EAC
139-72

Prevention of Runway Incursions

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1. ABBREVIATIONS/ACRONYMS

ADP	Airside driving permit
AIP	Aeronautical Information Publication ARIA
	Aerodrome runway incursion assessment
ATC	Air traffic control
ATIS	Automatic terminal information service
ATM	Air traffic management
NOTAM	Notice to airmen
PANS	Procedures for Air Navigation Services
RISC	Runway incursion severity classification
RTF	Radiotelephony
RVR	Runway visual range
RWY	Runway
SARPs	Standards and Recommended PracticesSMS
	Safety management system(s)
SSR	Secondary surveillance radar
UHF	Ultra-high frequency
VHF	Very high frequency

Chapter 1 Introduction

1.1 DEFINITION OF A RUNWAY INCURSION

The *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444) defines a runway incursion as:

"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."

1.2 INTRODUCTION TO RUNWAY INCURSION PREVENTION

1.2.1 Runway incursions have sometimes led to serious accidents with significant loss of life. Although they are not a new problem, with increasing air traffic, runway incursions have been on the rise.

1.2.2 Aviation safety programmes have a common goal — to reduce hazards and mitigate and manage residual risk in air transportation. Runway operations are an integral part of aviation; the hazards and risks associated with runway operations need to be managed in order to prevent runway incursions that may lead to accidents.

1.2.3 Several States and international organizations have embarked on extensive programmes to reduce the risk of runway incursions. According to a Transport Canada report (September 2000), a number of factors are likely to be responsible for the continuing increase in runway incursions, including traffic volume, capacity-enhancing procedures and aerodrome design. The report concluded that:

a) as traffic volume increases, the likelihood of a runway incursion increases more rapidly when capacity-enhancing procedures are in effect than when they are not;

b) if traffic remains the same, the potential for a runway incursion increases when capacity-enhancing procedures are put into operation;

c) many aerodrome improvement projects have resulted in a more complex aerodrome layout which, together with inadequate aerodrome design standards, signage, markings and lighting, and the lack of standard taxi routes and availability of improved aerodrome diagrams, has worsened the situation; and

d) increasing environmental pressure can compromise safe air traffic control (ATC) practices by requiring too many configuration changes.

The above factors, combined with inadequate training, poor infrastructure and system design and inadequateATC facilities, can lead to an increased risk of runway incursions.

1.2.4 Runway incursion prevention was closely examined by the Eleventh Air Navigation Conference (AN-Conf/11) (Montréal, September–October 2003). The Conference recommended that States take appropriate

actions to improve runway safety worldwide through the implementation of runway safety programmes. It was also recommended that when capacity-enhancing procedures at aerodromes are considered, appropriate safetystudies should be conducted which would take due consideration of the effect on runway safety. The Conference also urged ICAO to develop a common definition of runway incursion to be used worldwide.

1.2.5 In the ICAO accident and incident data reporting (ADREP) system, the use of a common taxonomy and severity classification to assess runway incursion error types and contributory factors and to identify the most serious incidents is fundamental to global risk reduction. A common definition, taxonomy and severity classification will allow for runway incursion data to be compared globally.

1.2.6 ICAO is also verifying via the ICAO Universal Safety Oversight Audit Programme (USOAP) the degree of implementation of runway safety programmes by States.

1.3 PURPOSE OF THIS MANUAL

1.3.1 While runway safety takes into account issues such as foreign object debris and animals straying onto the runway and other logistical deficiencies, this manual specifically addresses the subject of runway incursion prevention as it relates to the safe operation of aircraft, air traffic management, vehicle movement on the manoeuvring area and aerodrome management. Survey data have shown that pilots, driversand controllers consider runway incursions and the potential for collisions to be the most significant risk in aerodrome operations.

1.3.2 Successful prevention of runway incursions requires the collaboration of air traffic controllers, pilots, vehicle drivers and aerodrome management. This manual is intended for regulators, aerodrome designers and planners, aircraft operators, air navigation service providers, aerodrome operators and investigation boards within:

a) aerodrome having yet to commence a runway safety initiative;

b) aerodrome seeking additional guidance;

c) aerodrome having existing runway safety or reporting systems in place and seeking global harmonization; and

d) aerodrome seeking harmonization with ICAO safety management system (SMS) provisions.

1.3.3 This manual aims primarily to provide global guidance essential for the implementation of national or local runway safety programmes. Such initiatives aim to remove hazards and minimize the residual risk of runway incursions and to reduce active failures and the severity of their consequences. In all aspects ofthis manual, the principles of safety management systems (SMS) should be used to mitigate or eliminate thehazardous factors.

1.3.4 Beginning with a high-level discussion of causal factors, the manual explores the factorsthat can result in runway incursions. Initiatives are also identified that aircraft and aerodrome operators and air navigation service providers can adopt to remove hazards, mitigate residual risks and create a cooperative, effective and safe operational environment.

1.3.5 Much can be learned by analysing previous incidents and accidents. A standardized runwayincursion initial report form and a runway incursion causal factors identification form are included (Appendices F and G respectively) which will facilitate a global approach to data collection. Comprehensive analyses of data are essential to distinguish trends and causal factors and develop cost-effective risk reduction strategies.

1.3.6 A runway incursion severity classification (RISC) calculator is also available (see Appendix H). Use of the RISC calculator will enable a consistent assessment to be made of the severity of runway incursionevents.

1.3.7 Information about a computer programme (Aerodrome Runway Incursion Assessment (ARIA))that can help local runway safety teams to identify factors that contribute to runway incursions at a specific aerodrome is provided at Appendix I.

1.3.8 Safety initiatives addressing awareness, training infrastructure and procedures, and technologies such as the ICAO and EUROCONTROL runway safety toolkits are available (see Appendices J and K respectively). Educational material for pilots, controllers, vehicle drivers and aerodrome operators is described. Finally, guidance is offered on how can implement or improve runway incursion prevention safety programmes. Core to these initiatives is the uniform application of ICAO provisions which will ensure consistency of safe operations on the manoeuvring area.

Chapter 2 Contributory factors

2.1 BACKGROUND

2.1.1 Pilots, controllers and drivers can all be involved in runway incursions. A survey of operational staff showed that approximately thirty per cent of drivers, twenty per cent of air traffic controllers and fifty per cent of pilots have reported being involved in runway incursions (reference: EUROCONTROL survey, 2001). Mitigation strategies that address all three parties should be included in systemic solutions.

2.1.2 As noted previously, runway incursions may be the result of many different factors. Analysis of such an occurrence can be executed using the SHEL Model (sometimes referred to as SHELL Model) shown in Figure 2-1. Importantly, the SHEL Model does not draw attention to the different components in isolation, but to the interface between the human elements and the other factors. For example, the L-L interaction would include aspects of communication, cooperation and support; the L-H interaction would represent human- machine interface issues. The contributory factors described in this chapter (normally designated as Liveware by the SHEL Model) do not exclude contributions from other aspects of organizational life (e.g. policies, procedures, environment), which are critical factors associated with safety management systems and must be addressed to improve safety overall.

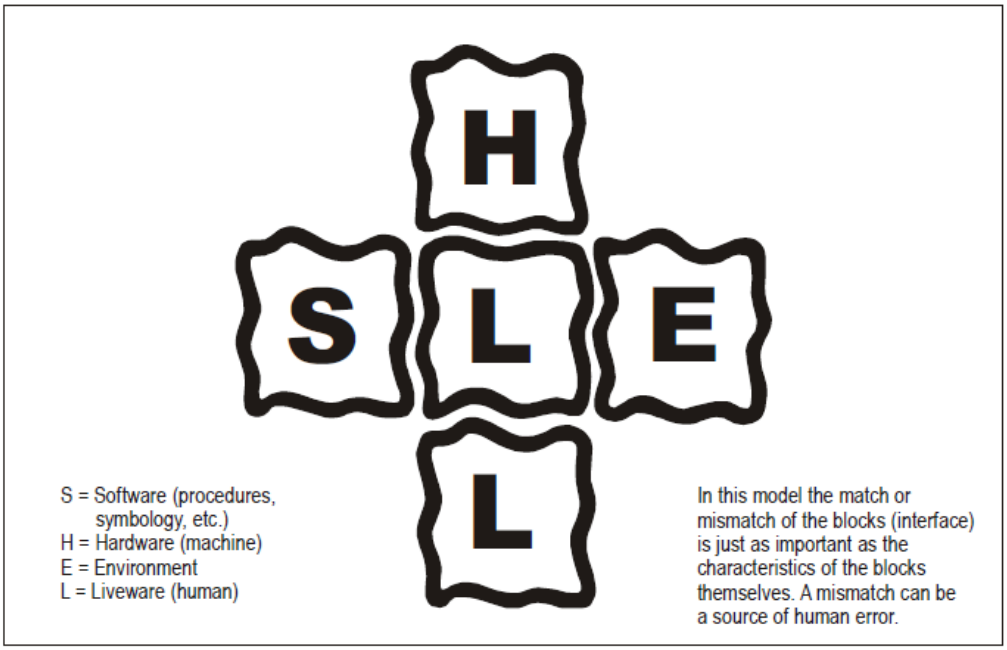

Figure 2-1. The SHEL Model

2.1.3 Runway incursions can be divided into several recurring scenarios. Common scenarios include:

a) an aircraft or vehicle crossing in front of a landing aircraft;

b) an aircraft or vehicle crossing in front of an aircraft taking off;

c) an aircraft or vehicle crossing the runway-holding position marking;

d) an aircraft or vehicle unsure of its position and inadvertently entering an active runway;

e) a breakdown in communications leading to failure to follow an air traffic control instruction;and

f) an aircraft passing behind an aircraft or vehicle that has not vacated the runway.

2.1.4 Statistics show that most runway incursions occur in visual meteorological conditions during daylight hours; however, most accidents occur in low visibility or at night. All runway incursions should be reported and analyzed, whether or not another aircraft or vehicle is present at the time of the occurrence.

2.2 BREAKDOWN IN COMMUNICATIONS

A breakdown in communications between controllers and pilots or airside vehicle drivers is a common factorin runway incursions and often involves:

a) use of non-standardized phraseology;

b) failure of the pilot or the vehicle driver to provide a correct readback of an instruction;

c) failure of the controller to ensure that the readback by the pilot or the vehicle driver conformswith the clearance issued;

d) the pilot and/or vehicle driver misunderstanding the controller’s instructions;

e) the pilot and/or vehicle driver accepting a clearance intended for another aircraft or vehicle;

f) blocked and partially blocked transmissions; and

g) overlong or complex transmissions.

See Appendix A for more detailed guidance on communication best practices.

2.3 PILOT FACTORS

2.3.1 Pilot factors that may result in a runway incursion include inadvertent non-compliance with ATC clearances. Often these cases result from a breakdown in communications or a loss of situational awareness in which pilots think that they are at one location on the aerodrome (such as a specific taxiway or intersection) when they are actually elsewhere, or they believe that the clearance issued was to enter the runway, when in fact it was not.

2.3.2 Other common factors include:

a) inadequate signage and markings (particularly the inability to see the runway-holdingposition lines);

b) controllers issuing instructions as the aircraft is rolling out after landing (when pilot workloadand cockpit noise are both very high);

c) pilots performing mandatory head-down tasks, which reduces situational awareness;

d) pilots being pressed by complicated and/or capacity enhancement procedures, leadingto rushed behaviour;

e) a complicated airport design where runways have to be crossed;

f) incomplete, non-standard or obsolete information about the taxi routing to expect; and

g) last-minute changes by ATC in taxi or departure routings.

See Appendix B for more detailed guidance on flight crew best practices including the sterile flight deckconcept.

2.4 AIR TRAFFIC CONTROL FACTORS

2.4.1 The most common controller-related actions identified in several studies are:

a) momentarily forgetting about:

1) an aircraft;

2) the closure of a runway;

3) a vehicle on the runway; or

4) a clearance that had been issued;

b) failure to anticipate the required separation, or miscalculation of the impending separation;

c) inadequate coordination between controllers;

d) a crossing clearance issued by a ground controller instead of an air/tower controller;

e) misidentification of an aircraft or its location;

f) failure of the controller to provide a correct readback of another controller’s instruction;

g) failure of the controller to ensure that the readback by the pilot or the vehicle driver conforms with the clearance issued;

h) communication errors;

i) overlong or complex instructions;

j) use of non-standard phraseologies; and

k) reduced reaction time due to on-the-job training.

2.4.2 Other common factors include:

a) distraction;

b) workload;

c) experience level;

d) inadequate training;

e) lack of a clear line of sight from the control tower;

f) human-machine interface; and

g) incorrect or inadequate handover between controllers.

See Appendix C for more detailed guidance on air traffic control best practices.

2.5 AIRSIDE VEHICLE DRIVER FACTORS

The most common driver-related factors identified in several studies are:

a) failure to obtain clearance to enter the runway;

b) failure to comply with ATC instructions;

c) inaccurate reporting of position to ATC;

d) communication errors;

e) inadequate training of airside vehicle drivers;

f) absence of radiotelephony equipment;

g) absence of radiotelephony training;

h) lack of familiarization with the aerodrome;

i) lack of knowledge of aerodrome signs and markings; and

j) lack of aerodrome maps for reference in vehicles.

See Appendix D for more detailed guidance on airside vehicle driver training including communications training for drivers.

2.6 AERODROME DESIGN FACTORS

2.6.1 Complex or inadequate aerodrome design significantly increases the probability of a runway incursion. The frequency of runway incursions has been shown in many studies to be related to the number of runway crossings and the characteristics of the aerodrome layout.

2.6.2 Common factors include:

a) the complexity of the airport layout including roads and taxiways adjacent to the runway;

b) insufficient spacing between parallel runways;

c) departure taxiways that fail to intersect active runways at right angles; and

d) no end-loop perimeter taxiways to avoid runway crossings.

See the *EACs 139-9 to 14* for more detailed guidance on aerodrome design.

Chapter 3 Establishing A Runway Incursion Prevention Programme

3.1 RUNWAY SAFETY TEAMS

3.1.1 A runway incursion prevention programme should start with the establishment of runway safety teams at individual aerodromes. The primary role of a local runway safety team, which may be coordinated by a central authority, should be to develop an action plan for runway safety, advise managementas appropriate on potential runway incursion issues and recommend strategies for hazard removal and mitigation of the residual risk. These strategies may be developed based on local occurrences or combined with information collected elsewhere.

3.1.2 The team should comprise representatives from aerodrome operations, air traffic service providers, airlines or aircraft operators, pilot and air traffic controller associations and any other groups witha direct involvement in runway operations. The team should meet on a regular basis. Frequency of meetings should be determined by the individual groups. At some aerodromes, other groups may already exist that could carry out the functions of a runway safety team.

3.2 OBJECTIVES

Once the overall number, type and severity of runway incursions have been determined, the team shouldestablish goals that will improve the safety of runway operations. Examples of possible goals are:

a) to improve runway safety data collection, analysis and dissemination;

b) to check that signage and markings are ECAA-compliant and visible to pilots and drivers;

c) to develop initiatives for improving the standard of communications;

d) to identify potential new technologies that may reduce the possibility of a runway incursion;

e) to ensure that procedures are compliant with ECAA Standards and Recommended Practices (SARPs); and

f) to initiate local awareness by developing and distributing runway safety education andtraining material to controllers, pilots and personnel driving vehicles on the aerodrome.

