

GM 14-33

## **CIVIL AVIATION AUTHORITY OF BANGLADESH**

# **Guidance Manual**

# **Runway Incursions And Collision Avoidance**



# **AERODROME STANDARD DIVISION**





## CIVIL AVIATATION AUTHORITY OF BANGLADESH

## Guidance Manual on Runway Incursions And Collision Avoidance

Version-2.0

27 June 2024

**Aerodrome Standard Division** 

## **RECORD OF AMENDMENTS**

Version/ Revision	Chapter Changed	Pages Replaced	Signature	Date

## **REVISION HISTORY**

Version/ Revision	Date	Chapter/ Section	Details
0.00		All	Manual on the Runway Incursions and Collision Avoidance
1st	01-10-2012	All	Manual on the Runway Incursions and Collision Avoidance
2nd	15-06-2024	All	Guidance Manual on the Runway Incursions and Collision Avoidance

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#### FOREWORD

In exercise of the powers conferred by the Section 14 of Civil Aviation Act 2017, the Chairman, Civil Aviation authority of Bangladesh has promulgated ANO-14 Vol-I by transposing the Provisions of ICAO Annex 14 Vol-1.as specific operating regulations for the Aerodrome Operators, operating in Bangladesh.

An Aerodrome Operator is expected to comply with the Regulations of the ANO-14 Vol-I and provisions of GM-14-21 and ICAO Doc 9870 relating to runway incursion. 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.

There may be circumstances where compliance of requirements by the Aerodrome Operator becomes difficult because of constraints of trained manpower, training facilities and/or other administrative formalities. These situations require CAAB to establish subject specific guidance manuals

This GM has been derived from Doc 9870. It provides guidance to the aerodrome operators in developing a runway incursion Prevention programme by establishing runway safety teams at Individual airports.

It is expected that the concerned Aerodrome Operator will take this GM as a reference/guidance material in order to establish a runway safety team for the development of a runway incursion Prevention programme.

This Guidance Manual is issued under the authority of the Director (AS) of Civil Aviation Authority of Bangladesh and will become effective on the date mentioned in the document and also will supersede the Air Navigation Order ANO(AD)A.7 issued on October 01 2012 on the same subject.

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#### CHAPTER 1. Overview of the Manual

#### 1.1. Background

1.1.1 With the growth in traffic volume, runway incursions have been showing a growing trend world over which have raised a considerable safety concern. Prevention of runway incursions has become a priority area. Runway incursions have sometimes led to serious accidents with significant loss of life. Although it is not a new problem, with the predicted growth of air traffic, the actual numbers of incidents are likely to rise, unless controlled and monitored with preventative actions.

1.1.2 Aviation safety programmes have a common goal – to reduce hazards, mitigate and manage residual risk in air transportation, which are the essential components of Safety Management System as recommended by ICAO in the field of Aircraft Operations (Annex-6), Air Traffic Service (Annex-11) and ANO 14 Vol-I Aerodrome Operations (Annex-14 Vol-I). Runway operations, which are vital part of activity at an airport; the hazards and risks associated with it; therefore, needs to be managed in order to prevent runway incursions that may lead to accidents.

1.1.3 The Air Navigation Conference of ICAO, which closely examined runway incursion prevention, in its eleventh meeting held in September – October 2003 in Montreal, Canada, recommended that States take appropriate actions to improve runway safety worldwide through the implementation of runway safety programmes. It also recommended that when capacity-enhancing procedures at aerodromes are considered, appropriate safety studies should

be conducted which would take due consideration of the effect on runway safety.

1.1.4 With the recent growth in air traffic in Bangladesh and enhancement of capacity at all major airports across the country, it has become vital that runway safety programmes are put in place to prevent runway incursions that may lead to incidents/ accidents.

#### 1.2. Glossary

#### 1.2.1 Terms

**Hot spot**. 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.

**Just Culture**. An atmosphere of trust in which people are encouraged (even rewarded) for providing essential safety-related information, but in which they are also clear about where the line must be drawn between acceptable and unacceptable behavior.

**Local runway safety teams**. A team comprised of representatives from aerodrome operations, air traffic services providers, airlines or aircraft operators, pilot and air traffic controllers associations and any other group with a direct involvement in runway operations that advise the appropriate management on the potential runway incursion issues and recommend mitigation strategies.

**Runway incursion**. Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft.

**Runway incursion severity classification (RISC) calculator**. A computer programme that classifies the outcome of runway incursions.

