND TAXILANE MINIMUM SEPARATION DISTANCES

Introduction

Taxiway to object separation

6.1 The taxiway minimum separation distances provide an area clear of objects that may endanger an aeroplane.

Note 1.— See Annex 14, Volume I, 3.9.

Note 2.— Additional guidance material on minimum separation distances is included in Doc 9157, Part 2.

Parallel taxiway separation

6.2 The minimum separation distance is equal to the wingspan plus maximum lateral deviation plus increment.

Note 1.— Information is given in Doc 9157, Part 2.

Note 2.— If the minimum required distance between the centre lines of two parallel taxiways is not provided, it is permissible to operate with lower separation distances at an existing aerodrome if a compatibility study, which may include a safety assessment, indicates that such lower separation distances would not adversely affect the safety or significantly affect the regularity of aeroplane operations.

Challenges

Taxiway to object separation

6.3 The separation distances during taxiing are intended to limit the potential of a collision between an aeroplane and an object (taxiway/object separation, taxilane/object separation).

Note.— Taxiway deviation statistics can be used to assess the risk of a collision between two aeroplanes or between an aeroplane and an object.

6.4 The causes and accident factors can include:

a) mechanical failure (hydraulic system, brakes, nose-gear steering);

b) conditions (standing water, loss of control on ice-covered surfaces, friction coefficient);

c) loss of the visual taxiway guidance system (markings and lights covered by snow); and

d) Human Factors (directional control, temporary loss of orientation resulting in aeroplanes being incorrectly positioned, etc.).

Parallel taxiway separation

6.5 The potential issues associated with parallel taxiway separation distances are:

a) the probability of a collision between an aeroplane running off a taxiway and an object (aeroplane on parallel taxiway); and

b) an aeroplane running off the taxiway and infringing the opposite taxiway strip.

6.6 Causes and accident factors can include:

a) Human Factors (crew, ATS);

b) hazardous meteorological conditions (such as reduced visibility);

c) aeroplane mechanical failure (such as engine, hydraulic system, flight instruments, control surfaces, autopilot);

d) surface conditions (standing water, loss of control on ice-covered surfaces, friction coefficient);

e) lateral veer-off distance; and

f) aeroplane size and characteristics (especially wingspan).

Potential solutions

Taxiway to object separation

6.7 Potential solutions can be developed by providing the following facilities, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) the use of reduced taxiing speed;

b) the provision of taxiway centre line lights;

c) the provision of taxi side-stripe markings (and inset taxiway edge lights);

d) the provision of special taxi routing for larger aeroplanes;

e) restrictions on aeroplanes (wingspan) allowed to use parallel taxiways during the operation of a specific aeroplane;

f) restrictions on vehicles using service roads adjacent to a designated aeroplane taxi route;

g) the use of "follow-me" guidance;

h) the provision of reduced spacing between taxiway centre line lights; and

i) the provision of straightforward taxiway naming and ground routings with respect to the hazard of taxiway veer-offs.

Note.— Special attention should be given to the offset of centre line lights in relation to centre line markings. Especially during winter conditions, distinguishing between markings and offset lights can be difficult.

Parallel taxiway separation

6.8 Potential solutions can be developed by providing the following facilities, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) place a restriction on the wingspan of aeroplanes using the parallel taxiway if continued unrestricted taxiway operation is desired;

b) consider the most demanding length of aeroplane that can have an impact on a curved taxiway section;

c) change taxiway routing; and

d) employ tactical control of aerodrome movements.

Note.— A-SMGCS could be utilized as a supporting means to the proposed solutions especially in low visibility conditions.

7. TAXIWAYS ON BRIDGES

Introduction

7.1 The width of that portion of a taxiway bridge capable of supporting aeroplanes, as measured perpendicularly to the taxiway centre line, is normally not less than the width of the graded area of the strip provided for that taxiway, unless a proven method of lateral restraint is provided which is not hazardous for aeroplanes for which the taxiway is intended.

Note.— Annex 14, Volume I, section 3.9, and Doc 9157, Part 2, provide information on taxiways on bridges.

7.2 Access is to be provided for RFF vehicles to intervene, in both directions within the specified response time, with the largest aeroplane for which the taxiway is intended.

7.3 If aeroplane engines overhang the bridge structure, it may be necessary to protect the adjacent areas, below the bridge, from engine blast.

Challenges

7.4 The following hazards are related to the width of taxiway bridges:

a) landing gear leaving the load-bearing surface;

b) deployment of an escape slide beyond the bridge, in case of an emergency evacuation;

c) lack of manoeuvring space for RFF vehicles around the aeroplane;

d) jet blast to vehicles, objects or personnel below the bridge;

e) structural damage to the bridge due to the aeroplane mass exceeding the bridge design load; and

f) damage to the aeroplane due to insufficient clearance of engines, wings or fuselage from bridge rails, lights or signs.

7.5 The causes and accident factors can include:

a) mechanical failure (hydraulic system, brakes, nose-gear steering);

b) surface conditions (standing water, loss of control on ice-covered surfaces, friction coefficient);

c) loss of the visual taxiway guidance system (markings and lights covered by snow);

d) Human Factors (directional control, disorientation, pilot's workload);

e) the position of the extremity of the escape slides; and

f) undercarriage design.

7.6 The main causes of and accident factors for jet blast effect below the bridge are:

a) power plant characteristics (engine height, location and power);

b) bridge blast protection width; and

c) taxiway centre line deviation factors (see taxiway excursion hazard in 4.1.4).

7.7 In addition to the specifications of Chapter 3, Safety Assessments, hazard prevention mechanisms should be based on the critical dimensions of the aeroplane in relation to the bridge width.

Potential solutions

7.8 Potential solutions can be developed by providing the following facilities, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) where feasible, strengthen existing bridges;

b) provide a proven method of lateral restraint to prevent the aeroplane from veering off the full bearing strength of the taxiway bridge;

c) provide an alternative path/bridge for RFF vehicles or implement emergency procedures to taxi the aeroplane away from such taxi bridges;

d) implement jet blast procedures to reduce the effects of jet blast on the undercroft; and

e) use the vertical clearance provided by high wings.