3.3 GENERIC TERMS OF REFERENCE

Suggested generic terms of reference for a runway safety team are to assist in enhancing runway safety by:

a) determining the number, type and, if available, the severity of runway incursions;

b) considering the outcome of investigation reports in order to establish local hot spots or problem areas at the aerodrome;

c) working as a cohesive team to better understand the operating difficulties of personnel working in other areas and recommending areas for improvement;

d) ensuring that the recommendations contained in this *EAC* are implemented;

e) identifying any local problem areas and suggesting improvements;

f) conducting a runway safety awareness campaign that focuses on local issues, for example, producing and distributing local hot spot maps or other guidance material as considered necessary; and

g) regularly reviewing the airfield to ensure its adequacy and compliance with ICAO SARPs.

3.4 HOT SPOTS

3.4.1 The ICAO definition of a hot spot is:

"A location on an aerodrome movement area with a history or potential risk of collision or runway incursion, and where heightened attention by pilots/drivers is necessary."

Note 1.— The criteria used to establish and chart a hot spot are contained in the PANS-ATM(Chapter 7) and Annex 4 — Aeronautical Charts *(Chapters 13, 14 and 15).*

Note 2.— Hazards associated with hot spots should be mitigated as soon as possible and so far as is reasonably practicable.

Examples of how hot spots are shown on charts are provided in Figures 3-1, 3-2 and 3-3.

3.4.2 Aerodrome charts showing hot spots should be produced locally, checked regularly for accuracy, revised as needed, distributed locally, and published in the Aeronautical Information Publication (AIP).

3.4.3 Once hot spots have been identified, suitable strategies should be implemented to remove the hazard and, when this is not immediately possible, to manage and mitigate the risk. These strategies may include:

a) awareness campaigns;

b) additional visual aids (signs, markings and lighting);

c) use of alternative routings;

d) construction of new taxiways; and

e) the mitigation of blind spots in the aerodrome control tower.

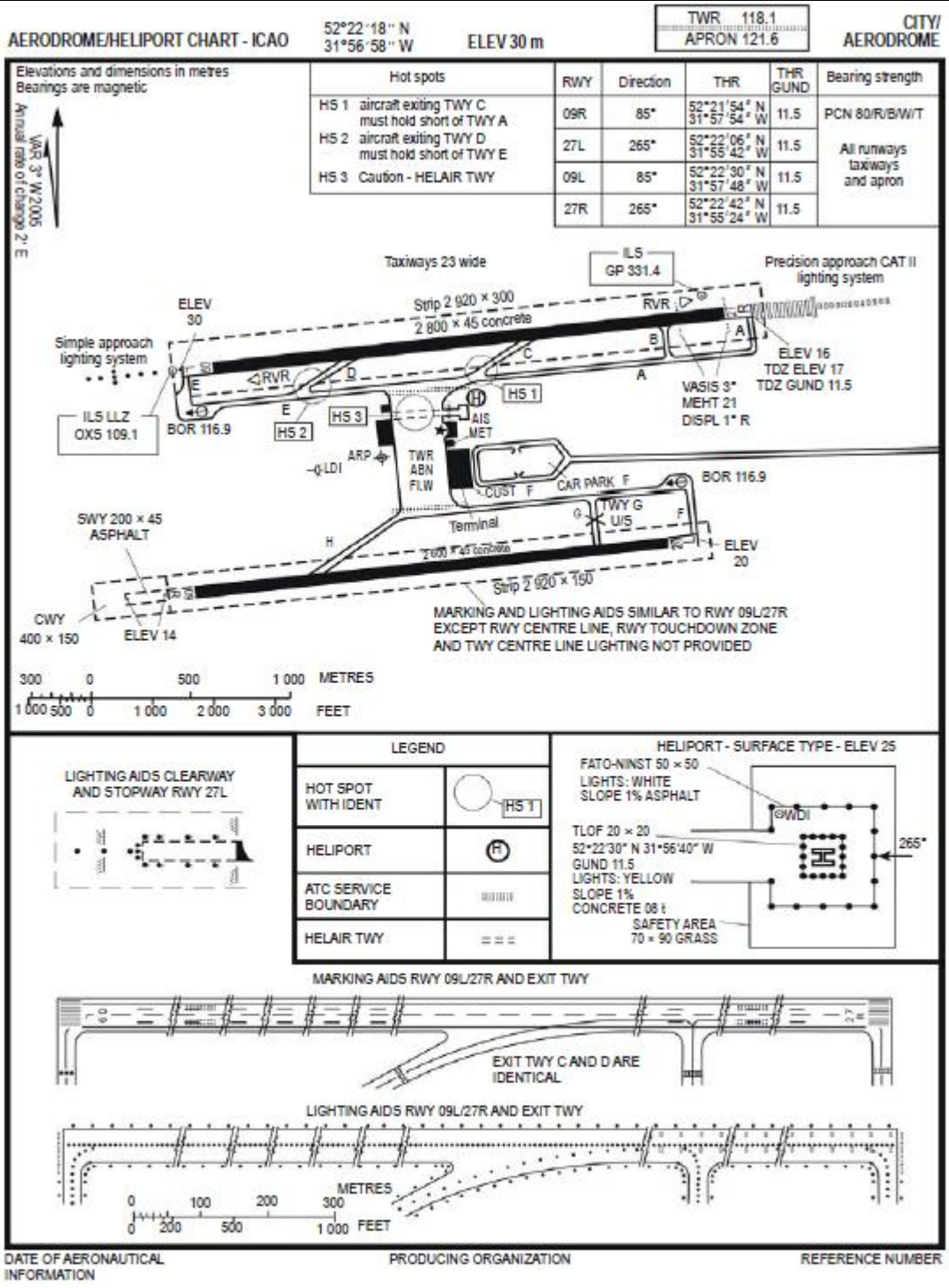

Figure 3-1. Sample Aerodrome/Heliport Chart — ICAO showing ICAO charting method for depiction of hot spots

(Associated provisions in Annex 4 and the PANS-ATM will become applicable on 22 November 2007)

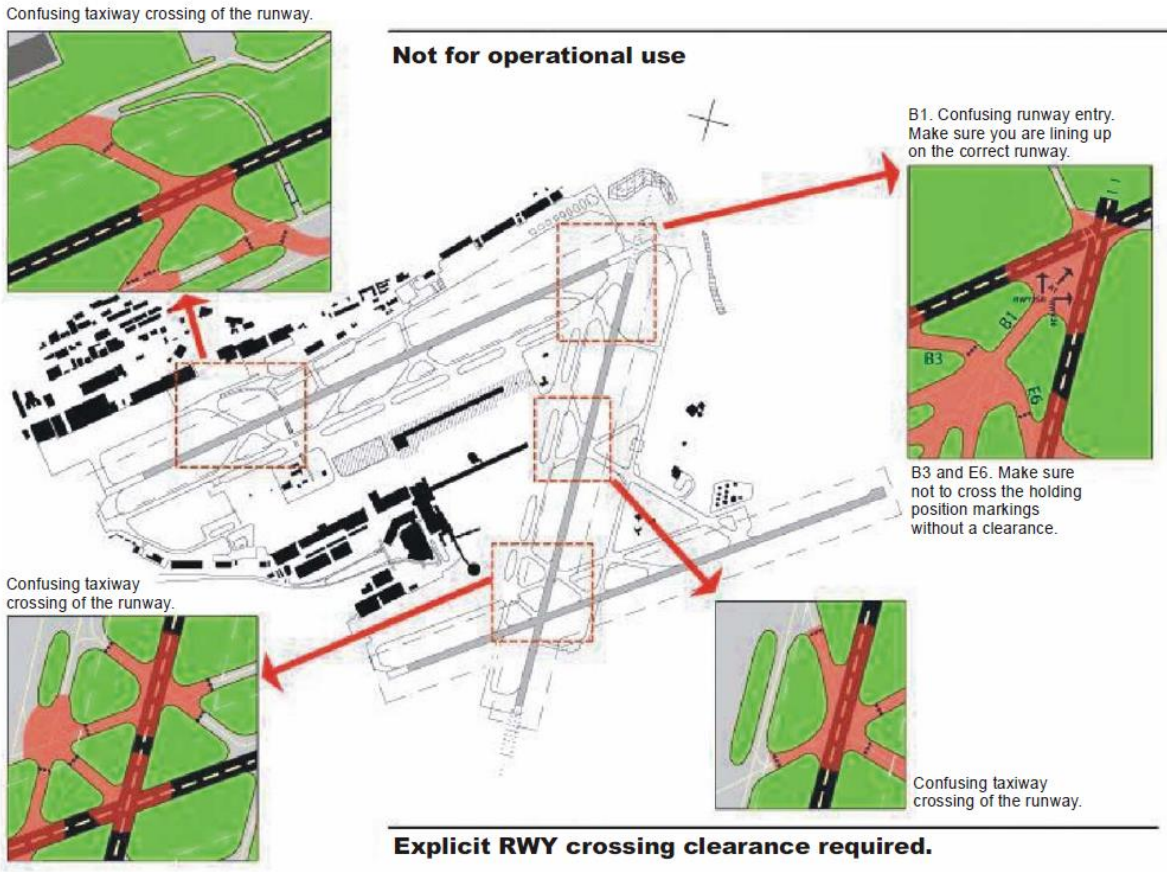

Figure 3-3. Example of hot spot detail

3.5 ACTION ITEMS

A plan containing action items for mitigating runway safety deficiencies should be developed. Action items should be aerodrome specific and linked to a runway safety concern, issue or problem at that aerodrome. Action items may include suggested changes to the physical features of, or facilities at, the aerodrome; air traffic control procedures; airfield access requirements; pilot and vehicle operator awareness; and productionof hot spot maps.

3.6 RESPONSIBILITY FOR TASKS ASSOCIATED WITH ACTION ITEMS

Each action item should have a designated person or organization which is responsible for completing the relevant tasks. There may be more than one person or organization affected by an action item; however, one person or organization should take the lead and be responsible for the completion of all the tasks associated with the action item. A realistic time frame to accomplish the work should also be associated witheach action item.

3.7 EFFECTIVENESS OF COMPLETED ACTION ITEMS

Periodically the effectiveness of implemented and/or completed action items should be assessed. This can be accomplished by comparing the results of the initial analysis and the current runway incursion status. For example, if an action item was to provide training for controllers, pilots or vehicle drivers, the effectiveness ofsuch training should be evaluated by the team. If the analysis shows little or no improvement in the number, type or severity of runway incursions, the team should re-evaluate the implementation of that action item.

3.8 EDUCATION AND AWARENESS

3.8.1 Education and awareness material such as newsletters, posters, stickers and other educational information are invaluable tools for reducing the risk of runway incursions. The ICAO runway safety toolkit, discussed in Appendix J, provides a wealth of information for educational and awareness programmes.

3.8.2 Other awareness material that may be helpful to local runway safety teams is available from:Airports

Council International (ACI)
www.airports.org

Air Services Australia
www.airservicesaustralia.com
European Organisation for the Safety of Air Navigation (EUROCONTROL)
www.eurocontrol.int/runwaysafety/public/subsite_homepage/homepage.html
Federal Aviation Administration (FAA)
www.faa.gov/runwaysafety
International Air Transport Association (IATA)
www.iata.org
International Civil Aviation Organization (ICAO)www.icao.int/fsix/res_ans.cfm
International Federation of Airline Pilots' Associations (IFALPA)
www.ifalpa.org
Transport Canada
www.tc.gc.ca/civilaviation/systemsafety/posters/tools.htm
United Kingdom Safety Regulation Group
http://www.caa.co.uk

Chapter 4 Recommendations For The Prevention Of Runway Incursions

4.1 INTRODUCTION

4.1.1 The following recommendations are the result of a systemic analysis of a number of runway incursions, the purpose of which was to identify the causes and contributory factors, both as active and latent failures, that led to the incidents that took place.

4.1.2 These recommendations will enhance the safety of runway operations through the consistent and uniform application of existing ICAO provisions and ECAA requirement, leading to predictability and greater situational awareness.

4.2 COMMUNICATIONS

4.2.1 The full aircraft or vehicle call sign should be used for all communications associated with runway operations.

4.2.2 Standard ICAO phraseologies should be used in all communications associated with runway operations.

4.2.3 Periodically it should be verified that pilots, drivers and air traffic controllers are using standard ICAO phraseologies in all communications associated with runway operations.

4.2.4 The readback procedures in the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444) should be used and should include communications with vehicles operating on the manoeuvring area.

4.2.5 All communications associated with runway operations should be conducted in accordance with ICAO language requirements for air-ground radiotelephony communications (Annex 10 — *Aeronautical Telecommunications*, Volume II,.and ECAR171 The use of standard aviation English at international aerodromes will improve the situational awarenessof everyone listening on the frequency.

4.2.6 All communications associated with the operation of each runway (vehicles, crossing aircraft, etc.) should be conducted on the same frequency as utilized for the take-off and landing of aircraft.

4.2.7 Short and simple messages should be used in ATC communications.

4.2.8 Appendix A contains more detailed guidance on communication best practices based on ICAO provisions.

4.3 AIRCRAFT OPERATORS

4.3.1 Pilots should be thoroughly trained on aerodrome signage, markings and lighting.

4.3.2 A requirement to obtain an explicit clearance to cross any runway should be included in theflight deck procedures. This includes runways not in use.

4.3.3 Best practices for pilots' planning of ground operations should be promoted.

4.3.4 The concept of a sterile flight deck while taxiing should be adopted. Information on this conceptis contained in Appendix B.

4.4 PILOTS

4.4.1 Pilots should never cross illuminated red stop bars when lining up on, or crossing, a runwayunless contingency procedures are in use that specifically allow this.

4.4.2 Pilots should not accept an ATC clearance that would require them to enter or cross a runwayfrom an obliquely angled taxiway.

4.4.3 If lined up on the runway and held more than 90 seconds beyond anticipated departuretime, pilots should contact ATC and advise that they are holding on the runway.

4.4.4 Pilots should turn on aircraft landing lights when take-off or landing clearance is received,and when on approach.

Note.— A globally acceptable procedure is to be defined.

4.4.5 Pilots should turn on strobe lights when crossing a runway.

Note.— A globally acceptable procedure is to be defined.

4.4.6 If there is any doubt when receiving a clearance or instruction, clarification should be immediately requested from ATC before the clearance or instruction is enacted.

4.4.7 If pilots have any doubt as to their exact position on the surface of an aerodrome, theyshould contact ATC and follow the associated ICAO procedure (PANS-ATM, Doc 4444).

4.4.8 Pilots should be "head-up" for a continuous watch during aerodrome surface operations.

4.4.9 Appendix B contains detailed guidance on flight crew best practices including the concept ofthe sterile flight deck.

4.5 AIR TRAFFIC SERVICE PROVIDERS ANDAIR TRAFFIC CONTROLLERS

4.5.1 Safety management systems that are in accordance with ICAO provisions and ECAA requirement should be implemented.

4.5.2 ATC should always use a clear and unambiguous method on the operating console to indicate that a runway is temporarily obstructed.

4.5.3 ATC should, whenever practical, give ATC en-route clearance prior to taxi.

4.5.4 Stop bars should be switched on to indicate that all traffic shall stop and switched off to indicate that traffic may proceed.

4.5.5 Aircraft or vehicles should never be instructed to cross illuminated red stop bars when entering or crossing a runway. In the event of unserviceable stop bars that cannot be deselected, contingency measures, such as follow-me vehicles, should be used.

4.5.6 It should be ensured that ATC procedures contain a requirement to issue an explicit clearance including the runway designator when authorizing a runway crossing or to hold short of any runway. This includes runways not in use.

4.5.7 It should be ensured that ATC procedures contain a requirement to include the runway designator when an instruction to hold short of any runway is issued.

4.5.8 Standard taxi routes should be developed and utilized to minimize the potential for pilot confusion.

4.5.9 Where applicable, progressive taxi instructions should be used to reduce pilot workload and the potential for confusion. Progressive taxi instructions must not infer a clearance to cross a runway.