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

#### **1.3.** 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 Practices
SMS	Safety management system(s)
SSR	Secondary surveillance radar
UHF	Ultra-high frequency
VHF	Very high frequency

#### Chapter 2. Introduction

#### 2.1. Definition of a Runway Incursion

"Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft."

#### 2.2. Introduction To Runway Incursion Prevention

2.1.1 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.

2.1.2 Aviation safety programme 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.

2.1.3 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 factors are:

- 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 inadequate ATC facilities, can lead to an increased risk of runway incursions.

#### 2.3. Purpose Of This Guidance Manual

# 2.1.4 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, drivers and controllers consider runway incursions and the potential for collisions to be the most significant risk in aerodrome operations.

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

#### 2.1.6 This manual aims primarily to provide guidance essential for the implementation of

national/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 of this manual, the principles of safety management systems (SMS) should be used to mitigate or eliminate the hazardous factors.

#### Chapter 3. Establishing A Runway Incursion Prevention Programme

#### 3.1. Establishment of Runway Safety Team

A runway incursion Prevention programme starts with the establishment of runway safety teams at Individual airports. The requirement for establishing the runway safety team is given below:

- a) Individual aerodrome operator shall establish runway safety teams at each of their aerodromes.
- b) The runway safety team shall comprise of representatives from
  - i. Aerodrome operator,
  - ii. Air traffic service provider,
  - iii. Airlines or aircraft operators, and
  - iv. Any other groups with a direct involvement in runway operations.
- c) The team shall be headed by the Executive Director/Director/ Airport Manager of the Airport as appropriate.
- d) The runway safety team shall have the terms of reference as given in Article 3.3.
- e) The primary role of a runway safety team shall be
  - i. To develop action plan for runway safety,
  - ii. Identify potential runway incursion issues, and
  - iii. Recommend strategies for hazard removal and mitigation of the individual risk.
- f) The team shall meet at least once in three month at aerodromes used for International Air Transport Services and once in six month at other aerodromes. Frequency of meetings may be increased keeping in view of traffic growth due to capacity enhancement.

#### 3.2. Objectives of the runway safety team

Once the overall number, type and severity of runway incursions have been determined, the team shall establish the following goals to improve the safety of runway operations:

- a) To improve runway safety data collection, analysis and dissemination as required in the SMS;
- b) To check that signage and markings are compliant with ANO 14 Vol-I 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 runway incursion;
- e) To initiate local awareness by developing and distributing runway safety education and training material to Air Traffic controllers, pilots, personnel driving vehicles on the air side and personnel working at aerodromes.

#### 3.3. Generic terms of reference for the runway safety team

The generic Terms of Reference for the runway safety team formed at individual aerodromes shall be: 27 June 2024 12

- 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 aerodromes;
- 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 the *Manual on the Prevention of Runway Incursions* (ICAO Doc 9870) and applicable on the various aspects of aerodrome operation are implemented;
- e) Identifying any local problem areas and suggesting improvements;
- f) Conducting a runway safety awareness campaign that focuses on local issues, e.g., 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 regulatory requirements contained in Civil Aviation Rules & ANO 14 Vol-I of CAAB and other related guidance material issued by Chairman, CAAB from time to time.
- Forwarding 'Runway Incursion Initial Report Form' and 'Casual Factors identification Form' (Appendix A & B) to Director Aerodrome Standard Division (ASD) of Flight Standard & Regulations Division by the Safety Managers of Aerodrome Operator. Casual Factor identification form to be completed in association with the assistance of Safety Managers.

#### 3.4. Action items to be prepared and monitored by the Runway Safety Team

- a) The outcome of the meetings of the Runway Safety Team shall be the development of a plan containing action items for mitigating runway safety deficiencies. The action plan would be aerodrome specific and linked to a runway safety concern, issue or problem at that aerodrome.
- b) Each action item shall 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; in such cases head of the safety team, shall co-ordinate with such persons or organizations for the completion of all tasks associated with the action item.
- c) The effectiveness of the implemented and/or completed action items should be assessed periodically. 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 of such 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.
- d) Education and awareness material such as newsletters, posters, stickers and other educational information are invaluable tools for reducing the risk of runway incursions. These should be used by the runway safety teams for the guidance and education of controllers, pilots, vehicle drivers and personnel working at the aerodromes.