7.9 The RFF vehicles need to have access to both sides of the aeroplane to fight any fire from the best position, allowing for wind direction as necessary. In case the wingspan of the considered aeroplane exceeds the width of the bridge, another bridge nearby can be used for access to the "other" side of an aeroplane rather than an increased bridge width; in this case the surface of the bypass routes are at least stabilized where it is unpaved.

Note.— The second case mentioned in 7.9 is practicable only where bridges are paired (parallel taxiways) or when there is a service road in the surrounding area. In any case, the bridge strength is to be checked, depending on the aeroplane planning to use it.

7.10 The protection from jet blast of vehicular traffic under/near the bridge is to be studied, consistent with the overall width of the taxiway and its shoulders.

7.11 In every case, the bridge width should be compatible with the deployment of escape slides. If the width of the bridge does not meet this criterion, it should be ensured that the available blast protection enables a safe and quick escape route.

Note.— Curved centre lines should be avoided leading up to, on and when leaving the bridge.

8. TAXIWAY SHOULDERS

Introduction

8.1 Taxiway shoulders are intended to protect an aeroplane operating on the taxiway from FOD ingestion and to reduce the risk of damage to an aeroplane running off the taxiway.

8.2 The taxiway shoulder dimensions are based on current information regarding the width of the outer engine exhaust plume for breakaway thrust. Furthermore, the surface of taxiway shoulders is prepared so as to resist erosion and ingestion of the surface material by aeroplane engines.

Note.— Guidance material is contained in Doc 9157, Part 2.

Challenges

8.3 The factors leading to reported issues are:

a) power plant characteristics (engine height, location and power);

b) taxiway shoulder width, the nature of the surface and its treatment; and
c) taxiway centre line deviation factors, both from the expected minor wander from tracking error and the effect of main gear track-in in the turn area while using the cockpit-over-centre line-steering technique.

Potential solutions

8.4 Potential solutions can be developed by providing the following facilities, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) *Excursion on the taxiway shoulder*. The thickness and composition of shoulder pavements should be such as to withstand the occasional passage of the aeroplane operating at the aerodrome that has the most demanding impact on pavement loading, as well as the full load of the most demanding aerodrome emergency vehicle. The impact of an aeroplane on pavements should be assessed and, if required, existing taxiways (if allowed to be used by these heavier aeroplanes) may need to be strengthened by providing a suitable overlay.

Note.— Surface materials of an asphalt paved shoulder of 10 to 12.5 cm thick (the higher thickness where widebodied aircraft jet blast exposure is likely) and firmly adhering to the underlying pavement layers (by way of a tack coat or other means that assures a well-bonded interface between the surface layer and the underlying strata) is generally a suitable solution.

b) *Jet blast*. Information on engine position and jet blast velocity contour at breakaway thrust mode is used to assess jet blast protection requirements during taxiing operations. A lateral deviation from the taxiway centre line should be taken into account, particularly in the case of a curved taxiway and the use of the cockpit-over-centre-line steering technique. The effect of jet blast can also be managed by the use of thrust management of the engines (in particular for four-engine aircraft).

Note.— Further information concerning aeroplane characteristics including the margins between the outer engine axis and the edge of the shoulder, and the distance from the outer engine to the ground can be found in the manufacturer's "Aircraft Characteristics for Airport Planning" manuals.

c) *RFF vehicles*. Operational experience with current aeroplanes on existing taxiways suggests that a compliant overall width of the taxiway and its shoulders permits the intervention of aeroplanes by occasional RFF vehicle traffic.

Note 1.— For NLA, the longer upper-deck escape chutes may reduce the margin between the shoulder edge and the extremity of these escape slides and reduce the supporting surface available to rescue vehicles.

Note 2.— In some cases, the bearing strength of the natural ground may be sufficient, without special preparation, to meet the requirements for shoulders. (Doc 9157, Part 1, provides further design criteria).

9. CLEARANCE DISTANCE ON AIRCRAFT STANDS

Introduction

9.1 Annex 14, Volume I, 3.13.6, recommends the minimum distance between an aeroplane using the stand and an obstacle.

Note.— Doc 9157, Part 2, provides additional guidance on this subject.

Challenges

9.2 The possible reasons for collision between an aeroplane and an obstacle on the apron or holding bay can be listed as:

a) mechanical failure (e.g. hydraulic system, brakes, nose-gear steering);

b) surface conditions (e.g. standing water, ice-covered surfaces, friction coefficient);

c) loss of the visual taxi guidance system (docking system out of service); and

d) Human Factors (directional control, orientation error).

9.3 The probability of a collision during taxiing depends more on Human Factors than on aeroplane performance. Unless technical failure occurs, aeroplanes will respond reliably to directional inputs from the pilot when taxiing at the usual ground speed. Nevertheless, caution should be exercised with regard to the impact of aeroplanes with larger wingspans.

Potential solutions

9.4 Potential solutions can be developed by providing the following facilities, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) appropriate condition of marking and signage;

b) apron stand lead-in lights;

c) azimuth guidance as a visual docking system;

d) appropriate training of operating and ground personnel should be ensured by an aerodrome operator;

e) operational restrictions (e.g. adequate clearances before and behind parked or holding aeroplanes due to the increased length of aeroplanes);

f) temporarily downgraded adjacent aircraft stands;

g) towing the aeroplane on/from the stand;

h) use of remote/cargo stands or “roll-through” parking positions for handling the aeroplane;

i) publication of procedures in the appropriate aeronautical documentation (i.e. closing or rerouting of taxilanes behind parked aeroplanes);

j) advanced visual guidance system;

k) marshaller guidance;

l) enhancing apron lighting levels in low visibility conditions; and

m) use of the vertical clearances provided by high wings.

Note 1.— Reduced separation at the gate is possible where azimuth guidance by a visual docking guidance system is provided.

Note 2.— Clearance at an aircraft stand between the aeroplane and the service road should be considered.