4.5.10 Existing visibility restrictions from the control tower which have a potential impact on the ability to see the runway should be assessed and any such areas should be clearly identified on a hot spot map.

4.5.11 Environmental constraints should not compromise safety, e.g. regular, multiple changes to the runway configuration.

4.5.12 It should be ensured that runway safety issues are included in the training and briefings for ATC staff.

4.5.13 Any hazards should be identified and any risks associated with runway capacity enhancing procedures (intersection departures, multiple line-ups, conditional clearances, etc.), when used individually or in combination, should be evaluated. If necessary, appropriate mitigation strategies should be developed.

4.5.14 Line-up clearance should not be issued to an aircraft if that aircraft will be required to holdon the runway for more than 90 seconds beyond the time it would normally be expected to depart.

4.5.15 When conditional clearances are used, specific training should be provided to ensure that such clearances are used strictly according to ICAO provisions.

4.5.16 When using multiple or intersection departures, oblique or angled taxiways that limit the ability of the flight crew to see the landing runway threshold or final approach area should not be used.

4.5.17 Controllers should be “head-up” for a continuous watch on aerodrome operations.

4.5.18 Appendix C contains detailed guidance on air traffic control best practices.

4.6 AERODROME OPERATORS AND VEHICLE DRIVERS

4.6.1 An important factor in preventing runway incursions is to limit the physical possibility for pilots and vehicle drivers to mistakenly enter runways. This basic principle includes, but is not limited to, the optimal use of perimeter taxiways, the avoidance of runway crossings, and simplistic and logical taxi/runway layouts in order to make the aerodrome instinctive, logical and user-friendly for vehicle drivers, air traffic controllers and pilots. Therefore, aerodrome operators shall include those elements in the design and location of the aerodrome infrastructure.

4.6.2 Safety management systems should be implemented in accordance with ICAO provisions , and ECAR 19 and continued focus on runway safety should be ensured.

4.6.3 The implementation of Annex 14 provisions should be confirmed, and maintenance programmesrelating to runway operations (e.g. markings, lighting, signage) should be implemented. It should be ensured thatsigns and markings are maintained and are clearly visible, adequate and unambiguous in all operating conditions.

4.6.4 During construction or maintenance, information about temporary work areas should be adequately disseminated and temporary signs and markings should be clearly visible, adequate and unambiguous in all operating conditions, in compliance with Annex 14 provisions.

4.6.5 A formal driver training and assessment programme should be introduced in accordance withthe driver training guidelines contained in Appendix D or, where already in place, these guidelines should bereviewed.

4.6.6 Formal communications training and assessment for drivers and other personnel who operate on or near the runway should be introduced.

4.6.7 Taxiways should be named in accordance with the ICAO naming conventions in ~~Annex 14~~ ECAR 139

4.6.8 If there is any doubt in the mind of a vehicle driver when receiving a clearance or instruction, clarification should be immediately requested from ATC before the clearance or instruction is enacted.

4.6.9 Vehicle drivers should immediately contact ATC when uncertain of their exact position on an aerodrome; if a driver realizes he/she is on the runway that driver should immediately vacate the runway.

4.6.10 Vehicle drivers should be “head-up” for a continuous watch during aerodrome operations.

4.6.11 Appendix D contains detailed guidance on airside vehicle driver best practices including communications training for drivers.

4.7 GENERAL AND REGULATORY RECOMMENDATIONS

4.7.1 Aerodrome inspector will focus on runway incursion risk reduction in their oversight activities.

4.7.2 At each aerodrome, a runway safety team should be established and maintained in accordancewith the terms of reference described in Chapter 3, 3.3.

4.7.3 A local runway incursion prevention awareness campaign should be initiated at each aerodrome for air traffic controllers, pilots and drivers and other personnel who are involved in runway operations. The awareness campaign should be periodically updated to maintain interest and operational impact.

4.7.4 All infrastructure and procedures relating to runway operations should be in compliance with ECAA provisions. Where differences exist, they should be published in the national AIP as appropriate and notified to ICAO if ICAO Standards are involved.

4.7.5 Aerodromes should be certified according to the provisions of ECAR139.

4.7.6 Joint cross-training and familiarization (such as the aerodrome resource management training course — see Appendix E) should be provided to pilots, air traffic controllers and vehicle drivers to increase their understanding of the roles and difficulties of personnel working in other areas. Where possible, visits to the manoeuvring area by all parties should take place for familiarization of signs, markings and aerodrome layout.

4.7.7 Best practices for regulators and air navigation service providers to consider when implementing strategies for preventing runway incursions by air traffic control are contained in Appendix C.

4.8 INCIDENT REPORTING AND INVESTIGATION

4.8.1 It should be ensured that all runway incursions are reported and investigated in sufficient detail to identify specific causal and contributory factors (see the reporting forms in Appendices F and G).

4.8.2 To enhance lesson learning, related runway safety data should be shared with other aviation safety organizations both nationally and internationally.

4.9 AERONAUTICAL INFORMATION

4.9.1 Time-critical aerodrome information that may affect operations on or near the runway should be provided to pilots in “real time” using radiotelephony communications.

4.9.2 The collection, provision and dissemination of aeronautical information should be in accordance with ICAO provisions.

4.9.3 Providers of aeronautical databases and charts should establish a process with aeronautical information services with the objective of ensuring the accuracy, timeliness and integrity of data. A process should be put in place to allow users to provide feedback on the accuracy of aeronautical information.

Chapter 5 Incident Reporting And Data Collection

5.1 OBJECTIVE

5.1.1 The objective of this chapter is to promote the use of a standardized approach for reporting and analysing information on runway incursions. This approach will support the analysis of runway incursions using the severity classification scheme. Global use of such an approach will enable to collect and share data to continually improve the safety of runway operations. This chapter will discuss the ways in which the information gained from the analysis of runway incursions can be used to enhancerunway safety.

5.1.2 To identify the causes and contributory factors of runway incursions, specific information must be collected on each occurrence. This information is best collected in a "just culture" environment (see 5.2) where reporting is promoted. This makes it possible to learn from runway incursion data collectively. The development of effective countermeasures to factors that result in runway incursions depends upon fact-based, systematic reporting and analysis of the causal factors. An international exchange of information has the potential to effectively contribute to global aviation safety in two ways. First, can contribute to gaining a full understanding of how individual errors evolve into runway incursions and potential collisions, leading to the development and implementation of effective mitigating measures. Second, can learnfrom the experiences of other States so that the same mistakes do not perpetuate.

5.2 JUST CULTURE AND SYSTEMIC ISSUES

5.2.1 "Just culture" is an atmosphere of trust in which people are encouraged to provide essential safety-related information but in which they are also clear about where the line must be drawn between acceptable and unacceptable behaviour. Just culture philosophy is designed to counter the strong natural inclination to blame individuals for errors that contribute to runway incursions. A key objective of the just culture perspective is to provide fair treatment for people, applying sanctions only where errors are considered to be intentional, reckless or negligent. The use of just culture in occurrence reporting was strongly advocated by the Eleventh Air Navigation Conference (AN-Conf/11).

5.2.2 Even the most conscientious and well-trained pilot, airside vehicle driver or air traffic controller is capable of making an error that results in a runway incursion. While a single pilot, driver or controller may be deemed responsible for the incursion, it is rarely the case that the individual is totally responsible for the error and its consequences. Pre-existing conditions, e.g. aerodrome design, and factors such as distraction, weather, traffic and workload peaks, are only some of the conditions that can induce human error.

5.2.3 The way in which an incident is analyzed is as important as the way in which information about the event is collected. Analysis protocols can support the tenets of just culture in several ways. First, error classification schemes must be sufficiently specific to support the development of mitigating measures. For example, an error category of "aircraft observation failure" does not adequately capture the occurrenceof a controller forgetting about an aircraft holding on the runway in anticipation of take-off, even though the controller should have scanned the runway before clearing another aircraft to land on the same runway. Stating that the controller "forgot" that the aircraft was there captures the nature of the controller's error, but not the factors that induced it.

5.2.4 Due consideration must be given both to the circumstances under which the error occurred (e.g. the tasks the individual was performing at the time and relevant environmental conditions) and to the latent conditions that originate deep within the organization (e.g. complex aerodrome layout, inadequate signs and markings, and high workload). Identifying the circumstances under which certain types of errors are likely to occur, such as at night or when the controller is working more than one control position, pointsto possible mitigating measures.

5.3 A STANDARD APPROACH TO RUNWAY INCURSIONINCIDENT REPORTING AND DATA

COLLECTION

5.3.1 The *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444), 2.4.1.2, requires ATS authorities to establish a formal incident reporting system for ATS personnel to facilitate the collection of information on actual or potential safety hazards or deficiencies related to the provision of ATS.

5.3.2 The initial runway incursion notification form (see Appendix F) requires the inclusion of data to describe the event and to classify its severity.

5.3.3 The runway incursion causal factors identification form (see Appendix G) establishes the how, what and why concerning the event and is to be completed once the detailed investigation intothe event has been completed.

5.3.4 Since there are few reported runway incursions per thousand aircraft movements, such incidents may appear to be unique to a particular aerodrome. It is only by pooling data that patterns of common causal factors can emerge.

5.3.5 The pooling of data requires that all participating organizations adopt a common, reliable and robust method of data collection. Furthermore, methods used to analyse the results should be harmonized to ensure the comparability of assessment results.

Note.— The quality of the investigations has a direct impact on the assessment of the risk ofcollision, the severity of the outcome, and the identification of causal and contributory factors.

Chapter 6 Classification Of The Severity Of Runway Incursions

6.1 SEVERITY CLASSIFICATION

6.1.1 The objective of runway incursion severity classification is to produce and record an assessment of each runway incursion. This is a critical component of risk measurement, where risk is a function of the severity of the outcome and the probability of recurrence. Whatever the severity of the occurrence, however, all runway incursions should be adequately investigated to determine the causal and contributory factors and to ensure risk mitigation measures are implemented to prevent any recurrence.

6.1.2 Severity classification of runway incursions should be assessed as soon as possible after the incident notification with due regard for the information required in 6.2. A reassessment of the final outcome may be applied at the end of the investigation process.

6.1.3 For the purpose of global harmonization and effective data sharing, when classifying the severity of runway incursions, the severity classification scheme in Table 6-1 should be applied. See Figure 6-1 for examples of severity classification.

Table 6-1. Severity classification scheme

Severity classification	Description*
A	A serious incident in which a collision is narrowly avoided.
B	An incident in which separation decreases and there is significant potential for collision, which may result in a time-critical corrective/evasive response to avoid a collision.
C	An incident characterized by ample time and/or distance to avoid a collision.
D	An incident that meets the definition of runway incursion such as the incorrect presence of a single vehicle, person or aircraft on the protectedarea of a surface designated for the landing and take-off of aircraft but with no immediate safety consequences.
E	Insufficient information or inconclusive or conflicting evidence precludesa severity assessment.

* Refer to Annex 13 for the definition of “incident”.

6.2 FACTORS THAT INFLUENCE SEVERITY

To properly classify the severity of a runway incursion the following information is required:

a) *Proximity of the aircraft and/or vehicle.* This distance is usually approximated by the controller or from the aerodrome diagram. When an aircraft flies directly over another aircraft or vehicle, then the closest vertical proximity should be used. When both aircraft are on the ground, the proximity that is used to classify the severity of the runway incursion is the closest horizontal proximity. When aircraft are separated in both horizontal and vertical planes, the proximity that best represents the probability ofcollision should be used. In incidents in which the aircraft are on intersecting runways, the distance from each aircraft to the intersection is used.

b) *Geometry of the encounter*. Certain encounters are inherently more severe than others. For example, encounters with two aircraft on the same runway are more severe than incidents with one aircraft on the runway and one aircraft approaching the runway. Similarly, head-on encounters are more severe than aircraft moving in the same direction.

c) *Evasive or corrective action.* When the pilot of an aircraft takes evasive action to avoid a collision, the magnitude of the manoeuvre is an important consideration in classifying the severity. This includes, but is not limited to, hard braking action, swerving, rejected take-off, early rotation on take-off, and go-around. The more severe the manoeuvre, the higher its contribution to the severity rating. For example, encounters involving a rejected take-off in which the distance rolled is 300 metres are more severe than thosein which the distance rolled is less than 30 metres.

d) *Available reaction time.* Encounters that allow the pilot little time to react to avoid a collision are more severe than encounters in which the pilot has ample time to respond. For example, in incidents involving a go-around, the approach speed of the aircraft and the distance to the runway at which the go-around was initiated needs to be considered in the severity classification. This means that an incident involving a heavy aircraft aborting the landing and initiating a go-around at the runway threshold is more severe than one that involves a light aircraft initiating a go-around on a one-mile final.

e) *Environmental conditions, weather, visibility and surface conditions.* Conditions that degrade the quality of the visual information available to the pilot and controller, such as poor visibility, increase the variability of the pilot and controller response and, as such, may increase the severity of the incursion. Similarly, conditions that degrade the stopping performance of the aircraft or vehicle, such as wet or icy runways, should also be considered.

f) *Factors that affect system performance.* Factors that affect system performance, such as communication failures (e.g. “open mike”) and communication errors (e.g. the controller’sfailure to correct an error in the pilot’s readback), also contribute to the severity of the incident.

6.3 RUNWAY INCURSION SEVERITY CLASSIFICATION CALCULATOR

A runway incursion severity classification (RISC) calculator (by ICAO) is (see Appendix H for a description). The calculator was developed to assist in assessing the severity of runway incursion events. Use of the RISC calculator should also enable a consistent assessment to be made. Alternatively, the severity of runway incursions can be classified manually using the guidance contained in 6.1 and 6.2.