- e) Identification of Hot Spots: Suitable strategies should be implemented to remove the hazard associated with hot spots. When this is not immediately possible, action should be initiated by adopting strategies to manage and mitigate the risk. These strategies may include
  - i. Awareness campaigns,
  - ii. Additional visual aids (signs, markings and lighting),
  - iii. Use of alternative routings,
  - vi. Construction of new taxiways, and
  - v. The mitigation of blind spots in the aerodrome control tower.
- f) Aerodromes charts showing hot spots should be produced by the aerodrome operator, checked regularly for accuracy, revised as needed, distributed locally and published in the Aeronautical Information Publication (AIP).

#### Chapter 4. Contributory Factors

#### 4.1. Background

4.1.1 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.

4.1.2 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.

4.1.3 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.

#### 4.2. Breakdown In Communications

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

- a) Use of non-standardized phraseology;
- b) Failure of the pilot or the vehicle driver to provide a correct read back of an instruction;
- c) Failure of the controller to ensure that the read back by the pilot or the vehicle driver conforms with 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.

#### 4.3. Pilot Factors

4.3.1 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. 4.3.2 Other common factors include:

- a) Inadequate signage and markings (particularly the inability to see the runway-holding position lines);
- b) Controllers issuing instructions as the aircraft is rolling out after landing (when pilot workload and 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, leading to 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.

#### 4.4. Air Traffic Control Factors

- 4.4.1 The most common controller-related actions identified in several studies are:
- a) Momentarily forgetting about:
  - i. An aircraft;
  - ii. The closure of a runway,
  - iii. A vehicle on the runway, or
  - iv. 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 read back of another controller's instruction;
- g) Failure of the controller to ensure that the read back 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.
- 4.4.2 Other common factors include:
- a) Workload & distraction;
- b) Inadequate training & experience level;
- c) Lack of a clear line of sight from the control tower;
- d) Incorrect or inadequate handover between controllers.

#### 4.5. 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.

## Chapter 5. Recommendations for the Prevention of Runway Incursions

#### 5.1. Introduction

5.1.1 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.

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

#### 5.2. Communications

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

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

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

5.2.4 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.

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

#### **5.3.** Aircraft Operators (Pilots)

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

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

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

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

#### 5.4. Air Traffic Service Providers And Air Traffic Controllers

5.4.1 Safety management systems that are in accordance with ICAO provisions should be implemented.

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

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

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

5.4.5 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.

5.4.6 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.

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

5.4.8 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.

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

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

5.4.11 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.

5.4.12 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.

5.4.13 Controllers should be "head-up" for a continuous watch on aerodrome operations.

#### 5.5. Aerodrome Operators And Vehicle Drivers

5.5.1 The aerodrome operators shall include the optimal use of perimeter taxiways, the avoidance of runway crossings, simplistic and logical taxi/runway layouts and other related elements in the design and location of the aerodrome infrastructure.

5.5.2 It should be ensured that signs and markings are maintained and are clearly visible, adequate and unambiguous in all operating conditions.

5.5.3 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.

5.5.4 A formal driver training and assessment programme should be introduced.

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

#### 5.6. Incident Reporting And Investigation

5.6.1 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).

5.6.2 To enhance lesson learning, related runway safety data should be shared with other aviation safety organizations.

#### 5.7. Aeronautical Information

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

5.7.2 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 6. Incident Reporting and Data Collection

#### 6.1. A Standard Approach To Runway Incursion Incident Reporting And Data Collection

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

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

6.1.3 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.

6.1.4 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.

## Chapter 7. Classification of the Severity of Runway Incursions

#### 7.1. Severity Classification

Severity of Runway Incursions is classified as follows:

Severity Classification	Description
A	A serious incident in which a collision is narrowly avoided.
В	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.
С	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 protected area 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 precludes a severity assessment.

#### 7.2. Objectives of Severity classification:

- 7.1.1 To produce and record an assessment of each runway incursion and probability of its recurrence.
- 7.1.2 To determine the causal and contributory factors and to apply the appropriate risk mitigation measures.
- 7.1.3To assess any incident notification with due regard to its severity classification and start the investigation process.
- 7.1.4 For the purpose of global harmonization and effective data sharing.