10. DE-ICING/ANTI-ICING FACILITIES

Introduction

10.1 Aeroplane de-icing/anti-icing facilities are provided at an aerodrome where icing conditions are expected to occur.

Note.— Safe and efficient aeroplane operations are of primary importance in the development of an aeroplane de-icing/anti-icing facility. (See Annex 14, Volume I, Chapter 3, section 3.15, on provisions for de-icing/anti-icing facilities.)

Challenges

10.2 The challenge is to provide adequately designed and well-located de-icing/anti-icing treatment facilities for the collection and safe disposal of fluids in an environmentally safe manner. The facility must be clear of OLS, not cause interference with radio navigation aids and be clearly visible from the air traffic control tower. In addition the facility should provide the following:

a) pads of sufficient space to accommodate the aeroplane and de-icing vehicles;

b) protection from jet blast;

c) drainage; and

d) removal of contaminants.

Potential solutions

10.3 Potential solutions can be developed by providing the following facilities, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) adequate space on the pad to ensure a clear paved area around the aeroplane to facilitate the movement of de-icing/anti-icing vehicles;

b) sufficient clearance between the pad and the adjacent manoeuvring areas taking the dimensions of aeroplanes into consideration;

c) surface markings to ensure wing tip clearance of obstructions and other aeroplanes, especially if another aeroplane is also to be accommodated on the pad;

d) the load bearing capacity of the existing structure;

e) the requirement for greater quantities of de-icing/anti-icing agents;

f) containment of excess run-off of de-icing/anti-icing agents;
g) turning circle capabilities of specific aeroplanes;

h) jet blast implications, especially in static breakaway and turns while exiting the facility, including the hazard to smaller aeroplanes nearby of possible degradation of agents; and

i) revision of pad management procedures in terms of the positioning and exiting of aeroplanes versus smaller aeroplane types.

Note.— Adequate procedures are developed where de-icing operations are conducted on the stand as opposed to at a remote facility.

11. PAVEMENT DESIGN

Introduction

11.1 To facilitate flight planning, various aerodrome data are required to be published, such as data concerning the strength of pavements, which is one of the factors required to assess whether the aerodrome can be used by an aeroplane of a specific all-up mass.

Note 1.— The aircraft classification number/pavement classification number (ACN/PCN) method is used for reporting pavement strength. Requirements are given in Annex 14, Volume I, section 2.6, and Attachment A, section 20. Doc 9157, Part 3 — Pavements*, contains guidance on reporting pavement strength using the ACN/PCN method.*

Note 2.— Criteria are established to regulate the use of a pavement by an aeroplane with an ACN higher than the PCN reported.

Challenges

11.2 The increased mass and/or gear load of the aeroplanes may require additional pavement support. Existing pavements and their maintenance will need to be evaluated for adequacy due to differences in wheel loading, tire pressure, and undercarriage design. Bridge, tunnel and culvert load-bearing capacities are a limiting factor, requiring some operational procedures.

Potential solutions

11.3 Potential solutions can be developed by providing the following facilities, alone or in combination with other measures. The following list is not in any particular order and is not exhaustive:

a) restrictions on aeroplanes with higher ACNs on specific taxiways, runway bridges or aprons; or

b) adoption of adequate pavement maintenance programmes.

Attachment A to Chapter 4

AEROPLANE
PHYSICAL CHARACTERISTICS

1. FUSELAGE LENGTH

The fuselage length may have an impact on:

a) the dimensions of the movement area (taxiway, holding bays and aprons), passenger gates and terminal areas;

b) the dimensions of aeroplane maintenance and repair facilities;

c) the aerodrome category for RFF;

d) ground movement and control (e.g. reduced clearance behind a longer aeroplane holding at an apron or a runway/intermediate holding position to permit the passing of another aeroplane);

e) de-icing facilities; and

f) clearance at the aircraft stand.

2. FUSELAGE WIDTH

The fuselage width is used to determine the aerodrome category for RFF.

3. DOOR SILL HEIGHT

The door sill height may have an impact on:

a) the operational limits of the air bridges;

b) mobile steps;

c) catering trucks;

d) precision runway monitor (PRM) access vehicles; and

e) dimensions of the apron.

4. AEROPLANE NOSE CHARACTERISTICS

The aeroplane nose characteristics may have an impact on the location of the runway-holding position of the aeroplane which should be clear of the runway OFZ.

5. TAIL HEIGHT

The tail height may have an impact on:

a) the location of the runway-holding position;

b) ILS critical and sensitive areas: In addition to the tail height of the critical aeroplane, tail composition, tail position and obstacle density (also fuselage height and length) can have an effect on ILS critical and sensitive areas, which have to be assessed by the service provider;

c) the dimensions of aeroplane maintenance services;

d) de-icing/anti-icing facilities;

e) aeroplane parking position (in relation to aerodrome OLS);

f) runway/parallel taxiway separation distances; and

g) the clearance of any aerodrome infrastructure or facilities built over stationary or moving aeroplanes.

6. WINGSPAN

The wingspan may have an impact on:

a) taxiway/taxilane separation distances (including runway/taxiway separation distances);

b) the dimensions of the OFZ;

c) the location of the runway-holding position (due to the impact of the wingspan on OFZ dimensions);

d) the dimensions of aprons and holding bays;

e) wake turbulence;

f) gate selection;

g) aerodrome maintenance services (e.g. snow removal to ensure adequate emergency vehicle to aeroplane clearance);

h) the dimensions of aerodrome or aeroplane maintenance facilities;

i) equipment for disabled aeroplane removal; and

j) de-icing.

7. WING TIP VERTICAL CLEARANCE

The wing tip vertical clearance may have an impact on:

a) taxiway separation distances with height-limited objects;

b) apron and holding bay clearances with height-limited objects;

c) aerodrome maintenance services (e.g. snow removal);

d) airfield signage clearances; and

e) service road locations.

8. COCKPIT VIEW

The relevant geometric parameters to assess the cockpit view are cockpit height, cockpit cut-off angle and the corresponding obscured segment. The cockpit view may have an impact on:

a) runway visual references (aiming point);

b) runway sight distance;

c) taxiing operations on straight and curved sections;

d) markings and signs on runways, turn pads, taxiways, aprons and holding bays;

e) lights: in low visibility conditions, the number and spacing of visible lights when taxiing may depend on the cockpit view; and

f) calibration of PAPI/VASIS (pilot eye height above wheel height on approach).