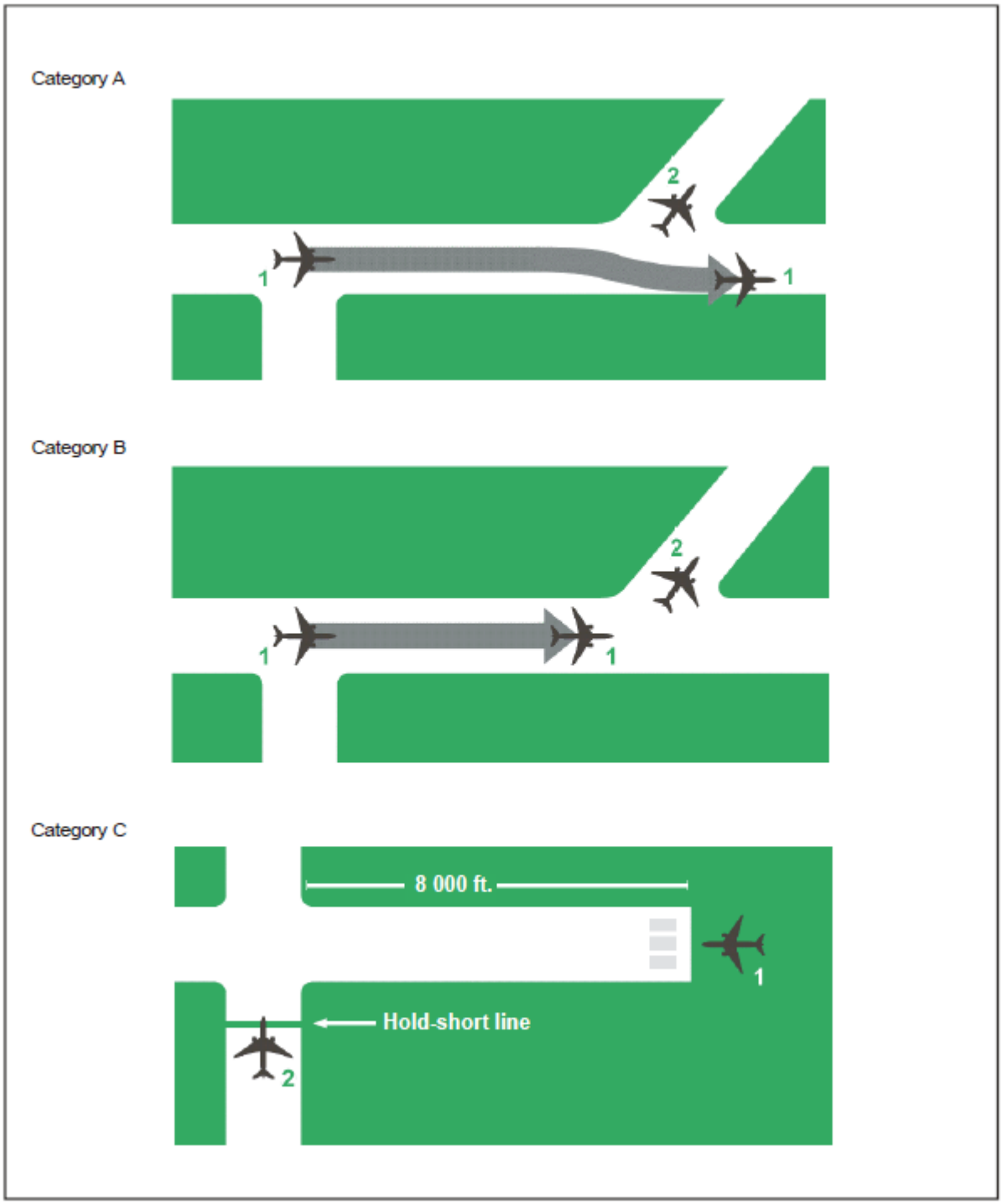

Figure 6-1. Severity classification examples

Appendix A Communication Best Practices

1. GENERAL

1.1 It is apparent from investigation reports and surveys regarding runway safety occurrences that communication issues are frequently a causal or contributory factor.

1.2 The demanding environment associated with runway operations requires that all participants accurately receive, understand and correctly read back all clearances and instructions being transmitted. While readback is not an ICAO requirement for vehicle drivers, it may be considered best practice to apply it to enhance safety.

1.3 If in doubt or uncertain of any clearance or instruction, or part of a clearance or instruction, flight crews should request clarification from ATC and subsequently read back all items of the clearance or instruction to ensure understanding.

1.4 At times, the volume, speed of delivery and complexity of radiotelephony (RTF) instructions can cause difficulty for controllers, vehicle drivers and/or pilots, especially when the language in use is not their native language. Transient crews not speaking in their native language are often susceptible to misunderstandings due to the use of colloquialisms. Therefore, the use of ICAO standard phraseology and phonetics is critical to enhancing the safety of operations.

1.5 The use of ICAO language requirements for air-ground radiotelephony communications (languagenormally used by the station on the ground or the English language)[1] will facilitate the establishment and maintenance of situational awareness for all participants associated with runway operations. To be effective, alimited set of phraseologies (15 to 20) could be identified for vehicle drivers. Annex 1 contains a Recommended Practice concerning the minimum language proficiency requirements for pilots and ATS personnel.

1.6 To maintain high levels of situational awareness, it is also recommended that communications for all operations on a runway (landing, departing and crossing aircraft, vehicles crossing and runway inspections, etc.) take place on the VHF channel assigned for that runway. To accommodate vehicles that are equipped with UHF radios only, channel/frequency “coupling” should be employed to ensure that all UHF communications associated with runway operations are simultaneously transmitted on the appropriate VHF frequency and vice versa.

1.7 The use of ICAO standard phraseologies for radiotelephony communications between aircraft and ground stations is essential to prevent misunderstanding of the intent of messages and to reduce the time required for communications. ICAO phraseology should be used in all situations for which it has been specified. When standard phraseology for a particular situation has not been specified, plain language is to be used.

1.8 The use of full call signs for all traffic operating on or in close proximity to a runway has been identified as a critical element in enhancing the safety of runway operations. While the ICAO provisions in Annex 10, Volume II, Chapter 5, allow for the use of abbreviated call signs in certain circumstances, it is deemed best practice not to use abbreviated call signs in runway operations.

2. ICAO PHRASEOLOGIES

2.1 Annex 10, Volume II, 5.1.1.1, states:

"ICAO standardized phraseology shall be used in all situations for which it has been specified. Only when standardized phraseology cannot serve an intended transmission, plain language shall be used."

2.2 Listed below are some of the key ICAO phraseologies that are applicable to operations on or in the vicinity of runways. These phraseologies apply to air traffic controllers, pilots and, when applicable, to vehicle drivers. For a complete listing of ATC phraseologies, refer to PANS-ATM (Doc 4444), Chapter 12, and Annex 10, Volume II.

Note.— Words in parentheses ( ) indicate that specific information, such as a level, a place or a time, must be inserted to complete the phrase, or alternatively that optional phrases may be used. Words in square parentheses [ ] indicate optional additional words or information that may be necessary in specific instances.

TAXI PROCEDURES

DEPARTURE:

ATC: (*call sign*) TAXI TO HOLDING POINT [*number*] [RUNWAY (*number*)].

WHERE DETAILED TAXI INSTRUCTIONS ARE REQUIRED:

ATC: (*call sign*) TAXI TO HOLDING POINT [(*number*)] [RUNWAY (*number*)] VIA (*specific route to be followed*) [TIME (*time*)] [HOLD SHORT OF RUNWAY (*number*)] [or CROSS RUNWAY (*number*)].

ATC: (*call sign*) TAXI VIA RUNWAY (*number*).

Pilot: (*call sign*) REQUEST BACKTRACK.

ATC: (*call sign*) BACKTRACK APPROVED.

ATC: (*call sign*) BACKTRACK RUNWAY (*number*).

OTHER GENERAL INSTRUCTIONS:

ATC: (*call sign*) FOLLOW (*description of other aircraft or vehicle*).

ATC: (*call sign*) VACATE RUNWAY.

Pilot/driver: RUNWAY VACATED (*call sign*).

HOLDING INSTRUCTIONS FROM ATC

(*call sign*) HOLD (*direction*) OF (*position, runway number, etc.*).(*call*

sign) HOLD POSITION.

(*call sign*) HOLD (*distance*) FROM (*position*).

HOLD AT A RUNWAY-HOLDING POINT:

(*call sign*) HOLD SHORT OF (*position*).

READBACK FROM PILOTS/DRIVERS

(*call sign*) HOLDING (*call sign*).

(*call sign*) HOLDING SHORT (*call sign*).

2.3 It should be noted that aircraft/vehicles should not hold closer to a runway than at designated runway-holding points.

2.4 The procedure words ROGER and WILCO are insufficient acknowledgement of the instructions HOLD, HOLD POSITION and HOLD SHORT OF (*position*). In each case the acknowledgement shall be made using the phraseology HOLDING or HOLDING SHORT, as appropriate.

TO CROSS A RUNWAY

Pilot/driver: (*call sign*) REQUEST CROSS RUNWAY (*number*).

ATC: (*call sign*) CROSS RUNWAY (*number*) [REPORT VACATED].

ATC: (*call sign*) TAXI TO HOLDING POINT [*number*] [RUNWAY (*number*)] VIA (*specific route to be followed*), [HOLD SHORT OF RUNWAY (*number*)] or [CROSS RUNWAY (*number*)].

Note 1.— If the control tower is unable to see the crossing aircraft or vehicle (e.g. night, low visibility), the instruction should always be accompanied by a request to report when the aircraft or vehicle has vacated the runway.

Note 2.— The pilot will, when requested, report "RUNWAY VACATED" only when the entire aircraft is beyond the relevant runway-holding position.

PREPARATION FOR TAKE-OFF
(clearance to enter runway and await take-off clearance)ATC:

(*call sign*) LINE UP [AND WAIT].

ATC: (*call sign*) LINE UP RUNWAY (*number — in multiple runway/intersection departures*).

ATC: (*call sign*) LINE UP. BE READY FOR IMMEDIATE DEPARTURE.

CONDITIONAL CLEARANCES

2.5 Conditional clearances must consist of the condition before the line-up instruction, and an acknowledgement of the correct (or otherwise) readback is required as part of the correct procedure.

ATC: SAS941, BEHIND DC9 ON SHORT FINAL, LINE UP BEHIND.

2.6 The acknowledgement of a conditional clearance must contain the condition in the readback.

Pilot: BEHIND LANDING DC9 ON SHORT FINAL, LINING UP BEHIND SAS941.

ATC: SAS941 [THAT IS] CORRECT.

2.7 The procedure makes no provision for vehicles to receive a conditional clearance.

Note 1.— Conditional phrases such as "behind landing aircraft" or "after departing aircraft" shall not be used for movements affecting the active runway(s), except when the aircraft or vehicles concerned are seen by the appropriate controller and pilot.

Note 2.— The aircraft or vehicle that is the subject of a conditional clearance should be clearly identified, and the identification should always be read back in full.

TAKE-OFF CLEARANCE

ATC: (*call sign*) RUNWAY (*number*) CLEARED FOR TAKE-OFF [REPORT AIRBORNE].

Note.— "REPORT AIRBORNE" is applicable in low visibility operations.

WHEN TAKE-OFF CLEARANCE HAS NOT BEEN COMPLIED WITH:

ATC: (*call sign*) TAKE OFF IMMEDIATELY OR VACATE RUNWAY [(*instructions*)].

ATC: (*call sign*) TAKE OFF IMMEDIATELY OR HOLD SHORT OF RUNWAY.

TO CANCEL A TAKE-OFF CLEARANCE:

ATC: (*call sign*) HOLD POSITION, CANCEL TAKE-OFF I SAY AGAIN CANCEL TAKE-OFF (*reasons*).

Pilot: HOLDING (*call sign*).

TO STOP A TAKE-OFF AFTER AN AIRCRAFT HAS COMMENCED TAKE-OFF ROLL:

ATC: (*call sign*) STOP IMMEDIATELY [(*repeat aircraft call sign*) STOP IMMEDIATELY].

Pilot: STOPPING (*call sign*).

3. READBACK

3.1 Equally important as the use of correct phraseologies is the need to obtain the required readbackin the order required and accurately.

3.2 Reproduced below are the relevant provisions in Annex 11 pertaining to this safety-critical element of runway operations.

"3.7.3 Readback of clearances and safety-related information

3.7.3.1 The flight crew shall read back to the air traffic controller safety-related parts of ATC clearances and instructions which are transmitted by voice. The following items shall always be read back:

a) ATC route clearances;

b) clearances and instructions to enter, land on, take off from, hold short of, cross and backtrack on any runway; and

c) runway-in-use, altimeter settings, SSR codes, level instructions, heading and speed instructions and, whether issued by the controller or contained in ATIS broadcasts, transition levels.

3.7.3.1.1 Other clearances or instructions, including conditional clearances, shall be read back or acknowledged in a manner to clearly indicate that they have been understood and willbe complied with.

3.7.3.1.2 The controller shall listen to the readback to ascertain that the clearance or instruction has been correctly acknowledged by the flight crew and shall take immediate action to correct any discrepancies revealed by the readback."

4. COMMUNICATION TECHNIQUES — GENERAL

4.1 Detailed below are the relevant provisions laid down in Annex 10, Volume II, and the PANS- ATM (Doc 4444), with regard to radio transmission guidelines and techniques.

Issue of en-route clearance

4.2 Whenever possible, an en-route clearance should be passed to an aircraft before the start of taxi. If this is not possible, controllers should try to avoid passing the clearance to a pilot engaged in complicated taxiing manoeuvres near the runway due to the possibility of distraction.

4.3 An ATC en-route clearance is *not* an instruction to take off or enter an active runway. The words "take off" are used only when an aircraft is cleared for take-off, or when cancelling a take-off clearance. At other times the word "departure" or "airborne" is used.

Readback requirements

4.4 The air traffic controller is responsible for checking the completeness and accuracy of the readback. An aircraft must include its call sign in the readback, and failure to do this shall be challenged by the controller.

Taxi instructions

4.5 Taxi instructions issued by a controller will always contain a clearance limit, which is the point at which the aircraft must stop until further permission to proceed is given. For departing aircraft the clearance limit will normally be the holding point of the runway in use, but it may be any other position on the aerodrome depending on prevailing traffic circumstances. When intersection departures are used, The appropriate holding point shall be clearly identified by ATC.

4.6 When a taxi clearance contains a taxi limit beyond a runway, it shall contain an explicit clearanceto cross that runway, or an instruction to hold short, even if the runway is not in use.

4.7 Communication with any aircraft using the runway for the purpose of taxiing should be transferredfrom the ground controller to the aerodrome controller prior to the aircraft entering/crossing a runway. It is strongly advised, when practicable, to use standard taxi routes.

4.8 For more complicated taxi instructions, it may be appropriate to divide the message into segments,placing the clearances and instructions in sequential order, to avoid the possibility of pilot misunderstanding.

For example:

An aircraft shall taxi to RWY 06R for take-off. The aircraft has to taxi via taxiways A and B and the taxi route will necessitate a runway crossing (RWY 06L). The holding point for RWY 06L on taxiway B is named B2.

ATC: AFR375, TAXI TO HOLDING POINT B2 VIA TAXIWAY ALPHA AND BRAVO, HOLD SHORT OF RWY 06L.

A/C: TAXI TO HOLDING POINT B2 VIA ALPHA AND BRAVO, HOLDING SHORT OF RUNWAY 06L, AFR375.

Subsequently:

A/C: AFR375 AT HOLDING POINT B2.

ATC: AFR375 CROSS RWY 06L, TAXI TO HOLDING POINT RWY 06R.

A/C: CROSS 06L, TAXI TO HOLDING POINT RWY 06R AFR375.

4.9 Further guidance on this subject can be found in Appendix B, paragraph 7.

4.10 It should be noted that the ICAO phraseology “taxi to holding point …” may be misunderstood bysome pilots due to the use of non-ICAO phraseology within North America, where “position and hold …” is used by ATC when issuing a line-up clearance. There have been a number of runway safety occurrences due to this misunderstanding, and the readbacks should be very carefully monitored.

Multiple line-ups on the same runway

4.11 In Europe, line-up instructions may be issued to more than one aircraft at different points on the same runway, using the ICAO criteria contained in Part 3 (Aerodrome Operations) of the EUR part of the *Regional Supplementary Procedures* (Doc 7030).

4.12 In addition to the standard phraseology in Chapter 12 of PANS-ATM (Doc 4444), the following ATC phraseology shall be used:

ATC: KLM123 LINE UP AND WAIT RUNWAY 22 INTERSECTION BRAVO NUMBER 2 FOR DEPARTURE NUMBER ONE AN AIR FRANCE B737 DEPARTING FROM ALPHA ONE.

A/C: LINING UP AND WAIT RUNWAY 22 INTERSECTION BRAVO NUMBER 2 KLM123.

Appendix B Best Practices On The Flight Deck

(Based on material provided by IATA and IFALPA)

1. AIM OF THIS APPENDIX

1.1 The aim of this appendix is to highlight some of the causal or contributory factors that have resulted in runway incursions and which were identified during a runway safety survey conducted by EUROCONTROL.

1.2 Aircraft operators are invited to review the material put forward in this appendix and, where necessary, amend their standard operating procedures with regard to ground operations.

2. CRITICAL PHASE OF FLIGHT

2.1 The number of ground movements on aerodromes has increased significantly over the last decades. To provide the needed capacity on the ground, it is necessary to continuously review the layout of the taxiway infrastructure and the increasingly complex taxiway systems at major aerodromes.