## Appendix A Runway Incursion Initial Report Form

Name of Aerodrome:	Report no:	
A. Date/time of runway incursion (in UTC) (YYYYMMDD hh mm)	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	ce)
Aircraft 1:Aircraft 2:		
Aircraft 3:		
Vehicle: _		
Person:		

F. Weather	conditions		
Wind:	Visi	bility/RVR:	
Temperat	ure (° Celsius):	Ceiling/cloud:	
Additiona	l information:		
G. Evasive	e action — Aircraft 1		
No 🗆			
Yes □	Select from the list b	below as appropria	ite:
Ca	ncelled take-off clearance		
Re	ejected take-off		distance rolled:
Ro	otated early		
De	elayed rotation		
Al	orupt stop		
Sv	verved		
М	issed approach		distance to runway threshold:
Ot	her		
H. Evasive	e action — Aircraft 2		
No 🗆			
Yes 🗆	Select from the list b	oelow as appropria	ate:
Ca Re Ro	nncelled take-off clearance ejected take-off otated early		distance rolled:
De Al	elayed rotation prupt stop		

	Swerved			
	Missed approach	□ distance to runw	vay threshold:	
	Other			
Ι	Evasive action — Vehicle			
·	No 🗆			
	Yes 🗆 Select from the list b	elow as appropriate:		
	Abrupt stop Swerved Other			
J.	Closest proximity Vertical (ft)	Horizo	ontal (m):	
K.	Communication difficulties			
	No 🗆			
	Yes $\Box$ Select from the	e list below as appropriate:		
	Readback/hearback	Blocked communication		
	Confused call signs	Aircraft on wrong frequence	cy/no radio □	
	Non-standard phraseology			
L.	ATC			
	Did ATC forget about:		Yes	No
	An aircraft/person/vehicle clear	red 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:

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review:			cation has been completed and the results
Initial assessme	ent of severity	7:	
Aircraft det	ails — Aircra	aft 1	
Registration	n no.:	Call sign:	SSR code (if applicable):
Flight no.:		Owner/operator:	Aircraft 1 type:
General aviation		IFR 🗆	
General aviation		IFR 🗆	
Military		VFR 🗆	
Military Non- scheduled Sabadulad		VFR 🗆	
Military Non- scheduled Scheduled Other		VFR 🗆	
Military Non- scheduled Scheduled Other Not applicable		VFR 🗆	
Military Non- scheduled Scheduled Other Not applicable Aircraft det	ails — Aircra	VFR 🗆	
Military Non- scheduled Scheduled Other Not applicable Aircraft det Registration	ails — Aircra	VFR 🗆 aft 2 Call sign:	SSR code (if applicable):
Military Non- scheduled Scheduled Other Not applicable Aircraft det Registration Flight no.:	ails — Aircra	VFR □ aft 2Call sign: Owner/operator	SSR code (if applicable): : Aircraft 2 type:
Military Non- scheduled Scheduled Other Not applicable Aircraft det Registration Flight no.:	ails — Aircra n no.: ls (select from	VFR □ aft 2Call sign: Owner/operator n the list below as appropria	SSR code (if applicable): : Aircraft 2 type: tte):
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Military Non- scheduled Scheduled Other Not applicable Aircraft det Registration Flight no.: Flight detai <u>Type of flig</u> General aviation Military Non- scheduled Scheduled Other Not	ails — Aircra n no.:	VFR □ aft 2Call sign: Owner/operator n the list below as appropriaIFR □ VFR □	SSR code (if applicable): :Aircraft 2 type: tte):

Registration	no.:	Call sign:	
Mobile no.:		Owner/operator:	Vehicle 1 type:
Other details	s (select from the	e list below as appropriate):	
Ty	pe of vehicle		
Runway inspection			
Bir	d control		
Tug	gging/towing		
Fire	e brigade		
Ma	intenance		
Sno	w clearing		
Mil	itary		
Mobile no.:		Owner/operato	or:
Vehicle 2 tv	ne:		
Other details	s (select from the	list below below as appropriate	):
Runway insj	pection $\Box$		
Bird control			
Tugging/tow	ving 🗆		
Fire brigade			
Maintenance	2		
	ng 🗆		
Snow clearing			
Snow clearin Military			

(name of person)

(date)

Date when detailed investigation will commence

# 2. INSTRUCTIONS FOR COMPLETING THE RUNWAY INCURSION INITIAL REPORT FORM

Item	
А	Indicate the date/time (in UTC) and conditions (day or night) of the runway incursion.
В	Provide details about the person submitting the report.
С	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.
Е	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.
М	Describe the runway incursion, by providing the information requested. Attach additional pages as required.
N, O, P, Q incursion.	Supply detailed information regarding the aircraft and vehicles involved in the runway
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 B**