Note.— Cockpit view with reference to the obscured segment is also affected by the attitude of the aeroplane on approach.

9. DISTANCE FROM THE PILOT'S EYE POSITION TO THE NOSE LANDING GEAR

The design of taxiway curves is based on the cockpit-over-centre-line concept. The distance from the pilot's eye position to the nose landing gear is relevant for:

a) taxiway fillets (wheel track);

b) the dimensions of aprons and holding bays; and

c) the dimensions of turn pads.

10. LANDING GEAR DESIGN

The aeroplane landing gear design is such that the overall mass of the aeroplane is distributed so that the stresses transferred to the soil through a well-designed pavement are within the bearing capacity of the soil. The landing gear layout also has an effect on the manoeuvrability of the aeroplane and the aerodrome pavement system.

11. OUTER MAIN GEAR WHEEL SPAN

The outer main gear wheel span may have an impact on:

a) runway width;

b) the dimensions of turn pads;

c) taxiway width;

d) taxiway fillets;

e) the dimensions of aprons and holding bays; and

f) the dimension of the OFZ.

12. WHEELBASE

The wheelbase may have an impact on:

a) the dimensions of turn pads;

b) taxiway fillets;

c) the dimensions of aprons and holding bays; and

d) terminal areas and aeroplane stands.

13. GEAR STEERING SYSTEM

The gear steering system may have an impact on the dimensions of turn pads and the dimensions of aprons and holding bays.

14. MAXIMUM AEROPLANE MASS

The maximum mass may have an impact on:

a) the mass limitation on existing bridges, tunnels, culverts and other structures under runways and taxiways;

b) disabled aeroplane removal;

c) wake turbulence; and

d) arresting systems when provided as an element of kinetic energy.

15. LANDING GEAR GEOMETRY, TIRE PRESSURE AND AIRCRAFT CLASSIFICATION NUMBER (ACN) VALUES

Landing gear geometry, tire pressure and ACN values may have an impact on the airfield pavement and the runway shoulders.

16. ENGINE CHARACTERISTICS

16.1 The engine characteristics include engine geometry and engine airflow characteristics, which may affect aerodrome infrastructure as well as ground handling of the aeroplane and operations in adjacent areas which are likely to become affected by jet blast.

16.2 The engine geometry aspects are:

a) the number of engines;

b) the location of engines (span and length);

c) the vertical clearance of engines; and

d) the vertical and horizontal extent of possible jet blast.

16.3 The engine airflow characteristics are:

a) idle, breakaway and take-off thrust exhaust velocities;

b) thrust reverser fitment and flow patterns; and

c) inlet suction effects at ground level.

16.4 The engine characteristics may be relevant for the following aerodrome infrastructure and operational aspects:

a) runway shoulder width and composition (jet blast and ingestion issues during take-off and landing);

b) shoulder width and composition of runway turn pads;

c) taxiway shoulder width and composition (jet blast and ingestion issues during taxiing);

d) bridge width (jet blast under the bridge);

e) the dimensions and location of blast protection fences;

f) the location and structural strength of signs;

g) the characteristics of runway and taxiway edge lights;

h) the separation between aeroplanes and adjacent ground service personnel, vehicles or passengers;

i) snow removal procedures;

j) the design of engine run-up areas and holding bays;

k) the design and use of functional areas adjacent to the manoeuvring area;

l) the design of air bridges; and

m) the location of refuelling pits on the aircraft stand.

17. MAXIMUM PASSENGER- AND FUEL-CARRYING CAPACITY

Maximum passenger- and fuel-carrying capacity may have an impact on:

a) terminal facilities;

b) fuel storage and distribution;

c) aerodrome emergency planning;

d) aerodrome rescue and fire fighting; and

e) air bridge loading configuration.

18. FLIGHT PERFORMANCE

Flight performance may have an impact on:

a) runway width;

b) runway length;

c) the OFZ;

d) runway/taxiway separation;

e) wake turbulence;

f) noise; and

g) aiming point and go-around marking.

Attachment B to Chapter 4

AEROPLANE OPERATIONAL CHARACTERISTICS

The following list of aeroplane ground servicing characteristics and requirements may affect the available aerodrome infrastructure. This list is not exhaustive; additional items may be identified by the stakeholders involved in the compatibility assessment process:

a) ground power;

b) passengers embarking and disembarking;

c) fuelling;

d) pushback and towing;

e) de-icing;

f) taxiing and marshalling;

g) aeroplane maintenance;

h) RFF;

i) equipment areas;

j) stand allocation; and

k) disabled aircraft removal.

Rationale

The following attachments contain a list of references used in Chapter 4 as well as selected aeroplane characteristics data. They are provided for convenience to allow the aerodrome operator to easily compare the characteristics of various commonly operated aeroplanes. However, the data will be subject to change and accurate data should always be obtained from the aircraft manufacturer’s documentation prior to any official assessment of compatibility.

Attachment C to Chapter 4

LIST OF REFERENCES

Annex 4 — *Aeronautical Charts*

Annex 10 — *Aeronautical Telecommunications*
Volume I — *Radio Navigation Aids*

Annex 14 — *Aerodromes*
Volume I — *Aerodrome Design and Operations.*

Annex 15 — *Aeronautical Information Services*

Airport Services Manual (Doc 9137)
Part 6 — *Control of Obstacles*
Part 8 — *Airport Operational Services*

Aerodrome Design Manual (Doc 9157)
Part 1 — *Runways*
Part 2 — *Taxiways, Aprons and Holding Bays*
Part 3 — *Pavements*
Part 4 — *Visual Aids*
Part 5 — *Electrical Systems*
Part 6 — *Frangibility*

Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476)

Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual (Doc 9830)

New Larger Aeroplanes — Infringement of the Obstacle Free Zone: Operational Measures and Aeronautical Study (Cir 301)

Operation of New Larger Aeroplanes at Existing Aerodromes (Cir 305)

Attachment D to Chapter 4

SELECTED AEROPLANE CHARACTERISTICS

Data are provided for convenience, are subject to change and should be used only as a guide. Accurate data should be obtained from the aircraft manufacturer's documentation. Many aeroplane types have optional weights and also engine thrusts; therefore pavement aspects and reference field lengths will vary, in some cases enough to change the aeroplane category. Reference field length should not be used for the design of aerodrome runway length, as the required length will vary depending on aerodrome elevation and reference temperature.