2.2 With the accelerated rate of enhancement and change at aerodromes in recent times, it is imperative that pilots remain aware of the signage and markings being applied. Every opportunity to familiarize oneself should be taken, and where possible, information critical to safe aerodrome operations should be shared.

2.3 The current generation of aircraft have highly automated and complex systems that allow the preparation and programming of the total flight to be done on the ground. This has resulted in flight deck workload peaks shifting to the ground phase of aircraft operations. This evolution is irreversible, andappropriate mitigating measures should be taken to prevent runway incursions as a result. Consequently thetaxi phase should be treated as a “critical phase of flight”.

3. PLANNING FOR TAXI OPERATIONS

A key point in the prevention of runway incursions is to apply preventative measures during the taxi phase. Prioritization of administrative and commercial tasks (such as weight and balance calculations, certain checklist items and the captain’s welcome speech) prior to leaving the ramp will assist in reducing the workload during the taxi phase and result in increased attention and improved situational awareness. This can be further enhanced by assigning one crew member to progressively monitor the progress of the flight against the aerodrome chart.

4. AERODROME FAMILIARIZATION

Preparations for departure and arrival at an aerodrome can be accomplished well in advance. Familiarization in preparation for the taxi operation is essential and should be completed at the gate or prior to starting descentas follows:

a) prepare the necessary charts for taxi and have them available for use during taxi;

b) take some time to study the aerodrome layout. Very often some system can be identified for the naming of taxiways;

c) remember to review the latest NOTAM for both the departure and arrival aerodrome for information concerning construction or taxiway/runway closures. Visualize this informationon the charts;

d) standard taxi routes are used more often at busy aerodromes. Review the routes expected to be used. If not cleared for the expected taxi route, take adequate time to become familiar with the new routing even if it requires stopping to do so;

e) pay special attention to the location of hot spots. These are locations on the aerodrome movement area where there is an increased risk of collisions. Know what runways will be encountered between departure and final destination;

f) plan the timing and execution of checklists so that no distractions occur when approaching and/or crossing runways, i.e. all eyes outside during this phase; and

g) conduct detailed briefings for all flight crew members, especially during night and low visibility operations, i.e. include “extra eyes” where available.

5. BRIEFINGS

5.1 The “before take-off” briefing should be simplified as much as possible. The pre-departure checklists should be gone through when the aircraft is stationary. Several taxi items can be addressed during the “before start” briefing at the gate. The briefing during taxi can be limited to a summary of the highlights and the items which have been altered since the “before start” briefing. This should also be done during the “descent” briefing.

5.2 The “before start” and “descent” briefings should also contain a complete review of the expected taxi routes with special attention to the hot spots. Special attention should be paid to temporary situations such as work in progress, other unusual activity and recent changes in the aerodrome layout. During this part of the briefing, the aerodrome charts should be referred to and all available information visualized.

5.3 Memory is “constructive” in that one has the tendency to fill in the blanks. Pilots should ensure that they follow the clearance or instruction that has actually been received and not the one expected to be received. Also, expectations established during the pre-taxi or pre-landing planning can be significantly altered with a different and unexpected clearance.

6. TAXI PROCEDURES

6.1 Clearance

6.1.1 The receipt of any clearance and the taxi clearance itself require the complete attention of all the flight crew on the flight deck. If necessary, taxi instructions should be written down, especially at complex or unfamiliar aerodromes, and the instructions should be cross-checked against the aerodrome chart. Any uncertainties about clearance or position on the aerodrome should be clarified before the start of taxi or after vacating the runway. When unsure of taxi instructions, the pilot should stop, request clarification from ATC and continue taxiing only when the required taxi routing has been confirmed. In case of doubt, the pilot should ask for clarification.

6.1.2 All flight crew members should monitor the clearance for taxi, take-off and landing, and they must be kept informed at all times when runway operations are in progress.

6.2 Public address announcements

6.2.1 Public address announcements from the flight deck should be made a moment before engine start-up or push-back and not during the taxi phase. Safety reports show that public address announcements to passengers, or commercial announcements, are a direct source of error in many events. Also, operational calls on the company frequency can cause the other pilot to be isolated on the flight deck. These calls and announcements should, if possible, be avoided while taxiing and especially when approaching the active runway.

6.2.2 If it is necessary to leave the ATC frequency, the pilot should notify the other flight crew member and, afterwards, be briefed by that crew member of what may have been missed.

6.3 Taxi best practices

6.3.1 Only one pilot can control the aircraft during taxi and his/her primary task is to safely taxi the aircraft. The pilot not flying should assist the pilot flying to the best of his/her ability by providing guidance based upon the cleared taxi routing and the aerodrome layout map.

6.3.2 All checklist activity should be cancelled when crossing and entering runways. One flight crew member should maintain full concentration on the runway traffic situation.

6.3.3 Red stop bars should never be crossed when lining up on or crossing a runway unless, in exceptional cases, the stop bars, lights or controls are reported to be unserviceable, and contingency measures, such as using follow-me vehicles, are in force. In these circumstances, whenever possible, alternative routes should be used.

6.3.4 When entering any runway, all available surveillance means should be used to check for traffic (left and right), e.g. all eyes to be used.

6.3.5 When cleared to line up and/or when crossing any runway, the aircraft should be positioned at a right angle to the runway where possible, in order to better observe other traffic, both arriving and departing.

6.3.6 The pilot should not rush. The higher the ground speed, the less time available to react, manoeuvre the aircraft and avoid obstacles. High speed also results in greater distance and time required to bring the aircraft to a complete stop. Time can be both an ally and an enemy and should be used wisely. The pilot should taxi defensively and be prepared for others' mistakes.

6.3.7 When a clearance to taxi to a point beyond a runway is received, it must include the authorization to cross that runway. A runway should never be crossed unless an explicit ATC clearance has been received.

6.3.8 The "sterile flight deck" concept while taxiing should be adopted. During movement of theaircraft the flight crew must be able to focus on their duties without being distracted by non-flight-related matters. Cabin crew should be made aware of this requirement if it is not a standard operating procedure. The following definition of a "sterile flight deck" is offered as a reference:

Sterile flight deck. Any period of time when the flight crew should not be disturbed, except formatters critical to the safe operation of the aircraft.

Disturbances may include, but not be limited to, calls received from non-operational areas (e.g. company),entry onto the flight deck by cabin crew, and extraneous conversations not related to the current phase of flight.

6.3.9 It is generally accepted that the need for a sterile cockpit commences as follows:

a) departure: when the aircraft engine(s) are started and ceases when the aircraft reaches10 000 feet elevation above the departure aerodrome;

b) arrival: when the aircraft reaches 10 000 feet elevation above the arrival aerodrome until theengine(s) are shut down after landing; and

c) at any other time determined and announced by the flight crew (e.g. in-flight emergency,security alert).

6.3.10 All aircraft lights should be used to help controllers and other pilots to see the aircraft. Fixed navigation lights and taxi lights should be on whenever the aircraft is moving. Landing lights should beturned on when cleared for take-off.

6.3.11 The audio box and volume adjustment should be checked whenever a frequency change is made.All flight crew should be on the appropriate frequency until all runways have been vacated after landing.

6.3.12 After landing, the runway should be vacated as soon as possible, but not by turning ontoanother runway, unless specifically instructed to do so. When the aircraft has vacated the active runway, thepilot should be prepared to stop to resolve any questions about the ATC clearance or about the aircraft position.

6.3.13 Anytime there is uncertainty about the location of the aircraft on the movement/manoeuvring area, the pilot should stop the aircraft, advise ATC, and seek clarification. Questions should be taken out of the flight deck. If necessary progressive taxi instructions should be requested.

6.3.14 The aircraft should never be stopped on a runway unless specifically instructed to do so.

PREPARATION FOR TAXI CHECKLIST

- If necessary write down the taxi route.
- Assign a crew member to progressively follow the aircraft's position on the aerodrome chart.
- Follow company SOPs with regard to exterior lighting when taxiing and clearedfor take-off — where possible, have maximum illumination.
- Adopt a sterile flight deck for the taxi phase.
- Be aware that the visibility required for taxiing may be less than the runwayvisual range (RVR).
- Be alert for mandatory signs, markings, stop bars and runway guard lights.
- Look for visual aids such as taxiway location information and destination signs.
- Designate a crew member to look for and report signs and markings and keeptrack of the aircraft's location against the aerodrome chart.
- Conduct pre-departure checklists when the aircraft is stationary.
- Use standard radio phraseology.
- Receive explicit clearance before crossing any runway.
- Read back all runway crossing or hold short clearances using correctphraseology.
- Do not be rushed by any party (ATC or company).
- Listen to clearances issued to other aircraft.

6.4 Language

6.4.1 While the language normally used by the station on the ground or the English language[1] is allowed,the use of standard aviation English at international aerodromes will enhance the situational awareness of allthose listening on the frequency.

6.4.2 Conducting and comprehending radiotelephony communications requires competence with standard phraseology as well as general proficiency in the language used for communications. Standard phraseology should be used at all times. Strict adherence to standard phraseology prevents miscommunications. See Appendix A for further information on communication best practices.

6.4.3 Speaking slowly is essential when operating in foreign regions. When the speech note is slowed, the response may be slower and clearer.

6.5 Readbacks

6.5.1 All clearances require a readback. The Standard in Annex 11, 3.7.3.1, states:

"The flight crew shall read back to the air traffic controller safety-related parts of ATC clearancesand instructions which are transmitted by voice. The following items shall always be read back:

a) ATC route clearances;

b) clearances and instructions to enter, land on, take off from, hold short of, cross and backtrackon any runway; and

c) runway-in-use, altimeter settings, SSR codes, level instructions, heading and speed instructionsand, whether issued by the controller or contained in ATIS broadcasts, transition levels."

6.5.2 All readbacks require a hearback. In order to complete this "communication loop", the readback must be complete and clear. The full clearance, including the call sign and runway designator, must be read back. "Roger" is not considered to be a readback.

6.6 Listen on the frequency

The pilot should listen on the frequency at all times and try to visualize the other traffic in the vicinity. The pilot should know what runways will be encountered between the aircraft's current location and finaldestination. Particular attention should be paid to all clearances and instructions issued to traffic involving those runways.

7. OTHER COMMUNICATION BEST PRACTICES

7.1 Extra attention is required when other aircraft with similar call signs are on the frequency.

7.2 An instruction to follow other traffic does not automatically include clearance to enter or cross a runway. Each aircraft requires a specific clearance to enter or cross any runway. If in doubt, clarification should be sought.

7.3 If an aircraft has been cleared to "line up and wait", then only a short delay on the runwayshould be anticipated. If in this position for an extended period, the pilot should so advise ATC and seek clarification.

7.4 Both the pilot flying and the pilot not flying should monitor the frequency and agree upon the acceptance of a clearance to taxi, cross a runway, take-off or land on a runway. Any misunderstanding or disagreement should be resolved immediately by contacting ATC for clarification.

7.5 The use of headsets improves the audibility of communications with ATC and on the flight deck.

7.6 The correct setting of the audio panel should be verified, especially after any temporary switch in audio sources.

7.7 The pilot should state the position of the aircraft on the aerodrome whenever making initial contact with any ground or aerodrome controller, regardless of whether it was previously stated to a different controller.

7.8 The "sterile cockpit" rule during the taxi phase should be adopted.

8. SITUATIONAL AWARENESS

8.1 General

One aspect of situational awareness is pilots knowing where they are and where they want to go, as well as visualizing a picture of the airport traffic in the vicinity. Even during daylight and in good visibility, pilots can get lost. Even worse is the situation where pilots think they know their position, but find themselves elsewhere. In darkness or low visibility conditions, additional care must be taken to ensure that accuracy in navigation on the ground and the highest degree of situational awareness is maintained by all members of the flight crew.

SITUATIONAL AWARENESS CHECKLIST

Before starting the approach:

- Obtain all needed information.
- Brief flight crew about planned primary runway exits and taxi routes.
- Eliminate as much distraction as possible.
- Have the aerodrome diagram available for instant use.
- Maintain situational awareness on final approach at night.
- Listen for clearances to other aircraft.

8.2 Visual aids

8.2.1 Charts, signs, markings and lighting are all aids to assist in determining position. A high level of awareness must be maintained to observe and respond to mandatory signs and markings. Correct knowledge of all symbols and signs is therefore necessary. All the visual information that is available should correlate with the actual situation. Gathering visual information and constantly questioning and cross- checking the aircraft's position is the task of the entire flight crew. A crew member who is in doubt or does not agree with something must speak up.

8.2.2 A head-down situation during taxi should be limited to the minimum amount of time possible.

8.2.3 When the pilot not taxiing the aircraft focuses on the instruments on the flight deck, that pilot is not able to monitor the progress of the aircraft. Before undertaking head-down actions, the other pilot should be so advised so that the navigating pilot can place added emphasis on maintaining navigational accuracy and situational awareness.

8.3 Other aids

8.3.1 Heading displays or compasses should be used to confirm runway or taxiway alignment with the information available from the charts. If available, the ILS centre line guidance system should be used to confirm correct runway alignment.

8.3.2 The entire runway and approach should be scanned in both directions before entering a runway and, if in doubt, clarification should be sought.

9. CONCLUSION

RUNWAY INCURSION PREVENTION CHECKLIST

- Strictly adhere to all relevant ICAO Standards and Recommended Practices, procedures and guidance material, including phraseologies.
- Ensure that flight crews follow the clearances or instructions that are actually received and not those they expect to receive.
- Ensure good planning of ground operations in order to decrease the workload during taxi. The flight and its associated risks starts during the preparation.
- Ensure that good situational awareness is the top priority during taxi, and involve all crew members.
- Make “crew resource management” principles during taxi as important as during the other phases of flight.
- Be defensive and let the built-in safety nets do their work so that a single mistake does not lead to a serious incident or accident.
- Never take anything for granted.

10. STOP BARS

The following extracts from ICAO Standards and Recommended Practices are provided to assist flight crewsin understanding the use and application of stop bars:

Annex 2 — *Rules of the Air*, Chapter 3:

“3.2.2.7.3 An aircraft taxiing on the manoeuvring area shall stop and hold at all lightedstop bars and may proceed further when the lights are switched off.”

Annex 14 — *Aerodromes*, Volume I — *Aerodrome Design and Operations*, Chapter 5:

“5.3.19.9 Selectively switchable stop bars shall be installed in conjunction with at least three taxiway centre line lights (extending for a distance of at least 90 m from the stop bar) inthe direction that it is intended for an aircraft to proceed from the stop bar.”

“5.3.19.13 *Note 1.— A stop bar is switched on to indicate that traffic stop and switched off to indicate that* traffic *proceed.”*

"5.4.3.35 A taxiway shall be identified by a designator comprising a letter, letters or a combination of a letter or letters followed by a number."

"5.4.3.36 **Recommendation.—** *When designating taxiways, the use of the letters I, O or X and the use of words such as inner and outer should be avoided wherever possible to avoid confusion with the numerals 1, 0 and closed marking.*"

"5.4.3.37 The use of numbers alone on the manoeuvring area shall be reserved for the designation of runways."

Procedures for Air Navigation Services — Air Traffic Management
(PANS-ATM, Doc 4444), Chapter 7:

"7.14.7 Stop bars

Stop bars shall be switched on to indicate that all traffic shall stop and switched off toindicate that traffic may proceed.

Note.— Stop bars are located across taxiways at the point where it is desired that trafficstop, and consist of lights, showing red, spaced across the taxiway."