#### **RUNWAY INCURSION CAUSAL FACTORS IDENTIFICATION FORM**

Name of the Aerodrome:

Vehicle:

Person:

		Initial runway in	ncursion 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:				

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

Severity	
А	
В	
С	
D	
Е	

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)

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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:	
	<ul> <li>performing other assigned duties, such as conducting operational telephone calls, weather observations and recording, issuing NOTAM and other operational information</li> </ul>	
	<ul> <li>engaging in non-operational activities such as a personal telephone call, extraneous conversation, reading material and radios</li> </ul>	
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:	
	<ul> <li>not proficient in ICAO language requirements for air-ground radiotelephony communications (language normally used by the station on the ground or the English language)</li> </ul>	
	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

orgot the details/limits of any clearance to operate on the manoeuvring area			
Distracted by:			
current work			
high noise levels			
)	orgot the details/limits of any clearance to operate on the manoeuvring area istracted by: current work high noise levels		

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• monitoring more than one frequency and possibly a mobile telephone	
• being disoriented or lost on the aerodrome	
Failure to report correct location	
Other (please specify).	
Markings signs and lighting	
Not ICAA-compliant	
Not provided	
Irregularly spaced	
Ambiguous and difficult to follow	
Poorly sized	
Poorly situated	
Poorly maintained	
Other (please specify).	

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).	

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#### 3.5 Clearances and instructions

Did not comply with ATC clearances and instructions	
Mistook a clearance intended for another vehicle or aircraft	
The driver did not advise ATC that he/she did not understand the clearance or instruction	
Other (please specify).	
С Л С	Did not comply with ATC clearances and instructions Aistook a clearance intended for another vehicle or aircraft The driver did not advise ATC that he/she did not understand the clearance or instruction Other (please specify).

#### E. Person submitting the form

Name			
Title	 		
Date			

## 1. INSTRUCTIONS FOR COMPLETING THE

#### RUNWAY INCURSION CAUSAL FACTORS IDENTIFICATION FORM

Item

А	Indicate the date/time	(in UTC) and	place of the runway	incursion.
/ \	maleute the dute/time	(m o r o) una	place of the full way	meansion.

- 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 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<sup>1</sup> is allowed, the use of standard aviation English at international aerodromes enhances the situational 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 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.

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 challenged by 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 has been 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 explicit clearance 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 may proceed 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 indicate that 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 traffic control, 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 A VEHICLE DRIVER TRAINING PROGRAMME

#### 2.1 Airside vehicle driver

The following elements should be considered when developing programmes and knowledge requirements for 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 State driver licensing system. b) National legislation and regulation
  - 1) government/State regulations related to general vehicle driving licences;
  - 2) State/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;
- aviation terminology used such as runway, taxiway, apron, roads, crossings, runway-holding points;
- 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 occurring on 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;

- 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 those related 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 other meteorological 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
- 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, for instructions 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

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- use of standard phraseology and ICAO air-ground radiotelephony communications procedures (there are no language requirements for vehicle drivers); application of Annex 14, Volume I, 9.7 (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. I) 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 depending upon the complexity of the aerodrome. Following initial training, a programme of refresher training should be organized 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 across the industry.

#### 4. REFERENCES

Airports Council International (ACI)

- (World) Apron Safety Handbook
- (World) Apron Signs and Markings Handbook

International Air Transport Association (IATA)

• Airport Handling Manual (AHM), current edition

International Civil Aviation Organization (ICAO)

- Annex 14 Aerodromes, Volume I Aerodrome Design and Operations, Chapter 9, 9.7, Aerodrome vehicle operations, and Attachment A, paragraph 18, Operators of vehicles
- *Procedures for Air Navigation Services Air Traffic Management* (PANS-ATM, Doc 4444), Chapter 7, Procedures for Aerodrome Control Service
- Safety Management Manual (SMM) (Doc 9859)

United Kingdom

- Airport Operators Association Airside Driver Training Scheme
- Civil Aviation Authority CAP 642 Airside Safety Management.

## 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**

## 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 experts to 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 by those States that wish to do so.

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 stop 150 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 of recurring 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 time is long. Therefore, each factor that adds to the variability of the outcome of the incursion is considered in the rating 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's acceptance 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

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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

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*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 G

## AERODROME RUNWAY INCURSION ASSESSMENT (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 H

## 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 I

## 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.
- 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

E-mail: runway.safety@EUROCONTROL.int

— END —