Aircraft model	Take-off weight (kg)	Take-off weight (lb)	Code	Reference field length (m)*	Wingspan (m)	Outer main gear wheel span (m)	Nose gear to main gear distance (wheel base) (m)	Nose gear to main gear distance (wheel base) (ft)	Cockpit to main gear distance (m)	Fuselage length (m)	Overall (maximum) length (m)	Maximum tail height (m)	Maximum tail height (ft)	Approach speed (1.3 × Vs) (kt)	Maximum evacuation slide length (m)*****
AIRBUS A318-100	68 000	149 914	3C	1 789	34.1	8.9	10.3	33.6	15.3	31.5	31.5	12.9	42.4	124	7.2
A319-100	75 500	166 449	4C	1 800	34.1	8.9	11.4	37.4	16.5	33.5	33.5	12.2	39.9	128	7.2
A320-200	77 000	169 756	4C	2 025	34.1	8.9	12.6	41.5	17.7	37.6	37.6	12.2	39.9	136	7.5
A321-200	93 500	206 132	4C	2 533	34.1	8.9	16.9	55.4	22.0	44.5	44.5	12.1	39.7	142	6.2
A300B4-200	165 000	363 763	4D	2 727	44.8	11.1	18.6	61.0	25.3	53.2	54.1	16.7	54.7	137	9.0
A300-600R	170 500	375 888	4D	2 279	44.8	11.1	18.6	61.0	25.3	53.2	54.1	16.7	54.7	135	9.0
A310-300	164 000	361 558	4D	2 350	43.9	11.0	15.2	49.9	21.9	45.9	46.7	16.0	52.3	139	6.9
A330-200	233 000	513 677	4E	2 479	60.3	12.6	22.2	72.8	28.9	57.3	58.4	18.2	59.8	136	11.5
A330-300	233 000	513 677	4E	2 490	60.3	12.6	25.4	83.2	32.0	62.6	63.7	17.2	56.4	137	11.5
A340-200	275 000	606 271	4E	2 906	60.3	12.6	22.2	72.8	28.9	58.3	59.4	17.0	55.8	136	11.0
A340-300	276 500	609 578	4E	2 993	60.3	12.6	25.4	83.2	32.0	62.6	63.7	17.0	55.8	139	11.0
A340-500	380 000	837 757	4E	3 023	63.4	12.6	28.0	91.9	34.5	66.0	67.9	17.5	57.4	142	10.9
A340-600	380 000	837 757	4E	2 864	63.4	12.6	33.1	108.6	39.8	73.5	75.4	17.9	58.7	148	10.5
A380-800	560 000	1 234 589	4F	2 779	79.8	14.3	29.7	97.4	36.4	70.4	72.7	24.4	80.1	138	15.2
ANTONOV An-2	5 500	12 125	1B	500	18.2	3.4	8.3	27.2	–0.6	12.7	12.4	4.1	13.55	62	
An-3	5 800	12 787	1B	390	18.2	3.5	8.3	27.2	–0.6	14.0	13.9	4.9	16.17	65	
An-28	6 500	14 330	1B	585	22.1	3.4	4.4	14.3	3.1	12.7	13.1	4.9	16.08	89	
An-38-100	9 500	20 944	2B	965	22.1	3.4	6.2	20.4	4.9	15.3	15.7	5.5	18.04	108	
An-38-200	9 930	21 892	2B	1 125	22.1	3.4	6.2	20.4	4.9	15.3	15.7	5.5	18.04	119	
An-24	21 000	46 296	3C	1 350	29.2	7.9	7.9	25.8	7.6	23.8	23.8	8.6	28.13	119	
An-24PB	22 500	49 603	3C	1 600	29.2	7.9	7.9	25.8	7.6	23.8	23.8	8.6	28.13	119	
An-30	22 100	48 721	3C	1 550	29.2	7.9	7.4	24.3	7.6	24.3	24.3	8.6	28.13	113	
An-32	27 000	59 524	3C	1 600	29.2	7.9	7.9	25.8	7.6	23.7	23.7	8.8	28.71	124	
An-72	31 200	68 783	3C	1 250	31.9	4.1	8.0	26.4	8.5	28.1	28.1	8.7	28.38	108	
An-148-100A	38 950	85 869	3C	1 740	28.9	4.6	10.6	34.6	10.6	26.1	29.1	8.2	26.89	124	
An-70	139 000	306 437	3D	1 610	44.1	5.9	14.0	45.9	14.9	39.7	40.6	16.4	53.81	151	
An-26	24 000	52 910	4C	1 850	29.2	7.9	7.7	25.1	7.6	23.8	23.8	8.8	28.76	124	
An-26B	25 000	55 115	4C	2 200	29.2	7.9	7.7	25.1	7.6	23.8	23.8	8.8	28.76	124	
An-32B-100	28 500	62 831	4C	2 080	29.2	7.9	7.9	25.8	7.6	23.7	23.7	8.8	28.71	127	
An-74	34 800	76 720	4C	1 920	31.9	4.1	8.0	26.4	8.5	28.1	28.1	8.7	28.38	108	
An-74TK-100	36 500	80 467	4C	1 920	31.9	4.1	8.0	26.4	8.5	28.1	28.1	8.8	28.71	108	
An-74T-200	36 500	80 467	4C	2 130	31.9	4.1	8.0	26.4	8.5	28.1	28.1	8.8	28.71	108	
An-74TK-300	37 500	82 672	4C	2 200	31.9	4.1	8.0	26.4	8.5	28.1	28.1	8.7	28.38	116	
An-140	21 000	46 296	4C	1 880	24.5	3.7	8.1	26.7	7.8	21.6	22.6	8.2	27.01	124	
An-140-100	21 500	47 399	4C	1 970	25.5	3.7	8.1	26.7	7.8	21.6	22.6	8.2	27.01	124	
An-148-100B	41 950	92 482	4C	2 020	28.9	4.6	10.6	34.6	10.6	26.1	29.1	8.2	26.89	124	
An-148-100E	43 700	96 340	4C	2 060	28.9	4.6	10.6	34.6	10.6	26.1	29.1	8.2	26.89	124	
An-158***	43 700	96 340	4C	2 060	28.6	4.6	11.7	38.3	11.8	27.8	30.8	8.2	26.89	126	
An-168***	43 700	96 340	4C	2 060	28.9	4.6	10.6	34.6	10.6	26.1	29.1	8.2	26.89	124	
An-12	61 000	134 480	4D	1 900	38.0	5.4	9.6	31.4	11.1	33.1	33.1	10.5	34.55	151	
An-22	225 000	496 032	4E	3 120	64.4	7.4	17.3	56.7	21.7	57.8	57.8	12.4	40.72	153	
An-124-100	392 000	864 198	4F	3 000	73.3	9.0	22.8	74.9	25.6	69.1	69.1	21.1	69.16	154	
An-124-100M-150	402 000	886 243	4F	3 200	73.3	9.0	22.8	74.9	25.6	69.1	69.1	21.1	69.16	160	
An-225	640 000	1 410 935	4F	3 430	88.40	9.01	29.30	96.13	16.27	76.62	84.00	18.10	59.38	167	
BOEING 707-320C	152 407	336 000	4D	3 079	44.4	8.0	18.0	59.1	20.9	44.4	46.6	13.0	42.5	137	6.6