11. REFERENCES

Federal Aviation Administration (FAA)

- *Controller and Pilot Error in Surface Operations*, Kim Cardosi, 2003
- Federal Aviation Regulations/Airman's Information Manual, 2002
- Runway Safety Blueprint 2002–2004, 2001
- *Runway Safety: It's Everybody's Business*, Kim Cardosi, 2001

FAA/International Air Transport Association (IATA)

- FAA/IATA Runway Incursion Prevention Program

International Civil Aviation Organization (ICAO)

- North American, Central American and Caribbean Regional Office, OPS Guidelines for thePrevention of Runway Incursion, 2002
- *Procedures for Air Navigation Services — Aircraft Operations* (Doc 8168), Fourth Edition, 1993

Netherlands

- University of Leiden, *Human Factors in Runway Incursion Incidents*, Patrick Hudson

Appendix C Air Traffic Control Best Practices

1. AIM OF THIS APPENDIX

1.1 The aim of this appendix is to highlight some of the causal or contributory factors that have resulted in runway incursions and which were identified during a runway safety survey in Europe in 2001. It is usually the responsibility of the air traffic service provider to put best practices in place to prevent runway incursions.

1.2 While the use of the language normally used by the station on the ground or the English language[1] is allowed, the use of standard aviation English at international aerodromes enhances thesituational awareness of all those listening on the frequency.

2. CLEARANCES

2.1 Whenever possible, an en-route clearance should be passed to an aircraft before the start of taxi.If this is not possible, controllers should try to avoid passing the clearance to a pilot engaged in complicated taxiing manoeuvres near the runway due to the possibility of distraction.

2.2 An en-route clearance does not authorize the pilot to take off or enter an active runway. The words"take off" shall be used only when an aircraft is cleared for take-off, or when cancelling a take-off clearance.

3. READBACK REQUIREMENTS

3.1 Readback requirements were introduced in the interest of flight safety. The stringency of the readback requirement is directly related to the possible seriousness of misunderstandings in the transmission and receipt of ATC clearances and instructions. Strict adherence to readback procedures ensures that the clearance or instruction has been received and understood correctly by the correct aircraft.

3.2 The flight crew must read back to the air traffic controller the safety-related parts of ATC clearances and instructions. The air traffic controller is responsible for checking the completeness and accuracy of the readback.

3.3 In accordance with Annex 11, the following items shall always be read back:

a) ATC route clearances;

b) clearances and instructions to enter, land on, take off from, hold short of, cross and backtrackon any runway; and

c) runway-in-use, altimeter settings, SSR codes, level instructions, heading and speed instructionsand, whether issued by the controller or contained in ATIS broadcasts, transition levels.

Other clearances or instructions, including conditional clearances, shall be read back or acknowledged in a manner to clearly indicate that they have been understood and will be complied with.

3.4 An aircraft must include its call sign in the readback, and failure to do so should be challengedby the controller.

3.5 PANS-ATM (Doc 4444), 4.5.7.5.2, states:
"The controller shall listen to the readback to ascertain that the clearance or instruction hasbeen correctly acknowledged by the flight crew and shall take immediate action to correct any discrepancies revealed by the readback."

This requirement constitutes an essential cross-check to confirm correct understanding of a clearance or instruction or part thereof by flight crews and vehicle drivers. This closed loop supports the safety and redundancy of pilot/vehicle-driver/controller communications, and whenever adverse factors are likely to affect communications, strict adherence to

this closed loop constitutes an important line of defence against communication errors.

4. TAXI INSTRUCTIONS

4.1 Taxi instructions issued by a controller must always contain a clearance limit, which is the point at which the aircraft must stop until an instruction to proceed is given. For departing aircraft, the clearance limit will normally be the runway-holding point of the runway in use, but it may be any other position on the aerodrome, including runway intersections, depending on prevailing traffic circumstances. When intersection departures are used, the appropriate runway-holding points shall be clearly identified by ATC.

4.2 When a taxi clearance contains a taxi limit beyond a runway, it must contain an explicitclearance to cross that runway, even if the runway is not in use. Where an expected or anticipated runway crossing is required, a means of communicating this to the pilots, at the gate or prior to descent, should be established.

4.3 Communication with any aircraft related to the use of a runway for the purpose of taxiing should be transferred from the ground controller to the aerodrome controller prior to the aircraft entering or crossing a runway.

4.4 It is strongly advised, when practicable, to use standard taxi routes. For more complicated taxi instructions, it may be appropriate to divide the message into segments, placing the clearances and instructions in sequential order, to avoid the possibility of pilot misunderstanding.

5. STOP BARS

5.1 Annex 2, 3.2.2.7.3, states:

"An aircraft taxiing on the manoeuvring area shall stop and hold at all lighted stop bars and mayproceed further when the lights are switched off."

This Standard applies both to runways and taxiways where fitted with stop bars. The objective of this Standard is to maintain the integrity of the stop bars, which are intended to protect the relevant part of a manoeuvring area.

5.2 PANS-ATM (Doc 4444), 7.14.7, states:

> "Stop bars shall be switched on to indicate that all traffic shall stop and switched off to indicatethat traffic may proceed."

As such, a controller should never issue a clearance to cross a stop bar without first switching off the stop bar. The only exception to this should be when contingency measures are required due to unserviceability. An example of a contingency measure is the use of a follow-me vehicle.

6. TAKE-OFF PROCEDURES

At aerodromes with separate ground control and aerodrome control functions, aircraft are transferred to the tower at or approaching the holding point. Since misunderstandings in the granting and acknowledgement of take-off clearances can result in serious consequences, care should be taken to ensure that the phraseology employed during the taxi manoeuvres cannot be interpreted as a take-off clearance.

7. POSITION HANDOVER

NAV CANADA in its runway safety survey found that a significant percentage of incidents involving ATC operational errors takes place after a controller position handover takes place. To ensure that the complete traffic situation is included in a position handover, the use of a standardized handover checklist should be considered.

Appendix D Airside Vehicle Driving Best Practices

Note.— This guidance is a compilation of material drawn from many sources including ICAO,IATA, ACI and a number of aerodromes that already operate vehicle driver training programmes.

1. INTRODUCTION

1.1 It is usually the responsibility of the aerodrome operator to have in place a formal training, assessment and authorization programme for all drivers operating airside. Information already exists that indicates that vehicles and their drivers have caused runway incursions at a number of aerodromes.

1.2 As a result of local hazard analyses in Europe in 2001, the operation of vehicles on the aerodrome has been highlighted as a potentially high-risk activity which demands that a number of formal control measures be put in place to manage the risk. A vehicle driver training programme is one of these control measures and should form part of the overall safety management system of the aerodrome operator.

1.3 The aerodrome operator should take the lead in developing an agreed standard for the vehicle driver training programme. There will be a requirement for cooperation and partnership with air trafficcontrol, ground handling agents, airlines and other airside service providers to ensure the safe operation of the aerodrome.

1.4 Depending upon the scale and complexity of the aerodrome and the individual requirements of the driver, the training programme should take into account the following main areas:

a) a generic airside vehicle driver training programme which covers operational safety and the health and safety aspects of operating vehicles, plant and equipment in close proximity to aircraft on the movement and manoeuvring areas, aprons, stands and airside roads;

b) specific training on the vehicle, plant and equipment, e.g. car, tug, high loader, coach;

c) additional training on the hazards associated with runways and taxiways if the specific job function requires the driver to operate on the manoeuvring area; and

d) training in the correct use of RTF and standard phraseology since an essential requirement for operating a vehicle on the manoeuvring area is the need to communicate with the aerodrome control tower.

1.5 The following guidance is considered to be “good practice” and is applicable to the majority of aerodromes. A generic framework is given for the four main areas described in 1.4. It is vital that both the theoretical formal training and practical experience cover all four areas. The aim of this guidance is to ensure consistency and a high degree of standardization in the manner in which a driver obtains an “airside driving permit”.

2. DEVELOPMENT OF A FRAMEWORK FOR AVEHICLE DRIVER TRAINING PROGRAMME

2.1 Airside vehicle driver

The following elements should be considered when developing programmes and knowledge requirementsfor an airside vehicle driver training programme:

a) Airside driving permit (ADP)

1) the issuing authority (normally the aerodrome operator), the validity of the permit in terms of time, conditions of use, and its transferability;

2) ownership of the permit and control and audit of permit issue;

3) local enforcement and driving offence procedures; and

4) relationship to driver licensing system.

b) National legislation and regulation

1) government/local regulations related to general vehicle driving licences;

2) regional/local government requirements; and

3) national aviation safety authority requirements/guidance for driving airside.

c) Aerodrome regulations and requirements

1) rules of the air and ATC procedures applicable to aerodromes as they relate to vehicles, particularly rights of way;

2) specific aerodrome regulations, requirements and local instructions;

3) local methods used to disseminate general information and instructions to drivers; and

4) local methods used to disseminate information regarding works in progress.

d) Personal responsibilities

1) agreed national or airport requirements concerning fitness to drive (medical and health standards);

2) issue and use of personal protective equipment such as high visibility clothing and hearing protection;

3) general driving standards;

4) no-smoking/no-drinking requirements airside;

5) responsibilities with respect to foreign object debris and fuel/oil spillage; and

6) the responsibility to ensure that a vehicle is suitable for the task and is used correctly.

e) Vehicle standards

1) condition and maintenance standards agreed at the aerodrome and/or national level;

2) the requirement to display obstruction lights and company insignia;

3) the requirement for, and content of, daily vehicle inspections;

4) agreed standards of aerodrome and company vehicle fault reporting and rectification;and

5) local requirements for the issue and display of airside vehicle permits.

f) General aerodrome layout

1) the general geography of the local aerodrome;

2) aviation terminology used such as runway, taxiway, apron, roads, crossings, runway-holdingpoints;

3) all aerodrome signs, markings and lighting for vehicles and aircraft;

4) specific reference to signs, markings and lighting used to guard runways and critical areas;and

5) specific reference to any controlled/uncontrolled taxiway crossing procedures.

g) Hazards of general airside driving

1) speed limits, prohibited areas and no parking regulations;

2) the danger zones around aircraft;

3) engine suction/ingestion and blast, propellers and helicopters;

4) aircraft refuelling;

5) foreign object debris and spillages;

6) vehicle reversing;

7) staff and passengers walking across aprons;

8) air bridges and other services such as fixed electrical ground power;

9) the general aircraft turnaround process;

10) aircraft emergency stop and fuel cut-off procedures;

11) hazardous cargo;

12) local vehicle towing requirements;

13) requirements for driving at night; and

14) requirements for driving in adverse weather conditions, particularly low visibility.

h) Local organizations

1) the role of the aerodrome operator in setting and maintaining standards;

2) the national aviation safety authority and its responsibilities;

3) the national and/or local police and their involvement with airside driving; and

4) other enforcement authorities dealing with vehicles, driving, health and safety.

i) Emergency procedures

1) actions and responsibilities in a crisis situation (any accident or significant incident occurringon the airport);

2) action in the event of a vehicle accident;

3) specific action in the event of a vehicle striking an aircraft;

4) action in the event of fire;

5) action in the event of an aircraft accident/incident; and

6) action in the event of personal injury.

j) Communications

1) radio procedures and phraseologies to be used, if applicable;

2) light signals used by ATC;

3) procedures to be used by vehicle drivers if lost or unsure of position;

4) local emergency telephone numbers; and

5) how to contact the local aerodrome safety unit.

k) Practical training (visual familiarization)

1) airside service roads, taxiway crossings and any restrictions during low visibility;

2) aprons and stands;

3) surface paint markings for vehicles and aircraft;

4) surface paint markings that delineate the boundary between aprons and taxiways;

5) signs, markings and lighting used on the taxiway that indicate the runways ahead;

6) parking areas and restrictions;

7) speed limits and regulations; and

8) hazards during aircraft turnarounds and aircraft movements.

2.2 Manoeuvring area vehicle driver

2.2.1 All drivers expected to operate on the manoeuvring area of an aerodrome should obtain an ADP covering the programme in 2.1. Any driver expected to drive on the manoeuvring area should also obtain an agreed period of experience in general airside driving before training to operate on the manoeuvring area.

2.2.2 The number of drivers permitted to drive on the manoeuvring area should be kept to the minimum necessary, and the functions they perform should normally be within the following areas of responsibility:

a) runway inspections;

b) bird control;

c) rescue and fire fighting;

d) essential engineering;

e) ATC;

f) snow clearing and de-icing; and

g) airline or handling agent for aircraft towing and runway crossings.

2.2.3 All drivers should be trained initially and be provided with refresher training at agreed intervals with particular additional emphasis on the following areas:

a) Aerodrome regulations and requirements

1) air traffic control rules, right of way of aircraft;

2) the definition of movement areas, manoeuvring areas, aprons, stands; and

3) methods used to disseminate information regarding works in progress.

b) Air traffic control

1) the aerodrome control function and area of responsibility;

2) the ground movement control function and area of responsibility;

3) normal and emergency procedures used by ATC relating to aircraft;

4) ATC frequencies used and normal handover/transfer points for vehicles;

5) ATC call signs, vehicle call signs, phonetic alphabet, and standard phraseology; and

6) demarcation of responsibilities between ATC and apron control if applicable.

c) Personal responsibilities

1) fitness to drive with particular emphasis on eyesight and colour perception;

2) correct use of personal protective equipment;

3) responsibilities with respect to foreign object debris; and

4) responsibilities with respect to escorting other vehicles on the manoeuvring area.

d) Vehicle standards

1) responsibility for ensuring the vehicle used is fit for the purpose and task;

2) requirements for daily inspection prior to operating on the manoeuvring area;

3) particular attention to the display of obstruction and general lights; and

4) serviceability of all essential communications systems with ATC and base operations.

e) Aerodrome layout

1) particular emphasis on signs, markings and lighting used on the manoeuvring area;

2) special emphasis on signs, markings and lighting used to protect the runway;

3) description of equipment essential to air navigation such as instrument landing systems(ILS);

4) description of protected zones related to ILS antenna;

5) description of ILS protected areas and their relation to runway-holding points;

6) description of runway instrument/visual strip, cleared and graded area; and

7) description of lighting used on the manoeuvring area with particular emphasis on thoserelated to low visibility operations.

f) Hazards of manoeuvring area driving

1) engine suction/ingestion and blast, vortex, propellers, and helicopter operations;

2) requirements for driving at night;

3) requirements for operations in low visibility and other adverse weather conditions;

4) procedures in the event of a vehicle or radio becoming unserviceable while on the manoeuvring area; and

5) right of way of aircraft, towed aircraft and rescue and fire fighting vehicles in an emergency.

g) Emergency procedures

1) actions to be taken in the event of a vehicle accident/incident;

2) actions to be taken in the event of an aircraft accident/incident;

3) actions to be taken if foreign object debris or other debris is found on runways and taxiways;

4) procedures to be used by vehicle drivers if lost or unsure of their position; and

5) local emergency telephone numbers.

h) Aircraft familiarization

1) knowledge of aircraft types and ability to identify all types normally operating at the aerodrome;

2) knowledge of airline call signs; and

3) knowledge of aircraft terminology relating to engines, fuselage, control surfaces, undercarriage, lights, vents, etc.

i) Practical training (visual familiarization)

1) all runways (including access and exit routes), holding areas, taxiways and aprons;

2) all signs, surface markings and lighting associated with runways, holding positions, CAT I,II and III operations;

3) all signs, surface markings and lighting associated with taxiways;

4) specific markings that demarcate the boundary between aprons and manoeuvring areas;

5) navigation aids such as ILS, protected area, antenna, RVR equipment and othermeteorological equipment;

6) hazards of operating around aircraft landing, taking off or taxiing; and

7) any locally used naming convention for particular areas or routes.

2.3 Radiotelephony (RTF)

2.3.1 The movement of vehicles on the manoeuvring area is subject to authorization by ATC. Depending upon the complexity of the aerodrome, ATC may operate a number of frequencies. Typically the aerodrome (tower) controller will be responsible for all vehicles operating on the runway, and the ground controller will be responsible for all vehicles operating on the taxiways. It is essential to fit all vehicles that operate on the runway with the appropriate radio communication frequencies.

2.3.2 All drivers of vehicles operating on the manoeuvring area should be expected to display a high degree of competence with respect to the use of RTF phraseology and ICAO language requirements for air- ground radiotelephony communications. Emphasis should be placed on the following areas:

a) Hierarchy of message priority

message priorities, an understanding of distress, alerting, control and information messages.

b) Phonetic alphabet

correct pronunciation of letters, words and numbers.

c) Standard phraseology

1) emphasis on the need for drivers to use standard phraseology; and

2) the need for caution with certain phrases such as “cleared” and “go ahead”.

d) Call signs for aircraft, ATC and vehicles

1) an understanding of terminology and acronyms used by ATC and pilots;

2) knowledge of the airline call signs used at the aerodrome; and

3) knowledge of vehicle call signs and that they should be appropriate to their function (e.g. “Operations”, “Fire”, “Engineer”) and numbered when more than one vehicle is used (e.g.“Fire 2”).

e) Readback procedures

the need for vehicle drivers to use standard readback, in the same manner as pilots, forinstructions such as “enter/cross the runway”, and if conditional clearances are used.

f) Readability scale

understanding and use of the readability scale from 1 to 5.

g) Lost or uncertain of position

understanding of local procedures for vehicle drivers lost or uncertain of their position on the manoeuvring area.

h) Vehicle breakdown

1) local procedure for vehicle breakdown on runways and taxiways; and

2) procedure for notifying ATC of vehicle failure.

i) Radio failure

1) understanding of the local procedure if radio failure occurs while on the runway or taxiway;and

2) understanding of the light signals that can be used by ATC to pass instructions to vehicles.

j) Transmitting techniques and use of RTF

1) understanding the reasons for listening out prior to transmitting;

2) use of standard phraseology and ICAO air-ground radiotelephony communications procedures (there are no language requirements for vehicle drivers); application of ECAR 139 item 139.335 (Aerodrome vehicle operations);

3) words and sounds to be avoided;

4) correct positioning of microphones to avoid voice distortion;

5) avoidance of "clipped" transmissions;

6) awareness of regional accents and variations of speech; and

7) speed of delivery of RTF phraseology.

k) Portable radios

1) correct use of radios;

2) effective range and battery life;

3) screening/shielding effects on the aerodrome; and

4) use of correct call signs, either related to a vehicle or a person.

l) Safety while using radios

1) local instructions regarding the use of portable radios and hand-held microphones while driving a vehicle; and

2) local instructions on the use of mobile telephones while operating airside.

3. GENERAL CONSIDERATIONS

3.1 All three training programmes should consist of two main parts, the first being the classroom/theoretical part which should include the use of prepared presentations, maps, diagrams, videos, booklets and checklists as appropriate. The second part should involve practical training and visual familiarization on the aerodrome with a suitably trained person. This practical tuition will take time dependingupon the complexity of the aerodrome. Following initial training, a programme of refresher training should beorganized after an agreed period of time.

3.2 Where the responsibility for vehicle driver training (apron and manoeuvring area) and RTF training is delegated to a third-party provider, the aerodrome management should institute a programme of audits, as part of its safety management system, to ensure that agreed standards are being maintained.

3.3 The framework for a vehicle driver training programme outlined in paragraph 2 is intended only as a guide and is based on current "good practice". It is incumbent on aerodrome operators to regularly review their vehicle driver training programmes against programmes and documentation available acrossthe industry.

Appendix E Aerodrome Resource Management Training Course

1. INTRODUCTION

An analysis of runway incursions has established that a number of them were the result of a breakdown in the team function by air traffic controllers, aircrew or vehicle drivers. This may have been due to incorrect communication practices or a failure to understand the roles and difficulties of personnel working in other areas. An aerodrome resource management training course has been produced by EUROCONTROL and is intended to enhance the team role of all those involved in runway operations. This course can be conducted at individual aerodromes or, alternatively, regional seminars can be organized. The course emphasizes developing the team role at each airport and also educating staff about the exact tasks and difficulties of others who operate on the manoeuvring area.

2. COURSE DESCRIPTION

2.1 The successful introduction of local runway safety teams can prove beneficial in the prevention of runway incursions. Local runway safety teams comprise pilots, airside vehicle drivers and air traffic controllers. The goal of the team is to work together to identify local causal factors in runway incursions and identify local solutions to prevent their recurrence. Presently all three members of this multi-professional team are working at the forefront of operational safety as individuals; they need to work as a team on the manoeuvring area.

2.2 The aerodrome resource management course is designed to train trainers to facilitate the tasks of the members of local runway safety teams and all operational staff working on the manoeuvring area.

2.3 The course also aims to raise awareness of the operational hazards faced every day when working on or around a runway, and the Human Factors aspect reveals the importance of communication, error management and situational awareness.

2.4 It is highly desirable that a representative cross section of air traffic controllers, aircrew and vehicle drivers attend this multi-disciplinary course. Detailed information can be obtained from:

www.eurocontrol.int/ians/public/subsite_homepage/homepage.html.

Appendix F ICAO model runway incursion initial report form

Report no.: _____

A. Date/time of runway incursion (in UTC) (YYYYMMDDhhmm) _____ Day ☐ Night ☐

B. Person submitting the report

Name: _____

Job title: _____

Telephone no.: _____

Facility/unit: _____

Date/time/place of completion of form: _____

C. ICAO aerodrome designator _____

D. Surface conditions *(Braking)* _____

_____

_____

E. Aircraft, vehicle or person involved in the runway incursion (indicate all those involved in the occurrence)

Aircraft 1: _____

Aircraft 2: _____

Aircraft 3: _____

Vehicle: _____

Person: _____

F. Weather conditions

Wind: _____ Visibility/RVR: _____

Temperature (° Celsius): _____ Ceiling/cloud: _____

Additional information:

_____

_____

_____

_____

_____

G. Evasive action — Aircraft 1

No ☐

Yes ☐ Select from the list below as appropriate:

Cancelled take-off clearance	☐	
Rejected take-off	☐	distance rolled: _____
Rotated early	☐	
Delayed rotation	☐	
Abrupt stop	☐	
Swerved	☐	
Missed approach	☐	distance to runway threshold: _____
Other	☐	

H. Evasive action — Aircraft 2

No ☐

Yes ☐ Select from the list below as appropriate:

Cancelled take-off clearance	☐	
Rejected take-off	☐	distance rolled: _____
Rotated early	☐	
Delayed rotation	☐	
Abrupt stop	☐	
Swerved	☐	
Missed approach	☐	distance to runway threshold: _____
Other	☐	

I. Evasive action — Vehicle

No ☐

Yes ☐ Select from the list below as appropriate:

Abrupt stop	☐
Swerved	☐
Other	☐

J. Closest proximity

Vertical (ft): _____ Horizontal (m): _____

K. Communication difficulties

No ☐

Yes ☐ Select from the list below as appropriate:

Readback/hearback	☐
Blocked communication	☐
Confused call signs	☐
Aircraft on wrong frequency/no radio	☐
Non-standard phraseology	☐

L. ATC

Did ATC forget about:	Yes	No
An aircraft/person/vehicle cleared onto or to cross a runway?	☐	☐
An aircraft on approach to land?	☐	☐
A runway closure?	☐	☐

M. Description of the incident and relevant circumstances

1. A description or diagram of the geometry of the incident scenario:

Description:

_____
_____
_____
_____

Diagram:

2. A description of any evasive or corrective action taken to avoid a collision:

3. An assessment of the available reaction time and the effectiveness of the evasive or corrective action:

4. An indication of whether a review of voice communication has been completed and the results of that review:

5. Initial assessment of severity:

N. Aircraft details — Aircraft 1

Registration no.: _____ Call sign: _____ SSR code (if applicable): _____

Flight no.: _____ Owner/operator: _____

Aircraft 1 type: _____

Flight details (select from the list below as appropriate):

Type of flight		*Flight rules*	
General aviation	☐	IFR	☐
Military	☐	VFR	☐
Non-scheduled	☐		
Scheduled	☐		
Other	☐		
Not applicable	☐		

O. Aircraft details — Aircraft 2

Registration no.: _____ Call sign: _____ SSR code (if applicable): _____

Flight no.: _____ Owner/operator: _____

Aircraft 2 type: _____

Flight details (select from the list below as appropriate):

Type of flight		*Flight rules*	
General aviation	☐	IFR	☐
Military	☐	VFR	☐
Non-scheduled	☐		
Scheduled	☐		
Other	☐		
Not applicable	☐		

P. Vehicle details — Vehicle 1

Registration no.: _____ Call sign: _____

Mobile no.: _____ Owner/operator: _____

Vehicle 1 type: _____

Other details (select from the list below below as appropriate):

Type of vehicle		*Other:*
Runway inspection	☐	
Bird control	☐	
Tugging/towing	☐	
Fire brigade	☐	
Maintenance	☐	
Snow clearing	☐	
Military	☐	

Q. Vehicle details — Vehicle 2

Registration no.: _____ Call sign: _____

Mobile no.: _____ Owner/operator: _____

Vehicle 2 type: _____

Other details (select from the list below below as appropriate):

Type of vehicle		*Other:*
Runway inspection	☐	
Bird control	☐	
Tugging/towing	☐	
Fire brigade	☐	
Maintenance	☐	
Snow clearing	☐	
Military	☐	

R. Report received by

_____ _____
(name of person) (date)

S. Date when detailed investigation will commence

_____

2. INSTRUCTIONS FOR COMPLETING THE RUNWAY INCURSION INITIAL REPORT FORM

Item	
A	Indicate the date/time (in UTC) and conditions (day or night) of the runway incursion.
B	Provide details about the person submitting the report.
C	Provide the aerodrome designator as indicated in *Location Indicators* (Doc 7910).
D	Supply information regarding the runway condition at the time of the runway incursion, which affected the braking action of the aircraft.
E	Identify the aircraft, vehicles or persons involved in the runway incursion. More details should be provided in N, O, P and Q.
F	Provide information on weather conditions such as wind, visibility, RVR, temperature, ceiling, cloud and additional information as required.
G, H, I	Provide information regarding evasive action taken by the aircraft and/or vehicles.
J	Provide information regarding the closest proximity or distance, horizontally and/or vertically, between both parties during the runway incursion or at the point at which both parties were aware of the situation and the aircraft was under control at taxi speed or less.
K, L	Provide information regarding communication difficulties and ATC memory lapses.
M	Describe the runway incursion, by providing the information requested. Attach additional pages as required.
N, O, P, Q	Supply detailed information regarding the aircraft and vehicles involved in the runway incursion.
R	Provide the name of the person receiving the report and date.
S	Indicate the date when the detailed investigation of the runway incursion will commence.

Appendix G ICAO model runway incursion casual factor identification form

Initial runway incursion report no.: _____

A. Date/time/place of runway incursion (in UTC) (YYYYMMDDhhmm) _____ (date) _____ (time) _____ (place)

B. Aircraft, vehicle or person involved in the runway incursion (indicate all those involved in the occurrence)

Aircraft 1: _____
Aircraft 2: _____
Aircraft 3: _____
Vehicle: _____
Person: _____

C. Severity of the runway incursion (select as appropriate)

Severity	
A	☐
B	☐
C	☐
D	☐
E	☐

D. Causal and coincident factors (select from the list as appropriate — multiple choices can be made)

1. AIR TRAFFIC CONTROL

1.1 *Communications*

1.1.1 Transmitted instructions were long, complex, spoken rapidly or not in accordance with ICAO language requirements for air-ground radiotelephony communications (language normally used by the station on the ground or the English language)[1] ☐

1. ICAO language requirements for air-ground radiotelephony communications are shown in Annex 10 — *Aeronautical Telecommunications*, Volume II, Chapter 5, and Annex 1 — *Personnel Licensing*, Chapter 1 and Appendix 1.

1.1.2	Did not obtain readbacks for clearances, instructions and coordination as required by ICAO	☐
1.1.3	Did not correct an error in a readback	☐
1.1.4	Issued a clearance to the wrong aircraft	☐
1.1.5	Confused similar call signs	☐
1.1.6	Transmission was completely blocked	☐
1.1.7	Deviation from established ICAO standard phraseologies	☐
1.1.8	Other (please specify). If not an ICAO procedure, please briefly describe the procedure used and where.	☐

_____

_____

_____

_____

_____

1.2 ***Situational awareness***

1.2.1	Head-down time due to equipment/displays; duties other than traffic processing such as inputting flight data	☐
1.2.2	Forgot:	
	• aircraft on an active runway	☐
	• aircraft cleared to cross a runway	☐
	• aircraft in the lined-up position	☐
	• aircraft on approach to land	☐
	• to issue a clearance	☐
	• that a clearance had already been issued	☐
	• closed runways	☐
	• a vehicle on an active runway	☐
	• a vehicle cleared to cross a runway	☐
1.2.3	Distractions due to:	
	• performing other assigned duties, such as conducting operational telephone calls, weather observations and recording, issuing NOTAM and other operational information	☐
	• engaging in non-operational activities such as a personal telephone call, extraneous conversation, reading material and radios	☐
1.2.4	Used a language not in accordance with ICAO language requirements for air-ground radiotelephony communications (language normally used by the station on the ground or the English language)	☐
1.2.5	Other (please specify).	☐

_____

_____

_____

_____

_____

1.2.6 Misidentified the aircraft or the aircraft's position due to: ☐

- incorrect position report ☐
- an incorrect expectation (e.g. expected the aircraft to be clear of the runway) ☐

1.2.7 Lack of visual scanning of ground movements ☐

1.2.8 Limitations on the view of the manoeuvring area from the ATC tower ☐

1.2.9 Recent runway configuration change ☐

1.2.10 Unusual runway configuration ☐

1.2.11 Error occurred within 15 minutes of assuming the control position ☐

1.2.12 Controller was conducting on-the-job training ☐

1.2.13 Fatigue ☐

1.2.14 Other (please specify). ☐

_____

_____

_____

_____

_____

1.3 ***Staffing***

1.3.1 ATC positions were combined on the same frequency ☐

1.3.2 Absence of a supervisor in the tower ☐

1.3.3 Supervisor was working a control position. ☐

1.4 ***Decision making***

1.4.1 Misjudged separation or anticipated separation ☐

1.4.2 Inadequate ATC to ATC coordination ☐

1.4.3 Other (please specify). ☐

_____

_____

_____

_____

_____

1.5 ***Procedures***

1.5.1 Misapplication of conditional clearances ☐

1.5.2 Use of multiple line-up clearances ☐

1.5.3 Other (please specify). If not an ICAO procedure, please briefly describe the procedure used and where. ☐

_____

_____

_____

_____

_____

_____

1.6 *Aerodrome works*

1.6.1 ATC not advised of works on the manoeuvring area ☐

1.6.2 Other (please specify). ☐

_____

_____

_____

_____

_____

2. FLIGHT CREW

2.1 *Communications*

2.1.1 Transmission was completely blocked ☐

2.1.2 Transmission was partially blocked ("stepped-on") ☐

2.1.3 Accepted a similar aircraft's clearance:

- with similar call signs ☐
- without similar call signs ☐

2.1.4 Deviation from established ICAO standard phraseologies ☐

2.1.5 Used other than ICAO language requirements for air-ground radiotelephony communications (language normally used by the station on the ground or the English language) in a situation not covered by ICAO standard phraseology ☐