Aircraft model	Take-off weight (kg)	Take-off weight (lb)	Code	Reference field length (m)*	Wingspan (m)	Outer main gear wheel span (m)	Nose gear to main gear distance (wheel base) (m)	Nose gear to main gear distance (wheel base) (ft)	Cockpit to main gear distance (m)	Fuselage length (m)	Overall (maximum) length (m)	Maximum tail height (m)	Maximum tail height (ft)	Approach speed (1.3 × Vs) (kt)	Maximum evacuation slide length (m)*****
717-200	54 885	121 000	3C	1 670	28.4	5.9	17.6	57.8	17.0	34.3	37.8	9.1	29.8	139	5.3
727-200	95 254	210 000	4C	3 176	32.9	7.1	19.3	63.3	21.4	41.5	46.7	10.6	34.9	136	6.1
727-200/W	95 254	210 000	4C	3 176	33.3**	7.1	19.3	63.3	21.4	41.5	46.7	10.6	34.9	136	6.1
737-200	58 332	128 600	4C	2 295	28.4	6.4	11.4	37.3	13.0	29.5	30.5	11.2	36.8	133	5.8
737-300	62 823	138 500	4C	2 170	28.9	6.4	12.4	40.8	14.0	32.2	33.4	11.2	36.6	133	7.0
737-300/W	62 823	138 500	4C	2 550	31.2**	6.4	12.4	40.8	14.0	32.2	33.4	11.2	36.6	133	7.0
737-400	68 039	150 000	4C	2 550	28.9	6.4	12.4	40.8	15.9	35.2	36.4	11.2	36.6	139	7.0
737-500	60 555	133 500	4C	2 470	28.9	6.4	11.1	36.3	12.7	29.8	31.0	11.2	36.6	128	7.0
737-500/W	60 555	133 500	4C	2 454	31.1**	6.4	11.1	36.3	12.7	29.8	31.0	11.2	36.6	128	7.0
737-600	65 091	143 500	3C	1 690	34.3	7.0	11.2	36.8	12.8	29.8	31.2	12.7	41.7	125	7.0
737-600/W	65 544	144 500	3C	1 640	35.8**	7.0	11.2	36.8	12.9	29.8	31.2	12.7	41.7	125	7.0
737-700	70 080	154 500	3C	1 600	34.3	7.0	12.6	41.3	14.2	32.2	33.6	12.7	41.7	130	7.0
737-700/W	70 080	154 500	3C	1 610	35.8**	7.0	12.6	41.3	14.2	32.2	33.6	12.7	41.7	130	7.0
737-800	79 016	174 200	4C	2 090	34.3	7.0	15.6	51.2	17.2	38.0	39.5	12.6	41.2	142	7.0
737-800/W	79 016	174 200	4C	2 010	35.8**	7.0	15.6	51.2	17.2	38.0	39.5	12.6	41.2	142	7.0
737-900	79 016	174 200	4C	2 240	34.3	7.0	17.2	56.3	18.8	40.7	42.1	12.6	41.2	141	7.0
737-900ER/W	84 912	187 200	4C	2 470	35.8**	7.0	17.2	56.3	18.8	40.7	42.1	12.6	41.2	141	7.0
747-SP	318 875	703 300	4E	2 710	59.6	12.4	20.5	67.3	22.9	53.9	56.3	20.1	65.8	140	14.3
747-100	341 555	753 000	4E	3 060	59.6	12.4	25.6	84.0	28.0	68.6	70.4	19.6	64.3	144	11.8
747-200	379 203	836 000	4E	3 150	59.6	12.4	25.6	84.0	28.0	68.6	70.4	19.6	64.3	150	11.8
747-300	379 203	836 000	4E	3 292	59.6	12.4	25.6	84.0	28.0	68.6	70.4	19.6	64.3	152	14.3
747-400ER	414 130	913 000	4E	3 094	64.9	12.6	25.6	84.0	27.9	68.6	70.7	19.6	64.3	157	14.3
747-400	396 893	875 000	4E	3 048	64.9	12.6	25.6	84.0	27.9	68.6	70.7	19.5	64.0	157	14.3
747-8	442 253	975 000	4F	3 070	68.4	12.7	29.7	97.3	32.0	74.2	78.0	19.2	62.8	150***	15.7
747-8F	442 253	975 000	4F	3 070	68.4	12.7	29.7	97.3	32.0	74.2	78.0	19.2	62.7	159***	11.7
757-200	115 666	255 000	4D	1 980	38.1	8.6	18.3	60.0	22.0	47.0	47.3	13.7	45.1	137	9.3
757-200/W	115 666	255 000	4D	1 980	41.1**	8.6	18.3	60.0	22.0	47.0	47.3	13.7	45.1	137	9.3
757-300	122 470	270 000	4D	2 400	38.1	8.6	22.3	73.3	26.0	54.4	54.4	13.7	44.9	143	9.3
767-200	163 747	361 000	4D	1 981	47.6	10.8	19.7	64.6	24.3	47.2	48.5	16.1	52.9	135	8.7
767-200ER	179 623	396 000	4D	2 743	47.6	10.8	19.7	64.6	24.3	47.2	48.5	16.1	52.9	142	8.7
767-300	163 747	361 000	4D	1 981	47.6	10.9	22.8	74.8	27.4	53.7	54.9	16.0	52.6	140	8.7
767-300ER	186 880	412 000	4D	2 540	47.6	10.9	22.8	74.8	27.4	53.7	54.9	16.0	52.6	145	8.7
767-300ER/W	186 880	412 000	4D	2 540	50.9**	10.9	22.8	74.8	27.4	53.7	54.9	16.0	52.6	145	8.7
767-400ER	204 117	450 000	4D	3 140	51.9	11.0	26.2	85.8	30.7	60.1	61.4	17.0	55.8	150	9.7
777-200	247 208	545 000	4E	2 380	60.9	12.9	25.9	84.9	28.9	62.9	63.7	18.7	61.5	136	12.0
777-200ER	297 557	656 000	4E	2 890	60.9	12.9	25.9	84.9	28.9	62.9	63.7	18.7	61.5	139	12.0
777-200LR	347 815	766 800	4E	3 390	64.8	12.9	25.9	84.9	28.9	62.9	63.7	18.7	61.5	140	12.0
777-300	299 371	660 000	4E	3 140	60.9	12.9	31.2	102.4	32.3	73.1	73.9	18.7	61.5	149	12.6
777-300ER	351 534	775 000	4E	3 060	64.8	12.9	31.2	102.4	32.3	73.1	73.9	18.8	61.8	149	12.6
B787-8	219 539	484 000	4E	2 660	60.1	11.6	22.8	74.8	25.5	55.9	56.7	16.9	55.5	140***	11.1
MD-81	64 410	142 000	4C	2 290	32.9	6.2	22.1	72.4	21.5	41.6	45.0	9.2	30.2	134	5.3
MD-82	67 812	149 500	4C	2 280	32.9	6.2	22.1	72.4	21.5	41.6	45.0	9.2	30.2	134	5.3
MD-83	72 575	160 000	4C	2 470	32.9	6.2	22.1	72.4	21.5	41.6	45.0	9.2	30.2	144	5.3
MD-87	67 812	149 500	4C	2 260	32.9	6.2	19.2	62.9	21.5	36.3	39.8	9.5	31.2	134	5.3
MD-88	72 575	160 000	4C	2 470	32.9	6.2	22.1	72.4	21.5	41.6	45.0	9.2	30.2	144	5.3
MD-90	70 760	156 000	3C	1 800	32.9	6.2	23.5	77.2	22.9	43.0	46.5	9.5	31.2	138	5.3
MD-11	285 990	630 500	4D	3 130	51.97	12.6	24.6	80.8	31.0	58.6	61.6	17.9	58.8	153	9.8
DC8-62	158 757	350 000	4D	3 100	45.2	7.6	18.5	60.8	20.5	46.6	48.0	13.2	43.3	138	6.7
DC9-15	41 504	91 500	4C	1 990	27.3	6.0	13.3	43.7	12.7	28.1	31.8	8.4	27.6	132	5.3
DC9-20	45 813	101 000	3C	1 560	28.4	6.0	13.3	43.7	12.7	28.1	31.8	8.4	27.6	126	5.3
DC9-50	55 338	122 000	4C	2 451	28.5	5.9	18.6	60.9	18.0	37.0	40.7	8.8	28.8	135	5.3
BOMBARDIER CS100****	54 930	121 100	3C	1 509	35.1	8.0	12.9	42.2	13.7	34.9	34.9	11.5	37.7	127	
CS100 ER****	58 151	128 200	3C	1 509	35.1	8.0	12.9	42.2	13.7	34.9	34.9	11.5	37.7	127	
CS300****	59 783	131 800	4C	1 902	35.1	8.0	14.5	47.5	15.3	38.1	38.1	11.5	37.7	133	
CS300 XT****	59 783	131 800	3C	1 661	35.1	8.0	14.5	47.5	15.3	38.1	38.1	11.5	37.7	133	
CS300 ER****	63 321	139 600	4C	1 890	35.1	8.0	14.5	47.5	15.3	38.1	38.1	11.5	37.7	133	
CRJ200ER	23 133	51 000	3B	1 680	21.2	4.0	11.4	37.4	10.8	24.4	26.8	6.3	20.7	140	
CRJ200R	24 040	53 000	4B	1 835	21.2	4.0	11.4	37.4	10.8	24.4	26.8	6.3	20.7	140	
CRJ700	32 999	72 750	3B	1 606	23.3	5.0	15.0	49.2	14.4	29.7	32.3	7.6	24.9	135	
CRJ700ER	34 019	75 000	3B	1 724	23.3	5.0	15.0	49.2	14.4	29.7	32.3	7.6	24.9	135	
CRJ700R****	34 927	77 000	4B	1 851	23.3	5.0	15.0	49.2	14.4	29.7	32.3	7.6	24.9	136	
CRJ900	36 514	80 500	3B	1 778	23.3	5.0	17.3	56.8	16.8	33.5	36.2	7.4	24.1	136	
CRJ900ER	37 421	82 500	4C	1 862	24.9	5.0	17.3	56.8	16.8	33.5	36.2	7.4	24.1	136	
CRJ900R	38 329	84 500	4C	1 954	24.9	5.0	17.3	56.8	16.8	33.5	36.2	7.4	24.1	137	
CRJ1000****	40 823	90 000	4C	1 996	26.2	5.1	18.8	61.7	18.3	36.2	39.1	7.5	24.6	138	
CRJ1000ER****	41 640	91 800	4C	2 079	26.2	5.1	18.8	61.7	18.3	36.2	39.1	7.5	24.6	138	
DHC-8-100	15 650	34 500	2C	890	25.9	7.9	8.0	26.2	6.1	20.8	22.3	7.5	24.6	101	
DHC-8-200	16 465	36 300	2C	1 020	25.9	8.5	8.0	26.1	6.1	20.8	22.3	7.5	24.6	102	