2.1.6 Used language not in accordance with ICAO language requirements for air-ground radiotelephony communications (language normally used by the station on the ground or the English language) ☐

2.1.7 Speech quality:

- not proficient in ICAO language requirements for air-ground radiotelephony communications (language normally used by the station on the ground or the English language) ☐
- poorly enunciated or heavily accented ☐
- spoken rapidly ☐
- spoken with an inconsistent volume ☐

2.1.8 Did not use headsets ☐

2.1.9 Received clearance or instructions during periods of high cockpit workload ☐

2.1.10 Did not advise ATC of a delay on the runway prior to take-off ☐

2.1.11 Other (please specify). ☐

_____

_____

_____

_____

_____

2.2	*Situational awareness*	
2.2.1	Crew conducting checklists while taxiing	☐
2.2.2	Crew member programming flight management system or other flight deck system while taxiing	☐
2.2.3	Crew member was on another radio frequency	☐
2.2.4	Competing radio communications	☐
2.2.5	Unfamiliar with the aerodrome layout	☐
2.2.6	Crew mistook their position on the aerodrome (thought they were in a different location)	☐
2.2.7	Fatigue	☐
2.2.8	Reported incorrect location to ATC	☐
2.2.9	Taxied fast	☐
2.2.10	Did not refer to the aerodrome diagram	☐
2.2.11	Did not listen to the automatic terminal information service (ATIS)	☐
2.2.12	Works on the manoeuvring area were not previously advised by NOTAM	☐
2.2.13	Used out-of-date or inaccurate publications or charts	☐
2.2.14	Failed to apply or correctly observe sterile cockpit procedures	☐
2.2.15	Other (please specify).	☐

_____

_____

_____

_____

_____

2.3	*Markings, signs and lighting*	
2.3.1	Not ICAO-compliant	☐
2.3.2	Not provided	☐
2.3.3	Irregularly spaced	☐
2.3.4	Ambiguous and difficult to follow	☐
2.3.5	Poorly sized	☐
2.3.6	Poorly situated	☐
2.3.7	Poorly maintained	☐
2.3.8	Other (please specify).	☐

_____

_____

_____

_____

_____

2.4 *Clearances and instructions*

2.4.1 Misunderstood clearance:

- conditional ☐
- follow ☐
- other ☐

2.4.2 Flight crew did not ask for clarification when they did not understand a clearance or instruction ☐

2.4.3 Did not inform ATC when could not comply with a clearance ☐

2.4.4 Forgot part of the clearance or instruction ☐

2.4.5 Entered the runway after being instructed to "hold short" ☐

2.4.6 Lined up on the runway after instruction to taxi to the runway-holding position (point) ☐

2.4.7 Took off without a clearance after being instructed to "line up and wait" ☐

2.4.8 Took off without a clearance after being instructed to taxi to the runway-holding position (point) ☐

2.4.9 Landed or departed on the wrong runway ☐

2.4.10 Landed or departed on the taxiway ☐

2.4.11 Other (please specify). ☐

_____

_____

_____

_____

_____

3. VEHICLE DRIVERS AND PEDESTRIANS

3.1 *Communications*

3.1.1 Did not operate on the appropriate:

- ground frequency for operations outside the runway strip ☐
- tower frequency for operations within the runway strip ☐

3.1.2 Turned the radio volume down or off after initial communication with ATC ☐

3.1.3 Other (please specify). ☐

_____

_____

_____

_____

_____

3.2 *Situational awareness*

3.2.1 Forgot the details/limits of any clearance to operate on the manoeuvring area ☐

3.2.2 Distracted by:

- current work ☐
- high noise levels ☐

- monitoring more than one frequency and possibly a mobile telephone ☐
- being disoriented or lost on the aerodrome ☐

3.2.3 Failure to report correct location ☐

3.2.4 Other (please specify). ☐

_____

_____

_____

_____

_____

3.3 ***Markings, signs and lighting***

3.3.1 Not ICAO-compliant ☐

3.3.2 Not provided ☐

3.3.3 Irregularly spaced ☐

3.3.4 Ambiguous and difficult to follow ☐

3.3.5 Poorly sized ☐

3.3.6 Poorly situated ☐

3.3.7 Poorly maintained ☐

3.3.8 Other (please specify). ☐

_____

_____

_____

_____

_____

3.4 ***Procedures***

3.4.1 Not adequately familiar with the aerodrome and its procedural requirements ☐

3.4.2 Did not refer to the current aerodrome NOTAM ☐

3.4.3 Did not refer to the current aerodrome diagram ☐

3.4.4 Used out-of-date or inaccurate publications or charts ☐

3.4.5 Did not advise ATC of work that affected operations ☐

3.4.6 Ground vehicles did not stop at required positions ☐

3.4.7 Other (please specify). ☐

_____

_____

_____

_____

_____

3.5 *Clearances and instructions*

3.5.1 Did not comply with ATC clearances and instructions ☐

3.5.2 Mistook a clearance intended for another vehicle or aircraft ☐

3.5.3 The driver did not advise ATC that he/she did not understand the clearance or instruction ☐

3.5.4 Other (please specify). ☐

_____

_____

_____

_____

_____

E. Person submitting the form

_____
Name

_____
Title

_____
Date

2. INSTRUCTIONS FOR COMPLETING THE RUNWAY INCURSION CAUSAL FACTORS IDENTIFICATION FORM

Item	
A	Indicate the date/time (in UTC) and place of the runway incursion.
B	Identify the aircraft, vehicles and persons involved in the runway incursion.
C	Classify the severity of the runway incursion according to Chapter 6 of the *Manual on the Prevention of Runway Incursions* (Doc 9870).
D	Fill out all causal and coincident factors applicable to the runway incursion.
E	Provide details of the person submitting the form and the date.

Note.— When instructed by ICAO, the information on this form should be sent to ICAO to facilitate global identification of runway incursion casual factors.

Appendix H Runway incursion severity classification (RISC) calculator

1. The runway incursion severity classification (RISC) calculator is a computer programme that classifies the outcome of runway incursions into one of three severity classifications: “A”, “B”, or “C”. (See Chapter 6, 6.1, for a description of these categories.) The RISC calculator programme does not store any data; it simply provides a quick, easy and standardized way to rate the severity of runway incursions. Experts’ judgements of severity are subject to a variety of factors. Severity judgements can change from person to person and from time to time. The calculator applies the same decision processes used by expertsto determine the severity rating. Because the rating (output) is standardized to the input, the ratings are consistent. Such consistency is essential to being able to examine trends over time or see the effects of mitigation strategies. This standardized method for rating the severity of runway incursions can be used to support global sharing and comparison of data

2. The foundation for the rating is the closest proximity, that is, how close the aircraft came to the other aircraft, vehicle or pedestrian in vertical and horizontal space. Factors that affect the probability of a collision are also included, such as aircraft dimensions and performance characteristics, visibility, the geometry of the conflict, and operator (controller, pilot or vehicle driver) responses.

3. The intent of the rating is to represent the risk incurred; factors such as visibility, available response time, avoidance manoeuvres executed and the conditions under which they were executed allows a characterization of that risk. For example, suppose two aircraft land on intersecting runways and stop150 m (500 ft) from each other. In unlimited visibility and without severe braking being executed by either pilot, the outcome that the aircraft would come no closer than 150 m (500 ft) has a higher chance ofrecurring than in reduced visibility (where there is degraded information for all parties) or with extreme avoidance manoeuvres having been executed. Similarly, if the available response time for one of the pilots is extremely short (e.g. less than 5 seconds), then more variability would be expected to be seen in the outcome of the pilot’s responses (and hence, the severity of the outcome) than if the available response timeis long. Therefore, each factor that adds to the variability of the outcome of the incursion is considered in therating and the more conservative rating is applied. This means that each relevant factor has the potential to make the severity rating higher than it would have been if it had been defined solely by the closest proximity.It should be noted that this is not the same as basing the rating on the worst possible, or least credible, outcome of the scenario. The calculator does not rate the severity of the incursion based on everything that could have gone wrong. Rather, the critical sources of variability within the scenario are taken into account,a weight is assigned to each factor (and to each element within the factor) that contributes to the variability, and a rating based on the weight assigned to the factors and the elements within each factor is generated. While it may be helpful to think of the weight as scaling the “severity” level of the factor (for example, a pilot’sacceptance of a clearance intended for another aircraft is more serious than a partially blocked transmission), it actually represents the level of variability that the factor introduces into the severity of the outcome.

4. The model starts with a set of situations or “scenarios” that broadly subsume all types of runway incursions that involve an aircraft and either another aircraft, vehicle or pedestrian. Exceptions are that the calculator cannot accommodate helicopters in the air or other vertical take-off and landing aircraft that are airborne. Also, the calculator is designed to categorize the severity of conflicts only between two aircraft (or between an aircraft and a vehicle or pedestrian). Therefore, the calculator cannot rate the severity of conflicts that involve more than two aircraft.

5. Runway incursions that involve only a single aircraft are automatically categorized as a “D”. The scenario describes the action of the parties involved in the incursion (landing, taking off, crossed the runway, crossed the hold short line, etc.). Each scenario has a specific set of factors associated with it. The severity rating is based on closest proximity (horizontal and/or vertical) and the set of weighted factors for the particular scenario.

6. Relevant factors can include:

a) visibility;
b) type of aircraft;
c) avoidance manoeuvre executed (whether initiated by the pilot or commanded by the controller):
   1) aborted take-off (or cancelled take-off clearance);
   2) rotated early to avoid a collision;
   3) executed a go-around;
   4) applied hard braking; and

5) swerved;

d) runway characteristics and conditions (width, braking action reported); and

e) degree to which the situation was controlled or uncontrolled (e.g. type of pilot/controller errors involved, whether all parties were on the frequency, whether the controller was aware of all of the parties involved).

7. Subsumed within each factor are elements. Elements within the visibility factor are levels of runway visual range, reported ceiling height and visibility, and day or night conditions. Runway characteristic factors include the width of the runway in situations in which an aircraft on the runway conflicts with an aircraft or vehicle approaching it from the side. This factor also includes runway conditions (dry, wet, braking action reported as poor or fair) in scenarios that involve avoidance manoeuvres in which braking action is a relevant factor (e.g. hard braking action reported, aborted take-off). There are several elements within the "controlled/uncontrolled" factor. One element concerns communication issues such as an aircraft not on the correct frequency, a partially or totally blocked transmission, the pilot accepting another aircraft's clearance, and readback/hearback errors. The other elements map to a lack of awareness on the part of the controller (e.g. the controller forgot about an aircraft) or the pilot (e.g. the pilot landed on the wrong runway).

8. The user of the calculator enters the above information into the appropriate fields and clicks on the"calculate rating" virtual button. The severity rating is then displayed. (A complete user's manual is provided with the CD.) Within the model, each scenario has a rating table associated with it. These tables specify, for various values of horizontal or vertical proximity, a severity rating for overall best case and worst case, and ratings for each factor at worst case when all other factors are best case. Each individual factor has associated with it a scale from zero to ten. A value of zero means there is no influence of that factor to make the severity of the given incursion greater than what is evident from the closest proximity alone. A value of ten means there is maximum influence of that factor to make the severity of the given incursion greater than what is evident from the closest proximity alone with other conditions normal. When all factors are ideal, i.e. good visibility, the aircraft are small (and, hence, relatively slow, lightweight and highly manoeuvrable), no pilot-controller communication anomalies, and no avoidance manoeuvres, then all factor values are zero. When this is the case, the severity of the runway incursion is adequately represented by the given closest horizontal or vertical proximity. If, on the other hand, all factor values are tens, then the situation is such that the resulting proximity of aircraft (or aircraft and other object) could easily have been much worse and is represented by a "worst case" severity rating for that scenario at the resulting proximity. The greater each factor rating, the greater the expected variability of closest proximity for recurring runway incursions under the same conditions. A detailed discussion of the mathematics behind the model is available in Sheridan, 2004. (Sheridan, T. (2004), *An Interpolation Method for Rating the Severity of Runway Incursions*, presented at the Symposium on Human Performance, Situation Awareness, and Automation, Daytona Beach, 23–25 March 2004).

9. The United States Federal Aviation Administration (FAA) has compared the results of the ratings generated by the calculator to the ratings of their subject matter experts and, as a result, will be using the calculator in their assessments of the severity of runway incursions.

10. The RISC model can be obtained from the ICAO website at:

www.icao.int/fsix/res_ans.cfm.

Appendix I
Aerodrome Runway IncursionAssessment (Aria)

1. Any airport runs a certain risk of a runway incursion. However due to specific characteristics, e.g. a high rate of runway crossings, some airports are more vulnerable than others. ARIA should make the important differences visible. The model generates a vulnerability index that is related to the runway incursion rate. The model is developed using a taxonomy-based approach. ARIA is a simple, easy-to-use model with the potential to be used at airports worldwide.

2. ARIA was developed using the results of previous studies on the causes and contributing factors of runway incursions. A set of risk factors has been selected that represents the most important determinants of runway incursion risk. Subsequently, the risk factors are weighted reflecting their relative importance for the risk of runway incursions. Likewise a set of risk reduction factors has been developed. The model has been validated with success against data from eighteen European airports, covering a wide range of characteristics (in terms of operations, layout, etc.).

3. ARIA can be obtained from:

www.eurocontrol.int/runwaysafety/public/subsite_homepage/homepage.html.

Appendix J ICAO Runway Safety Toolkit

1. The ICAO runway safety toolkit on CD-ROM was produced by the International Civil Aviation Organization (ICAO) and Embry Riddle Aeronautical University, Florida, United States, as part of a continuing effort to assist States in the implementation of runway incursion prevention programmes. This interactive toolkit is a compilation of the best educational material available, obtained over a period of several years, and draws on information and knowledge obtained during a series of ICAO seminars on the subject of runway safety held between October 2002 and October 2004. The toolkit is meant to be used with other runway safety tools such as the *Manual on the Prevention of Runway Incursions* (Doc 9870) and to support other runway incursion prevention programme initiatives.

2. The CD-ROM contains:

a) an opening statement by the President of the ICAO Council;

b) introduction to all users;

c) modules for air traffic control, flight operations, aerodrome and management responsibilities;and

d) supplemental material including a glossary of terms related to runway safety, an appendix containing ICAO provisions on runway safety, references and links to runway safety websites,posters, videos, and presentations given during the ICAO runway safety awareness and education campaign.

3. The CD-ROM can be obtained from the ICAO website at:

www.icao.int/fsix/res_ans.cfm.

Appendix K EUROCONTROL Runway Safety Toolkit

1. A runway safety CD-ROM was produced by EUROCONTROL, using expert advice from pilots, controllers and airport operators. The International Federation of Air Line Pilots' Associations (IFALPA), the International Federation of Air Traffic Controllers' Associations (IFATCA), the International Air Transport Association (IATA), the European Cockpit Association, the Group of Aerodrome Safety Regulators and the Joint Aviation Authorities (JAA) also provided invaluable input to the CD-ROM.

2. The CD-ROM contains:

a) the European Action Plan for the Prevention of Runway Incursions;

b) information (with graphics) on signs, markings and lighting; and

c) a self-assessment for pilots, drivers and air traffic controllers on knowledge of aerodrome signs,markings and lighting.

3. The CD-ROM is available from EUROCONTROL at:

Runway Safety Office
EUROCONTROL
rue de la Fusée, 96
B-1130 Brussels, Belgium

Website: www.eurocontrol.int/runwaysafety/public/subsite_homepage/homepage.html Email:

runway.safety@EUROCONTROL.int

— END —