Aircraft model	Take-off weight (kg)	Take-off weight (lb)	Code	Reference field length (m)*	Wingspan (m)	Outer main gear wheel span (m)	Nose gear to main gear distance (wheel base) (m)	Nose gear to main gear distance (wheel base) (ft)	Cockpit to main gear distance (m)	Fuselage length (m)	Overall (maximum) length (m)	Maximum tail height (m)	Maximum tail height (ft)	Approach speed (1.3 × Vs) (kt)	Maximum evacuation slide length (m)*****
DHC-8-300	18 643	41 100	2C	1 063	27.4	8.5	10.0	32.8	8.2	24.2	25.7	7.5	24.6	107	
DHC-8-400	27 987	61 700	3C	1 288	28.4	8.8	14.0	45.9	12.2	31.0	32.8	8.3	27.4	125	
EMBRAER ERJ 170-100 STD	35 990	79 344	3C	1 439	26.0	6.2	10.6	34.7	11.5	29.9	29.9	9.7	31.8	124	
ERJ 170-100 LR, SU and SE	37 200	82 012	3C	1 532	26.0	6.2	10.6	34.7	11.5	29.9	29.9	9.7	31.8	124	
ERJ 170-100 + SB 170-00-0016	38 600	85 098	3C	1 644	26.0	6.2	10.6	34.7	11.5	29.9	29.9	9.7	31.8	125	
ERJ 170-200 STD	37 500	82 673	3C	1 562	26.0	6.2	11.4	37.5	12.3	31.7	31.7	9.7	31.8	126	
ER 170-200 LR and SU	38 790	85 517	3C	1 667	26.0	6.2	11.4	37.5	12.3	31.7	31.7	9.7	31.8	126	
ERJ 170-200 + SB 170-00-0016	40 370	89 000	4C	2 244	26.0	6.2	11.4	37.5	12.3	31.7	31.7	9.7	31.8	126	
ERJ 190-100 STD	47 790	105 359	3C	1 476	28.7	7.1	13.8	45.3	14.8	36.3	36.3	10.6	34.8	124	
ERJ 190-100 LR	50 300	110 892	3C	1 616	28.7	7.1	13.8	45.3	14.8	36.3	36.3	10.6	34.8	124	
ERJ 190-100 IGW	51 800	114 199	3C	1 704	28.7	7.1	13.8	45.3	14.8	36.3	36.3	10.6	34.8	125	
ERJ 190-200 STD	48 790	107 563	3C	1 597	28.7	7.1	14.6	48.0	15.6	38.7	38.7	10.5	34.4	126	
ERJ 190-200 LR	50 790	111 972	3C	1 721	28.7	7.1	14.6	48.0	15.6	38.7	38.7	10.5	34.4	126	
ERJ 190-200 IGW	52 290	115 279	4C	1 818	28.7	7.1	14.6	48.0	15.6	38.7	38.7	10.5	34.4	128	

* Reference field length reflects the model/engine combination that provides the shortest field length and the standard conditions (maximum weight, sea level, std day, A/C off, runway dry with no slope).
** Span includes optional wiinglets.
*** Preliminary data.
**** Preliminary data — aircraft not yet certified.
***** Longest deployed slide lengths, including upper deck slides, referenced from aircraft centre line as measured horizontally. Data are based primarily on aircraft rescue fire fighting charts.

MAXIMUM LENGTH(1) OF EVACUATION SLIDES)

Model	Deployed length (2) (metres)	Model	Deployed length (2) (metres)
737-600/-700/-800/-900	7.0	A300-600	9.0
747-100/-200 (upper deck)	11.8	A310	6.9
747-100/-200 (lower deck)	11.5	A318	7.2
747-300/-400 (upper deck)	14.3	A319	7.2
747-300/-400 (lower deck)	11.5	A320	7.5
757-200/-300	9.3	A321	6.2
767-200/-300	8.7	A330-200/-300	11.5
767-400	9.7	A340-200/-300	11
777-200/-200ER/-200LR/-200F	12.0	A340-500	10.9
777-300/-300ER	12.6	A340-600	10.5
		A380	15.2

No data available for 787 or 747-8 at this time.

(1) Due to the variety of slides and slide manufacturers only the longest slides and average lengths are indicated here.

(2) Deployed lengths referenced are from the aircraft centre line as measured horizontally. Data are based primarily on aircraft rescue and fire fighting charts.

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ATTACHMENT D to State letter AN 4/1.1.53- 13/81

RESPONSE FORM TO BE COMPLETED AND RETURNED TO ICAO TOGETHER WITH ANY COMMENTS YOU MAY HAVE ON THE PROPOSED AMENDMENTS

To: The Secretary General
International Civil Aviation Organization
999 University Street
Montréal, Quebec
Canada, H3C 5H7

(State) _____

Please make a checkmark (✓) against one option for each amendment. If you choose options "agreement with comments" or "disagreement with comments", **please provide your comments on separate sheets**.

	Agreement without comments	*Agreement with comments**	*Disagreement without comments*	*Disagreement with comments*	*No position*
Amendment to Annex 14, Volume I – *Aerodrome Design and Operations* (Attachment B refers)					
Draft Doc xxxx *Procedures for Air Navigation Services - Aerodromes* (Attachment C refers)					

*"Agreement with comments" indicates that your State or organization agrees with the intent and overall thrust of the amendment proposal; the comments themselves may include, as necessary, your reservations concerning certain parts of the proposal and/or offer an alternative proposal in this regard.

Signature: _____ Date: _____

— END —